UNITED STATES COURT OF APPEALS
FOR THE SECOND CIRCUIT

STATES OF NEW YORK, CALIFORNIA, CONNECTICUT, ILLINOIS, MARYLAND, MAINE, MICHIGAN, MINNESOTA, NEW JERSEY, NEVADA, OREGON, VERMONT, and WASHINGTON, the COMMONWEALTH OF MASSACHUSETTS, the DISTRICT OF COLUMBIA, and the CITY OF NEW YORK,

Petitioners,

v.

U.S. DEPARTMENT OF ENERGY and DAN BROUILLETTE, Secretary, U.S. Department of Energy,

Respondents.

Docket No.

PETITION FOR REVIEW

Pursuant to Section 336(b)(1) of the Energy Policy and Conservation Act, 42 U.S.C. § 6306(b)(1), Section 702 of the Administrative Procedure Act, 5 U.S.C. § 702, and Rule 15 of the Federal Rules of Appellate Procedure, the States of New York, California, Connecticut, Illinois, Maryland, Maine, Michigan, Minnesota, New Jersey, Nevada, Oregon, Vermont, and Washington, the Commonwealth of Massachusetts, the District of Columbia, and the City of New York hereby petition this Court for review of a final action taken by respondents, published at 84 Fed. Reg. 71,626 *et seq*. (December 27, 2019), entitled "Energy Conservation Program: Energy Conservation Standards for General Service Incandescent Lamps." A copy of the final rule is attached hereto.

Dated: February 25, 2020

Respectfully submitted,

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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: Final determination.

SUMMARY: The Energy Policy and Conservation Act, 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. On September 5, 2019, the U.S. Department of Energy (''DOE'') published a notice of proposed determination (''NOPD'') in which DOE initially determined that energy conservation standards for GSILs do not need to be amended. In this final determination, DOE responds to comments received on the September 2019 GSIL NOPD and does not adopt amended energy conservation standards for GSILs. DOE has determined that amended energy conservation standards for GSILs would not be economically justified.

DATES: The effective date of this rule is December 27, 2019.

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

The docket web page can be found at *https://www.regulations.gov/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.

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

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Final Determination

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

DOE is issuing this final determination pursuant to the EPCA requirement that DOE must initiate a rulemaking for GSLs and, among other requirements, determine whether standards in effect for GSILs should be amended. (42 U.S.C. 6295(i)(6)(A)) DOE has concluded that energy conservation standards for GSILs do not need to be amended because more stringent standards are not economically justified. For ease of reference, the following provides a list of acronyms used in this final determination.

Term(s)	Reference in this final determination
Administrative Procedure Act	APA
Annual Energy Outlook	AEO
Capital Asset Pricing Model	CAPM
Code of Federal Regulations	CFR
Color Rendering Index	CRI
Commercial Building Stock Assessment	CBSA
Commercial Buildings Energy Consumption Survey	CBECS
Compact Fluorescent Lamp	CFL
Compliance Certification Management System	CCMS
Correlated Color Temperature	CCT
Direct Heating Equipment	DHE
Efficiency Level	EL
Energy Independence and Security Act of 2007	EISA
Energy Information Association	EIA
Energy Policy Conservation Act	EPCA
Environmental Assessment	EA
Environmental Impact Statement	EIS
Executive Order	EO
Final Information Quality Bulletin for Peer Review	Bulletin
Final Regulatory Flexibility Analysis	FRFA
Full-Fuel-Cycle	FFC
General Service Incandescent Lamp	GSIL
General Service Lamp	GSL
Government Regulatory Impact Model	GRIM
Halogen Infrared	HIR
Hours of Use	HOU
Incandescent Reflector Lamp	IRL
Industry Net Present Value	INPV
Infrared	IR
Initial Regulatory Flexibility Analysis	IRFA
Life-Cycle Cost	LCC
Light-Emitting Diode	LED
Lighting Market Characterization	LMC
Manufacturer Impact Analysis	MIA
Manufacturer Production Cost	MPC
Manufacturer Selling Price	MSP
Massachusetts Institute of Technology	MIT
Medium Screw Base	MSB
National Energy Modeling System	NEMS
National Energy Savings	NES
National Environmental Policy Act of 1969	NEPA
National Impact Analysis	NIA
Net Present Value	NPV
Notice of Data Availability	NODA
Notice of Proposed Definition and Data Availability	NOPDDA
Notice of Proposed Determination	NOPD
Notice of Proposed Rulemaking	NOPR
Office of Management and Budget	OMB
Office of Science and Technology Policy	OSTP
Organic Light-Emitting Diode	OLED
Out-of-Scope Substitute Lamps	LCC with Substitution
Parabolic Reflector	PAR
Payback Period	PBP
Regulatory Reform Officer	RRO
Request for Information	RFI
Research and Development	R&D
Residential Building Stock Assessment Metering Study	RBSAM
Residential Energy Consumption Survey	RECS
Secretary of Energy	Secretary
Selling, General, and Administrative	SG&A

[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).

Term(s)	Reference in this final determination
Small Business Administration	SBA
Survey of Consumer Finances	SCF
Technical Support Document	TSD
Trial Standard Level	TSL
U.S. Department of Energy	DOE
U.S. Securities and Exchange Commission	SEC
Unfunded Mandates Reform Act of 1995	UMRA
Volts	V

II. Introduction

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

A. Authority

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'') 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)) If DOE fails to complete a rulemaking in accordance with 42 U.S.C. 6295(i)(6)(A)(i)–(iv) or if 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 lumens per watt, the statute provides a ''backstop'' under which DOE must prohibit sales of GSLs that do not meet a minimum 45 lumens per watt 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 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedure for GSILs appears at Title 10 of the Code of Federal Regulations (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 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. (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, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt

[3] DOE has provided a more detailed explanation as to why the preemption exceptions are not available to California and Nevada in its General Service Lamps definition final rule published on September 5, 2019. 84 FR 46661, as well as in section V.E. of this document.

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 considers only 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, of 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 product 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 considers relevant.

(42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

DOE is publishing this final determination 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))

B. Background

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 Table II.1 and Table II.2 of this document.

TABLE II.1—FEDERAL ENERGY EFFICIENCY STANDARDS FOR STANDARD SPECTRUM GSILS

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

TABLE II.2—FEDERAL ENERGY CONSERVATION STANDARDS FOR MODIFIED SPECTRUM GSILS

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

2. History of Standards Rulemaking 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 Appropriations Rider, which had been

[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.

extended in multiple appropriations through 2017, is no longer in effect.[5]

In response to comments on the March 2016 GSL NOPR, DOE 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 October 2016 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 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. On September 5, 2019, DOE published a final rule withdrawing the revised definitions of GSL, GSIL, and supplemental terms established in the January 2017 definition final rules and maintaining the existing definitions of GSL and GSIL currently found in DOE's regulations (the 2019 GSL Definition Rule). 84 FR 46661.

DOE 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 an analysis of whether energy conservation standards for GSILs need to be amended. DOE published a notice of proposed determination on September 5, 2019 that proposed not to amend standards for GSILs because more stringent standards were not economically justified. 84 FR 46830. DOE considers comments received in response to the September 2019 GSIL NOPD in this final determination.

In addition to comments received at the public meeting, DOE received 24,166 written comments in response to the September 2019 GSIL NOPD contained in 105 documents posted in the docket at *https://www.regulations.gov/docket?D=EERE-2019-BT-STD-0022.* The organizations that submitted written comments or commented at the public meeting are listed in Table II.3.

TABLE II.3—SEPTEMBER 2019 GSIL NOPD WRITTEN COMMENTS FROM ORGANIZATIONS

Organization(s)	Reference in this final determination	Organization Type
Alliance to Save Energy	ASE	Efficiency Organization.
American Institute of Architects	AIA	Trade Association.
Appliance Standards Awareness Project	ASAP	Efficiency Organization.
Appliance Standards Awareness Project, American Council for an Energy Efficient Economy, Natural Resources Defense Fund, and National Consumer Law Center.	Joint Advocates	Efficiency Organizations.
Attorneys General of NY, CA, CO, CT, DC, IL, MA, MD, ME, MI, MN, NJ, NV, OR, VE, WA, New York City.	State Attorneys General	State/Federal Official or Agency.
California Energy Commission	CEC	State/Federal Official or Agency.
Colorado Energy Office and Colorado Department of Health and the Environment	State of Colorado	State/Federal Official or Agency.
Competitive Enterprise Institute, The Heritage Foundation, Eagle Forum, FreedomWorks Foundation, Thomas Jefferson Institute for Public Policy, Rio Grande Foundation, Nevada Policy Research Institute, Tradition Family Property Inc., Committee for a Constructive Tomorrow, Americans for Prosperity, Ethan Allen Institute, National Center for Public Policy Research and Project 21, and The Heartland Institute, 60 Plus Association (CEI et al).	Free Market Organizations	Free Market Organizations.

[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).

TABLE II.3—SEPTEMBER 2019 GSIL NOPD WRITTEN COMMENTS FROM ORGANIZATIONS—Continued

Organization(s)	Reference in this final determination	Organization Type
Consumer Federation of America	CFA	Consumer Advocate.
Fourteen U.S. Senators (Edward J. Markey, Jeanne Shaheen, Maria Cantwell, Patty Murray, Tina Smith, Sheldon Whitehouse, Richard Blumenthal, Mazie K. Hirono, Jeffrey A. Merkley, Jack Reed, Bernard Sanders, Ron Wyden, Chris Van Hollen, and Catherine Cortez Masto).	U.S. Senators	State/Federal Official or Agency.
Edison Electric Institute	EEI	Utility Association.
General Electric Lighting	GE	Manufacturer.
Institute for Policy Integrity	IPI	Think Tank.
National Electrical Manufacturers Association	NEMA	Trade Association.
Natural Resources Defense Council	NRDC	Efficiency Organization.
Northwest Power and Conservation Council	NPCC	Regional Agency/Association.
Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric	CA IOUs	Utilities.
Pennsylvania Department of Environmental Protection	PA DEP	State/Federal Official or Agency.
Sierra Club and Earthjustice	Sierra Club and Earthjustice.	Efficiency Organizations.
Westinghouse Lighting	Westinghouse	Manufacturer.

In addition to the comments from organizations listed in Table II.3, DOE received over 80 comments from individuals and 24,060 comments submitted by individuals via form letter. A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[6]

III. General Discussion

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 that DOE determines are appropriate. (42 U.S.C. 6295(q)) The product classes for this final determination are discussed in further detail in section VI.A.5 of this document. This final 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 VI.A.1 of this document.

[6] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to evaluate energy conservation standards for GSILs. (Docket No. EERE-2019-BT-STD-0022, which is maintained at *https://www.regulations.gov/#!docketDetail;D=EERE-2019-BT-STD-0022*). The references are arranged as follows: (Commenter name, comment docket ID number at page of that document).

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. DOE's current energy conservation standards for 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 a revised active mode test procedure 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 (''IRLs''). 82 FR 37031 (August 8, 2017).

C. Technological Feasibility

1. General

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

2. Maximum Technologically Feasible Levels

When DOE evaluates an amended standard for a type or class of covered

product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for 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 rulemaking are described in section VI.B.3 of this final determination and in chapter 5 of the final determination TSD.

D. Energy Savings

1. Determination of Savings

For each trial standard level (''TSL''), DOE projected energy savings from application of a TSL to GSILs purchased in the 30-year period that begins in the year of compliance with the potential amended standards (2023–2052).[7] The savings are measured over the entire lifetime of the GSILs and substitute lamps purchased in the 30-year analysis period. DOE quantified the energy savings attributable to a TSL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of amended energy conservation standards. In this case, the standards case represents energy savings not from the technology outlined in a TSL, but from product substitution as consumers are priced out of the market for GSILs.

DOE used its national impact analysis (''NIA'') spreadsheet model to estimate national energy savings (''NES'') from potential amended standards for GSILs. The NIA spreadsheet model (described in section VI.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 national energy savings 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.[8] 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 VI.G.1 of this document.

2. Significance of Savings

In determining whether amended standards are needed, DOE must consider whether such action would result in significant energy savings. (42 U.S.C. 6295(m)(1)(A)) Congress did not define the statutory term ''significant conservation of energy,'' and heretofore DOE's approach to this criteria has been inconsistent. To address this gap, DOE recently proposed to define a significant energy savings threshold in the ''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 and thus DOE is not applying the threshold proposed in the Process Rule update at this time.

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)(I)(VII)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of potential amended standards on manufacturers, DOE conducts a manufacturer impact analysis (''MIA''), as discussed in section VI.H of this document. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include (1) industry net present value (''INPV''), which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

For individual consumers, measures of economic impact include the changes in life-cycle cost (''LCC'') and payback period (''PBP'') associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the consumer costs and benefits expected to result from particular standards. DOE also evaluates the impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a standard. However, because DOE has concluded that amended standards for GSILs would not be economically justified for 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 (LCC and PBP)

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 a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of a product (including its installation) and the operating cost (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. 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 LCC analysis, DOE assumes that any purchases of the covered product occur

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

[8] 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).

in the first year of compliance with potential amended standards.

As described previously, 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). DOE's determination regarding economic justification must be based on LCC savings occurring as a result of the imposition of an amended standard for the covered product, *i.e.,* GSILs. Separately, 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). Accordingly, while DOE presents the LCC savings under a substitution scenario,[9] 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.

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 VI.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 VI.G, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Products

In establishing product classes, and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered products. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) The Secretary may not prescribe an amended or new standard if the Secretary finds (and publishes such finding) that interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially similar in the United States at the time of the Secretary's finding. (42 U.S.C. 6295(o)(4))

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) Because DOE is not amending a standard, DOE did not transmit its rulemaking to the Attorney General under this provision.

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. Consistent with its past approach,[10] because DOE has concluded amended standards for GSILs would not be economically justified for potential standard levels evaluated based on the PBP analysis, DOE did not conduct a utility impact analysis or emissions analysis for this notice.

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)) In this final determination, DOE based its analysis of economic justification on the second factor in 42 U.S.C. 6295(o)(2)(B)(i), namely, that the energy savings in operating costs of the covered product are insufficient to recover the upfront cost.

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 VII.B.2 of this final determination.

IV. DOE's Proposal and Discussion of Related Comments

Section V of this final rule addresses legal issues, section VI addresses comments on DOE's methodology, section VII contains the results of DOE's analysis, and section VII.E contains DOE's conclusion. DOE received several general comments expressing agreement or disagreement with DOE's proposed determination. NEMA, GE, Westinghouse, the Free Market Organizations, and one individual supported DOE's determination to not set more stringent standards for GSILs. (GE, No. 78 at p. 1; Westinghouse, No. 112 at p. 1–2; Free Market Organizations, No. 111 at p. 2–3, 6–7; NEMA, No. 88 at p. 2, 6; Strauch, No. 69 at p. 1) Additionally, several individuals stated that the incandescent lamp should not be banned.[11]

[9] Throughout this document, when DOE refers to the LCC savings for the substitution scenario, DOE is referring to the projected savings that could be achieved in a substitution scenario.

[10] *See* 81 FR 71325 (Oct. 17, 2016).

[11] See Smith, No. 31 at p. 1; Anonymous, No. 71 at p. 1; Brian, No. 72 at p. 1; Gazoobie, No. 75 at p. 1; Young, No. 99 at p. 1; Oates, No. 20 at p. 1; Berry, No. 67 at p. 1; Baker, No. 34 at p. 1, Baker,

Continued

Conversely, fourteen U.S. Senators, the attorneys general of sixteen U.S. States, State agencies, energy efficiency organizations, utilities, a think tank, and many individuals disagreed with DOE's proposal to not set more stringent standards for GSILs.[12] Additionally, fourteen U.S. Senators and other stakeholders stated that the Federal government should be acting to increase the use of energy efficient lighting products rather than back tracking or relaxing energy efficiency standards.[13] There were also over 24,060 comments submitted by individuals via form letter that disagreed with DOE's proposal. (NRDC, No. 92 at spreadsheet attachment)

NEMA and several individuals stated that consumer energy savings resulting from amending conservation standards for incandescent lamps will not be substantial enough to significantly impact consumers. (NEMA, No. 88 at pp. 4–5; Strauch, No. 69 at p. 1; Anonymous, No. 98 at p. 7; Anonymous, No. 98 at pp. 15–16) NEMA further explained that the additional average annual cost for using GSILs in 2021 is minimal. (NEMA, No. 88 at p. 19) The Free Market Organizations stated that DOE analysis indicates a more stringent GSIL standard would make incandescent lamps prohibitively expensive and for all practical purposes would be an outright ban making LED lamps the only viable choice. (Free Market Organizations, No. 111 at p. 4) An individual noted that banning lamps is an indirect way of targeting energy consumption and emissions. (Anonymous, No. 98 at pp. 8–9, 10, 17)

In contrast, other commenters suggested that DOE's proposal to not amend standards would harm the environment and result in high energy costs for consumers due to continued sales of inefficient lamps.[14] Several commenters indicated that continued manufacturing of incandescent lamps will lead to increases in waste resources.[15] Other individuals said that continued use and manufacturing of incandescent lamps leads to increases in greenhouse gas emissions, and therefore increases the risk of health issues such as respiratory and cardiovascular effects. (Anonymous, No. 70 at p. 2; Miller, No. 79 at p. 1; Indivisible Ventura, No. 100 at p. 1; Knight, No. 105 at p. 1; Warren, No. 108 at p. 1) NPCC stated that DOE's proposal to not amend GSIL standards could significantly increase Northwest electricity loads that will need to be offset through utility energy efficiency programs, which could result in higher costs and less equitable distribution of savings. (NPCC, No. 58 at p. 2) The 24,060 individual commenters stated that DOE's proposal is in conflict with the intent of legislation passed 12 years ago to ensure improved efficiency standards for light bulbs starting in January 1, 2020. (NRDC, No. 92 at spreadsheet attachment)

Many stakeholders commented on the economic benefit for consumers of the 45 lumens per watt backstop requirement applying to all lamps included in the January 2017 GSL definition. 82 FR 7276 (January 19, 2017) and 82 FR 7322 (January 19, 2017). Specifically, several commenters indicated that lighting standards for efficient lamps such as CFLs and LED lamps would allow consumers to realize energy savings of as much as $20 (CFA, No. 76 at p. 3, 17–18) to $55 (NRDC, No. 97 at p. 2) per lamp over a 10-year period or $100 (NRDC, No. 97 at p. 3) by 2025 to $180 (ASE, No. 95 at p. 2) per average household per year. One commenter indicated that cumulatively, consumers would save as much as $1.7 billion on bulb purchases in 2025 if such standards are in place. (Vondrasek, No. 101 at p. 4) The 24,060 individual commenters and many other stakeholders stated that withdrawing the January 2017 GSL definition and not adopting the 45 lumen per watt backstop would cost Americans up to $14 billion in electricity bills as of 2025 and would increase electricity usage by as much as 25 power plants annually, thereby increasing carbon emissions.[16]

Several individuals submitted comments stating that more efficient lamps save consumers money and reduce greenhouse gas emissions.[17] Specifically, several commenters stated that applying the 45 lumens per watt backstop requirement to the lamps in the January 2017 GSL definition would save an estimated 38 million tons of carbon emissions annually and generate approximately $1.9 billion per year in climate benefits. (NRDC, Public Meeting Transcript, No. 56 at p. 14; ASE, No. 95 at p. 2; IPI, No. 96 at p. 4)

The Joint Advocates asserted that DOE's proposal to not amend GSIL

No. 30 at p. 1; Anonymous, No. 68 at p. 1; Anonymous, No. 98 at p. 1.

