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**[6450-01-P]**

**DEPARTMENT OF ENERGY**

**10 CFR Part 431**

**[Docket Number EERE–2010–BT–STD–0043]**

**RIN: 1904-AC36**

# Energy Conservation Program: Energy Conservation Standards for High-Intensity Discharge Lamps

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

**ACTION:** Final Determination

**SUMMARY:** The Energy Policy and Conservation Act of 1975 (EPCA), as amended, requires DOE to prescribe test procedures and energy conservation standards for high-intensity discharge (HID) lamps for which it has determined that standards would be technologically feasible and economically justified, and would result in significant energy savings. In this final determination, DOE determines that energy conservation standards for high-intensity discharge (HID) lamps do not meet these criteria.

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

The docket webpage can be found at: https://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/23. This webpage contains a link to the docket for this notice on the regulations.gov site. The regulations.gov webpage contains simple instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact Ms. Brenda Edwards at (202) 586-2945 or by email: Brenda.Edwards@ee.doe.gov.

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**SUPPLEMENTARY INFORMATION:**

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## I. Synopsis of the Determination

DOE determines that energy conservation standards for HID lamps do not meet the EPCA requirements described in section II.A, that such standards be technologically feasible, economically justified, and result in a significant conservation of energy. (42 U.S.C. 6317(a)(1)) Specifically, DOE concludes that standards for high-pressure sodium (HPS) lamps are not technologically feasible, and that standards for mercury vapor (MV) and metal halide (MH) lamps are not economically justified (HPS, MV, and MH lamps are subcategories of HID lamps). DOE's determination is based on analysis of several efficacy levels (ELs) as a means of conserving energy. These analyses and DOE's results are described in the following sections of this notice and in the final determination technical support document (TSD).

## II. Introduction

### A. Legal Authority

Title III of EPCA (42 U.S.C.6291, et seq.), Pub. L. 94-163, sets forth a variety of provisions designed to improve energy efficiency. Part C of title III, which for editorial reasons was re-designated as Part A-1 upon incorporation into the U.S. Code (42 U.S.C. 6311–6317), establishes the "Energy Conservation Program for Certain Industrial Equipment," a program covering certain industrial equipment, which include the HID lamps that are the subject of this determination. Pursuant to EPCA, DOE must prescribe test procedures and energy conservation standards for HID lamps for which DOE has determined that standards would be technologically feasible, economically justified, and would result in a significant conservation of energy. (42 U.S.C. 6317(a)(1))

## B. Background

1. Current Standards

There are currently no Federal energy conservation standards for HID lamps.

2. History of Standards Rulemaking for High-Intensity Discharge Lamps

Pursuant to EPCA, in 2010 DOE published a final determination[1] (hereafter the "2010 determination") that standards for certain HID lamps are technologically feasible, economically justified, and would result in significant energy savings (a positive determination). 75 FR 37975 (July 1, 2010). As a result of the 2010 determination, DOE initiated a test procedure rulemaking for the specified lamps (see section IV.A).

DOE also initiated an energy conservation standards rulemaking in response to the 2010 determination. On February 28, 2012, DOE published in the Federal Register an announcement of the availability of a framework document for energy conservation standards for HID lamps, as well as a notice of a public meeting. 77 FR 11785. DOE held a public meeting on March 29, 2012, to receive feedback in response to the framework document.

DOE gathered additional information and performed interim analyses to develop potential energy conservation standards for HID lamps. On February 28, 2013, DOE published in the Federal Register an announcement of the availability of the interim

[1] The final determination is available at: http://www.regulations.gov/#!documentDetail;D=EERE-2006-DET-0112-0002.

technical support document (the interim TSD) and notice of a public meeting (hereafter, the “February 2013 notice”) to discuss and receive comments on the following matters: (1) the equipment classes DOE planned to analyze; (2) the analytical framework, models and tools that DOE used to evaluate standards; (3) the results of the interim analyses performed by DOE; and (4) potential standard levels that DOE could consider. 78 FR 13566. In the February 2013 notice, DOE requested comment on issues that would affect energy conservation standards for HID lamps or that DOE should address in the following analysis stage. The interim TSD is available at: http://www.regulations.gov/#!documentDetail;D=EERE-2010-BT-STD-0043-0016.

The interim TSD summarized the activities DOE undertook in developing standards for HID lamps. It also described the analytical framework that DOE uses in a typical energy conservation standards rulemaking, including a description of the methodology, the analytical tools, and the relationships among the various analyses that are part of the rulemaking. The interim TSD presented and described in detail each analysis DOE performed, including descriptions of inputs, sources, methodologies, and results.

The public meeting for the interim analysis took place on April 2, 2013. At this meeting, DOE presented the methodologies and results of the analyses set forth in the interim TSD. Interested parties discussed the following major issues at the public meeting: the scope of the interim analysis, equipment classes, sapphire arc tube technology, the engineering analysis (including representative units, baselines, and candidate standard levels [CSLs]), the life-cycle cost (LCC) and payback period (PBP) analysis, and the shipment analysis.

On October 21, 2014, DOE published a notice of proposed determination (NOPD) in the Federal Register which proposed that energy conservations standards for HID lamps were not justified. 79 FR 62910. In conjunction with the NOPD, DOE also published on its website the complete TSD for the NOPD, which incorporated the analyses DOE conducted and technical documentation for each analysis. The NOPD TSD was accompanied by the LCC spreadsheet, the national impact analysis (NIA) spreadsheet, and the manufacturer impact analysis (MIA) spreadsheet—all of which are available in the rulemaking docket EERE–2010–BT–STD–0043 at: http://www.regulations.gov/#!docketDetail;D=EERE-2010-BT-STD-0043.

In the NOPD, DOE invited comment, particularly on the following issues: (1) the HID lamps selected for and excluded from analysis of economic justification for standards, (2) the decision to analyze equal wattage replacement lamps, as well as the methodology used to select the equal wattage replacement lamps, (3) the decision to include replacement pathways other than full fixture replacement, and (4) the proposal of a negative determination stating that standards for HID lamps were not justified. 79 FR 62910 (October 21, 2014).

The NOPD detailed that there would not be a public meeting unless one was requested by stakeholders. Because a public meeting was not requested, DOE did not hold a public meeting for the NOPD.

All comments received by DOE in response to the NOPD were considered in this final determination, including those received during the reopened comment period. 80 FR 6016 (February 4, 2015). Chapter 2 of this TSD summarizes and responds to comments received on the NOPD.

DOE concludes in this final determination that standards for HID lamps do not meet the statutory requirements for the establishment of standards, based either upon lack of technological feasibility, economic justification, or significant energy savings.

3. Changes from the 2010 Determination

As discussed previously, DOE published a determination in 2010 that concluded that standards for certain HID lamps would be technologically feasible, economically justified, and would result in significant energy savings. 75 FR 37975 (July 1, 2010) Since the publication of the 2010 determination, DOE held public meetings, received written comments, conducted interviews with manufacturers, and conducted additional research. Based upon this new information, DOE revised its analyses for potential HID lamp energy conservation standards. The following sections summarize the major changes in assumptions and analyses between the 2010 determination and this final determination, in which DOE concludes that standards for HID lamps are either not technologically feasible or not economically justified.

a. Color

In contrast to the 2010 determination, DOE established separate equipment classes based on correlated color temperature (CCT) in this final determination. CCT represents the color appearance of a light source and is expressed in kelvin (K). The higher the CCT, the cooler or more blue the light appears, and the lower the CCT, the warmer or more red the light appears. HID lamps are available with a wide range of CCT values depending on lamp type and design. DOE's analysis of commercially available lamp manufacturer catalog data concluded that CCT is correlated with lamp efficacy. DOE determined that higher-CCT lamps are less efficacious than lower CCT lamps of the same wattage. Because CCT is an approximation of the color appearance of a lamp, commercial consumers typically specify different CCTs for different applications. Some lamp substitutions are not suitable because certain applications have specific color requirements (typically indoor applications that demand white light). Because CCT affects HID lamp efficacy and impacts consumer utility, DOE established separate equipment classes based on CCT.

DOE established two different equipment classes based on CCT for MH and MV lamps, ≥2800 K to ≤4500 K range (hereafter referred to as the 2800–4500 K CCT range) and >4500 and <7000 K (hereafter referred to as the 4501–6999 K CCT range). HPS lamps are the only HID lamps available below 2800 K. DOE investigated higher efficacy replacement options for HPS lamps such that commercial consumers could save energy while maintaining the utility (*e.g.*, CCT) of the lamp type. As discussed in section V.A.3, DOE concluded no technology options exist for improving the efficacy of HPS lamps. Therefore, DOE determined standards for HPS lamps are not technologically feasible and did not conduct a full economic analysis on standards for HID lamps below 2800 K in this final determination.

b. Replacement Options

In the 2010 determination, DOE assumed that any commercial consumer purchasing a compliant lamp would choose a reduced-wattage lamp more efficacious than their existing non-compliant lamp. However, DOE received feedback from manufacturer interviews that not all commercial consumers would choose to reduce wattage in response to standards for HID lamps. Some commercial consumers would choose to continue using their existing wattage (e.g., a more-efficacious, increased lumen output lamp that complies with standards, but has the same wattage) for the convenience and lower cost of not purchasing a new fixture and/or ballast that may be necessary for use with the reduced-wattage lamp. During interviews, manufacturers also indicated that some commercial consumers may not understand the metrics used to measure light output and would opt to keep lamps at their existing wattage because wattage is the metric they most commonly consider for lighting. These commercial consumers would experience an increase in light output, but no energy savings. As a result of this information, DOE modeled a portion of commercial consumers replacing lamps with more efficacious, equal wattage lamps in addition to commercial consumers replacing lamps with reduced wattage lamps in this final determination. This change reduced potential energy savings and corresponding operating cost savings associated with HID lamp standards. See chapter 5 of the final determination TSD for more details about the engineering analysis and chapter 11 of the final determination TSD for more detail about the NIA.

