[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 430

EERE-2019-BT-STD-0022

RIN 1904-AE76

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

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

ACTION: Notice of proposed determination and request for comment.

SUMMARY: The Energy Policy and Conservation Act of 1975, as amended (EPCA), directs DOE to initiate a rulemaking for general service lamps (GSLs) that, among other requirements, determines whether standards in effect for general service incandescent lamps (GSILs, a subset of GSLs) should be amended. In this notice of proposed determination (NOPD), DOE has initially determined that energy conservation standards for GSILs do not need to be amended and asks for comment on this proposed determination and associated analyses and results.

DATES: *Comments:* Written comments and information are requested and will be accepted on or before [**INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***].

Meeting: DOE will hold a public meeting on Tuesday, October 15, 2019, from 10:00 a.m. to 3:00 p.m., in Washington, D.C. The meeting will also be broadcast as a webinar. See section VII, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E-089, 1000 Independence Avenue, SW., Washington, DC 20585.

Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *http://www.regulations.gov*. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE-BT-STD-0022, by any of the following methods:

1) *Federal eRulemaking Portal*: *http://www.regulations.gov*. Follow the instructions for submitting comments.
2) *E-mail*: *GSIL2019STD0022@ee.doe.gov*. Include the docket number EERE-BT-STD-0022 in the subject line of the message.
3) *Postal Mail*: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-1445. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.
4) *Hand Delivery/Courier*: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW., 6th Floor, Washington, DC, 20024. Telephone: (202) 287-1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

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

Docket: The docket, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at *http://www.regulations.gov*. All

documents in the docket are listed in the *http://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 *http://www.regulations.gov/docket?D=EERE-2019-BT-STD-0022*. The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VII, "Public Participation," for further information on how to submit comments through *http://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

Ms. Lucy deButts, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Email: *ApplianceStandardsQuestions@ee.doe.gov*.

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

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

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Determination

Title III, Part B[1] of the Energy Policy and Conservation Act of 1975, as amended (EPCA),[2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291-6309) These products include GSILs, the subject of this NOPD.

DOE is issuing this NOPD pursuant to the EPCA requirement that DOE must initiate a rulemaking for GSLs that, among other requirements, determines whether standards in effect for GSILs (a subset of GSLs) should be amended. (42 U.S.C. 6295(i)(6)(A))

For this proposed determination, DOE analyzed GSILs defined at title 10 of the Code of Federal Regulations (CFR) part 430, subpart A, section 430.2 and subject to standards specified in 10 CFR 430.32(x). DOE first analyzed the technological feasibility of more efficient GSILs. For those GSILs for which DOE determined higher standards to be technologically feasible, DOE estimated energy savings that would result from potential energy conservation standards by conducting a national impacts analysis (NIA). DOE evaluated whether higher standards would be economically justified 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).

[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).

Based on the results of these analyses, summarized in section V of this document, DOE has tentatively determined that current standards for GSILs do not need to be amended because more stringent standards are not economically justified.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed determination, as well as some of the relevant historical background related to standards for GSLs.

A. Authority and Background

Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which includes GSILs (a subset of GSLs) as covered products. (42 U.S.C. 6292(a)(14)) Amendments to EPCA in the Energy Independence and Security Act of 2007 (EISA 2007) directed DOE to conduct two rulemaking cycles to evaluate energy conservation standards for GSLs. (42 U.S.C. 6295(i)(6)(A)-(B)) GSLs are currently defined in EPCA to include GSILs, compact fluorescent lamps (CFLs), general service light-emitting diode (LED) lamps and organic light-emitting diode (OLED) lamps, and any other lamps that the Secretary of Energy (Secretary) determines are used to satisfy lighting applications traditionally served by GSILs. (42 U.S.C. 6291(30)(BB))

For the first rulemaking cycle, Congress instructed DOE to initiate a rulemaking process prior to January 1, 2014, to consider two questions: (1) whether to amend energy conservation standards for general service lamps and (2) whether "the exemptions for certain incandescent lamps should be maintained or discontinued." (42 U.S.C. 6295(i)(6)(A)(i)) Further, if the Secretary determines that the standards in effect for GSILs should be amended, EPCA provides that a final rule must be published by January 1, 2017, with a compliance date at least 3 years

after the date on which the final rule is published. (42 U.S.C. 6295(i)(6)(A)(iii)) In developing such a rule, DOE must consider a minimum efficacy standard of 45 lumens per watt (lm/W). (42 U.S.C. 6295(i)(6)(A)(ii)) If DOE fails to complete a rulemaking in accordance with 42 U.S.C. 6295(i)(6)(A)(i)-(iv) or a final rule from the first rulemaking cycle does not produce savings greater than or equal to the savings from a minimum efficacy standard of 45 lm/W, the statute provides a "backstop" under which DOE must prohibit sales of GSLs that do not meet a minimum 45 lm/W standard beginning on January 1, 2020. (42 U.S.C. 6295(i)(6)(A)(v))

The EISA-prescribed amendments further directed DOE to initiate a second rulemaking cycle by January 1, 2020, to determine whether standards in effect for GSILs should be amended with more-stringent requirements and if the exemptions for certain incandescent lamps should be maintained or discontinued. (42 U.S.C. 6295(i)(6)(B)(i)) For the second review of energy conservation standards, the scope is not limited to incandescent lamp technologies. (42 U.S.C. 6295(i)(6)(B)(ii))

The energy conservation program for covered products 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. The Federal Trade Commission (FTC) is primarily responsible for labeling, and DOE implements the remainder of the program.

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

6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for GSILs appear at 10 CFR part 430, subpart B, appendix R.

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c)) Absent limited exceptions, states generally are precluded from adopting energy conservation standards for covered products both before an energy conservation standard becomes effective, and after an energy conservation standard becomes effective. (42 U.S.C. 6297(b) and (c)) However, the statute contains three narrow exceptions to this general preemption provision specific to GSLs in 42 U.S.C. 6295(i)(6)(A)(vi). Under the limited exceptions from preemption specific to GSLs that Congress included in EPCA, only California and Nevada have authority to adopt, with an effective date beginning January 1, 2018 or after, either: (1) a final rule adopted by the Secretary in accordance with 42 U.S.C. 6295(i)(6)(A)(i)-(iv); (2) if a final rule has not been adopted in accordance with 42 U.S.C. 6295(i)(6)(A)(i)-(iv), the backstop requirement under 42 U.S.C. 6295(i)(6)(A)(v); or (3) in the case of California only, if a final rule has not been adopted in accordance with 42 U.S.C. 6295(i)(6)(A)(i)-(iv), any California regulations related to "these covered products" adopted pursuant to state statute in effect as of the date of enactment of EISA 2007. (42 U.S.C. 6295(i)(6)(A)(vi)) Because none of these narrow exceptions from preemption are available to California and Nevada, all states, including California and Nevada, are prohibited from adopting energy conservation standards for GSLs.[3]

Pursuant to the amendments contained in EISA 2007, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby

[3] DOE provides a more detailed explanation as to why the preemption exceptions are not available to California and Nevada in its General Service Lamps Definition Rule published elsewhere in today's *Federal Register*.

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 for GSILs does not address standby mode and off mode energy use because DOE concluded in a 2009 final rule that these modes of energy consumption were not applicable to the lamps. 74 FR 31829, 31833 (July 6, 2009). In this analysis DOE only considers active mode energy use in its determination of whether energy conservation standards for GSILs need to be amended.

DOE is prohibited from prescribing an amended standard that DOE determines will not result in significant conservation of energy, is not technologically feasible, or is not economically justified. (42 U.S.C. 6295(o)(3)) An evaluation of economic justification requires that DOE determine whether the benefits of a standard exceed its burdens through consideration, to the greatest extent practicable, the following seven statutory factors:

1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;
2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;
3) The total projected amount of energy (or as applicable, water) savings likely to result directly from the standard;

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

5) The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard;

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

7) Other factors the Secretary of Energy ("Secretary") considers relevant.

(42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

DOE is publishing this NOPD in satisfaction of EPCA's requirement to determine whether the standards in effect for GSILs should be amended. (42 U.S.C. 6295(i)(6)(A)(i) and (iii))

1. Current Standards

In a final rule published on March 23, 2009, DOE codified the current energy conservation standards, prescribed by EISA, for GSILs manufactured after January 1, 2012; January 1, 2013; or January 1, 2014. 74 FR 12058. These standards require a color rendering index (CRI) greater than or equal to 80 for standard spectrum lamps (or greater than or equal to 75 for modified spectrum lamps) and, for four specified lumen ranges, a rated wattage no greater than and a rated lifetime no less than the values set forth in DOE's regulations at 10 CFR 430.32(x)(1) and repeated in the tables below.

Table II.1 Federal Energy Conservation Standards for Standard Spectrum GSILs

Rated lumen ranges	Maximum rate wattage	Minimum rate life-time	Effective date
1490-2600	72	1,000 hrs	1/1/2012
1050-1489	53	1,000 hrs	1/1/2013
750-1049	43	1,000 hrs	1/1/2014
310-749	29	1,000 hrs	1/1/2014

Table II.2 Federal Energy Conservation Standards for Modified Spectrum GSILs

Rated lumen ranges	Maximum rate wattage	Minimum rate life-time	Effective date
1118-1950	72	1,000 hrs	1/1/2012
788-1117	53	1,000 hrs	1/1/2013
563-787	43	1,000 hrs	1/1/2014
232-562	29	1,000 hrs	1/1/2014

2. History of Standards Rulemakings for GSILs

GSILs are a subset of GSLs. As described in section II.A, EPCA directed DOE to conduct two rulemaking cycles to evaluate energy conservation standards for GSLs and outlined several specific criteria for each rulemaking cycle. DOE initiated the first GSL standards rulemaking process by publishing in the *Federal Register* a notice of a public meeting and availability of a framework document. 78 FR 73737 (December 9, 2013); see also 79 FR 73503 (December 11, 2014) (notice of public meeting and availability of preliminary analysis). DOE later issued a notice of proposed rulemaking (NOPR) to propose amended energy conservation standards for GSLs. 81 FR 14528, 14629-14630 (March 17, 2016) (the March 2016 GSL NOPR). The March 2016 GSL NOPR focused on the first question that Congress directed DOE to consider—whether to amend energy conservation standards for general service lamps. (42 U.S.C. 6295(i)(6)(A)(i)(I)) In the March 2016 GSL NOPR proposing energy conservation standards for GSLs, DOE stated that it would be unable to undertake any analysis regarding GSILs and other incandescent lamps because of a then applicable congressional restriction (the Appropriations Rider[4]) on the use of appropriated funds to implement or enforce 10 CFR 430.32(x). 81 FR 14528, 14540-14541 (March 17, 2016). Notably, the applicability of this

[4] Section 312 of the Consolidated and Further Continuing Appropriations Act, 2016 (Pub. L. 114-113, 129 Stat. 2419) prohibits expenditure of funds appropriated by that law to implement or enforce: (1) 10 CFR 430.32(x), which includes maximum wattage and minimum rated lifetime requirements for GSILs; and (2) standards set forth in section 325(i)(1)(B) of EPCA (42 U.S.C. 6295(i)(1)(B)), which sets minimum lamp efficiency ratings for incandescent reflector lamps.

Appropriations Rider, which had been extended in multiple appropriations through 2017, is no longer in effect.[5]

In response to comments on the March 2016 GSL NOPR, DOE conducted additional research and published a notice of proposed definition and data availability (NOPDDA), which proposed to amend the definitions of GSIL, GSL, and other supporting terms. 81 FR 71794, 71815 (Oct. 18, 2016). DOE explained that the October 2016 NOPDDA related to the second question that Congress directed DOE to consider—whether "the exemptions for certain incandescent lamps should be maintained or discontinued," and stated explicitly that the NOPDDA was not a rulemaking to establish an energy conservation standard for GSLs. (42 U.S.C. 6295(i)(6)(A)(i)(II)); see also 81 FR 71798. The relevant "exemptions," DOE explained, referred to the 22 categories of incandescent lamps that are statutorily excluded from the definitions of GSIL and GSL. 81 FR 71798. In the NOPDDA, DOE clarified that it was defining what lamps constitute GSLs so that manufacturers could understand how any potential energy conservation standards might apply to the market. *Id*.

On January 19, 2017, DOE published two final rules concerning the definition of GSL and related terms. 82 FR 7276; 82 FR 7322. The January 2017 definition final rules amended the definitions of GSIL and GSL by bringing certain categories of lamps that had been excluded by statute from the definition of GSIL within the definitions of GSIL and GSL. Like the October 2016 NOPDDA, DOE stated that the January 2017 definition final rules related only to the second question that Congress directed DOE to consider, regarding whether to maintain or discontinue certain "exemptions." (42 U.S.C. 6295(i)(6)(A)(i)(II)). That is, neither of the two

[5] See, the Consolidated Appropriations Act of 2017 (Pub. L. 115-31, div. D, tit. III); See also, Consolidated Appropriations Act, 2018 (Pub. L. 115–141); Continuing Appropriations Act, 2019 (Pub. L. 115-245).

final rules issued on January 19, 2017, purported to establish energy conservation standards applicable to GSLs.

With the removal of the Appropriations Rider in the Consolidated Appropriations Act, 2017, DOE is no longer restricted from undertaking analysis and decision making required by the first question presented by Congress, *i.e.*, whether to amend energy conservation standards for general service lamps, including GSILs. Thus, on August 15, 2017, DOE published a notice of data availability (NODA) and request for information seeking data for GSILs and other incandescent lamps. 82 FR 38613 (August 2017 NODA). The purpose of this NODA was to assist DOE in making a decision on the first question posed to DOE by Congress; *i.e.*, a determination regarding whether standards for GSILs should be amended. Comments submitted in response to the NODA also led DOE to re-consider the decisions it had already made with respect to the second question presented to DOE; *i.e.*, whether the exemptions for certain incandescent lamps should be maintained or discontinued. As a result of the comments received in response to the August 2017 NODA, DOE re-assessed the legal interpretations underlying certain decisions made in the January 2017 definition final rules and issued a NOPR on February 11, 2019 to withdraw the revised definitions of GSL, GSIL, and the supporting definitions established in the January 2017 definition rules (the February 2019 NOPR). 84 FR 3120. DOE held a public meeting on February 28, 2019 to hear oral comments and solicit information and data relevant to the February 2019 NOPR. Representatives for manufacturers, trade associations, environmental and energy efficiency advocates, and other interested parties attended the meeting.[6]

[6] A transcript of the public meeting and supporting documents are available in the docket at: *https://www.regulations.gov/docket?D=EERE-2018-BT-STD-0010*.

