$$CEER = 1.04 \times \frac{SACC}{(3.7117 \times SACC^{0.6384})}$$

**Note:** The following letter will not appear in the Code of Federal Regulations.

U.S. DEPARTMENT OF JUSTICE
Antitrust Division
Renata B. Hesse
Acting Assistant Attorney General
RFK Main Justice Building
950 Pennsylvania Avenue NW
Washington, DC 20530–0001
(202) 514–2401 / (202) 616–2645 (Fax)

August 12, 2016

Anne Harkavy
Deputy General Counsel for Litigation, Regulation and Enforcement
U.S. Department of Energy
Washington, DC 20585

Re: Docket No. EERE–2013–BT–STD–0033

Dear Deputy General Counsel Harkavy:

I am responding to your June 13, 2016 letter seeking the views of the Attorney General about the potential impact on competition of proposed energy conservation standards for portable air conditioners.

Your request was submitted under Section 325(o)(2)(B)(i)(V) of the Energy Policy and Conservation Act, as amended (ECPA), 42 U.S.C. 6295(o)(2)(B)(i)(V), which requires the Attorney General to make a determination of the impact of any lessening of competition that is likely to result from the imposition of proposed energy conservation standards. The Attorney General's responsibility for responding to requests from other departments about the effect of a program on competition was delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR 0.40(g).

In conducting its analysis, the Antitrust Division examines whether a proposed standard may lessen competition, for example, by substantially limiting consumer choice or increasing industry concentration. A lessening of competition could result in higher prices to manufacturers and consumers.

We have reviewed the proposed standards contained in the Notice of Proposed Rulemaking (81 FR 38398, June 13, 2016) and the related technical support documents. We have also monitored the public meeting held on the proposed standards on July 20, 2016, and conducted interviews with industry members.

Based on the information currently available, we do not believe that the proposed energy conservation standards for portable air conditioners are likely to have a significant adverse impact on competition.

Sincerely,

Renata B. Hesse

[FR Doc. 2019–26350 Filed 1–9–20; 8:45 am]

**BILLING CODE 6450–01–P**

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## DEPARTMENT OF ENERGY

## 10 CFR Part 430

**[Docket Number EERE–2016–BT–STD–0022]**

**RIN 1904–AD69**

## Energy Conservation Program: Energy Conservation Standards for Uninterruptible Power Supplies

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

**ACTION:** Final rule.

**SUMMARY:** The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including battery chargers. EPCA also requires the U.S. Department of Energy (DOE) to periodically determine whether more-stringent standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this final rule, DOE is adopting new energy conservation standards for uninterruptible power supplies, a class of battery chargers. It has determined that the new energy conservation standards for these products would result in significant conservation of energy, and are technologically feasible and economically justified.

**DATES:** The effective date of this rule is March 10, 2020. Compliance with the new standards established for uninterruptible power supplies in this final rule is required on and after January 10, 2022.

**ADDRESSES:** The docket for this rulemaking, which includes **Federal Register** notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at *www.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 web page can be found at *http://www.regulations.gov/#!docketDetail;D=EERE-2016-BT-STD-0022.* The docket web page 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 the Appliance and Equipment Standards Program staff at (202) 586–6636 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

**FOR FURTHER INFORMATION CONTACT:**

Jeremy Dommu, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–9870. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

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

**SUPPLEMENTARY INFORMATION:**

### Table of Contents

## I. Synopsis of the Final Rule

Title III, Part B [1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified), established the Energy Conservation Program for Consumer Products Other Than Automobiles.[2] These products include battery chargers, the subject of this rulemaking.

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m))

In accordance with these and other statutory provisions discussed in this document, DOE is adopting new energy conservation standards for uninterruptible power supplies (hereafter referred to as ''UPSs''), a class of battery chargers. The adopted standards, which are expressed in average load adjusted efficiency, are shown in Table I–1. These standards apply to all products listed in Table I–1 and manufactured in, or imported into, the United States starting on and after two years after the publication of this final rule that utilize a NEMA 1–15P or 5–15P input plug and have an AC output.

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

[2] All references to EPCA in this document refer to the statute as amended through the Energy Efficiency Improvement Act of 2015, Public Law 114–11 (April 30, 2015).

TABLE I–1—ENERGY CONSERVATION STANDARDS FOR UPSS

[Compliance starting January 10, 2022]

| UPS product class | Rated output power | Minimum efficiency |
|---|---|---|
| Voltage and Frequency Dependent .... | $0W < P_{rated} \leq 300\ W$ | $-1.20E{-}06 * P^2_{rated} + 7.17E{-}04 * P_{rated} + 0.862$. |
| | $300\ W < P_{rated} \leq 700\ W$ | $-7.85E{-}08 * P^2_{rated} + 1.01E{-}04 * P_{rated} + 0.946$. |
| | $P_{rated} > 700\ W$ | $-7.23E{-}09 * P^2_{rated} + 7.52E{-}06 * P_{rated} + 0.977$. |
| Voltage Independent ........ | $0W < P_{rated} \leq 300\ W$ | $-1.20E{-}08 * P^2_{rated} + 7.19E{-}04 * P_{rated} + 0.863$. |
| | $300\ W < P_{rated} \leq 700\ W$ | $-7.67E{-}08 * P^2_{rated} + 1.05E{-}04 * P_{rated} + 0.946$. |
| | $P_{rated} > 700\ W$ | $-4.62E{-}09 * P^2_{rated} + 8.54E{-}06 * P_{rated} + 0.979$. |
| Voltage and Frequency Independent | $0W < P_{rated} \leq 300\ W$ | $-3.13E{-}08 * P^2_{rated} + 1.96E{-}04 * P_{rated} + 0.543$. |
| | $300\ W < P_{rated} \leq 700\ W$ | $-2.60E{-}08 * P^2_{rated} + 3.65E{-}04 * P_{rated} + 0.764$. |
| | $P_{rated} > 700\ W$ | $-1.70E{-}08 * P^2_{rated} + 3.85E{-}06 * P_{rated} + 0.876$. |

*A. Benefits and Costs to Consumers*

Table I–2 summarizes DOE's evaluation of the economic impacts of the adopted standards on consumers of UPSs, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[3] The average LCC savings are positive for all product classes, and the PBP is less than the average lifetime of UPSs, which is estimated to be between 5 and 10 years (see section IV.F).

TABLE I–2—IMPACTS OF ADOPTED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF UPSS

| Product class | Description | Average LCC savings (2015$) | Simple payback period (years) |
|---|---|---|---|
| 10a | VFD UPS | $32 | * 0.0 |
| 10b | VI UPS | 12 | 3.7 |
| 10c | VFI UPS | 36 | 4.4 |

* The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

DOE's analysis of the impacts of the adopted standards on consumers is described in section IV.F of this document.

*B. Impact on Manufacturers*

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the reference year through the end of the analysis period (2016–2048). Using a real discount rate of 6.1 percent, DOE estimates that the INPV for manufacturers of UPSs in the case without new standards is $2,575 million in 2015$. Under the adopted standards, DOE expects the change in INPV to range from −15.9 percent to 6.3 percent, which is approximately −$409 million to $162 million. In order to bring products into compliance with adopted standards, DOE expects the industry to incur total conversion costs of $36 million.

DOE's analysis of the impacts of the adopted standards on manufacturers is described in section IV.J and section V.B.2 of this document.

*C. National Benefits and Costs*[4]

DOE's analyses indicate that the adopted energy conservation standards for UPSs would save a significant amount of energy. Relative to the case without new standards, the lifetime energy savings for UPSs purchased in the 30-year period that begins in the anticipated year of compliance with the new standards (2019–2048), amount to 0.94 quadrillion British thermal units (Btu), or quads.[5] This represents a savings of 15 percent relative to the energy use of these products in the case without new standards (referred to as the ''no-new-standards case'').

The cumulative net present value (NPV) of total consumer benefits of the standards for UPSs ranges from $1.3 billion (at a 7-percent discount rate) to $3.0 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for UPSs purchased in 2019–2048.

In addition, the adopted standards for UPSs are projected to yield significant environmental benefits. DOE estimates that the standards will result in cumulative emission reductions (over the same period as for energy savings)

[3] The average LCC savings refer to consumers that are affected by a standard and are measured relative to the efficiency distribution in the no-new-standards case, which depicts the market in the compliance year in the absence of new standards (see section IV.F.8). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline product (see section IV.C).

[4] All monetary values in this document are expressed in 2015 dollars and, where appropriate, are discounted to 2016 unless explicitly stated otherwise.

[5] The quantity refers to full-fuel-cycle (FFC) energy savings. FFC energy savings includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and, thus, presents a more complete picture of the impacts of energy efficiency standards. For more information on the FFC metric, see section IV.H.1.

of 49 million metric tons (Mt)[6] of carbon dioxide ($CO_2$), 39 thousand tons of sulfur dioxide ($SO_2$), 63 thousand tons of nitrogen oxides ($NO_X$), 238 thousand tons of methane ($CH_4$), 0.73 thousand tons of nitrous oxide ($N_2O$), and 0.13 tons of mercury (Hg).[7] The estimated cumulative reduction in $CO_2$ emissions through 2030 amounts to 12 Mt, which is equivalent to the emissions resulting from the annual electricity use of 1.8 million homes.

The value of the $CO_2$ reduction is calculated using a range of values per metric ton (t) of $CO_2$ (otherwise known as the ''social cost of $CO_2$,'' or SC-$CO_2$) developed by a Federal interagency working group.[8] The derivation of the SC-$CO_2$ values is discussed in section IV.L.1. Using discount rates appropriate for each set of SC-$CO_2$ values, DOE estimates that the present value of the $CO_2$ emissions reduction (not including $CO_2$ equivalent emissions of other gases with global warming potential) is between $0.37 billion and $5.0 billion, with a value of $1.7 billion using the central SC-$CO_2$ case represented by $47.4/metric ton (t) in 2020. DOE also estimates the present value of the $NO_X$ emissions reduction to be $0.06 billion using a 7-percent discount rate, and $0.12 billion using a 3-percent discount rate.[9] DOE is still investigating appropriate valuation of the reduction in other emissions, and therefore did not include any such values in the analysis for this final rule.

Table I–3 summarizes the economic benefits and costs expected to result from the adopted standards for UPSs.

TABLE I–3—SELECTED CATEGORIES OF ECONOMIC BENEFITS AND COSTS OF ADOPTED ENERGY CONSERVATION STANDARDS FOR UPSS *

| Category | Present value (billion 2015$) | Discount rate (percent) |
|---|---|---|
| **Benefits** | | |
| Consumer Operating Cost Savings | 2.8 | 7 |
| | 5.6 | 3 |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 5% discount rate) ** | 0.37 | 5 |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 3% discount rate) ** | 1.7 | 3 |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 2.5% discount rate) ** | 2.6 | 2.5 |
| $CO_2$ Reduction (using 95th percentile SC-$CO_2$ at 3% discount rate) ** | 5.0 | 3 |
| $NO_X$ Reduction † | 0.06 | 7 |
| | 0.12 | 3 |
| Total Benefits ‡ | 4.5 | 7 |
| | 7.3 | 3 |
| **Costs** | | |
| Consumer Incremental Installed Costs | 1.4 | 7 |
| | 2.6 | 3 |
| **Total Net Benefits** | | |
| Including $CO_2$ and $NO_X$ Reduction Monetized Value ‡ | 3.1 | 7 |
| | 4.8 | 3 |

* This table presents the costs and benefits associated with UPSs shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the products purchased in 2019–2048. The incremental installed costs include incremental equipment cost as well as installation costs. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the proposed standards, some of which may be incurred in preparation for the rule. The $CO_2$ reduction benefits are global benefits due to actions that occur domestically.

** The interagency group selected four sets of SC-$CO_2$ values for use in regulatory analyses. Three sets of values are based on the average SC-$CO_2$ from the integrated assessment models, at discount rates of 5 percent, 3 percent, and 2.5 percent. For example, for 2020 emissions, these values are $13.5/t, $47.4/t, and $69.9/t, in 2015$, respectively. The fourth set ($139/t in 2015$ for 2015 emissions), which represents the 95th percentile of the SC-$CO_2$ distribution calculated using a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the SC-$CO_2$ distribution. The SC-$CO_2$ values are emission year specific. See section IV.L.1 for more details.

[6] A metric ton is equivalent to 1.1 short tons. Results for emissions other than $CO_2$ are presented in short tons.

[7] DOE calculated emissions reductions relative to the no-new-standards-case, which reflects key assumptions in the *Annual Energy Outlook 2016* (*AEO2016*). *AEO2016* represents current federal and state legislation and final implementation of regulations as of the end of February 2016. *AEO2016* incorporates implementation of the Clean Power Plan (CPP). DOE is using the *AEO2016* No-CPP case as a basis for its analysis because the standards finalized in this rulemaking will take effect before the requirements of the CPP. The standards finalized in this rulemaking will reduce the projected burden on the States to meet the requirements of the CPP since these standards are not included in the *AEO2016* Reference Case.

[8] United States Government—Interagency Working Group on Social Cost of Carbon. *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* May 2013. Revised July 2015. *https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf.*

[9] DOE estimated the monetized value of $NO_X$ emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.* See section IV.L.2 for further discussion. The U.S. Supreme Court has stayed the rule implementing the Clean Power Plan until the current litigation against it concludes. *Chamber of Commerce, et al.* v. *EPA, et al.,* Order in Pending Case, 577 U.S. __ __ (2016). However, the benefit-per-ton estimates established in the Regulatory Impact Analysis for the Clean Power Plan are based on scientific studies that remain valid irrespective of the legal status of the Clean Power Plan. To be conservative, DOE is primarily using a lower national benefit-per-ton estimate for $NO_X$ emitted from the Electricity Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011), the values would be nearly two-and-a-half times larger.

† DOE estimated the monetized value of $NO_X$ emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 for further discussion. *To be conservative,* DOE is primarily using a national benefit-per-ton estimate for $NO_X$ emitted from the electricity generating sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011), the values would be nearly two-and-a-half times larger.

‡ Total Benefits for both the 3-percent and 7-percent cases are presented using the average SC-$CO_2$ with 3-percent discount rate.

The benefits and costs of the adopted standards, for UPSs sold in 2019–2048, can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are (1) the reduced consumer operating costs, minus (2) the increases in product purchase prices and installation costs, plus (3) the value of the benefits of $CO_2$ and $NO_X$ emission reductions, all annualized.[10]

The national operating cost savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered products and are measured for the lifetime of UPSs shipped in 2019–2048. The benefits associated with reduced $CO_2$ emissions achieved as a result of the adopted standards are also calculated based on the lifetime of UPSs shipped in 2019–2048. Because $CO_2$ emissions have a very long residence time in the atmosphere, the SC-$CO_2$ values for $CO_2$ emissions in future years reflect impacts that continue through 2300. The $CO_2$ reduction is a benefit that accrues globally. DOE maintains that consideration of global benefits is appropriate because of the global nature of the climate change problem.

Estimates of annualized benefits and costs of the adopted standards are shown in Table I–4. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than $CO_2$ reduction, (for which DOE used a 3-percent discount rate along with the SC-$CO_2$ series that has a value of $47.4/t in 2020),[11] the estimated cost of the standards in this rule is $131 million per year in increased equipment costs, while the estimated annual benefits are $255 million in reduced equipment operating costs, $90 million in $CO_2$ reductions, and $5.1 million in reduced $NO_X$ emissions. In this case, the net benefit amounts to $219 million per year. Using a 3-percent discount rate for all benefits and costs and the SC-$CO_2$ series has a value of $47.4/t in 2020, the estimated cost of the standards is $140 million per year in increased equipment costs, while the estimated annual benefits are $301 million in reduced operating costs, $90 million in $CO_2$ reductions, and $6.6 million in reduced $NO_X$ emissions. In this case, the net benefit amounts to $257 million per year.

TABLE I–4—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS FOR UPSS *

| | Discount rate (percent) | Primary estimate | Low-net-benefits estimate | High-net-benefits estimate |
|---|---|---|---|---|
| | | (million 2015$/year) | | |
| **Benefits** | | | | |
| Consumer Operating Cost Savings | 7 | 255 | 231 | 284. |
| | 3 | 301 | 270 | 341. |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 5% discount rate) ** | 5 | 27 | 24 | 30. |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 3% discount rate) ** | 3 | 90 | 80 | 101. |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 2.5% discount rate) ** | 2.5 | 131 | 116 | 148. |
| $CO_2$ Reduction (using 95th percentile SC-$CO_2$ at 3% discount rate ) ** | 3 | 273 | 242 | 308. |
| $NO_X$ Reduction † | 7 | 5.1 | 4.6 | 13. |
| | 3 | 6.6 | 5.9 | 17. |
| Total Benefits ‡ | 7 plus $CO_2$ range | 287 to 533 | 260 to 478 | 327 to 606. |
| | 7 | 349 | 316 | 398. |
| | 3 plus $CO_2$ range | 335 to 581 | 300 to 519 | 388 to 666. |
| | 3 | 397 | 356 | 459. |
| **Costs** | | | | |
| Consumer Incremental Product Costs | 7 | 131 | 118 | 145. |
| | 3 | 140 | 124 | 157. |
| **Net Benefits** | | | | |
| Total ‡ | 7 plus $CO_2$ range | 156 to 402 | 142 to 361 | 182 to 460. |
| | 7 | 219 | 198 | 253. |
| | 3 plus $CO_2$ range | 195 to 441 | 176 to 394 | 231 to 509. |

[10] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2016, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.,* 2020 or 2030), and then discounted the present value from each year to 2016. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of $CO_2$ reductions, for which DOE used case-specific discount rates, as shown in Table I–3. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year, that yields the same present value.

[11] DOE used a 3-percent discount rate because the SC-$CO_2$ values for the series used in the calculation were derived using a 3-percent discount rate.

TABLE I–4—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS FOR UPSS *—Continued

| | Discount rate (percent) | Primary estimate | Low-net-benefits estimate | High-net-benefits estimate |
|---|---|---|---|---|
| | | (million 2015$/year) | | |
| | 3 | 257 | 231 | 302. |

* This table presents the annualized costs and benefits associated with UPSs shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the UPSs purchased from 2019–2048. The incremental installed costs include incremental equipment cost as well as installation costs. The results account for the incremental variable and fixed costs incurred by manufacturers due to the proposed standards, some of which may be incurred in preparation for the rule. The $CO_2$ reduction benefits are global benefits due to actions that occur nationally. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO 2016* No-CPP case, Low Economic Growth case, and High Economic Growth case, respectively. Shipment projections are also scaled based on the GDP index in the Low and High Economic Growth cases. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

** The $CO_2$ reduction benefits are calculated using four different sets of SC-$CO_2$ values. The first three use the average SC-$CO_2$ calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The fourth represents the 95th percentile of the SC-$CO_2$ distribution calculated using a 3-percent discount rate. The SC-$CO_2$ values are emission year specific. See section IV.L.1 for more details.

† DOE estimated the monetized value of $NO_X$ emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 for further discussion. For the Primary Estimate and Low Net Benefits Estimate, DOE used national benefit-per-ton estimates for $NO_X$ emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). For the High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011); these are nearly two-and-a-half times larger than those from the ACS study.

‡ Total Benefits for both the 3-percent and 7-percent cases are presented using the average SC-$CO_2$ with 3-percent discount rate. In the rows labeled "7% plus $CO_2$ range" and "3% plus $CO_2$ range," the operating cost and $NO_X$ benefits are calculated using the labeled discount rate, and those values are added to the full range of $CO_2$ values.

DOE's analysis of the national impacts of the adopted standards is described in sections IV.H, IV.K, and IV.L of this final rule.

*D. Conclusion*

Based on the analyses culminating in this final rule, DOE found the benefits to the nation of the standards (energy savings, consumer LCC savings, positive NPV of consumer benefit, and emission reductions) outweigh the burdens (loss of INPV and LCC increases for some users of these products). DOE has concluded that the standards in this final rule represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in significant conservation of energy.

**II. Introduction**

The following section briefly discusses the statutory authority underlying this final rule, as well as some of the relevant historical background related to the establishment of standards for battery chargers. DOE's regulations define ''battery charger'' as a device that charges batteries for consumer products, including battery chargers embedded in other consumer products. 10 CFR 430.2.

*A. Authority*

Title III, Part B of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (codified as 42 U.S.C. 6291–6309) established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program covering most major household appliances (collectively referred to as ''covered products''), which includes battery chargers.

Section 309 of the Energy Independence and Security Act of 2007 (''EISA 2007'') amended EPCA by directing DOE to prescribe, by rule, definitions and test procedure for the power use of battery chargers (42 U.S.C. 6295(u)(1)), and to issue a final rule that prescribes energy conservation standards for battery chargers or classes of battery chargers or determine that no energy conservation standard is technologically feasible and economically justified. (42 U.S.C. 6295(u)(1)(E)). DOE finalized energy conservation standards for some classes of battery chargers on June 13, 2016 (81 FR 38266), and the standards prescribed in this final rule for other classes of battery chargers represent an extension of those requirements.

Pursuant to EPCA, DOE's energy conservation program for covered products consists essentially of four parts: (1) Testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. The Federal Trade Commission (FTC) is primarily responsible for labeling, and DOE implements the remainder of the program. Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and (r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedure for battery chargers appears at title 10 of the Code of Federal Regulations (CFR) part 430, subpart B, appendix Y.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including battery chargers. Any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and (3)(B)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)) Moreover, DOE may not prescribe a standard: (1) For certain products, including battery chargers, if no test procedure has been established for the product, or (2) if DOE determines by rule that the standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(A)and (B)) In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

(1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;

(3) The total projected amount of energy (or as applicable, water) savings likely to result directly from the standard;

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

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

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

(7) Other factors the Secretary of Energy (Secretary) considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

Further, EPCA, as codified, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii))

EPCA, as codified, also contains what is known as an ''anti-backsliding'' provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6295(o)(1)) Also, the Secretary may not prescribe an amended or new standard if interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6295(o)(4))

Additionally, EPCA specifies requirements when promulgating an energy conservation standard for a covered product that has two or more subcategories. DOE must specify a different standard level for a type or class of products that has the same function or intended use if DOE determines that products within such group (A) consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6295(q)(1)) In determining whether a performance-related feature justifies a different standard for a group of products, DOE must consider such factors as the utility to the consumer of such a feature and other factors DOE deems appropriate. *Id.* Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

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

Finally, pursuant to the amendments contained in EISA 2007), any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)).