c. Shipments

For the 2010 determination, DOE calculated the installed base of HID lamps using historical shipments data provided by the National Electrical Manufacturers Association (NEMA). DOE projected future lamp shipments based on the lamp lifetimes and operating scenarios developed for the LCC and PBP analysis, as well as estimated market and substitution trends in the no-new-standards case and standards case. 75 FR 37975, 37981 (July 1, 2010). The shipments analysis and NIA for this final determination (see sections V.H and V.I) draw upon the same historical NEMA lamp shipments data in calculating the installed base of HID lamps, supplemented with additional shipments data and manufacturer input on HID market trends. DOE's current projections illustrate a sharper decline in and lower overall shipments of HID lamps than projected in the 2010 determination.

d. Summary of Changes

Since the publication of the 2010 determination, DOE received additional information from public meetings, written comments, manufacturer interviews, and further research. This new information led to the following major changes presented in this final determination: (1) the determination that equipment classes should be separated based on CCT; (2) the introduction of a percentage of commercial consumers replacing lamps with more efficacious, equal wattage lamps in response to potential standards; and (3) the revision downward of projected HID lamp shipments in the shipments analysis, based on supplemental data and manufacturer input collected on HID market trends. By creating separate equipment classes for CCT, DOE determined that standards for HPS lamps are not technologically feasible. Additionally, in modeling some commercial consumers replacing lamps with more efficacious, equal wattage lamps and revising downward projected shipments of HID lamps, the NIA yielded negative NPVs for all analyzed levels in this final determination (see section VI.C for a discussion of NIA results in the final determination). As such, DOE determined that standards for MV and MH lamps would not be economically justified.

## III. Issues Affecting the Lamps Analyzed by this Determination

### A. Lamps Analyzed by this Determination

HID is the generic name for a family of lamps including MV, MH, and HPS lamps. Although low-pressure sodium lamps are often included in the family, the definition of HID lamp set forth in EPCA requires the arc tube wall loading to be greater than three watts per square centimeter. (42 U.S.C. 6291(46)) Because low-pressure sodium lamps do not satisfy this requirement, they are not considered HID lamps according to the statute, and are therefore not considered in this final determination. Definitions for these lamps are discussed in chapter 2 of the final determination TSD.

DOE first analyzed the potential energy savings of the HID lamp types that fall within the EPCA definition of "HID lamp," as well as the technological feasibility of more efficient lamps for each lamp type. For the HID lamps that met these ladder EPCA criteria, DOE conducted a full economic analysis with the LCC analysis, NIA, and MIA (see sections V.G, V.I, and V.J below) to determine whether standards would be economically justified.

After considering the comments on the NOPD, DOE determined that there are no design options to increase the efficacy of HPS lamps, indicating that standards for this lamp technology are not technologically feasible. Specifically, DOE determined that sapphire arc tube technology is not a valid technology option for increased efficacy in HPS lamps (see section V.A.3.b below for further details).

Regarding MV and MH lamps, available information indicated that energy conservation standards for certain MV and MH lamps were both technologically feasible and would save a significant amount of energy. Therefore, DOE conducted the full economic analysis for those lamp types to determine whether standards would be economically justified. Specifically, DOE analyzed the economic justification of potential energy conservation standards for MH lamps with a rated wattage greater than or equal to 50 watts (W) and less than or equal to 2000 W, and CCTs greater than or equal to 2800 K and less than 7000 K. DOE also analyzed the economic justification of energy conservation standards for MV lamps with a rated wattage greater than or equal to 50 W and less than or equal to 1000 W, and CCTs greater than or equal to 3200 K and less than or equal to 6800 K. Table III.1 provides a summary of the HID lamps analyzed.

**Table III.1 CCT and Wattage Ranges Analyzed**

| Lamp Type | Wattage | CCT |
|---|---|---|
| MV | 50–1000 W | 3200–6800 K |
| MH | 50–2000 W | 2800–6999 K |

In summary, DOE excluded the following HID lamps from analysis of economic justification based on these lamps not meeting the criteria of significant energy savings or technological feasibility:

- HPS lamps;
- directional HID lamps;
- self-ballasted HID lamps;
- lamps designed to operate exclusively on electronic ballasts;
- high-color rendering index (CRI) MH lamps (a CRI greater than or equal to 95);
- colored MH lamps (a CRI of less than 40);
- MV lamps that are double-ended, have a non-screw base, and have no outer bulb;
- HID lamps that have a CCT of 5000–6999 K, have a non-screw base, and have non-T-shaped bulbs; and
- electrodeless HID lamps.

See chapter 2 of the final determination TSD for a more detailed discussion of which HID lamps did and did not meet the criteria for analysis and of the rationale behind those selections.

B. Standby/Off Mode

EPCA defines active mode as the condition in which an energy-using piece of equipment is connected to a main power source, has been activated, and provides one or more main functions. (42 U.S.C. 6295)(gg)(1)(A)) Standby mode is defined as the condition in which an energy-using piece of equipment is connected to a main power source and offers one or more of the following user-oriented or protective functions: facilitating the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer; or providing continuous functions, including information or status displays (including clocks) or sensor-based functions. Id. Off mode is defined as the condition in which an energy-using piece of equipment is connected to a main power source, and is not providing any standby or active mode function. Id.

DOE conducted an analysis of the applicability of standby mode and off mode energy use for HID lamps. DOE determined that HID lamps that are subject of this final determination do not operate in standby mode or off mode. HID lamps do not offer any secondary user-oriented or protective functions or continuous standby mode functions. Because all energy use of HID lamps is accounted for in the active mode, DOE did not analyze potential standards for lamp operation in standby and off mode in this final determination.

C. Metric

To analyze energy conservation standards related to HID lamps, DOE must select a metric for rating the performance of the lamps. DOE used initial efficacy for consideration and analysis of energy conservation standards for HID lamps. Additionally, because dimming is uncommon for HID lamps, DOE assessed initial efficacy of all lamps while operating at full light output.

D. Coordination of the Metal Halide Lamp Fixture and HID Lamp Rulemakings

For this final determination, DOE used shared data sources between the metal halide lamp fixture (MHLF) standards rulemaking (Docket No. EERE-2009-BT-STD-0018)[2] and this HID lamp determination. DOE's analysis of HID lamps assumed that MHLFs purchased after the compliance date of the MHLF final rule use ballasts compliant with those standards.

## IV. General Discussion

A. Test Procedures

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6314) Manufacturers of covered equipment must use these test procedures to certify to DOE that their equipment complies with EPCA energy conservation standards and to quantify the efficiency of their equipment. Also, these test procedures must be used whenever testing is required in an

[2] A final rule for MHLF energy conservation standards was published in February 2014. For more information on the MHLF standards rulemaking, see http://www.regulations.gov/#!docketDetail;D=EERE-2009-BT-STD-0018.

enforcement action to determine whether covered equipment complies with EPCA standards.

Based on comments received on a HID lamps test procedure notice of proposed rulemaking (NOPR) published on December 15, 2011 (76 FR 77914) and subsequent additional research, DOE proposed revisions to and clarification of the proposed HID lamp test procedures. DOE published these proposed revisions and clarifications in a test procedure supplemental notice of proposed rulemaking (SNOPR).[3] 79 FR 29631 (May 22, 2014). The analysis in this final determination is based upon the test procedures put forward in the test procedure SNOPR.

## B. Technological Feasibility

### 1. General

In the final determination, DOE conducted a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficacy of HID lamps. As the first step in such an analysis, DOE developed a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determined which of those means for improving efficacy are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible, pursuant to 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

[3] The HID lamp test procedure SNOPR is available at: http://www.regulations.gov/#!documentDetail;D=EERE-2010-BT-TP-0044-0013.

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). For further details on the screening analysis, see section V.B of this final determination and chapters 2 and 4 of the final determination TSD.

2. Maximum Technologically Feasible Levels

When DOE analyzes a new 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 that product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible ("max-tech") improvements in efficacy for HID lamps, using the design parameters for the most efficacious products available on the market or in working prototypes. (See chapter 5 of the final determination TSD.) The max-tech levels that DOE determined for this final determination are described in chapters 2 and 5 of the final determination TSD.

## C. Energy Savings

### 1. Determination of Savings

For each EL in each equipment class, DOE projected energy savings for the equipment that is the subject of this final determination purchased in the 30-year period that would begin in the expected year of compliance with any new standards (2018–2047). The savings are measured over the entire lifetime of equipment purchased in the 30-year analysis period.[4] DOE quantified the energy savings attributable to each EL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption in the absence of new mandatory efficacy standards, and it considers market forces and policies that affect demand for more efficient equipment.

DOE used its NIA spreadsheet model to estimate energy savings from potential standards for the equipment that are the subject of this final determination. The NIA spreadsheet model (described in section V.I of this notice) calculates energy savings in site energy, which is the energy directly consumed by equipment at the locations where they are used. DOE reports national energy savings on an annual basis in terms of the source (primary) energy savings, which is the savings in the energy that is used to generate and transmit the site energy. To convert site energy to source energy, DOE

[4] In the past DOE presented energy savings results for only the 30-year period that begins in the year of compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured over the entire lifetime of equipment purchased in the 30-year period. DOE has chosen to modify its presentation of national energy savings to be consistent with the approach used for its national economic analysis.

derived annual conversion factors from the model used to prepare the Energy Information Administration's (EIA's) Annual Energy Outlook 2015 (AEO2015).