The determination on whether to amend standards for GSILs remains a decision DOE is obligated to make and is addressed in this NOPD. DOE has used the data and comments received in response to the August 2017 NODA and any relevant data and comments received in response to the February 2019 NOPR to conduct its analysis of whether energy conservation standards for GSILs need to be amended.

III. General Discussion

DOE developed this proposed determination after considering oral and written comments, data, and information from interested parties that represent a variety of interests. This NOPD addresses issues raised by these commenters.

A. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q)) The product classes for this proposed determination are discussed in further detail in section IV.A.5 of this document. This proposed determination covers GSILs as currently defined in 10 CFR 430.2, which is the same as the statutory definition for GSIL. The scope of coverage is discussed in further detail in section IV.A.1 of this document.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation

standards and to quantify the efficiency of their product. DOE's current energy conservation standards for GSILs are expressed in terms of a maximum rated wattage and a minimum rated lifetime. (See 10 CFR 430.32(x))

A final rule published on July 6, 2009 revised the test procedure for GSILs to reflect the energy conservation standards prescribed by EISA. The July 2009 final rule concluded that GSILs do not operate in standby or off mode. 74 FR 31829. DOE published a test procedure final rule on January 27, 2012, establishing revised active mode test procedures for GSILs. 77 FR 4203. The test procedure for GSILs is codified in appendix R to subpart B of 10 CFR part 430.

DOE has since published a request for information (RFI) to initiate a data collection process to consider whether to amend DOE's test procedures for general service fluorescent lamps, GSILs, and incandescent reflector lamps. 82 FR 37031 (August 8, 2017).

C. Technological Feasibility

1. General

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

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

2. Maximum Technologically Feasible Levels

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

D. Energy Savings

1. Determination of Savings

For the trial standard level (TSL) evaluated, DOE projected energy savings from application of the TSL to the GSIL purchased in the 30-year period that begins in the assumed year of compliance with the potential standards (2023–2052). The savings are measured over the

entire lifetime of the GSILs and substitute lamps purchased in the 30-year period. DOE quantified the energy savings attributable to TSL 1 as the difference in energy consumption between the standards case with substitution effects 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. In this case, the standards case represents energy savings not from the technology outlined in TSL 1, but from product substitution as consumers are priced out of the market for GSILs. DOE used its NIA spreadsheet model to estimate national energy savings (NES) from potential amended standards for GSILs. The NIA spreadsheet model (described in section IV.G 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 site energy savings and source energy savings, the latter of which is the savings in the energy that is used to generate and transmit the site electricity. DOE also calculates NES in terms of full-fuel-cycle (FFC) energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.*, coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[7] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.G 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)) Although

[7] 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).

the term "significant" is not defined in EPCA, DOE recently proposed to define a significant energy savings threshold ("Process Rule"). 84 FR 3910 (February 13, 2019). Specifically, DOE stated that it is considering using a two-step approach that would consider both a quad threshold value (over a 30-year period) and a percentage threshold value to ascertain whether a potential standard satisfies 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." 84 FR 3901, 3924. DOE's updates to the Process Rule have not yet been finalized.

E. Economic Justification

1. Specific Criteria

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

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential amended standard on manufacturers, DOE conducts an MIA, as discussed in section IV.H. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include industry net present value (INPV), which values the industry based on expected future cash flows; cash flows by year; changes in revenue and income; and other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and

manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

For individual consumers, measures of economic impact include the changes in LCC and PBP associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the economic impacts applicable to a particular rulemaking. DOE also evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a national standard. However, because DOE has tentatively concluded amended standards for GSILs would not result in significant energy savings and, as discussed further in section V.E.3, would not be economically justified for one of the potential standard levels evaluated based on the PBP analysis, DOE did not conduct an LCC subgroup analysis for this notice.

b. Savings in Operating Costs Compared to Increase in Price

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of the covered product that is likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of a product (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that consumers will purchase the covered products

in the first year of compliance with amended standards. In this analysis, DOE estimates the consumer LCC of the covered product under a standards scenario and, as an input to the NPV, the consumer LCC of switching to substitute products as a replacement for the covered product. However, as described above the statutory factor addressed in this analysis is the savings in operating costs throughout the estimated average life of the *covered product* in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the *covered products* which are likely to result from the imposition of the standard (emphasis added). Moreover, EPCA prohibits DOE from prescribing an amended or new standard if doing so is likely to result in the unavailability in the United States in any *covered product* type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding (emphasis added). As such, while DOE presents the LCC of switching to substitute products as a replacement for the covered product, DOE cannot, in this determination, consider those LCC savings in making a determination as to whether amended standards for the covered product are economically justified because those LCC savings result from the unavailability of the covered product. Rather, DOE's determination regarding economic justification must be based on LCC savings resulting from establishing an amended standard for the covered product, i.e., GSILs.

The LCC savings for the considered standard levels are calculated relative to the no-new-standards case and the PBP for the considered efficacy levels are calculated relative to the baseline. DOE's LCC and PBP analysis is discussed in further detail in section IV.E of this document.

c. Energy Savings

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

d. Lessening of Utility or Performance of Products

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

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) Because DOE is not proposing standards for GSILs, DOE did not transmit a copy of its proposed determination to the Attorney General.

f. Need for National Energy Conservation

In evaluating the need for national energy conservation, DOE expects that energy savings from amended standards would likely provide improvements to the security and reliability of the nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the nation's electricity system. Energy savings from amended standards also would likely result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases primarily associated with fossil-fuel based energy production. Because DOE has tentatively concluded amended standards for GSILs would not be economically justified for the potential standard level evaluated based on the PBP analysis, DOE did not conduct a utility impact analysis or emissions analysis for this NOPD.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII))

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the effect potential amended energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-

presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable-presumption payback calculation is discussed in section V.B.2 of this document.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this proposed determination with regard to GSILs. Separate subsections address each component of DOE's analyses. DOE used several analytical tools to estimate the impact of potential energy conservation standards. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential energy conservation standards. The NIA uses a second spreadsheet set that provides shipments projections and calculates NES and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (GRIM), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available in the docket (see *Docket* section at the beginning of this NOPD).

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. This activity includes both quantitative and qualitative assessments, based primarily on publicly available information. The subjects addressed in the market and technology

assessment for this proposed determination include (1) a determination of the scope and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends, and (6) technologies or design options that could improve the energy efficiency of GSILs. The key findings of DOE's market assessment are summarized in the following sections.

1. Scope of Coverage

GSIL means a standard incandescent or halogen type lamp that is intended for general service applications; has a medium screw base; has a lumen range of not less than 310 lumens and not more than 2,600 lumens or, in the case of a modified spectrum lamp, not less than 232 lumens and not more than 1,950 lumens; and is capable of being operated at a voltage range at least partially within 110 and 130 volts; however this definition does not apply to the following incandescent lamps: (1) An appliance lamp; (2) A black light lamp; (3) A bug lamp; (4) A colored lamp; (5) An infrared lamp; (6) A left-hand thread lamp; (7) A marine lamp; (8) A marine signal service lamp; (9) A mine service lamp; (10) A plant light lamp; (11) A reflector lamp; (12) A rough service lamp; (13) A shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp); (14) A sign service lamp; (15) A silver bowl lamp; (16) A showcase lamp; (17) A 3-way incandescent lamp; (18) A traffic signal lamp; (19) A vibration service lamp; (20) A G shape lamp with a diameter of 5 inches or more; (21) A T shape lamp that uses not more than 40 watts or has a length of more than 10 inches; and (22) A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp of 40 watts or less. 10 CFR 430.2 In this analysis, DOE relied on the definition of "general service incandescent lamp" currently in 10 CFR 430.2.

2. Metric

Current energy conservation standards for GSILs are applicable to active mode energy use and are based on a maximum wattage for a given lumen range. In this proposed determination, DOE used efficacy (lumens divided by watts, or lm/W) to assess active mode energy use. The measurement of lumens and watts and the calculation of lamp efficacy for GSILs is included in the current test procedure at appendix R to subpart B of 10 CFR part 430.

3. Technology Options

To develop a list of technology options, DOE reviewed manufacturer catalogs, recent trade publications, technical journals, and the 2015 IRL final rule[8] for incandescent reflector lamps (IRLs), and consulted with technical experts. Based on DOE's review of product offerings and their efficacies in manufacturer catalogs and DOE's Compliance Certification Management System (CCMS) database, GSILs are not commercially available at efficacy levels above that which is currently required. However, DOE identified an infrared coatings technology previously used in commercially available IRLs that could be used to improve the efficiency of currently commercially available GSILs.

Infrared (IR) coatings on incandescent lamps are used to reflect some of the radiant energy emitted back onto the filament. This infrared radiation then supplies heat to the filament and the operating temperature increases. An increase in operating temperature results in a higher light output and therefore an increase in efficacy. These infrared coatings are most commonly applied directly to the burner, or capsule, of a halogen lamp, which achieves the greatest directed

[8] Documents from DOE's rulemaking for IRLs are available here: *https://www.regulations.gov/docket?D=EERE-2011-BT-STD-0006*.

reflection back onto the filament for the lowest infrared coating usage. For more detail, see chapter 3 of the technical support document (TSD) for the 2015 IRL final rule.[9]

In response to the August 2017 NODA and the February 2019 NOPR, several stakeholders commented on potential pathways to improve the efficacy of GSILs. The National Electrical Manufacturers Association (NEMA) and General Electric (GE) stated that there are no GSILs available that are more efficacious than the current GSILs on the market. (NEMA, No. 4 at p. 31;[10] GE, No. 3 at p. 7)[11] However, NEMA and GE both noted that more efficacious GSILs were previously manufactured and distributed in commerce. (NEMA, No. 4 at p. 32; GE, No. 3 at p. 14)[11] GE, several years ago, offered two GSILs that used a halogen capsule with an infrared coating, referred to as halogen infrared (HIR) technology. Both HIR lamps had rated lifetimes of 3,000 hours and the 60-watt equivalent had a rated wattage of 45 watts whereas the 100-watt equivalent had a rated wattage of 65 watts. GE stated that neither of the products were commercially successful and both were discontinued after several years. (GE, No. 3 at p. 14)[11] GE also noted that the lifetime of the HIR lamp could be shortened to reduce its wattage and therefore make it more efficacious but the purchase price would not change and there would be fewer hours over which to recover the high initial purchase price. (GE, No. 3 at p. 16)[11] NEMA added in response to the February 2019 NOPR that Venture Lighting had also sold but then discontinued a more efficacious halogen GSIL and that TCP had never introduced a more

[9] The TSD for the 2015 IRL final rule is available at *https://www.regulations.gov/document?D=EERE-2011-BT-STD-0006-0066*.

[10] A notation in this form provides a reference for information that is in the docket of either the August 2017 NODA (Docket No. EERE-2017-BT-NOA-0052) or the February 2019 NOPR (Docket No. EERE-2018-BT-STD-0010). This notation indicates that the statement preceding the reference is document number 4 in the applicable docket, and appears at page 31 of that document.

[11] These documents were submitted to the docket of DOE's request for data regarding incandescent lamps (Docket No. EERE-2017-BT-NOA-0052).

efficacious halogen GSIL because it determined the cost of the product was too high. (NEMA, No. 329 at pp. 37-38)[12]

Because HIR technology was used in GSILs in the past and is still used in commercially available IRLs, it is a technology that could be used to improve the efficiency of currently commercially available GSILs. Although IRLs include a reflector to direct light, the presence of a reflector is not necessary to employ HIR technology. An IR coating is applied directly to a halogen capsule, which is present in lamps both with and without reflectors. Indeed, currently commercially available GSILs and IRLs include halogen capsules. GE stated that the lamps were not commercially successful because they could not be "economically justified" (GE, No. 3 at pp. 14-16)[11], and DOE is directed by EPCA to consider enumerated factors in evaluating whether standards are economically justified. (42 U.S.C. 6295(o)(2)(B)(i)) The analysis corresponding to the EPCA requirements and the results are presented in section V. DOE does not consider cost when identifying technology options.

In summary, for this analysis, DOE considers the technology options shown in Table IV.1.

Table IV.1 GSIL Technology Options

Name of Technology Option	Description
Higher Temperature Operation	Operating the filament at higher temperatures, the spectral output shifts to lower wavelengths, increasing its overlap with the eye sensitivity curve.
Microcavity Filaments	Texturing, surface perforations, microcavity holes with material fillings, increasing surface area and thereby light output.
Novel Filament Materials	More efficient filament alloys that have a high melting point, low vapor pressure, high strength, high ductility, or good radiating characteristics.

[12] This document was submitted to the docket of DOE's proposal to withdraw the revised definitions of GSL and GSIL that take effect on January 1, 2020. (Docket No. EERE-2018-BT-STD-0010)

Name of Technology Option	Description
Thinner Filaments	Thinner filaments to increase operating temperature. This measure may shorten the operating life of the lamp.
Crystallite Filament Coatings	Layers of micron or submicron crystallites deposited on the filament surface that increases emissivity of the filament.
Higher Efficiency Inert Fill Gas	Filling lamps with alternative gases, such as Krypton, to reduce heat conduction.
Higher Pressure Tungsten-Halogen Lamps	Increased halogen bulb burner pressurization, allowing higher temperature operation.
Non-Tungsten-Halogen Regenerative Cycles	Novel filament materials that regenerate.
Infrared Glass Coatings	When used with a halogen burner, this is referred to as an HIR lamp. Infrared coatings on the inside of the bulb to reflect some of the radiant energy back onto the filament.
Infrared Phosphor Glass Coatings	Phosphor coatings that can absorb infrared radiation and re-emit it at shorter wavelengths (visible region of light), increasing the lumen output.
Ultraviolet Phosphor Glass Coatings	Phosphor coatings that convert ultraviolet radiation into longer wavelengths (visible region of light), increasing the lumen output.
High Reflectance Filament Supports	Filament supports that include a reflective face that reflects light to another filament, the reflective face of another filament support, or radially outward.
Permanent Infrared Reflector Coating Shroud	Permanent shroud with an IR reflector coating and a removable and replaceable lamp can increase efficiency while reducing manufacturing costs by allowing IR reflector coatings to be reused.
Higher Efficiency Burners	A double-ended burner that features a lead wire outside of the burner, where it does not interfere with the reflectance of energy from the burner wall back to the burner filament in HIR lamps.