[12] To improve readability, the citation was moved to a footnote: (Morgan, No. 55 at p. 1; NRDC, Public Meeting Transcript, No. 56 at p. 15; NPCC, No. 58 at p. 1; State of Colorado, No. 62 at p. 1; CFA, No. 76 at p. 1; PA DEP, No. 77 at p. 2; Covell, No. 94 at p. 1; State Attorneys General, No. 110 at p. 1; Coconut Moon, No. 35 at p. 1; Goldman, No. 36 at p. 1; Simpson, No. 38 at p. 1; LeRoy, No. 40 at p. 1; Meadow, No. 41 at p. 1; Caswell, No. 44 at p. 1; H, No. 47 at p. 1; Kodama, No. 49 at p. 1; Schnapp, No. 14 at p. 1; Anonymous, No. 17 at p. 1; United States Senate, No. 60 at p. 1; ASAP, Public Meeting Transcript, No. 56 at pp. 17–18; CA IOUs, No. 83 at p. 1; The Joint Advocates, No. 113 at p. 1–2; Rothenhaus, No. 16 at p. 1; IPI, No. 96 at p. 8; Energy Solutions, Public Meeting Transcript, No. 56 at pp. 11–12).

[13] To improve readability, the citation was moved to a footnote: (Behl, No. 3 at p. 1; Katz, No. 26 at p. 1; AIA, No. 29 at pp. 1–2; Dufford, No. 32 at p. 1; Werner, No. 37 at p. 1; Gancarz-Davies, No. 63 at p. 1; Masson, No. 73 at p. 1; Wodkowski, No. 91 at p. 1; IPI, No. 96 at p. 8; Indivisible Ventura, No. 100 at p. 1; Warren, No. 108 at p. 1; Blancq, No. 10 at p. 1; Sorkin, No. 13 at p. 1; Ting, No. 21 at p. 1; Das, No. 24 at p. 1; Knipe, No. 28 at p. 1; Datz, No. 39 at p. 1; Galayda, No. 42 at p. 1; HS, No. 45 at p. 1; Sorkin, No. 53 at p. 1; Dawes, No. 57 at p. 1; United States Senate, No. 60 at p. 1; Gsell, No. 64 at p. 1; Waller, No. 74 at p. 1; Miller, No. 79 at p. 1; Waltman, No. 80 at p. 1; Murphy, No. 81 at p. 1; Craven, No. 82 at p. 1; Combs, No. 84 at p. 1; Guttman, No. 85 at p. 1; Bibito, No. 86 at p. 1; Bowe, No. 87 at p. 1; Anonymous, No. 89 at p. 1; Posakony, No. 90 at p. 1; Wodkowski, No. 91 at p. 1; Puckett, No. 93 at p. 1; Hemm, No. 103 at p. 1; Knight, No. 105 at p. 1; Anonymous, No. 107 at p. 1; MacKenzie, No. 109 at p. 1; Zimmerman, No. 50 at p. 1; Parker, No. 51 at p. 1; Rosenberg, No. 52 at p. 1; Coyne, No. 54 at p. 1; Energy Solutions, Public Meeting Transcript, No. 56 at p. 10; Dashe, No. 61 at p. 1; Anonymous, No. 70 at p. 1).

[14] To improve readability, the citation was moved to a footnote: (CFA, No. 76 at pp. 2–4; NRDC, No. 97 at pp. 1–2; MacKenzie, No. 109 at p. 1; Plano, No. 7 at p. 1; Kimble, No. 8 at p. 1; CFA, Public Meeting Transcript, No. 56 at p. 25; PA DEP, No. 77 at p. 2; Warren, No. 108 at p. 1; Joint Advocates, No. 113 at p. 1–2; State Attorneys General, No. 110 at p. 1–2, 12, 28; Morgan, No. 55 at p. 1).

[15] To improve readability, the citation was moved to a footnote: (Barrett, No. 15 at p. 1; Das, No. 24 at p. 1; Hill, No. 25 at p. 1; AIA, No. 29 at p. 1–2; Baker, No. 30 at p. 1; Dufford, No. 32 at p. 1; Werner, No. 37 at p. 1; Datz, No. 39 at p. 1; Kodama, No. 48 at p. 1; Zimmerman, No. 50 at p. 1; Rosenberg, No. 52 at p. 1; Sorkin, No. 53 at p. 1; Coyne, No. 54 at p. 1; Morgan, No. 55 at p. 1; Energy Solutions, Public Meeting Transcript, No. 56 at p. 12; Dawes, No. 57 at p. 1; United States Senate, No. 60 at p. 1; Dashe, No. 61 at p. 1; Gsell, No. 64 at p. 1; Anonymous, No. 66 at p. 1; Anonymous, No. 70 at p. 1; Anonymous, No. 70 at p. 2; Craven, No. 82 at p. 1; Combs, No. 84 at p. 1; Anonymous, No. 89 at p. 1; CFA, No. 76 at p. 13; PA DEP, No. 77 at p. 2; IPI, No. 96 at p. 8; NRDC, No. 97 at pp. 1–3; Indivisible Ventura, No. 100 at p. 1; Knight, No. 105 at p. 1; Warren, No. 106 at p. 1; MacKenzie, No. 109 at p. 1; Joint Advocates, No. 113 at p. 1; NEMA, No. 88 at p. 20; State Attorneys General, No. 110 at p. 1, 23, 25, 27, 28; Anonymous, No. 98 at p. 25; Behl, No. 3 at p. 1; Sorkin, No. 13 at p. 1; Parker, No. 51 at p. 1; State of Colorado, No. 62 at p. 1; NRDC, No. 92 at p. 1; Coconut Moon, No. 35 at p. 1; Greacen, No. 6 at p. 1; Solutions by Design, No. 2 at p. 1; Guttman, No. 85 at p. 1; CFA, No. 76 at p. 3).

[16] To improve readability, the citation was moved to a footnote: (NRDC, No. 92 at spreadsheet attachment; AIA, No. 29 at p. 2; NRDC, Public Meeting Transcript, No. 56 at p. 14; Dawes, No. 57 at p. 1; CFA, No. 76 at p. 13; United States Senate, No. 60 at p. 1; Indivisible Ventura, No. 100 at p. 1; State of Colorado, No. 62 at p. 1; Energy Solutions, Public Meeting Transcript, No. 56 at p. 12; PA DEP, No. 77 at p. 2; IPI, No. 96 at p. 8; CFA, No. 76 at p. 22).

[17] To improve readability, the citation was moved to a footnote: (Coconut Moon, No. 35 at p. 1; Goldman, No. 36 at p. 1; Werner, No. 37 at p. 1; Simpson, No. 38 at p. 1; Datz, No. 39 at p. 1; LeRoy, No. 40 at p. 1; Meadow, No. 41 at p. 1; Caswell, No. 44 at p. 1; H, No. 47 at p. 1; Kodama, No. 49 at p. 1; Rosenberg, No. 52 at p. 1; Dashe, No. 61 at p. 1).

standards is an attempt to slow the transition to LED lamps and that it will waste energy and dollars and damage the environment. ASE stated that DOE's decision to publish this proposal will cause needless market uncertainty less than one year before new standards are set to take effect. (ASE, No. 95 at p. 3) The State Attorneys General stated that the backstop has already made an impact in the industry where manufacturers, retailers, consumers, and regulators have already anticipated the backstop standard going into effect. (State Attorneys General, No. 110 at pp. 9–10) CFA argued that DOE's proposal could lead to less shelf space for efficient light bulbs, making it more difficult for consumers to locate the efficient products that best meet their needs. (CFA, No. 76 at p. 7) The Joint Advocates strongly urged DOE to withdraw and redo its analysis. (Joint Advocates, No. 113 at XX.)

NEMA commented that further regulation is unnecessary because the market will achieve energy conservation goals for GSLs as effectively as a regulatory approach and without unnecessary, incremental regulatory burden. NEMA noted that consumers have historically voluntarily chosen more efficient lamps without requirements of Federal energy conservation standards. NEMA submitted data to argue that more efficient GSL designs have had success in the market, and that the acceptance of such designs and actual (not ''potential'') market penetration warrant adoption of a non-regulatory approach in this case. (NEMA, No. 88 at pp. 3, 21–31) p. 1)

DOE appreciates, and has considered, the comments that DOE has received regarding its proposal in the September 2019 GSIL NOPD.

V. Legal Issues and Discussion of Related Comments

A. Imposition of the Backstop

By law, the Secretary was required to initiate a rulemaking by January 1, 2014 to determine whether standards in effect for GSLs should be amended and whether exemptions for certain incandescent lamps should be maintained or discontinued based, in part, on exempted lamp sales. (42 U.S.C. 6295(i)(6)(A)(i)) If the Secretary determined that standards in effect for GSILs should be amended, the Secretary was obligated to publish a final rule establishing such standards no later than January 1, 2017. (42 U.S.C. 6295(i)(6)(A)(iii)) If the Secretary made a determination that standards in effect for GSILs should be amended, failure by the Secretary to publish a final rule by January 1, 2017, in accordance with the criteria in the law, would have resulted in the imposition of the backstop provision in 42 U.S.C. 6295(i)(6)(A)(v). That backstop requirement would have required that the Secretary prohibit the sale of any GSL that does not meet a minimum efficacy standard of 45 lm/W.

DOE received numerous comments asserting that the 45 lm/W backstop standard applicable to GSLs in 42 U.S.C. 6295(i)(6)(A)(v) has been triggered and is to go into effect on January 1, 2020. Such commenters include the Sierra Club and Earthjustice, NRDC, the Joint Advocates, CA IOUs, CEC, the Attorneys General, U.S. Senators, ASE, CFA, and the PA DEP. These commenters contend that the backstop standard was triggered by DOE's failure to complete a rulemaking in accordance with 42 U.S.C. 6295(i)(6)(A)(i)–(iv) and applies to all GSLs, including GSILs. Thus, commenters argued that DOE's proposed determination is not authorized by EPCA and that any final determination would be without legal effect. (*See* the State Attorneys General, No. 110 at p. 7; CEC, No. 102 at 3; Sierra Club and Earthjustice, No. 104 at 1; Joint Advocates, No. 113 at 3) The State Attorneys General argued against DOE's assertion in the 2019 GSL Definition Rule that the backstop has not yet been triggered because 42 U.S.C. 6295(i)(6)(A)(iii) requires a final GSIL standards rule by January 1, 2017, only if DOE determines that standards for GSILs should be amended. (the State Attorneys General, No. 110 at p. 9) The State Attorneys General disagree with the notion that because DOE has yet to decide whether to amend the standard, it is not obliged to issue a final standard by any deadline and the backstop provision is not triggered. *Id.* The State Attorneys General believe that this interpretation of EPCA is inconsistent with the statutory language establishing the backstop and would render its inclusion in the statute meaningless. *Id.* The CA IOUs disagreed with DOE's assertion in the 2019 GSL Definition Rule that it was unable to meet the statutory deadlines due to the limitations imposed by the Appropriations Rider, arguing that the Rider does not negate the reality that the backstop has been triggered. (CA IOUs, No. 83 at p. 2) Along these lines, the State Attorneys General argued that there is no basis to infer that Congress intended the Rider to suspend or repeal the schedule set forth in 42 U.S.C. 6295(i)(6)(A), and as a result the Rider is irrelevant as to whether the backstop was triggered. (the State Attorneys General, No. 110 at p. 10)

DOE received many comments relying on DOE's alleged failure to complete the deadlines set forth in 42 U.S.C. 6295(i)(6)(A) as evidence that DOE has triggered the backstop provision. As discussed in the 2019 GSL Definition Rule, DOE initiated the first GSL standards rulemaking process by publishing a notice of availability of a framework document in December 2013, which satisfied the requirements in 42 U.S.C. 6295(i)(6)(A)(i) to initiate a rulemaking by January 1, 2014. DOE subsequently issued the March 2016 NOPR proposing energy conservation standards for GSLs, but was unable to undertake any analysis regarding GSILs and other incandescent lamps in the NOPR because of a then-applicable Appropriations Rider. Once the Appropriations Rider was removed, DOE was able to undertake the analysis to determine whether standards for GSLs, including GSILs, should be amended per the requirements in 42 U.S.C. 6295(i)(6)(A)(i) and thus issued the September 2019 GSIL NOPD. This final rule completes DOE's obligation under the statute to determine whether standards for GSILs should be amended. There is no explicit deadline in 42 U.S.C. 6295(i)(6)(A)(iii) for making this negative determination, and Congress, through the Appropriations Rider, removed DOE's authority to make the required statutory determination regarding GSILs during the period the Rider was in effect. DOE did not regain the authority to make the determination regarding GSILs until the Rider was removed. Upon the removal of the Rider in 2017, DOE has worked swiftly to make the required determinations regarding incandescent lamps in 42 U.S.C. 6295(i)(6)(A). DOE is continuing to evaluate energy conservation standards for LEDs and CFLs and is working toward completing that task.

With regard to comments on the January 1, 2017, statutory deadline for the Secretary to complete a rulemaking for GSILs in 42 U.S.C. 6295(i)(6)(A)(iii), this deadline is premised on the Secretary's first making a determination that standards for GSILs should be amended. The Secretary fails to meet the requirement in 42 U.S.C. 6295(i)(6)(A)(iii) only if he (1) determines that standards for GSILs should be amended; and then (2) fails to publish a rule prescribing standards by January 1, 2017. That is, 42 U.S.C. 6295(i)(6)(A)(iii) does not establish an absolute obligation on the Secretary to publish a rule by a date certain, as is the case in numerous other provisions in EPCA. *See* 42 U.S.C. 6295(e)(4); 42

U.S.C. 6295(u)(1)(A); and 42 U.S.C. 6295(v)(1). Rather, the obligation to issue a final rule prescribing standards by a date certain applies if, and only if, the Secretary makes a determination that standards in effect for GSILs need to be amended. Interpreting the statute otherwise would suggest that, if the Secretary were to make a determination that standards in effect for GSILs do not need to be amended, the Secretary nonetheless would have an obligation to issue a final rule setting standards for those lamps that he determined did not necessitate amended standards. Although different readings of the statutory language have been suggested, it is DOE's conclusion that the best reading of the statute, is that Congress intended for the Secretary to make a predicate determination about whether the standards for GSILs should be amended, otherwise it could result in a situation where a prohibition is automatically imposed for a category of lamps for which no new standards, much less prohibition, are necessary. Since DOE now makes the predicate determination in this final rule that standards for GSILs do not need to be amended, the obligation to issue a final rule by a date certain does not exist and, as a result, the condition precedent to the potential imposition of the backstop requirement does not exist and no backstop requirement has been imposed.

B. EPCA's Anti-Backsliding Provision and Congressional Intent

Commenters asserted that even if DOE were authorized to amend standards for GSILs per 42 U.S.C. 6295(i)(6)(A), EPCA's prohibition against backsliding at 42 U.S.C. 6295(o)(1) limits DOE's authority to determine whether standards should be increased from a baseline efficacy level of 45 lm/W established by the backstop. (the State Attorneys General, No. 110 at p. 8) Because, the commenters asserted, the proposed determination would increase the maximum allowable energy use for GSILs, a subset of GSLs, commenters argue that EPCA's anti-backsliding provision forbids DOE from undertaking that action. (*See* the State Attorneys General, No. 110 at p. 8; Sierra Club and Earthjustice, No. 104 at p. 5; ASE, No. 95 at p. 3) The State Attorneys General noted that the anti-backsliding provision was intended to ensure progress toward higher efficiency standards and stability. Against this backdrop, these commenters stated that it defies credulity that Congress would have granted DOE unfettered discretion to avoid the backstop by issuing a determination not to amend nearly three years after the deadline Congress set for DOE to carry out its rulemaking responsibilities. (the State Attorneys General, No. 110 at p. 11) The State Attorneys General pointed to the Energy Independence and Security Act of 2007's (EISA's) legislative history as revealing clear congressional intent to rapidly transition the nation to more energy efficient lighting through, among other things, the elimination of inefficient, incandescent bulbs by 2020. (*Id.* at p. 10.) Along these lines, the Sierra Club and Earthjustice commented that Congress did not authorize DOE to issue a finding that standards in effect for GSILs should not be amended, because Congress designed the backstop to take effect unless displaced by a DOE rulemaking that would achieve greater energy savings. (Sierra Club and Earthjustice, No. 104 at p. 6)

The anti-backsliding provision at 42 U.S.C. 6295(o)(1) precludes DOE from amending an existing energy conservation standard to permit greater energy use or a lesser amount of energy efficiency. This provision is inapplicable to the current rulemaking because DOE has not established an energy conservation standard for GSLs from which to backslide. Commenters' assertions that the anti-backsliding provision has been violated hinge on the assumption that the backstop requirement for GSLs in 42 U.S.C 6295(i)(6)(A)(v) has been triggered and is currently in effect. However, DOE makes clear in this rule that because it has made the predicate determination not to amend standards for GSILs, there is no obligation to issue a final rule by January 1, 2017, and thus the backstop sales prohibition has not been triggered and is not in effect. Any discussion of backsliding is therefore misplaced. Furthermore, the determination DOE makes in this rulemaking is that the existing standards applicable to GSILs should remain as they are, *i.e.,* that those standards do not need to be amended. As a result, this rulemaking is in no way reducing the standards applicable to the subject lamps.

Additionally, as discussed in the 2019 GSL Definition Rule, even if the backstop requirement at 42 U.S.C. 6295(i)(6)(A)(v) were to apply, it would operate as a sales prohibition for any GSL that does not meet a minimum efficacy standard of 45 lm/W. The anti-backsliding provision states that the Secretary cannot prescribe any amended *standard* that would allow greater energy use or less efficiency. EPCA defines an energy conservation standard for consumer products as a performance standard that prescribes a minimum efficiency level or maximum quantity of energy usage for a covered product or, in certain circumstances, a design requirement. (42 U.S.C. 6291(6)) In contrast, a sales prohibition in EPCA is tied to whether a transaction in commerce can occur with respect to a covered product, but the prohibition is not itself a standard.[18] Because the scope of a sales prohibition is not the same as a standard, the minimum efficacy of 45 lm/W mandated by the backstop's sales prohibition is unchanged by this final rule. The anti-backsliding provision in 42 U.S.C. 6295(o) limits the Secretary's discretion only in prescribing standards, not sales prohibitions, and thus is inapplicable to the backstop requirement for GSLs in 42 U.S.C 6295(i)(6)(A)(v).

With regard to comments on congressional intent underlying EISA, general service LEDs did not exist in any commercially viable sense in 2007. It is therefore unlikely that Congress' intent in enacting EISA was to regulate incandescent lamps out of existence thirteen years in the future on the hope that such general service LEDs would be available. Moreover, the statutory text does not evidence such intent. In fact, the words of the statute suggest just the opposite. Specifically, in 42 U.S.C. 6295(i)(6)(B)(i)(I),[19] Congress required that DOE undertake, not later than January 1, 2020, a second, similar rulemaking to decide whether to amend standards applicable to the same incandescent lamps at issue in this rulemaking. The fact that Congress directed DOE to undertake this rulemaking, which is to be initiated not later than the first day of 2020, suggests that Congress did not intend such lamps to be regulated out of existence beginning on that very same day. The existence of subparagraph (B) suggests that the Secretary was not limited in his discretion under subparagraph (A) to imposition of either the 45 lm/W backstop standard or a DOE-promulgated standard for GSLs that was more stringent than 45 lm/W. Congress was open to the possibility that something less than a 45 lm/W standard for GSLs could be adopted, as evidenced by the statute's direction to DOE in 42 U.S.C. 6295(i)(6)(A)(ii)(II) to consider, but not require, a minimum standard of 45 lm/W for GSLs. Otherwise, subparagraph (B) would be mere

[18] *See* 42 U.S.C. 6302(a)(5) for another example of a sales prohibition.