DOE estimated full-fuel-cycle (FFC) energy savings. 76 FR 51281 (August 18, 2011), as amended at 77 FR 49701 (August 17, 2012). The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels, and thus presents a more complete picture of the impacts of energy efficiency standards. DOE's evaluation of FFC savings is driven in part by the National Academy of Science's (NAS) report on FFC measurement approaches for DOE's Appliance Standards Program.[5] The NAS report discusses that FFC was primarily intended for energy efficiency standards rulemakings where multiple fuels may be used by particular equipment. In the case of this final determination pertaining to HID lamps, only a single fuel—electricity—is consumed by the equipment. DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered equipment. Although the addition of FFC energy savings in rulemakings is consistent with the recommendations, the methodology for estimating FFC does not project how fuel markets would respond to a potential standards rulemaking. The FFC methodology simply estimates how much additional energy may be displaced if the estimated fuel were not consumed by the equipment covered in this final determination. It is also important to note that inclusion of FFC savings does not affect DOE's choice of potential standards. For more

[5] "Review of Site (Point-of-Use) and Full-Fuel-Cycle Measurement Approaches to DOE/EERE Building Appliance Energy- Efficiency Standards,'' (Academy report) was completed in May 2009 and included five recommendations. A copy of the study can be downloaded at: http://www.nap.edu/catalog/12670/review-of-site-point-of-use-and-full-fuel-cycle-measurement-approaches-to-doeeere-building-appliance-energy-efficiency-standards-letter-report.

information on FFC energy savings, see section V.I of this determination, and chapter 11 and appendix 11A of the final determination TSD.

2. Significance of Savings

To adopt standards that are more stringent for a covered product, DOE must determine that such action would result in "significant" energy savings. (42 U.S.C. 6295(o)(3)(B)) Although the term "significant" is not defined in the Act, the U.S. Court of Appeals, in Natural Resources Defense Council v. Herrington, 768 F.2d 1355, 1373 (D.C. Cir. 1985), indicated that Congress intended "significant" energy savings in the context of EPCA to be savings that were not "genuinely trivial." DOE analyzed the energy savings for each potential standard level for each equipment class in this final determination (presented below in section VI.C.1).

D. Economic Justification

In determining whether potential energy conservation standards for HID lamps would be economically justified, DOE analyzed the results of the following analyses: (1) the market and technology assessment that characterizes where and how HID lamps are used; (2) an engineering analysis that estimates the relationship between equipment costs and energy use; (3) an LCC and PBP analysis that estimates the costs and benefits to users from increased efficacy in HID lamps; (4) an NIA that estimates potential energy savings on a national scale and potential economic costs and benefits that would result from improving efficacy in the considered HID lamps; and (5) an MIA that determines the potential impact new standards for HID lamps would have on manufacturers.

## V. Methodology and Discussion

### A. Market and Technology Assessment

1. General

In conducting the market and technology assessment for this final determination, DOE developed information that provides an overall picture of the market for the equipment concerned, including the purpose of the products, the industry structure, and the market characteristics. This activity included both quantitative and qualitative assessments based on publicly available information. The subjects addressed in the market and technology assessment for this final determination include: equipment classes and manufacturers; historical shipments; market trends; regulatory and non-regulatory programs; and technologies that could improve the efficacy of the HID lamps under examination. See chapter 3 of the final determination TSD for further discussion of the market and technology assessment.

2. Equipment Classes

For this final determination, DOE divided equipment into classes by: (a) the type of energy used, (b) the capacity of the equipment, or (c) any other performance-related features that justifies different standard levels, such as features affecting consumer utility. (42 U.S.C. 6295(q)) DOE then considered establishing separate standard levels for each equipment class based on the criteria set forth in 42 U.S.C. 6317(a).

In this final determination, DOE analyzed CCT, wattage, bulb finish, and luminaire characteristic as the equipment-class-setting factors. DOE analyzed 24 equipment classes for HID lamps, as shown in Table V.1. See chapters 2 and 3 of the final determination TSD for a more detailed discussion on equipment classes analyzed for HID lamps.[6]

**Table V.1 Equipment Classes Analyzed in Final Determination**

| **CCT Range**<br>K | **Wattage**<br>W | **Bulb Finish*** | **Luminaire Characteristic**** |
|---|---|---|---|
| ≥2800 and ≤4500 | ≥50 and ≤400 | Clear | Enclosed |
| | | | Open |
| | | Coated | Enclosed |
| | | | Open |
| | >400 and ≤1000 | Clear | Enclosed |
| | | | Open |
| | | Coated | Enclosed |
| | | | Open |
| | >1000 and ≤2000 | Clear | Enclosed |
| | | | Open |
| | | Coated | Enclosed |
| | | | Open |
| >4500 and <7000 | ≥50 and ≤400 | Clear | Enclosed |
| | | | Open |
| | | Coated | Enclosed |
| | | | Open |
| | >400 and ≤1000 | Clear | Enclosed |
| | | | Open |
| | | Coated | Enclosed |
| | | | Open |
| | >1000 and ≤2000 | Clear | Enclosed |
| | | | Open |
| | | Coated | Enclosed |
| | | | Open |

* MV lamps regardless of bulb finish are placed in the clear equipment classes for their respective CCT and wattage.
** MV lamps are placed in the enclosed equipment classes for their respective wattage and CCT.

[6] When delineating the equipment class CCT ranges of ≥2800 K and ≤4500 K and of >4500 K and <7000 K in text, DOE uses the shorthand 2800 K – 4500 K and 4501 K – 6999 K, respectively. Similarly, when writing out the equipment class wattage ranges of ≥50 W and ≤400 W, >400 W and ≤1000 W, and >1000 W and ≤2000 W in text, DOE uses the shorthand 50 W – 400 W, 401 W – 1000 W, and 1001 W – 2000 W, respectively.

### 3. Technology Options

The following sections detail the technology options that DOE analyzed in this final determination as viable means of increasing the efficacy of HID lamps.

#### a. Mercury Vapor

MV ballasts, other than specialty application MV ballasts, have been banned from import or production in the United States since January 1, 2008. (42 U.S.C. 6295(ee)) This ban effectively limits the installation of new MV fixtures and ballasts, meaning the only MV lamps currently sold are replacement lamps. DOE understands there is limited industry design emphasis on MV lamps and that there are limited methods to improving the efficacy of MV lamps using MV technology. In this final determination, DOE found that change of technology is the sole method by which commercial consumers of MV lamps can obtain higher lamp efficacies.

#### b. High-Pressure Sodium Lamps

HPS lamps are already very efficacious (up to 150 lumens per watt), but have intrinsically poor color quality. DOE did not identify any technology options currently utilized in commercially available HPS lamps that increase lamp efficacy. In the interim analysis, DOE identified academic papers that indicated potential increases in efficacy were possible by constructing the arc tubes out of a sapphire material, or single crystal aluminum oxide. Several manufacturers produced HPS lamps with a sapphire arc tube beginning in the late 1970s, but these lamps have since been discontinued.

In the interim analysis, DOE found that sapphire material had five percent greater transmission of light compared to the traditionally used polycrystalline alumina (PCA) material and equated this with a potential five percent increase in lamp efficacy. 78 FR 13566 (Feb. 28, 2013). However, during manufacturer interviews held between the interim analysis and NOPD, DOE received feedback from manufacturers that the increase in transmission associated with using sapphire material instead of PCA does not necessarily result in an equal increase in efficacy. This is because the material does not transmit all wavelengths uniformly, which affects the perceived brightness of the light. Because these lamps are no longer manufactured, DOE cannot empirically validate the potential increase in efficacy using sapphire arc tubes. Additionally, DOE received feedback that HPS lamps using sapphire arc tubes are much more susceptible to catastrophic failure and would require enclosed fixtures for safe operation. Currently, all HPS lamps that are commercially available can be used in open fixtures. An enclosed fixture would reduce the efficacy of the sapphire HPS system (due to absorption in the lens used to enclose the fixture) and likely negate any small increase in efficacy gained from using sapphire arc tubes.

For these reasons, DOE does not believe that the use of sapphire arc tubes would increase the efficacy of HPS lamps in practice. As such, DOE concluded sapphire arc tubes are not a valid technology option for HPS lamps. Further, DOE found no other viable technology options to improve the efficacy of HPS lamps. Therefore, DOE determined standards for HPS lamps are not technologically feasible and did not analyze standards for HPS lamps in the final determination.

c. Metal Halide

DOE identified a number of technology options that could improve MH lamp efficacy. These technology options include improving arc tube design through the use of ceramic arc tubes, optimization of the arc tube, and optimization of the arc tube fill gas.

d. Summary

Table V.2 summarizes the technology options identified for HID lamps in this final determination. For more detail on the technology options that DOE analyzed to improve MV, HPS, and MH lamp efficacy, see chapters 2 and 3 of the final determination TSD.

**Table V.2 Final Determination HID Lamp Technology Options**

| Lamp Type | Technology Option | Description |
|---|---|---|
| HPS | None | No technology options available |
| MV | Change lamp type | Use MH technology instead of MV technology |
| MH | Ceramic arc tubes | Use CMH technology instead of quartz MH lamps |
| | Arc tube optimization | Design the shape of the arc tube so that it facilitates an increase in MH vapor pressure; change the thickness of quartz, optimize electrode positioning, improve the purity of the materials; and improve the manufacturing processes to ensure the consistency and quality of the arc tube construction |
| | Fill gas optimization | Optimize the gas fill pressure and chemistry |

B. Screening Analysis

DOE consults with industry, technical experts, and other interested parties to develop a list of technology options for consideration. In the screening analysis, DOE determines which technology options to consider further and which to screen out.

Appendix A to subpart C of 10 CFR part 430, "Procedures, Interpretations, and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products" (the Process Rule), sets forth procedures to guide DOE in its consideration and promulgation of new or revised energy conservation standards. These procedures elaborate on the statutory criteria provided in 42 U.S.C. 6295(o). In particular, sections 4(b)(4) and 5(b) of the Process Rule provide guidance to DOE for determining which technology options are unsuitable for further consideration: technological feasibility, practicability to manufacture, install and service, adverse impacts on product utility or product availability, and adverse impacts on health or safety.