4. Screening Analysis

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

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

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

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

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

10 CFR part 430, subpart C, appendix A, 4(a)(4) and 5(b)

In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed four criteria, it will be excluded from further consideration in the engineering analysis. Additionally, it is DOE policy not to include in its analysis any proprietary technology that is a unique pathway to achieving a certain efficacy level.

DOE reviewed the technology options identified in Table IV.1 and screened out several because DOE could not find evidence of their existence in working prototypes or commercially available products. For several of them, DOE also screened them out based on the practicability to manufacture and/or impacts on product utility. Table IV.2 summarizes the technology options screened out.

Table IV.2 GSIL Technology Options Screened Out of the Analysis

Design Option Excluded	Screening Criteria
Novel Filament Materials	Technological feasibility, Practicability to manufacture, install, and service, Adverse impact on product utility
Microcavity Filaments	Technological feasibility, Practicability to manufacture, install, and service, Adverse impact on product utility
Crystallite Filament Coatings	Technological feasibility, Practicability to manufacture, install, and service
High Reflectance Filament Supports	Technological feasibility, Practicability to manufacture, install, and service
Non-Tungsten-Halogen Regenerative Cycles	Technological feasibility, Practicability to manufacture, install, and service, Adverse impact on product utility
Permanent Infrared Reflector Coating Shroud	Technological feasibility, Practicability to manufacture, install, and service
Infrared Phosphor Glass Coating	Technological feasibility, Practicability to manufacture, install, and service
Ultraviolet Phosphor Glass Coating	Technological feasibility, Practicability to manufacture, install, and service

DOE did not screen out infrared glass coatings. As noted in section IV.A.3, infrared glass coatings were previously used to improve the efficiency of GSILs; however those products were not commercially viable and are no longer available. The existence of a commercially available GSIL that employed the technology in the recent past, in addition to the existence of a commercially available IRL that currently employs the technology on halogen capsules that could be used in GSILs, indicates that infrared glass coatings are technologically feasible and practicable to manufacture, install, and service. DOE is not aware of any adverse impacts on product utility or adverse impacts on health or safety; IRLs that use the technology have been available for at least 10 years with no significant issues. As described by GE, it was a business decision to discontinue the GSILs that utilized infrared glass coatings because of their high costs. DOE considers economic impacts on consumers, manufacturers, and the nation as described in sections IV.E, IV.H, and IV.G.

DOE tentatively concludes that the remaining technologies pass all four screening criteria to be examined further as design options in this analysis. In summary, DOE did not screen out

the following technology options and considers them as design options in the engineering analysis:

- Higher Temperature Operation
- Thinner Filaments
- Higher Efficiency Inert Fill Gas
- Higher Pressure Tungsten-Halogen Lamps
- Infrared Glass Coatings
- Higher Efficiency Burners

5. 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)) Product classes for GSILs are currently divided based on lamp spectrum and lumen output.

DOE proposes to maintain separate product classes based on lamp spectrum. Modified spectrum[13] lamps provide unique utility to consumers by providing a different type of light than standard spectrum lamps, much like fluorescent and light-emitting diode (LED) lamps with different correlated color temperature (CCT) values. However, the same technologies that modify the spectral emission of a lamp also decrease lamp efficacy. To modify the spectrum, the coating absorbs a portion of the light emission from the filament. Neodymium coatings or other coatings on modified spectrum lamps absorb some of the visible emission from the incandescent

[13] See CFR 430.2 for the definition of "modified spectrum" with respect to an incandescent lamp.

filament (usually red), creating a modified, reduced spectral emission. Since the neodymium or other coatings absorb some of the lumen output from the filament, these coatings decrease the efficacy of the lamp. Because of the impact on both efficacy and utility, DOE is proposing to maintain separate product classes based on spectrum. DOE is proposing separate product classes for standard spectrum GSILs (those without modification to the spectral emission) and modified spectrum GSILs (some portion of the spectral emission is absorbed).

DOE did not separate product classes based on lumen output for the evaluation under this proposed determination. As described in section IV.B.4, DOE evaluated efficacy levels (ELs) that use an equation to determine the minimum required efficacy based on the lamp's lumen output. Current product classes for GSILs are separated based on lumen output, with a constant maximum wattage specified for a given lumen range. This results in the minimum efficacy requirement increasing as lumen output increases across a given lumen range. DOE evaluated efficacy levels that follow the same trend; that is, minimum required efficacy increases as lumen output increases. Because DOE is evaluating efficacy levels based on an equation in which the minimum efficacy requirement changes based on the lumen output of the lamp, DOE did not evaluate separate product classes based on lumen output.

In summary, DOE evaluated two product classes for GSILs – one for GSILs that meet the definition of modified spectrum in 10 CFR 430.2 and one for standard spectrum GSILs (i.e. do not meet the definition of modified spectrum). See chapter 3 of the NOPD TSD for further discussion.

B. Engineering Analysis

In the engineering analysis, DOE selects representative product classes to analyze. It then selects baseline lamps within those representative product classes and identifies more-

efficacious substitutes for the baseline lamps. DOE uses these more-efficacious lamps to develop efficacy levels.

For this proposed determination, DOE selected more efficacious substitutes in the engineering analysis and determined the consumer prices of those substitutes in the product price determination. DOE estimated the consumer price of lamps directly because reverse-engineering is impractical since the lamps are not easily disassembled. 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.C discusses the product price determination.

The methodology for the engineering analysis consists of the following steps: (1) select representative product classes, (2) select baseline lamps, (3) identify more efficacious substitutes, (4) develop efficacy levels by directly analyzing representative product classes, and (5) scale efficacy levels to non-representative product classes. The details of the engineering analysis are discussed in chapter 5 of the NOPD TSD.

1. Representative Product Classes

In the case where a covered product has multiple product classes, DOE identifies and selects certain product classes as "representative" and concentrates its analytical effort on those classes. DOE chooses product classes as representative primarily because of their high market volumes. Based on its assessment of product offerings, DOE analyzed as representative standard spectrum GSILs (only 3 percent of commercially available halogen GSILs were marketed as having a modified spectrum). This is consistent with the 2015 IRL rulemaking in which DOE analyzed, with support from NEMA, standard spectrum IRLs as representative. 79 FR 24068, 24107 (April 29, 2014).

2. Baseline Lamps

For each representative product class, DOE selects a baseline lamp as a reference point against which to measure changes resulting from energy conservation standards. Typically the baseline lamp is the most common, least efficacious lamp that meets existing energy conservation standards. In this analysis, DOE selected as a baseline the least efficacious lamp meeting standards with the most common lumen output and, where possible, with the most common wattage, lifetime, input voltage, and shape for the product class.

DOE reviewed certified GSILs in DOE's compliance certification database and also used a database of commercially available products to identify the baseline lamp. DOE identified 60 watt equivalent lamps, or lamps with a lumen output between 750 and 1,049 lumens, to be the most common lamps based on the number of products certified within this lumen range in the compliance certification database. This is consistent with DOE's conclusion in the March 2016 GSL NOPR that 60-watt equivalent lamps were the most popular lamps within the 310 to 2,000 lumen product class. 81 FR 14528, 14568-14569 (March 17, 2016). DOE also analyzed certified GSILs to identify a common wattage and lifetime. For lamps with a lumen output between 750 and 1,049 lumens, DOE found certified rated wattage values to range from 41.9 to 43 watts and certified rated lifetime values to range from 1,000 to 2,056 hours. The wattage values were distributed among the range and about equally distributed between values that would round to 42 watts and values that would round to 43 watts. Products available in catalogs and on websites reported rated wattage to the nearest whole number rather than the nearest tenth of a watt. A database of commercially available products showed the most popular wattage to be 43 watts (92 percent of all halogen GSILs within the lumen range, 100 percent of all GSILs marketed as a 60 watt equivalent). Among GSILs with a lumen output between 750 and 1,049 lumens, the most

common rated lifetime was 1,000 hours (76 percent of all certified GSILs within the lumen range). This was consistent with the database for commercially available products – over 80 percent of halogen lamps with a lumen output between 750 and 1,049 lumens had a lifetime of 1,000 hours and all halogen lamps in the designated lumen range that were marketed as 60 watt equivalents also had a lifetime of 1,000 hours. In addition to rated wattage and rated lifetime, 95 percent of commercially available halogen lamps (100 percent of commercially available halogen lamps marketed as 60 watt equivalents) within the designated lumen range had an input voltage of 120 volts and 70 percent of commercially available halogen lamps within the designated lumen range had an A19 bulb shape.

DOE selected the baseline lamp shown in Table IV.3 because it just meets existing standards within the most common lumen range and also has other common characteristics described in the preceding paragraph. See chapter 5 of the NOPD TSD for more detail.

Table IV.3 Baseline GSIL

EL	Technology	Wattage	Bulb Shape	Initial Lumens	Rated Lifetime (hrs)	Efficacy (lm/W)
EL 0/Baseline	Halogen	43	A19	750	1,000	17.4

3. More-Efficacious Substitutes

Because few, if any, consumers are anticipated to buy HIR lamps under TSL 1, DOE expects that consumers who presently buy GSILs would substitute less expensive lamps, such as CFLs and LEDs. DOE evaluated more-efficacious lamps as replacements for the baseline lamp by considering commercially available products and technologies not eliminated in the screening analysis. DOE could not use data in the compliance certification database to evaluate more efficacious lamps because the information required to calculate efficacy was not included; rated

wattage was reported for a given lumen range rather than for an exact lumen output. Instead, DOE reviewed its database of commercially available GSILs for lamps that met the definition of a GSIL, had a lumen output between 750 and 1,049 lumens, had an A-shape, and had a higher efficacy than the baseline lamp while still exceeding the minimum standard established by EISA. DOE did not identify any commercially available GSILs that could serve as more efficacious substitutes for the baseline lamp.

Because no commercially available products could serve as a more efficacious substitute for the baseline lamp, DOE modeled a more efficacious substitute based on design options identified in the screening analysis. As noted in section IV.A.4, the technology options identified as design options must be technologically feasible; practicable to manufacture, install, and service; have no adverse impacts on product utility or product availability; and have no adverse impacts on health or safety.

DOE modeled a more efficacious substitute for the baseline lamp assuming that the modeled lamp utilized IR coatings on the halogen capsule within the baseline lamp. In this instance, the model is based on an actual lamp that previously had been commercially available but was taken off the market for economic reasons, including high upfront cost. The inclusion of an IR coating also increases the lamp's operating temperature and pressure (two other identified design options). DOE's modeled lamp did not incorporate thinner filaments, higher efficiency inert fill gas, or higher efficiency burners because it did not believe including those design options would increase the efficacy beyond that achieved by the combination of an IR coating and higher temperature and pressure operation.

DOE reviewed information submitted by GE regarding GSILs that it previously offered for sale. GE's 60 watt equivalent GSIL that employed IR coatings had a rated wattage of 45

watts and a lifetime of 3,000 hours. DOE reviewed information on discontinued products and found a label that indicated this product had a lumen output of 870 lumens. DOE used a similar methodology as in the 2009 IRL rulemaking[14] and the 2015 IRL rulemaking[15] to adjust the lumen output and lifetime of the lamp to be equal to that of the baseline lamp (see chapter 5 of the TSD for the 2009 IRL final rule). Making these adjustments lowered the rated wattage of the modeled lamp to 34.3 watts. This decrease in wattage in consistent with GE's comment that lowering the lifetime of the HIR lamp would reduce its wattage and therefore make it more efficacious. (GE, No. 3 at p. 16)[11] DOE identifies only energy-saving substitutes in the engineering analysis. The performance characteristics of the modeled HIR lamp are shown in Table IV.4.

Table IV.4 More Efficacious GSIL Substitutes

EL	Technology	Wattage	Bulb Shape	Initial Lumens	Rated Lifetime (hrs)	Efficacy (lm/W)
EL 1	HIR	34.3	A19	750	1,000	21.9

4. Efficacy Levels

After identifying more-efficacious substitutes for the baseline lamp, DOE developed ELs based on the consideration of several factors, including: (1) the design options associated with the specific lamps being studied, (2) the ability of lamps across lumen outputs to comply with the standard level of a given product class, and (3) the max-tech level.

DOE is employing an equation-based approach in this NOPD. DOE is relying on a continuous equation based on its assessment that a step function, where efficacy rises significantly at certain increments in lumen output, is not representative of the technology used

[14] DOE published a final rule on July 14, 2009 amending energy conservation standards for IRLs. The docket for the 2009 rulemaking is available at *https://www.regulations.gov/docket?D=EERE-2006-STD-0131*.
[15] Chapter 5 of the TSD for the 2015 IRL final rule is available at *https://www.regulations.gov/document?D=EERE-2011-BT-STD-0006-0066.*

by the products covered by this proposed determination. DOE recognizes that a step function increases the potential for products to be introduced at the lowest possible efficacy point in each step. While this could potentially encourage the development of similar-wattage products across the industry, a wide variety of replacement wattages would offer the consumer a greater number of choices. For example, LED lamps exist in many different wattages and consumer choice has been positively impacted. For these reasons, the limitations of a step function outweigh its benefits and DOE is therefore evaluating a standard based on a smooth, continuous equation.

DOE is evaluating a lumens-based approach in this notice. The primary utility provided by a lamp is lumen output, which can be achieved through a wide range of wattages depending on the lamp technology. For this reason, lamps providing equivalent lumen output and therefore intended for the same applications should be subject to the same minimum efficacy requirements. Thus, DOE is considering a continuous equation for ELs that develops a relationship between lumen output and efficacy.

DOE reviewed the equation form used in the March 2016 GSL NOPR to evaluate its applicability to GSILs. Specifically, DOE considered the following equation that relates the lumen output of a lamp to lamp efficacy:

$$Efficacy = A - 29.42 * 0.9983^{\text{initial lumen output}}$$

where A is a constant that varies by EL.

In the preliminary analysis[16] for the GSL energy conservation standards rulemaking, DOE utilized a database of commercially available lamps to evaluate efficacy trends of GSLs across a range of lumen outputs in order to fit the curve. DOE confirmed the curve fit matched product performance, particularly in the low and high ends of the GSL lumen range. Although

[16] Prior to publishing the March 2016 GSL NOPR, DOE published a notice in the *Federal Register* announcing the availability of the preliminary analysis. 79 FR 73503 (Dec. 11, 2014).