[19] This provision provides that, not later than January 1, 2020, the Secretary shall initiate a rulemaking procedure to determine whether standards in effect for general service incandescent lamps should be amended to reflect lumen ranges with more stringent maximum wattage than the standards specified in paragraph (1)(A).

surplusage as there would be no GSILs to evaluate at the time mandated for the subparagraph (B) rulemaking. Thus, Congress did not require DOE to establish an energy conservation standard in this present rulemaking that would eliminate GSILs from the market.

C. Product Substitutes

In the September 2019 GSIL NOPD, DOE preliminarily determined that any energy savings that might result from establishing a standard at the maximum technologically feasible level (referred to elsewhere in this document as ''TSL 1'', which denotes ''trial standard level 1'') are the result of product shifting as consumers abandon GSILs utilizing halogen infrared technology (''GSIL–HIR'') in favor of different product types having different performance characteristics or features. 84 FR 46857. DOE noted 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 of 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). Accordingly, DOE stated that it 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. 84 FR 46841. DOE concluded that it could not 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. *Id.* at 84 FR 46858.

Comments from the State Attorneys General, Sierra Club and Earthjustice, CA IOUs, CEC, the Joint Advocates, NRDC and the IPI disagreed with DOE's application of the features provision in 42 U.S.C. 6295(o)(4). (the State Attorneys General, No. 110 at p. 12; Sierra Club and Earthjustice, No. 104 at p. 10; CA IOUS, No. 83 at p. 2; CEC, No. 102 at p. 3; the Joint Advocates, No. 113 at p. 3; NRDC, No. 97 at p. 2; IPI, No. 96 at p. 4) In particular, the Sierra Club and Earthjustice stated that the text of the features provision, its legislative history, and other requirements in the statute make clear that for the features provision to block DOE from adopting a standard, not only must the standard result in the unavailability of the product performance characteristics, features, sizes, capacities, or volumes that are presently available, but the standard must leave the market with no alternative performance characteristics, features, sizes capacities, or volumes that are ''substantially the same'' as those that would be eliminated from the market. (the Sierra Club and Earthjustice, No. 104 at p. 11.) Additionally, the State Attorneys General asserted that DOE has employed the features provision to preserve incandescent lighting, a legacy technology that offers consumers no distinct performance-related utility. (the State Attorneys General, No. 110 at p. 12; see also CEC, No. 102 at p. 3). The State Attorneys General further stated that DOE's past refusal to treat lamp technology as a unique performance feature for product classification purposes highlights the arbitrary nature of DOE's September 2019 GSIL NOPD and its preferential treatment for incandescent lamp technology. *Id.* at 14. Further, CEC argued that DOE has neither made nor published any findings establishing by a preponderance of the evidence that GSILs provide performance characteristics that should be protected under 42 U.S.C. 6295(o)(4); the mere existence of GSILs as a covered product is inadequate. (CEC, No. 102 at 3). CEC also noted that DOE acknowledged in the September 2019 GSIL NOPD that CFLs and LEDs can be used to satisfy lighting applications traditionally served by incandescent general service lamps. *Id.* at 4. Lastly, the Joint Advocates asserted that DOE cannot use the possibility that manufacturers may choose to no longer offer GSILs to justify the application of an unavailability scenario, or as an excuse to avoid full rulemaking analysis. These commenters stated that EPCA cannot reasonably be read to ensure the availability of a particular technology in perpetuity. (Joint Advocates, No. 113 at p. 3)

Other commenters, including Free Market Organizations, GE, Westinghouse, and NEMA, supported DOE's conclusion in the September 2019 GSIL NOPD that the elimination of the GSIL from the market by an amended standard is foreclosed by 42 U.S.C. 6295(o)(4). (*See* Free Market Organizations, No. 111 at p. 4; *see also* NEMA, No. 88 at p. 14) NEMA commented that the GSIL has a significant performance characteristic or feature for a significant group of consumers of this product that is not replicated by the CFL or general service LED (yet): The incandescent lamp's ability to deep-dim light output to below 0.1% of maximum output. NEMA stated that the CFL and LED cannot achieve the deep-dimming capability of the incandescent lamp. (NEMA, No. 88 at p. 14) Further, NEMA stated that this performance and consumer utility are desirable to residential consumers for ambience effects in dining rooms, living rooms, bedrooms and other rooms of the home, as well as for safety in navigation in the middle of the night, and both are easily achieved with halogen technology. (*Id.* at 15.)

DOE also received comments describing other features that are unique to incandescent lamps. An individual stated that compared with CFLs and LED lamps, the incandescent lamp requires much fewer raw materials and is basically just a wire and glass. The individual added that incandescent technology produces natural warm light, has a 100 percent CRI, has a smooth spectrum with all colors, is omnidirectional, and is easy to use in control systems. The individual stated that the heat wasted by incandescent technology, typically 90–95 percent, can be used to provide warmth when useful (*i.e.,* building codes recommend not using the technology in the summer or warmer climates). (Anonymous, No. 98 at p. 10) Another individual stated that despite their higher operating costs and shorter lifetimes, incandescent lamps provide the highest CRI and ability to work on any type of dimmer or sensor, which is not true for other lighting technologies. (Gazoobie, No. 75 at p. 1)

Compared to incandescent lamps, several individuals expressed safety concerns about CFLs and LED lamps. Specifically, one individual noted potentially undesirable features of CFLs include flicker, mercury, and electromagnetic wave radiation issues (*e.g.,* UV light). Another individual noted that LED lamps contain chemicals. A separate individual commented that LED lamps or fixtures are not suitable for trouble lights—that is lights that are likely to break in the application they are used (*e.g.,* construction sites). (Anonymous, No. 27 at p. 1; Anonymous, No. 98 at p. 2; Anonymous, No. 98 at pp. 2, 25; Baker, No. 34 at p. 1)

Several individuals stated that certain performance characteristics of LED lamps, primarily brightness, flicker, and emittance of blue light wavelengths can cause eye damage, loss of sleep, and headaches among other health issues.[20]

[20] To improve readability, the citation was moved to a footnote: (Baker, No. 30 at p. 1; Smith, No. 31 at p. 1; McAra, No. 33 at p. 1; Baker, No. 34 at p. 1; Berry, No. 67 at p. 1; Anonymous, No. 68 at p. 1; Anonymous, No. 71 at p. 1; Brian, No. 72 at p. 1; Young, No. 99 at p. 1; Anonymous, No. 98 at p. 25; Anonymous, No. 98 at p. 3; McAra, No. 33 at p. 1).

An individual commented that not all LED lamps flicker, but that the general public does not necessarily know how to choose an LED bulb that does not flicker; flicker may cause headaches and irritability. This individual stated that LED lamps do not have any flicker information on the package, as there is no easy way to measure flicker; modulation and rate are key in determining how flicker may affect a person. Additionally, the individual commented that the general public is unaware of the importance of reducing harsh blue light in the evenings. The individual added that per DOE documentation, LEDs may emit more blue light as they age, although this varies between lamps. The individual asserted that blue light emitted by LEDs has been linked to health issues such as disturbing circadian rhythms, muscular degeneration, and various cancers. The commenter added that only those with money and knowledge can install smarter LED lamps that can change color spectrum at different times of the day. (McAra, No. 33 at p. 1; Anonymous, No. 71 at p. 1; Anonymous, No. 98 at p. 2)

42 U.S.C. 6295(o)(4) provides that the Secretary may not prescribe an amended or new standard under this section if the Secretary finds (and publishes such finding) that interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. The language in this provision prohibits DOE from setting a standard that would result in the unavailability of the product performance characteristics, features, sizes, capacities, or volumes that are presently available in the market.

Historically, DOE has determined whether a technology constitutes a performance characteristic (including reliability), feature, size, capacity, and volume (collectively referred to hereafter as ''features'') under EPCA on a case-by-case basis. As highlighted by NEMA in its comments, the incandescent lamp's ability to deep-dim light output to below 0.1% of maximum light output represents a significant feature of this product that is not replicated by the CFL or general service LED lamp. This feature is desirable to residential consumers for ambience effects in dining rooms, living rooms, bedrooms and other rooms of the home, as well as for safety in navigation in the middle of the night. Setting a standard at TSL 1 would likely force the unavailability of deep-dimming general service lamps from the market. (*See* NEMA, No. 88 at p. 15) Moreover, aside from eliminating this significant feature to consumers, NEMA, with the support of GE and Westinghouse, has shown by a preponderance of the evidence that adopting a higher efficiency standard for GSILs would completely destroy the market for GSILs, a covered product, which is in violation of 42 U.S.C. 6295(o)(4). Earthjustice and NRDC argued in their March 1, 2019 comments on a petition requesting an interpretive rule that DOE's proposed energy conservation standards for residential furnaces and commercial water heaters would result in the unavailability of performance characteristics within the meaning of 42 U.S.C. 6295(o)(4): ''Congress did not intend the resulting unavailability of any and every performance characteristic to be a barrier to the imposition of strong efficiency standards. Rather, the legislative history of the provision confirms that the problem Congress intended section 325(o)(4) of EPCA to address is the possibility that efficiency standards could completely destroy the market for a covered product.'' (Earthjustice/NRDC Joint Comment, No. 55 at p. 3). While we take no position (because we need not do so here) on the full scope of section 325(o)(4) of EPCA, we agree that section 325(o)(4) of EPCA is meant to preclude the imposition of efficiency standards that would completely destroy the market for a covered product. Thus, even if deep-dimming were not considered an important consumer feature under EPCA, DOE finds that 42 U.S.C. 6295(o)(4) prevents standards for GSILs, as a distinct covered product listed under 42 U.S.C. 6292(a)(14), from being set at a level that would increase the price to the point that the product would be noncompetitive and that would result in the removal of the product from the market.

D. Economic Justification

In the September 2019 GSIL NOPD, DOE tentatively concluded, based on the second EPCA factor concerning economic justification that DOE is required to evaluate in 42 U.S.C. 6295(o)(2)(B)(i)(II), that imposition of a standard at TSL 1, which as described in Section VII, represents the max-tech efficiency level for GSILs and is composed of modeled Halogen infrared lamps, is not economically justified because the operating costs of the covered product are insufficient to recover the upfront cost. 84 FR 46830, 46858. NEMA, GE, Westinghouse and the Free Market Organizations supported DOE's conclusion that more stringent standards for GSILs cannot be economically justified. (NEMA, No. 88 at p. 2; GE, No. 78 at p. 1; Westinghouse, No. 112 at p. 1; Free Market Organizations, No. 111 at p. 2). Westinghouse agreed with DOE that the cost of the more efficacious substitute modeled for GSILs would be prohibitive and represent a net loss to the consumer, and that, in the unlikely event any manufacturer chose to make it, very few consumers would be expected to purchase this product because they would lose money on every lamp. (Westinghouse, No. 112 at p. 1) GE stated that it is very unlikely that any lamp manufacturing business could economically justify an investment in manufacturing capacity for the modeled substitute product, which would contain Halogen-IR filament tubes. The GE factory that previously made Halogen-IR filament tubes has been closed and the production equipment no longer exists. (GE, No. 78 at p. 2)

Some commenters asserted that, in making this determination, DOE misapplied EPCA's requirements governing its analysis of economic justification, and that EPCA does not permit the Department to base its analysis of economic justification on the consideration of only one factor or to decline consideration of any of the statutory factors listed in 42 U.S.C. 6295(o)(2)(B)(i) based on the outcome of its analysis of any other factor. (the Sierra Club and Earthjustice, No. 104 at p. 9) For example, the State Attorneys General and the IPI commented that DOE's failure to conduct an emissions analysis prior to issuing its proposed determination violates EPCA's requirement in 42 U.S.C. 6295(o)(2)(B)(i)(VI) to evaluate the need for national energy and water conservation as part of its economic analysis. (the State Attorneys General, No. 110 at p. 15; IPI, No. 96 at pp. 3–4). The Sierra Club and Earthjustice commented that DOE failed to consider the fifth factor, which addresses impacts on competition; the sixth factor, which addresses the need for national energy and water conservation; and the seventh factor, which encompasses any other factors DOE considers relevant, such as the benefits that accrue when consumers switch from GSILs to other types of GSLs. (the Sierra Club and Earthjustice, No. 104 at pp. 9–10) The CA IOUs stated that DOE had failed to consider the total projected amount of energy, or as applicable, water savings

likely to result from the imposition of the standard as required by 42 U.S.C. 6295(o)(2)(B)(i)(III). (CA IOUs, No. 83 at p. 3) The IPI further asserted that DOE seeks to import a new factor, unavailability, into the statutory definition of economically justified which Congress did not intend the agency to consider. (IPI, No. 96. at p. 1)

When considering new or amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) DOE's analysis indicates that more stringent standards for modeled GSILs at TSL 1 would make the lamps prohibitively expensive to the consumer, aside from the fact that such a substitute would likely never even make it to market, given its past lack of commercial viability and manufacturer unwillingness to produce such an uneconomical product. Thus, amended energy conservation standards for GSILs would not be economically justified at any level above the current standard level, because the benefits of more stringent standards would not outweigh the burdens of a high upfront cost and long payback period for consumers.

DOE continues to be of the view that failure to meet one aspect of the seven factors in EPCA's consideration of economic justification can mean that a revised standard is not economically justified, and that DOE can reach such a conclusion, in appropriate circumstances, without considering all of the other factors. For example, on October 17, 2016, DOE published in the **Federal Register** a final determination that more stringent energy conservation standards for direct heating equipment (DHE) would not be economically justified, and based this determination solely on manufacturer impacts, the first EPCA factor that DOE is required to evaluate in 42 U.S.C. 6295(o)(2)(B)(i)(I). 81 FR 71325. Specifically, due to the lack of advancement in the DHE industry in terms of product offerings, available technology options and associated costs, and declining shipment volumes, DOE concluded that amending the DHE energy conservation standards would impose a substantial burden on manufacturers of DHE, particularly small manufacturers. *Id.* at 81 FR 71328. Notably, DOE received no stakeholder comments in opposition to its conclusions regarding economic justification in the DHE standards rulemaking.

In this final rule, DOE remains consistent with its approach in the DHE rule, and finds no economic justification for amending standards based on DOE's consideration of one of the seven factors in 42 U.S.C. 6295(o)(2)(B)(i), namely, that the energy savings in operating costs of the covered product are insufficient to recover the upfront cost.

E. Preemption

The State Attorneys General asserted that the September 2019 GSIL NOPD mischaracterizes the scope of federal preemption under EPCA. (the State Attorneys General, No. 110 at p. 16) These commenters argued that EPCA does not delegate to DOE authority to decide whether a given state law is preempted, and that DOE is not entitled to deference for its interpretation of EPCA's preemption provision. (*Id.* at p. 17) The State Attorneys General rejected DOE's statement in the NOPD that because none of the narrow exceptions from preemption provided for in 42 U.S.C. 6295(i)(6)(A)(vi) are available to California and Nevada, all states, including California and Nevada, are prohibited from adopting energy conservation standards for GSLs. *See* 84 FR 46832. On the contrary, the State Attorneys General commented that California and Nevada are entitled to exemption from preemption because DOE failed to fulfill the four required elements prescribed in 42 U.S.C. 6295(i)(6)(A)(i)–(iv), and therefore the exceptions to state preemption in clauses (vi)(II) and (vi)(III) have been triggered. (the State Attorneys General, No. 110 at pp. 18–19) CEC similarly noted that it had implemented its own standards for GSLs, including GSILs under EPCA's preemption exception in 42 U.S.C. 6295(i)(6)(A)(vi)(II). (CEC, No. 102 at p. 1). Additionally, the State of Colorado stated that Colorado's greenhouse gas emission reduction goals and energy efficiency standards will continue to apply in the state regardless of whether DOE finalizes the proposed rule. (State of Colorado, No. 62 at p. 1).

Federal energy conservation requirements generally supersede state laws or regulations concerning energy conservation 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 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, 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.

DOE reiterates in this rule that none of these narrow exceptions from preemption are available to California or Nevada. The first exception applies if DOE determines that standards in effect for GSILs need to be amended and issues a final rule setting standards for these lamps in accordance with 42 U.S.C. 6295(i)(6)(A)(i)–(iv). In that event, California and Nevada would be allowed to adopt a rule identical to the Federal standards rule. This exception does not apply because DOE has determined that standards in effect for GSILs do not need to be amended and thus has not issued a final rule setting standards for these lamps in accordance with 42 U.S.C. 6295(i)(6)(A)(i)–(iv). The second exception allows California and Nevada to adopt the statutorily prescribed backstop of 45 lm/W if DOE determines standards in effect for GSILs need to be amended and fails to adopt a final rule for these lamps in accordance with 42 U.S.C. 6295(i)(6)(A)(i)–(iv). This exception does not apply because DOE has determined not to amend standards for GSILs, and thus no obligation exists for DOE to issue a final rule setting standards for these lamps in accordance with the 42 U.S.C. 6295(i)(6)(A)(i)–(iv). The third exception does not apply because there were no California efficiency standards for GSLs in effect as of the date of enactment of EISA 2007. Therefore, all states, including California and Nevada, are prohibited from adopting energy conservation standards for GSLs, including GSILs.

F. Scope

Some commenters argued that DOE did not analyze the proper scope of products. For example, the State Attorneys General submitted that DOE's delayed, segmented review of GSL and GSIL standards is inconsistent with the detailed, expeditious and logical rulemaking process Congress set forth in 42 U.S.C. 6295(i)(6)(A). (The State Attorneys General, No. 110 at p. 16). Similarly, the CA IOUs maintained that DOE did not analyze the proper scope of products in the NOPD, and that DOE should have considered standards for the whole GSL product class, which includes fluorescent and LED technologies. (CA IOUs, No. 83 at p. 3) The CFA also took issue with DOE's approach in the September 2019 GSIL NOPD, commenting that, by ignoring superior technologies, like CFLs and especially LEDs, DOE runs afoul of the Administrative Procedure Act (APA) and violates executive branch guidance. (CFA, No. 76 at p. 20) Additionally, the Northwest Power and Conservation Council commented that to issue this NOPD that parses out and creates separate standards for lamps that are all GSLs by statute and that have the same function and intended use is contrary to the spirit of EPCA and potentially muddies the waters even further for the market to determine what technologies are subject to what standard in the coming year. (Northwest Power and Conservation Council, No. 58 at p. 2)

The Appropriations Rider precluded DOE from gathering data, performing the analysis required under 42 U.S.C. 6295(i)(6)(A), and implementing standards with respect to the incandescent lamp standards at issue in this determination. Since the Appropriations Rider has been removed, DOE continues to perform its statutory duties under EPCA, which include determining whether standards for GSILs should be amended. As that determination is the predicate for the imposition of a deadline for issuance of a rule, DOE addresses that determination first, in the present rulemaking. DOE has determined not to amend standards for GSILs at this time, and thus the existing standards for GSILs found at DOE's regulations at 10 CFR 430.32(x) remain applicable and will continue to apply after January 1, 2020. DOE is still considering whether standards in effect for GSLs, namely LEDs and CFLs, should be amended.

