DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE–2015–BT–STD–0006]

RIN 1905–AD51

Energy Conservation Program: Energy Conservation Standards for Fluorescent Lamp Ballasts

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 fluorescent lamp ballasts (''FLBs''). EPCA also requires the U.S. Department of Energy (''DOE'') to periodically determine whether more-stringent standards would be technologically feasible and cost effective, and would result in significant energy savings. In this final determination, DOE has determined that energy conservation standards for fluorescent lamp ballasts do not need to be amended.

DATES: The effective date of this final determination is December 16, 2020.

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

The docket web page can be found at *https://www.regulations.gov/document?D=EERE-2015-BT-STD-0006.* The docket web page contains instructions on how to access all documents, including public comments, in the docket.

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

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SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Final Determination

Title III, Part B [1] of the Energy Policy and Conservation Act, as amended (''EPCA''),[2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include fluorescent lamp ballasts, the subject of this final determination.

Pursuant to the EPCA requirement that not later than 6 years after issuance of any final rule establishing or amending an energy conservation standard for a covered product, DOE must publish either a notice of determination indicating that standards for the product do not need to be amended, or a notice of proposed rulemaking (''NOPR'') including new proposed energy conservation standards. (42 U.S.C. 6295(m)(1)(A) and (B))

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

[2] All references to EPCA in this document refer to the statute as amended through America's Water Infrastructure Act of 2018, Public Law 115–270 (October 23, 2018).

DOE analyzed fluorescent lamp ballasts subject to standards specified in title 10 of the Code of Federal Regulations (''CFR'') 430.32(m). In addition, DOE evaluated whether current standards should be extended to additional fluorescent lamp ballasts. Specifically, DOE considered standards for dimming ballasts and 4-foot T8 medium bipin (''MBP'') programmed start (''PS'') ballasts with an average current less than 140 milliampere (''mA'') (hereafter low-current PS ballasts). Hence, potential amended energy conservation standards in this final determination refer not only to changes to existing standards but also extension of standards to additional fluorescent lamp ballasts.

DOE first analyzed the technological feasibility of more efficient fluorescent lamp ballasts. For those fluorescent lamp ballasts for which DOE determined it to be technologically feasible to have higher standards or be subject to standards, DOE estimated energy savings that would result from potential energy conservation standards by conducting a national impact analysis (''NIA''). DOE evaluated whether these amended standards would be cost effective by conducting life-cycle cost (''LCC'') and payback period (''PBP'') analyses, and estimated the net present value (''NPV'') of the total costs and benefits experienced by consumers. In addition to the consideration of these criteria, DOE conducted a manufacturer impact analyses (''MIA'').

Based on the results of these analyses summarized in section V of this document, DOE has determined that current standards for fluorescent lamp ballasts do not need to be amended because amended standards would not be cost effective and would not result in significant energy savings.

II. Introduction

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

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 fluorescent lamp ballasts, the subject of this document. (42 U.S.C. 6292(a)(13)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(g)(5), and directs DOE to conduct future rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(g)(7)(A)–(B)) Through amendments to EPCA under the Energy Policy Act of 2005 (''EPACT 2005''), Public Law 109–58, Congress promulgated new energy conservation standards for certain fluorescent lamp ballasts. (EPACT 2005 section 135(c)(2); codified at 42 U.S.C. 6295(g)(8)(A))

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 the 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 fluorescent lamp ballasts appear at title 10 CFR part 430, subpart B, appendix Q.

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

Pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (''EISA 2007''), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE's current test procedure and standards for fluorescent lamp ballasts address standby mode and off mode energy use. In this analysis, DOE considers such energy use in its determination of whether energy conservation standards need to be amended.

DOE is issuing this final determination pursuant to 42 U.S.C. 6295(m), which states that 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. As a result of this review, DOE must either publish 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 make a new determination and publish either a notice of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(3)(B))

DOE must make the analysis on which the 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 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)) 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 that DOE 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 of, or initial charges for, or maintenance expenses of, the covered products that are likely to result from the standard. (42 U.S.C. 6295(n)(2) and 42 U.S.C. 6295(o)(2)(B)(i)(II))

B. Background

1. Current Standards

In a final rule published on November 14, 2011, DOE prescribed the current energy conservation standards for fluorescent lamp ballasts manufactured on and after November 14, 2014 (''2011 FL Ballast Rule''). 76 FR 70548. These standards require a minimum power factor of 0.9 or greater for ballasts that are not residential ballasts or 0.5 or greater for residential ballasts and a minimum ballast luminous efficiency (''BLE'') as set forth in DOE's regulations at 10 CFR 430.32(m) and repeated in Table II.1.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR FLUORESCENT LAMP BALLASTS

BLE = A / (1 + B * average total lamp arc power ^ − C) Where A, B, and C are as follows:

Description	A	B	C
Instant start and rapid start ballasts (not classified as residential) that are designed and marketed to operate:	0.993	0.27	0.25
4-foot medium bipin lamps.			
2-foot U-shaped lamps.			
8-foot slimline lamps.			
Programmed start ballasts (not classified as residential) that are designed and marketed to operate:	0.993	0.51	0.37
4-foot medium bipin lamps.			
2-foot U-shaped lamps.			
4-foot miniature bipin standard output lamps.			
4-foot miniature bipin high output lamps.			
Instant start and rapid start ballasts (not classified as sign ballasts) that are designed and marketed to operate 8-foot high output lamps	0.993	0.38	0.25
Programmed start ballasts (not classified as sign ballasts) that are designed and marketed to operate 8-foot high output lamps	0.973	0.70	0.37
Sign ballasts that are designed and marketed operate 8-foot high output lamps	0.993	0.47	0.25
Instant start and rapid start residential ballasts that are designed and marketed operate:	0.993	0.41	0.25
4-foot medium bipin lamps.			
2-foot U-shaped lamps.			
8-foot slimline lamps.			
Programmed start residential ballasts that are designed and marketed to operate:	0.973	0.71	0.37
4-foot medium bipin lamps.			
2-foot U-shaped lamps.			

2. History of Standards Rulemaking for Fluorescent Lamp Ballasts

In support of the present review of the fluorescent lamp ballast energy conservation standards, DOE prepared the ''Energy Conservation Standards Rulemaking Framework Document for Fluorescent Lamp Ballasts'' (''Framework Document''), which describes the procedural and analytical approaches DOE anticipated using to evaluate energy conservation standards for fluorescent lamp ballasts. On June 23, 2015, DOE published a notice announcing the availability of the Framework Document. 80 FR 35886. The Framework Document is available in the docket provided under the **ADDRESSES** section. DOE held a public meeting on July 17, 2015, at which it described the various analyses that DOE would conduct as part of its review of the energy conservation standards for fluorescent lamp ballasts, such as the engineering analysis, the LCC and PBP analyses, and the NIA. Representatives for manufacturers, trade associations, environmental and energy efficiency advocates, and other interested parties attended the meeting. The transcript of the public meeting is available in the docket provided under the **ADDRESSES** section.

On October 22, 2019, DOE published a notice of proposed determination (''October 2019 NOPD'') with the initial determination that energy conservation standards for fluorescent lamp ballasts do not need to be amended. 84 FR 56540. DOE held a webinar on October 30, 2019 to discuss the analysis and results of the October 2019 NOPD. A transcript of the webinar is available in the docket provided under the **ADDRESSES** section.

DOE received six comments in response to the October 2019 NOPD from the interested parties listed in Table II.2.

TABLE II.2—OCTOBER 2019 NOPD WRITTEN COMMENTS

Organization(s)	Reference in this final determination	Organization type
Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE).	CA IOUs	Utilities.
Signify North America Corporation	Signify	Manufacturer.
National Electrical Manufacturers Association	NEMA	Trade Association.
Lutron Electronics Co., Inc	Lutron	Manufacturer.

TABLE II.2—OCTOBER 2019 NOPD WRITTEN COMMENTS—Continued

Organization(s)	Reference in this final determination	Organization type
Institute for Policy Integrity	IPI	Think Tank.
John Danison	Danison	Individual.

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 the conclusions in this notice after considering oral and written comments, data, and information from interested parties that represent a variety of interests.

A. Product Classes and Scope of Coverage

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

The product classes for this proposed determination are discussed in further detail in section IV.B.3 of this document. This final determination covers fluorescent lamp ballasts defined as devices that are used to start and operate fluorescent lamps by providing a starting voltage and current and limiting the current during normal operation. 10 CFR 430.2. The scope of coverage is discussed in further detail in section IV.B.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. DOE's current energy conservation standards for fluorescent lamp ballasts are expressed in terms of BLE. 10 CFR 430.32(m)

DOE initiated a review of the FLB test procedure and on March 18, 2019, published a notice of proposed rulemaking (NOPR) for the FLB test procedure. In that NOPR DOE proposed to (1) update references to industry standards, (2) clarify the selection of reference lamps, (3) provide a second stabilization option for measuring ballast luminous efficiency, (4) provide a test procedure for measuring the performance of ballasts at light outputs less than full light output, and (5) revise the test procedure for measuring standby mode energy consumption. 84 FR 9910. In the final rule published September 14, 2020 DOE adopted (1) updates to references to industry standards, (2) clarification of selection reference lamps, (3) a second stabilization option for measuring BLE and general updates to the stabilization steps, and (4) revision of the standby mode energy consumption test procedure. 85 FR 56475. DOE did not adopt the proposed test procedure for measuring performance of ballasts at light output less than full light output. 85 FR 56485

C. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. Section 6(c)(1) of 10 CFR part 430, subpart C, appendix A (the ''Process Rule''). 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(c)(3)(i) and 7(b)(1) of the ''Process Rule''.

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(c)(3)(ii)–(v) and 7(b)(2)–(5) of the Process Rule. Section IV.C of this document discusses the results of the screening analysis for fluorescent lamp ballasts, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the final determination technical support document (''TSD'').

2. Maximum Technologically Feasible Levels

When DOE considers amended standards for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for fluorescent lamp ballasts, using the design parameters for the most efficient products available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.D 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''), DOE projected energy savings from the application of the EL to fluorescent lamp ballasts purchased in the 30-year period that begins in the year of compliance with the potential standards

[3] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for fluorescent lamp ballasts. (Docket No. EERE- EERE–2015–BT–STD–0006, which is maintained at *http://www.regulations.gov/docket?D=EERE-2015-BT-STD-0006*). The references are arranged as follows: (commenter name, comment docket ID number at page of that document).

(2023–2052).[4] The savings are measured over the entire lifetime of fluorescent lamp ballasts purchased in the 30-year analysis period. DOE quantified the energy savings attributable to each EL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of amended energy conservation standards.

DOE used its NIA spreadsheet models to estimate national energy savings (''NES'') from potential amended standards for fluorescent lamp ballasts. The NIA spreadsheet model (described in section IV.I 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. For natural gas, the primary energy savings are considered to be equal to the site energy savings. 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 multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section V.A.2.a 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); 42 U.S.C. 6295(n)(2)) The term ''significant'' is not defined in EPCA. DOE has established a significance threshold for energy savings. (See Section 6(b) of the Process Rule.) In evaluating the significance of energy savings, DOE conducts a two-step approach that considers both an absolute site energy savings threshold and a threshold that is the percent reduction in the covered energy use. *Id.* DOE first evaluates the projected energy savings from a potential max-tech standard over a 30-year period against a 0.3 quads of site energy threshold. (See Section 6(b)(2) of the Process Rule.) If the 0.3 quad-threshold is not met, DOE then compares the max-tech savings to the total energy usage of the covered equipment to calculate a percentage reduction in energy usage. (See Section 6(b)(3) of the Process Rule.) If this comparison does not yield a reduction in site energy use of at least 10 percent over a 30-year period, DOE proposes that no significant energy savings would likely result from setting new or amended standards. (See Section 6(b)(4) of the Process Rule.) The two-step approach allows DOE to ascertain whether a potential standard satisfies EPCA's significant energy savings requirements in 42 U.S.C. 6295(o)(3)(B) to ensure that DOE avoids setting a standard that ''will not result in significant conservation of energy.''

EPCA defines ''energy efficiency'' as the ratio of the useful output of services from a consumer product to the *energy use* of such product, measured according to the Federal test procedures. (42 U.S.C. 6291(5), *emphasis added*) EPCA defines ''energy use'' as the quantity of energy directly consumed by a consumer product at point of use, as measured by the Federal test procedures. (42 U.S.C. 6291(4)) Further, EPCA uses a household energy consumption metric as a threshold for setting standards for new covered products. (42 U.S.C. 6295(l)(1)(A–B)) Given this context, DOE relies on site energy as the appropriate metric for evaluating the significance of energy savings.

At the time of the October 2019 NOPD analysis, the two-step approach to determining significant energy savings had not been finalized. In the October 2019 NOPD, DOE reported the projected site energy savings over a 30-year analysis period for each EL evaluated. DOE tentatively determined in the October 2019 NOPD that amended standards at the evaluated ELs would not be cost effective. 84 FR 56540, 56583.

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 existing 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 is 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 must ultimately consider under 42 U.S.C. 6295(o)(2)(B) to support a finding of economic justification, if it is determined that amended standards are appropriate under the applicable statutory criteria. (42 U.S.C. 6295(o)(2)(B)(i)(II))

F. Other Analyses

In addition to the analyses conducted in consideration of the statutory criteria under EPCA's periodic review requirement at 42 U.S.C. 6295(m)(1), DOE also conducted an MIA that determines the potential economic impact of amended standards on FLB manufacturers.

The analyses employed by DOE in its consideration of each of the criteria applied are discussed in the following sections.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this final determination with regards to fluorescent lamp ballasts. Separate subsections address each component of DOE's analyses and respond to comments received.

A. Analysis Approach and Determination

DOE conducted several analyses (described in the following subsections) to estimate the impact of the standards considered in this document. Several of these analyses utilized spreadsheets as tools to generate quantitative results. The first spreadsheet calculates the LCC savings and PBP of potential amended or new energy conservation standards. The NIA uses a second spreadsheet set that provides shipments projections and calculates NES and net NPV of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet, the Government

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

[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).