## *B. Background*

### 1. Current Standards

In a final rule published on June 13, 2016, DOE prescribed the current energy conservation standards for battery chargers manufactured on and after July 13, 2018. 81 FR 38266. These standards, which do not cover UPSs, are set forth in DOE's regulations at 10 CFR 430.32 and are repeated in Table II–1.

TABLE II–1—FEDERAL ENERGY EFFICIENCY STANDARDS FOR BATTERY CHARGERS

| Product class | Product class description | Battery energy watt-hours (Wh) | Special characteristic or battery voltage | Adopted standard as a function of battery energy (kWh/yr) |
|---|---|---|---|---|
| 1 | Low-Energy | ≤5 Wh | Inductive Connection in Wet Environments. | 3.04. |
| 2 | Low-Energy, Low-Voltage | <100 Wh | <4 V | $0.1440 * E_{batt} + 2.95$. |
| 3 | Low-Energy, Medium-Voltage | | 4–10 V | For $E_{batt}$ <10Wh, 1.42 kWh/y $E_{batt}$ ≥10 Wh, $0.0255 * E_{batt} + 1.16$. |
| 4 | Low-Energy, High-Voltage | | >10 V | $0.11 * E_{batt} + 3.18$. |
| 5 | Medium-Energy, Low-Voltage | 100–3000 Wh | <20 V | $0.0257 * E_{batt} + .815$. |
| 6 | Medium-Energy, High-Voltage | | ≥20 V | $0.0778 * E_{batt} + 2.4$. |
| 7 | High-Energy | | >3000 Wh | $0.0502 * E_{batt} + 4.53$. |

### 2. History of Standards Rulemaking for UPSs

DOE originally proposed energy conservation standards for battery chargers including UPSs in the battery charger energy conservation standards NOPR published on March 27, 2012 (March 2012 NOPR). In this NOPR, DOE proposed to test all covered battery chargers, including UPSs, using the battery charger test procedure finalized on June 1, 2011 and to regulate them using a unit energy consumption (''UEC'') metric. See 77 FR 18478.

DOE issued a battery charger energy conservation standards supplemental notice of proposed rulemaking (''SNOPR'') to propose revised energy standards for battery chargers on September 1, 2015. See 80 FR 52850. This notice did not propose standards for UPSs because of DOE's intention to regulate UPS as part of the separate rulemaking for computer and battery backup systems. DOE also issued a battery charger test procedure NOPR on August 6, 2015, which proposed to exclude backup battery chargers, including UPSs, from the scope of the battery charger test procedure. See 80 FR 46855. DOE held a public meeting on September 15, 2015 to discuss both of these notices.

During 2014, DOE explored whether to regulate UPSs as ''computer systems.'' See, *e.g.,* 79 FR 11345 (Feb. 28, 2014) (proposed coverage determination); 79 FR 41656 (July 17, 2014) (computer systems framework document). DOE received a number of comments in response to those documents (and the related public meetings) regarding testing of UPSs and the appropriate venue to address these devices.

Additionally, DOE received a number of stakeholder comments on the August 2015 battery charger test procedure NOPR and the September 2015 battery charger energy conservation standard SNOPR regarding regulation of UPSs. After considering these comments, DOE reconsidered its position and found that since a UPS meets the definition of a battery charger, it is more appropriate to regulate UPSs as part of the battery charger rulemaking, rather than the computers rulemaking. While the changes proposed in the August 2015 battery charger test procedure NOPR and the September 2015 energy conservation standard SNOPR were finalized on May 20, 2016 (81 FR 31827) and June 13, 2016 (81 FR 38266), respectively, DOE continues to conduct rulemaking activities to consider test procedures and energy conservations standards for UPSs as part of ongoing and future battery charger rulemaking proceedings.

DOE published a notice of proposed rulemaking on May 19, 2016 to amend the battery charger test procedure to include specific testing requirements for UPSs (''UPS test procedure NOPR''). See 81 FR 31542. Subsequently, DOE proposed energy conservation standards for UPSs as part of the battery charger regulations in the NOPR published on August 5, 2016 (August 2016 NOPR). See 81 FR 52196. On December 12, 2016, DOE finalized the addition of specific testing provisions for UPSs in the UPS test procedure final rulemaking. See 81 FR 89806. DOE is now finalizing energy conservation standards for UPSs as part of the battery charger regulation in this final rule.

## III. General Discussion

In response to the August 2016 NOPR, DOE received written comments from 8 interested parties, including manufacturers, trade associations, standards development organizations and energy efficiency advocacy groups. Table III–1 lists the entities that commented on the August 2016 NOPR. These comments are discussed in further detail below. The full set of comments on the August 2016 NOPR can be found at: *https://www.regulations.gov/docket?D=EERE-2016-BT-STD-0022.*

TABLE III–1—INTERESTED PARTIES THAT PROVIDED WRITTEN COMMENTS ON THE AUGUST 2016 NOPR

| Commenter | Acronym | Organization type/affiliation | Comment No. (docket reference) |
|---|---|---|---|
| Appliance Standards Awareness Project, Alliance to Save Energy, Northwest Energy Efficiency Alliance, Natural Resources Defense Council, Northeast Energy Efficiency Partnerships, and Northwest Power and Conservation Council. | ASAP et al | Efficiency Organizations | 0020 |
| California Investor Owned Utilities | CA IOUs | Utility Association | 0016 |
| Edison Electric Institute | EEI | Utility Association | 0021 |
| Industrial Energy Consumers of America | IECA | Manufacturer Association | 0015 |
| National Electrical Manufacturers Associations and Information Technology Industry Council. | NEMA & ITI | Manufacturer Associations | 0019 |
| Philips Lighting | Philips Lighting | Manufacturer | 0022 |
| Schneider Electric | Schneider Electric | Manufacturer | 0017 |
| U.S. Chamber of Commerce, American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Petroleum Institute, Association of Home Appliance Manufacturers, Brick Industry Association, Council of Industrial Boiler Owners, National Association of Manufacturers, National Mining Association, National Oilseed Processors Association, and Portland Cement Association. | Associations | Manufacturer Associations | 0018 |

A number of interested parties also provided oral comments at the September 16, 2016, public meeting. These comments can be found in the public meeting transcript (Pub. Mtg. Tr., No. 0014) which is available on the docket.

### *A. Test Procedure*

DOE published the UPS test procedure final rule on December 12, 2016. 81 FR 89806. DOE advises all stakeholders to review that final rule.

### *B. Technological Feasibility*

#### 1. General

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

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

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for UPSs, using the design parameters for the most efficient products available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.B of this final rule and in chapter 5 of the final rule TSD.

*C. Energy Savings*

1. Determination of Savings

For each trial standard level (TSL), DOE projected energy savings from application of the TSL to UPSs purchased in the 30-year period that begins in the year of compliance with the adopted standards (2019–2048).[12] The savings are measured over the entire lifetime of UPSs purchased in the 30-year analysis period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of new energy conservation standards.

DOE used its national impact analysis (NIA) spreadsheet models to estimate national energy savings (NES) from potential new standards for UPSs. The NIA spreadsheet model (described in section IV.H of this final rule) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports national energy savings in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. For natural gas, the primary energy savings are considered to be equal to the site energy savings. DOE also calculates NES in terms of full-fuel-cycle (FFC) energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[13] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.2 of this final rule.

2. Significance of Savings

To adopt any new standards 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, for the District of Columbia Circuit 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 are not ''genuinely trivial.'' The energy savings for all the TSLs considered in this rulemaking, including the adopted standards, are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

*D. Economic Justification*

1. Specific Criteria

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

a. Economic Impact on Manufacturers and Consumers

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

For individual consumers, measures of economic impact include the changes in LCC and payback period (PBP) associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the economic impacts applicable to a particular rulemaking. DOE also evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a national standard.

b. Savings in Operating Costs Compared to Increase in Price (LCC and PBP)

EPCA requires DOE to consider the savings in operating costs throughout

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

[13] The FFC metric is discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51282 (Aug. 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012).

the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of a product (including its installation) and the operating cost (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value.

The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost due to a more-stringent standard by the change in annual operating cost for the year that standards are assumed to take effect.

For its LCC and PBP analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with new or amended standards. The LCC savings for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of new or amended standards. DOE's LCC and PBP analysis is discussed in further detail in section IV.F of this document.

c. Energy Savings

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

d. Lessening of Utility or Performance of Products

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

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) To assist the Department of Justice (DOJ) in making such a determination, DOE transmitted copies of its proposed rule and the NOPR TSD to the Attorney General for review, with a request that the DOJ provide its determination on this issue. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for UPS are unlikely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

f. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) The energy savings from the adopted standards are likely to provide improvements to the security and reliability of the Nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the Nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the Nation's needed power generation capacity, as discussed in section IV.M of this document.

DOE maintains that environmental and public health benefits associated with the more efficient use of energy are important to take into account when considering the need for national energy conservation. The adopted standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases (GHGs) associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K of this document; the estimated emissions impacts are reported in section V.B.6 of this final rule. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L of this document.

g. Other Factors

In determining whether an energy conservation standard is economically justified, DOE may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described above, DOE could consider such information under ''other factors.''

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the effect potential amended energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F of this final rule.

*E. Compliance Date*

The compliance date is the date when a covered product is required to meet a new or amended standard. In the August 2016 NOPR, DOE proposed a compliance period of two year following the publication date of a final UPS standard, which would result in a 2019 compliance date.

CA IOUs suggested that DOE align the compliance date for the UPS energy conservation standards with the June 2018 battery charger standards compliance date. (CA IOUs, No.0016 at p.1) After considering this recommendation, DOE believes that a two-year compliance interval is necessary to ensure that manufacturers have sufficient time to comply with the standards DOE is adopting for UPSs. UPSs were considered in the initial battery charger rulemaking efforts, which set a two year compliance period, and DOE feels that adopting an identical two year compliance period in this rulemaking is appropriate. 81 FR 38266.

CA IOUs additionally stated their understanding that the current California Title 20 UPS standards will remain in effect in California until the compliance date for the federal UPS standards in 2019. (CA IOUs, No.0016 at p.2) DOE clarifies that state energy conservation standards for UPSs prescribed or enacted before publication of this final rule, will not be preempted until the compliance date of the Federal energy conservation standards for UPSs. (42 U.S.C. 6295(ii)(1)) DOE further notes that the final DOE test procedure for UPSs preempts any state regulation regarding the testing of the energy efficiency of UPSs. See 42 U.S.C. 6297(a)(1).

*F. General Comments*

During the September 16, 2016 public meeting, and in subsequent written comments responding to the NOPR, stakeholders provided input regarding general issues pertinent to the rulemaking, such as issues regarding the proposed standard levels. These issues are discussed in this section.

1. Proposed Standard Levels

Schneider Electric disagreed with DOE's proposed standards, stating that the combination of broad scope and excessive minimum requirements, particularly for VI UPSs, will likely result in less consumer choice and a higher cost of compliance than estimated by DOE. (Schneider Electric, No. 0017 at p. 3) Schneider Electric also expressed concern that the proposed standard for VI UPSs is higher than that of VFD UPSs. (Schneider Electric, No. 0017 at p. 15) In contrast, ASAP et al. recommended that DOE adopt TSL 3 instead of TSL 2, in order to increase energy savings. They noted that TSL 3 would increase FFC energy savings by 6.8 percent and $CO_2$ savings by 6.4 percent. ASAP et al. believe that DOE's proposal of TSL 2 over TSL 3 is influenced by overly conservative assumptions in its analysis. (ASAP et al., No. 0020 at pp. 1–2)

The Department appreciates the stakeholder comments with regard to its proposed standards. In selecting a given standard, DOE must choose the level that achieves the maximum energy savings that is determined to be technologically feasible and economically justified. In making such a determination, DOE must consider, to the extent practicable, the benefits and burdens based on the seven criteria described in EPCA (see 42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII)). DOE's weighing of the benefits and burdens based on the final rule analysis and rationale for the standard selection is discussed in section V of this document. With regard to TSL 3, DOE notes that the NOPR analysis showed a negative net present value using a 7 percent discount rate for VFD UPSs at TSL 3, and marginally negative average LCC savings for VFD UPSs at TSL 3.[14] For this reason, DOE determined in the NOPR that TSL 3 was not economically justified.

## IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this rulemaking with regard to UPSs. Separate subsections address each component of DOE's analyses.

DOE used several analytical tools to estimate the impact of the standards adopted in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The national impacts analysis uses a second spreadsheet set that provides shipments projections and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (GRIM), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this rulemaking: *http://www.regulations.gov/#!docketDetail;D=EERE-2016-BT-STD-0022.* Additionally, DOE used output from the latest version of the Energy Information Administration's (EIA's) *Annual Energy Outlook* (*AEO*) for the emissions and utility impact analyses.

[14] See chapters 8 and 10 of the NOPR technical support document, available at: *https://www.regulations.gov/document?D=EERE-2016-BT-STD-0022-0001.*

*A. Market and Technology Assessment*

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. This activity includes both quantitative and qualitative assessments, based primarily on publicly-available information. The subjects addressed in the market and technology assessment for this rulemaking include (1) a determination of the scope of the rulemaking and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends, and (6) technologies or design options that could improve the energy efficiency of UPSs. The key findings of DOE's market assessment are summarized in this section IV.A. See chapter 3 of the final rule TSD for further discussion of the market and technology assessment.

1. Scope of Coverage and Product Classes

In the August 2016 NOPR, DOE proposed to maintain the scope of coverage for UPS energy conservation standards as defined by its proposal for the UPS test procedure. 81 FR 52206.

NEMA and ITI contended that DOE has misclassified UPSs as battery chargers and that the primary function of UPSs is equipment protection rather than charging batteries. A majority of UPSs fall outside the scope of the standalone battery charging systems and therefore should not be defined as battery chargers. (NEMA and ITI, No. 0019 at p. 2) As explained in section III.A of the UPS test procedure NOPR published on May 19, 2016, DOE notes that UPSs meet the statutory definition of battery charger as stated in 10 CFR 430.2. UPSs may provide various types of power conditioning and monitoring functionality depending on their architecture and input dependency. They also maintain the fully-charged state of lead acid batteries with high self-discharge rates so that in the event of a power outage, they are able to provide backup power instantly to the connected load. Maintaining the lead acid battery therefore directly affects a UPS's overall energy efficiency. In 10 CFR 430.2, a battery charger is defined as a device that charges batteries for consumer products. The definition of battery charger does not state that the primary function of the device must be to charge batteries for consumer products. Because UPSs that are in the scope of this rulemaking maintain lead acid batteries, DOE concludes that UPSs meet the definition of battery charger. 81 FR 31545.

During the public meeting held on September 16, 2016, Schneider Electric noted that households in the North America are generally wired for 12A at 120V, which gives them an approximate upper power limit of 1440W. Schneider Electric requested that DOE limit the scope of UPS rulemaking to a rounded up value of 1500W. (Schneider Electric, Pub. Mtg. Tr., No. 0014 at pp. 12–13) DOE notes that the December 12, 2016 UPS test procedure final rulemaking revised the scope of the UPS test procedure based on stakeholder comments received on the UPS test procedure NOPR. The UPS test procedure only applies to UPSs that use battery(s) as their energy storage systems, use a standardized NEMA 1–15P or 5–15P input plug and have an AC output. 81 FR 89806. NEMA 1–15P or 5–15P input plugs are capable of handling up to 15A at 125V, which gives them an upper power limit of 1875 W. In subsequent written comments since the public meeting, both NEMA and ITI, and Schneider Electric have expressed implicit support in favor of DOE's adoption of NEMA 1–15P and 5–15P input plugs to limit the scope of UPS rulemaking, but have requested that this limitation be added to both the test procedure and energy conservation standards. (NEMA and ITI, No. 0019 at p. 4; Schneider Electric, No. 0017 at p. 1) DOE agrees with NEMA and ITI and Schneider Electric and is therefore updating the scope such that any product that meets the definition of a UPS, utilizes a NEMA 1–15P or 5–15P input plug and has an AC output is covered under the energy conservation standard being adopted in this final rule. DOE notes that this harmonizes with the scope of the recent UPS test procedure. 81 FR 89806.

Philips Lighting requested that DOE clarify whether the proposed energy conservation standards only apply to consumer UPSs. Further, Philips Lighting requested DOE to state that emergency UPS systems, *i.e.* those listed in UL 924 *Standard for Emergency Lighting and Power Equipment,* are non-consumer products and are not subject to the proposed energy conservation standards. (Philips Lighting, No. 0022 at p. 1) Lastly, Philips Lighting inquired if certain lighting products such as lighting inverters and backup battery systems will be subject to the proposed energy conservation standards. (Philips Lighting, Pub. Mtg. Tr., No. 0014 at pp. 68–69)

DOE notes that its authority to implement energy conservation standards for battery chargers under EPCA extends only to consumer products. Thus, this rule applies to those UPSs that are of a type which, to any significant extent, are distributed into commerce for personal use or consumption. See 42 U.S.C. 6291(1). Additionally, the battery charger energy conservation standards, of which the UPS energy conservation standards are a subset, explicitly exclude from scope all back-up battery chargers except those that meet the definition of a UPS, utilize battery(s) as their energy storage system, use a standardized NEMA 1–15P or 5–15P input plug and have an AC output.

2. Technology Options

In the July 2014 computer and battery backup systems (computer systems) framework document, DOE identified three technology options for UPSs that would be expected to improve the efficiency of UPSs. The technologies options are: semiconductor improvements, digital signal processing and space vector modulation, and transformer-less UPS topologies.[15] Since the July 2014 framework document for computer systems, DOE has identified the following additional technology options from stakeholder comments and manufacturer interviews for UPSs: use of core materials with high magnetic permeability such as Sendust and Litz wiring in inductor design, wide band gap semiconductors such as silicon carbide and gallium arsenide, capacitors with low equivalent series resistance (ESR), printed circuit boards (PCBs) with higher copper content, and variable speed fan control.

DOE's further research into space vector modulation technology for UPSs has shown that it may have limited advantage in the scope of this rule and is intended primarily for higher power applications. Therefore, DOE did not consider this technology.

After identifying all potential technology options for improving the efficiency of UPSs, DOE performed the screening analysis (See section IV.B of this document and chapter 4 of the Final Rule TSD) on these technologies to determine which to consider further in the analysis and which to eliminate.

*B. Screening Analysis*

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

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

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

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

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

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

In sum, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the above four criteria, it will be excluded from further consideration in the engineering analysis. The reasons for eliminating any technology are discussed in the subsequent sections of this preamble.

The subsequent sections include comments from interested parties pertinent to the screening criteria, DOE's evaluation of each technology option against the screening analysis criteria, and whether DOE determined that a technology option should be excluded (''screened out'') based on the screening criteria.

1. Screened-Out Technologies

Transformer-Less UPS designs

Transformer-less UPS designs offer some of the highest efficiencies in the industry with lowered weight, wider input voltage tolerances, near unity input power factor, reduced harmonic distortion and need for components that mitigate electromagnetic interference (EMI) generated by the device. However, interviews with manufacturers have shown this to be a limited access

[15] *See* July 2014 computer and battery backup systems framework document, pp. 48–49.

technology with select manufacturers holding the intellectual property required for effective implementation. DOE therefore did not consider this technology for this rule.

2. Remaining Technologies

Through a review of each technology, DOE tentatively concludes that all of the other identified technologies listed in section IV.A.2 of this document met all four screening criteria to be examined further as design options in DOE's final rule analysis. In summary, DOE did not screen out the following technology options: use of materials with high magnetic permeability such as Sendust for the inductor core and Litz wiring in indictor coils, silicon carbide, gallium arsenide and other wide band gap semiconductors, capacitors with low ESR, PCBs with higher copper content and variable speed fan control.

DOE determined that these technology options are technologically feasible because they are being used or have previously been in commercially-available products or working prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria. For additional details, see chapter 4 of the Final Rule TSD.

NEMA and ITI contended that the remaining technology options combined will result in less than one percent increase in UPS efficiency at optimum performance and the burden of redesigning and testing for sub-percent improvement in UPS efficiency is not justified. (NEMA and ITI, No. 0019 at pp. 5–6) Schneider Electric argued that of all the remaining technologies, only higher copper content in PCBs and line cords has the potential of offering significant improvement in UPS efficiency only at the 100 percent loading point, which accounts for 30 percent of the average load adjusted efficiency. Further, Schneider Electric noted DOE is effectively limiting market participation to companies who own or have access to the fundamental intellectual property required to produce high efficiency UPSs by pushing UPS energy efficiency requirements well above the ENERGY STAR requirements. (Schneider Electric, No. 0017 at p. 3)

DOE notes that all remaining technology options were identified in consultation with manufacturers and other interested parties. These parties identified all remaining technology options as viable options for improving UPS efficiencies across all three product classes. Thus, while these remaining technologies may have varying effects on UPS efficiencies in each of the three product classes, DOE disagrees with Schneider Electric's written comment that only higher copper content in PCBs will likely create significant UPS efficiency gains and that all remaining technology options combined will improve UPS efficiency by less than one percent. Further, DOE notes that all remaining technology options satisfied the screening criteria, which ensures that the technology options are not protected by intellectual property laws and are readily available to all UPS manufacturers. Manufacturers may use any of the remaining technology options or their combination to improve the average load adjusted efficiencies of their UPS basic models. Lastly, DOE points out that per a stakeholder comment from ICF International at the September 16, 2016 public meeting, 78% of all UPS available in commerce are ENERGY STAR compliant, which demonstrates that technology options required to attain high levels of energy efficiency are readily available to multiple UPS manufacturers. (ICF, Pub. Mtg. Tr., No. 0014 at p. 24)

NEMA and ITI noted that VFD and VI UPSs typically do not have constantly rotating fans and argued that variable speed fan control technology will have limited effect on VFD and VI UPS efficiencies. Further, NEMA and ITI argued that wide band gap semiconductors are only useful in VFI UPS design with little usefulness in VI UPS designs and no usefulness in VFD UPS designs. NEMA and ITI contended that wide band gap semiconductors typically offer 0.25 percent improvement in UPS efficiency in applicable designs while costing up to three times more than traditional semiconductors. Lastly, NEMA and ITI argued that the use of Sendust and Litz wiring is limited to transformer-less UPS designs, which are not being pursued due to intellectual property limitations and requested that DOE consult with DOJ if the use of such designs is pursued. (NEMA and ITI, No. 0019 at p. 5)

DOE notes that of all the representative units across all three product classes, only the representative unit corresponding to EL 0 for VFI UPSs utilized variable speed fan control. None of the other representative units, including those used to generate EL 1 and EL 2 for VFI UPSs, utilized variable speed fan control or wide band gap semiconductors. While these two technology options were identified in consultation with manufacturers and other interested parties as viable options for improving UPS efficiencies across all three product classes, the efficiency levels being adopted in this final rule can be achieved without these two technology options as demonstrated by the representative units in VFD and VI UPS product classes. DOE disagrees with NEMA and ITI's claim that Sendust and Litz wiring technology options are limited to transformer-less UPS designs. UPSs across all three product classes incorporate a battery charger to keep their internal batteries fully charged. At the least, Sendust and Litz wiring may be used in the core and winding of transformers and inductors in these battery chargers to improve its efficiency which will improve the overall UPS efficiency.