For MH lamps, DOE identified ceramic arc tubes as a technology option that can improve lamp efficacy relative to quartz arc tubes. Ceramic arc tubes are a technology option used in all CMH lamps. Although CMH lamps are commercially available from 50–400 W, they are not manufactured from 401–2000 W.[7] DOE learned from manufacturers that it is technologically possible to create 401–1000 W CMH lamps on an individual scale in laboratory conditions. However, manufacturers may have difficulty

[7] There is one example of a CMH lamp in this wattage range. It is an 860 W CMH lamp that is designed to be used on a 1000 W ballast and can operate on both probe-start and pulse-start ballasts. Because this lamp employs proprietary technology, DOE does not use this lamp as an example of CMH lamps being commercially available from 401–1000 W.

producing these lamps on a scale large enough to serve the entire market. Because of this, DOE determined that ceramic arc tubes for 401–2000 W MH lamps do not pass the criterion that they be practicable to manufacture, install, and service. In this final determination, DOE did not consider ceramic arc tubes as design options for MH lamps from 401–2000 W.

All other technology options for MV and MH lamps meet the screening criteria and are considered as design options in the engineering analysis. These design options include changing from a MV lamp to a MH lamp, using ceramic arc tubes instead of quartz arc tubes, optimizing the arc tube shape and design, and optimizing the fill gas pressure and chemistry. These design options are summarized in Table V.3. Chapters 2 and 4 of the final determination TSD provide additional information regarding the design options considered in the final determination.

**Table V.3 Final Determination HID Lamp Design Options**

| Lamp Type | Design Option | Description |
|---|---|---|
| HPS | None | No design options available |
| MV | Change lamp type | Use MH technology instead of MV technology |
| MH | Ceramic arc tubes (50–400 W) | Use CMH technology instead of quartz MH lamps |
| | Arc tube optimization | Design the shape of the arc tube so that it facilitates an increase in MH vapor pressure; change the thickness of quartz, alter the fill gas chemistry; optimize electrode positioning; improve the purity of the materials; and improve the manufacturing processes to ensure the consistency and quality of the arc tube construction |
| | Fill gas optimization | Optimize the gas fill pressure and chemistry |

C. Engineering Analysis

For this final determination, DOE derived ELs in the engineering analysis and lamp end-user prices in the equipment price determination. The engineering analysis focuses on selecting commercially available lamps that incorporate design options that improve efficacy. The following discussion summarizes the general steps and results of the engineering analysis.

1. Representative Equipment Classes

When multiple equipment classes exist, to streamline analysis, DOE selects certain classes as “representative,” primarily because of their high market volumes and unique performance characteristics. DOE then scales the ELs from representative equipment classes to those equipment classes it does not analyze directly. Table V.4 lists the equipment classes that DOE selected as representative.

**Table V.4 Representative Equipment Classes for HID Lamps**

| CCT Range<br>K | Wattage<br>W | Bulb Finish* | Luminaire Characteristic** |
|---|---|---|---|
| ≥2800 and ≤4500 | ≥50 and ≤400 | Clear | Enclosed |
| | >400 and ≤1000 | Clear | Enclosed |
| | >1000 and ≤2000 | Clear | Enclosed |

* MV lamps regardless of bulb finish are placed in the clear equipment classes for their respective CCT and wattage.

** MV lamps are placed in the enclosed equipment classes for their respective wattage and CCT.

2. Baseline Lamps and Representative Lamp Types

Because no Federal energy conservation standards exist for HID lamps, the baseline lamps represent the most common, least efficacious lamps sold within the equipment class. For each baseline lamp, DOE selected more efficacious replacement lamps to measure potential energy-saving improvements. DOE refers to the baseline lamp and its more efficacious replacements collectively herein as a "representative lamp type." The representative lamp type is named by its baseline unit. For example, the 400 W MV representative lamp type refers to the 400 W MV baseline lamp and all of its more efficacious replacements.

DOE used performance data presented in manufacturer catalogs to determine lamp efficacy. DOE also considered other lamp characteristics in choosing the most appropriate baseline for each equipment class. These characteristics include the wattage and technology type (*i.e.*, MH or MV), among others. For some of the representative lamp types, DOE selected multiple baseline models to ensure consideration of different high-volume lamps and their associated commercial consumer economics. For example, although MV lamps are the least efficacious products available, the HID market has largely shifted away from MV lamps and commercial consumers of MH lamp-and-ballast systems incur different costs than commercial consumers of MV lamp-and-ballast systems. For these reasons, DOE selected both MV and MH lamps as baselines for certain equipment classes.

Table V.5 lists the baseline lamps and representative lamp types. See chapters 2 and 5 of the final determination TSD for additional detail.

**Table V.5 Baseline Lamps and Representative Lamp Types**

| CCT Range | Wattage | Bulb Finish* | Luminaire Characteristic** | Representative Lamp Type | Baseline Lamp Type | Baseline Wattage |
|---|---|---|---|---|---|---|
| 2800–4500 K | 50–400 W | Clear | Enclosed | 100 W MV | MV | 100 |
| | | | | | MH | 70 |
| | | | | 175 W MV | MV | 175 |
| | | | | | MH | 150 |
| | | | | 250 W MV | MV | 250 |
| | | | | | MH | 175 |
| | | | | 400 W MV | MV | 400 |
| | | | | | MH | 250 |
| | | | | 400 W MH | MH | 400 |
| | 401–1000 W | Clear | Enclosed | 1000 W MV | MV | 1000 |
| | | | | | MH | 750 |
| | | | | 1000 W MH | MH | 1000 |
| | 1001–2000 W | Clear | Enclosed | 2000 W MH | MH | 2000 |

* MV lamps regardless of bulb finish are placed in the clear equipment classes for their respective CCT and wattage.

** MV lamps are placed in the enclosed equipment classes for their respective wattage and CCT.

3. More Efficacious Substitutes

DOE selected commercially available HID lamps with efficacies above the baseline as replacements for the baseline model(s) in each representative equipment class. When selecting more efficacious substitute lamps, DOE considered only design options that meet the criteria outlined in the screening analysis (see section V.B). Depending on the equipment class (see Table V.6), DOE analyzed standard efficacy quartz MH, high efficacy quartz MH, and CMH lamps as more efficacious substitutes for the baseline lamps.

**Table V.6 More Efficacious Substitute Lamp Types**

| Equipment Class | More Efficacious Substitute Lamps Analyzed |
|---|---|
| 50–400 W | Standard efficacy quartz MH, high efficacy quartz MH, and CMH lamps |
| 401–1000 W | Standard efficacy quartz MH and high efficacy quartz MH lamps |
| 1001–2000 W | High efficacy quartz MH lamps |

In this final determination, DOE considered a number of different potential pathways a commercial consumer might choose when identifying replacements that are more efficacious. When purchasing a new and compliant lamp, a commercial consumer can purchase just a new lamp, a new lamp-and-ballast system, or an entirely new fixture. For each of these options, a commercial consumer can also choose between a replacement that maintains the wattage of the existing system or a reduced wattage replacement. See chapters 2 and 5 of the final determination TSD for additional detail.

4. Determine Efficacy Levels

DOE developed ELs based on: (1) the design options associated with the equipment class studied and (2) the max-tech EL for that class. DOE's ELs for this final determination are based on manufacturer catalog data. Table V.7 summarizes the EL equations for each representative equipment class. More information on the described ELs can be found in chapters 2 and 5 of the final determination TSD.

**Table V.7 Efficacy Level Equations for the Representative Equipment Classes**

| **Representative Equipment Class** | **Minimum Initial Efficacy† (lm/W)** | | |
|---|---|---|---|
| | **EL 1** | **EL 2** | **EL 3** |
| 2800–4500 K, 50–400 W, clear*/enclosed** | $38.5 \times P^{0.1350}$ | $44.4 \times P^{0.1350}$ | $40.4 \times P^{0.1809}$ |
| 2800–4500 K, 401–1000 W, clear/enclosed | $0.0116 \times P + 81.8$ | $0.0173 \times P + 92.8$ | N/A |
| 2800–4500 K, 1001–2000 W, clear/enclosed | 93.4 | N/A | N/A |

* MV lamps are placed in the clear equipment classes for their respective CCT and wattage regardless of bulb finish.
** MV lamps are placed in the enclosed equipment classes for their respective wattage and CCT.
† P is defined as the rated wattage of the lamp.

5. Scaling to Equipment Classes Not Directly Analyzed

For the equipment classes not analyzed directly, DOE scaled the ELs from the representative to non-representative equipment classes based on efficacy ratios observed in manufacturer catalog data. For example, DOE calculated an average percentage difference in efficacy between lamps in different equipment classes (one representative and one non-representative) and used this percentage difference to scale the ELs from the representative to the non-representative equipment classes. Table V.8 lists the scaling factors calculated in the final determination analysis.

**Table V.8 Scaling Factors**

| Bulb Finish | Luminaire Characteristic | CCT |
|---|---|---|
| 0.945 | 0.950 | 0.812 |

*To calculate the efficacy requirement for a scaled equipment class, the representative equipment class equation is multiplied by each scaling factor of the characteristics of the equipment class that differ from the representative class.

6. HID Systems

In this final determination, DOE only analyzed standards for HID lamps. However, HID lamps are just one component of an HID lighting system. HID lamps must be paired with specific ballasts to regulate the current and power supplied to the lamp. These lamp-and-ballast systems are then housed in an HID lamp fixture[8] to protect the components, enable mounting, and direct the light to the target area. When considering changes to HID lamps, DOE recognizes the importance of also analyzing the impact on both the ballast and the fixture. Additional components may also be required if placing a new lamp-and-ballast system in an existing fixture, including an appropriate lamp socket

[8] Here, DOE uses the term “fixture” to refer to the enclosure that houses the lamp and ballast.

and ballast brackets. See chapter 2, chapter 5, appendix 5A, and appendix 5B of the final determination TSD for additional detail.