GSILs were not included in that analysis because it was legally prohibited by an Appropriations Rider from doing so, the relationship characterized by the equation is consistent with the current standards for GSILs. The structure of the current standards, with a maximum wattage for a given lumen range, results in the least stringent requirement being at the lowest lumen output within each lumen range. Since the current standards have required compliance, products on the market have generally been offered at the lowest lumen output within given lumen range, likely because it is easiest to comply with these requirements. When plotting these commercially available lamps, the efficacy increases as lumen output increases, with the largest jump in efficacy occurring between the lowest and next-lowest lumen output range and each successive jump in efficacy being smaller than the one prior to it. The equation under consideration characterizes the same trend; that is, efficacy sharply increases as lumen output increases at the lowest part of the lumen range and then the increases slow down such that a curve is formed with a steep slope at the low end of the lumen range and a flatter slope at the high end of the lumen range. Because the equation from the March 2016 GSL NOPR characterizes the same lumen output-efficacy relationship shown by the current GSIL standards, DOE has used this equation form to establish ELs for GSILs.

As described in section IV.B.3, DOE identified, through modeling, one GSIL technology that could perform at an efficacy higher than existing standards. DOE developed one EL based on the efficacy of the more modeled lamp. Based on a lumen output of 750 lumens and an efficacy of 21.9 lm/W (see Table IV.4), DOE determined EL 1 to have an A value of 30.0. Table IV.5 summarizes the EL developed by the engineering analysis.

Table IV.5 EL for GSIL Representative Product Class Based on Engineering Analysis

Representative Product Class	Efficacy Level	Efficacy
		lm/W
Standard Spectrum GSILs	EL 1	30.0-29.42*0.9983^Initial Lumen Output

5. Scaling to Other Product Classes

DOE identifies and selects certain product classes as representative and analyzes these product classes directly. DOE chooses representative product classes primarily due to their high market volumes. The ELs for product classes that are not directly analyzed ("non-representative product classes") are then determined by scaling the ELs of the representative product classes. For this analysis DOE directly analyzed standard spectrum GSILs but did not directly analyze modified spectrum GSILs.

DOE developed an EL for the modified spectrum product class by scaling the EL of the standard spectrum product class. The primary difference between these product classes is the lamp spectrum; a coating applied to the lamp modifies its spectral emission but also decreases its efficacy. DOE developed a scaling factor by comparing existing standards for standard spectrum GSILs to similar modified spectrum GSILs. From this analysis DOE determined that the modified spectrum lamps are 25 percent less efficacious than standard spectrum lamps. DOE applied this reduction to the A-value for the EL developed in section IV.B.4.

Table IV.6 summarizes the efficacy requirements for the non-representative product class.

Table IV.6 EL for GSIL Non-Representative Product Class Based on Engineering Analysis

Non-Representative Product Class	Efficacy Level	Efficacy
		lm/W
Modified Spectrum GSILs	EL 1	22.5-29.42*0.9983^Initial Lumen Output

6. Product Substitutes

If energy conservation standards for GSILs are amended, consumers may substitute alternative lamps that are not GSILs due to the high upfront cost and long PBP associated with HIR technology. DOE notes that EPCA prohibits DOE from prescribing an amended or new standard if that standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. 42 U.S.C. 6295(o)(4) As such, DOE could not set a standard applicable to GSILs that results in consumers being left with no choice but an alternative lamp that is a different product type or has different performance characteristics or features than GSILs.

In this analysis, DOE considered several alternatives available to consumers that have the same base type (medium screw base) and input voltage (120 volts) as the baseline lamp. DOE considered two more efficacious lamps that consumers may choose if standards for GSILs are amended: a CFL and an LED lamp. As noted by GE and NEMA, CFLs and LED lamps can be used to satisfy lighting applications traditionally served by incandescent general service lamps. (GE, No. 3 at p. 7; NEMA, No. 4 at p. 31)[11] For consumers who are resistant to changing technology, and for those who are trying to replace a 60 watt incandescent lamp with a 60 watt replacement, DOE also considered a shatter-resistant incandescent lamp that is exempt from the definition of GSIL. Because this lamp is not a GSIL, it would not be subject to amended standards for GSILs and would remain available on the market. However, all of the lamps considered in this consumer choice analysis represent a change in product type, technology and performance characteristics compared to a halogen or HIR lamp, and, thus are provided for

informational purposes only. Table IV.7 summarizes the performance characteristics of the GSIL alternatives that consumers can choose if GSIL standards are amended.

Table IV.7 Alternative Lamps Consumers May Substitute For GSILs

Option	Technology	Wattage	Bulb Shape	Initial Lumens	Rated Lifetime (hrs)	Efficacy (lm/W)
A	Incandescent	60	A19	587	4,000	9.8
B	CFL	13	Spiral	900	10,000	69.2
C	LED	9	A19	800	15,000	88.9

C. Product Price Determination

Typically, DOE develops manufacturer selling prices (MSPs) for covered products and applies markups to create end-user prices to use as inputs to the LCC analysis and NIA. Because GSILs are difficult to reverse-engineer (*i.e.*, not easily disassembled), DOE directly derives end-user prices for GSILs. End-user price refers to the product price a consumer pays before tax and installation.

In the March 2016 GSL NOPR, DOE observed a range of consumer prices paid for a lamp, depending on the distribution channel through which the lamp was purchased. Specifically, DOE identified the following four main distribution channels: Small Consumer-Based Distributors (*i.e.*, internet retailers, grocery stores, drug stores); Large Consumer-Based Distributors: (*i.e.*, home centers, mass merchants, hardware stores); Electrical Distributors; and State Procurement. For each distribution channel, DOE calculated an average price for the representative lamp unit at each EL using prices for the representative lamp unit and similar lamp models. Because the similar lamp models included in the average price were equivalent to the representative lamp unit in terms of performance and utility (*i.e.*, had similar wattage, CCT, bulb shape, base type, CRI), DOE considered the pricing of these lamps to be representative of

the technology of the EL. DOE developed average end-user prices for the representative lamp units sold in each of the four main distribution channels identified. DOE then calculated an average weighted end-user price using estimated shipments through each distribution channel. DOE applied a 10 percent weighting to the Small Consumer-Based Distributors channel, 80 percent to the Large Consumer-Based Distributors channel, 5 percent to the Electrical Distributors channel, and 5 percent to the State Procurement channel.

DOE used the methodology from the March 2016 GSL NOPR to calculate the prices for the GSIL baseline lamp and the three consumer choice alternatives. GSILs and the three consumer choice alternatives are purchased through the same distribution channels as the CFL and LED lamps analyzed in the March 2016 GSL NOPR.

Because DOE modeled an HIR lamp at EL 1, which is not currently commercially available, DOE could not gather prices for commercially available lamps and use the same methodology as the March 2016 GSL NOPR. Instead, DOE reviewed the incremental pricing from the 2015 IRL final rule for the baseline halogen lamp and the more efficacious HIR substitute. HIR technology can be utilized in both omnidirectional lamps and reflector lamps because it is applied directly to halogen capsules contained within both lamp types. DOE therefore added the incremental change in end-user price from the 2015 IRL final rule to the baseline GSIL analyzed in this evaluation.

GE stated that HIR lamps are expensive because the coating of the halogen capsules occurs during a slow and expensive batch manufacturing process. A heavy glass outer jacket is also used because the capsule operates at a higher pressure than standard halogen capsules. GE stated that the price for the HIR lamp it used to offer for sale ranged from $6.00 to $9.00 per lamp depending on the retailer and packaging quantity and that the average price was $7.00 per

lamp. GE asserted that reducing the price much below $6.00 was not a long-term economic option because the high cost of the product left little profit margin for the manufacturer or retailer at lower prices. (GE, No. 325 at p. 5)[12] As described in the preceding paragraph, DOE determined the price of the HIR lamp at EL 1 by reviewing the prices for the halogen baseline and HIR lamp in the 2015 IRL final rule. That analysis concluded the price of the HIR lamp to be $7, which aligns with the price estimate submitted by GE. DOE notes that $7 is significantly more than consumers currently pay for 43W Halogen lamps ($1.81), IRLs ($2.15), CFLs ($2.94), and LEDs ($3.00), further illustrating that HIR lamp technology is not commercially viable.

Table IV.8 summarizes the prices of the GSILs analyzed in this rulemaking and Table IV.9 summarizes the prices of the alternative lamps consumers may choose if standards for GSILs are amended.

Table IV.8 End-User Prices for GSILs

EL	Technology	Wattage	Initial Lumens	Rated Lifetime (hrs)	Efficacy (lm/W)	End-User Price
EL 0	Halogen	43	750	1,000	17.4	$1.81
EL 1	HIR	34.3	750	1,000	21.9	$7.00

Table IV.9 End-User Prices for Consumer Choice Alternatives

Option	Technology	Wattage	Initial Lumens	Rated Lifetime (hrs)	Efficacy (lm/W)	End-User Price
A	Inc	60	587	4,000	9.8	$2.15
B	CFL	13	900	10,000	69.2	$2.94
C	LED	9	800	15,000	88.9	$3.00

D. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of GSILs in representative U.S. single-family homes, multi-family residences, and commercial buildings, and to assess the energy savings potential of an amended energy conservation standard applied to GSILs. To develop annual energy use estimates, DOE multiplied GSIL input power

by the number of hours of use (HOU) per year and a factor representing the impact of controls. The energy use analysis estimates the range of energy use of GSILs in the field (*i.e.*, as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

DOE analyzed energy use in the residential and commercial sectors separately but did not explicitly analyze GSILs installed in the industrial sector. This is because far fewer GSILs are installed in that sector compared to the commercial sector, and the average operating hours for GSILs in the two sectors were assumed to be approximately equal. In the energy use and subsequent analyses, DOE analyzed these sectors together (using data specific to the commercial sector), and refers to the combined sector as the commercial sector.

1. Operating Hours

a. Residential Sector

GE commented in response to the August 2017 NODA on GSILs and other incandescent lamps that the 2010 DOE Lighting Market Characterization (LMC) report[17] estimated operating hours of GSLs at 1.8 hours per day. (GE, No. 3 at p. 5)[11] DOE notes that a newer version of the LMC report has subsequently come out and that both the 2010 and 2015 LMC reports relied primarily on data from field studies in California.[18] To take into account the regional variability in the average HOU of GSILs in the residential sector—which were assumed to have similar HOU to MSB A-type lamps—DOE used the same methodology as for the March 2016 GSL

[17] Navigant Consulting, Inc. Final Report: 2010 U.S. Lighting Market Characterization. 2012. U.S. Department of Energy: Washington, D.C. (Last accessed July 22, 2019.) http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf.

[18] Navigant Consulting, Inc. 2015 U.S. Lighting Market Characterization. 2017. U.S. Department of Energy: Washington, D.C. Report No. DOE/EE-1719. (Last accessed July 5, 2019.) https://energy.gov/eere/ssl/downloads/2015-us-lighting-market-characterization.

NOPR. DOE used data from various regional field-metering studies of GSL operating hours conducted across the U.S. to determine the regional variation in average HOU. Chapter 7 of the NOPD TSD lists the regional metering studies used. Specifically, DOE determined the average HOU for each EIA 2015 Residential Energy Consumption Survey (RECS) reportable domain (*i.e.*, state, or group of states).[19, 20] For regions without HOU metered data, DOE used data from adjacent regions. DOE estimated the national weighted-average HOU of GSILs in the residential sector to be 2.3 hours per day.

The operating hours of lamps in actual use are known to vary significantly based on the room type the lamp is located in; therefore, DOE estimated this variability by developing HOU distributions for each room type using data from Northwest Energy Efficiency Alliance's (NEEA's) Residential Building Stock Assessment Metering Study (RBSAM),[21] a metering study of 101 single-family houses in the Northwest. DOE assumed that the shape of the HOU distribution for a particular room type would be the same across the United States, even if the average HOU for that room type varied by geographic location. To determine the distribution of GSILs by room type, DOE used data from NEEA's 2011 RBSAM for single-family homes,[22] which included GSL room-distribution data for more than 1,400 single-family homes throughout the Northwest.

[19] The 2015 RECS provided detail only to the division, not reportable domain, level; therefore, in creating its residential consumer sample DOE randomly assigned a RECS reportable domain to each consumer based on the reportable domain breakdown from RECS 2009.
[20] U.S. Department of Energy–Energy Information Administration. 2015 RECS Survey Data. (Last accessed July 2, 2019.) https://www.eia.gov/consumption/residential/data/2015/.
[21] Ecotope Inc. Residential Building Stock Assessment: Metering Study. 2014. Northwest Energy Efficiency Alliance: Seattle, WA. Report No. E14-283. (Last accessed July 5, 2019.) https://neea.org/resources/2011-rbsa-metering-study.
[22] Northwest Energy Efficiency Alliance. 2011 Residential Building Stock Assessment Single-Family Database. (Last accessed July 5, 2019.) https://neea.org/resources/2011-rbsa-single-family-database.

b. Commercial Sector

DOE determined the HOU for commercial GSILs in the same way as for the March 2016 GSL NOPR. For each commercial building type presented in the 2015 LMC, DOE determined average HOU based on the fraction of installed lamps utilizing each of the light source technologies typically used in GSLs and the HOU for each of these light source technologies. DOE estimated the national-average HOU for the commercial sector by weighting the building-specific HOU for GSLs by the relative floor space of each building type as reported in in the 2012 EIA Commercial Buildings Energy Consumption Survey (CBECS).[23] The national weighted-average HOU for GSLs, and therefore GSILs, in the commercial sector were estimated at 11.8 hours per day. To capture the variability in HOU for individual consumers in the commercial sector, DOE used data from NEEA's 2014 Commercial Building Stock Assessment (CBSA).[24] As for the residential sector, DOE assumed that the shape of the HOU distribution from the CBSA was similar for the U.S. as a whole.

2. Input Power

The input power used in the energy use analysis is the input power presented in the engineering analysis (section IV.B) for the representative lamps considered in this rulemaking.

3. Lighting Controls

For GSILs that operate with controls, DOE assumed an average energy reduction of 30 percent (in keeping with the March 2016 GSL NOPR). This estimate was based on a meta-analysis of field measurements of energy savings from commercial lighting controls by

[23] U.S. Department of Energy–Energy Information Administration. 2012 CBECS Survey Data. (Last accessed July 5, 2019.) http://www.eia.gov/consumption/commercial/data/2012/index.cfm?view=microdata.
[24] Navigant Consulting, Inc. 2014 Commercial Building Stock Assessment: Final Report. 2014. Northwest Energy Efficiency Alliance: Seattle, WA. (Last accessed July 5, 2019.) https://neea.org/resources/2014-cbsa-final-report.

Williams, et al.[25] Because field measurements of energy savings from controls in the residential sector are very limited, DOE assumed that controls would have the same impact as in the commercial sector.