Lastly, NEMA and ITI noted that some of the remaining technology options coupled with the high proposed energy conservation standards will tread into patent-protected areas, potentially lessening competition. NEMA and ITI noted that DOE is obliged to consult with DOJ regarding the potential competition effects and marketplace issues. (NEMA and ITI, No. 0019 at p. 16) As explained in section IV.B, DOE identified these technologies in consultation with manufacturers and other interested parties. These technology options have been screened for intellectual property protection and are readily available to all UPS manufacturers. Therefore, DOE disagrees with the stakeholder claim that these technology options will tread into patent-protected areas. Further, DOJ concluded that the proposed energy conservation standards for UPSs are unlikely to have a significant adverse impact on competition. DOJ's assessment letter is attached to the end of this rule.

*C. Engineering Analysis*

In the engineering analysis, DOE establishes the relationship between the manufacturer production cost (MPC) and improved UPS efficiency. This relationship serves as the basis for cost-benefit calculations for individual consumers, manufacturers, and the Nation. DOE typically structures the engineering analysis using one of three approaches: (1) Design option, (2) efficiency level, or (3) reverse engineering (or cost assessment). The design-option approach involves adding the estimated cost and associated efficiency of various efficiency-improving design changes to the baseline product to model different levels of efficiency. The efficiency-level approach uses estimates of costs and efficiencies of products available on the market at distinct efficiency levels to develop the cost-efficiency relationship. The reverse-engineering approach involves testing products for efficiency and determining cost from a detailed bill of materials (BOM) derived from reverse engineering representative products. The efficiency ranges from that of the least-efficient UPS sold today (*i.e.,* the baseline) to the maximum technologically feasible efficiency level. At each efficiency level examined, DOE determines the MPC; this relationship is referred to as a cost-efficiency curve.

DOE used a combination of the design-option and efficiency-level approach when determining the efficiency curves for UPSs. UPSs are composed of a single highly integrated PCB consisting of control and power conversion circuitry without any interchangeable components. The efficiency-level approach therefore is more suited to creating the cost-efficiency relationship since components cannot be removed to understand their impact on overall power consumption. However, DOE did use the design-option approach to determine the maximum technologically feasible EL because these products are not available on the market currently.

DOE began its analysis by completing a comprehensive study of the market for units that are in scope. A review of retail sales data, the ENERGY STAR qualified product list of compliant devices and manufacturer interviews aided DOE in identifying the most prevalent units in the market as well as those that are the least and most expensive and efficient. DOE then used a combination of purchased units for in-house efficiency testing as well as efficiency data directly from the ENERGY STAR database of compliant devices. The data from testing and the ENERGY STAR database allowed DOE to choose representative units and create multiple ELs for each product class.

1. Testing

In taking the hybrid efficiency-level and design option approach, DOE chose multiple units of the same product class striving to ensure variations between successive units (*e.g.* LCDs, communication ports, etc.) were removed. The resultant efficiency values and data obtained from manufacturers were then curve-fitted and extrapolated to the entire power range (defined by the scope) to create multiple ELs. For example, DOE tested several VFD representative units and identified additional ones from the ENERY STAR data in the 300–500W range to create four ELs for VFD UPSs, which when compared against the device's MPC demonstrated a direct positive correlation.

NEMA and ITI and Schneider Electric noted that because of differences between DOE's proposed test procedure and ENERGY STAR's test procedure for UPSs, DOE must adjust the average load adjusted efficiency of representative units whose efficiency data were collected from ENERGY STAR data by 0.2 to 0.4 percent. (NEMA and ITI, No. 0019, pp. 9–10, Schneider Electric, No. 0017 at p. 15) Similarly, during the public meeting held on September 16, 2016, ICF International stated that the differences between the two test procedures would produce a variance between 0.1 to 0.3 percent in the average load adjusted efficiency of UPSs. (ICF International, Pub. Mtg. Tr., No. 0014 at pp. 93). NEMA and ITI requested in written comments that if the DOE persists on pursuing the strict ELs as proposed in the NOPR, DOE must either mathematically determine the impacts of the proposed new UPS test procedure and adjust the ENERGY STAR data accordingly or undertake an extensive amount of additional physical testing and base the standard on these new data. (Schneider Electric, No. 0019 at p. 2)

DOE identifies in Table IV–1 the representative units that were tested as well as those whose efficiency values were collected from the ENERGY STAR database. DOE has revised its analysis for all ELs identified in Table IV–1 for which the efficiency value of representative units were collected from the ENERGY STAR database to account for the differences between DOE's test procedure and the ENERGY STAR test procedure for UPSs. Further, Table IV–1 shows that among the ELs proposed as energy conservation standards during the NOPR and finalized in this rulemaking, EL 1 for VFD UPSs and EL 1 for VI UPSs use a representative unit where the efficiency value was collected from the ENERGY STAR database and therefore did not have a battery connected during test. DOE is adopting the EL 1 for VFD UPSs and EL 1 for VI UPSs but notes that because DOE has revised its analysis to account for the differences between DOE's test procedure and the ENERGY STAR test procedure for UPSs, the standard equations have been slightly altered. For VFI UPSs, DOE is finalizing the proposed standard equation at EL 1 because the representative units for this EL was tested using DOE's proposed test procedure which automatically captures the losses due to a connected battery, and thus, no adjustments are necessary. The test data and the corresponding analysis for this EL therefore does not require an update.

TABLE IV–1—TEST PROCEDURE USED FOR EACH REPRESENTATIVE UNIT

| Product class | EL 0 | EL 1 | EL 2 | EL 3 |
|---|---|---|---|---|
| VFD UPS | DOE | ENERGY STAR | DOE | Not Applicable. |
| VI UPS | DOE | ENERGY STAR | DOE | Not Applicable. |
| VFI UPS | DOE | DOE | ENERGY STAR | Not Applicable. |

2. Representative Units and Efficiency Levels

Individual ELs for a UPS product class were created by curve-fitting and extrapolating the efficiency values of either a test unit or that of a unit identified from the ENERGY STAR database as explained in the previous section, IV.C. Each of the ELs are labeled EL 0 through EL 3 and reflect increasing efficiency due to technological advances. EL 0 represents baseline performance, EL 1 is described as the minimum required efficiency to be ENERGY STAR compliant, EL 2 is the best technology currently available in the market and EL 3 is the maximum efficiency theoretically achievable. As such, a representative unit for EL 0 was selected from the least efficient market segment of a particular product class. EL 1 and EL 2 were then represented by the least and most efficient ENERGY STAR unit respectively in the same power range. While DOE derived EL 0 through EL 2 via testing and using the online ENERGY STAR database, DOE created EL 3 from data obtained during manufacturer interviews.

Schneider Electric disagreed with DOE's approach of deriving an EL extending to the entire output power range of the scope based on the test result of a single representative unit. Schneider Electric further contended that DOE's selection of representative units appears arbitrary, that the corresponding ELs fail to account for fixed core losses that dominate at lower output power ranges and the shape of the ELs in all three product classes does not align with either the data provided by DOE or the ENERGY STAR database. Similarly, NEMA and ITI argued that the DOE offers no proof of why a curve makes more sense, or why it offers sufficient improvement over the well-established flat-bar requirements of ENERGY STAR. NEMA and ITI also argued that a curve based approach unfairly prejudices products that have a slightly lower efficiency because they are satisfying consumer demanded secondary functions like USB charge ports, wireless connectivity etc. Schneider Electric also argued that DOE's data set appears statistically insignificant in terms of the number of units tested, feature sets and power levels when compared to the consumer UPS market and underrepresents UPSs with rated output powers less than 300W, which incur higher fixed losses. Specifically, Schneider Electric disagreed with DOE's methodology of determining ELs for VFD UPSs with rated output power greater than 700W, VI UPSs with rated output power less than 300W, and VFI UPSs with rated output power less than 700W without testing UPSs in these output power ranges. If DOE were to select and test representative units in these ranges, Schneider Electric asserted DOE would find that there are not enough models in the marketplace for all UPSs under 300W, VFD UPSs greater than 1000W and VFI units under 600W to establish statistically valid baselines from which to derive requirements. However, Schneider Electric did note other units with lower efficiencies among DOE's test data set that had a lower average weighted efficiency and these would have been more suited as the representative unit for baseline efficiency, EL 0. (NEMA and ITI, No. 0019 at pp. 6–7; Schneider Electric, No. 0017 at pp. 2, 4, 6–9; Schneider Electric, Pub. Mtg. Tr., No. 0014 at pp. 50–51)

As explained earlier in this section, DOE did not select representative units nor establish ELs based on a statistical analysis of the efficiency distributions of the UPS market. DOE selected representative units on the basis of a unit's ability to achieve a certain average load adjusted efficiency at a particular cost while ensuring that the technology used to arrive at that efficiency passes DOE's screening analysis and is readily available to all manufacturers. In selecting representative units, DOE intentionally strived to minimize additional feature sets so that they would have minimal impact on the unit's efficiency measurement. Similarly, DOE attempted to keep the output power range constant between successive representative units of the same product class, ensuring that the resultant efficiency levels can be reasonably compared to one another without additional variables. Therefore, contrary to Schneider Electric's comment, DOE's selection of representative units were not arbitrary and were carefully selected.

Further, in measuring the input and output powers of a single representative unit at multiple loading points, DOE also effectively captured the energy performance of UPSs across the entire output power range. For example, measuring a 400W VFD UPS at 25% load successfully captures how fixed losses dominate at lower power levels. DOE's proposed ELs, each of which was derived using a single representative unit, is shown in Figure IV–1 through Figure IV–3. The shape of these ELs demonstrate less stringent efficiency requirements at lower output power levels since high efficiency values are harder to achieve where fixed losses dominate. DOE therefore believes that its use of a single representative unit to derive ELs for the entire output power range of the scope is accurate and reiterates that the ELs were not generated to conform to all the units tested by DOE for the NOPR analysis or to the publically available ENERGY STAR database. To expect the ELs to align with these data is to have misunderstood how DOE's engineering analysis and testing were performed. Finally in response to NEMA and ITI's comment regarding a preference for a flat line standard similar to that of ENERGY STAR, DOE believes that would be inaccurate in that it would treat UPSs of all power ranges equally, incentivizing secondary features across certain power ranges while excluding them from others.

While DOE did not derive ELs using statistical analysis of the efficiency distribution of the UPS market, DOE did use efficiency distribution data in its downstream analyses to evaluate what proportion of the UPS market would shift in response to a certain EL as well as each EL's cost and benefit to the individual consumer, the manufacturer and the Nation.

Lastly, in response to Schneider Electric's argument that there are units among DOE's dataset with a lower average load adjusted efficiency than the ones selected by DOE as representative units for establishing EL 0 for VFD and VI UPSs, DOE clarifies that while EL 0 establishes a baseline, its intention is not to represent the absolute least efficient units in the marketplace. Instead EL 0 simply represents a market segment that demonstrates a generally lower efficiency trend and the bulk of UPS shipments below EL 1. This is because, in the absence of preexisting Federal energy conservation standards, which is the case for UPSs, the absolute least efficient unit available in the market can be as inefficient as a certain UPS manufacturer desires, making it an outlier instead of a representation of the general least efficient market segment. Therefore, selecting the least efficient units found in commerce as EL 0 representative units is not an accurate representation of the general least efficient market segment.

Figure IV–1 through Figure IV–3 are graphical representations of the ELs for VFD UPS, VI UPS and VFI UPS types respectively.[16] Each EL is subdivided into power ranges for simplicity and is a piecewise approximation of the unit's overall efficiency across the entire power range as shown in the figures. Chapter 5 of the Final Rule TSD has additional detail on the curve-fit equations for each EL and UPS product class.

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[16] These figures are also available in Docket No. EERE–2016–BT–STD–0022

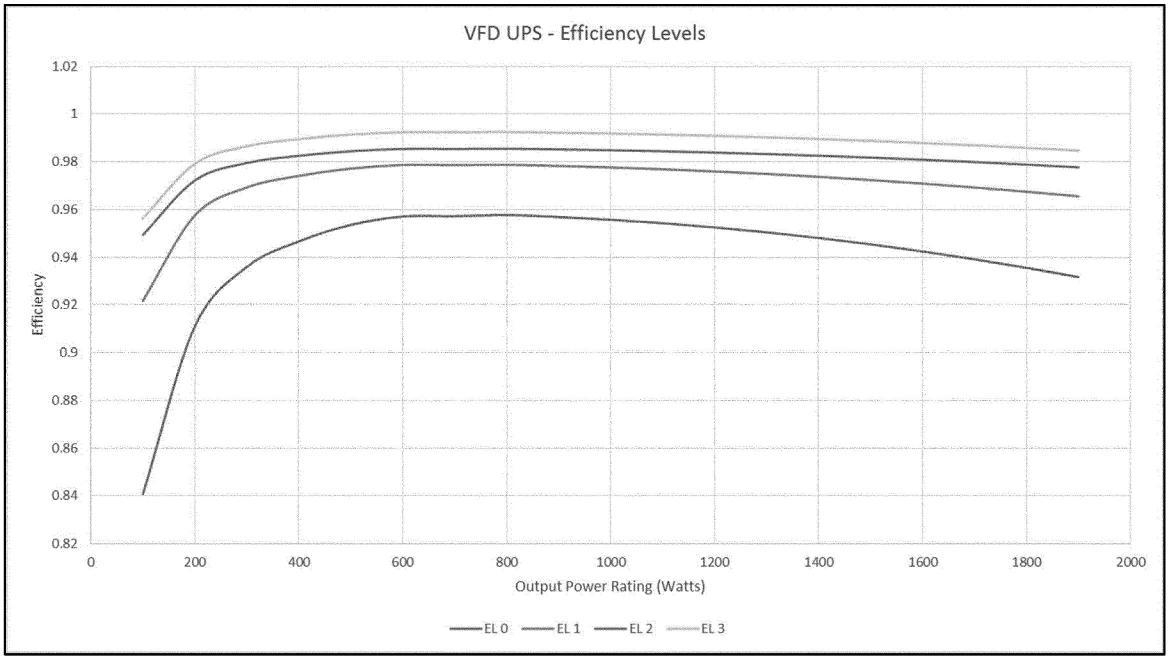


**Figure IV-1 Graphical Representation of VFD UPS Efficiency Levels**

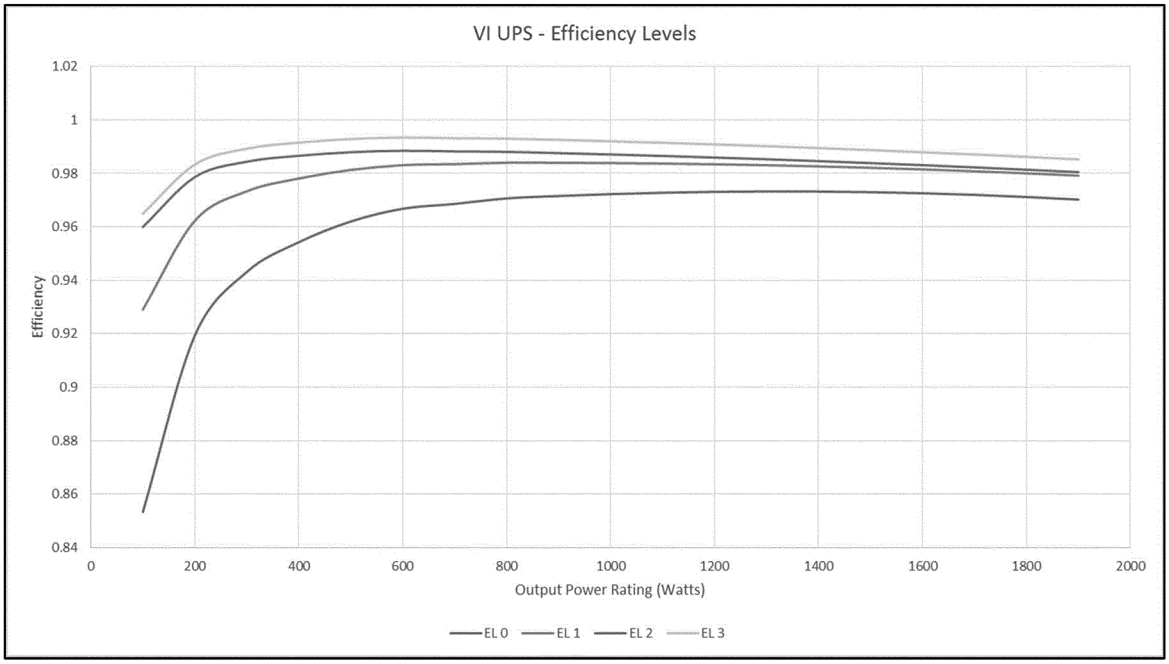


**Figure IV-2 Graphical Representation of VI UPS Efficiency Levels**

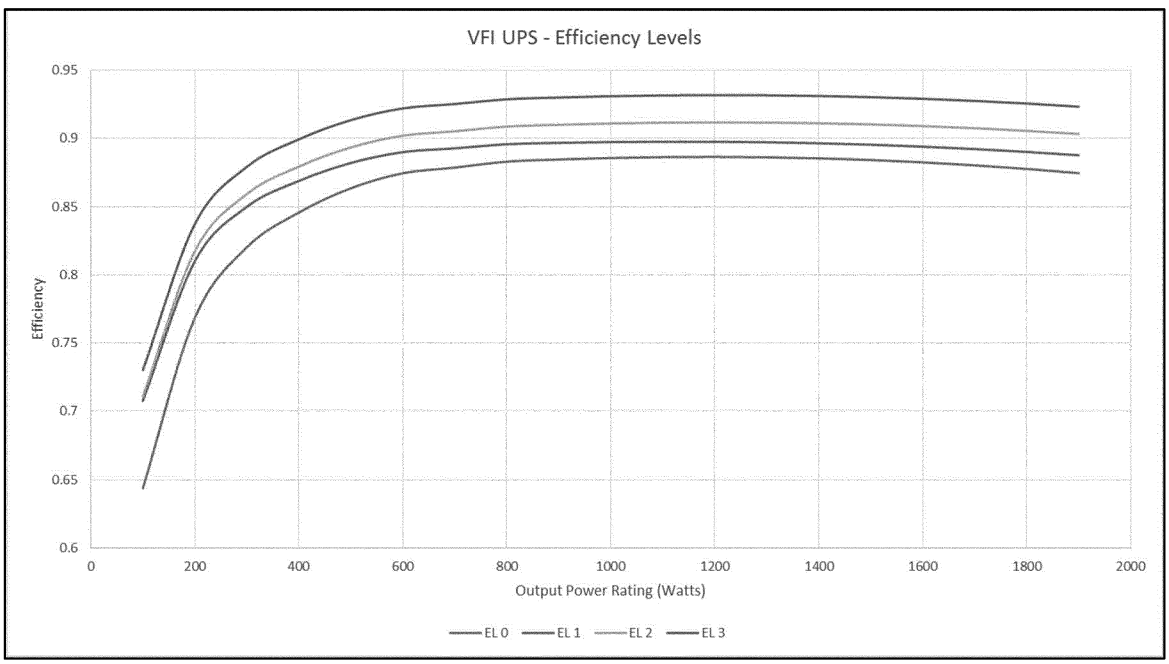


**Figure IV-3 Graphical Representation of VFI UPS Efficiency Levels**

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Schneider Electric noted that five VFD UPSs tested by DOE pass DOE's proposed energy conservation standard for the VFD UPS product class within the margin of gauge R&R variances for the test equipment at Schneider Electric, indicating a marginal failure. Further, Schneider Electric noted that none of the VI UPS units tested by DOE as part of the NOPR analysis or any of the compliant VI UPSs with rated output power less than 1000W listed in the ENERGY STAR database meet DOE's proposed EL 2 for the VI UPS product class. Schneider Electric argued that adoption of EL 2 for the VI UPS product class will eliminate VI UPSs with rated output powers less than 1000W, which would be a violation of clause 325(o)(4) of EPCA. Lastly, Schneider Electric argued that there is no evidence in the NOPR TSD or the ENERGY STAR database to support that VFI UPSs with rated output powers less than 700W will pass DOE's proposed EL 1 for the VFI UPS product class. (Schneider Electric, No. 0017 at pp. 4, 9–10, 11–12)

DOE notes that that compliance certification sampling provisions outlined in 10 CFR part 429 provide the necessary allowance in certified rating to accommodate small part to part variations such as gauge R&R variances. In response to Schneider Electric's comment that none of the units tested by DOE passes the proposed standard, DOE clarifies that this is due to the best-fit curves overshooting at certain data points resulting in a set of equations that are marginally more stringent than intended by as much as one-tenth of a percent. Among the test data published in the August 2016 NOPR were the efficiency values for the VI UPS EL 2 representative unit. Because EL 2 for VI UPSs was created using this representative unit's efficiency values, the unit itself would only pass the standard if it remained exactly as derived. However, due to the over approximation by the best fit curves as explained above, the EL appeared more stringent at certain data points causing the representative unit to demonstrate a marginal fail. DOE has adjusted the standard equations to account for this over approximation in this final rule which will resolve the issue with the EL 2 representative unit not passing the very EL it helped create. Additionally, the lack of a VI UPS unit in the ENERGY STAR database does not necessarily mean products that can achieve the required efficiency does not exist in the marketplace. ENERGY STAR is a voluntary program with stringent testing and compliance requirements, which manufacturers may not choose to undergo. The EL 2 representative unit for VI UPSs is again such an example. Similarly, as of October 10, 2016, there are five compliant VFI UPSs in the ENERGY STAR database under 700W, of which three units pass the EL 1 standard for VFI UPSs with significant margin to account for differences between DOE's test procedure and ENERGY STAR's. This refutes Schneider Electric's argument that there are currently no VFI UPSs under 700W in the ENERGY STAR database and continues to demonstrate that technology options are readily available to UPS manufacturers to produce VFI UPSs that meet DOE's adopted energy conservation standard.