D. Equipment Price Determination

The equipment price determination describes the methodology followed in developing end-user prices for HID lamps and manufacturer selling prices (MSPs) for ballasts, fixtures, and retrofit kit components (brackets and sockets) analyzed in this final determination. DOE developed ballast and fixture MSPs in addition to lamp MSPs because a change of ballast and fixture is often required when switching to a more efficacious lamp. In addition, DOE developed MSPs for brackets and sockets packaged in lamp-and-ballast retrofit kits because commercial consumers will sometimes also have the option of keeping the fixture housing and installing a new lamp-and-ballast system. These systems will often require a change in the socket and brackets used for mounting the ballast.

For HID lamps, DOE developed three sets of discounts from blue-book prices, representing low (State procurement), medium (electrical distributors), and high (Internet retailers) end-user lamp prices. For MH ballasts, fixtures, sockets, and brackets, DOE performed teardown analyses to estimate manufacturer production costs (MPCs) and a manufacturer markup analysis to estimate the MSPs. For additional detail on the equipment price determination, see chapters 2, 6, and appendix 6A of the final determination TSD.

E. Markups Analysis

Markups are multipliers that relate MSPs to end-user purchase prices, and vary with the distribution channel through which commercial consumers purchase the equipment. DOE estimated end-user prices for representative HID lamp designs directly, rather than develop MSPs from a bill of materials and manufacturer markup analysis (final determination TSD chapter 6).[9] However, DOE estimated price markups to calculate end-user prices from MSPs for HID ballasts and fixtures as inputs to the LCC and PBP analysis, and the NIA (chapters 9 and 11, respectively, of the final determination TSD). Appendix 6A of the final determination TSD describes the process by which DOE developed MPCs and MSPs for HID ballasts and fixtures. Chapters 2 and 7 of the final determination TSD provides additional detail on the markup analysis for developing end-user prices for HID ballasts and fixtures.

F. Energy Use Analysis

For the energy use analysis, DOE estimated the energy use of HID lamp-and-ballast systems in actual field conditions. The energy use analysis provided the basis for other DOE analyses, particularly assessments of the energy savings and the savings in operating costs that could result from DOE's adoption of potential new standard levels. DOE multiplied annual usage (in hours per year) by the lamp-and-ballast system input power (in watts) to develop annual energy use estimates. Chapters 2 and 8 of the final determination TSD provide a more detailed description of DOE's energy use analysis.

[9] For this final determination, DOE used estimated markups to develop MSPs for HID lamps for the MIA (see chapter 12 of the final determination TSD).

G. Life-Cycle Cost and Payback Period Analysis

DOE conducted the LCC and PBP analysis to evaluate the economic effects of potential energy conservation standards for HID lamps on individual commercial consumers. For any given EL, DOE calculated the PBP and the change in LCC relative to an estimated baseline equipment EL. The LCC is the total commercial consumer expense over the life of the equipment, consisting of purchase, installation, and operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounted future operating costs to the time of purchase and summed them over the lifetime of the equipment. The PBP is the estimated amount of time (in years) it takes commercial consumers to recover the increased purchase cost (including installation) of more efficacious equipment through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost (normally higher) by the change in average annual operating cost (normally lower) that results from the more stringent standard. Chapters 2 and 9, and appendices 9A and 9B, of the final determination TSD provide details on the spreadsheet model and all the inputs to the LCC and PBP analysis.

H. Shipments Analysis

DOE projected equipment shipments to calculate the national effects of potential standards on energy use, NPV, and future manufacturer cash flows. DOE developed shipment projections based on an analysis of key market drivers for each considered HID lamp type. In DOE's shipments model, shipments of equipment are driven by new construction, stock replacements, and other types of purchases. The shipments model takes an accounting approach, tracking market shares of each equipment class and the vintage of units in the existing stock. Stock accounting uses equipment shipments as inputs to estimate the age distribution of in-service equipment stocks for all years. The age distribution of in-service equipment stocks is a key input to calculations of both the NES and the NPV, because operating costs for any year depend on the age distribution of the stock. Chapters 2 and 10 of the final determination TSD provide a more detailed description of DOE's shipments analysis.

## I. National Impact Analysis

DOE's NIA assessed the cumulative NES and the cumulative national economic impacts of ELs (i.e., potential standards cases) considered for the equipment classes analyzed. The analysis measures economic impacts using the NPV metric, which presents total commercial consumer costs and savings expected to result from potential standards at specific ELs, discounted to their present value. For a given EL, DOE calculated the NPV, as well as the NES, as the difference between a no-new-standards case projection and the standards-case projections. Chapters 2 and 11, and appendices 11A and 11B, of the final determination TSD provide details on the spreadsheet model and all the inputs to the NIA.

## J. Manufacturer Impact Analysis

DOE conducted an MIA for HID lamps to estimate the financial impact of potential energy conservation standards on manufacturers. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model customized for HID lamps covered in this final determination. The key GRIM inputs are industry cost structure data, shipment data, equipment costs, and assumptions about markups and conversion costs. The key MIA output is industry net present value (INPV). DOE used the GRIM to calculate cash flows using standard accounting principles and to compare changes in INPV between a no-new-standards case and various ELs at each equipment class (the standards cases). The difference in INPV between the no-new-standards case and standards cases represents the financial impact of potential energy conservation standards on HID lamp manufacturers. Different sets of assumptions (scenarios) produce different INPV results. The qualitative part of the MIA addresses how potential standards could impact manufacturing capacity and industry competition, as well as any differential impact the potential standard could have on any particular subgroup of manufacturers. See chapter 12 of this final determination TSD for additional details on DOE's MIA.

## VI. Analytical Results

### A. Economic Impacts on Individual Commercial Consumers

To evaluate the net economic impact of standards on commercial consumers, DOE conducted an LCC and PBP analysis for each EL. In general, higher efficacy equipment would affect commercial consumers in two ways: (1) annual operating expenses would decrease; and (2) purchase prices would increase. Section V.G of this determination discusses the inputs DOE used for calculating the LCC and PBP.

The key outputs of the LCC analysis are mean LCC savings relative to the baseline equipment, as well as a probability distribution or likelihood of LCC reduction or increase, for each efficacy level and equipment class.[10] In its LCC analysis, DOE traditionally assumes that the commercial consumer purchases a covered design upon the compliance date of potential standards (in this case, 2018). The resulting values then necessarily reflect the projected market for HID equipment in 2018, and are reported by equipment class in Table VI.1, Table VI.2, and Table VI.3.

The LCC analysis also estimates the fraction of commercial consumers for which the LCC will decrease (net benefit), remain unchanged (no impact), or increase (net cost) relative to the baseline case. The last column in each table contains the median PBPs for the commercial consumers purchasing a design compliant with the efficacy level.

In evaluating these results relative to cumulative NPV, it is important to note that the LCC and PBP analysis does not reflect the long-term dynamics of the declining market for HID equipment, which are captured in the NIA shipments period (2018 – 2047). As a result, the average LCC savings—based on the projected 2018 market—may be positive in some cases (*e.g.*, EL 2 and EL 3 for the >2800 K and ≤4500 K and ≥50 W to ≤400 W equipment class), whereas the cumulative NPV results for these ELs are negative (see Table VI.16). DOE explored the effects of the declining HID market on average LCC savings by conducting a sensitivity analysis based on the projected market in 2022, with results reported by equipment class in Table VI.4, Table VI.5, and Table VI.6. These results show a general erosion of average LCC savings, and demonstrate increasing consistency with the cumulative NPV results. For the >2800 K and ≤4500 K

[10] Commercial consumers, in the no-new-standards scenario, who buy the equipment at or above the EL under consideration, would be unaffected (no impact) if the potential standard were to be set at that EL.

and ≥50 W to ≤400 W equipment class, average LCC savings for EL 2 become negative, with a majority of affected commercial consumers remaining negatively impacted. Average LCC savings for EL 3 in this equipment class—while still positive—are significantly diminished, with a majority of affected commercial consumers experiencing a net cost. Following this trend, DOE would expect LCC savings for EL 3 to become increasingly negative for an increasing proportion of affected commercial consumers over the NIA analysis period.

Based on this sensitivity analysis, DOE believes its main LCC and PBP analysis results (including some cases of positive average LCC savings) are consistent with negative cumulative NPV results in the NIA, given the declining market for HID equipment. Chapter 9 of the final determination TSD examines the relationship of the LCC and PBP analysis and projected HID market in further detail.

**Table VI.1 HID Lamps >2800 K and ≤4500 K and ≥50 W to ≤400 W—LCC and PBP Results**

| Efficacy Level | Life-Cycle Cost 2014$ | | | Life-Cycle Cost Savings | | | | Median Payback Period Years |
|---|---|---|---|---|---|---|---|---|
| | Installed Cost | Discounted Operating Cost | LCC | Average Savings 2014$ | Percentage of Commercial Consumers that Experience* | | | |
| | | | | | Net Cost | No Impact | Net Benefit | |
| Baseline | 335.60 | 1726.95 | 2062.55 | -- | -- | -- | -- | -- |
| 1 | 340.72 | 1724.33 | 2065.05 | (2.50) | 1 | 99 | 0 | 100.00 |
| 2 | 393.94 | 1662.25 | 2056.20 | 6.35 | 52 | 36 | 12 | 100.00 |
| 3 | 533.97 | 1437.77 | 1971.74 | 90.81 | 36 | 23 | 42 | 11.00 |
| * Any minor incongruities among various reported metrics are the result of rounding. | | | | | | | | |

**Table VI.2 HID Lamps >2800 K and ≤4500 K and >400 and ≤1000 W—LCC and PBP Results**

| Efficacy Level | Life-Cycle Cost 2014$ | | | Life-Cycle Cost Savings | | | | Median Payback Period years |
|---|---|---|---|---|---|---|---|---|
| | Installed Cost | Discounted Operating Cost | LCC | Average Savings 2014$ | Percentage of Commercial Consumers that Experience* | | | |
| | | | | | Net Cost | No Impact | Net Benefit | |
| Baseline | 484.68 | 6065.71 | 6550.39 | -- | -- | -- | -- | -- |
| 1 | 484.68 | 6065.71 | 6550.39 | 0.00 | 0 | 100 | 0 | N/A** |
| 2 | 526.13 | 6100.06 | 6626.19 | (75.80) | 90 | 9 | 2 | 100.00 |

* Any minor incongruities among various reported metrics are the result of rounding.
** Zero impacted commercial consumers (median PBP calculated for affected commercial consumers only).