Regulatory Impact Model (''GRIM''), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this rulemaking: *https://www.regulations.gov/docket?D=EERE-2015-BT-STD-0006.*

DOE received several comments on its analytical approach. IPI stated that by not including an analysis of potential emissions reductions from setting higher efficiency standards for fluorescent lamp ballasts DOE violated the statutory requirements. (IPI, No. 26 at p. 1) First, IPI discussed the significance of energy conservation criteria and asserted that even if significance of the energy conservation, technological feasibility, and cost effectiveness are the criteria for a determination, emissions reductions are directly relevant to the ''significance'' of the energy savings. Further, IPI stated that ''significance'' can be evaluated by comparing whether the ''value'' of energy savings ''outweighed'' the ''cost'' (citing *NRDC* v. *Herrington,* 768 F.2d 1355, 1374 n.19 (D.C. Cir. 1985)) and under that interpretation, environmental benefits should be a central factor in weighing the significance of energy savings. (IPI, No. 26 at p. 2) IPI further asserted EPCA provides analogous factors to the ''significance of energy'' criteria, such as consideration of the ''need for national energy . . . conservation'' in evaluating the economic justification for standards, which include consideration of environmental effects, and that DOE must consider these additional factors. (IPI, No. 26 at pp. 2, 3; referencing *Zero Zone Inc.* v. *Dept. of Energy,* 832 F.3d 654, 677 (7th Cir. 2016)) IPI also relied on court interpretations of statutory authority other than that governing the Appliance Standards Program. (IPI, No. 26 at p. 3)

Second, IPI discussed DOE's reliance on cost effectiveness rather than economic justification for the determination. IPI stated that DOE summarizes it review of standards as fulfilling the requirements ''to periodically determine whether more stringent, amended standards would be technologically feasible and economically justified'', but failed to explain why it ignored the factors for determining if a standard is economically justified. IPI asserted that there are two possible outcomes outlined in 42 U.S.C. 6295(m)(1) of a single review process and that criteria for developing an amended standard should be relevant in determination if amended standards are appropriate or not, which includes ''the need for nation energy . . . conservation''. (IPI, No. 26 at pp. 2–3)

Additionally, IPI stated that by not including an analysis of the potential emissions reductions and the monetized values of such reductions, DOE violated the 2015 Framework Document, which described emissions analysis as part of the methodology DOE would employ. Additionally, IPI stated DOE contravened past DOE practices of routinely analyzing emissions and considering the social cost of greenhouse gasses in its analysis. (IPI, No. 26 at p. 1)

DOE disagrees with IPI's characterization of the statutory requirements applicable in the present case. In the Process Rule, DOE defined how to determine significance of energy savings under EPCA and developed a two-step process to make that determination. (See 85 FR 8703, 8655–8676.) In this rulemaking DOE applied the two-step approach which considers both an absolute site energy savings threshold and a threshold that is the percent reduction in the covered energy use. (See Section 6(b) of the Process Rule.)

Further, as stated in section II.A of this document, DOE is issuing this final determination pursuant to periodic review required under 42 U.S.C. 6295(m). Section 6295(m) provides that not later than 6 years after issuance of any final rule establishing or amending a standard, the Secretary of Energy (''Secretary'') shall publish (A) a notice of the determination of the Secretary that standards for the product do not need to be amended, based on the criteria established under subsection (n)(2); or (B) a notice of proposed rulemaking including new proposed standards based on the criteria established under subsection (o) and the procedures established under subsection (p). (42 U.S.C. 6295(m)(1)(A) and (B)) The statute plainly provides two separate sets of criteria—one set for a determination that standards do not need to be amended, and one set for proposed standards. The criteria that are the basis for proposed standards include the requirements that any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(m)(1)(B) and 42 U.S.C. 6295(o)(2)(A) and 42 U.S.C. 6295(3)(B)) A determination of ''economically justified'' requires consideration of seven factors,[6] including the ''need for national energy conservation'' factor cited by IPI. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

However, DOE did not propose amended or new standards for fluorescent lamp ballasts, and is not adopting any such amendments. DOE proposed to determine that energy conservation standards for fluorescent lamp ballasts do not need to be amended. EPCA explicitly provides a more limited set of criteria on which a determination that standards do not need to be amended must be based. Such a determination 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 42 U.S.C. 6295(n)(2); *emphasis added*) The ''cost effective'' consideration is a more limited consideration than the ''economically justified'' consideration required for proposing and adopting amended energy conservation standards.

EPCA specifies that consideration of cost effectiveness requires DOE consider, only one of the seven factors for economic justification, 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 42 U.S.C. 6295(o)(2)(B)(i)(II)) The cost effectiveness evaluation required by the plain language of EPCA requires DOE to evaluate impacts to consumers (*i.e.,* operating costs and increase in initial price). DOE has historically addressed the ''cost effectiveness'' criterion

[6] In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors: (1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard; (2) the savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard; (3) the total projected amount of energy (or as applicable, water) savings likely to result directly from the standard; (4) any lessening of the utility or the performance of the covered products likely to result from the standard; (5) the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard; (6) the need for national energy and water conservation; and (7) other factors the Secretary considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

through LCC, PBP, and NPV analyses,[7] and has continued to do so in the present case. IPI's reliance on the ''need for national energy conservation'' and related interpretations are misplaced. EPCA does not direct DOE to consider the ''need for national energy conservation'' as part of a determination that energy conservation standards do not need to be amended.

In advance of the October 2019 NOPD, DOE prepared the Framework Document, which describes the procedural and analytical approaches DOE anticipated using to evaluate FLB standards. As stated in that document, the Framework Document provided a starting point for developing standards used to facilitate input and was not definitive with respect to any issue to be determined in the rulemaking. (Framework Document, No. 1 at p. 1) Discussion of an emissions analysis in the Framework Document was presented in the context of the analyses DOE would expect to conduct for a NOPR, *i.e.,* analyses that would be conducted in support of proposed standards. (Framework Document, No. 1 at pp. 5–6) As stated, DOE is not proposing new or amended standards for fluorescent lamp ballasts.

DOE received general comments agreeing with its tentative conclusion in the October 2019 NOPD that amended FLB standards are not warranted. NEMA, Signify, Lutron, and CA IOUs agreed with DOE's proposed determination to not amend FLB standards. (NEMA, No. 24 at p. 2; Signify, No. 27 at p. 2; Signify, Public Meeting Transcript, No. 21 at p. 50; Lutron, No. 23 at p. 2; CA IOUs, No. 25 at p. 1) CA IOUs stated that because of the steady decline of ballast shipments due to advances in light-emitting diode (''LED'') luminaires, the changes in ballast technology to achieve what would be minimal energy savings are not warranted and would also likely not be cost effective. (CA IOUs, No. 25 at p. 2) Lutron also cited the small potential for energy savings and conclusions of DOE's NPV analysis as reasons not to amend standards. (Lutron, No. 23 at p. 2) NEMA stated that manufacturers are focusing on LED lighting systems and are not investing now or in the future in fluorescent ballast technology. NEMA stated that any changes to existing standards would result in manufacturers discontinuing products, thereby limiting product availability. NEMA stated that the burdens and negative impacts of such actions would not be outweighed by the minor energy savings that may remain at the max tech efficiency level. (NEMA, No. 24 at pp. 1–3) Signify added that regulatory action was not necessary to accelerate the transition from fluorescent lighting to LED lighting. (Signify, No. 27 at p. 2) Lutron agreed that amended standards would result in discontinuing products that in turn could require end users to replace entire systems when doing only minor retrofits or replacing failed components. (Lutron, No. 23 at p. 2)

NEMA asserted that there is naturally-occurring market adoption of LED technology by users of fluorescent technology. NEMA stated that the switch to LED fixtures can be triggered by (1) newer lamp/older ballast compatibility problems in lamp replacements, (2) ballast failure, (3) reducing electricity operating costs, or (4) building renovation. NEMA added that lower cost and longer life are driving forces for migration away from FLB technology, and this consumer and technology driven shift is a good example of ''other than regulatory action'' accomplishing an intended outcome without government regulation. NEMA concluded that regulations that impacted cost or availability of products to hasten migration to other technology are unnecessary. (NEMA, No. 24 at pp. 5–6)

Lutron requested that if DOE changed the conclusion of the proposed determination based on stakeholder comments, a supplementary NOPR or similar document with an updated analysis be published for comment. (Lutron, No. 23 at p. 2)

In this final determination, DOE is finalizing its initial conclusion that changes to FLB standards are not warranted (see section V.B for further details). The following sections describe the analyses DOE conducted in support of this final determination.

B. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. This activity includes both quantitative and qualitative assessments, based primarily on publicly-available information. The subjects addressed in the market and technology assessment for this rulemaking include: (1) A determination of the scope of the rulemaking and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends, and (6) technologies or design options that could improve the energy efficiency of fluorescent lamp ballasts. 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

Fluorescent lamp ballast means a device that is used to start and operate fluorescent lamps by providing a starting voltage and current and limiting the current during normal operation. 10 CFR 430.2. In this analysis, DOE relied on the definition of ''fluorescent lamp'' in 10 CFR 430.2, which provides the specific lamp lengths, bases, and wattages included by the term. Any product meeting the definition of fluorescent lamp ballast is included in DOE's scope of coverage, though all products within the scope of coverage may not be subject to standards.

As part of its review of energy conservation standards for fluorescent lamp ballasts, DOE evaluated whether current standards should be extended to additional fluorescent lamp ballasts.

Fluorescent lamp ballasts manufactured on or after November 14, 2014, that are designed and marketed to operate at an input voltage at or between 120 volts (V) and 277 V, to operate with an input current frequency of 60 hertz, and for use with fluorescent lamps as defined in 10 CFR 430.2 are currently required to comply with the energy conservation standards at 10 CFR 430.32(m)(1).

Fluorescent lamp ballasts manufactured on or after November 14, 2014, that are designed and marketed to operate at an input voltage at or between 120 and 277 V; to operate with an input current frequency of 60 hertz for dimming to 50 percent or less of the maximum output of the ballast; and to operate one or two F34T12 lamps, two F96T12 Energy Saver (''ES'') lamps, or two F96T12 high output (''HO'') ES lamps are required to comply with the energy conservation standards at 10 CFR 430.32(m)(2).

The following fluorescent lamp ballasts are exempt from standards: (1) A dimming ballast designed and marketed to operate exclusively lamp types other than one F34T12, two

[7] *See e.g.,* 76 FR 70548, 70595 (''Consumers affected by new or amended standards usually experience higher purchase prices and lower operating costs. Generally, these effects on individual consumers are best summarized by changes in LCCs and by the payback period.'') and 76 FR 70548, 70562 (''For consumers in the aggregate, DOE calculates the NPV from a national perspective of the economic impacts on consumers over the forecast period used in a particular rulemaking.'')

F34T12, two F96T12/ES, or two F96T12HO/ES lamps; (2) a low-frequency ballast that is designed and marketed to operate T8 diameter lamps, is designed and marketed for use in electromagnetic interference-sensitive-environments only, and is shipped by the manufacturer in packages containing 10 or fewer ballasts; and (3) a programmed start ballast that operates 4-foot medium bipin T8 lamps and delivers on average less than 140 mA to each lamp. 10 CFR 430.32(m)(3).

Of these exemptions, in the October 2019 NOPD, DOE included in the analysis all fluorescent lamp ballasts that are dimmable and PS ballasts operating 4-foot MBP T8 lamps and using less than 140 mA (*i.e.,* low-current PS ballasts). 84 FR 56540, 56545–56548.

In the October 2019 NOPD, DOE determined that alternative options such as using PS ballasts with operating current at 140 mA or higher, paired with reduced-wattage lamps or decreasing the number of lamps in the system could provide low light output levels comparable to those attained using low-current PS ballasts. DOE identified lamp-and-ballast replacements that maintained system light output within 10 percent of a lamp-and-ballast system using a low-current PS ballast and saved energy. Because reasonable alternatives to providing low light output utility offered by low-current PS ballasts were available, DOE found no reason to continue the exemption of low-current PS ballasts. DOE did not receive any comments on this assessment. 84 FR 56540, 56547. In this final determination, DOE continued to include low-current PS ballasts in the analysis.

In the October 2019 NOPD, DOE determined that standards for dimming ballasts could potentially result in energy savings. Since the 2011 FL Ballast Rule, DOE has observed an increase in dimming products. DOE's review of manufacturer catalogs indicates a wide range of dimming ballast products available for use with several lamp types.[8] Further, DOE has observed a range of efficiencies for dimming ballasts, indicating that less efficient products can be improved. Additionally, state and local regulations and building codes with increased dimming and/or lighting control requirements (*e.g.,* CA Title 24 and ANSI/ASHRAE/IES Standard 90.1–2016[9]) will continue to support installation of dimming ballasts in the near future. 84 FR 56540, 56545–56546. DOE did not receive any comments on this assessment. In this final determination, DOE continued to include dimming ballasts in the analysis.

In summary, in addition to fluorescent lamp ballasts subject to current energy conservation standards, in this analysis DOE evaluated all fluorescent lamp ballasts that are dimmable and PS fluorescent lamp ballasts that operate 4-foot T8 MBP lamps and deliver on average less than 140 mA to each lamp.

2. Metric

DOE's current energy conservation standards for fluorescent lamp ballasts are expressed in terms of BLE. It is calculated using the following equation where A, B, and C are predefined constants and power is the total lamp arc power operated by a ballast (see section IV.D.4 for further details):

$$BLE = \frac{A}{1 + B * power^{-C}}$$

NEMA stated that the constants used to determine BLE would need to be adjusted for dimming ballasts as these ballasts have greater fixed losses due to the additional functionality. (NEMA, No. 24 at p. 3)

In this final determination, as in the October 2019 NOPD, DOE evaluated dimming ballasts as a separate product class in order to account for the added circuitry in dimming ballasts that make them less efficient than comparable standard ballasts. (*See* section IV.B.3 and 84 FR 56540, 56555–6). Because dimming ballasts have a separate set of efficiency levels, a separate equation to account for their lower efficiency compared to standards ballasts is not required.