It is also important to note that, In addition to the changes made to the analysis discussed in the previous two sections, IV.C.1 and IV.C.2, DOE updated its analysis with AEO2016 data as explained in section IV.H.2. In selecting a given standard, DOE must choose the level that achieves the maximum energy savings that is determined to be technologically feasible and economically justified. In making such a determination, DOE found that TSL 2 is no longer economically justified as a result of the above changes. Therefore, as described in section V.C, DOE is adopting TSL 1 in this final rule, which includes a less stringent standard for VI UPSs than initially proposed, and accordingly alleviates objections from Schneider Electric on the stringency of the proposed level for this product class.

Schneider Electric and NEMA and ITI also requested that DOE thoroughly examine the performance of secondary features that are unrelated to battery charging. All three stakeholders commented that these secondary features which include services such as USB charging ports, wired and wireless connectivity, displays, communications and other functions provide significant added utility to the consumer and DOE risks eliminating these consumer demanded utilities from UPS products by only considering cost versus electrical efficiency relationship. Further Schneider Electric provided a list of these consumer requested features along with what their corresponding allowance should be and proposed an alternate adjusted efficiency metric that accommodates the suggested allowances in place of the average load adjust efficiency metric proposed by DOE in the UPS test procedure. (NEMA and ITI, No. 0019 at pp. 3; Schneider Electric, No. 0017 at pp. 1–2, 13)

After careful review of the stakeholder comments summarized above, DOE is including provisions in the UPS test procedure to allow the limiting of secondary features that do not contribute to the maintenance of fully charged battery(s) or delivery of load power, similar to the provisions in place in the test procedure for all other battery chargers. See the December 12, 2016 UPS test procedure final rulemaking. 81 FR 89806. This will allow manufacturers to disable these secondary features in order to reduce or eliminate the impact that the energy consumption of these features has on the measured efficiency metric. However, DOE is not adopting the proposed alternative calculation that Schneider Electric proposed at this time. DOE does note that there are provisions in place, as outlined in 10 CFR 430.27, for an interested party to submit a petition for a test procedure waiver for a basic model of a covered product if the basic model's design prevents it from being tested according to the test procedure or if the results of the test procedure yield materially inaccurate or unrepresentative comparative data. When a waiver or interim waiver is granted, manufacturers are permitted to use an alternative test method to evaluate the performance of their product type in a manner representative of the energy consumption characteristics of the basic model. Accordingly, manufacturers may pursue this approach to petition DOE to allow the use of an alternative test method, which may include an alternative method for calculating the efficiency metric used to certify compliance with applicable energy conservation standards. More information on the waiver process is available on DOE's website: *http://energy.gov/eere/buildings/test-procedure-waivers.*

3. Cost Analysis

For UPSs, DOE developed average manufacturer and distribution markups for ELs by examining the annual Securities and Exchange Commission (SEC) 10–K reports filed by publicly-traded UPS manufacturers and distribution chains and further verified during stakeholder interviews. DOE used these validated markups to convert consumer prices into manufacturer selling prices (MSPs) and then into MPCs.

In general, DOE's cost analysis of representative units demonstrated a direct correlation between MPC and average load adjusted efficiency (see Figure 5.5.1 through 5.5.3 in chapter 5 of the Final Rule TSD). However, the one exception to this correlation was the EL 1 representative unit for VFD UPSs. This representative unit has a higher output power rating and average load adjusted efficiency, but a lower MPC compared to the EL 0 representative unit of the same product class.

In addition to the two representative units discussed here, DOE has found other VFD UPSs that demonstrate this negative correlation between MPC and average load adjusted efficiency between EL 0 and EL 1.

DOE believes that this exception to the otherwise direct correlation between MPC and average load adjusted efficiency of UPSs has several possible explanations. For the VFD UPSs in scope of this rulemaking, DOE believes consumers may typically be more concerned with the reliability of the protection the product provides, than its energy efficiency. Despite the presence of less expensive and more efficient units, DOE believes less efficient legacy units continue to be sold in the marketplace because consumers are familiar with these models and trust the level of protection and safety they offer even if more energy efficient UPS models with similar functionality and dependability are available at lower prices. Additionally, an unproven model that is more efficient yet less expensive may be perceived by consumers as less reliable. This perceived negative correlation between reliability and price of UPSs may take away an incentive from UPS manufacturers to improve the design of these models that have established a reputation of being dependable. Further, DOE's own analysis and consultation with subject matter experts, and stakeholders comments have confirmed that increases in UPS efficiency using the technology options identified in section IV.B.2 will not negatively impact the reliability of the product.

It is also worth noting that the difference in MSP between the VFD UPS EL 0 and EL 1 representative units is $5.10 and while this can be significant on its own, it may only be a small fraction of the cost of the connected equipment that it is protecting or the potential loss in productivity if said connected equipment were to lose power. DOE believes this is one of the reasons why devices at EL 0 continue to exist in the market place at a price higher than more efficient EL 1 models.

However, negative costs are unexpected in an economic theory that assumes a perfect capital market with perfect rationality of agents having complete information. In such a market, because more efficient UPSs save consumers money on operating costs compared to the baseline product, consumers would have an incentive to purchase them even in the absence of standards. For these reasons, DOE discussed perceived lower reliability of less expensive models as a possible explanation for the exception to the otherwise direct correlation between MPC and average load adjusted efficiency of UPSs and requested comments on its understanding of why less efficient UPSs continue to exist in the market at a price higher than more efficient units. DOE also requested comments on the impact that energy conservation standards for UPSs will have on the costs and efficiencies of existing UPS models, including various aspects of the inputs to the installed cost analysis, such as assumptions about consumers' response to first cost versus long-term operating cost, assumptions for manufacturer capital and product conversion costs, and other factors.

NEMA and ITI responded to this request for comment by stating their agreement with DOE's analysis that less efficient VFD units continue to sell in the marketplace at a higher price due to perceived reliability. However, NEMA and ITI also stated that DOE did not analyze the high likelihood that these products include other features such as USB charging ports, wired and wireless connectivity, integrated on-board data displays, or other performance features in the NOPR TSD. Taken in this context, the DOE's statement can be followed to a logical conclusion that consumers will accept slightly lower efficiency and higher cost for greater functionality and utility. Similarly, Schneider Electric commented that less efficient UPSs continue to exist in the market at a higher price due to various factors such as but not limited to form factor, display functionality, legibility, outlet quantity, position, line cord length, battery runtime, surge protection rating, environmentally friendly materials and packaging, communication and software capability, brand reputation and reliability and product warranty. (NEMA and ITI, No. 0019 at p. 13; Schneider Electric, No. 0017 at p. 16)

DOE appreciates the feedback from NEMA and ITI and Schneider Electric and generally agrees with some of the features highlighted such as brand reputation, product warranty, form factor, materials and packaging as possible reasons for why less efficient units continue to exist in the market at a higher price. DOE has therefore kept the cost analysis intact from the NOPR.

### *D. Markups Analysis*

The markups analysis develops appropriate markups (*e.g.,* retailer markups, distributor markups, contractor markups) in the distribution chain and sales taxes to convert the consumer prices, derived in the engineering analysis, into the MSPs for each product class and EL. The MSPs calculated in the markups analysis are then used as inputs to the MIA. The prices derived in the engineering analysis are marked up to reflect the distribution chain of UPSs. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin. For UPSs, the main parties in the distribution chain are retailers. The final prices, which also include sales taxes, are then used in the LCC and PBP analyses.

For retailers, DOE developed separate markups for baseline products (baseline markups) and for the incremental cost of more-efficient products (incremental markups). Incremental markups are coefficients that relate the change in the MSP of higher-efficiency models to the change in the retailer sales price. DOE relied on economic data from the U.S. Census Bureau [17] to estimate average baseline and incremental markups.

The manufacturer markups, which convert MSPs to MPCs are calculated as part of the MIA and are not presented in the markups analysis. DOE developed average manufacturer markups by examining the annual SEC 10–K reports filed by publicly traded UPS manufacturers then refining these estimates based on manufacturer feedback.

Chapter 6 of the final rule TSD provides details on DOE's development of markups for UPSs.

### *E. Energy Use Analysis*

The purpose of the energy use analysis is to determine the annual energy consumption of UPSs at different efficiencies in representative U.S. single-family homes, multi-family residences, and commercial buildings, and to assess the energy savings potential of increased UPS efficiency. The energy use analysis estimates the range of energy use of UPSs in the field (*i.e.,* as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

To develop energy use estimates, DOE multiplied UPS power loss as a function of rated output power, as derived in the engineering analysis, by annual operating hours. In the NOPR, DOE assumed that UPSs are operated for 24 hours per day, 365 days per year, at a typical load specific to each product class. DOE assumed average loading for VFD UPSs to be 25 percent, average loading for VI products to be 50 percent, and average loading for VFI products to be 75 percent.

CA IOUs agreed with DOE's loading assumption of 25% for VFD UPSs, but noted that existing computer usage data suggest this loading is likely to be low. Furthermore, CA IOUs disagreed with DOE's loading assumption of 50% for VI UPSs, arguing that these products are much more likely to be utilized with

[17] U.S. Census Bureau. Annual Retail Trade Survey, Electronics and Appliance Stores. 2012. *www.census.gov/retail/arts/historic_releases.html.*

servers instead of desktop computers, and that average loading is more likely to be similar to VFI UPS. CA IOUs requested DOE assume a similar loading assumption for VI UPSs as in the ENERGY STAR UPS specification. (CA IOUs, No. 0016 at pp. 2–3) In the absence of energy use field data for UPSs, Schneider supports the average loading conditions used in ENERGY STAR. (Schneider Electric, No. 0017 at p. 16)

In response to these comments, DOE has adjusted its loading assumptions for all product classes in the energy use analysis to match those in the ENERGY STAR UPS specification and in the DOE UPS test procedure. For VFD UPSs with rated output power of 1500 W or less, the weighted average loading assumption uses the following weights: 0.2 at 25 percent loading, 0.2 at 50 percent loading, 0.3 at 75 percent loading, and 0.3 at 100 percent loading. For all other UPSs, the weighted average loading assumption uses the following weights: 0.3 at 50 percent loading, 0.4 at 75 percent loading, and 0.3 at 100 percent loading. DOE agrees that little field data exist on the energy use of UPSs, and that in the absence of such data, it is preferable to rely upon the consensus loading assumptions agreed upon as part of the ENERGY STAR specification development.

CA IOUs additionally requested that DOE consider the efficiency degradation of UPSs which may occur over the lifetime of a product. Age-induced battery degradation and elevated self-discharge rates would lead to an increase in energy use with age. (CA IOUs, No. 0016 at p. 3) DOE notes that no data are available, nor were they submitted, on how the energy use of UPSs may change with age. Furthermore, it is possible to regularly replace UPS batteries over the lifetime of a UPS, eliminating the potential efficiency degradation due to an aging battery. The battery replacement cost is assumed to be the same across all efficiency levels in the analysis, and therefore was not included in the LCC analysis. For these reasons, DOE did not include efficiency degradation with age in its energy use analysis for the final rule.

CA IOUs further requested that DOE revise its energy use analysis to take into account the usage of UPSs that can act as mobile battery packs. CA IOUs contend that the energy usage of such devices is significantly different from other UPSs, since the device undergoes far more discharge cycles and is likely to operate more frequently with a partially discharged battery, increasing energy use. (CA IOUs, No. 0016 at pp. 4–5) DOE notes that devices that act only as a mobile battery pack, and are not designed to provide continuity of load in case of input power failure, do not meet the definition of a UPS. Additionally, any UPS that only has outputs providing direct current (*e.g.,* USB ports) is outside the scope of this rulemaking. Many products classified as mobile battery packs would therefore not be subject to energy conservation standards for UPSs. DOE's market analysis suggests that hybrid devices that meet the definition of a UPS, include AC outputs, and can additionally act as a mobile battery pack, constitute a very small minority of the total UPS market. There are a limited number of models meeting this description available on the market. Furthermore, these devices are far less likely to be regularly used as a mobile battery pack, given that removing the mobile battery pack (including the battery component) for remote device charging negates the UPS functionality of the device to provide continuity of load in case of input power failure. DOE assumes that consumers would only occasionally use the mobile battery pack with such devices. For these reasons, DOE believes that the energy usage of such devices is likely to be very similar to traditional UPSs, and has not adjusted its energy use analysis with respect to UPSs that can act as mobile battery packs.

EEI requested that the energy use analysis be revised to account for the energy consumption of the UPS components only, and not include the energy usage of connected loads. (EEI, No. 0021 at p. 4) DOE clarifies that its energy use analysis only considers the energy consumed by the UPS device itself, including energy conversion losses that occur while providing power to a connected load. The energy use analysis does not include energy that merely passes through the UPS. However, in order to calculate this energy consumption by the UPS, it is necessary to assume the energy going through the UPS to the connected end-use equipment. It is for this reason that DOE considers the type of connected equipment when determining the average loading condition assumptions. In the absence of any field data for UPSs, DOE is relying on the ENERGY STAR loading assumptions for the final rule.

To capture the diversity of products available to consumers, DOE collected data on the distribution of UPS output power rating from product specifications listed on online retail websites. DOE then developed product samples for each UPS product class based on a market-weighted distribution of product features found to impact efficiency as determined by the engineering analysis.

Chapter 7 of the final rule TSD provides details on DOE's energy use analysis for UPSs.

### *F. Life-Cycle Cost and Payback Period Analysis*

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for UPSs. The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE used the following two metrics to measure consumer impacts:

- The LCC (life-cycle cost) is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.
- The PBP (payback period) is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of UPSs in the absence of new or amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline product.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of housing units, as well as one for commercial buildings. For each sample household and commercial building, DOE determined the energy consumption for the UPS and the appropriate electricity price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of UPSs.

DOE was unable to locate a survey sample specific to UPS users for either the residential or commercial sector. However, as mentioned in the previous section, manufacturer interviews indicate that most VFD products are used with personal computers, around three quarters of low-end VI products are used with computers and workstations, and around three quarters of higher-end VI and VFI products are used with servers. DOE thus created residential and commercial samples for desktop computers as a proxy for the sample of VFD and VI UPS owners, and a sample for servers as a proxy for the sample of VFI UPS owners.

DOE developed its residential sample from the set of individual responses to the Consumer Electronics Association's (CEA's) *16th Annual CE Ownership and Market Potential Study*.[18] CEA administered the survey to a random, nationally representative sample of more than 2,000 U.S. adults in January and February 2014. The individual-level survey data that CEA provided to DOE were weighted to reflect the known demographics of the sample population; weighting by geographic region, gender, age, and race were used to make the data generalizable to the entire U.S. adult population. From this dataset, DOE constructed its household sample for UPSs by considering the number of desktop computers per household in conjunction with 2013 household income and state of residence.

To create a commercial building sample, DOE relied on EIA's Commercial Buildings Energy Consumption Survey (CBECS), a nationally representative survey with a rich dataset of energy-related characteristics of the nation's stock of commercial buildings.[19] Individual survey responses from the most recent survey in 2012 allowed DOE to consider how the commercial penetration of servers and desktop computers varies by principal building activity and by Census Division. DOE used these microdata to construct the commercial sample of UPSs, which are assumed to back up and condition power for servers and desktop computers.

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

The computer model DOE uses to calculate the LCC and PBP relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and UPS user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units and 10,000 commercial buildings per simulation run.

DOE calculated the LCC and PBP for all consumers of UPSs as if each were to purchase a new product in the first year of required compliance with new standards. Any new standards would apply to UPSs manufactured two years after the date on which any new standard is published. Therefore, for purposes of its analysis, DOE used 2019 as the first year of compliance with any new standards for UPSs.

Table IV–2 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the final rule TSD and its appendices.

TABLE IV–2—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS *

| Inputs | Source/method |
|---|---|
| Product Cost | Derived by multiplying MPCs by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to project product costs. |
| Installation Costs | Assumed no change with efficiency level. |
| Annual Energy Use | Power loss (a function of rated output power) multiplied by annual operating hours. Average number of hours at a typical load based on ENERGY STAR load profile. Variability: Distribution of rated power from online retail websites. |
| Energy Prices | Electricity: Based on 2014 marginal electricity price data from the Edison Electric Institute. Variability: Electricity prices vary by season, U.S. region, and baseline electricity consumption level. |
| Energy Price Trends | Based on *AEO2016* price projections. |
| Repair and Maintenance Costs | Assumed no change with efficiency level. |
| Product Lifetime | Based on literature review and manufacturer interviews. Variability: Based on a Weibull distribution. |
| Discount Rates | Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances. |
| Compliance Date | 2019. |

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

1. Product Cost

To calculate consumer product costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described above (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products, because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency product. The prices used in the LCC and PBP analysis are MPC in the compliance year, as described in chapter 5 of the TSD.

Examination of historical price trends for a number of appliances that have been subject to energy conservation standards indicates that an assumption of constant real prices and costs may overestimate long-term trends in appliance prices. Economic literature and historical data suggest that the real costs of these products may in fact trend downward over time according to

[18] Available for purchase at *http://store.ce.org/Default.aspx?TabID=251&productId=782583.*

[19] U.S. Department of Energy—U.S. Energy Information Administration. Commercial Buildings Energy Consumption Survey (CBECS). 2012 Public Use Microdata File. 2015. Washington, DC. *http://www.eia.gov/consumption/commercial/data/2012/index.cfm?view=microdata.*

''learning'' or ''experience'' curves. On February 22, 2011, DOE published a notice of data availability (NODA) stating that DOE may consider refining its analysis by addressing equipment price trends. 76 FR 9696. It also raised the possibility that once sufficient long-term data are available on the cost or price trends for a given product subject to energy conservation standards, DOE would consider these data to forecast future trends. However, DOE found no data or manufacturer input to suggest appreciable price trends for UPSs, and thus assumed no price trend for UPSs.

ASAP et al. noted that DOE has included price trends in its analyses for several other products, including mature products, and implied that DOE should incorporate a price trend for UPSs. (ASAP et al., No. 0020 at p. 3) DOE notes that its methodology for determining appropriate price trends for a given product relies on collecting sufficient historical data on shipments and prices to perform the necessary analysis. DOE reiterates that it was unable to find any such data for UPSs. In the absence of data, DOE assumed no price trend for UPSs in the final rule.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE found no evidence that installation costs would be impacted with increased efficiency levels for UPSs. DOE received no comments on installation costs for UPSs.

3. Annual Energy Consumption

For each sampled household and commercial building, DOE determined the energy consumption for a UPS at different efficiency levels using the approach described in section IV.E of this document.

4. Energy Prices

DOE used marginal electricity prices to characterize the incremental savings associated with ELs above the baseline. The marginal electricity prices vary by season, region, and baseline household electricity consumption level for the LCC. DOE estimated these prices using data published with the Edison Electric Institute (EEI) Typical Bills and Average Rates reports for summer and winter 2014.[20] DOE assigned seasonal marginal prices to each household or commercial building in the LCC sample based on its location and its baseline monthly electricity consumption for an average summer or winter month. For a detailed discussion of the development of electricity prices, see appendix 8D of the final rule TSD.

To estimate electricity prices in future years, DOE multiplied the average regional prices by annual energy price factors derived from the forecasts of annual average residential and commercial electricity price changes by region that are consistent with cases described on p. E–8 in *AEO 2016*.[21] *AEO 2016* has an end year of 2040. To estimate price trends after 2040, DOE used the average annual rate of change in prices from 2020 to 2040. DOE received no comments on its estimation of energy prices.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. For UPSs, DOE assumed that small incremental increases in product efficiency produce no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products. DOE received no comments on maintain or repair costs.

6. Product Lifetime

For UPSs, DOE performed a search of the published literature to identify minimum and maximum average lifetimes from a variety of sources. DOE also considered input from manufacturer interviews conducted in early 2015. Table IV–3 summarizes the UPS lifetimes that DOE compiled from the literature and manufacture interviews. Where a range for lifetime was given, DOE noted the minimum and maximum values; where there was only one figure, DOE recorded this figure as both the minimum and maximum value. DOE computed mean lifetime by averaging these values across the product class.

TABLE IV–3—UPS PRODUCT LIFETIMES FROM LITERATURE AND MANUFACTURER INPUT

| Product class | Description | Lifetimes (years) | | | |
|---|---|---|---|---|---|
| | | Minimum | Mean | Median | Maximum |
| 10a | VFD UPS | 3 | 5 | 5 | 7 |
| 10b | VI UPS | 5 | 6.3 | 6 | 8 |
| 10c | VFI UPS | 8 | 10 | 10 | 12 |

Using these minimum, maximum, and mean lifetimes, DOE constructed survival functions for the various UPS product classes. No more than 10 percent of units were assumed to fail before the minimum lifetime, and no more than 90 percent of units were assumed to fail before the maximum lifetime. DOE assumed these survival functions have the form of a cumulative Weibull distribution, a probability distribution commonly used to model appliance lifetimes. Its form is similar to that of an exponential distribution, which models a fixed failure rate, except a Weibull distribution allows for a failure rate that can increase over time as appliances age. DOE received no comments on its estimate of UPS lifetimes. For additional discussion of UPS lifetimes, refer to chapter 8 of the final rule TSD.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating costs. DOE estimated a distribution of residential discount rates for UPSs based on

[20] Edison Electric Institute. *Typical Bills and Average Rates Report.* Winter 2014 published April 2014, Summer 2014 published October 2014. *http://www.eei.org/resourcesandmedia/products/Pages/Products.aspx.*

[21] EIA. *Annual Energy Outlook 2016 with Projections to 2040.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/.* The standards finalized in this rulemaking will take effect a few years prior to the 2022 commencement of the Clean Power Plan compliance requirements. As DOE has not modeled the effect of CPP during the 30 year analysis period of this rulemaking, there is some uncertainty as to the magnitude and overall effect of the energy efficiency standards. These energy efficiency standards are expected to put downward pressure on energy prices relative to the projections in the AEO 2016 case that incorporates the CPP. Consequently, DOE used the electricity price projections found in the AEO 2016 No-CPP case as these electricity price projections are expected to be lower, yielding more conservative estimates for consumer savings due to the energy efficiency standards.

consumer financing costs and the opportunity cost of consumer funds.