**Table VI.3 HID Lamps >2800 K and ≤4500 K and >1000 W to ≤2000 W—LCC and PBP Results**

| Efficacy Level | Life-Cycle Cost 2014$ | | | Life-Cycle Cost Savings | | | | Median Payback Period years |
|---|---|---|---|---|---|---|---|---|
| | Installed Cost | Discounted Operating Cost | LCC | Average Savings 2014$ | Percentage of Commercial Consumers that Experience* | | | |
| | | | | | Net Cost | No Impact | Net Benefit | |
| Baseline | 579.09 | 680.88 | 1259.97 | -- | -- | -- | -- | -- |
| 1 | 634.99 | 639.31 | 1274.30 | (14.33) | 7 | 90 | 3 | 29.34 |

* Any minor incongruities among various reported metrics are the result of rounding.

**Table VI.4 HID Lamps >2800 K and ≤4500 K and ≥50 W to ≤400 W—LCC and PBP Results (2023 Projected Market Basis)**

| Efficacy Level | Life-Cycle Cost 2014$ | | | Life-Cycle Cost Savings | | | | Median Payback Period Years |
|---|---|---|---|---|---|---|---|---|
| | Installed Cost | Discounted Operating Cost | LCC | Average Savings 2014$ | Percentage of Commercial Consumers that Experience* | | | |
| | | | | | Net Cost | No Impact | Net Benefit | |
| Baseline | 326.84 | 1688.79 | 2015.63 | -- | -- | -- | -- | -- |
| 1 | 327.03 | 1688.69 | 2015.72 | (0.08) | 0 | 100 | 0 | 100.00 |
| 2 | 521.25 | 1555.77 | 2077.02 | (61.39) | 52 | 37 | 10 | 44.38 |
| 3 | 583.73 | 1401.66 | 1985.39 | 30.24 | 42 | 23 | 35 | 15.60 |

* Any minor incongruities among various reported metrics are the result of rounding, including cases where the percentage of commercial consumers experiencing a net cost or net benefit are greater than zero, but round to zero.

**Table VI.5 HID Lamps >2800 K and ≤4500 K and >400 and ≤1000 W—LCC and PBP Results (2023 Projected Market Basis)**

| Efficacy Level | Life-Cycle Cost 2014$ | | | Life-Cycle Cost Savings | | | | Median Payback Period years |
|---|---|---|---|---|---|---|---|---|
| | Installed Cost | Discounted Operating Cost | LCC | Average Savings 2014$ | Percentage of Commercial Consumers that Experience* | | | |
| | | | | | Net Cost | No Impact | Net Benefit | |
| Baseline | 478.73 | 6031.96 | 6510.69 | -- | -- | -- | -- | -- |
| 1 | 478.73 | 6031.96 | 6510.69 | 0.00 | 0 | 100 | 0 | N/A** |
| 2 | 735.66 | 5980.27 | 6715.93 | (205.25) | 91 | 9 | 0 | 100.00 |

* Any minor incongruities among various reported metrics are the result of rounding.
** Zero impacted commercial consumers (median PBP calculated for affected commercial consumers only).

**Table VI.6 HID Lamps >2800 K and ≤4500 K and >1000 W to ≤2000 W—LCC and PBP Results (2023 Projected Market Basis)**

| Efficacy Level | Life-Cycle Cost 2014$ | | | Life-Cycle Cost Savings | | | | Median Payback Period years |
|---|---|---|---|---|---|---|---|---|
| | Installed Cost | Discounted Operating Cost | LCC | Average Savings 2014$ | Percentage of Commercial Consumers that Experience* | | | |
| | | | | | Net Cost | No Impact | Net Benefit | |
| Baseline | 639.90 | 687.87 | 1327.78 | -- | -- | -- | -- | -- |
| 1 | 716.39 | 633.18 | 1349.57 | (21.80) | 10 | 86 | 4 | 29.60 |

* Any minor incongruities among various reported metrics are the result of rounding.

B. Economic Impacts on Manufacturers

DOE performed the MIA to estimate the impact of analyzed energy conservation standards on manufacturers of HID lamps. The following sections describe the expected impacts on HID lamp manufacturers at each EL for each equipment class. Chapter 12 of the final determination TSD explains the MIA in further detail.

1. Industry Cash-Flow Analysis Results

The tables in the following sections depict the financial impacts (represented by changes in INPV) of analyzed energy conservation standards on HID lamp manufacturers as well as the conversion costs that DOE estimates HID lamp manufacturers would incur at each EL for each equipment class. To evaluate the range of cash-flow impacts on the HID lamp industry, DOE modeled two markup scenarios that correspond to the range of anticipated market responses to analyzed standards. Each scenario results in a unique set of cash flows and corresponding industry values at each EL for each equipment class. 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 (2015) through the end of the analysis period (2047).

To assess the upper (less severe) end of the range of analyzed impacts on HID lamp manufacturers, DOE modeled a flat, or preservation of gross margin, markup scenario. This scenario assumes that in the standards case, manufacturers would be able to pass along all the higher production costs required for more efficacious equipment to their commercial consumers. To assess the lower (more severe) end of the range of potential impacts, DOE modeled a preservation of operating profit markup scenario. The preservation of operating profit markup scenario assumes that in the standards case, manufacturers would be able to earn the same operating margin in absolute dollars as they would in the no-new-standards case. This represents the lower bound of industry profitability in the standards case.

Table VI.7 and Table VI.8 present the projected results of the 50-400 W equipment class under the flat and preservation of operating profit markup scenarios.

**Table VI.7 Manufacturer Impact Analysis for the ≥50 W to ≤400 W Equipment Class - Flat Markup Scenario**

| | Units | No-New-Standards Case | EL | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| **INPV** | 2014$ millions | 290.0 | 285.3 | 256.6 | 311.8 |
| **Change in INPV** | 2014$ millions | - | (4.7) | (33.3) | 21.8 |
| | % | - | (1.6) | (11.5) | 7.5 |
| **Product Conversion Costs** | 2014$ millions | - | 7.4 | 31.4 | 55.0 |
| **Capital Conversion Costs** | 2014$ millions | - | - | 6.0 | 54.5 |
| **Total Conversion Costs** | 2014$ millions | - | 7.4 | 37.4 | 109.5 |

**Table VI.8 Manufacturer Impact Analysis for the ≥50 W to ≤400 W Equipment Class - Preservation of Operating Profit Markup Scenario**

| | Units | No-New-Standards Case | EL | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| **INPV** | 2014$ millions | 290.0 | 284.9 | 239.8 | 214.1 |
| **Change in INPV** | 2014$ millions | - | (5.1) | (50.1) | (75.9) |
| | % | - | (1.7) | (17.3) | (26.2) |
| **Product Conversion Costs** | 2014$ millions | - | 7.4 | 31.4 | 55.0 |
| **Capital Conversion Costs** | 2014$ millions | - | - | 6.0 | 54.5 |
| **Total Conversion Costs** | 2014$ millions | - | 7.4 | 37.4 | 109.5 |

Table VI.9 and Table VI.10 present the projected results of the 401-1000 W equipment class under the flat and preservation of operating profit markup scenarios.

**Table VI.9 Manufacturer Impact Analysis for the ≥400 W to ≤1000 W Equipment Class - Flat Markup Scenario**

| | Units | No-New-Standards Case | EL | |
|---|---|---|---|---|
| | | | 1 | 2 |
| **INPV** | 2014$ millions | 44.6 | 44.2 | 44.8 |
| **Change in INPV** | 2014$ millions | - | (0.3) | 0.2 |
| | % | - | (0.8) | 0.6 |
| **Product Conversion Costs** | 2014$ millions | - | 0.5 | 4.9 |
| **Capital Conversion Costs** | 2014$ millions | - | - | 0.8 |
| **Total Conversion Costs** | 2014$ millions | - | 0.5 | 5.7 |

**Table VI.10 Manufacturer Impact Analysis for the ≥400 W to ≤1000 W Equipment Class - Preservation of Operating Profit Markup Scenario**

| | Units | No-New-Standards Case | EL | |
|---|---|---|---|---|
| | | | 1 | 2 |
| **INPV** | 2014$ millions | 44.6 | 44.2 | 40.7 |
| **Change in INPV** | 2014$ millions | - | (0.3) | (3.9) |
| | % | - | (0.8) | (8.7) |
| **Product Conversion Costs** | 2014$ millions | - | 0.5 | 4.9 |
| **Capital Conversion Costs** | 2014$ millions | - | - | 0.8 |
| **Total Conversion Costs** | 2014$ millions | - | 0.5 | 5.7 |

Table VI.11 and Table VI.12 present the projected results of the 1001-2000 W equipment class under the flat and preservation of operating profit markup scenarios.