G. NEPA

In the September 2019 GSIL NOPD, DOE preliminarily concluded that the proposed rule fits within DOE's categorical exclusion A4 from the National Environmental Policy Act of 1969 (NEPA), which applies to actions that are interpretations or rulings with respect to existing regulations. 84 FR 46859; see also 10 CFR part 1021, subpart D, appendix A4. DOE received comments from the Sierra Club and Earthjustice disagreeing with DOE's proposed use of the A4 categorical exclusion. These commenters asserted that DOE's actions are not merely interpreting or ruling on an existing regulation, but, rather, that the September 2019 GSIL NOPD implements a statutory command to evaluate amendments to statutorily prescribed energy conservation standards. (Sierra Club and Earthjustice, No. 104 at p. 12) The Sierra Club and Earthjustice argued that DOE's proposal to cite categorical exclusion A4 avoids reviewing the environmental impacts of the proposed determination and suggests that DOE believes the same exclusion would be applicable whenever DOE refuses to amend an energy conservation standard. *Id.* The commenters stated that DOE could not finalize the September 2019 GSIL NOPD without completing a review of environmental impacts. *Id.*

Similarly, the State Attorneys General argued that DOE had decided to apply, without any reasoning, categorical exclusion A4 to its proposed determination—rather than conduct an environmental impact statement (EIS) or environmental assessment (EA)—was arbitrary and capricious. (the State Attorneys General, No. 110 at pp. 22, 24) These commenters stated that they were unable to find any past instance in which DOE's Office of Energy Efficiency and Renewable Energy had relied on categorical exclusion A4 to support its determination not to undertake NEPA review for a proposed action. (*Id.* at p. 26) Additionally, the commenters asserted that DOE's statement in the September 2019 GSIL NOPD about completing its NEPA review before issuing the final action makes it unclear as to whether DOE is, in fact, carrying out a NEPA review. (*Id.* at p. 22)

In this final determination, DOE concludes that amended energy conservation standards for GSILs would not be economically justified at any level above the current standard level. DOE disagrees with commenters that it did not use the appropriate categorical exclusion for the September 2019 GSIL NOPD. Categorical exclusion A4 accurately reflects the effect of this rulemaking, which is to maintain the status quo of an existing regulation by interpreting the existing standard. Because DOE is not adopting an amended energy conservation standard for GSILs, and thus is not changing the existing regulations, there are no significant environmental impacts to be evaluated under NEPA.

Historically, DOE had prepared numerous EAs and findings of no significant impact (''FONSI'') for rulemakings that established energy conservation standards for consumer products and industrial equipment.[21] In light of these experiences assessing the environmental effects of energy conservation standards, DOE proposed and finalized categorical exclusion B5.1 to specifically target energy conservation standard rulemakings as part of the changes made to its NEPA Implementing Procedures. 76 FR 214, 228; 76 FR 63764; see also 10 CFR part 1021, subpart D, appendix B5.1. During that rulemaking process, DOE received neither negative comments nor objections to its proposal to adopt categorical exclusion B5.1 when the department's implementing procedures were finalized in October 2011. 76 FR 63764, 63766. In practice, DOE's decades of conducting EAs and resulting FONSI determinations are relied upon whenever DOE utilizes categorical exclusion B5.1 as part of an energy conservation standard rulemaking. Therefore, DOE reasonably relies on categorical exclusion B5.1 to meet its NEPA obligations in situations where completing an energy conservation standard rulemaking would not otherwise impose a need to conduct an environmental assessment. While DOE has determined to not apply categorical exclusion B5.1 in this rulemaking, its decision nonetheless to not conduct an EA remains consistent with rulemakings that do amend energy conservation standards.

DOE's actions here find further support when viewed in the context of the DHE final rule. In the DHE final rule not to amend standards, DOE determined, with no stakeholder objections, that conducting an EA for its environmental review under NEPA was not required because updated standards were not being adopted. Arguably, DOE could make the same conclusion in this rulemaking, because amended standards for GSILs are similarly not being adopted.

[21] See Technical Support Document for the National Environmental Policy Act Implementing Procedures, Final Rule, September 27, 2011, pp 46–48, for examples of prior EAs and FONSI determinations. *https://www.energy.gov/nepa/downloads/technical-support-document-department-energys-notice-final-rulemaking.*

H. Other Environmental Laws and Intergovernmental Consultation

The State Attorneys General asserted that the September 2019 GSIL NOPD violates several environmental laws, including the Endangered Species Act, the Coastal Zone Management Act, and the National Historic Preservation Act. (State Attorneys General, No. 110 at pp. 26–27) In response to these concerns, DOE reiterates that this rulemaking determines *not* to amend energy conservation standards for GSILs, and, therefore, the existing standards applicable to GSILs remain in effect. Because this rulemaking maintains the status quo, there is no action that DOE is taking, and thus there are no environmental impacts to evaluate under the above listed statutes.

Additionally, the State Attorneys General commented that DOE's failure to consult with state and local governments regarding the September 2019 GSIL NOPD violates Executive Order 13132, which sets forth certain requirements for Federal agencies formulating and implementing actions that preempt State law or that have Federalism implications. (*Id.* at pp. 27–28) As part of the notice and comment process set by the APA, DOE published the September 2019 GSIL NOPD in the **Federal Register**, providing interested parties, including state and local governments, notice of its initial decision not to amend energy conservation standards for GSILs. (84 FR 46858; 5 U.S.C. 553). In addition to publishing notice of the proposed determination, DOE held a public meeting on the September 2019 GSIL NOPD on Tuesday, October 15, 2019. By following the statutory requirements of EPCA and the APA's rulemaking process, the same process DOE has followed for many years without objection by states, DOE provided ample opportunity for state and local governments to offer input and consult with DOE, via comments or otherwise, regarding DOE's initial determination not to amend the current energy conservation standard for GSILs.

VI. Methodology and Discussion of Related Comments

This section addresses the analyses that DOE has performed for this final determination with regard to GSILs. Separate subsections address each component of DOE's analyses.

DOE used several analytical tools to estimate the impact of the standards considered in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended energy conservation standards. The NIA uses a second spreadsheet that provides shipments projections and calculates NES and NPV of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses a third spreadsheet, the Government Regulatory Impact Model (''GRIM''), to assess manufacturer impacts of potential amended standards. These three spreadsheets are available on the DOE website for this rulemaking (see Docket section at the beginning of this final determination).

A. Market and Technology Assessment

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.

As discussed in section II.A, DOE continued to analyze GSILs as the covered product in this final determination. DOE did consider the possibility that consumers may choose out-of-scope substitutes, such as CFLs and LED lamps, if standards for GSILs were amended. See section VI.B.6 for a more detailed discussion of those lamps.

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 final rule, 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 [22] for incandescent reflector lamps, 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 fourteen technology options in the September 2019 GSIL NOPD that could be used to improve the efficiency of currently commercially available GSILs.

Westinghouse noted that commercially available GSILs already include many of the technology options identified where they are cost effective and can be used in a manner that meets necessary product performance and important safety considerations. (Westinghouse, No. 112 at p. 1) Because GSILs are already operating close to their optimum level, NEMA stated that the technology options not screened out will not provide a significant increase in lamp efficacy. (NEMA, No. 88 at p. 6; Westinghouse, No. 112 at p. 1) While improvements in efficacy from any single technology option may be minor, DOE concludes in this final determination that all technology options identified in the September 2019 GSIL NOPD could potentially increase the efficacy of GSILs.

DOE also received comments on specific technology options. Regarding higher pressure operation, NEMA stated that halogen lamps are at the practical limit of higher pressure operation without risking safety. (NEMA, No. 88 at pp. 6) DOE considers alterations to the lamp that might be necessary for safety reasons if the lamp operates at a higher pressure. See VI.B.3 for more detail.

Regarding higher efficiency inert fill gas, NEMA stated that halogen lamps are already using xenon and krypton to reduce heat conduction. Consequently,

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

NEMA commented that improving lamp efficacy via alternative fill gasses is not a viable option. (NEMA, No. 88 at pp. 6) NEMA submitted a similar comment during the 2015 IRL rulemaking and DOE noted that while the majority of standards-compliant IRLs utilize xenon, the amount of xenon used in a lamp can vary. DOE concluded in that rulemaking that xenon could be used to improve lamp efficacy and DOE reaches the same conclusion in this final determination. 80 FR 4042, 4059 (January 26, 2015).

NEMA stated that certain technology options require redesigning the current halogen incandescent lamp, adding to their cost. NEMA elaborated with the following examples: (1) Use of higher pressure requires adding a heavy glass outer jacket to contain a potential rupture of the filament tube caused by the increased pressure and (2) thinner filaments require tighter coil spacing to maintain the efficacy and avoid hot shock issues leading to early lamp failure. Additionally, NEMA explained that for the higher efficiency burner design option, using a double-ended burner in itself is not more efficient, rather it reduces costs by allowing for a smaller capsule design. (NEMA, No. 88 at pp. 6–7) DOE considers technology options regardless of their cost. DOE considers cost impacts in determining the economic justification of any standard levels developed using the technology options identified. See VI.B.3 for more detail regarding lamp alterations necessary to eliminate safety concerns.

Additionally, NEMA stated that higher temperature improves efficacy but shortens lifetime and would only make sense for a lamp with lifetime lower than 1,000 hours. NEMA added the same would apply to use of thinner filaments which require higher temperature operation. (NEMA, No. 88 at pp. 6) DOE understands that for certain technologies there may be a tradeoff between efficacy and lifetime. DOE does not consider efficacy levels that necessitate a reduction in lamp lifetime relative to the baseline.

In the September 2019 GSIL NOPD DOE stated that the infrared (IR) glass coating technology option involves coatings that reflect some radiant energy emitted back onto the filament, which supplies heat to the filament increasing its temperature and thereby increasing lamp efficacy. 84 FR 46830, 46836 (September 5, 2019). NEMA clarified the increase in efficacy from IR glass coatings is due to the lamp reusing the radiant energy emitted back on to the filament resulting in less power needed to heat the filament. NEMA added that just increasing the temperature of the filament would shorten the lamp lifetime. (NEMA, No. 88 at p. 7) DOE agrees that reduction of power is also a component in this technology option. In chapter 3 of the NOPD TSD, DOE noted that in addition to the increase in temperature leading to an increase light output, the reflected IR radiation from IR glass coatings can also decrease the amount of energy needed to heat the filament.

DOE also received comments regarding two technology options that were not identified in the September 2019 GSIL NOPD that should be considered by DOE in this final determination. The Joint Advocates noted that DOE did not consider the technology used in the Philips EcoClassic HIR lamp operated at 230 volts (''V'') that was introduced in Europe. The Joint Advocates explained that the lamp used an internal power supply to drive the halogen capsule at 12 volts allowing Philips to use a sturdy, compact filament and achieve 50 percent energy savings over the conventional halogen bulb. (Joint Advocates, No. 113 at pp. 4–5, 7)

DOE has considered the use of an integral ballast (or a transformer) in an incandescent lamp that steps down the line voltage to a lower voltage (*i.e.,* integrally ballasted low voltage) in previous IRL rulemakings. In the 2009 IRL rulemaking [23] DOE identified this as a technology option and was aware that an integrally ballasted low voltage lamp was offered in Europe. 73 FR 13620, 13644 (March 13, 2008). In that rulemaking, CA IOUs provided test data showing prototypes of integrally ballasted low voltage IRLs operating at 120 V that could reach higher efficacies than the baseline. However, because the prototype that could reach the max-tech level also used a developmental design option (*i.e.,* silverized reflectors), DOE determined that the actual achievable efficacy when manufactured at a large scale was unclear. Additionally, Philips commented that higher mains voltages found in Europe (such as 220 V and 240 V) allow greater improvements in efficiency to be obtained by IRL with integrated transformers, but such improvements could not be obtained as easily in the U.S., where a mains voltage of 120 V is used. Therefore, in the 2009 IRL rulemaking, DOE recognized integrally ballasted low voltage lamps as a design option but did not base max-tech or adopt any TSL on the test data provided for the design option. 74 FR 34080, 34135 (July 14, 2009). In the 2015 IRL rulemaking, DOE removed integrally ballasted low voltage lamps as a technology option after receiving feedback that lamps using the technology are limited to certain wattages due to heat dissipation issues caused by the electronic components. Specifically, NEMA cited a 30 W limit and manufacturers in interviews cited a limiting range of 20 to 35 W. 80 FR 4060 (January 26, 2015). Based on the lack of definitive data on achievable efficacy and potential technological issues with wattages necessary to provide a lumen output within the range stated by the GSIL definition, DOE is not considering integrally ballasted low voltage lamps as a technology option in this analysis.

The Joint Advocates also stated DOE did not include photonic crystals as infrared reflectors used in a proof-of-concept high-efficiency bulb presented by researchers from the Massachusetts Institute of Technology (MIT).[24] (Joint Advocates, No. 113 at pp. 4–5, 7) DOE reviewed the MIT research cited by commentators and determined it presents a technology option for improving GSIL efficacy not identified in the September 2019 GSIL NOPD. The technology option uses a photonic filter designed to ensure IR radiation is completely reflected back to the filament while visible light is emitted out. The filter can be a 1- to 3-dimensional photonic crystal that surrounds the filament.[25] [26] In this final determination DOE identifies photonic filters as a technology option for increasing GSIL efficacy.

In this final determination, DOE has identified 15 technology options (see Table VI.1) to improve the efficacy of GSILs, as measured by the DOE test procedure. See section VI.A.4 for a discussion of which technology options were screened out of the analysis, see section VI.B.3 for a more complete discussion of how the remaining technology options (called design options) were incorporated into the more efficacious HIR lamps modeled in the engineering analysis, and see section

[23] Documents from DOE's rulemaking for IRLs are available here: *https://www.regulations.gov/docket?D=EERE-2006-STD-0131.*

[24] Ognjen, Ilic et al. ''Tailoring high-temperature radiation and the resurrection of the incandescent source'' Nature Nanotechnology 11, 320–324 (2016).

[25] Bermel, et al. (2014) *U.S. Patent No. 8,823,250 B2.* Washington, DC: U.S. Patent and Trademark Office.

[26] Ognjen, Ilic et al. ''Tailoring high-temperature radiation and the resurrection of the incandescent source'' Nature Nanotechnology 11, 320–324 (2016).

VI.C for a discussion of how lamp prices were determined.

TABLE VI.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.
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.
Photonic Filter	A photonic filter surrounding the filament designed to ensure IR radiation is reflected back to the emitter while visible light is emitted out.

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.

In the September 2019 GSIL NOPD, DOE screened out eight technology options because DOE could not find evidence of their existence in working prototypes or commercially available products, they were not practicable to manufacture, and/or they impacted product utility. NEMA agreed with the technology options that DOE screened out for the reasons set forth in the September 2019 GSIL NOPD. (NEMA, No. 88 at p. 6) DOE received no other adverse comments regarding the screening analysis. Therefore, the technology options that were screened out in the September 2019 GSIL NOPD are also screened out in this final determination.

As described in VI.A.3, in this final determination DOE added photonic filters as a technology option; photonic filters around filaments reflect IR radiation back to the filament while allowing visible light to exit. However, filter and filament stability, evaporation of filament material, and optimization of the spacing between the filter and filament have been cited as potential challenges in the development of this technology.[27] Further, DOE's review of the paper cited by the Joint Advocates and the patent for the technology does not indicate that a complete lamp was assembled with the photonic filter included and DOE believes including photonic filters would require use of manufacturing techniques not currently used in the mass production of GSILs. Therefore, DOE screens out this technology option based on the first criterion, technological feasibility, and

[27] Arny Leroy, Bikram Bhatia, Kyle Wilke, Ognjen Ilic, Marin Soljačić, et al. ''High performance incandescent lighting using a selective emitter and nanophotonic filters,'' Proceedings from SPIE Optical Engineering + Applications, 2017.

the second criterion, practicability to manufacture.

The technology options screened out of this analysis are summarized in Table VI.2 of this document.

TABLE VI.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.
Photonic Filters	Technological feasibility, Practicability to manufacture, install, and service.

DOE concludes that all of the other identified technologies listed in Table VI.1 met all four screening criteria to be examined further as design options in DOE's final determination. In summary, DOE did not screen out the following technology options:

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

5. Product Classes

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. In the September 2019 GSIL NOPD, DOE proposed to maintain separate product classes based on lamp spectrum but did not propose to maintain separate product classes based on lumen output.

CA IOUs stated that modified spectrum lamps do not need to be in a separate product class and efficacy allowances in current regulations for these products are too large. (CA IOUs, No. 83 at p. 3)

As described in section VI.A.1, DOE considers GSILs to be the covered product in this final determination and therefore DOE considers only GSILs when establishing product classes. The CA IOUs did not provide any rationale for why modified spectrum GSILs should be in the same product class as standard spectrum GSILs. Modified spectrum [28] lamps provide unique utility to consumers by providing a different type of light than standard spectrum lamps, much like fluorescent and 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 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 maintaining separate product classes based on spectrum.

In summary, DOE evaluates 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 final determination 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 rulemaking, 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 VI.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 further detail in chapter 5 of the final determination 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, in the September 2019 GSIL NOPD DOE analyzed standard spectrum GSILs as representative (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).

[28] Definition of ''*Modified spectrum*'' is set out at 10 CFR 430.2.

NRDC requested DOE provide market shares or sales data for modified spectrum incandescent lamps. NRDC stated that major retailers have switched their house-branded lamps to be modified spectrum lamps. NRDC added that modified spectrum incandescent or halogen lamps provide little to no energy savings and less light compared to the old incandescent lamps. (NRDC, Public Meeting Transcript, No. 56 at pp. 39, 42) GE disagreed with NRDC noting that GE's halogen Reveal lamps are sold at the same wattages (*i.e.,* 43 W, 53 W) as the comparable halogen lamp on the market and have the same effect.[29] (GE, Public Meeting Transcript, No. 56 at pp. 42–43)

Westinghouse stated that using the number of models as a proxy for market data is not an effective approach. However, Westinghouse stated that anecdotally it could confirm the volume of modified spectrum lamps is lower than standard spectrum. (Westinghouse, Public Meeting Transcript, No. 56 at pp. 39–40) GE also confirmed that standard spectrum products outsell modified spectrum products by a significant percentage. (GE, Public Meeting Transcript, No. 56 at p. 43)

DOE consulted available market reports, such as the 2015 U.S. Lighting Market Characterization,[30] searched for shipment information regarding modified spectrum incandescent lamps, and reviewed market reports for LED lamps, such as those available from DOE's Solid-State Lighting Program, to get a better sense of the popularity of modified spectrum lamps as compared to standard spectrum lamps. There is very little public information available. As noted by GE during the public meeting, NEMA does not track shipments of modified spectrum lamps. (GE, Public Meeting Transcript, No. 56 at p. 41) Available information includes product offerings (with lamps designated as modified or standard spectrum), industry support in past DOE rulemakings for IRLs that standard spectrum lamps are much higher volume than modified spectrum lamps, and manufacturer confirmation at the October 2019 public meeting that standard spectrum GSILs have higher shipments than modified spectrum GSILs. Given the available information, DOE continues to analyze standard spectrum GSILs as representative in the final determination.

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 the September 2019 GSIL NOPD, 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.

Sierra Club and Earthjustice stated that DOE had not analyzed the correct baseline lamp because the backstop standard has been triggered and all GSLs sold beginning January 1, 2020 will need to meet a 45 lumens per watt standard. (Sierra Club and Earthjustice, No. 104 at p. 7) As stated in section V.A, the backstop has not yet been triggered and therefore DOE did not consider a minimum standard of 45 lumens per watt when selecting a baseline lamp.

GE confirmed that the lumen output of the traditional 60-watt incandescent lamp, selected by DOE, is the most popular lumen output on the market. (GE, No. 78 at p. 2) DOE received no other comments regarding the baseline lamp selected in the September 2019 GSIL NOPD and therefore selects the same baseline lamp for this final determination (shown in Table VI.3). See chapter 5 of the final determination TSD for more detail.

TABLE VI.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

In the September 2019 GSIL NOPD, 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, DOE modeled a more efficacious substitute for the baseline lamp in the September 2019 GSIL NOPD. The modeled lamp was based on an actual lamp that previously had been commercially available but was taken off the market for economic reasons. GE previously offered for sale GSILs that used HIR technology; 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[31] and the 2015 IRL rulemaking[32] 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.