For this NOPD, DOE assumed that 9 percent of residential GSILs are on controls, which aligns with the fraction of lamps reported to be on dimmers or occupancy sensors in the 2015 LMC.

As in the March 2016 GSL NOPR, for the NOPD DOE assumed that building codes would drive an increase in floor space utilizing controls in the commercial sector. DOE notes that the estimate of the impact of controls on energy consumption increases over time in the commercial sector, but does not require an update to the HOU estimate.

DOE welcomes any relevant data and comment on the energy use analysis methodology.

E. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic effects on individual consumers of potential energy conservation standards for GSILs. In particular, DOE performed LCC and PBP analyses to evaluate, in part, the savings in operating costs throughout the estimated average life of GSILs compared to any associated increase in costs likely to result from the standards TSL. The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE used the following two metrics to measure effects on the consumer:

- The LCC (life-cycle cost) is the total consumer expense of an appliance or product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy

[25] Williams, A., B. Atkinson, K. Garbesi, E. Page, and F. Rubinstein. Lighting Controls in Commercial Buildings. LEUKOS. 2012. 8(3): pp. 161–180.

use, maintenance, and repair) and any applicable disposal costs. To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product. For this NOPD, DOE presents annualized LCC because average GSIL lifetimes are less than a year in the commercial sector.

- The PBP (payback period) 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 efficacy levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For each considered efficiency standard level, DOE measures the change in annualized LCC relative to the annualized LCC in the no-new-standards case, which reflects the estimated efficacy distribution of GSILs in the absence of new or amended energy conservation standards. DOE presents LCC savings results for two scenarios with different efficacy distributions: DOE presents the LCC savings of GSILs, the covered product in this NOPD, for a GSIL-only scenario in which consumers select only between GSIL options and also includes LCC savings for a scenario with substitution in which consumers may purchase out-of-scope lamps as an input to the NPV calculation. For details on the two scenarios, see section IV.F. The PBP for each efficacy level is measured relative to the baseline efficacy level. The LCC savings with substitution effects is additionally not comparable to the PBP analysis because it extends beyond the covered product in this NOPD.

For each considered efficacy level, DOE calculated the annualized LCC and PBP for a nationally-representative set of potential customers. Separate calculations were conducted for the residential and commercial sectors. DOE developed consumer samples based on the 2015

RECS and the 2012 CBECS for the residential and commercial sectors, respectively. For each consumer in the sample, DOE determined the energy consumption of the lamp purchased and the appropriate electricity price. By developing consumer samples, the analysis captured the variability in energy consumption and energy prices associated with the use of GSILs.

DOE added sales tax, which varied by state, and installation cost (for the commercial sector) to the cost of the product developed in the product price determination to determine the total installed cost. Inputs to the calculation of operating expenses include annual energy consumption, energy prices and price projections, lamp lifetimes, and discount rates. DOE created distributions of values for lamp lifetimes, discount rates, and sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

For the GSIL standard case (*i.e.*, case where a standard would be in place at a particular TSL), DOE measured the annualized LCC savings resulting from the technological requirements for GSILs at the considered standard relative to the efficacy distribution in the no-new-standards case for the covered product scenario. DOE also presents annualized LCC savings that include substitution effects and their effects on efficacy distribution in the standards case relative to the estimated efficacy distribution in the no-new-standards case for a scenario in which consumers can substitute out-of-scope products. The efficacy distributions in the substitution scenario include market trends that can result in some lamps with efficacies that exceed the minimum efficacy associated with the standard under consideration. In contrast, the PBP only considers the average time required to recover any increased first cost associated with a purchase at a particular EL relative to the baseline product.

The computer model DOE used to calculate the annualized LCC and PBP results 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 consumer user samples. The model calculated the annualized LCC and PBP for a sample of 10,000 consumers per simulation run.

DOE calculated the annualized LCC and PBP as if each consumer were to purchase a new product in the expected year of required compliance with amended standards. Any amended standards would apply to GSILs manufactured 3 years after the date on which any amended standard is published. (42 U.S.C. 6295(i)(6)(A)(iii)) As this proposed rule is being published in 2019, DOE used 2023 as the first full year in which compliance with any amended standards for GSILs could occur.

Table IV.10 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the NOPD TSD and its appendices.

Table IV.10 Summary of Inputs and Methods for the LCC and PBP Analysis*[26]

Inputs	Source/Method
Product Cost	Weighted-average end-user price determined in the product price determination. For the LCC with substitution, DOE used a price-learning analysis to project the price of the CFL and LED lamp alternatives in the compliance year.
Sales Tax	Derived 2023 population-weighted-average tax values for each state based on Census population projections and sales tax data from Sales Tax Clearinghouse.
Installation Costs	Used RSMeans and U.S. Bureau of Labor Statistics data to estimate an installation cost of $1.54 per installed GSIL for the commercial sector.
Annual Energy Use	Derived in the energy use analysis. Varies by geographic location and room type in the residential sector and by building type in the commercial sector.
Energy Prices	Based on 2018 average and marginal electricity price data from the Edison Electric Institute. Electricity prices vary by season and U.S. region.
Energy Price Trends	Based on AEO 2019 price forecasts.
Product Lifetime	A Weibull survival function is used to provide the survival probability as a function of GSIL age, based on the GSIL's rated lifetime, sector-specific HOU, and impact of dimming.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances.
Efficacy Distribution	Estimated by the market-share module of shipments model. See chapter 9 of the NOPD TSD for details.
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 NOPD TSD.

1. Product Cost

As noted in section IV.C, DOE rulemaking analyses typically calculate consumer product costs by multiplying MSPs developed in the engineering analysis by the markups along with sales taxes. For GSILs, the engineering analysis determined end-user prices directly; therefore, for the LCC analysis, the only adjustment was to add sales taxes, which were assigned to each household or building in the LCC sample based on its location.

In the LCC with substitution scenario, DOE used a price-learning analysis to determine the impact of GSIL standards on consumers who select a CFL or LED lamp alternative under a standard. The price-learning analysis accounts for changes in LED lamp prices that are expected

[26] Although DOE addresses the validity of California law relating to GSILs in the General Service Lamps Definition Rule published elsewhere in today's Federal Register, in generating its consumer samples, DOE did not sample consumers from California.

to occur between the time for which DOE has data for lamp prices (2018) and the assumed compliance date of the rulemaking (2023). For details on the price-learning analysis, see section IV.F.1.b.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. For this NOPD, DOE assumed an installation cost of $1.54 per installed commercial GSIL (based on RSMeans[27] and U.S. Bureau of Labor Statistics data[28]), but zero installation cost for residential GSILs.

3. Annual Energy Consumption

For each sampled household or commercial building, DOE determined the energy consumption for a lamp using the approach described previously in section IV.D of this document.

4. Energy Prices

DOE used both marginal and average electricity prices to calculate operating costs. Specifically, DOE used average electricity prices for the baseline EL and marginal electricity prices to characterize incremental electricity cost savings associated with other TSLs. DOE estimated these prices using data published with the Edison Electric Institute (EEI) Typical Bills and Average Rates reports for summer and winter 2018.[29] DOE assigned seasonal marginal and average prices to each household in the LCC sample based on its location. DOE assigned

[27] RSMeans. Facilities Maintenance & Repair Cost Data 2013. 2012. RSMeans: Kingston, MA.
[28] U.S. Department of Labor–Bureau of Labor Statistics. May 2014 Occupational Employment Statistics Survey. National Occupational and Wage Estimates. (Last accessed July 30, 2019.) http://www.bls.gov/oes/tables.htm.
[29] Edison Electric Institute. Typical Bills and Average Rates Report. 2018. Winter 2018, Summer 2018: Washington, D.C.

seasonal marginal and average prices to each commercial building in the LCC sample based on its location and annual energy consumption.

5. Energy Price Trends

To arrive at electricity prices in future years, DOE multiplied the electricity prices described above by the forecast of annual residential or commercial electricity price changes for each Census division from EIA's AEO 2019, which has an end year of 2050.[30] To estimate the trends after 2050, DOE used the compound annual growth rate of change between 2035 and 2050. For each purchase sampled, DOE applied the projection for the Census division in which the purchase was located. The AEO electricity price trends do not distinguish between marginal and average prices, so DOE used the same (AEO 2019) trends for both marginal and average prices.

DOE used the electricity price trends associated with the AEO Reference case, which is a business-as-usual estimate, given known market, demographic, and technological trends.

6. Product Lifetime

DOE considered the lamp lifetime to be the service lifetime (i.e., the age at which the lamp is retired from service). For GSILs, the lifetime model incorporates the rated lifetime, the presence of controls, and the installation sector. For CFL and LED lamp alternatives, DOE used the methodology from the reference ("Renovation-Driven") lifetime scenario from the March 2016 GSL NOPR.

For a detailed discussion of the development of lamp lifetimes, see appendix 8C of the NOPD TSD.

[30] U.S. Energy Information Administration. Annual Energy Outlook 2019 with projections to 2050. 2019. Washington, DC. Report No. AEO2019. (Last accessed July 5, 2019.) https://www.eia.gov/outlooks/AEO/pdf/AEO2019.pdf.

7. Discount Rates

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

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

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 (SCF) for 1995, 1998, 2001, 2004, 2007, 2010, 2013, and

2016.[31] 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.

For commercial 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.

8. Efficacy Distribution

To accurately estimate the share of consumers that would be affected by a potential energy conservation standard at a particular TSL, DOE's LCC analysis considered the projected distribution (*i.e.*, market shares) of product efficacies that consumers purchase under the no-new-standards case and the standards case (*i.e.*, the case where a standard would be set at TSL 1) in the assumed compliance year. The estimated market shares for the no-new-standards case and each standards case are determined by the shipments analysis and are shown in Table IV.11 and Table IV.12 for the LCC with substitution scenario and the LCC GSIL-only scenario, respectively. In the LCC with substitution scenario, DOE estimates that the GSILs that are covered by this NOPD would account for 11.3% of the residential market share in 2023 in the absence of federal standards, and 3.8% of the residential market under TSL 1. That is, most

[31] U.S. Board of Governors of the Federal Reserve System. Survey of Consumer Finances. 1995, 1998, 2001, 2004, 2007, 2010, 2013 and 2016. (Last accessed July 16, 2019.) http://www.federalreserve.gov/econresdata/scf/scfindex.htm.

consumers would switch from GSILs to out-of-scope substitutes under TSL 1 due to high product price.

Table IV.11 GSIL Market Share Distribution by Trial Standard Level in 2023—LCC with Substitution

Trial Standard Level	EL 0 43 W Halogen (%)	EL 1 34.3 W HIR (%)	60 W Incandescent* (%)	13 W CFL* (%)	9 W LED* (%)	Total** (%)
Residential						
No-New-Standards	11.3	0	4.0	5.2	79.5	100
TSL 1	0	3.8	4.1	6.2	86.0	100
Commercial						
No-New-Standards	2.7	0	0	3.1	94.2	100
TSL 1	0	0.3	0	3.2	96.5	100

* Incandescent lamps, CFLs, and LED lamps are out-of-scope consumer choice alternatives for GSILs (see section IV.B.6).
** The total may not sum to 100% due to rounding.

The market share for GSIL lamps in the LCC GSIL-only (i.e. covered product) scenario are shown in Table IV.12. DOE estimates HIR lamps will represent 2.3% of the GSIL residential market in the no-new-standards case.

Table IV.12 GSIL Market Share Distribution by Trial Standard Level in 2023—LCC Standards Scenario

Trial Standard Level	EL 0 43 W Halogen (%)	EL 1 34.3 W HIR (%)	Total* (%)
Residential			
No-New-Standards	97.7	2.3	100
TSL 1	0	100	100
Commercial			
No-New-Standards	99.0	1.0	100
TSL 1	0	100	100

* The total may not sum to 100% due to rounding.

See section IV.F of this NOPD and chapter 9 of the NOPD TSD for further information on the derivation of the market efficacy distributions.

9. LCC Savings Calculation

DOE calculated the annualized LCC savings at TSL 1 based on the change in annualized LCC for the standards case compared to the no-new-standards case. In the covered product scenario, this approach models the actual lifecycle cost of HIR lamps under TSL 1 compared to the lifecycle cost of GSILs in the no-new standards case. In contrast, the LCC savings results in the substitution scenario also includes out-of-scope lamps in the efficacy distribution for both the standards case and the no-new-standards case. That is, the LCC with substitution analysis considers the upfront price and operating costs of out-of-scope lamps that consumers would substitute for covered GSILs. This approach models how consumers would substitute other lamps (which are more efficient and sometimes less-expensive) and is intended to more accurately reflect the impact of a potential standard on consumers. In a standards scenario, consumers are unable to recover the upfront price of HIR lamps and as a result experience negative LCC savings.

DOE used the consumer-choice model in the shipments analysis to determine the fraction of consumers that purchase each lamp option under a standard, but the model is unable to track the purchasing decision for individual consumers in the LCC sample. However, DOE must track any difference in purchasing decision for each consumer in the sample in order to determine the fraction of consumers who experience a net cost. Therefore, DOE assumed that the rank order of consumers, in terms of the efficacy of the product they purchase, is the same in the no-new-standards case as in the standards cases. In other words, DOE assumed that the consumers who

purchased the most-efficacious products in the efficacy distribution in the no-new-standards case would continue to do so in standards cases, and similarly, those consumers who purchased the least efficacious products in the efficacy distribution in the no-new-standards case would continue to do so in standards cases. This assumption is only relevant in determining the fraction of consumers who experience a net cost in the annualized LCC savings calculation, and has no effect on the estimated national impact of a potential standard.

10. Payback Period Analysis

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

The inputs to the PBP calculation for each efficacy 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 typically uses the same inputs as the LCC analysis, except that discount rates are not needed. In this notice, DOE presents the LCC savings in the standards case for a covered product scenario along with an LCC with substitution scenario, the latter of which differs from the PBP because it includes out-of-scope lamps rather than only the product that would be directly regulated by a GSIL standard.

EPCA, as amended, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficacy level, DOE determined

the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price projection for the year in which compliance with the amended standards would be required.

DOE welcomes any relevant data and comment on the LCC and PBP analysis methodology.

F. 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.[32] The shipments model takes a stock-accounting approach, tracking market shares of each product class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because lamp energy consumption and operating costs for any year depend on the age distribution of the stock. The shipments analysis also provides the efficacy distribution in the year of compliance which is an input to calculating LCC savings.