NEMA stated that due to complications in evaluating cathode heat losses, effective and repeatable BLE measurements of dimming ballasts could only be taken at full light output. (NEMA, No. 24 at p. 3) Signify agreed stating that at full light output when the filament (*i.e.,* cathode) heating circuit is disconnected. (Signify, No. 27 at p. 1) NEMA also commented that as ballasts enter dimming mode, the operational frequency increases, as well introducing instrument uncertainty. Additionally, NEMA stated that while no change is required to the current DOE test procedure for measuring dimming ballasts at 100 percent light output, at any other light output, a new test circuit and multiport power analyzer equipment would be required. (NEMA, No. 24 at p. 3)

No comments were received suggesting that dimming ballasts be tested at an output other than 100 percent.

This analysis is based on measuring the BLE at full light output for all ballasts, including dimming ballasts.

3. 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)(1))

In the October 2019 NOPD, DOE assessed the product classes shown in the following list in its analysis. 84 FR 56540, 56556. In describing product classes, DOE includes the types of lamps each class of ballast operates. In the October 2019 NOPD, DOE updated the lamp types for existing product classes based on a review of the latest product offerings on the market and added 4-foot miniature bipin (MiniBP) standard output (''SO'') and 4-foot MiniBP HO lamp types to the instant start (''IS'')/rapid start (''RS'') (not classified as residential), IS/RS residential, and PS residential product classes. *Id.* Additionally, DOE evaluated dimming ballasts as a separate product class. *Id.* at 84 FR 56555. The product classes assessed are as follows:

(1) IS and RS ballasts (not classified as residential) that operate
  (a) 4-foot MBP lamps
  (b) 2-foot U-shaped lamps
  (c) 4-foot MiniBP SO lamps
  (d) 4-foot MiniBP HO lamps
  (e) 8-foot single pin (''SP'') slimline lamps
(2) PS ballasts (not classified as residential) that operate
  (a) 4-foot MBP lamps
  (b) 2-foot U-shaped lamps
  (c) 4-foot MiniBP SO lamps
  (d) 4-foot MiniBP HO lamps
(3) IS and RS ballasts (not classified as sign ballasts) that operate
  (a) 8-foot HO lamps
(4) PS ballasts (not classified as sign ballasts) that operate
  (a) 8-foot HO lamps
(5) Sign ballasts that operate
  (a) 8-foot HO lamps
(6) IS and RS residential ballasts that operate

[8] Specifically, 4-foot MBP lamps, 2-foot U-shaped lamps, 4-foot MiniBP SO lamps, and 4-foot MiniBP HO lamps.

[9] American Society of Heating, Refrigerating, and Air-Conditioning Engineers. *ANSI/ASHRAE/IES Standard 90.1–2016—Energy Standard for Buildings Except Low-Rise Residential Buildings.* Atlanta, GA: ASHRAE, 2016.

(a) 4-foot MBP lamps
(b) 2-foot U-shaped lamps
(c) 4-foot MiniBP SO lamps
(d) 4-foot MiniBP HO lamps
(e) 8-foot SP slimline lamps
(7) PS residential ballasts that operate
(a) 4-foot MBP lamps
(b) 2-foot U-shaped lamps
(c) 4-foot MiniBP SO lamps
(d) 4-foot MiniBP HO lamps
(8) Dimming ballasts that operate
(a) 4-foot MBP lamps
(b) 2-foot U-shaped lamps
(c) 4-foot MiniBP SO lamps
(d) 4-foot MiniBP HO lamps

Id. at 84 FR 56556.

DOE did not receive comments on product classes presented in the October 2019 NOPD. In this final determination DOE continues to separate fluorescent lamp ballasts into the same product classes as in the October 2019 NOPD. See chapter 3 of the final determination TSD for further discussion.

4. Technology Options

In the October 2019 NOPD market and technology assessment, DOE identified the technology options listed in Table IV.1 to improve the efficiency of fluorescent lamp ballasts, as measured by the DOE test procedure.

TABLE IV.1—FLUORESCENT LAMP BALLAST TECHNOLOGY OPTIONS

Technology option	Description
Electronic ballast	Use an electronic ballast design
Improved Components:	
Transformers/Inductors	Use litz wire to reduce winding losses. Use wire with multiple smaller coils instead of one larger coil to increase the number of turns of wire. Use optimized-gauge copper to increase the conductor cross section to reduce winding losses. Use shape-optimized winding to reduce the proximity effect. Use low-loss ferrite materials to create the core of the inductor.
Diodes	Use diodes with a lower voltage drop.
Capacitors	Use capacitors with a lower effective series resistance.
Transistors	Use transistors with low drain-to-source resistance.
Improved Circuit Design:	
Cathode Cutout or Cutback	Remove or reduce cathode/filament heating after lamp has started.
Integrated Circuits	Substitute discrete components with an integrated circuit.
Starting Method	Use the IS starting method instead of a rapid start RS starting method.

84 FR 56540, 56552.

CA IOUs stated that the use of smaller coils or increasing steel laminations would cause larger ballast sizes and that shape-optimized windings are not cost effective for the small savings potential. (CA IOUs, No. 25 at p. 1)

As an initial matter, DOE does not consider cost when identifying technology options; a cost assessment of each efficiency level is assessed in the LCC and PBP analysis and NIA. Using multiple smaller coils instead of one larger coil will increase the number of turns of wire, which can increase the induced voltage, and thereby minimize losses from the transformer.[10] The total number of windings needed is divided into several coils, which allows for greater flexibility in utilizing the space of the assembly and not changing the size of the ballast.[11] Regarding increasing steel laminations, this technology option was not proposed in the October 2019 NOPD as DOE determined that it may not minimize losses in ballasts that operate at high frequencies (*i.e.,* electronic ballasts), which are the ballasts analyzed in this determination. 84 FR 56540, 56551.

NEMA asserted that there had been no technological changes in FLB technology since the last DOE energy conservation standards rule on fluorescent lamp ballasts became effective in 2014. (NEMA, No. 24 at p. 2)

Based on DOE's review of the product offerings and their efficiencies in manufacturer catalogs and DOE's Compliance Certification Database (''CCD''), there are ballasts on the market at multiple levels of efficiencies. DOE finds that the technology options identified, individually and/or in combination, are being utilized to improve the efficiency of products.

DOE continues to consider the technology options identified in the October 2019 NOPD (see Table IV.1) in this final determination. See chapter 3 of the final determination TSD for further discussion.

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

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

(5) *Unique-Pathway Proprietary Technologies.* If a technology has proporiety protection and represents a unique pathway to achieving a given

[10] US20110018666A1, Multiple coils fluorescent lamp ballast. April 1, 2008. Available at *https://patents.google.com/patent/US20110018666.*

[11] US20110018666A1, Multiple coils fluorescent lamp ballast. April 1, 2008. Available at *https://patents.google.com/patent/US20110018666.*

efficiency level, it will not be considered further.

Sections 6(c)(3) and 7(b) of the Process Rule.

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.

1. Screened-Out Technologies

In the October 2019 NOPD, DOE did not screen out any technology options identified. DOE did not receive any comments on technology options that should be screened out. 84 FR 56540, 56554. In this final determination, DOE did not screen out any technology options identified.

2. Remaining Technologies

Through a review of each technology, DOE concludes that all of the identified technologies listed in section IV.B.4 meet all five screening criteria and are examined further as design options. In summary, DOE did not screen out the following technology options:

(1) Electronic Ballasts
(2) Improved Components
(a) Use litz wire to reduce winding losses.
(b) Use wire with multiple smaller coils instead of one larger coil to increase the number of turns of wire.
(c) Use optimized-gauge copper or increase the conductor cross section to reduce winding losses.
(d) Use shape-optimized winding to reduce the proximity effect losses.
(e) Use diodes with lower voltage drop to lower losses.
(f) Use capacitors with a lower effective series resistance.
(g) Use transistors with low drain-to-source resistance.
(h) Use low-loss ferrite to create the core of the inductor.
(3) Improved Circuit Design
(a) Remove filament heating after the lamp has started.
(b) Substitute discrete components with an integrated circuit.

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 these technology options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service; do not result in adverse impacts on product utility, product availability, health, or safety; and are not proprietary).

John Danison, an individual commentator, stated researchers should make fluorescent lamp ballasts safer, more cost effective, and last longer. He stated the current expectancy of a ballast is 6 months after which it will start leaking and/or sparking, and if a bad ballast burns, it could release toxins resulting in serious health issues. (Danison, No. 22 at p. 1)

As noted, DOE has determined that the design options used to achieve the efficiency of fluorescent lamp ballasts do not have an adverse impact on product utility or safety. Danison provided references regarding pre-1979 ballast technology and general information on fluorescent ballasts but did not provide any support for his stated safety concern, and DOE was unable to verify it through other resources. DOE did not receive any comments during any phase of this rulemaking or the previous 2011 FL Ballast Rule to indicate that a ballast's life expectancy is only 6 months or that its mode of failure could present health and safety concerns. DOE also did not find any similar concerns cited in relevant product or industry literature. Therefore, DOE continues to consider the design options identified in the October 2019 NOPD in this final determination. For additional details, see chapter 4 of the final determination TSD.

D. Engineering Analysis

As in the October 2019 NOPD, for this final determination, DOE selected more efficient substitutes in the engineering analysis and determined the end-user consumer prices of those substitutes in the product price determination. DOE estimated the consumer price of ballasts directly because reverse engineering ballasts is impractical due to the use of potting, which is a black pitch added to the ballast enclosure to reduce vibration damage and act as a heat sink for the circuit board. Potting does not allow for the visual observation and identification of individual components of the ballast making it infeasible to apply a reverse-engineering approach. By combining the results of the engineering analysis and the product price determination, DOE derived typical inputs for use in the LCC analysis and NIA. Section IV.E discusses the product price determination (see chapter 6 of the final determination TSD for further detail).

The methodology for the engineering analysis consists of the following steps:

(1) selecting representative product classes,
(2) selecting baseline ballasts,
(3) identifying more efficient substitutes,
(4) developing efficiency levels, and
(5) scaling efficiency levels to non-representative product classes.

DOE used the BLE values from the compliance certification database to identify ballasts for all product classes except dimming. Because most dimming ballasts are not currently subject to standards and therefore do not have data in the compliance certification database, DOE determined BLE values by using catalog input power and the associated total lamp arc power. As fluorescent lamp ballasts are designed to operate fluorescent lamps, DOE considered properties of the entire lamp-and-ballast system in the engineering analysis. DOE paired baseline and more-efficient ballasts with full-wattage and/or reduced wattage lamps, where appropriate, to reflect the most common configurations of lamp-and-ballast systems.

The results of these steps are summarized in the following sections. The details of the engineering analysis are discussed in chapter 5 of the final determination TSD.

1. Representative Product Classes

In the case where a covered product has multiple product classes, DOE may identify and select certain product classes as ''representative'' and concentrates its analytical effort on those classes. For fluorescent lamp ballasts, DOE chose product classes as representative primarily because of their high market volumes. Within certain representative product classes, DOE also selected multiple representative ballast types to account for multiple high-volume units within the same product class.

Table IV.2 shows the FLB product classes, and shaded in grey are the representative product classes and representative ballast types selected for analysis in the October 2019 NOPD.

TABLE IV.2—REPRESENTATIVE PRODUCT CLASSES AND REPRESENTATIVE BALLAST TYPES

Product class description *	Representative ballast type(s)
IS/RS Commercial	
IS/RS Commercial ballasts that operate:	2L 4-foot MBP; 4L 4-foot MBP, 2L 8-foot SP slimline.

TABLE IV.2—REPRESENTATIVE PRODUCT CLASSES AND REPRESENTATIVE BALLAST TYPES—Continued

Product class description *	Representative ballast type(s)
• 4-foot MBP. • 2-foot U-shaped. • 4-foot MiniBP SO. • 4-foot MiniBP HO. • 8-foot SP slimline lamps.	
PS Commercial	
PS Commercial ballasts that operate: • 4-foot MBP • 2-foot U-shaped • 4-foot T5 SO • 4-foot T5 HO lamps	2L 4-foot MBP, 4L 4-foot MBP, 2L 4-foot MiniBP SO, 2L 4-foot MiniBP HO.
IS/RS 8-foot HO	
IS/RS ballasts that operate 8-foot HO lamps	2L 8-foot recessed double contact (RDC) HO.
PS 8-foot HO	
PS ballasts that operate 8-foot HO lamps	N/A.
Sign	
Sign ballasts that operate 8-foot HO lamps	4L 8-foot RDC HO.
IS/RS Residential	
IS/RS Residential ballasts that operate: • 4-foot MBP. • 2-foot U-shaped. • 4-foot MiniBP SO. • 4-foot MiniBP HO. • 8-foot SP slimline lamps.	2L 4-foot MBP.
PS Residential	
PS Residential ballasts that operate: • 4-foot MBP. • 4-foot MiniBP SO. • 4-foot MiniBP HO. • 2-foot U-shaped.	N/A.
Dimming	
Dimming ballasts that operate: • 4-foot MBP. • 4-foot MiniBP SO. • 4-foot MiniBP HO. • 2-foot U-shaped.	2L 4-foot MBP 0–10V, 2L 4-foot MiniBP SO 0–10 V, 2L 4-foot MiniBP HO 0–10 V.

* Grey shading indicates a representative product class.

84 FR 56540, 56558.

DOE did not receive any comments on the representative product classes presented in the October 2019 NOPD. DOE continues to analyze the representative product classes analyzed in the October 2019 NOPD in this final determination.