DOE applies weighted average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates.[22] DOE notes that the LCC does not analyze the appliance purchase decision, so the implicit discount rate is not relevant in this model. The LCC estimates net present value over the lifetime of the product, so the appropriate discount rate will reflect the general opportunity cost of household funds, taking this time scale into account. Given the long time horizon modeled in the LCC, the application of a marginal interest rate associated with an initial source of funds is inaccurate. Regardless of the method of purchase, consumers are expected to continue to rebalance their debt and asset holdings over the LCC analysis period, based on the restrictions consumers face in their debt payment requirements and the relative size of the interest rates available on debts and assets. DOE estimates the aggregate impact of this rebalancing using the historical distribution of debts and assets.

To establish residential discount rates for the LCC analysis, DOE identified all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings. It estimated the average percentage shares of the various types of debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances [23] (SCF) for 1995, 1998, 2001, 2004, 2007, 2010, and 2013. Using the SCF and other sources, DOE developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity and income groups, weighted by the shares of each type, is 4.3 percent. DOE received no comments on its estimate of residential discount rates. See chapter 8 of the final rule TSD for further details on the development of consumer discount rates.

To establish commercial discount rates for the LCC analysis, DOE estimated the cost of capital for companies that purchase a UPS. The weighted average cost of capital is commonly used to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so their cost of capital is the weighted average of the cost to the firm of equity and debt financing, as estimated from financial data for publicly traded firms in the sectors that purchase UPSs. For this analysis, DOE used Damodaran online [24] as the source of information about company debt and equity financing. The average rate across all types of companies, weighted by the shares of each type, is 5.2 percent. DOE received no comments on its estimate of commercial discount rates. See chapter 8 of the final rule TSD for further details on the development of commercial discount rates.

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

To accurately estimate the share of consumers that would be affected by a potential energy conservation standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution (market shares) of product efficiencies under the no-standards case (*i.e.,* the case without amended or new energy conservation standards). To estimate the efficiency distribution of UPSs for 2019, DOE examined a recent ENERGY STAR qualified product list. Although these model lists are not sales-weighted, DOE assumed they were a reasonable representation of the market.

The estimated market penetration of ENERGY STAR-qualified UPSs was 78 percent in 2013, the most recent year for which data were available.[25] During the public meeting held on September 16, 2016, ICF International confirmed that ENERGY STAR compliant UPSs have an estimated 78 percent market penetration. (ICF International, Pub. Mtg. Tr., No. 0014 at p. 24) DOE assumed market penetration to be 78 percent for all three UPS product classes, as the 2013 Unit Shipment Data report does not distinguish between UPS architectures. In order to assess how qualified products fit into proposed efficiency levels, DOE analyzed a qualified product list downloaded on February 16, 2016, after cross-checking inconsistencies in reported UPS product type with product specifications on retail websites. For the 266 qualified in-scope models, DOE compared average efficiency to the efficiency required for each EL, as determined in the engineering analysis. Finally, DOE assumed that the market share represented by non-ENERGY-STAR-qualified products would belong to the least-efficient efficiency level analyzed. The estimated market shares for the no-new-standards case for UPSs are shown in Table IV–4. DOE received no other comments on the estimated market shares for the no-new-standards case. See chapter 8 of the final rule TSD for further information on the derivation of the efficiency distributions.

TABLE IV–4—ESTIMATED MARKET SHARES (%) IN EACH EFFICIENCY LEVEL FOR NO-NEW-STANDARDS CASE

| Product class | Description | Efficiency level | | | |
|---|---|---|---|---|---|
| | | EL 0 (baseline) | EL 1 | EL 2 | EL 3 |
| 10a | VFD UPS | 31 | 47 | 21 | 1.5 |
| 10b | VI UPS | 65 | 29 | 6.4 | 0.0 |
| 10c | VFI UPS | 71 | 23 | 5.8 | 0.0 |

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

[23] Board of Governors of the Federal Reserve System. *Survey of Consumer Finances.* Various dates. Washington, DC. *http://www.federalreserve.gov/pubs/oss/oss2/scfindex.html.*

[24] Damodaran, A. *Cost of Capital by Sector.* January 2014. (Last accessed September 25, 2014.) New York, NY. *http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/wacc.htm.*

[25] Environmental Protection Agency—ENERGY STAR Program. *Certification Year 2013 Unit Shipment Data.* 2014. Washington, DC. *https://www.energystar.gov/index.cfm?c=partners.unit_shipment_data.*

These market shares in each efficiency level were estimated based on national data. Regional data are not available. All other factors being the same, it would be anticipated that higher efficiency purchases in certain regions in the no-standards case would correlate positively with higher energy prices. To the extent that this occurs, it would be expected to result in some lowering of the consumer operating cost savings from those calculated in this final rule.

9. Payback Period Analysis

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

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

As noted above, EPCA, as amended, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price projection for the year in which compliance with the new standards would be required.

*G. Shipments Analysis*

DOE uses projections of annual product shipments to calculate the national impacts of potential amended or new energy conservation standards on energy use, NPV, and future manufacturer cash flows.[26] Because UPSs back up and condition power for electronics, whose technology evolves more rapidly than many other appliances, DOE did not rely on a stock accounting approach common to other appliances. Instead, DOE largely elected to extrapolate forecasted trends from market research data. Data from Frost & Sullivan [27] and ENERGY STAR unit shipments [28] provided the foundation for DOE's shipments analysis for UPSs. DOE calculated shipment values for 30 years, from 2019, the first year of compliance, through 2048, the last year of the analysis period.

1. Shipment Projections in the No-New-Standards Case

DOE relied on data from Frost & Sullivan and ENERGY STAR to develop the shipments in the no-standards case for UPSs.[29] Frost & Sullivan provide global UPS unit shipments from 2009 to 2019 for the relevant output range <1000 W. Because the next output power range for which shipments are provided is 1–5 kilo-watts (kW), and only UPSs with a NEMA 1–15P or 5–15P plug (approximately corresponding to a rated output power <1800 W) are in scope, DOE excluded this power range from the shipments analysis. Doing so results in a more conservative shipment projection. For <1000 W, Frost & Sullivan supply North American revenue as a percent of global revenue for 2009 to 2019, so DOE assumed that the percent of revenue is a reasonable proxy for percent of shipments. Multiplying global shipments by the North American percentage of revenue, and then by 0.9 under the assumption that the United States makes up 90 percent of the North American market, yielded U.S. UPS shipments.

Frost & Sullivan provide no classification by type of UPS within the relevant power range. However, the 2013 ENERGY STAR unit shipment data collection process [30] provides such a breakdown; in that year, market penetration of UPSs was 78 percent,[31] so DOE assumed these data are representative of the market. DOE used these data to determine how <1000 W UPSs are apportioned among different topologies for 2013 to 2019, assuming this allocation stays constant: 50 percent VFD, 39 percent VI, and 12 percent VFI. The Frost & Sullivan data indicate that the commercial sector dominates UPS revenue in the <1000 W market segment; therefore, DOE assumed a split of 90 percent commercial and 10 percent residential shipments.

To project UPS shipments from 2020–2048, DOE extrapolated the linear trends forecasted by Frost & Sullivan from 2014 to 2019. In conjunction with the 2013 fixed split between topologies and a fixed portion of 0.9 for the United States relative to North American shipments, DOE projected the increasing linear trend in global UPS shipments <1 kW and the decreasing linear share of North American revenue to forecast shipments from 2019 to 2048.

NEMA and ITI noted that ENERGY STAR shipment data for UPSs indicate an 18 percent decline in shipments from 2014 and 2015. They also note that shipment projections of desktop computers show a declining market. NEMA and ITI state that DOE's shipments analysis is in error, and relies on historical data which is no longer applicable. (NEMA and ITI, No. 0019 at p. 13) In response to DOE's request for shipment data in the NOPR, Schneider also noted that ENERGY STAR shipment volume estimates have been in decline, but did not provide any shipment data due to confidentiality restrictions. (Schneider Electric, No. 0017 at p. 16)

DOE clarifies that its shipment analysis does not depend on historical data gathered independently, but rather relies on the analysis provided by the market research firm Frost & Sullivan. Frost & Sullivan provide their own market projections out to 2019 (partially based on its own historical data), after which DOE linearly extrapolated the shipment trends. DOE has no reason to suspect the Frost & Sullivan analysis is flawed, and continues to rely on it for the final rule. DOE acknowledges that there may have been short-lived market impacts in the past year or two due to various economic factors, and that the ENERGY STAR shipment data may reflect this dynamic. However, DOE notes that the penetration of ENERGY STAR products in the market may fluctuate, and ENERGY STAR shipment estimates do not provide a complete picture of the market. DOE further emphasizes that its shipment analysis is a long term projection over 30 years starting in 2019.

[26] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are lacking. In general one would expect a close correspondence between shipments and sales.

[27] Cherian, A. *Analysis of the Global Uninterruptible Power Supplies Market: Need for Greater Power Reliability Driving Growth.* Frost & Sullivan. 2013. San Antonio, TX. *http://www.frost.com/c/10077/sublib/display-report.do?id=NC62-01-00-00-00.*

[28] Environmental Protection Agency—ENERGY STAR Program. *Certification Year 2013 UPS Unit Shipment Data.* 2013. Washington, DC. *https://www.energystar.gov/index.cfm?c=partners.unit_shipment_data.*

[29] Cherian, A. *Analysis of the Global Uninterruptible Power Supplies Market: Need for Greater Power Reliability Driving Growth.* Frost & Sullivan. 2013. San Antonio, TX. *http://www.frost.com/c/10077/sublib/display-report.do?id=NC62-01-00-00-00.*

[30] Environmental Protection Agency—ENERGY STAR Program. *Certification Year 2013 UPS Unit Shipment Data.* 2013. Washington, DC. *https://www.energystar.gov/index.cfm?c=partners.unit_shipment_data.*

[31] Ibid.

DOE acknowledges that desktop computer shipments are in decline, but notes that server shipments are not. Furthermore, Schneider acknowledged during the public meeting held on September 16, 2016, that there are growing applications of UPSs other than desktop computers and servers (*e.g.,* voice over internet Protocol, modems, routers, other wired and wireless network devices). (Schneider Electric, Pub. Mtg. Tr., No. 0014 at pp. 83–84; ASAP et al., No. 0020 at p. 2) DOE therefore believes it is reasonable to assume that the UPS market will grow during the time period of its analysis, as supported by Frost & Sullivan's analysis, even if the desktop computer market declines.

DOE acknowledges that there is some uncertainty regarding the future market growth of UPSs, and few analyses exist in the literature over the time period in DOE's analysis. As a result, DOE performed a sensitivity scenario of the national impact analysis assuming lower shipment growth over the 30-year analysis period. This sensitivity scenario is described in appendix 10B of the final rule TSD. While the absolute value of the energy savings estimates vary using this alternate shipments scenario, the relative comparison of the different trial standard levels analyzed does not.

2. Shipments in a Standards Case

Increases in product prices resulting from standards may affect shipment volumes. To DOE's knowledge, price elasticity estimates are not readily available in existing literature for UPSs, and hence DOE assumed a price elasticity of demand of zero.

During the public meeting held on September 16, 2016, Schneider inquired if price elasticity was factored into the analysis. (Schneider Electric, Pub. Mtg. Tr., No. 0014 at pp. 64–65) Schneider believes that DOE's analysis overestimates the market's willingness to absorb costs. (Schneider Electric, No. 0017 at p. 16) EEI similarly inquired as to how prices could increase without having a negative effect on shipments and manufacturer profits. (EEI, Pub. Mtg. Tr., No. 0014 at p. 66) NEMA and ITI disagreed with DOE's underlying assumption that consumers will continue to purchase UPSs of specific topologies regardless of price impacts. They stated that consumers of UPSs are very price-conscious. (NEMA and ITI, No. 0019 at p.6) NEMA and ITI also stated that as mobile computing and cloud computing services have grown relative to desktop computing, consumers can more easily opt to switch to these options instead of purchasing a more expensive UPS. Therefore, the price elasticity for UPSs is non-zero. (NEMA and ITI, No. 0019 at p. 14) No data were provided, however, to support the above statements.

DOE assumes that UPSs are not discretionary electronic devices, and consumers purchase UPSs for power continuity, power reliability, safety, and security needs which cannot be addressed by other products. Consumers with such critical needs are unlikely to forgo or delay the purchase of a UPS. DOE further assumes that in response to a modest price increase in UPSs, consumers are very unlikely to respond by switching from desktop computing to a much more expensive mobile computing platform with similar performance. DOE therefore believes that the UPS market is price inelastic, and continues to assume a price elasticity of demand of zero in its analysis in the absence of any data suggesting otherwise. Furthermore, there are many features available in specific UPS product classes (*e.g.,* power conditioning, precise voltage regulation) that provide important utility. DOE believes it is unlikely that a consumer would substitute or interchange different UPS topologies. Schneider confirmed DOE's understanding during the public meeting held on September 16, 2016, that the different product classes are not substitutes for one another and provide different utility. (Schneider Electric, Pub. Mtg. Tr., No. 0014 at p. 104) DOE therefore continues to assume in its analysis a cross-elasticity of demand of zero, and that there is no product class switching in response to energy conservation standards.

See chapter 9 of the final rule TSD for further details on the development of shipments projections. In response to the above comments regarding the price elasticity of demand, DOE acknowledges that no data exist to inform the analysis for UPSs. As a result, DOE performed a sensitivity scenario of the national impact analysis assuming a non-zero price elasticity of demand in the residential sector. DOE did not perform a sensitivity scenario using a non-zero price elasticity in the commercial sector, as DOE believes business requirements for safety and security result in an inelastic market. A price elasticity developed for household appliances was used in the absence of any literature estimates specific to UPSs. This sensitivity scenario is described in appendix 10B of the final rule TSD. While the absolute value of the energy and operating cost savings estimates vary using this alternate price elasticity scenario, the relative comparison of the different trial standard levels analyzed does not.

*H. National Impact Analysis*

The NIA assesses the national energy savings (NES) and the national net present value (NPV) from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[32] (''Consumer'' in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual product shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of UPSs sold from 2019 through 2048.

DOE evaluates the impacts of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. For this projection, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of products with efficiencies greater than the standard.

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

Table IV–5 summarizes the inputs and methods DOE used for the NIA analysis for the final rule. Discussion of these inputs and methods follows the

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

table. See chapter 10 of the final rule TSD for further details.

TABLE IV–5—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

| Inputs | Method |
|---|---|
| Shipments | Annual shipments from shipments model. |
| Compliance Date of Standard | 2019. |
| Efficiency Trends | No-New-Standards case: no efficiency trend Standard cases: ''roll-up'' scenario. |
| Annual Energy Consumption per Unit | Annual weighted-average values are a function of energy use at each TSL. |
| Total Installed Cost per Unit | Annual weighted-average values are a function of cost at each TSL. Incorporates projection of future product prices based on historical data. |
| Annual Energy Cost per Unit | Annual weighted-average values as a function of the annual energy consumption per unit and energy prices. |
| Repair and Maintenance Cost per Unit | Annual values do not change with efficiency level. |
| Energy Prices | *AEO2016* projections (to 2040) and extrapolation through 2048. |
| Energy Site-to-Primary and FFC Conversion | A time-series conversion factor based on *AEO2016.* |
| Discount Rate | Three and seven percent. |
| Present Year | 2016. |

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. Section IV.F.8 of this rule describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment-weighted average efficiency) for each of the considered product classes for the year of anticipated compliance with an amended or new standard. To project the trend in efficiency for UPSs over the entire shipments projection period, DOE examined past improvements in efficiency over time. Little data exist to suggest that UPS efficiencies would improve in the 30 years following 2019 in the no-standards case. The approach is further described in chapter 10 of the final rule TSD.

Schneider submitted a figure showing that UPS efficiency has improved from 1995 to 2016 in the absence of a mandatory energy conservation standard, due to consumer demand and the impact of voluntary programs such as ENERGY STAR. (Schneider Electric, No. 0017 at p. 17) Similarly, NEMA and ITI stated that there is little relevant historic efficiency trend information because the UPS market has already been transformed by the ENERGY STAR UPS program. (NEMA and ITI, No. 0019 at 14) In contrast, CA IOUs agreed with DOE's assessment that UPS efficiencies would not improve in the no-new-standards case, as evidenced by the reported average maintenance-mode power consumptions of UPSs in the California Energy Commission (CEC) appliance database from 2013-to-date. (CA IOUs, No. 0016 at pp. 3–4) DOE notes that the figure submitted by Schneider was for a 1500 VA VFI UPS only, and was not accompanied by the underlying data, nor were any details provided regarding how the data were assembled. It is unclear whether the figure is representative of all UPSs, of all VFI UPSs, of only a subset of VFI UPSs at this rated output power, or of only a single UPS with a specific set of unchanging features. Schneider did not provide data on the efficiency trend for all product classes of UPSs. Given these limitations with the figure submitted by Schneider, and the available data found in the CEC appliance database, there is not sufficient data to suggest UPS efficiency has improved in the absence of an energy conservation standard. DOE continues to assume no efficiency improvement in the no-new-standards case for the final rule.

For the standards cases, DOE used a ''roll-up'' scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective (2019). In this scenario, the market shares of products in the no-standards case that do not meet the standard under consideration would ''roll up'' to meet the new standard level, and the market share of products above the standard would remain unchanged. To develop standards case efficiency trends after 2019, DOE implemented the same trend as in the no-standards case: Zero percent for UPSs.

2. National Energy Savings

The national energy savings analysis involves a comparison of national energy consumption of the considered products between each potential standards case (TSL) and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO2016.* Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

In 2011, in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use full-fuel-cycle (FFC) measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System (NEMS) is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [33] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive

[33] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009,* DOE/EIA–0581(2009), October 2009. Available at *http://www.eia.gov/forecasts/aeo/index.cfm.*

emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10A of the final rule TSD.

EEI disagreed with DOE's use of *AEO2015* in the analysis for the NOPR, stating that the site-to-primary and FFC conversion factors do not take into account the latest estimates available in *AEO2016*. (EEI, No. 0021 at pp. 5–6) DOE has updated its analysis with *AEO2016* for the final rule.

3. Net Present Value Analysis

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

The operating cost savings are energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate electricity prices in future years, DOE multiplied the average regional prices by annual energy price factors derived from the forecasts of annual average residential and commercial electricity price changes by region that are consistent with cases described on p. E–8 in *AEO 2016*.[34] *AEO 2016* has an end year of 2040. To estimate price trends after 2040, DOE used the average annual rate of change in prices from 2020 through 2040. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO2016* that have lower and higher economic growth and lower and higher energy price trends. NIA results based on these cases are presented in appendix 10B of the final rule TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final rule, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis.[35] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

### *I. Consumer Subgroup Analysis*

In analyzing the potential impact of new or amended energy conservation standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a new or amended national standard. The purpose of a subgroup analysis is to determine the extent of any such disproportional impacts. DOE evaluates impacts on particular subgroups of consumers by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. For this final rule, DOE analyzed the impacts of the considered standard levels on two subgroups: (1) Low-income households and (2) small businesses. DOE used the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on these subgroups. Chapter 11 in the final rule TSD describes the consumer subgroup analysis.

### *J. Manufacturer Impact Analysis*

1. Overview

DOE conducted an MIA for UPSs to estimate the financial impacts of new energy conservation standards on manufacturers of UPSs. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA primarily relies on the GRIM, an industry cash flow model with inputs specific to this rulemaking. The key GRIM inputs are data on the industry cost structure, manufacturer production costs (MPCs), and shipments; as well as assumptions about manufacturer markups and manufacturer conversion costs. The key MIA output is INPV. The GRIM calculates annual cash flows using standard accounting principles. DOE used the GRIM to compare changes in INPV between the no-standards case and various TSLs (the standards cases). The difference in INPV between the no-standards case and the standards cases represents the financial impact of new energy conservation standards on UPS manufacturers. Different sets of assumptions (markup scenarios) produce different INPV results. The qualitative part of the MIA addresses factors such as manufacturing capacity; characteristics of, and impacts on, any particular subgroup of manufacturers; the cumulative regulatory burden placed on UPS manufacturers; and any impacts on competition.

2. GRIM Analysis and Key Inputs

DOE uses the GRIM to quantify the changes in cash flows over time due to new energy conservation standards. These changes in cash flows result in either a higher or lower INPV for the standards cases compared to the no-standards case. The GRIM analysis uses a standard annual cash flow analysis that incorporates manufacturer costs, manufacturer markups, shipments, and industry financial information as inputs. It then models changes in costs, investments, and manufacturer margins that result from new energy conservation standards. The GRIM uses these inputs to calculate a series of annual cash flows beginning with the reference year of the analysis, 2016, and continuing through the terminal year of the analysis, 2048. DOE computes INPV by summing the stream of annual discounted cash flows during the analysis period. DOE used a real discount rate of 6.1 percent, the same discount rate used in the August 2016 NOPR, for UPS manufacturers in this final rule. NEMA and Schneider commented that the discount rate was inappropriate for this analysis (NEMA and ITI, No. 0019, at p. 14) (Schneider Electric, No. 0017 at p. 18). DOE used publicly available information from the SEC 10-Ks of publicly traded UPS manufacturers to estimate a discount rate that was reflective of the capital structure of the UPS industry. DOE then asked for feedback on its estimated discount rate of 8.2 percent during manufacturer interviews. Based on

[34] EIA. *Annual Energy Outlook 2016 with Projections to 2040.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/.* The standards finalized in this rulemaking will take effect a few years prior to the 2022 commencement of the Clean Power Plan compliance requirements. As DOE has not modeled the effect of CPP during the 30 year analysis period of this rulemaking, there is some uncertainty as to the magnitude and overall effect of the energy efficiency standards. These energy efficiency standards are expected to put downward pressure on energy prices relative to the projections in the AEO 2016 case that incorporates the CPP. Consequently, DOE used the electricity price projections found in the AEO 2016 No-CPP case as these electricity price projections are expected to be lower, yielding more conservative estimates for consumer savings due to the energy efficiency standards.