1. Shipments Model

The shipments model projects shipments of GSILs over a thirty-year analysis period for the no-new-standards case and for the standards case. Separate shipments projections are calculated for the residential sector and for the commercial sector. The shipments model used to estimate GSIL lamp shipments for this rulemaking has three main interacting elements: (1) a lamp demand module that estimates the demand for GSIL lighting and GSIL alternatives for each year of the analysis period; (2) a price-learning module that projects future prices based on

[32] 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.

historic price trends; and (3) a market-share module that assigns shipments to the available lamp options.

DOE modeled shipments for two scenarios: For the purposes of the covered product scenario LCC scenario, DOE ran a version of the shipments analysis where consumers selected between product options for the covered product at issue in this NOPD (i.e. GSILs). As an input to the NIA, DOE modeled a scenario where consumers select between GSIL options and out of scope alternatives, including CFL, LED, and traditional incandescent *(e.g.*, shatter resistant) lamps, because amended standards on GSILs could affect substitution rates. DOE welcomes any relevant data and comment on the shipments analysis methodology.

a. Lamp Demand Module

The lamp demand module first estimates the national demand for GSILs and potential alternative products in each year for the covered product scenario and the substitution scenario, respectively. The demand calculation assumes that sector-specific lighting capacity (maximum lumen output of installed lamps) remains fixed per square foot of floor space over the analysis period, and total floor space changes over the analysis period according to the EIA's *AEO 2019* projections of US residential and commercial floor space.[33] A lamp turnover calculation estimates demand for new lamps in each year based on the growth of floor space in each year, the expected demand for replacement lamps, and sector-specific assumptions about the distribution of per-lamp lumen output desired by consumers. The demand for replacements is computed based on the historical shipments of lamps, the expected lifetimes of the lamps (in terms of total hours of operation), and sector-specific assumptions about lamp operating hours.

[33] U.S. Energy Information Administration. Annual Energy Outlook 2019 with projections to 2050. 2019. Washington, DC. Report No. AEO2019. (Last accessed July 5, 2019.) https://www.eia.gov/outlooks/AEO/pdf/AEO2019.pdf.

For the substitution scenario, the lamp demand module also accounts for the adoption of integral LED luminaires into lighting applications traditionally served by GSILs and for consumers' transitioning between GSILs and CFLs or LED lamps both prior to and during the analysis period, either spontaneously or due to amended standards.

NEMA commented in response to the February 2019 NOPR that shipments of GSILs are declining as shipments of LED lamps continue to exhibit strong growth and that GSILs represent a reduced fraction of the overall stock of GSLs compared to a few years ago (NEMA, No. 329 at pp. 44-48)[12]. Along similar lines, LEDVANCE commented in response to the August 2017 NODA on GSILs and other incandescent lamps that there has been brisk substitution of GSILs with LED lamps and declines in lamp shipments as consumers switch to LED lamps with longer lifetimes. (LEDVANCE, No. 9 at p. 3)[11] In the shipments analysis for this NOPD, DOE incorporated data on relative lamp shipments and market share by technology through 2018, as provided by NEMA in its comments on the February 2019 NOPR and in its published lamp indices.[34] (NEMA, No. 329 at pp. 52-53)[12] DOE notes that these data show a much faster adoption of LED GSLs than has previously been projected by DOE's solid-state lighting program; further, the data show that LED GSL adoption is growing at the expense of both CFLs and GSILs. In the scenario for substitution, fitting the NEMA data to the widely used Bass model for the market adoption of new technology[35] suggests that, even in the absence of Federal regulation, LED lamps will have captured a significant majority of the GSL market by 2023 (79.5 percent of the residential market and 92.0 percent of the commercial market). After incorporating this growth in LED lamp market share prior to 2023 the shipments analysis for this

[34] National Electrical Manufacturers Association. Lamp Indices. (Last accessed July 23, 2019.) http://www.nema.org/Intelligence/Pages/Lamp-Indices.aspx.
[35] Bass, F. M. A New Product Growth Model for Consumer Durables. Management Science. 1969. 15(5): pp. 215–227.

NOPD shows a substantial growth in LED lamp shipments prior to 2023, owing to the ongoing market transition in the absence of standards.

b. Price-Learning Module

The price-learning module estimates lamp prices in each year of the analysis period using a standard price-learning model,[36] which relates the price of a given technology to its cumulative production, as represented by total cumulative shipments. GSILs represent a mature technology that have reached a stable price point due to the high volume of total cumulative shipments, so price learning was not considered in the LCC GSIL-only scenario. However, in the scenario with substitution, CFL and LED alternative lamps may continue to drop in price due to price learning. Current cumulative shipments are determined for each lighting technology (CFL and LED) at the start of the analysis period and are augmented in each subsequent year of the analysis based on the shipments determined for the prior year. New prices for each technology are calculated from the updated cumulative shipments according to the learning (or experience) curve for each technology. The current year's shipments, in turn, affect the subsequent year's prices. Because LED lamps are a relatively young technology, their cumulative shipments increase rapidly and hence they undergo a substantial price decline during the shipments analysis period. CFL prices, by contrast, undergo a negligible price decline, owing to the low shipments volume and relative maturity of this technology.

c. Market-Share Module

The market-share module apportions the lamp shipments in each year among the different lamp options developed in the engineering analysis, based on consumer sensitivity various lamp

[36] Taylor, M. and S. K. Fujita. Accounting for Technological Change in Regulatory Impact Analyses: The Learning Curve Technique. 2013. Lawrence Berkeley National Laboratory: Berkeley, CA. Report No. LBNL-6195E. (Last accessed June 23, 2015.) https://eta.lbl.gov/publications/accounting-technological-change.

features. For the covered product scenario, to lamp price energy savings were the only features considered. For the substitution scenario, lifetime and mercury content were also considered, as measured in a market study,[37] as well as on consumer preferences for lighting technology as revealed in historical shipments data. The market-share module assumes that, when replacing a lamp, consumers will choose among all of the available lamp options. Substitution matrices were developed to specify the product choices available to consumers. The substitution scenario considered CFLs, LEDs, and traditional incandescent alternatives to the covered product. The available options additionally depend on the case under consideration; in each standards case corresponding to a TSL, only those lamp options at or above the particular standard level, and relevant alternative lamps, are considered to be available. In the substitution scenario, the market-share module also incorporates a limit on the diffusion of LED technology into the market using the widely accepted Bass adoption model,[38] the parameters of which are based on data on the market penetration of LED lamps published by NEMA,[39] as discussed previously. In the LCC covered product scenario, DOE used a Bass diffusion curve in the no-new-standards case to model the adoption of HIR lamps assuming these lamps would be a new entry to market in 2020. The Bass diffusion curves puts a limit on the maximum market share allowed for HIR lamps in each year of the analysis.

In this way, the module assigns market shares to the different ELs, and consumer choice alternatives, based on observations of consumer preferences.

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[37] Krull, S. and D. Freeman. Next Generation Light Bulb Optimization. 2012. Pacific Gas and Electric Company. (Last accessed July 23, 2019.) http://www.etcc-ca.com/sites/default/files/OLD/images/stories/Lighting_Conjoint_Study_v020712f.pdf.

[38] Bass, F. M. A New Product Growth Model for Consumer Durables. Management Science. 1969. 15(5): pp. 215–227.

[39] National Electrical Manufacturers Association. Lamp Indices. (Last accessed July 23, 2019.) http://www.nema.org/Intelligence/Pages/Lamp-Indices.aspx.

G. National Impact Analysis

The NIA assesses the NES and the national NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific TSLs.[40] ("Consumer" in this context refers to consumers of the product being regulated and includes both residential and commercial consumers.) DOE calculated the NES and NPV based on projections of annual product shipments and prices from the shipments scenario with substitution, along with the HOU and energy prices from the energy use and LCC with substitution analyses.[41] For the present analysis, DOE projected the energy savings, operating-cost savings, product costs, and NPV of consumer benefits over the lifetime of GSILs sold from 2023 through 2052. However, unlike for other DOE rulemakings, the energy savings and NPV of consumer benefits are not those associated with the technology in question for TSL 1. The price of HIR lamps under TSL 1 would be preventatively high for most consumers, and HIR efficacy is too low for consumers to recover these costs in energy savings. Because manufacturers are unlikely to product HIR lamps and consumers are unlikely to purchase them, there are no energy savings or benefits from transitioning to HIR technology.

DOE evaluates the impacts of new and amended standards by comparing a case without such standards against standards-case projections. The no-new-standards case characterizes energy use and consumer costs in the absence of new or amended energy conservation standards. DOE compares the no-new-standards case with projections characterizing the market if DOE adopted new or amended standards at specific TSLs. For the standards cases, DOE considers how a given standard would likely affect the market shares of products with efficacies greater than the standard, as well as consumer choice alternatives. Any energy savings or benefits

[40] The NIA accounts for impacts in the 50 States and the U.S. territories.
[41] For the NIA, DOE adjusts the installed cost data from the LCC analysis to exclude sales tax, which is a transfer.

estimated in the standards case are the result of product shifting as, given GE's experience and the economics at issue, manufacturers are unlikely to produce and consumers are unlikely to purchase GSIL-HIR products. Instead, consumers are more likely to substitute different product types such as CFLs and LEDs, which have different performance characteristics and features. As noted above, EPCA prohibits DOE from prescribing an amended or new standard if that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding.

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

Table IV.12 summarizes the inputs and methods DOE used for the NIA analysis for the NOPD. Discussion of these inputs and methods follows the table.

Table IV.12 Summary of Inputs and Methods for the National Impact Analysis

Inputs	Method
Shipments	Annual shipments for each lamp option from shipments model for the no-new standards case and each TSL analyzed
Assumed compliance date of standard	January 1, 2023
No-new-standards efficacy distribution	Estimated by the market-share module of the shipments analysis
Standards-case efficacy distribution	Estimated by the market-share module of the shipments analysis
Annual energy use per unit	Calculated for each lamp option based on inputs from the Energy Use Analysis
Total installed cost per unit	Uses lamp prices, and for the commercial sector only, installation costs from the LCC analysis.
Electricity prices	Estimated marginal electricity prices from the LCC analysis
Energy price trends	*AEO 2019* forecasts (to 2050) and extrapolation thereafter
Annual operating cost per unit	Calculated for each lamp option using the energy use per unit, and electricity prices and trends
Energy Site-to-Source Conversion	A time-series conversion factor based on *AEO 2019*
Discount rate	Three and seven percent real
Present year	2019

1. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products in each standards case with consumption in the case with no new or amended energy conservation standards. DOE calculated the annual national energy consumption by multiplying the number of units (stock) of each lamp option (by vintage or age) by the unit energy consumption (also by vintage) for each year in the analysis. The NES is based on the difference in annual national energy consumption for the no-new-standards case and each of the standards cases. DOE estimated the energy consumption and savings based on site electricity and converted that quantity to the energy consumption and savings at the power plant using annual conversion factors derived from *AEO 2019*. Cumulative energy savings are the sum of NES for each year over the analysis period, taking into account the full lifetime of GSILs shipped in 2052.

DOE tracks both the energy consumption of GSILs and substitute out-of-scope lamps (*e.g.*, CFL, LED, and traditional incandescent lamps). Under the standards case, the increase in cost or lack of availability of GSIL options can lead to consumers choosing out-of-scope alternative lamps. This leads to a decrease in GSIL shipments that appears as a decrease in GSIL energy consumption, while the increase in out-of-scope shipments appears as an increase in energy consumption for those lamp types. DOE also calculated the overall energy impact of a standard including the increased energy consumption of out-of-scope lamps.

DOE generally accounts for the direct rebound effect in its NES analyses. Direct rebound reflects the idea that as appliances become more efficient, consumers use more of their service because their operating cost is reduced. In the case of lighting, the rebound effect could be manifested in increased HOU or in increased lighting density (lamps per square foot). DOE assumed no rebound effect for GSILs in this analysis, consistent with the assumption of no rebound in the reference scenario in the March 2016 GSL NOPR. DOE is not aware of any data supporting rebound when consumers switch from halogen GSILs to HIR GSILs. DOE seeks any relevant data and comment on the potential rebound effect for GSILs.

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 (August 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System (NEMS) is the most appropriate tool for its FFC analysis and its

intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector that EIA uses to prepare its *AEO*.[42] The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the NOPD TSD.

2. Net Present Value Analysis

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

The direct efficacy improvements from TSL 1 do not result in any benefits. First, manufacturers are unlikely to produce HIR lamps. Manufacturers that have produced and attempted to sell such lamps in the recent past have found it uneconomic to do so. However, if a manufacturer were hypothetically willing to produce such a lamp, consumers would either 1) purchase the HIR lamp and be unable to recoup the expense in energy savings or 2) choose not to purchase the HIR lamp due to high purchase price. As a result DOE does not anticipate that adoption of HIR technology to result directly in any consumer benefits. Instead, any benefit from TSL 1 would result from product shifting as consumers substitute more efficient alternative product types with different performance characteristics and features. As discussed in section

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

IV.F.1.b of this NOPD, DOE developed prices for alternative LED and CFL lamps using a price-learning module incorporated in the shipments analysis.

The operating cost savings in this document are primarily the result of product shifting. The operating-cost savings are primarily energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of electricity. To estimate energy prices in future years, DOE multiplied the average national marginal electricity prices by the forecast of annual national-average residential or commercial electricity price changes in the Reference case from *AEO 2019*, which has an end year of 2050. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2035 to 2050.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPD, 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.[43] 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.

H. Manufacturer Impact Analysis

DOE performed an MIA to estimate the financial impacts of potential amended energy conservation standards on manufacturers of GSILs. DOE relied on the GRIM, an industry cash

[43] United States Office of Management and Budget. Circular A-4: Regulatory Analysis," (Sept. 17, 2003), section E (Available at: *https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf*).

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 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 amended energy conservation standards on manufacturers. To capture the uncertainty relating to manufacturer pricing strategies following potential amended standards, the GRIM estimates a range of possible impacts under different manufacturer 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.[44]

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

[44] 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.

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 2019 (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 6.1 percent for GSIL 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).

1. Manufacturer Production Costs

Manufacturing more efficacious GSILs is more expensive because of the machinery required to coat halogen capsules and the process by which the capsules are coated. The changes in the MPCs of covered products can affect the revenues, gross margins, and cash flow of the industry. Typically, DOE develops MSPs for the covered products using reverse-engineering. These costs are used as an input to the LCC analysis and NIA. However, because GSILs are difficult to reverse-engineer, DOE derived end-user prices directly in the product price determination and then used the end-user prices in conjunction with distribution chain markups to calculate the MSPs of GSILs. See section IV.C for a further explanation of the product price determination.