2. Baseline Ballasts

For each representative product class, DOE selected a baseline ballast as a reference point against which to measure changes resulting from energy conservation standards. Typically, the baseline ballast is the most common, least efficient ballast that meets existing energy conservation standards. In this analysis, DOE selected as baselines the least efficient ballast meeting standards that operated the most common lamp type (*i.e.,* wattage and diameter) and where possible, has the most common ballast factor, input voltage, and operating voltage type [12] for the product class. In the October 2019 NOPD, DOE directly analyzed the baseline ballasts shown in Table IV.3.

TABLE IV.3—BASELINE BALLASTS

Product class	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage * (*V*)	Power factor	Ballast factor	Input power (*W*)	BLE
IS/RS Commercial	2L 4-foot MBP	32 W T8	IS	277, Universal	0.97	0.89	57.6	0.903
	4L 4-foot MBP	32 W T8	IS	277, Universal	0.98	0.88	112.2	0.916
	2L 8-foot SP slimline	59 W T8	IS	277, Universal	0.98	0.88	109.2	0.920
PS Commercial	2L 4-foot MBP	32 W T8	PS	277, Universal	0.90	0.88	57.1	0.900
	4L 4-foot MBP	32 W T8	PS	277, Universal	0.90	0.87	110.5	0.920
	2L 4-foot MiniBP SO	28 W T5	PS	277, Universal	0.98	1.00	62.4	0.891
	2L 4-foot MiniBP HO	54 W T5	PS	277, Universal	0.98	0.99	116.8	0.912
IS/RS 8-foot HO	2L 8-foot RDC HO	110 W T12	RS	277, Universal	0.99	0.89	197.7	0.900
Sign	4L 8-foot RDC HO	110 W T12	RS	120, Dedicated	0.90	** 0.61	271.6	0.898
IS/RS Residential	2L 4-foot MBP	32 W T8	IS	120, Dedicated	0.50	0.88	58.9	0.872
Dimming	2L 4-foot MBP 0–10V	32 W T8	PS	277, Universal	0.98	0.88	59.0	0.871
	2L 4-foot MiniBP SO 0–10V	28 W T5	PS	277, Universal	0.98	1.00	64.0	0.869

[12] Operating voltage type denotes whether the ballast can operate multiple voltages and is considered universal or can only operate one voltage and is considered dedicated.

TABLE IV.3—BASELINE BALLASTS—Continued

Product class	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage * (*V*)	Power factor	Ballast factor	Input power (*W*)	BLE
	2L 4-foot MiniBP HO 0–10V	54 W T5	PS	277, Universal	0.98	1.00	118.0	0.912

* Universal indicates that the ballast can operate multiple voltages (*i.e.,* 120 V or 277 V); dedicated indicates it can only operate the voltage specified.
** DOE found limited information on ballast factors of ballasts in the Sign product class. Based on this information, DOE used the most common ballast factor found in catalogs for the product class for representative units that did not specify ballast factor.

84 FR 56540, 56559.

DOE did not receive any comments on the baseline ballasts selected in the October 2019 NOPD and maintained the selected baseline ballasts for this final determination. See chapter 5 of the final determination TSD for more detail.

3. More Efficient Ballasts

In the analysis for the October 2019 NOPD, DOE selected more-efficient ballasts as replacements for each of the baseline ballasts by considering technologies not eliminated in the screening analysis. 84 FR 56540, 56559. DOE considered these technologies in the engineering analysis, either by modeling potential efficiency improvements due to the design options or by analyzing commercially available ballasts in which the design options are incorporated. *Id.*

DOE selected a more-efficient fluorescent lamp ballast with the same or similar ballast factor as the baseline ballast, so that light output would be maintained without needing to change the spacing of the fixture. *Id.* Specifically, DOE ensured that potential substitutes maintained the system light output within 10 percent of the baseline lamp-and-ballast system light output. *Id.* Finally, DOE selected more-efficient substitutes that showed an improvement in BLE and a reduction in input power. *Id.*

DOE did not receive any comments on the more-efficient ballasts selected in the October 2019 NOPD. DOE maintained the more-efficient ballasts selected in the October 2019 NOPD for this final determination. See section IV.D.4 and chapter 5 of the final determination TSD for more detail.

4. Efficiency Levels

After identifying more-efficient substitutes for each of the baseline ballasts, DOE developed ELs based on the consideration of several factors, including: (1) The design options associated with the specific ballasts being studied, (2) the ability of ballasts across wattages to comply with the standard level of a given product class, and (3) the max-tech level. In the October 2019 NOPD, DOE used the same equation-based approach used in the 2011 FL Ballast Rule. 84 FR 56540, 56560. DOE determined that a power law equation best modeled the observed trend between total lamp arc power and average BLE. Specifically, DOE used the following equation to develop ELs that relate the total lamp arc power operated by a ballast to BLE:

$$BLE = \frac{A}{1 + B * power^{-C}}$$

The ELs and the characteristics of the representative units identified in the October 2019 NOPD (84 FR 56540, 56564) are summarized in Table IV.4 to Table IV.9. Product classes have up to two or three levels of efficiencies. EL 1 represents an improved ballast with more-efficient components (*e.g.,* transformers, diodes, capacitors, transistors) that minimize losses and improved circuit design (*e.g.,* integrated circuitry). EL 2 represents an advanced ballast with improved components and improved circuit design. EL 3 represents a ballast with the most efficient combination of improved components and circuit design.

CA IOUs stated that the last FLB standards rule set requirements that drove the market to achieve the highest tier of efficiency practically available and they were unaware of higher efficiency ballasts on the market. CA IOUs stated that ballasts on the market are at or close to achieving the highest operational efficiency that is still cost effective, and there is no premium ballast that represents EL 4. (CA IOUs, No. 25 at pp. 1–2) NEMA also commented that no changes should be made to the ELs. (NEMA, No. 24 at p. 3)

Signify stated it was unsure of the validity of the data used to project a BLE increase from 0.913 (EL 1) to 0.940 (max-tech) for the 2-lamp 4-foot MBP ballasts in the IS/RS commercial product class and that it had to conduct a more detailed review. Signify further stated that regardless, the increase in BLE is too small to support amending standards. (Signify, No. 27 at p. 1)

DOE used BLE values certified by manufacturers in the DOE compliance certification database to develop efficiency levels. For each representative ballast type, DOE examined the spread of BLE values, including clusters of similar BLE values and distinctive increases in BLE values to identify ELs. DOE also examined BLE values for different product families for each of several manufacturers to confirm tiers of efficiencies.

DOE maintained the ELs and associated representative units presented in the October 2019 NOPD in this final determination. The ELs and the representative units for each representative product class are shown in Table IV.4 through Table IV.9. See chapter 5 of the final determination TSD for more detail.

TABLE IV.4—IS/RS COMMERCIAL REPRESENTATIVE UNITS

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage, (*V*)*	Power factor	Ballast factor	Input power (*W*)	BLE
IS/RS Commercial	EL 1	2L 4-foot MBP	32 W T8	IS	277, Universal	0.98	0.88	56.3	0.913
		4L 4-foot MBP	32 W T8	IS	277, Universal	0.98	0.88	110.9	0.927
		2L 8-foot SP slimline	59 W T8	IS	277, Universal	0.98	0.88	108.5	0.926
IS/RS Commercial	EL 2	2L 4-foot MBP	32 W T8	IS	277, Universal	0.98	0.88	55.7	0.923
		4L 4-foot MBP	32 W T8	IS	277, Universal	0.98	0.88	109.7	0.937
		2L 8-foot SP slimline	59 W T8	IS	277, Universal	0.98	0.87	106.4	0.934
IS/RS	EL 3	2L 4-foot MBP	32 W T8	IS	277, Universal	0.99	0.89	55.3	0.940
		4L 4-foot MBP	32 W T8	IS	277, Universal	0.98	0.87	107.0	0.950

TABLE IV.4—IS/RS COMMERCIAL REPRESENTATIVE UNITS—Continued

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage, (V)*	Power factor	Ballast factor	Input power (W)	BLE
		2L 8-foot SP slimline**	59 W T8	IS	277, Universal	0.98	0.87	105.1	0.945

* Universal indicates that the ballast can operate multiple voltages (*i.e.,* 120 V or 277 V).
** Grey shading indicates a modeled product.

TABLE IV.5—PS COMMERCIAL REPRESENTATIVE UNITS

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage (V*)	Power factor	Ballast factor	Input power (W)	BLE
PS Commercial	EL 1	2L 4-foot MBP	32 W T8	PS	277, Universal	0.97	0.88	56.3	0.913
		4L 4-foot MBP	32 W T8	PS	277, Universal	0.98	0.87	109.5	0.928
		2L 4-foot MiniBP SO	28 W T5	PS	277, Universal	0.98	1.00	61.4	0.905
		2L 4-foot MiniBP HO	54 W T5	PS	277, Universal	0.97	1.00	115.9	0.928
	EL 2	2L 4-foot MBP	32 W T8	PS	277, Universal	0.98	0.88	53.9	0.953
		4L 4-foot MBP	32 W T8	PS	277, Universal	0.99	0.87	107.6	0.944
		2L 4-foot MiniBP SO	28 W T5	PS	277, Universal	0.98	1.00	59.8	0.929
		2L 4-foot MiniBP HO	54 W T5	PS	277, Universal	0.98	1.00	113.6	0.947

* Universal indicates that the ballast can operate multiple voltages (*i.e.,* 120 V or 277 V).

TABLE IV.6—IS/RS 8-FOOT HO REPRESENTATIVE UNITS

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage (V*)	Power factor	Ballast factor	Input power (W)	BLE
IS/RS 8-foot HO	EL 1	2L 8-foot RDC HO**	110 W T12	RS	277, Dedicated	0.98	0.90	192.7	0.934
	EL 2	2L 8-foot RDC HO	110 W T12	RS	277, Universal	0.98	0.90	188.0	0.957

* Universal indicates that the ballast can operate multiple voltages (*i.e.,* 120 V or 277 V).

TABLE IV.7—SIGN REPRESENTATIVE UNITS

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage (V*)	Power factor	Ballast factor**	Input power (W)	BLE
Sign	EL 1	4L 8-foot RDC HO	110 W T12	IS	120, Dedicated	0.99	0.61	265.1	0.920
	EL 2	4L 8-foot RDC HO	110 W T12	IS	120, Dedicated	0.90	0.61	258.4	0.944

* Dedicated indicates it can only operate the voltage specified.
** DOE found limited information for ballast factor, and therefore used the most common ballast factor found in product class for representative units that did not specify ballast factor.

TABLE IV.8—IS/RS RESIDENTIAL REPRESENTATIVE UNITS

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage (V)*	Power factor	Ballast factor	Input power (W)	BLE
IS/RS Residential	EL 1	2L 4-foot MBP	32 W T8	IS	120, Dedicated	0.56	0.85	56.2	0.884
	EL 2	2L 4-foot MBP	32 W T8	IS	120, Dedicated	0.56	0.85	55.2	0.899
	EL 3	2L 4-foot MBP	32 W T8	IS	120, Dedicated	0.55	0.83	53.1	0.913

* Dedicated indicates it can only operate the voltage specified.

TABLE IV.9—DIMMING REPRESENTATIVE UNITS

Product class	EL	Ballast type	Lamp type	Starting method	Input voltage/ operating voltage (V)*	Power factor	Ballast factor	Input power (W)	BLE
Dimming	EL 1	2L 4-foot MBP 0–10V	32 W T8	PS	277, Universal	0.98	0.87	57.0	0.891
		2L 4-foot MiniBP SO 0–10V	28 W T5	PS	277, Universal	0.98	1.00	63.0	0.883
		2L 4-foot MiniBP HO 0–10 V	54 W T5	PS	277, Universal	0.98	1.00	118.0	0.912
	EL 2	2L 4-foot MBP 0–10V**							
		2L 4-foot MiniBP SO 0–10V	28W T5	PS	277, Universal	0.98	1.00	62.0	0.897
		2L 4-foot MiniBP HO 0–10 V**							
	EL 3	2L 4-foot MBP 0–10V	32 W T8	PS	277, Universal	0.99	0.88	56.0	0.918
		2L 4-foot MiniBP SO 0–10V	28 W T5	PS	277, Universal	0.99	1.00	61.0	0.911
		2L 4-foot MiniBP HO 0–10V	54 W T5	PS	277, Universal	0.98	1.00	115.9	0.928

* Universal indicates that the ballast can operate multiple voltages (*i.e.,* 120 V or 277 V).
** Grey shading indicates levels at which products did not exist.

Table IV.10 summarizes the efficiency requirements at each EL for the representative product classes.

TABLE IV.10—SUMMARY OF ELS FOR REPRESENTATIVE PRODUCT CLASSES

Representative product class	Efficiency level	BLE = A / (1 + B * total lamp arc power − C) where A, B, and C are as follows:		
		A	B	C
IS/RS Commercial	EL 1	0.993	0.24	0.25
	EL 2		0.21	
	EL 3		0.16	
PS Commercial	EL 1	0.993	0.43	0.37
	EL 2		0.31	
IS/RS Residential	EL 1	0.993	0.33	0.25
	EL 2		0.28	
	EL 3		0.24	
IS/RS 8-foot HO	EL 1	0.993	0.24	0.25
	EL 2		0.14	
Sign	EL 1	0.993	0.32	0.25
	EL 2		0.24	
Dimming	EL 1	0.993	0.56	0.37
	EL 2		0.48	
	EL 3		0.40	

5. Scaling to Other Product Classes

DOE identified and selected certain product classes as representative and analyzed these product classes directly. DOE chose these representative product classes primarily due to their high market volumes. The ELs for product classes that were not directly analyzed (''non-representative product classes'') were then determined by scaling the ELs of the representative product classes. Specifically, DOE did not analyze PS 8-foot HO ballasts or PS residential ballasts directly. In the October 2019 NOPD, DOE developed ELs for the PS 8-foot HO product class by scaling the ELs of the IS/RS 8-foot HO product class and developed ELs for PS residential product class by scaling the ELs of the IS/RS residential product class. 84 FR 56540, 56564. The primary difference between these sets of product classes is the starting method. From its analysis of pairs of ballasts between the product classes, DOE determined that the ballasts with a PS starting method are 2 percent less efficient than those with IS starting method. DOE then applied this reduction in BLE to develop the appropriate EL equation curves for the PS 8-foot HO and PS residential product class. See chapter 5 of the final determination TSD for more detail. Table IV.11 summarizes the efficiency requirements at each EL for the non-representative product classes.