DOE received several comments regarding the characteristics of the HIR lamp modeled in the engineering analysis. NRDC stated that DOE failed to

[29] DOE interprets ''have the same effect'' as meaning they are perceived as providing the same amount of light.

[30] Available at *https://www.energy.gov/sites/prod/files/2017/12/f46/lmc2015_nov17.pdf.*

[31] 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.*

[32] 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.*

provide the method used to determine the performance characteristics of the modeled lamp and information on the actual lamp sold by GE in their analysis. (NRDC, No. 97 at p. 4) In September 2019 GSIL NOPD, DOE stated that it modeled the more efficacious substitute at EL 1 using a previously offered GE lamp with a rated wattage 45 watts, a lifetime of 3,000 hours, and a lumen output of 870 lumens. DOE explained that it used the same methodology used in the previous IRL rulemakings (both the 2009 IRL Rulemaking and the 2015 IRL Rulemaking) to adjust the lumen output and lifetime of the lamp. 84 FR 46830, 46840. DOE specified the equation used to make these adjustments in chapter 5 of the NOPD TSD. DOE developed this equation and its associated constants in the 2009 IRL rulemaking using a set of equations from the IESNA Handbook that relate voltage to lumens, wattage, and lifetime. (See chapter 5 of 2009 IRL final rule TSD and 2015 IRL final rule TSD.) DOE determined that the equation used in the IRL rulemakings could be applied GSILs because they use the same technology to produce light. DOE continues to use the equation described in this paragraph to model lamps in this final determination.

DOE received comments confirming the performance characteristics of the HIR lamp modeled at EL 1. GE stated that DOE had modeled the representative unit at EL 1 based on a technically sound lamp that was offered by GE for a few years. GE confirmed that if the lumen output of the lamp it offered (870 lumens) was lowered to 750 lumens and the lifetime of the lamp it offered (3,000 hours) was lowered to 1,000 hours, the wattage of the lamp would be similar or the same as the wattage of the HIR lamp modeled by DOE. (GE, Public Meeting Transcript, No. 56 at pp. 49–50) GE stated that it no longer sells HIR technology in its A-line lamps because it cannot economically compete with current lighting options. (GE, Public Meeting Transcript, No. 56 at p. 53; GE, No. 78 at p. 2)

DOE also received comments regarding the design options incorporated into the modeled lamp. In the September 2019 GSIL NOPD, DOE stated that the modeled lamp utilized an IR coating and also higher temperature and pressure operation. DOE stated that the modeled lamp did not incorporate thinner filaments, higher efficiency inert fill gas, or higher efficiency burners because DOE 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.

NEMA agreed with DOE's initial determination that an HIR lamp is the only technologically feasible GSIL alternative that is more efficacious than the halogen lamp currently on the market. (NEMA, No. 88 at p. 5) GE stated that while different advanced filament technologies were evaluated in the past 20 years, only HIR technology identified by DOE has proven technologically feasible to manufacture for commercial sale and therefore, represents the best design option for this analysis. (GE, No. 78 at p. 2) Rothenhaus similarly stated that HIR technology is the most efficient form of GSIL. (Rothenhaus, No. 16 at p. 2)

IPI disagreed with DOE's decision to not incorporate thinner filaments, higher efficiency inert fill gas, and higher efficiency burner design options in the modeled lamp. IPI stated that in doing so, DOE did not consider that technological development due to regulatory pressure may reduce the cost or increase the efficacy of these additional technology options, making higher efficiency GSILs available. (IPI, No. 96 at p. 5) The Joint Advocates noted that DOE identified other, valid energy efficiency technologies such as thinner filaments and less conductive inert fill gas but did not develop an energy efficiency level that included these options. (Joint Advocates, No. 113 at pp. 3–4)

Regarding design options incorporated into the modeled HIR lamp, DOE notes that the incorporation of certain design options may affect other aspects of lamp operation and/or increase the cost of the lamp. After reviewing the comments and reviewing images of the label on the product previously offered by GE, DOE concludes that the modeled HIR lamp incorporates the following technology options: Higher temperature operation, higher pressure operation, IR glass coatings, and higher efficiency burners. As described in the September 2019 GSIL NOPD, IR coatings on incandescent lamps are used to reflect some of the radiant energy emitted back onto the filament which can result in higher temperature operation. Further, as described by NEMA and GE, a halogen capsule with an IR coating operates at a much higher pressure than a standard halogen capsule. Thus, applying an IR coating also results in higher temperature and higher pressure operation. (GE, Public Meeting Transcript, No. 56 at p. 53; NEMA, No. 88 at p. 5) In addition, the image of the label for the 45 watt HIR lamp previously offered by GE shows a double-ended burner. As stated in the 2009 IRL final rule, double-ended burners are more efficient than single-ended burners because the lead wire inside of a single-ended burner prevents a certain amount of energy from reaching the burner wall and being reflected back to the filament (a double-ended burner features a lead wire outside of the capsule, where it does not interfere with the reflectance of energy from the burner wall back to the filament). 74 FR 34080, 34106–34107 (July 14, 2019). Thus, the modeled lamp in the engineering analysis also incorporates the most efficient burner.

Although DOE identified higher efficiency fill gas and thinner filaments as design options, DOE does not incorporate them into the modeled HIR lamp. DOE lacks information regarding the specific gas composition in the capsule of the GE lamp previously offered for sale, and therefore it lacks information regarding the efficacy improvement possible from improving the fill gas. Further, DOE is not aware whether the filament of the GE HIR lamp can be improved. As stated by NEMA, thinner filaments in an HIR lamp require tighter coil spacing in order to maintain efficacy and avoid ''hot shock'' issues, which leads to early failure of the lamp. (NEMA, No. 88 at p. 6) It is unclear if using a thinner filament than that used in the GE HIR lamp would cause the lamp's lifetime to decrease due to ''hot shock.''

DOE received several comments regarding other more efficacious substitutes that could have been included in the analysis. The Joint Advocates commented that DOE modeled a lamp that was less economically desirable than the product offered for sale by GE. (Joint Advocates, No. 113 at pp. 3–4) NRDC agreed and stated that it was odd that DOE failed to analyze the actual lamp that was sold by GE. (NRDC, No. 97 at p. 4)

DOE did not directly analyze the GE HIR lamp previously offered for sale because its wattage (45 watts) was higher than the wattage of the baseline lamp (43 watts). Energy conservation standards prescribed by DOE must be designed to achieve the maximum improvement in energy efficiency, which the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Further, relevant to GSILs, EPCA defines an ''energy conservation standard'' as a performance standard which prescribes a minimum level of energy efficiency or a maximum quantity of energy use. (42 U.S.C. 6291(6)(A)) In accordance with these statutory provisions, the engineering analysis evaluates only

energy-saving substitutes in the engineering analysis.

Several commenters stated that even though DOE considered a more efficacious substitute that utilized IR coatings, DOE did not consider the maximum efficacy that could be achieved using HIR technology. NRDC stated that GSILs have been introduced to the market with higher efficacies and lower prices than the more efficacious substitute considered by DOE. As a result, NRDC argued, DOE's analysis underestimates potential benefits and overstates the cost of updated efficiency standards for GSILs. NRDC stated that DOE must update its analysis with additional ELs prior to the issuance of a final rule. (NRDC, Public Meeting Transcript, No. 56 at p. 16) The Joint Advocates stated that Venture Lighting had previously offered an HIR lamp (''Vybrant 2X'') at a higher efficiency and longer life than the one DOE analyzed at max tech. The Joint Advocates noted that the lamp used a less expensive technique for applying the IR coating to the halogen capsule and was sold at $3.50 per bulb. The Joint Advocates were unaware of any consumer concerns about the performance or longevity of the lamp. (Joint Advocates, No. 113 at pp. 4–5, 7) NRDC provided details that Venture Lighting offered a 50 W replacement for the 100 W incandescent lamp and a 30 W replacement for the 60 W incandescent and 43 W halogen incandescent lamps. (NRDC, No. 97 at p. 4) Further the Joint Advocates noted that Technical Consumer Products (TCP) had announced an HIR lamp with an even higher efficiency than the Vybrant 2X for a similar price, but that it was never commercially introduced in the U.S. (Joint Advocates, No. 113 at pp. 4–5, 7) NRDC noted that the TCP lamp had 2,000-hour lifetime. (NRDC, No. 97 at p. 4)

Regarding Venture Lighting's high efficiency HIR lamp, NEMA stated that it was available for three months before it was withdrawn because the lamp filament would cross over on itself resulting in a shortened lifetime or immediate failure (referred to as ''hot shock''). NEMA explained that the lamp filament needs to be positioned precisely to maximize absorption of infrared light and maximize lamp efficacy. This poses mechanical and chemical constraints on filament construction and material as well as design challenges to accommodate other components of the lamp structure such as a fuse link, which is required for safe operation of the lamp. NEMA noted that the expense of overcoming these design challenges would not result in a cost-effective product for the consumer. NEMA stated that Venture Lighting decided that the product could not be commercialized due to the technical and cost issues. (NEMA, No. 88 at pp. 9–10)

DOE appreciates the comments regarding more efficient HIR lamps. However, for the reasons that follow, DOE did not use them to develop a more efficacious lamp than the one modeled in the September 2019 GSIL NOPD. Commenters focused on two products when stating that DOE should consider a more efficacious lamp than that considered in the September 2019 GSIL NOPD: A lamp advertised by TCP and a lamp sold by Venture Lighting, known as the Vybrant 2X lamp. Commenters indicate that both lamps utilize, or were advertised to utilize, HIR technology to achieve efficacies greater than the lamp modeled by DOE in the September 2019 GSIL NOPD. While the TCP lamp was announced in 2011, it was never commercially introduced for sale. DOE did not base a more efficacious substitute on the TCP product because it is unclear whether the advertised performance characteristics would have remained the same when it was manufactured on a commercial scale. Further, TCP informed NEMA that the lamp was never offered for sale because the cost of the product was too high. (NEMA, No. 329 at p. 38) [33] As the cost is only identified as ''too high,'' it is also unclear what the cost of the product would be in the retail market. The Vybrant 2X lamp, in contrast, was offered for sale for a period of three months in 2013 via Venture's website. Commenters state that it was priced at $3.50 in 2013. (Joint Advocates, No. 113 at pp. 4; NRDC, No. 97 at p. 4) Venture informed NEMA that the Vybrant 2X lamp was withdrawn for technical and product performance reasons because the lamp experienced ''hot shock'' issues whereby the filament would cross over on itself and create short life or immediate failure. Because of these technical issues and because of cost issues, Venture concluded the product would not be commercialized and discontinued the product. (NEMA, No. 329 at p. 38) [34] DOE did not base a more efficacious substitute on the Vybrant 2X lamp offered by Venture because the lifetime of the lamp did not appear to meet the advertised value and it was unclear what value should be used for the actual lifetime. There is a relationship between lifetime, wattage, and lumen output for incandescent/halogen lamps, and absent all three pieces of information it is not possible to fairly compare the level of technology from one lamp to another. For these reasons, DOE did not model a more efficacious substitute with an efficacy greater than that of the HIR lamp modeled in the September 2019 GSIL NOPD.

Regarding the lamp modeled in the September 2019 GSIL NOPD, while DOE changed the lumen output of the GE lamp previously offered for sale (870 lumens) to be equal to that the lumen output of the baseline lamp (750 lumens), several stakeholders commented on DOE's approach to changing the lifetime of the GE lamp (3,000 hours) to be equal to that of the baseline lamp (1,000 hours). GE stated that the minimum lifetime allowed under current regulations, 1,000 hours, will produce the most efficacious design possible. (GE, No. 78 at p. 2) However, NEMA and GE stated that while they agreed with the performance characteristics of the HIR lamp modeled by DOE, they believe that consumers will receive better economic value for a 3,000-hour HIR lamp rather than one that is 1,000 hours as modeled by DOE. (NEMA, No. 88 at p. 8; GE, Public Meeting Transcript, No. 56 at pp. 49–50) NEMA stated that modeling the substitute at 1,000 hours to reduce the wattage does not lower the initial cost of the lamp but does decrease the hours to recover the cost. Specifically, NEMA stated that the 10.7 watts energy saving of efficiency level (''EL'') 1 over the baseline, would yield a $1.40 saving over a period of 1,000 hours (at $0.1312/kWh), which does not justify paying $6.00 more for the lamp. NEMA added this is supported by GE's and Philip's business decision to offer a longer-life lamp. (NEMA, No. 88 at p. 8)

The Joint Advocates stated that DOE took an ''economically unacceptable'' product and hypothesized an even less economically acceptable version on which to base its analysis. (Joint Advocates, No. 113 at pp. 3–4) IPI stated that DOE did not consider lamp options with comparable performance to EL 1 but with a different lifetime, and thus did not consider the impact of such options on cost and the payback period. (IPI, No. 96 at pp. 6–7) The Joint Advocates recommended that DOE evaluate an efficacy level below EL 1 (EL 0.5) that achieves a 26 percent improvement over the baseline based on a 43 W lamp that has a lumen output

[33] This comment was submitted in response to docket number EERE–2018–BT–STD–0010 and is available here: *https://www.regulations.gov/document?D=EERE-2018-BT-STD-0010-0329.*

[34] This comment was submitted in response to docket number EERE–2018–BT–STD–0010 and is available here: *https://www.regulations.gov/document?D=EERE-2018-BT-STD-0010-0329.*

of 800 lumens and lifetime of 3,000 hours. (Joint Advocates, No. 113 at p. 5)

DOE analyzes energy-saving substitutes in the engineering analysis. As described previously in this section, because the wattage of the commercially available GE lamp was greater than that of the baseline lamp, DOE adjusted the performance characteristics to create an energy-saving substitute. Adjusting both the lifetime and the lumen output resulted in a lamp with the lowest possible wattage (*i.e.,* the most energy-saving substitute). However, DOE acknowledges that adjusting both lifetime and lumen output is not necessary to create an energy-saving substitute. If DOE adjusts only the lumen output to be equal to that of the baseline lamp, the wattage decreases from 45 watts to 39.3 watts. The lifetime of 3,000 hours would be maintained. DOE analyzes this lamp as a new option at EL 0.5 in this final determination. The performance characteristics of the modeled HIR lamps are shown in Table VI.4.

TABLE VI.4—MORE EFFICACIOUS GSIL SUBSTITUTES

EL	Technology	Wattage	Bulb shape	Initial lumens	Rated lifetime (hrs)	Efficacy (lm/W)
EL 0.5	HIR	39.3	A19	750	3,000	19.1
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.

In the September 2019 GSIL NOPD, DOE employed an equation-based approach for efficacy levels. DOE considered the following equation that relates the lumen output of a lamp to lamp efficacy:

$$Efficacy = A - 29.42 * 0.9983^{\text{initial lumen output}} \quad \text{Equation 1.}$$

where A is a constant that varies by EL. The equation characterizes efficacy as sharply increasing as lumen output increases at the lowest part of the lumen range and then the increase slows 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.

DOE did not receive any comments regarding the form of the equation and therefore continues to use the same equation form in this final determination.

As described in section VI.B.3, DOE identified, through modeling, two more efficacious GSIL substitutes. DOE developed two ELs based on the efficacies of the modeled lamps. Table VI.5 summarizes the ELs developed by the engineering analysis.

TABLE VI.5—ELS FOR GSIL REPRESENTATIVE PRODUCT CLASS

Representative product class	Efficacy level	Efficacy (lm/W)
Standard Spectrum GSILs	EL 0.5	27.2–29.42 * 0.9983 ∧ Initial Lumen Output.
	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 rulemaking, 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. 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 VI.B.4 of this document.

CA IOUs commented that a reduced efficacy allowance for modified spectrum lamps is not needed. CA IOUs noted that in incandescent lamps, light spectrum is modified by filtering out certain wavelengths after they are generated whereas high efficacy light sources can be designed to produce the desired wavelengths and without reducing efficacy. (CA IOUs, No. 83 at pp. 3–4).

As discussed in section V, the covered products in this rulemaking are GSILs. Therefore, DOE did not consider CFL or LED lamps when establishing product classes or determining the appropriate scaling factor. As indicated by the existing standards for GSILs, modified spectrum lamps cannot be as efficient as standard spectrum lamps. DOE did not receive any adverse comments to reducing efficacy levels by 25 percent to account for the capabilities of modified spectrum GSILs. DOE therefore continues to use this scaling factor in the final determination.

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

TABLE VI.6—ELS FOR GSIL NON-REPRESENTATIVE PRODUCT CLASS

Non-representative product class	Efficacy level	Efficacy (lm/W)
Modified Spectrum GSILs	EL 0.5	20.4–29.42 * 0.9983 ^ Initial Lumen Output.
	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. In the September 2019 GSIL NOPD, 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. 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.

Several commenters agreed that LED lamps were a likely substitute for GSILs; compared to the modeled HIR lamp, LED lamps were significantly more efficient and had a longer lifetime while also being less expensive. The Joint Advocates stated that LED lamps are more than five times as efficient as halogen lamps and last ten times as long. (Joint Advocates, No. 113 at p. 1) NRDC stated that LED lamps are extremely cost-effective replacements for incandescent and halogen lamps and are available in a wide range of shapes, base types, and brightness levels. (NRDC, Public Meeting Transcript, No. 56 at pp. 13–14) PA DEP explained that LED lamps are readily available as a replacement option for all GSIL applications. (PA DEP, No. 77 at p. 2) CFA stated that both CFL and LED technologies have much higher efficiencies and lower costs than the HIR level analyzed. (CFA, No. 76 at p. 5) An individual commented that store shelves are stocked with LED lamps because they are efficient, cheap, and dimmable. (Dufford, No. 32 at p. 1).

DOE also received several comments regarding the shatter-resistant incandescent lamp. The State Attorneys General and the Joint Advocates stated that DOE's scenarios in the September 2019 GSIL NOPD were unrealistic and over-estimated costs associated with more stringent GSIL standards because DOE assumed consumers would substitute GSILs with shatter-proof lamps but did not account for the fact that if shatter-proof lamp sales increased, DOE would be required to establish standards for these lamps or EPCA's backstop specific to these lamps would be triggered. (State Attorneys General, No. 110 at p. 16; Joint Advocates, No. 113 at p. 6) The State Attorneys General noted that exempt shatter-resistant incandescent lamps consume more energy than other substitutes such as CFL or LED lamps. (State Attorneys General, No. 110 at p. 16) NEMA commented that data available to and published by DOE indicates that shipments of this product have been steadily declining for over a decade now, and there is absolutely no evidence of substitution of shatter-resistant lamps for GSILs, CFLs or general service LEDs. Shipments of the shatter-resistant incandescent lamps have declined 67 percent since 2011. NEMA explained that a shatter-resistant lamp has special coating to contain the glass if the glass envelope is broken. NEMA added that the lamp's reduced lumen output due to the coating will affect consumer acceptance as a meaningful substitute for a GSIL or a GSL and that these lamps are usually used in food service, food manufacturing, water treatment, and other industrial applications. (NEMA, No. 88 at pp. 11–12).

DOE agrees with commenters that a separate backstop provision applies to shatter-resistant incandescent lamps if sales exceed a certain threshold. The shipments of shatter-resistant incandescent lamps forecasted in the September 2019 GSIL NOPD would have exceeded that threshold and therefore DOE would have had to complete an accelerated rulemaking or impose a maximum wattage limitation of 40 watts and a requirement that those lamps be sold at retail only in a package containing one lamp. 42 U.S.C. 6295(l)(4)(H) In this final determination, DOE removed the shatter-resistant incandescent lamp as an option that consumers may choose in response to a higher standard for GSILs because the lumen output of a 40 watt shatter-resistant incandescent lamp would be insufficient for people replacing a 43 watt halogen GSIL. Whereas the halogen GSIL has a lumen output of 750 lumens, 40 watt shatter-resistant lamps have lumen outputs from about 265 lumens to 415 lumens.