**Table VI.11 Manufacturer Impact Analysis for the ≥1000 W to ≤2000 W Equipment Class - Flat Markup Scenario**

| | Units | No-New-Standards Case | EL |
|---|---|---|---|
| | | | 1 |
| INPV | 2014$ millions | 3.0 | 2.2 |
| Change in INPV | 2014$ millions | - | (0.8) |
| | % | - | (25.2) |
| Product Conversion Costs | 2014$ millions | - | 0.6 |
| Capital Conversion Costs | 2014$ millions | - | 0.4 |
| Total Conversion Costs | 2014$ millions | - | 0.9 |

**Table VI.12 Manufacturer Impact Analysis for the ≥1000 W to ≤2000 W Equipment Class - Preservation of Operating Profit Markup Scenario**

| | Units | No-New-Standards Case | EL |
|---|---|---|---|
| | | | 1 |
| INPV | 2014$ millions | 3.0 | 2.3 |
| Change in INPV | 2014$ millions | - | (0.7) |
| | % | - | (24.4) |
| Product Conversion Costs | 2014$ millions | - | 0.6 |
| Capital Conversion Costs | 2014$ millions | - | 0.4 |
| Total Conversion Costs | 2014$ millions | - | 0.9 |

2. Impacts on Employment

DOE quantitatively assessed the impacts of analyzed energy conservation standards on direct employment. DOE used the GRIM to estimate the domestic labor expenditures and number of domestic production workers in the no-new-standards case and at each EL for the 50–400 W equipment class, since the 50–400 W equipment class represents over 90 percent of all covered HID lamp shipments in 2018. Furthermore, manufacturers stated that most domestic employment decisions would be based on the standards set for the 50–400 W equipment class.

The employment impacts shown in Table VI.13 represent the potential production employment that could result following analyzed energy conservation standards. The upper bound of the results estimates the maximum change in the number of production workers that could occur after compliance with the analyzed energy conservation standards assuming that manufacturers continue to produce the same scope of covered equipment in the same domestic production facilities. It also assumes that domestic production does not shift to lower labor-cost countries. Because there is a real risk of manufacturers evaluating sourcing decisions in response to analyzed energy conservation standards, the lower bound of the employment results includes the estimated total number of U.S. production workers in the industry who could lose their jobs if some or all existing production were moved outside of the United States.

DOE estimates that approximately one third of the HID lamps sold in the United States are manufactured domestically. With this assumption, DOE estimates that in the absence of potential energy conservation standards, there would be approximately 219 domestic production workers involved in manufacturing HID lamps in 2018. The table below shows the range of the impacts of analyzed standards on U.S. production workers in the HID lamp industry.

**Table VI.13 Potential Changes in the Total Number of Domestic High-Intensity Discharge Lamp Production Workers in 2018**

| | No-New-Standards Case | 50–400 W Equipment Class EL | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Total Number of Domestic Production Workers in 2018 (without changes in production locations) | 219 | 220 | 228 | 357 |
| Potential Changes in Domestic Production Workers in 2018* | | 0 to 1 | (110) to 9 | (219) to 138 |

*DOE presents a range of potential employment impacts. Numbers in parentheses indicate negative numbers

3. Impacts on Manufacturing Capacity

HID lamp manufacturers stated that they did not anticipate any significant capacity constraints unless all lamps in the 50–400 W equipment class had to be converted to CMH technology. Most manufacturers stated that they do not have the equipment to produce the volume of CMH lamps that would be necessary to satisfy demand. Manufacturers would have to expend significant capital resources to obtain additional equipment that is specific to CMH lamp production. Manufacturers also pointed out that thousands of man-hours would be necessary to redesign specific lamps and lamp production lines at ELs requiring CMH. The combination of obtaining new equipment and the engineering effort that manufacturers would have to undergo could cause significant downtime for manufacturers. Most manufacturers agreed that there would not be any significant capacity constraints at any ELs that did not require CMH technology.

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 did not identify any adversely impacted subgroups for HID lamps for this final determination based on the results of the industry characterization. DOE analyzed the impacts on small manufacturers as required by the Regulatory Flexibility Act, 5 USC 601, et seq.

5. Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of recent 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 equipment. For these reasons, DOE conducted a cumulative regulatory burden analysis to make sure that the standards considered in this determination do not create a cumulative regulatory burden that is unacceptable to the overall lighting industry.

C. National Impact Analysis

1. Significance of Energy Savings

For each efficacy level, DOE projected energy savings for HID lamps purchased in the 30-year period that begins in the year 2018, ending in the year 2047. The savings are measured over the entire lifetime of equipment purchased in the 30-year period. DOE quantified the energy savings attributable to each efficacy level as the difference in energy consumption between each standards case and the no-new-standards case. Table VI.14 presents the estimated primary energy savings for each efficacy level analyzed. Table VI.15 presents the estimated FFC energy savings for each efficacy level. Chapter 11 of the final determination TSD describes these estimates in more detail.

**Table VI.14 Cumulative National Primary Energy Savings for HID Lamp Efficacy Levels for Units Sold in 2018–2047**

| Equipment Class | Efficacy Level | National Primary Energy Savings quads |
|---|---|---|
| ≥2800 K and ≤4500 K and ≥50 W to ≤400 W | 1 | 0.003 |
| | 2 | 0.14 |
| | 3 | 1.34 |
| ≥2800 K and ≤4500 K and >400 and ≤1000 W | 1 | 0.00 |
| | 2 | 0.002 |
| ≥2800 K and ≤4500 K and >1000 W to ≤2000 W | 1 | 0.001 |

**Table VI.15 Cumulative National Full-Fuel-Cycle Energy Savings for HID Lamp Efficacy Levels for Units Sold in 2018–2047**

| Equipment Class | Efficacy Level | National FFC Energy Savings quads |
|---|---|---|
| ≥2800 K and ≤4500 K and ≥50 W to ≤400 W | 1 | 0.003 |

| | | |
|---|---|---|
| | 2 | 0.15 |
| | 3 | 1.40 |
| ≥2800 K and ≤4500 K and >400 and ≤1000 W | 1 | 0.00 |
| | 2 | 0.002 |
| ≥2800 K and ≤4500 K and >1000 W to ≤2000 W | 1 | 0.001 |

2. Net Present Value of Commercial Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for commercial consumers that would result from the efficacy levels considered for HID lamps. In accordance with the Office of Management and Budget's (OMB's) guidelines on regulatory analysis,[11] DOE calculated the NPV using both a 7-percent and a 3-percent real discount rate. The 7-percent rate is an estimate of the average before-tax rate of return on private capital in the U.S. economy, and reflects the returns on real estate and small business capital as well as corporate capital. This discount rate approximates the opportunity cost of capital in the private sector (OMB analysis has found the average rate of return on capital to be near this rate). The 3-percent rate reflects the potential effects of standards on private consumption (e.g., through higher prices for products and reduced purchases of energy). This rate represents the rate at which society discounts future consumption flows to their present value. It can be approximated by the real rate of return on long-term government debt (i.e., yield on U.S. Treasury notes), which has averaged about 3 percent for the past 30 years.

[11] OMB Circular A-4, section E (Sept. 17, 2003). Available at: www.whitehouse.gov/omb/circulars_a004_a-4.

Table VI.16 shows the commercial consumer NPV results for each efficacy level DOE considered for HID lamps, using both 7-percent and 3-percent discount rates. In each case, the impacts cover the lifetime of equipment purchased in 2018 through 2047. See chapter 11 of the final determination TSD for more detailed NPV results.

**Table VI.16 Net Present Value of Commercial Consumer Benefits for HID Lamp Efficacy Levels for Units Sold in 2018–2047**

| Equipment Class | Efficacy Level | Net Present Value billion 2014$ | |
|---|---|---|---|
| | | 7-Percent Discount Rate | 3-Percent Discount Rate |
| ≥2800 K and ≤4500 K and ≥50 W to ≤400 W | 1 | (0.03)* | (0.01) |
| | 2 | (1.21) | (2.20) |
| | 3 | (1.69) | (1.14) |
| ≥2800 K and ≤4500 K and >400 and ≤1000 W | 1 | 0.00 | 0.00 |
| | 2 | (0.25) | (0.49) |
| ≥2800 K and ≤4500 K and >1000 W to ≤2000 W | 1 | (0.012) | (0.02) |

* Values in parenthesis are negative values.

D. Determination

As required by EPCA, this final determination analyzed whether standards for HID lamps would be technologically feasible, economically justified, and would result in significant energy savings. (42 U.S.C. 6317(a)(1)) Each of these criteria is discussed below.

1. Technological Feasibility

EPCA mandates that DOE determine whether energy conservation standards for HID lamps would be "technologically feasible." (42 U.S.C. 6317(a)(1)) DOE determines that standards for HPS lamps would not be technologically feasible due to the lack of technology options discussed in section V.A.3. DOE determines that standards for MV lamps for specialty applications are not technologically feasible because MH lamps do not provide adequate ultraviolet light output to act as a direct substitute for specialty application MV lamp (see chapter 2 of the final determination TSD for additional detail). DOE determines that energy conservation standards for certain other HID lamps (MV and MH lamps) would be technologically feasible because they can be satisfied with HID lighting systems currently available on the market. However, DOE has some concern regarding the limited market availability of MH lamps that meet EL 3 at 250 W. Currently, only one manufacturer produces a lamp subject to standards that meets EL 3 at 250 W, though some lamps not subject to standards (i.e., lamps operated by electronic ballasts only) may also be available as an energy saving replacement.

2. Significance of Energy Savings

EPCA also mandates that DOE determine whether energy conservation standards for HID lamps would result in "significant energy savings." (42 U.S.C. 6317(a)(1)) DOE determines that standards for certain categories of HID lamps (MH and MV lamps less than 50 W, MH lamps greater than 2000 W, MV lamps greater than 1000 W, directional lamps, self-ballasted lamps, lamps designed to operate exclusively on electronic ballasts, high-CRI MH lamps, colored MH lamps, and electrodeless lamps) would not result in significant energy savings due to low shipment market share (see chapter 2 of the final determination TSD for additional detail). However, DOE estimates that a standard for all other HID lamps would result in maximum energy savings of up to 1.4 quads over a 30-year analysis period (2018–2047). Therefore, DOE determines that potential energy conservation standards for certain HID lamps would result in significant energy savings.

3. Economic Justification

EPCA requires DOE to determine whether energy conservation standards for HID lamps would be economically justified. (42 U.S.C. 6317(a)(1)) Using the methods and data described in section V.G, DOE conducted an LCC analysis to estimate the net costs/benefits to users from increased efficacy in the considered HID lamps. DOE then aggregated the results from the LCC analysis to estimate national energy savings and national economic impacts in section VI.A. DOE also conducted an MIA to estimate the financial impact of potential energy conservation standards on manufacturers.