DOE did not receive any comments on the scaling to non-representative product classes presented in the October 2019 NOPD. In this final determination, DOE maintained the scaling factors and resulting efficiency levels from the October 2019 NOPD for the non-representative product classes.

TABLE IV.11—SUMMARY OF ELS FOR NON-REPRESENTATIVE PRODUCT CLASSES

Non-representative product class	Efficiency level	BLE = A / (1 + B * total lamp arc power − C) where A, B, and C are as follows:		
		A	B	C
PS 8-foot HO	EL 1	0.973	0.45	0.37
	EL 2		0.26	
PS Residential	EL 1	0.973	0.54	0.37
	EL 2		0.46	
	EL 3		0.39	

E. Product Price Determination

Typically, DOE develops manufacturer selling prices (''MSPs'') for covered products in the engineering analysis and applies markups to create end-user prices to use as inputs to the LCC analysis and NIA. Because fluorescent lamp ballasts are difficult to reverse-engineer (*i.e.,* not easily disassembled due to potting), DOE directly derives end-user prices for the ballasts covered in this final determination.

In the October 2019 NOPD, DOE developed end-user consumer prices for the representative units sold in each of the main distribution channels identified for fluorescent lamp ballasts. DOE then calculated an average weighted consumer price using estimated shipments that go through each distribution channel. 84 FR 56540, 56565–56566.

DOE did not receive any comments on the pricing methodology or results. For this final determination DOE maintained the methodology and final average weighted end-user prices for representative units from the October 2019 NOPD. See chapter 6 of the final determination TSD for further details and pricing results.

F. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of fluorescent lamp ballasts at different BLE in representative U.S. commercial and industrial buildings, outdoor installations, and single-family homes and multi-family residences, and to assess the energy savings potential of increased BLE for fluorescent lamp ballasts. The energy use analysis estimates the range of energy use of fluorescent lamp ballasts 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 standards.

The energy conservation standards for fluorescent lamps are not within the scope of this analysis; however, the input power of the complete lamp-and-ballast system is considered for the energy use analysis because ballasts are not intended to operate without lamps. The energy use characterization provides estimates of annual energy use for representative lamp-and-ballast systems that DOE evaluates in the LCC and PBP analyses and the NIA. To develop annual energy use estimates, DOE multiplied annual usage (in hours per year) by the system input power (in watts). In the October 2019 NOPD, DOE developed an energy use analysis. 84 FR 56540, 56566–56568.

DOE analyzed the typical operating hours of the different sectors. DOE then weighted the ballast operation by sector to develop average operating hours. DOE selected the most common fluorescent lamps used with each analyzed ballast to develop representative lamp-and-ballast systems. DOE developed the system input power estimates in the engineering analysis. To characterize the country's average use of fluorescent lamp ballasts for a typical year, DOE developed annual operating hours by sector, using the most recent data available from the 2015 U.S. Lighting Market Characterization (''LMC''), which was published in 2017.[13] 84 FR 56540, 56566.

Fluorescent lamp ballasts can operate a variety of lamp types. The October 2019 NOPD included a mixture of lamp types operated by the fluorescent lamp ballast including full wattage fluorescent lamp (*e.g.,* 32 W 4-foot T8), reduced wattage fluorescent lamp (*e.g.,* 30 W 4-foot T8, 28 W 4-foot T8, and 25 W 4-foot T8), and tubular light-emitting diode (''TLED'') lamps (*e.g.,* UL Type A 13 W 4-foot T8). The mixture of specific lamps operated by the fluorescent lamp directly relates to the input power of the fluorescent ballast. DOE included a mixture of full wattage fluorescent lamps, reduced wattage fluorescent lamps, and TLED lamps in the energy use analysis. 84 FR 56540, 56566–56568.

Lighting controls can reduce the energy use of fluorescent lamp ballasts. In the October 2019 NOPD, DOE assumed reduced energy from lighting controls for programmed-start ballasts. *Id.* These ballasts are intended for use with occupancy sensors.

In the October 2019 NOPD, DOE requested comment to improve DOE's energy-use analysis, as well as any data supporting alternate operating hour estimates or assumptions regarding dimming of fluorescent lamp ballasts, operating hours, and operating hour reductions from lighting controls in commercial, industrial, and residential sectors. 84 FR 56540, 56568. NEMA stated that DOE's methodology and estimating assumptions were sufficient. (NEMA, No. 24 a pp. 3–4) Signify provided some suggested papers regarding use of lighting controls that could be found within the Illuminating Engineering Society (''IES'') technical library. Signify also stated that the papers specifically cited in their comments were illustrative. (Signify, No. 27 at p. 2)

DOE's analysis did utilize research papers within the IES technical library. DOE included data from *Lighting Controls in Commercial Buildings,* which was published in an IES journal, in the energy use analysis (see chapter 7 of the final determination TSD).[14] DOE received no comments related to changing the mixture of lamp operated by the fluorescent ballasts, operating hours of the fluorescent lamp ballasts, nor the application of lighting controls. For the final determination, DOE maintained the mixture of lamps operated by the fluorescent ballasts, operating hours of the fluorescent lamp ballasts, and the application of lighting controls as in the analysis for the 2019 October NOPD. Chapter 7 of the final determination TSD provides details on DOE's energy use analysis for fluorescent lamp ballasts.

G. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for fluorescent lamp ballasts in the October 2019 NOPD. 84 FR 56540, 56568. The effect of amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE used the following two metrics to measure consumer impacts:

- The LCC is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (MSP, 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 standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case. DOE refers to the change as ''LCC savings.'' LCC savings reflect the estimated efficiency distribution of fluorescent lamp ballasts in the absence of amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline product.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of potential customers. Fluorescent lamp ballasts are used widely in commercial, industrial, and residential settings. For each product class, DOE identified the types of customers likely to use the ballasts, the number of hours per year each customer type would likely use the ballasts, and a probability of selection for each customer type in the Monte Carlo analysis.

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

[13] U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy. 2015 U.S. Lighting Market Characterization. November 2017. *https://energy.gov/eere/ssl/2015-us-lighting-market-characterization.*

[14] Williams, AA, BA Atkinson, K Garbesi, E Page, FM Rubinstein. *Lighting Controls in Commercial Buildings.* Leukos: The Journal of the Illuminating Engineering Society. 2012. 8(3): pp. 161–180. *https://eaei.lbl.gov/publications/lighting-controls-commercial.*

sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

The computer model DOE uses to calculate the LCC and PBP relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and FLB user samples. For this rulemaking, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball™ add-on.[15] The model calculated the LCC and PBP for products at each efficiency level for 10,000 FLB installations per simulation run. The analytical results include a distribution of 10,000 data points showing the range of LCC savings for a given efficiency level relative to the no-new-standards case efficiency distribution. In performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency is chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC and PBP calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more-efficient products, DOE avoids overstating the potential benefits from increasing product efficiency. DOE calculated the LCC and PBP for all consumers of fluorescent lamp ballasts as if each were to purchase a new product in the first year of required compliance with new or amended standards. Amended standards apply to fluorescent lamp ballasts manufactured 3 years after the date on which any new or amended standard is published. (42 U.S.C. 6295(m)(4)(A)) Therefore, DOE used 2023 as the first year of compliance with any amended standards for fluorescent lamp ballasts.

Table IV.12 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 and its appendices of the final determination TSD.

TABLE IV.12—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS *

Inputs	Source/method
Product Cost	Derived by multiplying product costs from the engineering analysis by (one plus) sales tax rates.
Installation Costs	Baseline installation cost determined with data from RS Means. Assumed no change with efficiency level.
Annual Energy Use	The total annual energy use multiplied by the hours per year. Average number of hours based 2015 LMC.
Energy Prices	Based on the Energy Information Administration's (EIA's) Form 861 data for 2018.** Average energy prices determined for 50 states plus the District of Columbia.
Energy Price Trends	Based on *Annual Energy Outlook 2020 (AEO2020)* price projections.
Repair and Maintenance Costs	Assumed no change with efficiency level.
Product Lifetime	Average: 12.5 years for commercial installations (approximately 38,000 hours), 12.5 years for outdoor installations (approximately 41,000 hours), 11.4 years for industrial installations (50,000 hours), and 15 years for residential installations (approximately 10,800 hours).
Discount Rates	For the residential product class, the calculations involve identifying all possible debt or asset classes that might be used to purchase fluorescent lamp ballasts or might be affected indirectly. The primary data source was the Federal Reserve Board's Survey of Consumer Finances. For other product classes, the calculations involve estimating weighted average cost of capital for large numbers of companies and using the results to develop discount rate distributions. The primary data were from the Damodaran Online web site † and the Federal Reserve Board. ‡
Rebound Effect	Rebound is not assumed to be present among FLB consumers. Most consumers are commercial and industrial consumers, and the FLB/light user tends to not see the bills so there would be no perceived change in the cost of using the light.
Compliance Date	2023.

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

** DOE used Average Price by State by Provider (EIA–826), sorted for Total Electric Industry, obtained from the EIA webpage *https://www.eia.gov/electricity/data/state/*.

† See the data page on Damodaran Online, *http://pages.stern.nyu.edu/~adamodar.*

‡ In addition to the previously referenced Survey of Consumer Finances, DOE used interest rate data obtained from the Federal Reserve Bank of St. Louis' FRED Economic Data tool found at *https://fred.stlouisfed.org/.*

1. Product Cost

As noted in section IV.E, DOE rulemaking engineering analyses typically calculate MSPs. Typically, the MSPs are used to develop consumer prices by applying wholesale and retail delivery chain markups developed in a separate markup analysis, and by adding sales taxes. For fluorescent lamp ballasts, the engineering analysis determined end-user prices directly; therefore, for the LCC analysis, the only adjustment was to add sales taxes.

In prior energy conservation standards rulemakings, DOE estimated the total installed costs per unit for equipment and then assumed that costs remain constant throughout the analysis period. For example, prices were held constant throughout the analysis period for the 2009 final rule for commercial ice-cream freezers; self-contained commercial refrigerators, commercial freezers, and commercial refrigerator-freezers without doors; and remote condensing commercial refrigerators, commercial freezers, and commercial refrigerators-freezers. 74 FR 1092 (Jan. 9, 2009) This assumption is conservative because equipment costs tend to decrease over time. In 2011, DOE published a notice of data availability (''NODA'') titled *Equipment Price Forecasting in Energy Conservation Standards Analysis.* 76 FR 9696 (Feb. 22, 2011). In the NODA, DOE proposed a methodology for determining whether equipment prices have trended downward in real terms. The methodology examines so-called price or experiential learning, wherein, with ever-increasing experience with the production of a product, manufacturers are able to reduce their production costs

[15] Crystal Ball™ is a commercially available software tool to facilitate the creation of these types of models by generating probability distributions and summarizing results within Excel, available at *http://www.oracle.com/technetwork/middleware/crystalball/overview/index.html* (last accessed June 18, 2020).

through innovations in technology and process.

Consistent with the February 2011 NODA, DOE examined historical price data specific to electronic ballasts for the October 2019 NOPD and the analysis yielded learning coefficients indicating a 14.8 percent decrease in ballast prices for every doubling in cumulative ballast shipments. However, the October 2019 NOPD analyses excluded the price trends from the LCC consumer prices, noting that with shipments falling from historical values, cumulative shipments do not double relative to 2015 (the last year of historical ballast price data compiled for evaluating price trends) in any shipments scenario. The price trends assumptions were presented in the October 2019 NOPD along with the request for comments on any aspect of the NOPD. 84 FR 56540, 56579–56580. DOE received no comments on the learning trends analysis. Consistent with the October 2019 NOPD, for this final determination DOE excluded price trends from the consumer costs of fluorescent lamp ballasts used in the LCC and PBP analysis as well as downstream analyses.

Lamp manufacturing is also subject to the learning process. The focus of this final determination is the fluorescent lamp ballast. However, fluorescent lamp ballasts are designed to operate fluorescent lamps and therefore, the cost analysis accounts for the lamp-and-ballast system. The analysis assumes a differing mixture of general service fluorescent lamps (''GSFL'') and TLEDs operated by the ballasts. TLED prices are expected to be affected by price learning and are expected to decline significantly over the next 3 years. Therefore, to better represent the total installed cost of the ballast and lamp systems, price learning was applied to the lamps operated by the fluorescent lamp ballasts.

Because this final determination is not analyzing lamps, lamp shipments and price information were not collected for this rulemaking. Rather, price trend information for lamps was developed from the final rule for the GSFL standards rulemaking published in January 2015. 80 FR 4041 (Jan. 26, 2015). As discussed in chapter 8 and Appendix 8C of this FLB final determination TSD, the GSFL price trends were incorporated into the LCC analysis to account for learning in the lamp manufacturing process. The distribution of lamps selected for use by consumers is not expected to differ for ballasts at different efficiency levels.