Table VI.7 summarizes the performance characteristics of the GSIL alternatives that consumers can choose if GSIL standards are amended.

TABLE VI.7—ALTERNATIVE LAMPS CONSUMERS MAY SUBSTITUTE FOR GSILS

Option	Technology	Wattage	Bulb shape	Initial lumens	Rated lifetime (hrs)	Efficacy (lm/W)
A	CFL	13	Spiral	900	10,000	69.2
B	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 September 2019 GSIL NOPD, DOE used the same methodology as the March 2016 GSL NOPR to calculate the prices for the GSIL baseline lamp and the consumer choice alternatives. GSILs and the 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. Instead, for the modeled HIR lamp in the September 2019 GSIL NOPD, DOE added the incremental change in end-user price from the 2015 IRL final rule to the price of the baseline halogen GSIL.

DOE received several comments regarding the price of the HIR lamp at EL 1. Some commenters supported the price determined by DOE. According to GE the HIR lamp it used to sell was expensive to make because of how it was constructed as well as the heavy glass covering required due to the higher pressure of the filament tube. (GE, Public Meeting Transcript, No. 56 at p. 53) GE stated that the numerous layers of coatings required on the filament tubes made it a slow and a laborious process that could not be done on a high-speed production line. (GE, Public Meeting Transcript, No. 56 at p. 59) NEMA noted that the slow batch production made it difficult for the GE and Philips HIR lamps to attain the same economies scale that a lower cost halogen lamp would have. (NEMA, No. 88 at p. 9) NEMA explained that the halogen IR tube is 6 to 8 times more expensive than the halogen incandescent capsule. (NEMA, No. 88 at p. 5) NEMA also noted that manufacturers indicated that there are distinct safety issues with the halogen IR lamp. One manufacturer's safety protocol required the lamp to be sold in an expensive heavy glass outer jacket to contain a filament tube rupture (the halogen IR filament tube operates at a much higher pressure than standard halogen capsules). Another manufacturer addressed the safety issue by operating its halogen IR filament tube at a low voltage, but this required an expensive electronic transformer in each lamp. Either solution was very expensive. (NEMA, No. 88 at p. 5) While DOE had calculated an incremental production cost for HIR technology using information from the 2015 IRL rulemaking, NEMA noted that switching from a standard to a more expensive IR halogen burner increases the price by a much higher percentage in a general service A-line incandescent lamp compared to a Parabolic Reflector (PAR) Lamp. (NEMA, No. 88 at p. 5)

In contrast, several commenters disagreed with the price determined by DOE and stated that it should be lower. The Joint Advocates stated that DOE provides no explanation of how the incremental value of $5.19 was determined. (Joint Advocates, No. 113 at p. 5) IPI noted that DOE had stated that it had used the IRL prices derived in the 2015 IRL rulemaking to develop the price for the modeled HIR lamp. However, IPI stated that the 2015 IRL rulemaking showed a difference of $2.62 in 2018$ between the baseline IRL and the HIR IRL while in the September 2019 GSIL NOPD analysis the difference between the baseline GSIL and the modeled HIR lamp was $5.19 in 2018$. IPI added that there was a 1,000-hour difference between the baseline IRL and HIR IRL lamp and DOE never explains how this was accounted for in using the IRL price differential to develop the price of the modeled HIR lamp. (IPI, No. 96 at p. 6) NRDC noted that HIR lamps had previously been sold at about $3.50 before any volume increases. (NRDC, Public Meeting Transcript, No. 56 at pp. 58–59) The Joint Advocates added that DOE should have determined the incremental cost using the price of the Venture Lighting Vybrant 2X lamp ($3.93 in 2019$) which had not experienced the high product costs of the more expensive IRL lamps. This would have resulted in an incremental cost of $3.39 in 2019$. (Joint Advocates, No. 113 at p. 5)

Westinghouse countered that due to the cost of the burner, complexity of the filament position, the specific filament type, and the coating process, it did not understand how the Vibrant 2X lamp could be sold at $3.50. Westinghouse reasoned that it may have been an attempt to gain market share that would later offset costs or to close out inventory. Westinghouse added that for the price to be that low, one of the manufacturers would have to absorb the up-front capital investment until volume caught up, and that such a manufacturer would never absorb the cost. (Westinghouse, Public Meeting Transcript, No. 56 at pp. 60–61)

CFA stated that based on a study of approaches used by DOE programs, there is a consistent tendency for product costs to be much lower than projected by the agency. CFA asserted that this is due to setting standards that set a performance level but not dictating the technologies that can be used to achieve the level. CFA commented that this results in companies producing the lowest possible cost product that meets standards. (CFA, No. 76 at p. 15)

Regarding the Vybrant 2X lamp, DOE notes that although it may have been sold for a period of time at $3.50, as discussed in section VI.B.3 it is unclear what the lifetime of the lamp was given that the lamp experienced early failure and was ultimately withdrawn for technical reasons. Because DOE could not confirm the performance characteristics associated with the $3.50 Vybrant 2X lamp, DOE did not consider the lamp in its determination of the price of the modeled HIR lamps.

DOE reviewed its methodology for calculating the price of the modeled HIR lamp in light of the comments received. NEMA noted that the halogen IR filament tube operates at a much higher pressure than standard halogen capsules. Manufacturers have dealt with this in two distinct ways: Adding an expensive heavy glass outer jacket or operating the halogen IR filament tube at a low voltage by adding an expensive electronic transformer. DOE's review of its methodology from the September 2019 GSIL NOPD concluded that this change in cost due to safety issues was not included because the PAR-shaped IRLs analyzed in the 2015 rulemaking use different glass than GSILs and the PAR glass does not require alteration in the presence of an IR-coated halogen capsule.

For the final determination, DOE has revised its pricing methodology to account for lamp adaptations that are necessary for safety reasons in the presence of an IR-coated halogen capsule. Instead of calculating the incremental change in cost for adding an IR-coated capsule to a halogen lamp based on the change in cost of an IRL, DOE calculated the incremental change in cost based on the change in cost of a GSIL. Specifically, DOE used the pricing information provided by GE for a halogen and HIR GSIL to calculate the cost of adding an IR-coated halogen capsule and otherwise modifying the lamp to account for the safety concerns of higher-pressure operation. Per NEMA's comment in response to the March 2016 GSL NOPR, the average price of the GE HIR lamp was $7 compared to the $1.25 price for the 1,000 hour halogen lamp, resulting in an incremental increase of $5.75 in 2012$ (NEMA also stated in that comment that GE's HIR lamp was withdrawn in 2012). Using the consumer price index to inflate the incremental cost to 2018$, DOE calculated the incremental cost to be $6.29 in 2018$ and added that cost to the price for the baseline halogen lamp from the September 2019 GSIL NOPD. Because both more efficacious substitutes are derived from the same GE lamp, they are the same price.

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

TABLE VI.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 0.5	HIR	39.3	750	3,000	19.1	8.10
EL 1	HIR	34.3	750	1,000	21.9	8.10

TABLE VI.9—END-USER PRICES FOR CONSUMER CHOICE ALTERNATIVES

Option	Technology	Wattage	Initial lumens	Rated lifetime (hrs)	Efficacy (lm/W)	End-user price
A	CFL	13	900	10,000	69.2	$2.94
B	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.

All comments received on the energy use methodology from the September 2019 GSIL NOPD were supportive (GE, No. 78 at p. 2; NEMA, No. 88 at p. 8; Westinghouse, No. 112 at p. 1) and DOE has continued to use the same methodology in the final determination.

1. Operating Hours

a. Residential Sector

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 medium screw base (''MSB'') A-type lamps—DOE used data from various regional field-metering studies of GSL operating hours conducted across the U.S. Chapter 7 of the final determination TSD lists the regional metering studies used. Specifically, DOE determined the average HOU for each Energy Information Association (''EIA'') 2015 Residential Energy Consumption Survey (''RECS'') reportable domain (*i.e.,* state, or group of states).[35] [36] 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),[37] 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,[38] which included GSL room-distribution data for more than 1,400 single-family homes throughout the Northwest.

b. Commercial Sector

For each commercial building type presented in the 2015 Lighting Market Characterization (''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'').[39] The national weighted-average HOU for GSLs, and therefore GSILs, in the commercial sector was 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).[40] As for the

[35] 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.

[36] 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/.*

[37] 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.*

[38] 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.*

[39] 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.*

[40] Navigant Consulting, Inc. *2014 Commercial Building Stock Assessment: Final Report.* 2014. Northwest Energy Efficiency Alliance: Seattle, WA.

Continued

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 VI.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. This estimate was based on a meta-analysis of field measurements of energy savings from commercial lighting controls by Williams, et al.,[41] 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.

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.

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.

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 a 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 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 final determination, DOE presents annualized LCC because average GSIL lifetimes are less than a year in the commercial sector and because the lifetimes differ between ELs.
- 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 a simple 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.[42]

DOE received a comment from an individual suggesting that the life-cycle cost analysis should also include costs associated with mining, component manufacturing, and product assembly. (Anonymous, No. 98 at p. 7) DOE notes that the life-cycle cost calculation is intended to provide an economic assessment from the consumer's perspective and includes only those costs a consumer would be sensitive to, such as the product price or operating costs. DOE also notes that mining, manufacturing, and assembly costs may be imbedded in the purchase price.

For each considered 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. Due to the Department's statutory obligations to examine and compare the savings and cost increases for covered products, DOE presents LCC savings results for two scenarios with different efficacy distributions: DOE presents the LCC savings of GSILs, the covered product in this final determination, for a scenario representing only shipments of GSILs, and also includes LCC savings for a scenario that includes shipments of out-of-scope lamps as an input to the NPV calculation. This latter LCC savings is relevant as an input to the NPV, but it does not compare the savings and price increases of the covered product because it also includes out-of-scope products. For details on the two scenarios, see section VI.F of this document. The PBP for each efficacy level is measured relative to the baseline efficacy level. The LCC savings with substitution effects are not comparable to the PBP analysis because they extend beyond the covered product in this final determination.

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 a 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

(Last accessed July 5, 2019.) *https://neea.org/resources/2014-cbsa-final-report.*

[41] Williams, A., B. Atkinson, K. Garbesi, E. Page, and F. Rubinstein. Lighting Controls in Commercial Buildings. *LEUKOS.* 2012. 8(3): pp. 161–180. (Last accessed July 5, 2019.) *https://www.tandfonline.com/doi/abs/10.1582/LEUKOS.2012.08.03.001.*

[42] The simple payback period calculation does not account for the additional cost of any needed replacement lamps when comparing lamps with different lifetimes.

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 final determination is expected to publish by the end of 2019, DOE used 2023 as the first full year in which compliance with any amended standards for GSILs could occur.

Table VI.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 final determination TSD and its appendices.

TABLE VI.10—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS * [43]

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 final determination 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 final determination TSD.

1. Product Cost

As noted in section VI.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 product price determination calculated 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 lamp prices that are expected to occur between the time for which DOE has data for lamp prices (2018) and the assumed compliance date of the rulemaking (2023).

DOE did not include price learning for HIR GSILs in the final determination, because DOE did not project any shipments of HIR GSILs since manufacturers are highly unlikely to produce these lamps given the upfront cost to bring such lamps to market. For details on the price-learning analysis, see section VI.F.1.b of this document.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. For this final determination, DOE assumed an installation cost of $1.54 per installed commercial GSIL (based on RSMeans [44] and U.S. Bureau of Labor Statistics data [45]), 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 VI.D of this document.

4. Energy Prices

Consistent with the September 2019 GSIL NOPD, 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 Typical Bills and Average Rates reports for summer and winter 2018.[46] DOE assigned seasonal marginal and average prices to each household in the LCC sample based on its location. DOE assigned seasonal marginal and average prices to each commercial building in the LCC sample

[43] Although DOE addresses the invalidity of California law relating to GSILs in the 2019 GSL Definition Rule, published on September 5, 2019, and reiterates that view in this final rule, in generating its consumer samples DOE did not sample consumers from California.

[44] RSMeans. *Facilities Maintenance & Repair Cost Data 2013.* 2012. RSMeans: Kingston, MA.

[45] U.S. Department of Labor—Bureau of Labor Statistics. *Occupational Employment and Wages, May 2018: 49–9071 Maintenance and Repair Workers, General.* May 2018. (Last accessed July 30, 2019.) *http://www.bls.gov/oes/current/oes499071.htm.*

[46] Edison Electric Institute. *Typical Bills and Average Rates Report.* 2018. Winter 2018, Summer 2018: Washington, DC.

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 Annual Energy Outlook (''AEO'') 2019, which has an end year of 2050.[47] 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. In response to this approach in the September 2019 GSIL NOPD, IPI commented that, while AEO 2019 projects relatively flat residential and commercial electricity prices in the reference case, electricity prices can vary considerably across different scenarios. IPI said that the reference case does not account for potential future changes in laws and policies that could affect electricity prices. (IPI, No. 96 at pp. 7–8) IPI also commented that DOE should consider other reasonable assumptions about future electricity prices, and whether such assumptions would change its determinations. (*Id.*) DOE notes that in the context of a proposed or final rule, DOE does consider how the high- and low-growth AEO scenarios, including the associated electricity price trends, impact the analytical results and whether a standard would still be economically justified. However, in the context of a proposed or final determination, if the analytical results in the reference scenario indicate that a standard would not be economically justified, it is unnecessary to consider how the analytical results might differ under additional scenarios, as DOE would not set a standard that is not economically justified in the reference scenario.

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). In the September 2019 GSIL NOPD, DOE's lifetime model for halogen and HIR GSILs was based on a convolution of Weibull distributions that translated the rated lifetime and sector-specific operating hours distribution into a sector-specific distribution of survival probability, accounted for the increase in lifetime resulting from dimming, and served to bring historic shipments and stock of incandescent lamps into alignment. In the public meeting for the September 2019 GSIL NOPD, NRDC noted that DOE's average lifetime, in years, for halogen and HIR GSILs was longer than would be expected for lamps with a rated lifetime of 1,000 hours. (NRDC, Public Meeting Transcript, No. 56 at p. 102) For the final determination, DOE continues to use the approach from the September 2019 GSIL NOPD to model historic shipments of GSILs and initialize the stock turnover model, but uses a simplified lifetime approach to project shipments of GSILs over the analysis period. In contrast to the September 2019 GSIL NOPD approach, DOE has simplified the lifetime model for GSILs in the final determination to use the average sector-specific operating hours, as opposed to the full sector-specific operating hours distributions, and no longer includes the Weibull distribution that was intended to bring historic shipments and stock into alignment. DOE notes that the average lifetime of GSILs still somewhat exceeds the expected lifetime based solely on rated lifetime and average hours of use. This reflects the impact of dimming on the lifetime distribution for GSILs.

To model lifetime for the CFL and LED lamp out-of-scope substitutes in the September 2019 GSIL NOPD, DOE used the methodology from the reference (''Renovation-Driven'') lifetime scenario from the March 2016 GSL NOPR. DOE did not receive any comments objecting to the lifetime models for these lamps, and has continued to use the same methodology for the final determination.

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

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 would be 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.[48] 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.

IPI objected to DOE's approach to discount rates in the September 2019 GSIL NOPD, arguing that interest rates have been falling for an extended period

[47] 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.*

[48] 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 August 8, 2019.) *http://www.federalreserve.gov/econresdata/scf/scfindex.htm.*

of time and that DOE should not include older data in its projection of future discount rates. (IPI, No. 96 at p. 8) IPI encouraged DOE to test its payback against other reasonable discount rate assumptions. (*Id.*)

Commercial discount rates are estimated as the weighted average cost of capital, which is calculated from four key components: Share of equity financing, share of debt financing, cost of equity, and cost of debt. Parameters of the cost of capital equation can vary substantially over time, and therefore the estimates can vary with the time period over which data are selected and the technical details of the data-averaging method. The cost of equity is estimated using the capital asset pricing model (CAPM), which is a function of the risk-free rate, risk premium, and firm or industry beta. Federal Reserve guidance was used to select the historic period of data and the choice of averaging method. In use of CAPM, the Federal Reserve suggests capturing a forty-year period for calculating risk premiums because it is ''sufficiently long to smooth cyclical fluctuations in realized returns, but short enough to reflect trends in required returns.'' (Federal Reserve Bank Services Private Sector Adjustment Factor: Docket No. OP–1229, Washington, DC retrieved from *https://www.federalregister.gov/documents/2005/10/17/05-20660/federal-reserve-bank-services-private-sector-adjustment-factor*) The method for estimating the residential discount rate parallels that of the commercial discount rate to the extent possible, and it thus aims to capture observed variations in household debt and asset rates over a similar historical time horizon.

The commercial and residential discount rate estimation methods used in the GSIL determination maintain analytical consistency with those applied across rules for other appliances and equipment. The use of historic data provides a comparatively conservative estimate of benefits of standards, but it is robust to previously-observed market fluctuations. However, even if discount rates were decreased several percentage points to represent a shorter recent time frame, analytical results would not be substantially changed in the absence of any projected shipments for GSILs under a standard. And DOE notes that the payback period calculation does not include a discount rate. If, as the comment notes, risk-free rates do continue to remain low in the future, the rolling average of the commercial and residential discount rate estimation methods will incorporate these values and decrease accordingly.

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 0.5 or TSL 1, which, as defined in this section, correspond to efficiency levels 0.5 and 1, respectively) in the assumed compliance year. The estimated market shares for the no-new-standards case and each standards case are based on the shipments analysis and are shown in Table VI.11 for the LCC with substitution scenario. In response to the market shares projected for the substitution scenario in the September 2019 GSIL NOPD, a couple of commenters noted that while DOE stated that GSILs would be unavailable under a standard, DOE projected that HIR GSILs would be 3.8 percent of the residential market share in 2023. (IPI, No. 96 at p. 5; Rothenhaus, No. 16 at p. 1–2) For the final determination, in response to comments on HIR GSIL shipments, DOE has not projected any shipments of HIR GSILs, and thus the GSIL market share is 0 percent under a standard. This projection is also consistent with comments from industry indicating that manufacturers are highly unlikely to produce HIR lamps in a standards case. For more details on the HIR shipments, see section VI.F of this document. In the LCC with substitution scenario, DOE estimates that the GSILs that are covered by this notice would account for 10.8 percent of residential market share in 2023 in the absence of federal standards, and 0 percent of the residential market under TSL 0.5 or TSL 1. That is, all consumers would switch from GSILs to out-of-scope substitutes under TSL 0.5 or TSL 1. DOE notes that the market share of GSILs has declined in the no-new-standards case for the LCC with substitution scenario in this final determination due to the reduction in estimated average lifetime of GSILs (see section VI.E.6 of this document). This reduction in estimated average lifetime of GSILs results in a faster market transition to out-of-scope substitute lamps.