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

manufacturer feedback, DOE adjusted the discount rate to be 6.1 percent for use in the UPS August 2016 NOPR and final rule GRIMs. Many of the GRIM inputs came from the engineering analysis, shipment analysis, manufacturer interviews, and other research conducted during the MIA. The major GRIM inputs are described in detail in the following sections.

a. Capital and Product Conversion Costs

DOE expects new energy conservation standards for UPSs to cause manufacturers to incur conversion costs to bring their production facilities and product designs into compliance with new standards. For the MIA, DOE classified these conversion costs into two major groups: (1) Capital conversion costs and (2) product conversion costs. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new product designs can be fabricated and assembled. Product conversion costs are investments in research, development, testing, marketing, certification, and other non-capitalized costs necessary to make product designs comply with new standards.

In the August 2016 NOPR, DOE estimated product conversion costs for manufacturers that would have to redesign their UPSs to meet standards. DOE did not estimate capital conversion costs in the August 2016 NOPR. After reviewing comments in response to the August 2016 NOPR, DOE included capital conversion costs and increased product conversion costs for the final rule, based on these comment responses. The revised conversion costs used in the final rule are significantly higher at each of the TSLs than the conversion costs presented in the August 2016 NOPR. The conversion costs used in this final rule are presented in section V.B.2.a.

During the NOPR public meeting, NEMA questioned how the shipments analysis impacted the product conversion costs estimated and commented that only the products that already meet adopted standards would not require redesign (NEMA and ITI, No. 0019 at p. 15) (NEMA, Pub. Mtg. Tr., No. 0014 at p. 62). DOE agrees that UPSs that do not meet adopted standards would require redesign. DOE uses the efficiency distributions for each product class from the shipments analysis to determine how many UPS models in each product class would not meet the required ELs. For the final rule, DOE updated the efficiency distributions used in the shipments analysis. DOE used this updated efficiency distribution in the final rule MIA. More information on the updated shipments analysis can be found in section IV.G if this final rule and in chapter 9 of the final rule TSD.

NEMA and Schneider also commented that compliance with adopted standards would require investments in testing equipment and tooling to print new circuit boards for redesigned UPSs. (NEMA and ITI, No. 0019 at p. 15) (Schneider Electric, No. 0017 at p. 19) In the final rule, DOE accounted for these additional investments for tooling in the capital conversion cost estimates included in the final rule, based on these comment responses. DOE did not include the cost of testing equipment in the capital conversion costs. DOE recognizes that manufacturers will incur additional testing costs in complying with adopted standards. However, DOE included these additional testing costs as part of the product conversion costs, since DOE believes that most UPS manufacturers will outsource testing to third parties. To estimate industry-wide testing costs, DOE used quotes from third party laboratories to calculate the cost of testing two units for all of the models in the UPS industry. DOE notes that the UPS final rule test procedure does not require manufacturers to test two units per platform and stipulates that manufacturers may choose to test either one or two units per model. DOE used the cost of testing two units per platform to reflect DOE's uncertainty of which testing option a manufacturer may choose. Please see the December 12, 2016 UPS test procedure final rulemaking for more information. 81 FR 89806.

Schneider commented that testing equipment would become stranded because the increase in price of UPS caused by the adopted standards would reduce the demand for UPSs (Schneider Electric, No. 0017 at p. 20). DOE did not estimate stranded assets for testing equipment. The shipments analysis shows that UPS shipment volume increases throughout the analysis period, indicating that there would not be reduced demand for UPSs following adopted standards. Based on the shipments analysis, DOE does not believe that testing equipment would become stranded at any of the analyzed ELs. For more information on the shipments analysis, please see section IV.G of this final rule and chapter 9 of the final rule TSD.

Schneider further commented on the duration of UPS product design cycles and asserted that these cycles are typically longer than the two year compliance period for adopted UPS standards (Schneider Electric, No. 0017 at p. 2, 19) (Schneider Electric, Pub. Mtg. Tr., No. 0014 at p. 75–76). In the final rule, DOE accounted for the increased level of investment required to redesign UPS models outside of the regular product design cycles by significantly increasing the product redesign cost estimates included in the product conversion costs of the August 2016 NOPR.

ASAP and the CA IOUs commented that the product conversion costs estimated in the August 2016 NOPR were over-estimated, given that the majority of manufacturers would choose to increase their production capacity for transformer-less UPSs instead of redesigning covered UPSs that do not meet adopted standards (ASAP *et al.,* No. 0020 at p. 2) (CA IOUs, No. 0016 at p. 1–2). DOE estimates conversion costs specific to bringing covered products into compliance with adopted standards. DOE does not factor any potential manufacturer decisions regarding products that are outside of the scope of the rulemaking in its calculation of conversion costs. Conversely, Schneider commented that the required efficiency levels incentivize manufacturers to produce UPSs that are either less than 300W or greater than 1000W instead of redesigning failing UPSs within the wattage range of current product offerings. Schneider stated that DOE did not account for investments manufacturers would need to make to bring these products into compliance with adopted standards (Schneider Electric, No. 007 at p. 5, 8). DOE estimates conversion costs specific to bringing current product offerings into compliance without increasing or decreasing their current wattage. DOE does not model a situation where manufacturers adjust UPS wattages as a result of adopted energy conservation standards in either the shipment analysis or the conversion costs estimates in the MIA.

See chapter 12 of the final rule TSD for a complete description of DOE's assumptions for capital and product conversion costs.

b. Manufacturer Production Costs

Manufacturing more efficient UPSs is more expensive than manufacturing baseline products due to the need for more costly materials and components. The higher MPCs for these more efficient products can affect the revenue and gross margin, and cash flow for the industry, making these product costs key inputs for the GRIM and the MIA. In the MIA, DOE used the MPCs calculated in the engineering analysis, as described in section IV.C and further detailed in chapter 5 of the final rule TSD. DOE used the same MPCs in this final rule that were used in the August 2016 NOPR.

c. Shipment Scenarios

INPV, the key GRIM output, depends on industry revenue, which depends on the quantity and prices of UPSs shipped in each year of the analysis period. Industry revenue calculations require forecasts of: (1) Total annual shipment volume of UPSs; (2) the distribution of shipments across product classes (because prices vary by product class); and, (3) the distribution of shipments across ELs (because prices vary by efficiency).

In the no-standards case shipment analysis, shipments of UPSs were based on market forecast data from Frost and Sullivan and ENERGY STAR. Since UPS technology evolves more rapidly than other appliance technologies, DOE extrapolated forecasted trends from market research data instead of relying on a stock accounting approach.

DOE modeled a roll-up shipment scenario to estimate shipments of UPSs. In the roll-up shipment scenario, consumers who would have purchased UPSs that fail to meet the new standards in the no-standards case, purchase UPSs that just meet the new standards, but are not more efficient than those standards, in the standards cases. Those consumers that would have purchased compliant UPSs in the no-standards case continue to purchase the exact same UPSs in the standards cases. DOE updated the shipments analysis for the final rule based on comments and data provided in response to the shipment analysis presented in the August 2016 NOPR. The MIA used these updated shipments in the final rule.

For a complete description of the updated shipments see the shipments analysis discussion in section IV.G of this final rule and in chapter 9 of the final rule TSD.

d. Markup Scenarios

As discussed in section IV.J.2.b, the MPCs for UPSs are the manufacturers' costs for those products. These costs include materials, direct labor, depreciation, and overhead, which are collectively referred to as the cost of goods sold (COGS). The MSP is the price received by UPS manufacturers from their customers, typically a distributor but could be the direct users, regardless of the downstream distribution channel through which the UPSs are ultimately sold. The MSP is not the cost the end-user pays for the UPS since there are typically multiple sales along the distribution chain and various markups applied to each sale. The MSP equals the MPC multiplied by the manufacturer markup. The manufacturer markup covers all the UPS manufacturer's non-production costs (*i.e.,* SG&A, R&D, and interest) as well as profit. Total industry revenue for UPS manufacturers equals the MSPs at each EL multiplied by the number of shipments at that EL for each product class.

Modifying these manufacturer markups in the standards cases yields a different set of impacts on UPS manufacturers than in the no-standards case. For the MIA, DOE modeled two standards case markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for UPS manufacturers following the implementation of new energy conservation standards. The two markup scenarios are; (1) a preservation of gross margin, or flat, markup scenario and (2) a pass through markup scenario. Each scenario leads to different manufacturer markup values, which, when applied to the inputted MPCs, result in varying revenue and cash flow impacts on UPS manufacturers.

DOE modeled two markup scenarios to represent the upper and lower bounds of prices and profitability following adopted standards. The preservation of gross margin markup scenario represents the best case scenario for manufacturers. DOE recognizes that manufacturers do not expect to be able to mark up the additional cost of production in the standards cases, given the competitive UPS market, and modeled the pass through markup scenario to represent a lower bound on profitability. DOE used the same markup scenarios in the final rule MIA that were used in the in August 2016 NOPR.

3. Manufacturer Interviews

DOE conducted interviews with manufacturers following the publication of the July 2014 framework document in preparation for the NOPR analysis. Schneider inquired if DOE had conducted additional interviews specific to UPSs after the manufacturer interviews that took place in preparation for the March 27, 2012 battery charger NOPR (Schneider Electric, Pub. Mtg. Tr., No. 0014 at p. 54). DOE did conduct manufacturer interviews with UPS manufacturers in 2016 in preparation for the August 2016 NOPR. DOE did not conduct any further interviews with manufacturers between the August 2016 NOPR and the final rule, because further interviews were not necessary to alter the MIA for the final rule. Instead DOE, relied on comments from interested parties to update the MIA for the final rule.

During these interviews, DOE asked manufacturers to describe their major concerns with this UPS rulemaking. UPS manufacturers identified one key issue during these interviews, the burden of testing and certification.

UPS manufacturers stated that the costs associated with testing and certifying all of their products covered by this rulemaking could be burdensome. UPS manufacturers commented that since efficient products do not typically earn a premium in the UPS market, manufacturers do not regularly conduct efficiency testing or pursue energy-efficient certifications for the majority of their product offerings. As a result, the testing and certification required for compliance with a potential standard represents additional costs to the typical product testing conducted by UPS manufacturers. Since adopted standards would require all UPS offerings to be tested and certified, UPS manufacturers explained that this process could become expensive. DOE included the testing and certification costs as part of the product conversion costs included in section IV.J.2.a of this final rule.

In response to the August 2016 NOPR, NEMA and Schneider commented that the test procedure could require multiple days to complete, which could become costly. NEMA and Schneider further stated that the increased testing time could place a constraint on production capacity (NEMA, Pub. Mtg. Tr., No. 0014 at p. 60) (Schneider Electric, No. 0017 at p. 19, 21). DOE did not test any models covered by the scope of the adopted standards that required multiple days to test. DOE does not find that the time needed to complete the test procedure would limit manufacturers' ability to meet demand for compliant UPSs.

*K. Emissions Analysis*

The emissions analysis consists of two components. The first component estimates the effect of potential energy conservation standards on power sector and site (where applicable) combustion emissions of $CO_2$, $NO_X$, $SO_2$, and Hg. The second component estimates the impacts of potential standards on emissions of two additional greenhouse gases, $CH_4$ and $N_2O$, as well as the reductions to emissions of all species due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion. The associated emissions are referred to as upstream emissions.

The analysis of power sector emissions uses marginal emissions factors that were derived from data in *AEO2016,* as described in section IV.M Details of the methodology are described in the appendices to chapters 13 and 15 of the final rule TSD.

Combustion emissions of $CH_4$ and $N_2O$ are estimated using emissions intensity factors published by the EPA—GHG Emissions Factors Hub.[36] The FFC upstream emissions are estimated based on the methodology described in chapter 15 of the final rule TSD. The upstream emissions include both emissions from fuel combustion during extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of $CH_4$ and $CO_2$.

The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

The *AEO* incorporates the projected impacts of existing air quality regulations on emissions. *AEO2016* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of the end of February 2016. DOE's estimation of impacts accounts for the presence of the emissions control programs discussed in the following paragraphs.

$SO_2$ emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on $SO_2$ for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) $SO_2$ emissions from 28 eastern States and DC were also limited under the Clean Air Interstate Rule (CAIR). 70 FR 25162 (May 12, 2005). CAIR created an allowance-based trading program that operates along with the Title IV program. In 2008, CAIR was remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect.[37] In 2011, EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (Aug. 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR,[38] and the court ordered EPA to continue administering CAIR. On April 29, 2014, the U.S. Supreme Court reversed the judgment of the D.C. Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion.[39] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR.[40] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.[41] *AEO2016* incorporates implementation of CSAPR.

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess $SO_2$ emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in $SO_2$ emissions by any regulated EGU. In past years, DOE recognized that there was uncertainty about the effects of efficiency standards on $SO_2$ emissions covered by the existing cap-and-trade system, but it concluded that negligible reductions in power sector $SO_2$ emissions would occur as a result of standards.

Beginning in 2016, however, $SO_2$ emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the MATS final rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for $SO_2$ (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, $SO_2$ emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO2016* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2016. Both technologies, which are used to reduce acid gas emissions, also reduce $SO_2$ emissions. Under the MATS, emissions will be far below the cap established by CSAPR, so it is unlikely that excess $SO_2$ emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in $SO_2$ emissions by any regulated EGU.[42] Therefore, DOE believes that energy conservation standards that decrease electricity generation will generally reduce $SO_2$ emissions in 2016 and beyond.

CSAPR established a cap on $NO_X$ emissions in 28 eastern States and the District of Columbia. Energy conservation standards are expected to have little effect on $NO_X$ emissions in those States covered by CSAPR because excess $NO_X$ emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in $NO_X$ emissions from other facilities. However, standards would be expected to reduce $NO_X$ emissions in the States not affected by the caps, so DOE estimated $NO_X$ emissions reductions from the standards considered in this final rule for these States.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO2016,* which incorporates the MATS.

[36] Available at *www2.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub.*

[37] See *North Carolina* v. *EPA,* 531 F.3d 896 (D.C. Cir. 2008), modified on rehearing, 550 F.3d 1176 (D.C. Cir. 2008).

[38] See *EME Homer City Generation, L.P.* v. *EPA,* 696 F.3d 7 (D.C. Cir. 2012).

[39] See *EPA* v. *EME Homer City Generation, L.P.* 134 S. Ct. 1584 (U.S. 2014). The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain States due to their impacts in other downwind States was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR.

[40] See *EME Homer City Generation, L.P.* v. *EPA,* Order (D.C. Cir. filed October 23, 2014) (No. 11–1302).

[41] On July 28, 2015, the D.C. Circuit issued its opinion regarding the remaining issues raised with respect to CSAPR that were remanded by the Supreme Court. The D.C. Circuit largely upheld CSAPR but remanded to EPA without *vacating* certain States' emission budgets for reconsideration. *EME Homer City Generation, LP* v. *EPA,* 795 F.3d 118 (D.C. Cir. 2015).

[42] DOE notes that on June 29, 2015, the U.S. Supreme Court ruled that the EPA erred when the agency concluded that cost did not need to be considered in the finding that regulation of hazardous air pollutants from coal- and oil-fired electric utility steam generating units (EGUs) is appropriate and necessary under section 112 of the Clean Air Act (CAA). *Michigan* v. *EPA,* 135 S. Ct. 2699 (2015). The Supreme Court did not vacate the MATS rule, and DOE has tentatively determined that the Court's decision on the MATS rule does not change the assumptions regarding the impact of energy conservation standards on $SO_2$ emissions. Further, the Court's decision does not change the impact of the energy conservation standards on mercury emissions. The EPA, in response to the U.S. Supreme Court's direction, has now considered cost in evaluating whether it is appropriate and necessary to regulate coal- and oil-fired EGUs under the CAA. EPA concluded in its final supplemental finding that a consideration of cost does not alter the EPA's previous determination that regulation of hazardous air pollutants, including mercury, from coal- and oil-fired EGUs, is appropriate and necessary. 81 FR 24420 (April 25, 2016). The MATS rule remains in effect, but litigation is pending in the D.C. Circuit Court of Appeals over EPA's final supplemental finding MATS rule.

The *AEO 2016* Reference case (and some other cases) assumes implementation of the Clean Power Plan (CPP), which is the EPA program to regulate $CO_2$ emissions at existing fossil-fired electric power plants.[43] For the current analysis, impacts are quantified by comparing the levels of electricity sector generation, installed capacity, fuel consumption and emissions consistent with the projections described on page E–8 of *AEO 2016* and various side cases.[44]

*L. Monetizing Carbon Dioxide and Other Emissions Impacts*

As part of the development of this rule, DOE considered the estimated monetary benefits from the reduced emissions of $CO_2$ and $NO_X$ that are expected to result from each of the TSLs considered. In order to make this calculation analogous to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the projection period for each TSL. This section summarizes the basis for the monetary values used for $CO_2$ and $NO_X$ emissions and presents the values considered in this final rule.

For this final rule, DOE relied on a set of values for the social cost of $CO_2$ (SC-$CO_2$) that was developed by a Federal interagency process. The basis for these values is summarized in the next section, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the final rule TSD.

1. Social Cost of Carbon

The SC-$CO_2$ is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) climate-change-related changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. Estimates of the SC-$CO_2$ are provided in dollars per metric ton of $CO_2$. A domestic SC-$CO_2$ value is meant to reflect the value of damages in the United States resulting from a unit change in $CO_2$ emissions, while a global SC-$CO_2$ value is meant to reflect the value of damages worldwide.

Under section 1(b)(6) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), agencies must, to the extent permitted by law, ''assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.'' The purpose of the SC-$CO_2$ estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing $CO_2$ emissions into cost-benefit analyses of regulatory actions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

As part of the interagency process that developed these SC-$CO_2$ estimates, technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SC-$CO_2$ values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SC-$CO_2$ estimates used in the rulemaking process.

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of $CO_2$ emissions, the analyst faces a number of challenges. A report from the National Research Council[45] points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of GHGs, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise questions of science, economics, and ethics and should be viewed as provisional.

Despite the limits of both quantification and monetization, SC-$CO_2$ estimates can be useful in estimating the social benefits of reducing $CO_2$ emissions. Although any numerical estimate of the benefits of reducing $CO_2$ emissions is subject to some uncertainty, that does not relieve DOE of its obligation to attempt to factor those benefits into its cost-benefit analysis. Moreover, the interagency working group (IWG) SC-$CO_2$ estimates are well supported by the existing scientific and economic literature. As a result, DOE has relied on these estimates in quantifying the social benefits of reducing $CO_2$ emissions. DOE estimates the benefits from reduced emissions in any future year by multiplying the change in emissions in that year by the SC-$CO_2$ values appropriate for that year. The NPV of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years.

It is important to emphasize that the current SC-$CO_2$ values reflect the IWG's best assessment, based on current data, of the societal effect of $CO_2$ emissions. The IWG is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across Federal agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced $CO_2$ emissions. The interagency group did not undertake any original analysis. Instead, it combined SC-$CO_2$ estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values that represented the first sustained interagency effort within the U.S. government to develop an SC-$CO_2$ estimate for use in regulatory analysis. The results of this preliminary effort were presented in several

[43] U.S. EPA, ''Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units'' (80 FR 64662, October 23, 2015). *https://www.federalregister.gov/articles/2015/10/23/2015-22842/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.*

[44] As DOE has not modeled the effect of CPP during the 30 year analysis period of this rulemaking, there is some uncertainty as to the magnitude and overall effect of the energy efficiency standards. With respect to estimated $CO_2$ and $NO_X$ emissions reductions and their associated monetized benefits, if implemented the CPP would result in an overall decrease in $CO_2$ emissions from electric generating units (EGUs), and would thus likely reduce some of the estimated $CO_2$ reductions associated with this rulemaking.

[45] National Research Council. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.* 2009. National Academies Press: Washington, DC.

proposed and final rules issued by DOE and other agencies.

b. Current Approach and Key Assumptions

After the release of the interim values, the IWG reconvened on a regular basis to generate improved SC-$CO_2$ estimates. Specially, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models commonly used to estimate the SC-$CO_2$: the FUND, DICE, and PAGE models. These models are frequently cited in the peer-reviewed literature and were used in the last assessment of the Intergovernmental Panel on Climate Change (IPCC). Each model was given equal weight in the SC-$CO_2$ values that were developed.

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models, while respecting the different approaches to quantifying damages taken by the key modelers in the field. An extensive review of the literature was conducted to select three sets of input parameters for these models: Climate sensitivity, socio-economic and emissions trajectories, and discount rates. A probability distribution for climate sensitivity was specified as an input into all three models. In addition, the interagency group used a range of scenarios for the socio-economic parameters and a range of values for the discount rate. All other model features were left unchanged, relying on the model developers' best estimates and judgments.

In 2010, the IWG selected four sets of SC-$CO_2$ values for use in regulatory analyses. Three sets of values are based on the average SC-$CO_2$ from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SC-$CO_2$ estimate across all three models at a 3-percent discount rate, was included to represent higher-than-expected impacts from climate change further out in the tails of the SC-$CO_2$ distribution. The values grow in real terms over time. Additionally, the IWG determined that a range of values from 7 percent to 23 percent should be used to adjust the global SC-$CO_2$ to calculate domestic effects,[46] although preference is given to consideration of the global benefits of reducing $CO_2$ emissions. Table IV–6 presents the values in the 2010 interagency group report.[47]

TABLE IV–6—ANNUAL SC-$CO_2$ VALUES FROM 2010 INTERAGENCY REPORT

[2007$ per metric ton $CO_2$]

| Year | Discount rate | | | |
|---|---|---|---|---|
| | 5% | 3% | 2.5% | 3% |
| | Average | Average | Average | 95th Percentile |
| 2010 | 4.7 | 21.4 | 35.1 | 64.9 |
| 2015 | 5.7 | 23.8 | 38.4 | 72.8 |
| 2020 | 6.8 | 26.3 | 41.7 | 80.7 |
| 2025 | 8.2 | 29.6 | 45.9 | 90.4 |
| 2030 | 9.7 | 32.8 | 50.0 | 100.0 |
| 2035 | 11.2 | 36.0 | 54.2 | 109.7 |
| 2040 | 12.7 | 39.2 | 58.4 | 119.3 |
| 2045 | 14.2 | 42.1 | 61.7 | 127.8 |
| 2050 | 15.7 | 44.9 | 65.0 | 136.2 |

In 2013 the IWG released an update (which was revised in July 2015) that contained SC-$CO_2$ values that were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[48] DOE used these values for this final rule. Table IV–7 shows the updated sets of SC-$CO_2$ estimates from the 2013 interagency update (revised July 2015) in 5-year increments from 2010 through 2050. The full set of annual SC-$CO_2$ estimates from 2010 through 2050 is reported in appendix 14A of the final rule TSD. The central value that emerges is the average SC-$CO_2$ across models at the 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the IWG emphasizes the importance of including all four sets of SC-$CO_2$ values.