To determine MPCs of GSILs from the end-user prices calculated in the engineering analysis, DOE divided the end-user prices by the home center markup to calculate the MSP. DOE then divided the MSP by the manufacturer markup to get the MPCs. DOE determined the home center markup to be 1.52 and the manufacturer markup to be 1.40 for all GSILs. Markups are further described in section IV.H.4 of this document.

2. Shipments Projections

The GRIM estimates manufacturer revenues based on total unit shipment projections and the distribution of those shipments by TSL. 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 starting in 2019 (the reference year) and ending in 2052 (the end year of the analysis period).

3. Product and Capital Conversion Costs

Potential amended energy conservation standards could cause manufacturers to incur conversion costs to bring their production facilities and product designs into compliance. DOE evaluated the level of conversion-related expenditures that would be needed to comply with each considered TSL. 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 submitted during the 2015 IRL rulemaking to estimate costs to update manufacturer production lines. 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 the analyzed TSL using DOE's public 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 at the analyzed TSL.

To evaluate the level of product conversion costs manufacturers would likely incur to comply with the analyzed energy conservation standards, DOE used data submitted during the 2015 IRL rulemaking to estimate per model R&D and testing and certification costs for the TSL. DOE then estimated the number of models that would need to be redesigned at each analyzed TSL. DOE then multiplied these numbers together to get the final estimated product conversion costs for the analyzed TSL.

In general, DOE assumes all conversion-related investments occur between the estimated year of 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.9 and section V.D of this document.

4. Markup Scenarios

To calculate the MPCs used in the GRIM, DOE divided the end-user prices calculated in the engineering analysis by the home center markup and the manufacturer markup. The home center markup was calculated in the March 2016 GSL NOPR by reviewing SEC 10-K reports of publicly traded home centers. DOE continued to use a home center markup of 1.52 in this analysis.

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 manufacturer 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 markup scenario; and (2) a technology specific 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 scenario, DOE applied a single uniform "gross margin percentage" manufacturer markup of 1.40 across all analyzed lamps, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues for all lamps analyzed.

Under the technology specific markup scenario, DOE assumed that incandescent lamps, CFLs, and LED lamps have different manufacturer markups. As sales of lamp technologies that are no longer able to meet the analyzed energy conservation standards are no longer sold, the average manufacturer markup is reduced. DOE estimated an incandescent lamp manufacturer markup of approximately 1.525, a CFL manufacturer markup of approximately 1.453, and an LED lamp manufacturer markup of approximately 1.380. In the no-new-standards case these technology specific manufacturer markups produce an identical INPV as in the preservation of gross margin markup scenario.

A comparison of industry financial impacts under the two manufacturer markup scenarios is presented in section V.D.1 of this document.

V. Analytical Results and Conclusions

A. Trial Standard Levels

DOE analyzed the benefits and burdens of one trial standard level for GSILs. TSL 1 is composed of EL 1 and is the max-tech EL for GSILs.

DOE analyzed the benefits and burdens by conducting the analyses described in section IV for each TSL. Table V.1 presents the TSLs and the corresponding ELs for GSLs.

Table V.1 Composition of TSLs for GSILs

TSL	EL	Technology Required to Comply with Standard	Description
TSL 0	EL 0	Halogen	No new GSIL standard
TSL 1	EL 1	Halogen Infrared(HIR)	HIR standard in 2023

B. Economic Impacts on Individual Consumers

DOE analyzed the cost effectiveness (*i.e.*, the savings in operating costs compared to any increase in purchase price likely to result from the imposition of a standard) by considering the LCC and PBP. DOE presents the LCC of the covered product (i.e., HIR lamps) and also presents a second LCC, which is used as an input for the NPV, which goes beyond GSILs and accounts for the purchase price and operating costs of out-of-scope substitute lamps ("LCC with substitution"). These analyses are discussed in the following sections.

1. Life-Cycle Cost and Payback Period

In general, higher-efficiency products can affect consumers in two ways: (1) purchase price increases and (2) annual operating costs decrease. Inputs used for calculating the annualized 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 annualized LCC calculation also uses product lifetime and a discount rate.

Table V.2 shows the average annualized LCC and PBP results for the ELs considered for GSILs in this analysis. For both the residential and commercial sector, the payback period for HIR lamps is approximately three times longer than the product life. As a result, consumers who buy HIR technologies have increased life cycle costs and do not see a benefit at TSL 1. Table V.3 shows the average annualized LCC savings for HIR lamps under TSL 1. Over 97% of

residential and commercial consumers who purchase HIR lamps experience a net cost in the standards case.

Table V.4 shows the average annualized LCC savings under a product shifting scenario for TSL 1. Very few consumers are anticipated to buy HIR technology in the standards case, assuming manufacturers produce the product. Instead these numbers reflect the result of a substitution effect as consumers are priced out of the market for GSILs. That is, TSL 1 is anticipated to increase the cost of GSILs by 286 percent relative to a no-standards case, therefore driving some consumers to shift toward out-of-scope alternative lamps, yielding a reduction in operating costs relative to the base case.

DOE recognizes that the current quantifiable framework does not represent the full welfare effects of this shift in consumer purchase decisions due to an energy conservation standard. In the 2015 IRL final rule, DOE "committed to developing a framework that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards." (80 FR 4141) DOE remains committed to this goal and to enhancing the methodology the Department uses to represent and quantify the consumer welfare impacts of its standards.

Table V.2 Average Annualized LCC and PBP Results by Efficacy Level

EL	Average Costs 2018$					Simple Payback years	Average Lifetime years
	Installed Cost	Annualized Installed Cost	First Year's Operating Cost	Annualized Lifetime Operating Cost	Annualized LCC		
Residential Sector							
0	1.94	1.99	4.50	4.70	6.69	--	2.0
1	7.49	7.69	3.59	3.75	11.44	6.09	2.0
Commercial Sector							
0	3.48	12.39	13.56	14.68	27.08	--	0.7
1	9.04	32.19	10.82	11.71	43.91	2.03	0.7

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

Table V.3 Average Annualized LCC Savings Results by Trial Standard Level—Covered Product (GSILs)

TSL	EL	GSIL Life-Cycle Cost Savings	
		Average Annualized LCC Savings* 2018$	Percent of Consumers that Experience Net Cost
Residential Sector			
1	1	-4.77	97.7
Commercial Sector			
1	1	-16.85	99.0

Table V.4 Average Annualized LCC Savings Results by Trial Standard Level—LCC with Substitution

TSL	EL	Life-Cycle Cost Savings	
		Average Annualized LCC Savings* 2018$	Percent of Consumers that Experience Net Cost
Residential Sector			
1	1	1.23	4.0
Commercial Sector			
1	1	10.36	0.43

* The savings represent the average annualized LCC savings for affected consumers.

The cost of HIR lamps cannot be recovered, and the LCC savings are negative for the covered product at issue in this NOPD. When accounting for out-of-scope product substitutes, average LCC savings are positive at TSL 1 because the majority of consumers shift to an out-of-scope LED lamp.

2. Rebuttable Presumption Payback

As discussed in section IV.E.9, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption PBP for each of the considered ELs, DOE used discrete values, and, as required by EPCA, based the energy use calculation on the DOE test procedure for GSILs. In contrast, the PBPs presented in section V.B.1 were calculated using distributions that reflect the range of energy use in the field. See chapter 8 of the NOPD TSD for more information on the rebuttable presumption payback analysis.

C. National Impact Analysis

This section presents DOE's estimates of the NES and the NPV of consumer benefits that would result from each of the considered TSLs as potential amended standards. For these estimates, DOE included the impact of consumers substituting GSILs for out-of-scope CFL, LED, and incandescent alternatives.

1. Energy Savings

To estimate the energy savings attributable to potential amended standards for GSILs, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2023–2052). Table V.4 presents DOE's projections of the NES for each TSL considered for GSILs, as well as considered GSIL alternatives. The savings were calculated using the approach described in section IV.G of this document. In addition to GSIL energy savings, Table V.4 illustrates the increased energy consumption of consumers who transition to

out-of-scope lamps, including CFL, LED, and incandescent alternatives, because more consumers purchase these lamps at TSL 1 relative to the no-standards case.

Table V.4 Cumulative National Energy Savings for GSILs and GSIL alternatives; 30 Years of Shipments (2023–2052)

		TSL 1
Site Energy Savings (quads)	GSILs	0.240
	CFL alternatives	(0.003)
	LED alternatives	(0.043)
	Incandescent alternatives	(0.002)
	Total	0.192
Source Energy Savings (quads)	GSILs	0.646
	CFL alternatives	(0.009)
	LED alternatives	(0.115)
	Incandescent alternatives	(0.007)
	Total	0.516
FFC Energy Savings (quads)	GSILs	0.677
	CFL alternatives	(0.010)
	LED alternatives	(0.120)
	Incandescent alternatives	(0.007)
	Total	0.540

OMB Circular A-4[45] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this proposed determination, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[46] The review

[45] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Available at https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf.

[46] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. If DOE makes a determination that amended standards are not needed, it must conduct a subsequent review within three years following such a determination. As DOE is evaluating the need to amend the standards, the sensitivity analysis is based on the review timeframe associated with amended standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6-year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to GSILs. 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.5. The impacts are counted over the lifetime of GSILs purchased in 2023–2031.

Table V.6 Cumulative National Energy Savings for GSILs and GSIL alternatives; 9 Years of Shipments (2023–2031)

		TSL 1
Site Energy Savings (quads)	GSILs	0.075
	CFL alternatives	(0.003)
	LED alternatives	(0.012)
	Incandescent alternatives	(0.001)
	Total	0.059
Source Energy Savings (quads)	GSILs	0.204
	CFL alternatives	(0.007)
	LED alternatives	(0.033)
	Incandescent alternatives	(0.003)
	Total	0.161
FFC Energy Savings (quads)	GSILs	0.214
	CFL alternatives	(0.007)
	LED alternatives	(0.035)
	Incandescent alternatives	(0.003)
	Total	0.169

2. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from TSL 1 for GSILs. However, as described above, the benefits of TSL 1 do not come from improved efficiency for the product for which DOE is making a determination whether existing standards should be amended. Rather, due to the likelihood that manufacturers will not produce the product, and fact that consumers would be unlikely to buy it, DOE does not anticipate that adoption of HIR technology will result in any consumer benefits. Instead, any benefit from TSL 1 is the result of product shifting as consumers respond to the high upfront

price of HIR lamps and substitute lower-cost, out-of-scope alternatives. In accordance with OMB's guidelines on regulatory analysis,[47] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.7 shows the consumer NPV results with impacts counted over the lifetime of GSILs purchased in 2023–2052.

Table V.7 Cumulative Net Present Value of Quantifiable Consumer Benefits for GSILs and GSIL alternatives; 30 Years of Shipments (2023–2052)

		TSL 1
3 percent (billions 2018$)	GSILs	5.436
	CFL alternatives	(0.110)
	LED alternatives	(1.082)
	Incandescent alternatives	(0.071)
	Total	4.173
7 percent (billions 2018$)	GSILs	2.960
	CFL alternatives	(0.072)
	LED alternatives	(0.602)
	Incandescent alternatives	(0.044)
	Total	2.241

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.8. 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.8 Cumulative Net Present Value of Quantifiable Consumer Benefits for GSIL and GSIL alternatives; 9 Years of Shipments (2023–2031)

		TSL 1
3 percent (billions 2018$)	GSILs	2.154
	CFL alternatives	(0.088)
	LED alternatives	(0.441)
	Incandescent alternatives	(0.040)
	Total	1.585
7 percent (billions 2018$)	GSILs	1.548
	CFL alternatives	(0.062)
	LED alternatives	(0.328)
	Incandescent alternatives	(0.030)

[47] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Available at *https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf*.

	Total	1.128

D. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of analyzed energy conservation standards on manufacturers of GSILs. In this instance, DOE also can look to the actual experience of manufacturers that have produced HIR lamps in the recent past. The following section describes the expected impacts on GSIL manufacturers at the analyzed TSL.

1. 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 GSILs, as well as the conversion costs that DOE estimates manufacturers of GSILs would incur at the analyzed TSL.

To evaluate the range of cash-flow impacts on the GSIL industry, DOE modeled two manufacturer markup scenarios that correspond to the range of anticipated market responses to potential standards. Each markup scenario results in a unique set of cash flows and corresponding industry values at the analyzed TSL. In the following discussion, the INPV results refer to the difference in industry value between the no-new-standards case and the standards case that result from the sum of discounted cash flows from the reference year (2019) through the end of the analysis period (2052).

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 efficacious products to their consumers. DOE also modeled a

technology specific markup scenario. In the technology specific markup scenario, different lamp technologies (incandescent, CFL, LED) have different manufacturer markups.

Table V.8 and Table V.9 present the results of the industry cash flow analysis for GSIL manufacturers under the preservation of gross margin and the technology specific markup scenarios.

Table V.9 Manufacturer Impact Analysis for GSILs – Preservation of Gross Margin Markup Scenario

	Units	No-New-Standards Case	TSL 1
INPV	*2018$ millions*	317.5	312.2
Change in INPV	*2018$ millions*	-	(5.0)
	%	-	(1.6)
Product Conversion Costs	*2018$ millions*	-	2.8
Capital Conversion Costs	*2018$ millions*	-	6.0
Total Conversion Costs	*2018$ millions*	-	8.8

Table V.10 Manufacturer Impact Analysis for GSILs – Technology Specific Markup Scenario

	Units	No-New-Standards Case	TSL 1
INPV	*2018$ millions*	317.5	313.6
Change in INPV	*2018$ millions*	-	(3.7)
	%	-	(1.2)
Product Conversion Costs	*2018$ millions*	-	2.8
Capital Conversion Costs	*2018$ millions*	-	6.0
Total Conversion Costs	*2018$ millions*	-	8.8

At TSL 1, DOE estimates that impacts on INPV will range from -$5 million to -$3.7 million, or a change in INPV of -1.6 to -1.2 percent. At TSL 1, free cash-flow is $30.0 million,

which is a decrease of approximately $3.7 million compared to the no-new-standards case value of $33.7 million in 2022, the year leading up to the potential standard.

At TSL 1, GSIL manufacturers spend approximately $6 million to purchase equipment necessary to manufacture HIR capsules and spend approximately $2.8 million in R&D and testing costs to introduce the newly created HIR products. Lighting manufacturers sell approximately 15 million fewer units annually after 2023 at TSL 1 because most consumers purchase longer lifetime products. Should manufacturers make the unlikely decision to produce HIR lamps, they might experience some increase in revenue due to some consumers purchasing significantly more expensive HIR lamps. However, any increase in revenue is outweighed by the $8.8 million in conversion costs that is spent prior to the compliance year in both the preservation of gross margin and technology specific margin markup scenarios. This results in a slight decrease in INPV in both markup scenarios. Manufacturers, anticipating the cost of transitioning product lines and the lack of consumer interest in HIR lamps, are highly unlikely to undertake these expenses.