DOE first considered the most efficacious level, EL 3, which is applicable only to the 50 W–400 W equipment class. Regarding economic impacts to commercial consumers, DOE notes that regulation of the 400 W MH representative lamp type (a subset of the 50–400 W equipment class) does not allow commercial consumers to purchase only a new lamp at EL 3. In this case, all commercial consumers would need to purchase a new ballast and fixture in addition to a new lamp in order to achieve energy and cost savings. Purchasing a new lamp, ballast, and fixture rather than only a lamp represents a large first cost difference (about a 400 percent increase). All other lamp types and equipment classes offer a direct lamp replacement (a more efficacious, but equal wattage replacement). The 50–400 W equipment class at EL 3 has an estimated negative NPV of commercial consumer benefit of –$1.69 billion using a 7-percent discount rate, and a negative NPV of commercial consumer benefit of –$1.14 billion using a 3-percent discount rate.

Regarding economic impacts to manufacturers, at EL 3 for the 50–400 W equipment class, DOE estimates industry will need to invest approximately $109.5 million in conversion costs. New investment would be necessary to produce EL 3 CMH lamps at a mass market scale for the 50–400 W equipment class. As a result, EL 3 has large conversion costs. At EL 3 for the 50–400 W equipment class, the projected change in INPV ranges from a decrease of $75.9 million to an increase of $21.8 million, which equates to a decrease of 26.2 percent and an increase of 7.5 percent, respectively, in INPV for manufacturers of HID lamps.

On the basis of the negative NPV, large differences in first costs for some commercial consumers, and potential decrease in industry net present value for HID lamp manufacturers (including large conversion costs), DOE determined that the EL 3 standard was not economically justified.

DOE then considered the next most efficacious level, EL 2, which applies to the 50–400 W and 401–1000 W equipment classes. Regarding economic impacts to commercial consumers, the 50–400 W equipment class at EL 2 has an estimated negative

NPV of commercial consumer benefit of –$1.21 billion using a 7-percent discount rate, and a negative NPV of commercial consumer benefit of –$2.20 billion using a 3-percent discount rate. The 401–1000 W equipment class at EL 2 has an estimated negative NPV of commercial consumer benefit of –$0.25 billion using a 7-percent discount rate, and a negative NPV of commercial consumer benefit of –$0.49 billion using a 3-percent discount rate.

Regarding economic impacts to manufacturers, at EL 2 for the 50–400 W equipment class, DOE estimates industry will need to invest approximately $37.4 million in conversion costs. At EL 2 for the 401–1000 W equipment class, DOE estimates industry will need to invest approximately $5.7 million in conversion costs. Conversion costs are small because minimal capital expenditures are necessary to produce EL 2 compliant lamps at a mass market scale. At EL 2 for the 50–400 W equipment class, the projected change in INPV ranges from a decrease of $50.1 million to a decrease of $33.3 million, which equates to a decrease of 17.3 percent and a decrease of 11.5 percent, respectively, in INPV for manufacturers of HID lamps. At EL 2 for the 401–1000 W equipment class, the projected change in INPV ranges from a decrease of $3.9 million to an increase of $0.2 million, which equates to a decrease of 8.7 percent and an increase of 0.6 percent, respectively, in INPV for manufacturers of HID lamps.

On the basis of the negative NPV and potential decrease in industry net present value for HID lamp manufacturers, DOE determined that an EL 2 standard was not economically justified.

Finally, DOE considered EL 1, which applies to the 50–400 W, 401–1000 W, and 1001–2000 W equipment classes. Regarding economic impacts to commercial consumers, the 50–400 W equipment class at EL 1 has an estimated negative NPV of commercial consumer benefit of –$0.03 billion using a 7-percent discount rate, and a negative NPV of commercial consumer benefit of –$0.01 billion using a 3-percent discount rate. The 401–1000 W equipment class at EL 1 has an NPV of commercial consumer benefit of $0.0 using a 7-percent discount rate, and $0.0 using a 3-percent discount rate. The 1001–2000 W equipment class at EL 1 has an estimated negative NPV of commercial consumer benefit of –$0.012 billion using a 7-percent discount rate, and an estimated negative NPV of –$0.02 billion using a 3-percent discount rate. The NPV for 400–1000 W equipment class because of no shipments for this baseline.

Regarding economic impacts to manufacturers, at EL 1 for the 50–400 W equipment class, DOE estimates industry will need to invest approximately $7.4 million in conversion costs. At EL 1 for the 401–1000 W equipment class, DOE estimates industry will need to invest approximately $0.5 million in conversion costs. At EL 1 for the 1001–2000 W equipment class, DOE estimates industry will need to invest approximately $0.9 million in conversion costs. Conversion costs are small because minimal capital expenditures are necessary to produce EL 1 compliant lamps at a mass market scale. At EL 1 for the 50–400 W equipment class, the projected change in INPV ranges from a decrease of $5.1 million to a decrease of $4.7 million, which equates to a decrease of 1.7 percent and a decrease of 1.6 percent, respectively, in INPV for manufacturers of HID lamps. At EL 1 for the 401–1000 W equipment class, the projected change in INPV is a decrease of $0.3 million, which equates to a decrease of 0.8 percent, in INPV for manufacturers of HID lamps. At EL 1 for the 1001–2000 W equipment class, the projected change in INPV ranges from a decrease of $0.8 million to a decrease of $0.7 million, which equates to a decrease of 25.2 percent and a decrease of 24.4 percent, respectively, in INPV for manufacturers of HID lamps.

On the basis of the negative NPV and potential decrease in industry net present value for HID lamp manufacturers, DOE determined that an EL 1 standard was not economically justified.

4. Conclusions

DOE determines that standards for HID lamps are either not technologically feasible, would not result in significant energy savings, or are not economically justified (see Table VI.17). Therefore, DOE is not establishing energy conservation standards for HID lamps.

**Table VI.17 Rationale for Not Establishing Energy Conservation Standards**

| **Lamp Category** | | | **Rationale** |
| --- | --- | --- | --- |
| Directional HID lamps | | | Would not result in significant energy savings |
| Self-ballasted HID lamps | | | Would not result in significant energy savings |
| HID lamps designed to operate exclusively on electronic ballasts | | | Would not result in significant energy savings |
| HID lamps that have a CCT of 5000–6999 K, have a non-screw base, and have a non-T-shaped bulb | | | Not technologically feasible |
| Electrodeless HID lamps | | | Would not result in significant energy savings |
| Other HID Lamps | HPS Lamps | | Not technologically feasible |
| | MV Lamps | MV lamps less than 50 W or greater than 1000 W | Would not result in significant energy savings |
| | | MV lamps that are double-ended, have a non-screw base, and have no outer bulb | Not technologically feasible |

| | | | |
|---|---|---|---|
| | | MV lamps greater than or equal to 50 W and less than or equal to 1000 W. | Not economically justified |
| | MH Lamps | MH lamps less than 50 W or greater than 2000 W | Would not result in significant energy savings |
| | | MH lamps with CCT less than 2800 K and greater than or equal to 7000 K | Would not result in significant energy savings |
| | | High-CRI MH lamps | Would not result in significant energy savings |
| | | Colored MH lamps | Would not result in significant energy savings |
| | | MH lamps greater than or equal to 50 W and less than or equal to 2000 W. | Not economically justified |

## VII. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

This final determination is not subject to review under Executive Order (E.O.) 12866, "Regulatory Planning and Review." 58 FR 51735 (October 4, 1993).

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, and a final regulatory flexibility analysis (FRFA) for any such rule that an agency adopts as a final rule, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (August 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. In the final determination, DOE finds that standards for HID lamps would not meet all of the required criteria of technologically feasibility, economic justification, and significant energy savings. The final determination does not establish any energy conservation standards for HID lamps, and DOE is not prescribing standards for HID lamps at this time. On the basis of the foregoing, DOE certifies that the final determination has no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an FRFA for this final determination. DOE will transmit this certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

This final determination does not impose new information or record keeping requirements since it does not impose any standards. Accordingly, the Office of Management and Budget (OMB) clearance is not required under the Paperwork Reduction Act. (44 U.S.C. 3501 et seq.)

D. Review Under the National Environmental Policy Act of 1969

In this final determination, DOE determines that energy conservation standards for HID lamps do not meet all of the required criteria of technologically feasibility, economic justification, and significant energy savings. DOE has determined that review under the National Environmental Policy Act of 1969 (NEPA), Pub. L. 91-190, codified at 42 U.S.C. 4321 et seq. is not required at this time because standards are not being imposed. NEPA review can only be initiated "as soon as environmental impacts can be meaningfully evaluated." Because this final determination concludes only that future standards are not warranted, and does not propose or set any standard, DOE has determined that there are no environmental impacts to be evaluated at this time. Accordingly, neither an environmental assessment not an environmental impact statement is required.

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 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. As this final determination finds that standards are not warranted for HID lamps, there is no impact on the policymaking discretion of the states. Therefore, no 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; and (3) provide a clear legal standard for affected conduct rather than a general standard and promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). 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. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. 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/gc/office-general-counsel. This final determination contains neither an intergovernmental mandate nor a mandate that may result in the expenditure of $100 million or more in any year, so these UMRA requirements do not apply.

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This final determination does 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

DOE has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (Mar. 18, 1988) that this final determination does 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 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 proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

Because the final determination finds that standards for HID lamps are not warranted, it is not a significant energy action, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under the Information Quality Bulletin for Peer Review

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

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. 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. The "Energy Conservation Standards Rulemaking Peer Review Report" dated February 2007 has been disseminated and is available at the following website: www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.

## VIII. Approval of the Office of the Secretary

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

Issued in Washington, DC, on December 2, 2015.

David Danielson
Assistant Secretary
Energy Efficiency and Renewable Energy