The calculations of product cost are consistent with the October 2019 NOPD calculations. The October 2019 NOPD requested input on all aspects of the analysis, and no comments were received on the calculation of product cost. DOE updated the analysis to 2019 dollars (2019$), updated the state sales tax rates, and otherwise retained the product costs calculations used in the October 2019 NOPD for use in the final determination.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE used data from RSMeans to estimate the baseline installation cost for fluorescent lamp ballasts. For the October 2019 NOPD, DOE used the same installation costs for ballasts at each efficiency level. 84 FR 56540, 56569–56570. The October 2019 NOPD requested input on all aspects of the analysis, and no comments were received on the calculation of installation cost used in the NOPD. Given a lack of comment or other new evidence, DOE updated input data to use 2020 RSMeans values adjusted to 2019$ and continued using the same installation costs for ballasts at each efficiency level for the final determination.

3. Annual Energy Consumption

DOE determined the energy consumption for fluorescent lamp ballasts at different efficiency levels using the approach described previously in section IV.F of this document.

4. Energy Prices

DOE derived average annual electricity prices for 50 states plus the District of Columbia using data from the EIA's Form EIA–861 annual survey.[16] EIA calculated average electric prices by dividing total electric revenues by total kWh energy sales, using data aggregated by customer class and by state. The final determination analysis used the data for 2018, with prices adjusted to 2019$.

To estimate energy prices in future years, DOE multiplied the average state-level electricity prices by a projection of annual change in regional electricity prices in the *Annual Energy Outlook 2020* (''*AEO2020*''), which has an end year of 2050.[17] *AEO2020* includes price projections by Census regions, which were used for the analyses presented herein. To estimate future electricity prices, DOE uses the price index for the Census region corresponding to each state. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2040 through 2050.

DOE did not receive any comments on the energy prices used in the October 2019 NOPD. The final determination methodology for developing energy prices is the same as the October 2019 NOPD methodology. DOE used the most current data available for the final determination analyses. DOE updated base year electricity prices from 2017 to 2018, future price trends from EIA AEO2019 to AEO2020 projections, and the dollar year from 2018$ to 2019$.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in product efficiency produce no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products. In the October 2019 NOPD, DOE modeled ballasts as not being repaired, and maintenance costs as lamp replacement costs only. 84 FR 56540, 56570. DOE received no comments on maintenance and repair costs. In this final determination, DOE treated ballasts as not repaired and maintenance as limited to lamp replacement.

6. Product Lifetime

For the October 2019 NOPD, DOE used a 12.5-year average lifetime for the commercial sector installations, 11.4-year average lifetime for industrial sector installations, a 12.5-year average lifetime for outdoor lighting, and a 15-year life for the residential sector. In the October 2019 NOPD, DOE explained that combining DOE's estimate of 50,000 hours from the FLB Framework Document and the average operating hours developed for the NOPD yielded average ballast lifetimes of 16.6 years and 11.4 years, for commercial and industrial installations, respectively. However, 16.6 years is significantly longer than the lifetime of commercial ballasts used in the 2011 Ballast Rule. 84 FR 56540, 56569–56570. For the 2011 Ballast Rule, DOE used 12.5 years. While preparing the October 2019 NOPD, DOE found no literature confirming a 16.6-year product lifetime and focused instead on searching for evidence contradicting the lifetime of 12.5 years. No such evidence was identified. For the October 2019 NOPD,

[16] Available at *https://www.eia.gov/electricity/data/state/.*

[17] U.S. Department of Energy—Energy Information Administration. *Annual Energy Outlook 2020 with Projections to 2050.* 2020. Washington, DC. (#AEO2020). Available at *https://www.eia.gov/outlooks/aeo/.*

DOE assumed commercial ballasts would have a 12.5-year average lifetime which, when multiplied by the average commercial sector operating hours per year, yields a lifetime of approximately 38,000 hours. 84 FR 56540, 56570. DOE received no comments on product lifetime. In this final determination, DOE has retained the product lifetimes expressed in years from the October 2019 NOPD.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to commercial, industrial, and residential consumers to estimate the present value of future operating costs. DOE estimated a distribution of discount rates for fluorescent lamp ballasts based on the cost of capital of publicly traded firms in the sectors that purchase fluorescent lamp ballasts.

As part of its analysis, DOE also applies weighted average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates.[18] DOE notes that the LCC does not analyze the product purchase decision, so the implicit discount rate is not relevant in this model. The LCC estimates net present value over the lifetime of the product, so the appropriate discount rate will reflect the general opportunity cost of household or business funds, taking this time scale into account. Given the long-time frame modeled in the LCC, the application of a marginal interest rate associated with an initial source of funds is inaccurate. Regardless of the method of purchase, consumers are expected to continue to rebalance their debt and asset holdings over the LCC analysis period, based on the restrictions consumers face in their debt payment requirements and the relative size of the interest rates available on debts and assets. DOE estimates the aggregate effect of this rebalancing using the historical distribution of debts and assets.

To establish residential discount rates for the LCC analysis, DOE identified all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings. It estimated the average percentage shares of the various types of debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances [19] (''SCF'') for 1995, 1998, 2001, 2004, 2007, 2010, 2013, and 2016. Using the SCF and other sources, DOE developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. In the Crystal Ball™ analyses, for each of the 10,000 simulations, the model selects an income group and then selects a discount rate from the distribution for that group.

For commercial and industrial consumers, DOE used the cost of capital to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so the cost of capital is the weighted-average cost to the firm of equity and debt financing. This corporate finance approach is referred to as the weighted-average cost of capital. DOE used currently available economic data in developing discount rates. See chapter 8 of the final determination TSD for details on the development of consumer discount rates.

DOE described the discount rate calculations in the October 2019 NOPD and the accompanying TSD chapter 8 and appendix 8D. 84 FR 56540, 56570–56571. DOE received no comments on the discount rate calculations. For the final determination, DOE used the same methodologies as used for the October 2019 NOPD. The residential discount rate and commercial discount rate calculations were updated to include more current input data from the Federal Reserve and Damodaran Online. The commercial discount rate update includes use of Damodaran Online data disaggregated by industry sector, and current as of the end of 2019.

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

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

To estimate the energy efficiency distribution of fluorescent lamp ballasts for 2023, DOE analyzed the distribution of ballasts in the databases used in the engineering analysis. For the non-dimming ballasts, the main source of information is the DOE compliance certification database.[20] For non-dimming ballasts, DOE relied on product offerings in manufacturer catalogs.

DOE described the energy efficiency distribution in the October 2019 NOPD TSD chapter 8. 84 FR 56540, 56571. DOE received no comments on the NOPD energy efficiency distribution. DOE used the same distribution in the final determination. See chapter 8 of the final determination TSD for the estimated efficiency distributions.

9. Payback Period Analysis

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

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

H. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential amended energy conservation standards on energy use, NPV, and future manufacturer cash flows.[21] 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 key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

In the October 2019 NOPD, DOE modeled four declining shipment scenarios. 84 FR 56540, 56572–56573. DOE received written comments supporting the projection of declining

[18] The implicit discount rate is inferred from a consumer purchase decision between two otherwise identical goods with different first cost and operating cost. It is the interest rate that equates the increment of first cost to the difference in net present value of lifetime operating cost, incorporating the influence of several factors: Transaction costs, risk premiums and response to uncertainty, time preferences, and interest rates at which a consumer is able to borrow or lend.

[19] Board of Governors of the Federal Reserve System. Survey of Consumer Finances. Available at *http://www.federalreserve.gov/PUBS/oss/oss2/scfindex.html.*

[20] *https://www.regulations.doe.gov/ccms.*

[21] 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.

shipments. CA IOUs, Lutron, and NEMA all stated that there is an ongoing and continual decline in shipments of fluorescent lamp ballasts. (CA IOUs, No. 25 at p. 2; Lutron, No. 23 at p. 2; NEMA, No. 24 at p. 2)

Both Signify and NEMA also provided data in comments related to the shipment volume. Signify stated that the current (2019) fluorescent lamp ballast market may be only 15 percent of the total shipments in 2011. (Signify, No. 27 at p. 2) NEMA provided a figure indexed to 2015 indicating the 2019 volume was roughly 30 percent the volume of 2015 shipments. (NEMA, No. 24 at pp. 4, Fluorescent Driver Index graph)

In this final determination, DOE continued to rely on projections of declining shipments but calibrated the volume of shipments by reducing the volume of shipments per comments received. In the October 2019 NOPD, DOE modeled four shipment scenarios and DOE retained those scenarios for this final.

(1) Scenario #1—declining shipments that all terminate in 2024.

(2) Scenario #2—declining shipments that all terminate in 2040.

(3) Scenario #3—declining shipments that approach zero near the end of the analysis period (2052). This scenario is close to a year-over-year linear reduction of shipments by 20 percent.

(4) Scenario #4—declining shipments that terminate near the end of the analysis period. This scenario is based on a slower decline rate in the initial part of the analysis period and is similar to a projected decline in fluorescent lamps. See 84 FR 56540, 56572.

DOE presented in the October 2019 NOPD results under each of the four scenarios but relied on scenario #3 as the reference case. 84 FR 56540, 56572. DOE requested comment in the October 2019 NOPD about whether the shipment scenarios were reasonable and likely to occur. *Id.* at 84 FR 56574. DOE also requested comment on which of the four scenarios best characterize future shipments of fluorescent lamp ballasts. *Id.*

NEMA stated that any shipment scenario that includes a near-20 percent rate of decline is useful for estimations/modeling. (NEMA, No. 24 at p. 5)

Dimming ballasts were included in the shipment scenarios. DOE requested comment regarding the rate of decline for dimming ballast shipments as compared to non-dimming ballasts. 84 FR 56540, 56574. NEMA provided general information about the cost of dimming ballasts stating they involve more complex circuitry and tend to sell at a higher price than fixed output ballasts. NEMA stated that logically the higher price would equate to a higher rate of decline based on competition with LED technology. (NEMA, No. 24 at p. 4) NEMA stated that that the demand for dimming ballasts is declining faster than the decline for fluorescent lamps. (NEMA, No. 24 at p. 2) NEMA stated that the dimming ballast shipment scenario appears accurate. (NEMA, No. 24 at p. 5) Therefore, DOE utilized a similar declining shipment scenario for dimming ballasts in the 2019 NOPD and this final determination.

I. National Impact Analysis

DOE conducted a NIA in the October 2019 NOPD. 84 FR 56540, 56574–56576. 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.[22] (“Consumer” in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual product shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of fluorescent lamp ballasts sold from 2023 through 2052.

DOE evaluates the effects of amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each product class in the absence of 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 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 products with efficiencies greater than the standard.

DOE uses a spreadsheet model to calculate the energy savings and the national consumer costs and savings from each EL. Interested parties can review DOE’s analyses by changing various input quantities within the spreadsheet.[23] The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

Table IV.13 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 10 of the final determination TSD for further details.

TABLE IV.13—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard.	2023.
Efficiency Trends.	No-new-standards case, Standard cases.
Annual Energy Consumption per Unit.	Annual weighted-average values are a function of energy use at each EL.
Total Installed Cost per Unit.	Annual weighted-average values are a function of cost at each EL. Incorporates projection of future product prices based on historical data.
Annual Energy Cost per Unit.	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit.	Annual values do not change with efficiency level.
Energy Price Trends.	*AEO2020* projections (to 2050) and extrapolation thereafter.
Energy Site-to-Primary and FFC Conversion.	A time-series conversion factor based on *AEO2020.*
Discount Rate	Three and seven percent.
Present Year	2020.

NEMA stated that in the 2011 FL Ballast Rule the difference in energy savings between the two TSLs with the highest efficiency levels was negligible, the increase in net benefit to the country was trivial, and the capital conversion costs for manufacturers were significant indicating fluorescent lamp ballasts are already very efficient and additional energy savings not needed.[24] (NEMA,

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

[23] The spreadsheet is in the docket and can be found at *https://www.regulations.gov/document?D=EERE-2015-BT-STD-0006-0017.*

[24] For context, in the 2011 FL Ballast Rule, DOE evaluated trial standard levels (“TSLs”) 3A and 3B. TSL 3A represented energy conservation standards at the maximum technologically feasible level for all product classes except for residential and 8-foot HO IS/RS product classes; and TSL 3B represented the maximum technologically feasible level for all product classes. 76 FR 70547, 70596. The difference

No. 24 at p. 2) Similarly Lutron stated energy savings are small and supported DOE's net present value conclusion. (Lutron, No. 23 at p. 2) No stakeholder input was received related to different methods or additional data sets. The final determination NIA methodology was consistent with the October 2019 NOPD.

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. Section IV.G.8 of this document describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment-weighted average efficiency) for each of the considered product classes for the year of anticipated compliance with an amended or new standard.

For the standards cases, DOE used a ''roll-up'' scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective (2023). In this scenario, the market shares of products in the no-new-standards case that do not meet the standard under consideration would ''roll up'' to meet the amended standard level, and the market share of products above the standard would remain unchanged.

DOE has included within the NIA model a standards-induced shift scenario in which if EL 1 is selected, 25 percent of the consumers would migrate to a new LED technology. If EL 2 is selected, 50 percent of the consumers would migrate to a new LED technology, and if EL 3 is selected, 75 percent of the consumers would migrate to a new LED technology. Within the NIA model, the percentage of customers migrating away is not fixed and can be changed by the user.

Within DOE's standard-induced shift away from a FLB scenario, DOE modeled the shift to occur at different increments at each EL and not at a specific PBP or specific increase in FLB price. The PBPs vary for all of the product classes and ballasts. The potential cost differential between the baseline ballast and a more efficient EL ballast varies across the products classes as well.