2. 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, all production facilities that once produced GSILs in the U.S. have either closed or are scheduled to close prior to 2023, the estimated compliance year of analyzed standards. Therefore, DOE assumed there will not be any domestic employment for GSIL production after 2023, and that none of the analyzed standards would impact domestic GSIL production employment. While there is limited CFL and LED lamp production in the U.S., DOE does not assume that any CFL or LED lamp domestic production employment would be impacted by the analyzed standards.

Therefore, the proposed determination would not have a significant impact on domestic employment in the GSIL industry.

3. Impacts on Manufacturing Capacity

DOE does not anticipate any significant capacity constraints at the analyzed energy conservation standards. At TSL 1, manufacturers would most likely need to purchase machines used to coat halogen capsules. These machines are known equipment and are currently used for incandescent reflector lamp production. Equipment costs for these machines are included in the MIA as part of the capital conversion costs at TSL 1. Supply would most likely be able to meet the increase in demand for the machines given the 3-year compliance period for any potential energy conservation standards.

4. 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 identified one manufacturer subgroup for GSILs, small manufacturers.

For the small business subgroup analysis, DOE applied the small business size standards published by the Small Business Administration (SBA) to determine whether a company is considered a small business. The size standards are codified at 13 CFR part 121. To be categorized as a small business under NAICS code 335110, "electric lamp bulb and part manufacturing," a GSIL manufacturer and its affiliates may employ a maximum of 1,250 employees. The 1,250-employee threshold includes all employees in a business's parent

company and any other subsidiaries. The small business subgroup analysis is discussed in section VI.C of this document.

5. 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 pertaining to appliance efficiency. However, given the tentative conclusion discussed in section V.E, DOE did not conduct a cumulative regulatory burden analysis.

E. Proposed Determination

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

factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also "result in significant conservation of energy." (42 U.S.C. 6295(o)(3)(B))

In response to the August 2017 NODA, energy efficiency advocates[48] (EEAs) submitted a comment in support of a standard that eliminates incandescent lamps. EEAs stated that despite falling prices, increased choices, and rising sales of LED lamps, incandescent lamps will retain a large share of the US lighting market unless a standard eliminates them. EEAs noted that historical experience with technology substitution indicates that legacy technologies, like the incandescent light bulb, usually persist in the market long after they stop being a cost-effective choice for consumers. (EEAs, No. 11 at p. 10)[11]

However, NEMA stated the current energy conservation standards for GSILs cannot be amended in accordance with the criteria set forth in 42 U.S.C. 6295(o), and therefore DOE should determine not to amend standards for GSILs. (NEMA, No. 329 at p. 38)[12] GE added that there are only two pathways to achieve significant energy savings for GSILs: 1) consider a 45 lm/W standard or 2) consider mandating HIR technology. Regarding the first approach, GE concluded that because there are no incandescent or halogen products even close to 45 lm/W on the market, DOE can quickly reach a conclusion that 45 lm/W GSIL products are not technically feasible. DOE agrees with GE's assertion concerning the technological feasibility of a 45 lm/W standard for GSILs. DOE notes that EPCA requires that DOE make a determination whether standards in effect for general service lamps should be amended to establish more stringent standards than certain standards specified in EPCA. 42 U.S.C. 6295(i)(6)(A)(i)(I). In making

[48] The group described as the "energy efficiency advocates" includes the Appliance Standards Awareness Project, American Council for an Energy Efficient Economy, National Consumer Law Center, Consumer Federation of America, Natural Resources Defense Council, Northwest Energy Efficiency Alliance, Northeast Energy Efficiency Partnerships, Alliance to Save Energy, Northwest Power & Conservation Council, and the Southeast Energy Efficiency Alliance.

that determination DOE is not limited to incandescent technologies and DOE must consider a minimum standard applicable to GSLs of 45 lm/W. 42 U.S.C. 6295(i)(6)(A)(ii) DOE will make that determination and will consider a 45 lm/W standard in a subsequent document. Regarding the second approach, GE stated that DOE has already concluded in the 2015 IRL final rule that a standard level mandating HIR technology is not economically justified. GE pointed out that as nothing has changed with this technology, DOE has no reason to believe that the outcome of such an analysis for A-line lamps would produce a different result. (GE, No. 325 at p. 4)[12]

As described previously, when considering proposed standards, the amended energy conservation standard that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Because an analysis of potential economic justification and energy savings first requires an evaluation of the relevant technology, in the following sections DOE first discusses the technological feasibility of amended standards. DOE then addresses the energy savings and economic justification associated with potential amended standards.

1. Technological Feasibility

EPCA mandates that DOE consider whether amended energy conservation standards for GSILs would be technologically feasible. (42 U.S.C. 6295(o)(2)(A)) DOE has tentatively determined that there are design options that would improve the efficacy of GSILs. These design options are being used in similar products (IRLs) that are commercially available and have been used in commercially available GSILs in the past and therefore are technologically feasible. (See sections IV.A.3 and IV.A.4 for further information.) Hence, DOE has tentatively determined that amended energy conservation standards for GSILs are technologically feasible.

2. Significant Conservation of Energy

EPCA also mandates that DOE consider whether amended energy conservation standards for GSILs would result in result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) As stated in section III.D.2, DOE has not finalized updates to the Process Rule, in which DOE considers how to determine whether a new or amended standard would result in a significant energy savings. As this rule is not yet finalized, the Department is not relying on that proposed threshold for this determination. However, DOE is still required by statute to issue only such standards as will save a significant amount of energy. (42 U.S.C. 6295(o)(3)(B))

As described above, there are no energy savings or benefits from transitioning to HIR technology. Any energy savings that might result from establishing a standard at that TSL 1 are the result of product shifting as consumers abandon GSIL-HIR products in favor of different product types having different performance characteristics and features. DOE notes that EPCA prohibits DOE from prescribing an amended or new standard if that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. 42 U.S.C. 6295(o)(4)

3. Economic Justification

In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens, considering to the greatest extent practicable the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) One of those seven factors is 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. This factor is assessed using life cycle cost and payback period analysis, discussed in section III.E.1.b of this NOPD.

Given the high upfront cost and long payback period, these analyses do not anticipate that consumers will benefit from introduction of HIR lamp technology. Additionally, the recent experiences of two manufacturers who attempted and failed to market such a products illustrates that they are not commercially viable. At TSL 1, DOE believes there is uncertainty as to whether manufacturers would spend the capital required to produce HIR lamps given the low probability of recovering those costs as consumers substitute less costly products. Manufacturers could instead choose to forego the investment and produce other lighting products or exit the market entirely.

After considering the analysis and weighing the benefits and the burdens, DOE concluded that, at TSL 1 for GSILs, the benefits of energy savings and positive NPV of consumer benefits would be outweighed by the fact that the covered product PBP exceeds covered product lifetime by nearly a factor of three. Based on the second EPCA factor that DOE is required to evaluate, DOE has tentatively concluded that imposition of a standard at TSL 1 is not economically justified because the operating costs of the covered product are insufficient to recover the upfront cost. Based on these considerations, DOE is not amending energy conservation standards for GSILs.

DOE has presented additional consumer choice analysis anticipating that if it were to establish a standard at TSL 1, most consumers will substitute other available products, such as LEDs, CFLs, and non-GSIL incandescent lamps (the substitution scenario). DOE then estimated the NPV of the total costs and benefits experienced by the Nation in this scenario. (See results in

Table V.7 and Table V.8) DOE also conducted an MIA to estimate the impact of amended energy conservation standards on manufacturers of GSILs in this consumer choice scenario. (See results in Table V.9 and Table V.10)

Under the consumer choice analysis, the NPV of consumer benefits at TSL 1 would be $2.241 billion using a discount rate of 7 percent, and $4.173 billion using a discount rate of 3 percent. However, this NPV is based on the anticipated lifecycle costs to consumers who substitute other lamps due to price sensitivity or the unavailability of GSILs. At TSL 1, the average covered product LCC impact is a cost of $4.77 in the residential sector and $16.85 in the commercial sector. The simple payback period is 6.09 years (compared to an average lifetime of 2.0 years) in the residential sector and 2.03 years (compared to an average lifetime of 0.6 years) in the commercial sector. The fraction of GSIL consumers who experience a net LCC cost is 97.7 percent in the residential sector and 99 percent in the commercial sector. At TSL 1, DOE estimates that INPV will decrease between $5.0 million to $3.7 million, or a decrease in INPV of 1.6 to 1.2 percent. However, EPCA prohibits DOE from prescribing an amended or new standard if that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. DOE cannot find economic justification in a standard the purpose of which is to force the unavailability of a product type, performance characteristic or feature in contravention of EPCA.

In this proposed determination, based on the initial determination that amended standards would not be economically justified, and that there would not be any benefits from transitioning

to HIR technology at TSL 1, DOE has tentatively determined that energy conservation standards for GSILs do not need to be amended. DOE will consider all comments received on this proposed determination in issuing any final determination.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

This proposed determination has been determined to be a significant regulatory action for purposes of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993). As a result, the Office of Management and Budget (OMB) reviewed this proposed determination.

B. Review Under Executive Orders 13771 and 13777

On January 30, 2017, the President issued Executive Order (E.O.) 13771, "Reducing Regulation and Controlling Regulatory Costs." 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." E.O. 13777 required the head of each agency to 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 initially concludes that this proposed determination is consistent with the directives set forth in these executive orders. As discussed in this document, DOE is not proposing to amend energy conservation standards for GSILs and the proposed rule would not yield any costs or cost savings. Therefore, if finalized as proposed, this NOPD is expected to be 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) 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 Executive Order

13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (*http://energy.gov/gc/office-general-counsel*).

DOE reviewed this proposed determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. Because DOE is proposing not to amend standards for GSILs, if adopted, the determination would not amend any energy conservation standards. On the basis of the foregoing, DOE certifies that the proposed determination, if adopted, would have no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an IRFA for this proposed 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 National Environmental Policy Act of 1969

DOE is analyzing this NOPD in accordance with the National Environmental Policy Act of 1969 (NEPA) and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for actions which are interpretations or rulings with respect to existing regulations. 10 CFR part 1021, Subpart D, Appendix A4. DOE anticipates that this action 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. DOE will complete its NEPA review before issuing the final action.

E. Review Under Executive Order 13132

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

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform," imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal

governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *http://energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf*.

This proposed 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.

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

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

I. Review Under Executive Order 12630

Pursuant to Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (March 15, 1988), DOE has determined that this proposed determination would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to

the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed this NOPD under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor Executive Order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

Because this proposed determination does not propose amended energy conservation standards for GSILs, 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.

L. Information Quality

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (OSTP), issued its Final Information Quality Bulletin for Peer Review (the Bulletin). 70

FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are "influential scientific information," which the Bulletin defines as "scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions." *Id.* at 70 FR 2667.

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a report describing that peer review.[49] 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 energy conservation standards in the case of the present action.

VII. Public Participation

A. Attendance at Public Meeting

The time, date and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this document. If you plan to attend the public

[49] "Energy Conservation Standards Rulemaking Peer Review Report." 2007. Available at *http://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0*.

meeting, please notify Ms. Regina Washington at (202) 586-1214 or *Regina.Washington@ee.doe.gov.*

Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures which require advance notice prior to attendance at the public meeting. If a foreign national wishes to participate in the public meeting, please inform DOE of this fact as soon as possible by contacting Ms. Regina Washington at (202) 586-1214 or by e-mail: *Regina.Washington@ee.doe.gov* so that the necessary procedures can be completed.

DOE requires visitors to have laptops and other devices, such as tablets, checked upon entry into the building. Any person wishing to bring these devices into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing these devices, or allow an extra 45 minutes to check in. Please report to the visitor's desk to have devices checked before proceeding through security.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding ID requirements for individuals wishing to enter Federal buildings from specific States and U.S. territories. DHS maintains an updated website identifying the State and territory driver's licenses that currently are acceptable for entry into DOE facilities at *https://www.dhs.gov/real-id-enforcement-brief*. A driver's license from a State or territory identified as not compliant by DHS will not be accepted for building entry and one of the alternate forms of ID listed below will be required. Acceptable alternate forms of Photo-ID include U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by States and territories as identified on the DHS website (Enhanced licenses issued by these States and territories are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government-issued Photo-ID card.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/41*. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address shown in the **ADDRESSES** section at the beginning of this NOPR. The request and advance copy of statements must be received at least one week before the public meeting and may be emailed, hand-delivered, or sent by mail. DOE prefers to receive requests and advance copies via email. Please include a telephone number to enable DOE staff to make a follow-up contact, if needed.

C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

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

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

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

D. The Time and Date of the Public Meeting and Submission of Comments

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

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

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

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

DOE processes submissions made through *http://www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable

for up to several weeks. Please keep the comment tracking number that *http://www.regulations.gov* provides after you have successfully uploaded your comment.

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

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

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

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery/courier two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include (1) a description of the items, (2) whether and why such items are customarily treated as confidential within the industry, (3) whether the information is generally known by or available from other sources, (4) whether the information has previously been made available to others without obligation concerning its confidentiality, (5) an explanation of the competitive injury to the submitting person that would result from public disclosure, (6) when such information might lose its confidential character due to the passage of time, and (7) why disclosure of the information would be contrary to the public interest.

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

E. Issues on Which DOE Seeks Comment

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

1) DOE seeks comment on the technology options identified and the ones selected as design options in the screening analysis. See sections IV.A.3 and IV.A.4 of this document.
2) DOE seeks comment on the performance characteristics of the more efficacious substitute modeled for GSILs. See section IV.B.3 of this document.
3) DOE welcomes any relevant data and comment on the energy use analysis methodology. See section IV.D of this document.
4) DOE welcomes any relevant data and comment on the LCC and PBP analysis methodology. See section IV.E of this document.
5) DOE welcomes any relevant data and comment on the shipments analysis methodology. See section IV.F of this document.
6) DOE seeks any relevant data and comment on the potential rebound effect for GSILs. See section IV.G.1 of this document.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed determination.

Signed in Washington, DC, on August 28, 2019

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Daniel R Simmons
Assistant Secretary
Energy Efficiency and Renewable Energy

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