TABLE VI.11—GSIL MARKET SHARE DISTRIBUTION BY TRIAL STANDARD LEVEL IN 2023—LCC WITH SUBSTITUTION

Trial Standard Level	EL 0 43 W Halogen (%)	EL 0.5 39.3 W HIR (%)	EL 1 34.3 W HIR (%)	13 W CFL * (%)	9 W LED * (%)	Total ** (%)
Residential						
No-New-Standards	10.8	0	0	5.6	83.6	100
TSL 0.5	0	0	0	7.9	92.1	100
TSL 1	0	0	0	7.9	92.1	100
Commercial						
No-New-Standards	2.7	0	0	3.1	94.2	100
TSL 0.5	0	0	0	3.3	96.7	100
TSL 1	0	0	0	3.3	96.7	100

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

Regarding the market share for GSIL lamps in the LCC GSIL-only (*i.e.,* covered product) scenario, without any shipments of HIR GSILs, the efficacy distribution is simply that all consumers in the consumer sample purchase the EL 0 halogen lamp in the no-new-standards case, and no consumers purchase any of the GSIL lamp options under the standards cases. That is, the efficacy distribution considers that the 10.8% of consumers who purchase halogen lamps

would continue to make the same purchase.

See section VI.F of this document and chapter 9 of the final determination TSD for further information on the derivation of the market efficacy distributions for the scenario with substitution.

9. LCC Savings Calculation

DOE calculated the annualized LCC savings at TSL 0.5 and 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 lifecycle cost of HIR lamps under TSL 0.5 and TSL 1 compared with 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 also 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 as an input into the NPV to reflect actual consumer behavior. In the covered product scenario, which includes only the product that would be directly regulated by a GSIL standard, no consumers purchase the EL 0.5 or EL 1 HIR lamps. Although consumers would not experience actual savings in this scenario, DOE provides a comparison of annualized LCC at each EL to compare the upfront price increase to operating cost savings. DOE provides this analysis to illustrate the choices facing consumers in the EL 0.5 and EL 1 standards scenarios.

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 initial installed cost is not recovered in reduced operating expenses.[49]

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 document, 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.

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.[50] 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.

In the September 2019 GSIL NOPD, 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 (*i.e.,* GSILs). As an input to the NIA, DOE modeled a scenario where consumers selected between GSIL options and out-of-scope alternatives, including CFLs, LED lamps, and traditional incandescent (*e.g.,* shatter resistant) lamps, because amended standards on GSILs could affect substitution rates.

DOE received a number of comments on the projected shipments of HIR lamps during the analysis period. EEI expressed surprise that consumers would purchase an HIR lamp, given the higher purchase price compared to CFLs and LED lamps. (EEI, Public Meeting Transcript, No. 56 at pp. 57–58) CFA found the covered-product shipments scenario unrealistic, expressing doubt that a large volume of consumers would behave irrationally by purchasing HIR lamps. (CFA, No. 76 at pp. 2–3) Lamp manufacturers argued that, given the market transition toward LED lamps and that HIR GSILs do not currently exist on the market, no manufacturer would undertake the upfront cost to bring such lamps to market and, thus, there should not be any projected shipments of HIR GSILs. (GE, Public Meeting Transcript, No. 56 at p. 62; NEMA, No. 88 at pp. 5, 8–9, 11, 14; Westinghouse, No. 112 at p. 2) DOE agrees that it is very unlikely that any HIR GSILs will be produced, given the market's overall shift toward LEDs and the information provided by industry manufactures, and has therefore not projected any shipments of

[49] The simple payback period calculation does not account for the additional cost of any needed replacement lamps when comparing lamps with different lifetimes.

[50] 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.

HIR GSILs in this final determination. Given that HIR GSILs were the only lamp options available under a standard in the covered product scenario, DOE has not projected shipments for this scenario. In the final determination, DOE projects shipments for out-of-scope alternative lamps.

Additionally, DOE received comment on projected shipments of shatter-resistant lamps. NEMA commented that sales of shatter-resistant lamps are currently low and declining. (NEMA, No. 88 at p. 12) Several commenters noted that if sales increased to exceed a specific threshold, 42 U.S.C. 6295(l)(4)(H) would cause DOE to set a standard or trigger a backstop specific to shatter resistant lamps. (Westinghouse, Public Meeting Transcript, No. 56 at pp. 86–87; NEMA, No. 88 at p. 12; Joint Advocates, No. 113 at p. 6; State Attorneys General, No. 110 at p. 16) The Joint Advocates commented that the 40 watt maximum imposed by the backstop would limit shipments because a 40 watt shatter-resistant incandescent lamp would be incapable of providing adequate levels of light for common uses. (Joint Advocates, No. 113 at p. 6) The State Attorneys General commented that DOE overestimated costs associated with a standard in the September 2019 GSIL NOPD because it assumed extended sales of shatter-resistant lamps. (State Attorneys General, No. 110 at p. 16)

DOE acknowledges that the projected shipments of the shatter-resistant incandescent lamps in the September 2019 GSIL NOPD were large enough to trigger the product-specific backstop provision, which would impose a maximum wattage of 40 watts and a requirement that those lamps be sold at retail in a package containing only one lamp. DOE also notes that the September 2019 GSIL NOPD did not model a significant shift to non-GSIL incandescent products under a standard; shipments of shatter-resistant incandescent lamps increased by only 0.1 percent in the presence of a standard for GSILs as compared to the no-new-standards case. While traditional incandescent lamps, such as shatter-resistant lamps, may exist as a theoretical substitute, given the limited practical impact on the analytical results, DOE has removed shatter-resistant lamps as an option for consumers in the final determination, as discussed in the engineering analysis (see section VI.B.6). Therefore DOE has not projected shipments of such lamps in its analysis.

1. Shipments Model

The shipments model projects shipments of GSILs over a thirty-year analysis period for the no-new-standards case and for standards cases. 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 available lamp options for each year of the analysis period; (2) a price-learning module that projects future prices based on historic price trends; and (3) a market-share module that assigns shipments to the available lamp options.

a. Lamp Demand Module

The lamp demand module first estimates the national demand in each year for GSILs and potential alternative products. 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 U.S. residential and commercial floor space.[51] 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. In the September 2019 GSIL NOPD, the lamp demand module for the scenario with substitution also accounted 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. DOE maintains this methodology for the shipments projections in the final determination.

[51] 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.*

b. Price-Learning Module

The price-learning module estimates lamp prices in each year of the analysis period using a standard price-learning model,[52] which relates the price of a given technology to its cumulative production, as represented by total cumulative shipments. Current cumulative shipments are determined for each lighting technology expected to undergo learning 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.

In the September 2019 GSIL NOPD, DOE only applied learning to lamps with CFL and LED technologies. DOE stated that GSILs represent a mature technology that has reached a stable price point due to the high volume of total cumulative shipments, so price learning was not considered for this technology. However, several stakeholders argued that price learning should be included for HIR GSIL lamps, specifically, as these lamps are not currently on the market and do not represent a mature technology and thus prices would decline with an increase in shipments. (IPI, No. 96 at p. 7; CEC, No. 102 at pp. 4–5; Joint Advocates, No. 113 at p. 6; Rothenhaus, No. 16 at p. 1) The Joint Advocates also noted that DOE applied price learning to HIR IRLs in the 2015 IRL final rule. (Joint Advocates, No. 113 at pp. 5–6). In the final determination, DOE is not projecting any shipments of HIR GSILs. Without any increase in cumulative shipments, these is no decrease in product price due to price learning.

Alternative lamps with CFL and LED technologies may continue to drop in price due to price learning as a result of increases in cumulative shipments. 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. Commenters agreed with application of

[52] 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.*

price learning for LED lamps, given the observed price declines and DOE maintained the same approach to price learning for the final determination. (CFA, No. 76 at p. 7; PA DEP, No. 77 at p. 2) CFA also commented that DOE's failure to set a standard on GSILs and would slow the progress of LEDs in gaining market share and diminish the extent to which economies of scale continue to bring down the purchase price of LEDs. DOE notes that the analysis reflects that the price of LED lamps declines slightly more slowly in the no-new-standards case compared to the standards cases, but that the difference in LED lamp purchase price is minimal.

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

In the September 2019 GSIL NOPD, DOE used a market-share module that considered purchase price, energy savings, lifetime, and mercury content as measured in a market study,[53] as well as on consumer preferences for lighting technology as revealed in historical shipments data for estimating product market share in the scenario with substitution. DOE uses the same features in the market-share module for its projections in the final determination.

In the September 2019 GSIL NOPD, HIR GSILs, CFLs, LED lamps, and traditional incandescent alternatives were all available as options under a standard in the scenario with substitution. In the final determination, DOE only considers CFL and LED alternatives as potential substitutes for halogen GSILs in the shipments analysis. As discussed previously, in this final determination, DOE did not include traditional incandescent alternatives as a potential substitute and DOE assumed that manufacturers would not produce HIR GSILs in the no-new-standards cases or under an amended standards case and therefore they would not be available as options to consumers in the market-share module.

The market-share module incorporates a limit on the diffusion of LED technology into the market using the widely accepted Bass adoption model,[54] the parameters of which are based on data on the market penetration of LED lamps published by NEMA.[55] In this final determination, DOE maintains the same methodology and derived parameters as was used in the September 2019 GSIL NOPD.

In response to the September 2019 GSIL NOPD, there was consensus that the market has been transitioning to LED lamps (ASAP, Public Meeting Transcript, No. 56 at p. 18; NPCC, No. 58 at p. 2; NEMA, No. 88 at p. 4; Free Market Organizations, No. 111 at p. 3; Westinghouse, No. 112 at p. 1) and general agreement with the shipments trends for LED lamps, CFLs, and halogen GSILs in the analysis. (GE, No. 78 at p. 3; NEMA, No. 88 at p. 10, 12; Westinghouse, No. 112 at p. 2) NRDC commented that some consumers continue to buy incandescent lamps, due to slightly lower purchase prices and a tendency to purchase products similar to past purchases (NRDC, Public Meeting Transcript, No. 56 at p. 14) and ASAP commented that a GSIL standard would push more customers to purchase LED lamps. (ASAP, Public Meeting Transcript, No. 56 at p. 18) DOE notes these observations and that these comments are consistent with DOE's analysis in the September 2019 GSIL NOPD.

While NEMA generally agreed with DOE's projected trend of declining lamp shipments from 2018 to 2019 in the September 2019 GSIL NOPD, NEMA did not expect the decline to be quite as steep as presented in Figure 9.4 in chapter 9 of the NOPD TSD. (NEMA, No. 88 at p. 13) DOE projects lamp shipments over the shipments analysis period, which begins in 2019, using historical shipments in conjunction with estimates for lamp retirement functions as described in section VI.E.6 of this document. The projected drop in shipments is due to consumers choosing lamps with longer lifetimes, consistent with NEMA's lamp indices,[56] leading to slower turnover in stock and fewer overall shipments of general service lamps. DOE also notes that historical shipments for 2018 were higher than shipments between the years 2015–2017 which showed consecutive declines in lamp shipments, making the projected drop in shipments for 2019 appear steep relative to shipments in 2018. The drop in shipments for 2019 is less dramatic when factoring in the overall historical trend of declining lamp shipments from 2015–2017.

CFA commented in response to the September 2019 GSIL NOPD that the no-new-standard base case uses the behavior of the market with standards to project what market behavior would be without standards. (CFA, No. 76 at p. 5) DOE clarifies that the no-new-standard case assumes no amended standard, but does include the existing standards for GSILs from EISA that were phased in between 2012 and 2014.

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.[57] (''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 analysis, along with the HOU and energy prices from the energy use and LCC analysis.[58] 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, the energy savings and NPV of consumer benefits are not those associated with the technology in question for TSL 0.5 and TSL 1. Because manufacturers will not produce HIR lamps and consumers will not purchase them, there are no energy savings or benefits from transitioning

[53] Krull, S. and D. Freeman. *Next Generation Light Bulb Optimization.* 2012. Pacific Gas and Electric Company. (Last accessed December 17, 2015.) *http://www.etcc-ca.com/sites/default/files/OLD/images/stories/Lighting_Conjoint_Study_v020712f.pdf.*

[54] Bass, F. M. A New Product Growth Model for Consumer Durables. *Management Science.* 1969. 15(5): pp. 215–227. (Last accessed January 22, 2016.) *http://www.jstor.org/stable/2628128?seq=1#page_scan_tab_contents.*

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

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

[57] The NIA accounts for impacts in the 50 States and the U.S. territories.

[58] For the NIA, DOE adjusts the installed cost data from the LCC analysis to exclude sales tax, which is a transfer.

from the GSIL baseline 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 estimated in the standards case are the result of product shifting as consumers substitute different product types such as CFLs and LED lamps.

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 VI.12 summarizes the inputs and methods DOE used for the NIA analysis for the final determination. Discussion of these inputs and methods follows the table.

TABLE VI.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	2020.

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.

As in the September 2019 GSIL NOPD, in the final determination, DOE tracks both the energy consumption of GSILs and substitute out-of-scope lamps. Under the standards case, the lack of availability of GSIL options leads consumers to choose 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 the September 2019 GSIL NOPD and commenters supported this assumption. (GE, No. 78 at p. 3; NEMA, No. 88 at p. 17; Westinghouse, No. 112 at p. 2) DOE maintains this assumption for the final determination.

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*.[59] The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the final determination TSD.

In response to the September 2019 GSIL NOPD, EEI commented that the site-to-primary and FFC factors used by DOE are too high and that DOE should anticipate that they will decline more than AEO currently projects. (EEI, Public Meeting Transcript, No. 56 at pp. 117–119) DOE acknowledges that renewable power sources are expected to account for a growing share of national electricity generation. Because these technologies do not consume fuel, the ''source'' (or ''primary'') energy from these sources cannot be accounted for in

[59] 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/).*

the same manner as it is for fossil fuel sources. EIA has historically used a fossil fuel equivalency approach when calculating the primary energy associated with renewable electricity generation. As a result, DOE's site-to-primary conversion factors are only slightly affected by increase in renewable electricity and decrease in coal-fired generation.

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 efficacy improvements from TSL 0.5 and TSL 1 do not result in any direct benefits from the purchase of GSIL lamps meeting those standards. As discussed in section VI.F of this document, manufacturers would not produce HIR lamps in the standards case. Manufacturers that have produced and attempted to sell such lamps in the recent past have found it uneconomic to do so. Benefits from TSL 0.5 and TSL 1 result from product shifting as consumers substitute more efficient out-of-scope alternative lamps. As discussed in section VI.F.1.b of this document, DOE developed prices for alternative LED lamps and CFLs using a price-learning module incorporated in the shipments analysis.

The operating cost savings in this document are a result of product shifting. The operating-cost savings are 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 the September 2019 GSIL 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.[60] 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. In the September 2019 GSIL NOPD, DOE used a present year of 2019. For this final determination, DOE has updated the present year to 2020.

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 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 output is INPV, which is the sum of industry annual cash flows over the analysis period, discounted using the industry weighted average cost of capital. The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the no-new-standards case and the standards cases. The difference in INPV between the no-new-standards case and the standards cases represent the financial impact of the analyzed 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 U.S. Securities and Exchange Commission (''SEC'') or corporate annual reports.[61]

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

The GRIM spreadsheet uses inputs to arrive at a series of annual cash flows, beginning in 2020 (the reference year of the analysis) and continuing to 2052. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. DOE used a real discount rate of 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 manufacturer production costs (''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. 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. These end-user prices are used as an input to the LCC analysis and NIA. DOE updated the end-user price for the modeled HIR lamp in the final determination (see section VI.C). DOE uses this updated end-user

[60] 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*).

[61] 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.

price in the MIA conducted as part of the final determination.

To determine MPCs of GSILs from the end-user prices calculated in the product price determination, 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 VI.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 efficacy mix over time can significantly affect manufacturer finances. For this analysis, the GRIM uses the NIA's annual shipment projections derived from the shipments analysis from 2020 (the reference year) to 2052 (the end year of the analysis period). The shipment analysis was updated for the final determination. DOE uses the updated shipment projections in the MIA conducted for the final determination. The updated shipment analysis is described in further detail in section VI.F of this document.

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 the analyzed 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.

As part of the September 2019 GSIL NOPD, DOE evaluated the level of capital conversion costs and product conversion costs manufacturers would likely incur at the analyzed TSL to manufacture the volume of projected HIR shipments. In response to the September 2019 GSIL NOPD, NEMA stated that no manufacturer would invest to produce a general service HIR lamp in the current market environment, now or in the reasonably foreseeable future, even if standards were set above baseline. NEMA stated that when GE and Philips brought their expensive HIR lamps to market, general service LED lamps had not been commercialized and now they are competitive in price and exceeding in sales compared to GSILs. Therefore, NEMA states, they would not expect any appreciable HIR product shipments to appear in the market in either the no-new-standards case or the standards cases. (NEMA, No. 88 at p. 4–5, 9–11) Similarly, GE stated it is very unlikely that any lamp manufacturing business could economically justify an investment in manufacturing capacity for A-line lamps containing HIR filament tubes. The GE factory that previously made HIR filament tubes has been closed and the production equipment no longer exists. (GE, No. 78 at p. 3) NEMA further noted that over the past two years, manufacturers have begun withdrawing from manufacturing halogen infrared PAR lamps and much of what continues to be available for sale is slow-moving older inventory. This fact lends further credibility to the proposition that HIR GSILs will not be forthcoming in the event of a standard that requires them. (NEMA, No. 88 at p. 5) Westinghouse stated if someone saw an opportunity and had $8 million, such a person may attempt to make an HIR lamp but it was not aware of any major manufacturer intending to invest that kind of money in a product that people may not purchase. (Westinghouse, Public Meeting Transcript, No. 56 at p. 124)

As part of this final determination, DOE updated the shipment analysis described in section VI.F of this document. DOE is no longer projecting shipments for HIR lamps in either the standards cases or the no-new-standards case. Therefore, for the MIA conducted for the final determination, DOE estimated that manufacturers would not incur any conversion costs in the standards cases for HIR GSILs as there are no shipments of those products.

4. Markup Scenarios

To calculate the MPCs used in the GRIM, DOE divided the end-user prices calculated in the product price determination analysis by the home center markup and the manufacturer markup. DOE continued to use the home center markup of 1.52 that was used in the September 2019 GSIL NOPD.

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

Under the preservation of gross margin percentage scenario, DOE applied a single uniform ''gross margin percentage'' 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 at all lamps analyzed. This markup scenario is identical to the one used in the September 2019 GSIL NOPD.

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 slightly altered the technology specific markups in the final determination due to the changes in the shipment analysis. For the final determination DOE estimated an incandescent lamp manufacturer markup of approximately 1.532, a CFL manufacturer markup of approximately 1.459, and an LED lamp manufacturer markup of approximately 1.386. 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 markup scenarios is presented in section VII.D.1 of this document.

VII. Analytical Results and Conclusions

A. Trial Standard Levels

DOE analyzed the benefits and burdens of two TSLs for GSILs. TSL 0.5 is a new TSL analyzed in the final determination and is composed of EL 0.5, which is modeled on lamps with a 3,000 hour life. TSL 1, which was included in the September 2019 NOPD,

is composed of EL 1 and is the max-tech EL for GSILs. Analyses were conducted as described in section VI for each TSL. Table VII.1 presents the TSLs and the corresponding efficacy levels that DOE has identified for potential amended energy conservation standards for GSILs.

TABLE VII.1—TRIAL STANDARD LEVELS FOR GSILS

TSL	EL	Technology required to comply with standard	Description
TSL 0	EL 0	Halogen	No new GSIL standard.
TSL 0.5	EL 0.5	HIR (3,000 hour lamp)	HIR standard in 2023.
TSL 1	EL 1	HIR (1,000 hour lamp)	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.,* GSILs) and also presents a second LCC, which is used as an input for the NPV, which goes beyond GSILs and also 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 cost decreases. 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 VII.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 four times longer than the product life.