In the October 2019 NOPD, DOE requested comment about the following: (1) The percentage of customers that might migrate away from FLB technology, (2) the specific incremental cost that could trigger a standards-induced shift away from fluorescent lamp ballasts, (3) the approach for input power and price for LED devices considered in a standards-induced shift, (4) any potential impediments that would prevent users of fluorescent lamp ballasts from switching to LED lighting to garner additional energy savings, and (5) the expected effect of potential standards on the rate at which FLB consumers transition to non-FLB technology. 84 FR 56540, 56575. NEMA cited a lack of firsthand knowledge on the subjects. NEMA postulated the shift could be driven from amortization of current investments, LED conversion initial cost, and the role of TLEDs in the industry. Specifically, NEMA stated that TLEDs are compatible with most fixed-output fluorescent ballasts, though less so with dimming ballasts. NEMA also stated that low operating hours of an installation may decrease the incentive to switch to LED lighting. NEMA was not knowledgeable about the percentage of installations shifting to LED but noted the shift was occurring with any light source. (NEMA, No. 24 at p. 6) With no comments providing any additional data or suggestions for the modeling approach, for the final determination, DOE calculated product efficiency trends consistently with the October 2019 NOPD.

Chapter 10 of the final determination TSD provides details on DOE's NIA for fluorescent lamp ballasts.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (*i.e.,* an EL) and the case with no 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 source energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO2020.* Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is occasionally associated with a direct rebound effect, which refers to an increase in utilization of the product due to the increase in efficiency. As discussed in Table IV.12, DOE did not find rebound present in the FLB market and therefore was not included in the NIA.

In 2011, in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System (''NEMS'') is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [25] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used generally for deriving FFC measures of energy use and emissions is described in chapter 10 of the final determination TSD.

The calculations of energy savings are consistent with the October 2019 NOPD calculations with updates to energy prices, costs, and shipments described in IV.G and IV.H of this document.

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

in NPV between 3Aand 3B rounded to 1 percent at a 7 percent discount rate and rounded to 0 percent at a 3 percent discount rate. The impact on industrial net present value was a decrease of $33 million between 3A and 3B, or a decrease of 4.4 percent relative to the no-new-standards base. 76 FR 70547, 70620.

[25] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009,* DOE/EIA–0581(2009), October 2009. Available at *https://www.eia.gov/outlooks/aeo/nems/overview/index.html.*

savings over the lifetime of each product shipped during the projection period.

As discussed in section IV.G of this document, DOE developed FLB price trends based on electronic ballasts. By 2052, which is the end date of the projection period, the average FLB price is projected to drop 4.5 percent relative to 2016. DOE's projection of product prices is described in appendix 8C of the final determination TSD. Consistent with the October 2019 NOPD, for this final determination, DOE excluded price trends from the consumer costs of fluorescent lamp ballasts used in the NIA.

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 *AEO2020,* which has an end year of 2050. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2040 through 2050.

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.[26] 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.

No stakeholder input was received that suggested either a different methodology or additional data sets. In the final determination NIA methodology was consistent with the October 2019 NOPD.

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

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impacts of potential amended energy conservation standards on manufacturers of fluorescent lamp ballasts. DOE relied on the GRIM, an industry cash flow model with inputs specific to this rulemaking. The key GRIM inputs include data on the industry cost structure, unit production costs, product shipments, manufacturer markups, and investments in research and development (''R&D'') and manufacturing capital required to produce compliant products. The key GRIM outputs are the industry net present value (''INPV''), which is the sum of industry annual cash flows over the analysis period, discounted using the industry-weighted average cost of capital, and the impact to domestic manufacturing employment. The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the no-new-standards case and each standards case. The difference in INPV between the no-new-standards case and a standards case represents the financial impact of the amended energy conservation standard on manufacturers.

To capture the uncertainty relating to manufacturer pricing strategies following amended standards, the GRIM estimates a range of possible impacts under different markup scenarios.

DOE created initial estimates for the industry financial inputs used in the GRIM (*e.g.,* tax rate; working capital rate; net property plant and equipment expenses; selling, general, and administrative (''SG&A'') expenses; R&D expenses; depreciation expenses; capital expenditures; and industry discount rate) based on publicly available sources, such as company filings of form 10–K from the SEC or corporate annual reports.[27] DOE then further calibrated these initial estimates during manufacturer interviews to arrive at the final estimates used in the GRIM.

The GRIM uses several factors to determine a series of annual cash flows starting with the announcement of potential standards and extending over a 30-year period following the compliance date of potential standards. These factors include annual expected revenues, costs of sales, SG&A and R&D expenses, taxes, and capital expenditures. In general, energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) Creating a need for increased investment, (2) raising production costs per unit, and (3) altering revenue due to higher per-unit prices and changes in sales volumes.

The GRIM spreadsheet uses inputs to arrive at a series of annual cash flows, beginning in 2020 (the reference year of the analysis) and continuing to 2052. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. DOE used a real discount rate of 9.6 percent for FLB manufacturers. This initial discount rate estimate was derived using the capital asset pricing model in conjunction with publicly available information (*e.g.,* 10-year treasury rates of return and company specific betas). DOE then confirmed this initial estimate during manufacturer interviews. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 11 of the final determination TSD.

[27] 10-Ks are collected from the SEC's EDGAR database: *https://www.sec.gov/edgar.shtml* or from annual financial reports collected from individual company websites.

2. Manufacturer Production Costs

Manufacturing more efficient fluorescent lamp ballasts is typically more expensive because of the use of more complex components, which are typically more costly than baseline components. The changes in the MPCs of covered products can affect the revenues, gross margins, and cash flow of the industry. Typically, DOE develops MPCs for the covered products using reverse-engineering. These costs are used as an input to the LCC analysis and NIA. However, because ballasts are difficult to reverse-engineer, DOE directly derived end-user prices in the engineering analysis and then used the end-user prices in conjunction with markups to calculate the MPCs of fluorescent lamp ballasts. DOE used the same end-user prices in this final determination that were used in the proposed determination, however, DOE updated the prices to 2019$. See IV.E for a further explanation of product price determination.

To determine MPCs of fluorescent lamp ballasts from the wholesale prices calculated in the engineering analysis, DOE divided the wholesale prices by the wholesaler markup to calculate the MSP. DOE then divided the MSP by the manufacturer markup to get the MPCs. DOE determined the wholesaler markup to be 1.23 and the manufacturer markup to be 1.40 for all fluorescent lamp ballasts. DOE used the same markups in this final determination that were used in the proposed determination. Markups are further described in section IV.J.5 of this document.

3. Shipments Projections

The GRIM estimates manufacturer revenues based on total unit shipment projections and the distribution of those shipments by EL. Changes in sales volumes and efficiency mix over time can significantly affect manufacturer finances. For this analysis, the GRIM uses the NIA's annual shipment projections from shipments scenario #3 (reference case, see section IV.H) starting in 2020 (the reference year) and ending in 2052 (the end year of the analysis period). DOE updated the shipment analysis for the final determination (see section IV.H). The GRIM uses these updated shipments as part of the final determination MIA. See chapter 9 of the final determination TSD for additional shipment details.

4. Product and Capital Conversion Costs

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

To evaluate the level of capital conversion costs manufacturers would likely incur to comply with the analyzed energy conservation standards, DOE used data from the 2011 FL Ballast Rule to estimate costs to update manufacturer production lines by product class. DOE then estimated the number of production lines currently in existence and the number of production lines that would be required to be updated at each analyzed EL using DOE's compliance certification database. DOE then multiplied these numbers together (*i.e.,* capital conversion costs per production line and number of production lines that would need to be updated) to get the final estimated capital conversion costs for each product class at each analyzed EL. To evaluate the level of product conversion costs manufacturers would likely incur to comply with the analyzed energy conservation standards, DOE used data from the 2011 FL Ballast Rule to estimate per model R&D and testing and certification costs for each product class and EL. DOE then estimated the number of models that would need to be redesigned for each product class at each analyzed EL. DOE then multiplied these numbers together to get the final estimated product conversion costs for each product class at each analyzed EL. DOE used the same conversion cost estimates in this final determination that were used in the proposed determination; however, DOE updated the conversion cost estimates to 2019$.

In general, DOE assumes all conversion-related investments occur between the announcement of a potential energy conservation standard (*i.e.,* the publication of the final rule) and the year by which manufacturers must comply with the potential amended standards. The conversion cost figures used in the GRIM can be found in Table V.6 and Table V.7 of this document. For additional information on the estimated capital and product conversion costs, see chapter 11 of the final determination TSD.

DOE received comments related to manufacturers' willingness to make investments related to fluorescent lamp ballasts. Lutron stated it is not making investments to create new fluorescent lamp ballast products or improving existing ones. (Lutron, No. 23 at p. 2) Similarly, NEMA stated no NEMA manufacturer is investing in fluorescent lamp ballast technology and changes to standards will lead discontinuation of products rather than new investment to meet potential energy conservation standards. NEMA added that product R&D in this area has shifted to LED technology (*i.e.,* LED drivers). (NEMA, No. 24 at p. 2)

DOE understands that fluorescent lamp ballasts are a declining lighting technology and that most manufacturers are focused on products that utilize LED technology. However, DOE estimated the conversion costs necessary for manufacturers to produce the quantity of fluorescent lamp ballasts projected in the shipment analysis. As stated previously these industry conversion cost estimates are displayed in Table V.6 and Table V.7 of this document.

5. Markup Scenarios

To calculate the MPCs used in the GRIM, DOE divided the wholesaler prices calculated in the engineering analysis by the wholesaler markup and the manufacturer markup. The wholesaler markup was calculated in the 2011 FL Ballast Rule by reviewing SEC 10–K reports of electrical wholesalers. DOE also coordinated with the National Association of Electrical Distributors by contacting two representative electrical wholesalers, who confirmed that DOE's calculated markups were consistent with their actual ballast markups. DOE continued to use a wholesaler markup of 1.23 in this final determination.

The manufacturer markup accounts for the non-production costs (*i.e.,* SG&A, R&D, and interest) along with profit. Modifying the manufacturer markup in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case markup scenarios to represent uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of analyzed energy conservation standards: (1) A preservation of gross margin percentage markup scenario and (2) a preservation of operating profit markup scenario. These scenarios lead to different manufacturer markup values that, when applied to the MPCs, result in varying revenue and cash flow impacts.

Under the preservation of gross margin percentage scenario, DOE applied a single uniform ''gross margin percentage'' markup across all ELs, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all ELs within a product class. To calculate the preservation of gross margin markup, DOE took the manufacturer markup used in the 2011 FL Ballast Rule and compared it to the manufacturer markups calculated by examining the SEC 10-Ks of all publicly traded FLB manufacturers and confirmed this with manufacturers during interviews. DOE determined that the manufacturer markup used in the 2011 FL Ballast Rule was consistent with the current SEC 10-Ks of the publicly traded FLB manufacturers and most manufacturers agreed during manufacturer interviews. Therefore, DOE used 1.40 as the manufacturer markup in the preservation of gross margin markup scenario. DOE assumes that this markup scenario represents the upper bound to industry profitability under analyzed energy conservation standards.

Under the preservation of operating profit markup scenario, DOE modeled a situation in which manufacturers are not able to increase operating profit in proportion to increases in manufacturer production costs. Under this scenario, as the cost of production increases, manufacturers are generally required to reduce the manufacturer markups to maintain cost competitive offerings in the market. Therefore, gross margin (as a percentage) shrinks in the standards cases in this markup scenario. This markup scenario represents the lower bound to industry profitability under amended energy conservation standards. DOE used the same manufacturer markups in this final determination that were used in the proposed determination.

DOE did not receive comment on the markup scenarios and continued with the approach as presented in the October 2019 NOPD. A comparison of industry financial impacts under the two manufacturer markup scenarios is presented in section V.A.3.a of this document.

6. Manufacturer Interviews

Prior to the publication of the October 2019 NOPD, DOE interviewed manufacturers of fluorescent lamp ballasts and asked them to describe their major concerns regarding a potential rulemaking to amend the standards for fluorescent lamp ballasts. Major areas of concerns identified in manufacturer interviews were discussed in the October 2019 NOPD. 84 FR 56540, 56578. DOE considered the information received during these interviews in the development of the NOPD and this final determination as discussed in the October 2019 NOPD. *See id.*

V. Analytical Results and Conclusions

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

A. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on FLB consumers by looking at the effects that potential amended standards at each EL would have on the LCC and PBP. DOE usually evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a national standard. However, given the negative NPV at each EL and the conclusion discussed in section V.B.2, DOE did not conduct a consumer subgroup analysis for this final determination.

In general, higher-efficiency products affect consumers in two ways: (1) Purchase price increases and (2) annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* product price plus installation costs) and operating costs (*i.e.,* annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Table V.1 shows the LCC and PBP results for the ELs considered for fluorescent lamp ballasts.

TABLE V.1—AVERAGE LCC AND PBP RESULTS FOR FLUORESCENT LAMP BALLASTS

Efficiency level *	LCC savings 2019$	Simple payback period years
EL 1	0	12
EL 2	1	10
EL 3	1	10

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

2. National Impact Analysis

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

a. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for fluorescent lamp ballasts, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each EL. 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 (2023–2052). Table V.2 presents DOE's projections of the NES for each EL considered for fluorescent lamp ballasts for reference shipment scenario 3 (see IV.H). Results of all shipment scenarios are provided in chapter 10 of the final determination TSD. The savings were calculated using the approach described in section IV.I.2 of this document.

TABLE V.2—CUMULATIVE NATIONAL ENERGY SAVINGS FOR FLUORESCENT LAMP BALLASTS; 30 YEARS OF SHIPMENTS (2023–2052)

	Efficiency level		
	Quads		
	1	2	3
Site energy	0.009	0.026	0.032
Source energy	0.023	0.069	0.086
FFC energy	0.024	0.072	0.090

OMB Circular A–4 [28] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[29] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to fluorescent lamp ballasts. 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.3 for reference shipment scenario 3 (see section IV.H). The impacts are counted over the lifetime of fluorescent lamp ballasts urchased in 2023–2031.