TABLE IV–7—ANNUAL SC-$CO_2$ VALUES FROM 2013 INTERAGENCY UPDATE (REVISED JULY 2015)

[2007$ per metric ton $CO_2$]

| Year | Discount Rate | | | |
|---|---|---|---|---|
| | 5% | 3% | 2.5% | 3% |
| | Average | Average | Average | 95th Percentile |
| 2010 | 10 | 31 | 50 | 86 |

[46] It is recognized that this calculation for domestic values is approximate, provisional, and highly speculative. There is no *a priori* reason why domestic benefits should be a constant fraction of net global damages over time.

[47] United States Government–Interagency Working Group on Social Cost of Carbon. *Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* February 2010. *https://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf.*

[48] United States Government–Interagency Working Group on Social Cost of Carbon. *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* May 2013. Revised July 2015. *https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf.*

TABLE IV–7—ANNUAL SC-$CO_2$ VALUES FROM 2013 INTERAGENCY UPDATE (REVISED JULY 2015)—Continued

[2007$ per metric ton $CO_2$]

| Year | Discount Rate | | | |
|---|---|---|---|---|
| | 5% | 3% | 2.5% | 3% |
| | Average | Average | Average | 95th Percentile |
| 2015 | 11 | 36 | 56 | 105 |
| 2020 | 12 | 42 | 62 | 123 |
| 2025 | 14 | 46 | 68 | 138 |
| 2030 | 16 | 50 | 73 | 152 |
| 2035 | 18 | 55 | 78 | 168 |
| 2040 | 21 | 60 | 84 | 183 |
| 2045 | 23 | 64 | 89 | 197 |
| 2050 | 26 | 69 | 95 | 212 |

It is important to recognize that a number of key uncertainties remain, and that current SC-$CO_2$ estimates should be treated as provisional and revisable because they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned previously points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the IWG process. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.[49]

DOE converted the values from the 2013 interagency report (revised July 2015) to 2015$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of SC-$CO_2$ cases, the values for emissions in 2020 were $13.5, $47.4, $69.9, and $139 per metric ton avoided (values expressed in 2015$)]. DOE derived values after 2050 based on the trend in 2010–2050 in each of the four cases in the interagency update.

DOE multiplied the $CO_2$ emissions reduction estimated for each year by the SC-$CO_2$ value for that year in each of the four cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SC-$CO_2$ values in each case.

The U.S. Chamber of Commerce (USCC) and the Industrial Energy Consumers of America commented on the development of and the use of the SC-$CO_2$ values in DOE's analyses. A group of trade associations led by the USCC objected to DOE's continued use of the SC-$CO_2$ in the cost-benefit analysis and stated that the SC-$CO_2$ calculation should not be used in any rulemaking until it undergoes a more rigorous notice, review, and comment process. (U.S. Chamber of Commerce, No. 0078 at p. 41) IECA stated that before DOE applies any SC-$CO_2$ estimate in its rulemaking, DOE must correct the methodological flaws that commenters have raised about the IWG's SC-$CO_2$ estimate. IECA referenced a U.S. Government Accountability Office (GAO) report that highlights severe uncertainties in SC-$CO_2$ values. (IECA, No. 0015 at p. 2)

In conducting the interagency process that developed the SC-$CO_2$ values, technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. Key uncertainties and model differences transparently and consistently inform the range of SC-$CO_2$ estimates. These uncertainties and model differences are discussed in the IWG's reports, as are the major assumptions. Specifically, uncertainties in the assumptions regarding climate sensitivity, as well as other model inputs such as economic growth and emissions trajectories, are discussed and the reasons for the specific input assumptions chosen are explained. However, the three integrated assessment models used to estimate the SC-$CO_2$ are frequently cited in the peer-reviewed literature and were used in the last assessment of the IPCC. In addition, new versions of the models that were used in 2013 to estimate revised SC-$CO_2$ values were published in the peer-reviewed literature. Although uncertainties remain, the revised estimates that were issued in November 2013 are based on the best available scientific information on the impacts of climate change. The current estimates of the SC-$CO_2$ have been developed over many years, using the best science available, and with input from the public. As noted previously, in November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SC-$CO_2$ estimates. 78 FR 70586 (Nov. 26, 2013). In July 2015, OMB published a detailed summary and formal response to the many comments that were received. DOE stands ready to work with OMB and the other members of the IWG on further review and revision of the SC-$CO_2$ estimates as appropriate.

The GAO report mentioned by IECA noted that the working group's processes and methods used consensus-based decision making, relied on existing academic literature and models, and took steps to disclose limitations and incorporate new information.[50]

IECA stated that the SC-$CO_2$ estimates must be made consistent with OMB Circular A–4, and noted that it uses a lower discount rate than recommended by OMB Circular A–4 and values global benefits rather than solely U.S. domestic benefits. (IECA, No. 0015 at p. 5)

[49] In November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SC-CO2 estimates. 78 FR 70586. In July 2015 OMB published a detailed summary and formal response to the many comments that were received: This is available at *https://www.whitehouse.gov/blog/2015/07/02/estimating-benefits-carbon-dioxide-emissions-reductions.* It also stated its intention to seek independent expert advice on opportunities to improve the estimates, including many of the approaches suggested by commenters.

[50] *http://www.gao.gov/products/GAO-14-663.* (Last accessed Sept. 22, 2016)

OMB Circular A–4 [51] provides two suggested discount rates for use in regulatory analysis: 3% and 7%. Circular A–4 states that the 3% discount rate is appropriate for ''regulation [that] primarily and directly affects private consumption (*e.g.,* through higher consumer prices for goods and services).'' (OMB Circular A–4 p. 33). The interagency working group that developed the SC-$CO_2$ values for use by Federal agencies examined the economics literature and concluded that the consumption rate of interest is the correct concept to use in evaluating the net social costs of a marginal change in $CO_2$ emissions, as the impacts of climate change are measured in consumption-equivalent units in the three models used to estimate the SC-$CO_2$. The interagency working group chose to use three discount rates to span a plausible range of constant discount rates: 2.5, 3, and 5 percent per year. The central value, 3 percent, is consistent with estimates provided in the economics literature and OMB's Circular A–4 guidance for the consumption rate of interest.

Regarding the use of global SC-$CO_2$ values, DOE's analysis estimates both global and domestic benefits of $CO_2$ emissions reductions. Following the recommendation of the IWG, DOE places more focus on a global measure of SC-$CO_2$. The climate change problem is highly unusual in at least two respects. First, it involves a global externality: Emissions of most greenhouse gases contribute to damages around the world even when they are emitted in the United States. Consequently, to address the global nature of the problem, the SC-$CO_2$ must incorporate the full (global) damages caused by GHG emissions. Second, climate change presents a problem that the United States alone cannot solve. Even if the United States were to reduce its greenhouse gas emissions to zero, that step would be far from enough to avoid substantial climate change. Other countries would also need to take action to reduce emissions if significant changes in the global climate are to be avoided. Emphasizing the need for a global solution to a global problem, the United States has been actively involved in seeking international agreements to reduce emissions and in encouraging other nations, including emerging major economies, to take significant steps to reduce emissions. When these considerations are taken as a whole, the interagency group concluded that a global measure of the benefits from reducing U.S. emissions is preferable. DOE's approach is not in contradiction of the requirement to weigh the need for national energy conservation, as one of the main reasons for national energy conservation is to contribute to efforts to mitigate the effects of global climate change.

IECA stated that the social cost of carbon places U.S. manufacturing at a distinct competitive disadvantage. IECA added that the higher SC-$CO_2$ cost drives manufacturing companies offshore and increases imports of more carbon-intensive manufactured goods. (IECA, No. 0015 at pp. 1–2) DOE notes that the SC-$CO_2$ is not a cost imposed on any manufacturers. It is simply a metric that Federal agencies use to estimate the societal benefits of policy actions that reduce $CO_2$ emissions.

IECA stated that the social cost of carbon value is unrealistically high in comparison to carbon market prices. (IECA, No. 0015 at p. 3) The SC-$CO_2$ is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year, whereas carbon trading prices in existing markets are simply a function of the demand and supply of tradable permits in those markets. Such prices depend on the arrangements in specific carbon markets, and bear no necessary relation to the damages associated with an incremental increase in carbon emissions.

2. Social Cost of Other Air Pollutants

As noted previously, DOE estimated how the considered energy conservation standards would decrease power sector $NO_X$ emissions in those 22 States not affected by the CSAPR.

DOE estimated the monetized value of $NO_X$ emissions reductions from electricity generation using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards.[52] The report includes high and low values for $NO_X$ (as $PM_{2.5}$) for 2020, 2025, and 2030 using discount rates of 3 percent and 7 percent; these values are presented in appendix 14B of the final rule TSD. DOE primarily relied on the low estimates to be conservative.[53] The national average low values for 2020 (in 2015$) are $3,187/ton at 3-percent discount rate and $2,869/ton at 7-percent discount rate. DOE developed values specific to the sector for UPSs using a method described in appendix 14B of the final rule TSD. For this analysis DOE used linear interpolation to define values for the years between 2020 and 2025 and between 2025 and 2030; for years beyond 2030 the value is held constant.

DOE multiplied the emissions reduction (in tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate.

DOE is evaluating appropriate monetization of reduction in other emissions in energy conservation standards rulemakings. DOE has not included monetization of those emissions in the current analysis.

*M. Utility Impact Analysis*

The utility impact analysis estimates several effects on the electric power generation industry that would result from the adoption of new or amended energy conservation standards. The utility impact analysis estimates the changes in installed electrical capacity and generation that would result for each TSL. The analysis is based on published output from the NEMS associated with *AEO2016.* NEMS produces the *AEO* Reference case, as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. For the current analysis, impacts are quantified by comparing the levels of electricity sector generation, installed capacity, fuel consumption and emissions consistent with the projections described on page E–8 of *AEO 2016* and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the final rule TSD.

The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation,

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

[52] Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.* See Tables 4A–3, 4A–4, and 4A–5 in the report. *The U.S. Supreme Court has stayed the rule implementing the Clean Power Plan until the current litigation against it concludes. Chamber of Commerce, et al.* v. *EPA, et al., Order in Pending Case, 577 U.S. __(2016). However, the benefit-per-ton estimates established in the Regulatory Impact Analysis for the Clean Power Plan are based on scientific studies that remain valid irrespective of the legal status of the Clean Power Plan.*

[53] For the monetized $NO_X$ benefits associated with $PM_{2.5}$, the related benefits are primarily based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009), which is the lower of the two EPA central tendencies. Using the lower value is more conservative when making the policy decision concerning whether a particular standard level is economically justified. If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2012), the values would be nearly two-and-a-half times larger. (See chapter 14 of the final rule TSD for citations for the studies mentioned above.)

primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of electricity savings calculated in the NIA to provide estimates of selected utility impacts of potential new or amended energy conservation standards.

EEI disagreed with DOE's utility impact analysis, believing the results are overstated. EEI believes that 0 MW of capacity will be installed with or without the proposed standards coming into effect, and that there should be no estimated savings associated with ''avoiding'' renewable capacity that will be built anyway. (EEI, No. 0021 at pp. 7–8) DOE's analysis does not estimate how much new power plant capacity will not be installed as a result of lower demand caused by standards. Rather, the analysis estimates the difference in total installed capacity in the standards case compared to the base case. The lower electricity demand could allow more coal-fired capacity to be retired, and also mean that less renewable capacity will be needed.

### *N. Employment Impact Analysis*

DOE considers employment impacts in the domestic economy as one factor in selecting a standard. Employment impacts from new or amended energy conservation standards include both direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the products subject to standards, their suppliers, and related service firms. The MIA addresses those impacts. Indirect employment impacts are changes in national employment that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more-efficient appliances. Indirect employment impacts from standards consist of the net jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, caused by (1) reduced spending by consumers on energy, (2) reduced spending on new energy supply by the utility industry, (3) increased consumer spending on the products to which the new standards apply and other goods and services, and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[54] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, the BLS data suggest that net national employment may increase due to shifts in economic activity resulting from energy conservation standards.

DOE estimated indirect national employment impacts for the standard levels considered in this final rule using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 (ImSET).[55] ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer- based I–O model having structural coefficients that characterize economic flows among 187 sectors most relevant to industrial, commercial, and residential building energy use.

DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2019–2025), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the final rule TSD.

## V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for UPSs. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for UPSs, and the standards levels that DOE is adopting in this final rule. Additional details regarding DOE's analyses are contained in the final rule TSD supporting this document.

### *A. Trial Standard Levels*

DOE analyzed the benefits and burdens of four TSLs for UPSs. These TSLs were developed by combining specific efficiency levels for each of the product classes analyzed by DOE. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the final rule TSD.

Table V–1 presents the TSLs and the corresponding efficiency levels that DOE has identified for potential energy conservation standards for UPSs. TSL 4 represents the maximum technologically feasible (''max-tech'') energy efficiency for all product classes. TSL 3 represents maximum NES while at positive NPV in aggregate across all three product classes (the NPV of VFD UPSs is negative). TSL 2 represents maximum energy savings at positive NPV for all product classes. TSL 1 represents the minimum possible standard considered, and also corresponds to the maximum consumer NPV for each product class.

[54] See U.S. Department of Commerce–Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997. U.S. Government Printing Office: Washington, DC. Available at *http://www.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf.*

[55] Livingston, O.V., S.R. Bender, M.J. Scott, and R.W. Schultz. *ImSET 4.0: Impact of Sector Energy Technologies Model Description and User's Guide.* 2015. Pacific Northwest National Laboratory: Richland, WA. PNNL–24563.

TABLE V–1 TRIAL STANDARD LEVELS FOR UPSS

| Product class | Description | Trial standard level | | | |
|---|---|---|---|---|---|
| | | TSL 1 | TSL 2 | TSL 3 | TSL 4 |
| 10a | VFD UPSs | EL 1 | EL 1 | EL 2 | EL 3 |
| 10b | VI UPSs | EL 1 | EL 2 | EL 2 | EL 3 |
| 10c | VFI UPSs | EL 1 | EL 1 | EL 1 | EL 3 |

*B. Economic Justification and Energy Savings*

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on UPS consumers by looking at the effects that potential new standards at each TSL would have on the LCC and PBP. DOE also examined the impacts of potential standards on selected consumer subgroups. These analyses are discussed below.

a. Life-Cycle Cost and Payback Period

In general, higher-efficiency products affect consumers in two ways: (1) Purchase price increases and (2) annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* product price plus installation costs), and operating costs (*i.e.,* annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the final rule TSD provides detailed information on the LCC and PBP analyses.

Table V–2 through Table V–7 show the LCC and PBP results for the TSLs considered for each product class. In the first of each pair of tables, the simple payback is measured relative to the baseline product. In the second table, the impacts are measured relative to the efficiency distribution in the in the no-new-standards case in the compliance year (see section IV.F.8 of this document). Because some consumers purchase products with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the baseline product and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

TABLE V–2—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 10a

[VFD UPSs]

| TSL | Efficiency level | Average costs (2015$) | | | | Simple payback (years) | Average lifetime (years) |
|---|---|---|---|---|---|---|---|
| | | Installed cost | First year's operating cost | Lifetime operating cost | LCC | | |
| Residential: | | | | | | | |
| | Baseline | 98 | 16 | 72 | 169 | ........................ | 5.0 |
| 1 | 1 | 92 | 8 | 34 | 126 | 0 | 5.0 |
| 2 | 1 | 92 | 8 | 34 | 126 | * 0 | 5.0 |
| 3 | 2 | 121 | 5 | 23 | 144 | 2.2 | 5.0 |
| 4 | 3 | 139 | 3 | 13 | 152 | 3.2 | 5.0 |
| Commercial: | | | | | | | |
| | Baseline | 70 | 12 | 50 | 121 | | 5.0 |
| 1 | 1 | 66 | 6 | 24 | 90 | 0 | 5.0 |
| 2 | 1 | 66 | 6 | 24 | 90 | * 0 | 5.0 |
| 3 | 2 | 91 | 4 | 16 | 107 | 2.6 | 5.0 |
| 4 | 3 | 107 | 2 | 9 | 116 | 3.8 | 5.0 |

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

* The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

TABLE V–3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 10a

[VFD UPSs]

| TSL | Efficiency level | Life-cycle cost savings | |
|---|---|---|---|
| | | Average LCC savings * (2015$) | Percent of consumers that experience net cost |
| Residential: | | | |
| 1 | 1 | 43 | 0 |
| 2 | 1 | 43 | ** 0 |
| 3 | 2 | −1 | 50 |

TABLE V–3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 10a—Continued

[VFD UPSs]

| TSL | Efficiency level | Life-cycle cost savings | |
|---|---|---|---|
| | | Average LCC savings* (2015$) | Percent of consumers that experience net cost |
| 4 | 3 | −9 | 75 |
| Commercial: | | | |
| 1 | 1 | 31 | 0 |
| 2 | 1 | 31 | **0 |
| 3 | 2 | −5 | 51 |
| 4 | 3 | −13 | 81 |

* The savings represent the average LCC for affected consumers.

** The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

TABLE V–4—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 10b

[VI UPSs]

| TSL | Efficiency level | Average costs (2015$) | | | | Simple payback (years) | Average lifetime (years) |
|---|---|---|---|---|---|---|---|
| | | Installed cost | First year's operating cost | Lifetime operating cost | LCC | | |
| Residential: | | | | | | | |
| | Baseline | 111 | 22 | 124 | 235 | | 6.3 |
| 1 | 1 | 141 | 13 | 72 | 213 | 3.1 | 6.3 |
| 2 | 2 | 162 | 9 | 52 | 214 | 3.9 | 6.3 |
| 3 | 2 | 162 | 9 | 52 | 214 | 3.9 | 6.3 |
| 4 | 3 | 623 | 6 | 32 | 655 | 31 | 6.3 |
| Commercial: | | | | | | | |
| | Baseline | 80 | 16 | 87 | 167 | | 6.3 |
| 1 | 1 | 106 | 10 | 50 | 156 | 3.5 | 6.3 |
| 2 | 2 | 125 | 7 | 36 | 161 | 4.7 | 6.3 |
| 3 | 2 | 125 | 7 | 36 | 161 | 4.7 | 6.3 |
| 4 | 3 | 533 | 4 | 22 | 556 | 37 | 6.3 |

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

TABLE V–5—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 10b

[VI UPSs]

| TSL | Efficiency level | Life-cycle cost savings | |
|---|---|---|---|
| | | Average LCC savings* (2015$) | Percent of consumers that experience net cost |
| Residential: | | | |
| 1 | 1 | 23 | 8 |
| 2 | 2 | 14 | 41 |
| 3 | 2 | 14 | 41 |
| 4 | 3 | −428 | 100 |
| Commercial: | | | |
| 1 | 1 | 11 | 9 |
| 2 | 2 | 2 | 51 |
| 3 | 2 | 2 | 51 |
| 4 | 3 | −392 | 100 |

* The savings represent the average LCC for affected consumers.

TABLE V–6—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 10c

[VFI UPSs]

| TSL | Efficiency level | Average costs (2015$) | | | | Simple payback (years) | Average lifetime (years) |
|---|---|---|---|---|---|---|---|
| | | Installed cost | First year's operating cost | Lifetime operating cost | LCC | | |
| Residential: | | | | | | | |
| | Baseline | 409 | 125 | 1,037 | 1,445 | | 10.0 |
| 1 | 1 | 460 | 111 | 919 | 1,379 | 3.6 | 10.0 |
| 2 | 1 | 460 | 111 | 919 | 1,379 | 3.6 | 10.0 |
| 3 | 1 | 460 | 111 | 919 | 1,379 | 3.6 | 10.0 |
| 4 | 3 | 1,181 | 72 | 594 | 1,776 | 14 | 10.0 |
| Commercial: | | | | | | | |
| | Baseline | 293 | 88 | 685 | 978 | | 10.0 |
| 1 | 1 | 339 | 78 | 607 | 946 | 4.5 | 10.0 |
| 2 | 1 | 339 | 78 | 607 | 946 | 4.5 | 10.0 |
| 3 | 1 | 339 | 78 | 607 | 946 | 4.5 | 10.0 |
| 4 | 3 | 975 | 51 | 393 | 1,368 | 18 | 10.0 |

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

TABLE V–7—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 10c

[VFI UPSs]

| TSL | Efficiency level | Life-cycle cost savings | |
|---|---|---|---|
| | | Average LCC Savings* (2015$) | Percent of consumers that experience net cost |
| Residential: | | | |
| 1 | 1 | 66 | 3 |
| 2 | 1 | 66 | 3 |
| 3 | 1 | 66 | 3 |
| 4 | 3 | −344 | 91 |
| Commercial: | | | |
| 1 | 1 | 32 | 2 |
| 2 | 1 | 32 | 2 |
| 3 | 1 | 32 | 2 |
| 4 | 3 | −393 | 100 |

* The savings represent the average LCC for affected consumers.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on low-income households and small businesses. Table V–8 through Table V–13 compares the average LCC savings and PBP at each efficiency level for the consumer subgroups, along with the average LCC savings for the entire consumer sample. In most cases, the average LCC savings and PBP for low-income households and small businesses at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the final rule TSD presents the complete LCC and PBP results for the subgroups.