Projected shipments are typically used as an input to calculate LCC savings. In this case, because DOE projects zero shipments of the covered product in a standards scenario, DOE compares the upfront price increase to operating cost savings to examine the annualized LCC at each EL. The annualized LCC at EL 0.5 in the residential sector is $6.83 compared to $6.28 at the baseline, representing a cost increase of $0.55. The annualized LCC at EL 0.5 in the commercial sector is $27.14 compared to $28.44 at the baseline, a savings of $1.30. The annualized LCC at EL 1 in the residential sector is $10.77 compared to $6.28 at the baseline, a cost increase of $4.49. The annualized LCC at EL 1 in the commercial sector is $52.13 compared to $28.44 at the baseline, a cost increase of $23.69. DOE provides this analysis to illustrate the choices facing consumers in the EL 0.5 and EL 1 standards case.

Table VII.3 shows the average annualized LCC savings for TSL 0.5 and TSL 1 under the substitution scenario. No consumers are anticipated to buy HIR technology in the standards case. Instead, these numbers reflect the result of a substitution effect as consumers substitute out-of-scope lamps for GSILs that are no longer available, yielding a reduction in operating costs relative to the no-new-standards case.

TABLE VII.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	Change in annualized LCC		
Residential Sector								
0	1.94	1.57	4.51	4.71	6.28	.....	.....	1.5
0.5	8.67	2.47	4.12	4.36	6.83	(0.55)	17.3	4.5
1	8.67	7.02	3.60	3.76	10.77	(4.49)	7.4	1.5
Commercial Sector								
0	3.48	13.77	13.55	14.67	28.44	.....	.....	0.4
0.5	10.21	13.71	12.38	13.43	27.14	1.30	5.8	1.3
1	10.21	40.43	10.81	11.70	52.13	(23.69)	2.5	0.4

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 and does not account for the additional cost of any needed replacement lamps when comparing lamps with different lifetimes.

TABLE VII.3—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			
0.5	0.5	3.27	0.0
1	1	3.27	0.0
Commercial Sector			
0.5	0.5	12.75	0.0
1	1	12.76	0.0

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

The cost of HIR lamps cannot be recovered during their lifetime. Consumers are unlikely to buy HIR technology in the standards case, assuming manufacturers would even produce the product given the upfront cost to bring such lamps to market. Instead, any potential savings reflect the result of a substitution effect as consumers are priced out of the market for GSILs. That is, TSL 0.5 and TSL 1 are anticipated to increase the cost of GSILs by 346 percent relative to a no-standards case. This drives some consumers to shift toward out-of-scope alternative lamps, yielding a reduction in operating costs relative to the base case. Additionally, the annualized LCC would be $0.55 higher at EL 0.5 and $4.49 higher at EL 1 for residential consumers, meaning that HIR lamps would impose a net cost on affected consumers. However, because no consumers purchase the EL 0.5 and EL 1 HIR lamps, DOE is unable to provide an estimate for the proportion of consumers who would bear a net cost in the standards case.

An individual commented in response to the September 2019 GSIL NOPD that an LCC subgroup analysis should also be conducted. (Vondrasek, No. 101 at p. 5) DOE notes that in the context of a proposed or final rule, DOE considers LCC subgroup analysis for subgroups which may be disproportionately affected, such as low-income consumers or small businesses, to determine whether a standard would still be economically justified for these subgroups. However, in the context of a proposed or final determination, if the analytical results for the full consumer sample indicate that a standard would not be economically justified, it is unnecessary to consider how the analytical results might differ for a subgroup of that sample, as DOE would not set a standard that is not economically justified for the full sample.

2. Rebuttable Presumption Payback

As discussed in section VI.E.9 of this document, 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 VII.B.1 of this section were calculated using distributions that reflect the range of energy use in the field. See chapter 8 of the final determination TSD for more information on the rebuttable presumption payback analysis. Regardless of whether the rebuttable presumption PBP had been met, 42 U.S.C. 6295(o)(4) would prevent DOE from setting standards at that level.

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.

1. Energy Savings

To estimate the energy savings attributable to potential amended standards for GSILs, DOE compared consumer energy consumption under the no-new-standards case to consumer 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 VII.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 VI.G of this document. In addition to GSIL energy savings, Table VII.4 illustrates the increased energy consumption of consumers who transition to out-of-scope CFL and LED lamp alternatives, because more consumers purchase these lamps at TSL 0.5 and TSL 1 relative to the no-new-standards case. At both TSLs the impact of a standard is the same, as DOE anticipates that manufacturers will not produce HIR lamps under an amended GSIL standard and that consumers will only purchase CFL and LED lamp out-of-scope options. DOE notes that the reduction in energy savings in the final determination compared to the September 2019 GSIL NOPD is a result of the shorter lifetime for halogen GSILs, which results in a faster market transition to more efficient out-of-scope lamps in the no-new-standards case.

TABLE VII.4—CUMULATIVE NATIONAL ENERGY SAVINGS FOR GSILS AND GSIL ALTERNATIVES; 30 YEARS OF SHIPMENTS

[2023–2052]

	TSL 0.5	TSL 1
Site energy savings (quads):		
GSILs	0.197	0.197

TABLE VII.4—CUMULATIVE NATIONAL ENERGY SAVINGS FOR GSILS AND GSIL ALTERNATIVES; 30 YEARS OF SHIPMENTS—Continued

[2023–2052]

	TSL 0.5	TSL 1
CFL alternatives	(0.006)	(0.006)
LED alternatives	(0.036)	(0.036)
Total	0.155	0.155
Source Energy Savings (quads):		
GSILs	0.532	0.532
CFL alternatives	(0.016)	(0.016)
LED alternatives	(0.098)	(0.098)
Total	0.419	0.419
FFC Energy Savings (quads):		
GSILs	0.557	0.557
CFL alternatives	(0.016)	(0.016)
LED alternatives	(0.102)	(0.102)
Total	0.438	0.438

OMB Circular A–4 [62] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this final determination, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[63] The review 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 VII.5 of this document. The impacts are counted over the lifetime of GSILs purchased in 2023–2031.

TABLE VII.5—CUMULATIVE NATIONAL ENERGY SAVINGS FOR GSILS AND GSIL ALTERNATIVES; 9 YEARS OF SHIPMENTS

[2023–2031]

	TSL 0.5	TSL 1
Site Energy Savings (quads):		
GSILs	0.061	0.061
CFL alternatives	(0.005)	(0.005)
LED alternatives	(0.009)	(0.009)
Total	0.047	0.047
Source Energy Savings (quads):		
GSILs	0.166	0.166
CFL alternatives	(0.013)	(0.013)
LED alternatives	(0.024)	(0.024)
Total	0.129	0.129
FFC Energy Savings (quads):		
GSILs	0.174	0.174
CFL alternatives	(0.014)	(0.014)
LED alternatives	(0.025)	(0.025)
Total	0.136	0.136

[62] 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.*

[63] 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.

2. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the considered TSLs for GSILs. However, as described previously, the benefits of the considered TSLs do not come from improved efficiency for the product for which DOE is making a determination whether existing standards should be amended. Rather, because manufacturers will not produce HIR lamps in the standard case, any benefit from an amended standard is the result of consumers shifting to out-of-scope alternatives. In accordance with OMB's guidelines on regulatory analysis,[64] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table VII.6 shows the consumer NPV results with impacts counted over the lifetime of GSILs purchased in 2023–2052.

TABLE VII.6—CUMULATIVE NET PRESENT VALUE OF QUANTIFIABLE CONSUMER BENEFITS FOR GSILS AND GSIL ALTERNATIVES; 30 YEARS OF SHIPMENTS

[2023–2052]

	TSL 0.5	TSL 1
3 percent (billions 2018$):		
GSILs	5.539	5.539
CFL alternatives	(0.192)	(0.192)
LED alternatives	(0.969)	(0.969)
Total	4.378	4.378
7 percent (billions 2018$):		
GSILs	3.217	3.217
CFL alternatives	(0.133)	(0.133)
LED alternatives	(0.566)	(0.566)
Total	2.518	2.518

The NPV results based on the aforementioned 9-year analytical period are presented in Table VII.7 of this document. 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 VII.7—CUMULATIVE NET PRESENT VALUE OF QUANTIFIABLE CONSUMER BENEFITS FOR GSIL AND GSIL ALTERNATIVES; 9 YEARS OF SHIPMENTS

[2023–2031]

	TSL 0.5	TSL 1
3 percent (billions 2018$):		
GSILs	2.184	2.184
CFL alternatives	(0.168)	(0.168)
LED alternatives	(0.353)	(0.353)
Total	1.663	1.663
7 percent (billions 2018$):.		
GSILs	1.675	1.675
CFL alternatives	(0.121)	(0.121)
LED alternatives	(0.285)	(0.285)
Total	1.268	1.268

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.

D. Economic Impacts on Manufacturers

DOE performed a manufacturer impact analysis (''MIA'') to estimate the impact of analyzed energy conservation standards on manufacturers of GSILs. The following section describes the expected impacts on GSIL manufacturers at each considered TSL. Chapter 11 of the final determination TSD explains the analysis in further detail.

1. Industry Cash Flow Analysis Results

In this section, DOE provides results from the Government Regulatory Impact Model (''GRIM''), which examines changes in the industry that would result from the analyzed standard. Table VII.8 and Table VII.9 illustrate the estimated financial impacts (represented

[64] 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.*

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 TSLs.

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 TSLs. In the following discussion, the INPV results refer to the difference in industry value between the no-new-standards case and the standards cases that result from the sum of discounted cash flows from the reference year (2020) through the end of the analysis period (2052).

DOE modeled a preservation of gross margin markup scenario. This scenario assumes that in the standards cases, 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 VII.8 and Table VII.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 VII.8—MANUFACTURER IMPACT ANALYSIS FOR GSILS—PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

	Units	No-new-standards case	TSL 0.5	TSL 1
INPV	*2018$ millions*	298.3	292.4	292.4
Change in INPV	*2018$ millions*		(5.9)	(5.9)
	%		(2.0)	(2.0)
Product Conversion Costs	*2018$ millions*			
Capital Conversion Costs	*2018$ millions*			
Total Conversion Costs	*2018$ millions*			

TABLE VII.9—MANUFACTURER IMPACT ANALYSIS FOR GSILS—TECHNOLOGY SPECIFIC MARKUP SCENARIO

	Units	No-new-standards case	TSL 0.5	TSL 1
INPV	*2018$ millions*	298.3	270.9	270.9
Change in INPV	*2018$ millions*		*(27.5)	*(27.5)
	%		(9.2)	(9.2)
Product Conversion Costs	*2018$ millions*			
Capital Conversion Costs	*2018$ millions*			
Total Conversion Costs	*2018$ millions*			

* Values do not add exactly due to rounding.

At TSL 0.5 and at TSL 1, DOE estimates that impacts on INPV will range from −$27.5 million to −$5.9 million, or a change in INPV of −9.2 to −2.0 percent. At TSL 0.5 and at TSL 1, there is no change in free cash-flow from the no-new-standards case since manufacturers do not have any conversion costs. Therefore, free cash-flow remains at $31.7 million in 2022, the year leading up to the potential standard, which is the same value as in the no-new-standards case.

At TSL 0.5 and TSL 1, the change in shipment-weighted average MPC in 2023 increases 2.7 percent. However, lighting manufacturers sell approximately 19 million fewer units annually after 2023 because most consumers purchase longer lifetime products. This decrease in sales volume outweighs the small increase in average MPC causing INPV to decrease in both markup scenarios.

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 standards. 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 the analysis. 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 also does not assume that any CFL or LED lamp domestic production employment would be impacted by the analyzed standards. Therefore, the final determination would not have a significant impact on domestic employment in the GSIL industry.

Several individuals, some through a form letter process, stated that DOE's proposed determination would put thousands of manufacturing jobs at risk. (Coconut Moon, No. 35 at p. 1; Goldman, No. 36 at p. 1; LeRoy, No. 40 at p. 1; Meadow, No. 41 at p. 1; Caswell, No. 44 at p. 1; H, No. 47 at p. 1; Kodama, No. 49 at p. 1; Dashe, No. 61 at p. 1; Werner, No. 37 at p. 1; Datz, No. 39 at p. 1; Kodama, No. 48 at p. 1; Anonymous, No. 98 at p. 16) DOE assumes the analyzed energy conservation standards would not impact GSIL domestic production, as none exists. Additionally, DOE assumes the final determination would not decrease the limited CFL and LED lamp domestic production, as those lamps would continue to be sold in the U.S. Therefore, DOE does not believe that any jobs related to the manufacturing of GSILs, CFLs, or LED lamps are at risk due to this final determination.

3. Impacts on Manufacturing Capacity

DOE does not anticipate any significant capacity constraints at the analyzed energy conservation standards. As previously discussed in section VI.F, DOE did not estimate any HIR lamp sales (EL 0.5 and EL 1) in either the no-new-standards case or in the standards cases. Therefore, manufacturers would not need to purchase machines used to coat halogen capsules. Additionally, manufacturers would not need to add capacity for either CFLs or LED lamps in the standards cases as there would already be excess production capacity for those lamps in the analyzed

compliance year since DOE estimates higher production volumes of both of those lamps in the years leading up to the compliance date of the analyzed 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 VIII.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 regulatory actions of other Federal agencies and States 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 conclusion discussed in section VII.E of this document, DOE did not conduct a cumulative regulatory burden analysis.

E. Conclusion

When considering amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

For this final determination, DOE considered the impacts of amended standards for GSILs at analyzed TSLs, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation. 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 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. Hence, DOE has 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 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 significant energy savings. As this rule is not yet finalized, DOE 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 previously, there are no energy savings or benefits from transitioning to HIR technology. HIR lamps would burden consumers with net costs, because the installed cost of the technology is too high to recoup via energy savings. As a result, any energy savings that might result from establishing a standard at TSL 0.5 or TSL 1 are the result of product shifting as consumers abandon HIR GSIL 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 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 section.

Given the high upfront cost and long payback period, these analyses do not anticipate that consumers will benefit from the introduction of HIR lamp technology. Additionally, the recent experiences of two manufacturers that attempted and failed to market such

products illustrates that they are not commercially viable. At TSL 0.5 and TSL 1, manufacturers would not spend the capital required to produce HIR lamps given the low probability of recovering those costs as consumers substitute less costly non-GSIL products. Manufacturers would 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 five in the residential sector and more than a factor of six in the commercial sector. Further, HIR products at EL 1 represent an additional annualized life cycle cost of $4.49 in the residential sector and $23.69 in the commercial sector relative to the baseline GSIL. The simple payback period is 7.4 years (compared to an average lifetime of 1.5 years) in the residential sector and 2.5 years (compared to an average lifetime of 0.4 years) in the commercial sector. At TSL 1, DOE estimates that INPV will decrease between $27.5 million to $5.9 million, or a decrease in INPV of 9.2 to 2.0 percent. Based on the second EPCA factor that DOE is required to evaluate, DOE has concluded that imposition of a standard at TSL 1 is not economically justified because the operating cost savings of the covered product are insufficient to recover the upfront cost. Based on these considerations, DOE is not amending energy conservation standards to adopt TSL 1 for GSILs.

DOE has presented additional consumer choice analysis anticipating that if it were to establish a standard at TSL 1, consumers would substitute other available products, such as LED lamps and CFLs (the substitution scenario). DOE then estimated the NPV of the total costs and benefits experienced by the Nation in this scenario. DOE also conducted an MIA to estimate the impact of amended energy conservation standards on manufacturers of GSILs in this consumer choice scenario. Under the consumer choice analysis, the NPV of consumer benefits at TSL 1 would be $2.518 billion using a discount rate of 7 percent, and $4.378 billion using a discount rate of 3 percent. However, this NPV is based on the anticipated lifecycle cost savings to consumers who substitute other lamps due to the unavailability of GSILs. As explained elsewhere in this document, EPCA requires DOE to compare the savings in operating costs of the covered product compared to any cost increase of the covered products which are likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) Although the NPV is projected based on shipments of out-of-scope lamps, DOE's consideration of life cycle costs is limited to the covered product examined here—that is, GSILs. As discussed in section V.C. of this final rule, 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. In addition to being economically unjustified, amended standards for GSILs would force the unavailability of a product type, performance characteristic or feature in contravention of EPCA.

After considering the analysis and weighing the benefits and the burdens, DOE concluded that, at TSL 0.5 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 four in the residential sector and more than a factor of four in the commercial sector. At EL 0.5, the annualized covered product LCC is an additional $0.55 in the residential sector and a decrease of $1.30 in the commercial sector relative to the baseline GSIL. The simple payback period is 17.3 years (compared to an average lifetime of 4.5 years) in the residential sector and 5.8 years (compared to an average lifetime of 1.3 years) in the commercial sector. At TSL 0.5, DOE estimates that INPV will decrease between $27.5 million to $5.9 million, or a decrease in INPV of 9.2 to 2.0 percent. Based on the second EPCA factor that DOE is required to evaluate, DOE has concluded that imposition of a standard at TSL 0.5 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 to adopt TSL 0.5 for GSILs.

DOE has presented additional consumer choice analysis anticipating that if it were to establish a standard at TSL 0.5, consumers would substitute other available products, such as LED lamps and CFLs (the substitution scenario). DOE then estimated the NPV of the total costs and benefits experienced by the Nation in this scenario. DOE also conducted an MIA to estimate the impact of amended energy conservation standards on manufacturers of GSILs in this consumer choice scenario.

Under the substitution analysis, the NPV of consumer benefits at TSL 0.5 would be $2.518 billion using a discount rate of 7 percent, and $4.378 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 the unavailability of GSILs. As explained elsewhere in this document, EPCA requires DOE to compare the savings in operating costs of the covered product compared to any cost increase of the covered products which are likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) Although the NPV is projected based on shipments of out-of-scope lamps, DOE's consideration of life cycle costs is limited to the covered product examined here—that is, GSILs.

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. In addition to being economically unjustified, amended standards for GSILs would result in the unavailability of a product type, performance characteristic or feature in contravention of EPCA.

In this final determination, based on the determination that amended standards would not be economically justified, DOE has determined that energy conservation standards for GSILs do not need to be amended.

VIII. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and Administrative Procedure Act

This final 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, OMB reviewed this rule.

DOE finds good cause pursuant to 5 U.S.C. 553(d)(3) to waive the delay in effective date for this rule. The energy conservation standards applicable to GSILs will be precisely the same after the effective date of this rule as they are

prior to that date. As such, a delay in effectiveness is unnecessary as it would serve no useful purpose.

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 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:

(i) Eliminate jobs, or inhibit job creation;

(ii) Are outdated, unnecessary, or ineffective;

(iii) Impose costs that exceed benefits;

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

(v) 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 (vi) Derive from or implement Executive Orders or other Presidential directives that have been subsequently rescinded or substantially modified.

As discussed in this document, DOE is not amending the energy conservation standards for GSILs and the final determination would not yield any costs or cost savings. Therefore, this final determination is an E.O. 13771 other action.

C. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') and a final regulatory flexibility analysis (''FRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by 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 final determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. DOE is not amending energy conservation standards for GSILs. On the basis of the foregoing, DOE certifies that this final determination does not have a significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an FRFA for this final determination.

D. Review Under the National Environmental Policy Act of 1969

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

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. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final determination. A discussion of Federal preemption as it applies to GSILs can be found in section V.E of this final rule. DOE has examined this rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. 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 final 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 regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *http://energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

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

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

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

I. Review Under Executive Order 12630

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

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

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

K. Review Under Executive Order 13211

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

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

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 prepared a report describing that peer review.[65] 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 rulemaking.

M. Congressional Notification

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

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

IX. Approval of the Office of the Secretary

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

Signed in Washington, DC, on December 17, 2019.

Daniel R. Simmons,

Assistant Secretary, Energy Efficiency and Renewable Energy.

[FR Doc. 2019–27515 Filed 12–26–19; 8:45 a.m.]

BILLING CODE 6450–01–P