[28] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. *http://www.whitehouse.gov/omb/circulars_a004_a-4/.*

[29] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

TABLE V.3—CUMULATIVE NATIONAL ENERGY SAVINGS FOR FLUORESCENT LAMP BALLASTS; 9 YEARS OF SHIPMENTS (2023–2031)

	Efficiency level		
	Quads		
	1	2	3
Site energy	0.006	0.017	0.022
Source energy	0.015	0.045	0.058
FFC energy	0.016	0.047	0.061

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the ELs considered for fluorescent lamp ballasts. In accordance with OMB's guidelines on regulatory analysis,[30] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.4 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2023–2052 for reference shipment scenario 3 (see section IV.H). Results of all shipment scenarios are provided in chapter 10 of the final determination TSD.

TABLE V.4—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR FLUORESCENT LAMP BALLASTS; 30 YEARS OF SHIPMENTS (2023–2052)

	Efficiency level		
	billion 2019$		
	1	2	3
3 percent	(0.077)	(0.053)	(0.098)
7 percent	(0.71)	(0.084)	(0.127)

The NPV results based on the aforementioned 9-year analytical period and reference shipment scenario (see section IV.H) are presented in Table V.5. The impacts are counted over the lifetime of products purchased in 2023–2031. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.5—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR FLUORESCENT LAMP BALLASTS; 9 YEARS OF SHIPMENTS (2023–2031)

	Efficiency level		
	billion 2019$		
	1	2	3
3 percent	(0.050)	(0.023)	(0.043)
7 percent	(0.053)	(0.059)	(0.087)

3. Economic Impacts on Manufacturers

In addition to the analysis conducted as required under 42 U.S.C. 6395(m)(1)(A), DOE performed an MIA to estimate the impact of analyzed energy conservation standards on manufacturers of fluorescent lamp ballasts. The following sections describe the expected impacts on fluorescent lamp manufacturers at each EL. Chapter 11 of the final determination TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

In this section, DOE provides the results from the MIA, which examines changes in the industry that would result from the analyzed standards. The following tables illustrate the estimated financial impacts (represented by changes in INPV) of potential amended energy conservation standards on manufacturers of fluorescent lamp ballasts, as well as the conversion costs that DOE estimates manufacturers of fluorescent lamp ballasts would incur at each EL.

To evaluate the range of cash-flow impacts on the FLB industry, DOE modeled two markup scenarios that correspond to the range of anticipated market responses to potential standards. Each scenario results in a unique set of cash flows and corresponding industry values at each EL. In the following discussion, the INPV results refer to the difference in industry value between the no-new-standards case and the standards cases that result from the sum of discounted cash flows from the reference year (2020) through the end of the analysis period (2052).

To assess the upper (less severe) end of the range of potential impacts on FLB manufacturers, DOE modeled a preservation of gross margin markup scenario. This scenario assumes that in the standards case, manufacturers would be able to pass along all the higher production costs required for more efficient products to their consumers. To assess the lower (more severe) end of the range of potential impacts, DOE modeled a preservation of

[30] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. *http://www.whitehouse.gov/omb/circulars_a004_a-4/.*

operating profit markup scenario. The preservation of operating profit markup scenario assumes that in the standards cases, manufacturers would be able to earn the same operating margin in absolute dollars as they would in the no-new-standards case.

Table V.6 and Table V.7 present the results of the industry cash flow analysis for FLB manufacturers under the preservation of gross margin and preservation of operating profit markup scenarios, respectively. See chapter 11 of the final determination TSD for results of the complete industry cash flow analysis by product class.

TABLE V.6—MANUFACTURER IMPACT ANALYSIS FOR ALL FLUORESCENT LAMP BALLAST—PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

	Units	No-new-standards case	EL 1	EL 2	EL 3
INPV	*2019$ millions*	210.0	147.4	83.4	70.6
Change in INPV	*2019$ millions*		(62.6)	(126.6)	(139.5)
	%		(29.8)	(60.3)	(66.4)
Product Conversion Costs	*2019$ millions*		69.2	132.9	147.7
Capital Conversion Costs	*2019$ millions*		17.5	33.2	35.9
Total Conversion Costs	*2019$ millions*		86.7	166.2	183.6

TABLE V.7—MANUFACTURER IMPACT ANALYSIS FOR ALL FLUORESCENT LAMP BALLAST—PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	No-new-standards case	EL 1	EL 2	EL 3
INPV	*2019$ millions*	210.0	144.3	76.4	61.0
Change in INPV	*2019$ millions*		(65.7)	(133.7)	(149.0)
	%		(31.3)	(63.6)	(70.9)
Product Conversion Costs	*2019$ millions*		69.2	132.9	147.7
Capital Conversion Costs	*2019$ millions*		17.5	33.2	35.9
Total Conversion Costs	*2019$ millions*		86.7	166.2	183.6

b. Direct Impacts on Employment

DOE typically presents quantitative estimates of the potential changes in production employment that could result from the analyzed energy conservation standard levels. However, for this final determination, DOE determined that no manufacturers have domestic FLB production. Therefore, this determination would not have a significant impact on domestic employment in the FLB industry.

c. Impacts on Manufacturing Capacity

DOE does not anticipate any significant capacity constraints at any of the analyzed energy conservation standards. The more efficient components are currently being used in existing FLB models and worldwide supply would most likely be able to meet the increase in demand given the 3-year compliance period for any potential energy conservation standards.

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop an industry cash-flow estimate may not be adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting cost structures substantially different from the industry average could be affected disproportionately. DOE only identified one manufacturer subgroup for fluorescent lamp ballasts, small manufacturers. Given that DOE is issuing this final determination pursuant to 42 U.S.C. 6295(m)(1) and given the conclusion discussed in section V.B, DOE did not conduct a manufacturer subgroup analysis on small business manufacturers for this final determination.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the product-specific regulatory actions of other Federal agencies that affect the manufacturers of a covered product. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE typically conducts an analysis of cumulative regulatory burden as part of its rulemakings proposing new or amended energy conservation standards. However, given the conclusion discussed in section V.A.3, DOE did not conduct a cumulative regulatory burden analysis.

B. Final Determination

As required by EPCA, this final determination analyzes whether amended standards for fluorescent lamp ballasts would result in significant conservation of energy, be technologically feasible, and be cost-effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) Any new or amended standards issued by the Secretary would be required to comply with the economic justification and other requirements of 42 U.S.C. 6295(o). In addition to these criteria, DOE also estimated the impact on manufacturers. The criteria considered under 42 U.S.C. 6295(m)(1)(A) and the additional analysis are discussed below. Because an analysis of cost effectiveness and energy savings first require an evaluation of the relevant technology, DOE first discusses the technological feasibility of amended standards. DOE then addresses the cost effectiveness and energy savings associated with potential amended standards.

1. Technological Feasibility

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

2. Cost Effectiveness

EPCA requires DOE to consider whether energy conservation standards for fluorescent lamp ballasts would be cost effective through an evaluation of 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 products which are likely to result from the imposition of the standard. (42 U.S.C. 6295(m)(1)(A), 42 U.S.C 6295(n)(2)(C), and 42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducted an LCC analysis to estimate the net costs/benefits to users from increased efficiency in the considered fluorescent lamp ballasts. (See results in Table V.1).

DOE then aggregated the results from the LCC analysis to estimate the NPV of the total costs and benefits experienced by the Nation. (See results in Table V.4.) 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 first considered the most efficient level, EL 3 (max-tech), which would result in negative NPV at a 3-percent and 7-percent discount rate. On the basis of negative NPV, DOE determined that EL 3 is not cost effective.

DOE then considered the next most efficient level, EL 2, which would result in negative NPV at a 3-percent and 7-percent discount rate. On the basis of negative NPV, DOE determined that EL 2 is not cost effective.

DOE then considered the next most efficient level, EL 1, which would result in negative NPV at a 3-percent and 7-percent discount rate. On the basis of negative NPV, DOE determined that EL 1 is not cost effective.

3. Significant Conservation of Energy

EPCA also mandates that DOE consider whether amended energy conservation standards for fluorescent lamp ballasts would result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(A)) As discussed, to determine whether energy savings is significant, DOE conducts a two-step approach that considers both an absolute site energy savings threshold and a threshold that is the percent reduction in the covered energy use. (See Section 6(b) of the Process Rule.) DOE first evaluates the projected energy savings from a potential max-tech standard over a 30-year period against a 0.3 quads of site energy threshold. (See Section 6(b)(2) of the Process Rule.) If the 0.3 quad-threshold is not met, DOE then compares the max-tech savings to the total energy usage of fluorescent lamp ballast to calculate a percentage reduction in energy usage. (See Section 6(b)(3) of the Process Rule.) If this comparison does not yield a reduction in site energy use of at least 10 percent over a 30-year period, the energy savings are deemed to not be significant. (See Section 6(b)(4) of the Process Rule.)

DOE estimates that amended standards for fluorescent lamp ballasts would result in site energy savings of 0.009 quads at EL 1, 0.026 quads at EL 2, and 0.032 quads at EL 3 over a 30-year analysis period (2023–2052). (See results in Table V.2.) Therefore, the projected energy savings from potential standards for fluorescent lamp ballasts do not meet the 0.3 quad of site energy threshold.

DOE then determined that over the 30-year analysis period the percentage of reduction in energy use at the potential max-tech standard level compared to the total energy usage of fluorescent lamp ballasts was one percent. This does not yield a reduction in site energy use of at least 10 percent over a 30-year period.

Because neither criterion for determining significant energy savings specified in Section 6(b)(3) of the Process Rule are met by the potential max-tech standard for fluorescent lamp ballasts, no significant energy savings will result from setting new or amended standards.

4. Other Analysis

In this analysis, DOE also conducted an MIA to estimate the impact of potential energy conservation standards on manufacturers of fluorescent lamp ballasts. (See results in Table V.6 and Table V.7.) Each EL for all applicable product classes is estimated to result in FLB manufacturers experiencing a loss in INPV.

5. Summary

In this final determination, based on the consideration of cost effectiveness and significant energy savings, DOE is not amending energy conservation standards for fluorescent lamp ballasts.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

This final determination has been determined to be not significant for purposes of Executive Order (''E.O.'') 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993) and E.O. 13563, a supplement to E.O. 12866, 76 FR 3281 (Jan. 21, 2011). As a result, OMB did not review this final determination.

B. Review Under Executive Orders 13771 and 13777

On January 30, 2017, the President issued E.O. 13771, ''Reducing Regulation and Controlling Regulatory Costs.'' 82 FR 9339 (Feb. 3, 2017). E.O. 13771 stated the policy of the executive branch is to be prudent and financially responsible in the expenditure of funds, from both public and private sources. E.O. 13771 stated it is essential to manage the costs associated with the governmental imposition of private expenditures required to comply with Federal regulations.

Additionally, on February 24, 2017, the President issued E.O. 13777, ''Enforcing the Regulatory Reform Agenda.'' 82 FR 12285 (Mar. 1, 2017). E.O. 13777 required the head of each agency designate an agency official as its Regulatory Reform Officer (''RRO''). Each RRO oversees the implementation of regulatory reform initiatives and policies to ensure that agencies effectively carry out regulatory reforms, consistent with applicable law. Further, E.O. 13777 requires the establishment of a regulatory task force at each agency. The regulatory task force is required to make recommendations to the agency head regarding the repeal, replacement, or modification of existing regulations, consistent with applicable law. At a minimum, each regulatory reform task force must attempt to identify regulations that:

(1) Eliminate jobs, or inhibit job creation;

(2) Are outdated, unnecessary, or ineffective;

(3) Impose costs that exceed benefits;

(4) Create a serious inconsistency or otherwise interfere with regulatory reform initiatives and policies;

(5) Are inconsistent with the requirements of Information Quality Act, or the guidance issued pursuant to that Act, in particular those regulations that rely in whole or in part on data, information, or methods that are not publicly available or that are insufficiently transparent to meet the standard for reproducibility; or

(6) Derive from or implement Executive orders or other Presidential directives that have been subsequently rescinded or substantially modified.

DOE concludes that this final determination is consistent with the directives set forth in these Executive orders.

As discussed in this document, DOE is not amending the energy conservation standards for fluorescent lamp ballasts. Therefore, this final determination is an E.O. 13771 other action.

C. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') and a final regulatory flexibility analysis (''FRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (*http://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. This final determination is not amending energy conservation standards for fluorescent lamp ballasts. Therefore, DOE certifies that this final determination has no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared a FRFA for this final determination. DOE will transmit 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).

D. Review Under the Paperwork Reduction Act

Manufacturers of fluorescent lamp ballasts must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for fluorescent lamp ballasts, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including fluorescent lamp ballasts. 76 FR 12422 (Mar. 7, 2011); 80 FR 5099 (Jan. 30, 2015). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

E. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act of 1969 (''NEPA''), DOE has analyzed this final determination in accordance with NEPA and DOE's NEPA implementing regulations (10 CFR part 1021). DOE has determined that this rule qualifies for categorical exclusion A4 because it is an interpretation or ruling in regards to an existing regulation and otherwise meets the requirements for application of a categorical exclusion. See 10 CFR 1021.410. Therefore, DOE has determined that promulgation of this rule is not a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA, and does not require an environmental assessment or an environmental impact statement.

F. Review Under Executive Order 13132

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

G. 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.

H. Review Under the Unfunded Mandates Reform Act of 1995

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

This 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 the private sector. As a result, the analytical requirements of UMRA do not apply.

I. 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.

J. Review Under Executive Order 12630

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 18, 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.

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

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

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

Because this final determination does not amend energy conservation standards for fluorescent lamp ballasts, it is not a significant energy action, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on this final determination.

M. Information Quality

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

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and prepared a report describing that peer review.[31] 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. DOE has determined that the peer-reviewed analytical process continues to reflect current practice, and the Department followed that process for developing its determination in the case of the present rulemaking.

N. 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

[31] The 2007 ''Energy Conservation Standards Rulemaking Peer Review Report'' is available at the following website: *http://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0.*

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

This document of the U.S. Department of Energy was signed on December 3, 2020, by Daniel R Simmons, 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 U.S. 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 December 4, 2020.

Treena V. Garrett,

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

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