TABLE V–8—COMPARISON OF LCC SAVINGS AND PBP FOR LOW-INCOME HOUSEHOLDS AND ALL HOUSEHOLDS FOR PRODUCT CLASS 10a

[VFD UPSs]

| TSL | Average life-cycle cost savings (2015$) | | Simple payback period (years) | |
|---|---|---|---|---|
| | Low-income households | All households | Low-income households | All households |
| 1 | 47 | 43 | 0.0 | 0.0 |
| 2 | 47 | 43 | *0.0 | *0.0 |
| 3 | 1 | −1 | 2.0 | 2.2 |
| 4 | −7 | −9 | 2.9 | 3.2 |

* The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

TABLE V–9—COMPARISON OF LCC SAVINGS AND PBP FOR LOW-INCOME HOUSEHOLDS AND ALL HOUSEHOLDS FOR PRODUCT CLASS 10b

[VI UPSs]

| TSL | Average life-cycle cost savings (2015$) | | Simple payback period (years) | |
|---|---|---|---|---|
| | Low-income households | All households | Low-income households | All households |
| 1 | 27 | 23 | 2.9 | 3.1 |
| 2 | 18 | 14 | 3.6 | 3.9 |
| 3 | 18 | 14 | 3.6 | 3.9 |
| 4 | −424 | −428 | 29 | 31 |

TABLE V–10—COMPARISON OF LCC SAVINGS AND PBP FOR LOW-INCOME HOUSEHOLDS AND ALL HOUSEHOLDS FOR PRODUCT CLASS 10c

[VFI UPSs]

| TSL | Average life-cycle cost savings (2015$) | | Simple payback period (years) | |
|---|---|---|---|---|
| | Low-income households | All households | Low-income households | All households |
| 1 | 75 | 66 | 3.4 | 3.6 |
| 2 | 75 | 66 | 3.4 | 3.6 |
| 3 | 75 | 66 | 3.4 | 3.6 |
| 4 | −313 | −344 | 13 | 14 |

TABLE V–11—COMPARISON OF LCC SAVINGS AND PBP FOR SMALL BUSINESSES AND ALL BUSINESSES FOR PRODUCT CLASS 10a

[VFD UPSs]

| TSL | Average life-cycle cost savings (2015$) | | Simple payback period (years) | |
|---|---|---|---|---|
| | Small businesses | All businesses | Small businesses | All businesses |
| 1 | 30 | 31 | 0.0 | 0.0 |
| 2 | 30 | 31 | *0.0 | *0.0 |
| 3 | −5 | −5 | 2.6 | 2.6 |
| 4 | −14 | −13 | 3.8 | 3.8 |

* The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

TABLE V–12—COMPARISON OF LCC SAVINGS AND PBP FOR SMALL BUSINESSES AND ALL BUSINESSES FOR PRODUCT CLASS 10b

[VI UPSs]

| TSL | Average life-cycle cost savings (2015$) | | Simple payback period (years) | |
|---|---|---|---|---|
| | Small businesses | All businesses | Small businesses | All businesses |
| 1 | 9 | 11 | 3.7 | 3.7 |
| 2 | 1 | 2 | 4.7 | 4.7 |
| 3 | 1 | 2 | 4.7 | 4.7 |
| 4 | −394 | −392 | 37 | 37 |

TABLE V–13—COMPARISON OF LCC SAVINGS AND PBP FOR SMALL BUSINESSES AND ALL BUSINESSES FOR PRODUCT CLASS 10c

[VFI UPSs]

| TSL | Average life-cycle cost savings (2015$) | | Simple payback period (years) | |
|---|---|---|---|---|
| | Small businesses | All businesses | Small businesses | All businesses |
| 1 | 29 | 32 | 4.5 | 4.5 |
| 2 | 29 | 32 | 4.5 | 4.5 |
| 3 | 29 | 32 | 4.5 | 4.5 |
| 4 | −402 | −393 | 18 | 18 |

c. Rebuttable Presumption Payback

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

Table V–14 presents the rebuttable-presumption payback periods for the considered TSLs for UPSs. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for this rule are economically justified through a more detailed analysis of the economic impacts of those levels, pursuant to 42 U.S.C. 6295(o)(2)(B)(i), that considers the full range of impacts to the consumer, manufacturer, Nation, and environment. The results of that analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level, thereby supporting or rebutting the results of any preliminary determination of economic justification.

TABLE V–14—REBUTTABLE-PRESUMPTION PAYBACK PERIODS

| TSL | 10a (VFD UPSs) | 10b (VI UPSs) | 10c (VFI UPSs) |
|---|---|---|---|
| Residential: | | | |
| 1 | 0 | 3.1 | 3.6 |
| 2 | *0 | 3.9 | 3.6 |
| 3 | 2.2 | 3.9 | 3.6 |
| 4 | 3.2 | 31 | 14 |
| Commercial: | | | |
| 1 | 0 | 3.7 | 4.5 |
| 2 | *0 | 4.7 | 4.5 |
| 3 | 2.6 | 4.7 | 4.5 |
| 4 | 3.8 | 37 | 18 |

*The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of new energy conservation standards on UPS manufacturers. The following section describes the estimated impacts on UPS manufacturers at each analyzed TSL. Chapter 12 of the final rule TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

Table V–15 and Table V–16 present the financial impacts (represented by changes in INPV) of analyzed standards on UPS manufacturers as well as the conversion costs that DOE estimates UPS manufacturers would incur at each TSL. To evaluate the range of cash-flow impacts on the UPS industry, DOE modeled two markup scenarios that correspond to the range of anticipated market responses to new standards. Each scenario results in a unique set of cash flows and corresponding industry values at each TSL.

In the following discussion, the INPV results refer to the difference in industry value between the no-standards case and the standards cases that result from the sum of discounted cash flows from the reference year (2016) through the end of the analysis period (2048). The results also discuss the difference in cash flows between the no-standards case and the standards cases in the year before the compliance date for new standards. This difference in cash flow represents the size of the required conversion costs relative to the cash flow generated by the UPS industry in the absence of new energy conservation standards.

To assess the upper (less severe) bound of the range of potential impacts on UPS manufacturers, DOE modeled a preservation of gross margin markup scenario. This scenario assumes that in the standards cases, manufacturers would be able to fully pass on higher production costs required to produce more efficient products to their consumers. Specifically, the industry would be able to maintain its average no-standards case gross margin (as a percentage of revenue) despite the higher product costs in the standards cases. In general, the larger the product price increases, the less likely manufacturers are to achieve the cash flow from operations calculated in this scenario because it is less likely that manufacturers would be able to fully mark up these larger cost increases.

To assess the lower (more severe) bound of the range of potential impacts on manufacturers, DOE modeled the pass through markup scenario. In this scenario DOE assumes that manufacturers are able to pass through the incremental costs of more efficient UPSs to their customers, but without earning any additional operating profit on those higher costs. This scenario represents the lower bound of the range of potential impacts on manufacturers because manufacture margins are compressed as a result of this markup scenario.

TABLE V–15—MANUFACTURER IMPACT ANALYSIS FOR UNINTERRUPTIBLE POWER SUPPLIES—PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

| | Units | No standards case | Trial standard level | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| INPV | 2015$ millions | 2,575 | 2,737 | 2,832 | 2,964 | 7,376 |
| Change in INPV | 2015$ millions | | 162 | 257 | 389 | 4,801 |
| | % | | 6.3 | 10.0 | 15.1 | 186.4 |
| Product Conversion Costs | 2015$ millions | | 28 | 35 | 38 | 44 |
| Capital Conversion Costs | 2015$ millions | | 9 | 11 | 12 | 14 |
| Total Conversion Costs | 2015$ millions | | 36 | 47 | 50 | 58 |

TABLE V–16—MANUFACTURER IMPACT ANALYSIS FOR UNINTERRUPTIBLE POWER SUPPLIES—PASS THROUGH MARKUP SCENARIO

| | Units | No standards case | Trial standard level | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| INPV | 2015$ millions | 2,575 | 2,167 | 1,939 | 1,599 | (691) |
| Change in INPV | 2015$ millions | | (409) | (636) | (976) | (3,266) |
| | % | | (15.9) | (24.7) | (37.9) | (126.8) |
| Product Conversion Costs | 2015$ millions | | 28 | 35 | 38 | 44 |
| Capital Conversion Costs | 2015$ millions | | 9 | 11 | 12 | 14 |
| Total Conversion Costs | 2015$ millions | | 36 | 47 | 50 | 58 |

* Numbers in parentheses indicate negative numbers.

TSL 1 sets the efficiency level at EL 1 for all UPSs. At TSL 1, DOE estimates impacts on INPV to range from −$409 million to $162 million, or a change in INPV of −15.9 percent to 6.3 percent. At this TSL, industry free cash flow is estimated to decrease by approximately 15.2 percent to $74 million, compared to the no-standards case value of $87 million in 2018, the year leading up to the adopted standards.

As TSLs approach max-tech, the number of UPS shipments that do not meet required efficiency levels, and subsequently the number of UPSs requiring redesign, increases. Conversion costs scale with the increased number of UPSs that require redesign to meet efficiency levels. At TSL 1, DOE estimates that UPS manufacturers will incur a total of $36 million in conversion costs. DOE estimates that manufacturers will incur $28 million in product conversion costs at TSL 1 as manufacturers comply with test procedure requirements and increase R&D efforts necessary to redesign UPSs that do not meet efficiency levels. Capital conversion costs are estimated to be $9 million at TSL 1, driven by investments in tooling required to print new circuit boards for redesigned UPSs.

At TSL 1, the shipment-weighted-average MPCs decrease by approximately 2 percent for VFD UPSs and increase by approximately 18 percent for VI UPSs and 10 percent for VFI UPSs relative to the no-standards case MPCs in 2019, the compliance year of the adopted standards. In the preservation of gross margin markup scenario, manufacturers are able to recover their $36 million in conversion costs over the course of the analysis period through the increases in MPCs for VI and VFI UPSs causing a slightly positive change in INPV at TSL 1 under the preservation of gross margin markup scenario.

Under the pass through markup scenario, the MPC increases at TSL 1 result in reductions in manufacturer markups from 1.57 in the no-standards case to 1.44 for VI UPSs and from 1.76 in the no-standards case to 1.67 for VFI UPSs at TSL 1. The MPC decrease for VFD UPSs at TSL 1 results in an increase in manufacturer markup from 1.55 in the no-standards case to 1.57 at TSL 1. The reductions in manufacturer markups for VI and VFI UPSs and $36 million in conversion costs incurred by manufacturers cause a moderately negative change in INPV at TSL 1 under the pass through markup scenario.

TSL 2 sets the efficiency level at EL 1 for VFD and VFI UPSs and EL 2 for VI UPSs. At TSL 2, DOE estimates impacts on INPV to range from −$636 million to $257 million, or a change in INPV of −24.7 percent to 10.0 percent. At this TSL, industry free cash flow is estimated to decrease by approximately 19.5 percent to $70 million, compared to the no-standards case value of $87 million in 2018, the year leading up to the adopted standards.

DOE expects higher conversion costs at TSL 2 than at TSL 1 because TSL 2 sets the efficiency level at EL 2 for VI UPSs, resulting in an increased number of VI UPSs that do not meet the efficiency levels required at this TSL. DOE estimates that manufacturers will incur a total of $47 million in conversion costs at TSL 2. DOE estimates that manufacturers will incur $35 million in product conversion costs at TSL 2 as manufacturers comply with test procedure requirements and increase R&D efforts necessary to redesign UPSs to meet the required efficiency levels at TSL 2. Capital conversion costs are estimated to be $11 million at TSL 2, driven by investments in tooling required to print new circuit boards for redesigned UPSs.

At TSL 2, the shipment-weighted-average MPCs decrease by approximately 2 percent for VFD UPSs and increase by approximately 38 percent for VI UPSs and 10 percent for VFI UPSs relative to the no-standards case MPCs in 2019, the compliance year of the standards. In the preservation of gross margin markup scenario, manufacturers are able to recover their $47 million in conversion costs over the course of the analysis period through the increases in MPCs for VI and VFI UPSs causing a moderately positive change in INPV at TSL 2 under the preservation of gross margin markup scenario.

Under the pass through markup scenario at TSL 2, the MPC increases result in reductions in manufacturer markups from 1.57 in the no-standards case to 1.37 for VI UPSs at TSL 2 and from 1.76 in the no-standards case to 1.67 for VFI UPSs at TSL 2. The MPC decrease for VFD UPSs at TSL 2 results in an increase in manufacturer markup from 1.55 in the no-standards case to 1.57 in the standards case at TSL 2. The reductions in manufacturer markups for VI and VFI UPSs and $47 million in conversion costs cause a significantly negative change in INPV at TSL 2 under the pass through markup scenario.

TSL 3 sets the efficiency level at EL 1 for VFI UPSs and EL 2 for VFD and VI UPSs. At TSL 3, DOE estimates impacts on INPV to range from −$976 million to $389 million, or a change in INPV of −37.9 percent to 15.1 percent. At this TSL, industry free cash flow is estimated to decrease by approximately 20.9 percent to $69 million, compared to the no-standards case value of $87 million in 2018, the year leading up to the adopted standards.

DOE estimates that manufacturers will incur a total of $50 million in conversion costs at TSL 3. DOE estimates that manufacturers will incur $38 million in product conversion costs at TSL 3 as manufacturers comply with test procedure requirements and increase R&D efforts necessary to redesign VFD and VI UPSs to have best-in-market efficiency and VFI UPSs to meet the required efficiency level at TSL 3. Capital conversion costs are estimated to be $12 million at TSL 3, driven by investments in tooling required to print new circuit boards for redesigned UPSs.

At TSL 3, the shipment-weighted-average MPCs increase by approximately 25 percent for VFD UPSs, 38 percent for VI UPSs, and 10 percent for VFI UPSs relative to the no-standards case MPCs in 2019, the compliance year of the adopted standards. In the preservation of gross margin markup scenario, manufacturers are able to recover their $50 million in conversion costs over the course of the analysis period through the increases in MPCs causing a moderately positive change in INPV at TSL 3 under the preservation of gross margin markup scenario.

Under the pass through markup scenario at TSL 3, the increases in shipment-weighted-average MPCs result in reductions in manufacturer markups, from 1.55 in the no-standards case to 1.43 for VFD UPSs at TSL 3, from 1.57 in the no-standards case to 1.37 for VI UPSs at TSL 3, and from 1.76 in the no-standards case to 1.67 for VFI UPSs at TSL 3. The reductions in manufacturer markups and $50 million in conversion costs incurred by manufacturers cause a significantly negative change in INPV at TSL 3 under the pass through markup scenario.

TSL 4 sets the efficiency level at EL 3 for all UPSs, which represents max-tech. At TSL 4, DOE estimates impacts on INPV to range from −$3,266 million to $4,801 million, or a change in INPV of −126.8 percent to 186.4 percent. At this TSL, industry free cash flow is estimated to decrease by approximately 24.3 percent to $66 million, compared to the no-standards case value of $87 million in 2018, the year leading up to the adopted standards.

DOE expects that manufacturers will incur higher total conversion costs at TSL 4 than at any of the lower TSLs because manufacturers will required to redesign the vast majority of their UPSs to meet max-tech. DOE estimates that manufacturers will incur $44 million in product conversion costs as manufacturers comply with test procedure requirements and increase R&D efforts necessary to redesign UPSs to meet max-tech at TSL 4. Capital conversion costs are estimated to be $14 million at TSL 4, driven by investments in tooling required to print new circuit boards for the majority of UPSs.

At TSL 4, the shipment-weighted-average MPCs increase significantly by approximately 46 percent for VFD UPSs, 489 percent for VI UPSs, and 207 percent for VFI UPSs relative to the no-standards case MPCs in 2019, the compliance year of the adopted standards. In the preservation of gross margin markup scenario, manufacturers are able to recover their $58 million in conversion costs over the course of the analysis period through the increases in MPCs causing a significantly positive change in INPV at TSL 4 under the preservation of gross margin markup scenario.

Under the pass through markup scenario at TSL 4, the MPC increases result in reductions in manufacturer markups, from 1.55 in the no-standards case to 1.36 for VFD UPSs at TSL 4, from 1.57 in the no-standards case to 1.30 for VI UPSs at TSL 4, and from 1.76 in the no-standards case to 1.30 for VFI UPSs at TSL 4. The reductions in manufacturer markups and $58 million in conversion costs incurred by manufacturers cause a significantly negative change in INPV at TSL 4 under the pass through markup scenario.

b. Impacts on Employment

Manufacturer interviews, comment responses to the August 2016 NOPR, and DOE's research indicate that all UPS components that would be modified to improve the efficiency of UPSs are manufactured abroad (Schneider Electric, Pub. Mtg. Tr., No. 0014 at p. 72). DOE was able to identify a handful of UPS manufacturers that do assemble these UPS components domestically. Based on manufacturer interviews, DOE stated in the August 2016 NOPR that there would most likely not be an impact on the amount of domestic workers involved in the assembly of UPSs due to new energy conservation standards. 81 FR 52230. Subsequently, DOE did not conduct a quantitative domestic employment impact analysis on UPS manufacturers in the August 2016 NOPR.

NEMA and Schneider Electric commented that manufacturers may move their assembly abroad as testing and assembling compliant UPSs becomes more expensive (Schneider Electric, No. 0017 at p. 20). NEMA went on to reference the number of companies listed in the Online Certifications Directory from Underwriters Laboratories [56] with the ''YEDU'' UPS category code as examples of UPS manufacturers with domestic assembly that could be moved abroad due to adopted standards (NEMA and ITI, No. 0019 at p. 15). In the final rule, DOE quantified the potential impacts on domestic UPS assembly employment. DOE recognizes that while there is no domestic UPS production, or production employees, there could be impacts to domestic UPS assembly employment as a result of adopted standards. DOE reviewed the Online Certifications Directory from Underwriters Laboratories and used the listings to determine the proportion of UPS assembly that takes place in the United States. DOE found 83 manufacturer listings registered under

[56] Underwriters Laboratories. Online Certifications Directory. Last Accessed October 10, 2016. *http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html?utm_source=ulcom&utm_medium=web&utm_campaign=database.*

the ''YEDU'' code for certification of UPS models. DOE did not include any manufacturer listings registered with Underwriters Laboratories for certification of products outside the scope of this rulemaking, such as remote battery supply cabinets. Of the 83 total listings registered for certification of UPS models, DOE found 45 UPS manufacturers with domestic facilities. Using these listings, DOE determined that approximately 54 percent of UPS assembly takes place in the United States.

DOE used the GRIM to estimate the domestic assembly expenditures and the number of domestic assembly workers in the no-standards case at each TSL. DOE used statistical data from the U.S. Census Bureau's 2014 Annual Survey of Manufacturers to calculate labor expenditures associated with the North American Industry Classification System (NAICS) code 335999. DOE estimated that 10 percent of labor expenditures for this NAICS code is attributed to UPS assembly expenditures in the no-standards case.

Table V–17 represents the potential impacts the adopted standards could have on domestic UPS assembly employment. The upper bound of the results estimates the maximum change in the number of assembly workers that could occur after compliance with adopted energy conservation standards when assuming that manufacturers continue to assemble the same scope of covered products. It also assumes that domestic assembly does not shift to lower labor-cost countries. To address the risk of manufacturers choosing to assemble UPSs abroad, the lower bound of the employment results estimate the maximum decrease in domestic UPS assembly workers in the industry if some or all existing assembly was moved outside of the United States. While the results present a range of estimates, the following sections also include qualitative discussions of the impacts on UPS assembly at the various TSLs. Finally, the domestic UPS assembly employment impacts shown are independent of the employment impacts from the broader U.S. economy, documented in chapter 17 of the final rule TSD.

DOE estimates that in the absence of new energy conservation standards, there would be approximately 206 domestic employees involved in assembling UPSs in 2019. Table V–17 presents the range of potential impacts of adopted energy conservation standards on domestic assembly workers in the UPS industry.

TABLE V–17—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC UNINTERRUPTABLE POWER SUPPLY ASSEMBLY WORKERS IN 2019

| | No standards case | Trial standard level | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| Total Number of Domestic Assembly Workers in 2019 (without changes in production locations) | 206 | 206 | 206 | 206 | 206 |
| Potential Changes in Domestic Assembly Workers in 2019 * | | 0–(41) | 0–(62) | 0–(103) | 0–(206) |

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

At the upper end of the employment impact range, DOE does not expect any impact on the amount of domestic workers involved in the assembly of UPSs at the analyzed TSLs. While compliant UPS component configurations may change or become more costly, DOE estimates that the same amount of employees would be needed to assemble these products.

At the lower end of the range, DOE models a situation where some domestic employment associated with UPS assembly moves abroad as a result of new energy conservation standards. As UPS MPCs increase due to adopted standards, NEMA and Schneider stated that manufacturers may relocate domestic assembly facilities to countries with lower labor costs in an effort to reduce the total cost of UPS production (Schneider Electric, No. 0017 at p. 20) (NEMA and ITI, No. 0019 at p. 15). The lower end of the employment impact range represents these potential relocation decisions as decreases in domestic assembly employment at higher TSLs. At TSL 1, the TSL adopted in this final rule, DOE concludes that, based on the shipment analysis, manufacturer interviews, and the results of the domestic assembly employment analysis, manufacturers could face a moderate negative impact on domestic assembly employment due to the increased total cost of UPS assembly in 2019.

DOE also recognizes there are several UPS and UPS component manufacturers that have employees in the U.S. that work on design, technical support, sales, training, testing, certification, and other requirements. However, feedback from manufacturer interviews and comment responses to the August 2016 NOPR did not indicate there would be negative changes in the domestic employment of the design, technical support, or other departments of UPS and UPS component manufacturers located in the U.S. in response to new energy conservation standards.

c. Impacts on Manufacturing Capacity

UPS manufacturers stated that they did not anticipate any capacity constraints at any of the analyzed ELs, given a two-year timeframe from the publication of a final rule and the compliance year.

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop an industry cash-flow estimate may not be adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche product manufacturers, and manufacturers exhibiting cost structures substantially different from the industry average could be affected disproportionately. DOE identified one manufacturer subgroup that it believes could be disproportionally impacted by energy conservation standards and would require a separate analysis in the MIA, small businesses. DOE analyzes the impacts on small businesses in a separate analysis in section VI.B of this final rule as part of the Regulatory Flexibility Analysis. DOE did not identify any other adversely impacted manufacturer subgroups for this rulemaking based on the results of the industry characterization.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves considering the cumulative impact of multiple DOE standards and the regulatory actions of other Federal agencies and States that affect the manufacturers of a covered product. A standard level is not economically justified if it contributes to an unacceptable cumulative regulatory burden. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

Some UPS manufacturers could also make other products that could be subject to energy conservation standards set by DOE. DOE looks at these regulations that could affect UPS manufacturers that will take effect approximately 3 years before or after the estimated 2019 compliance date of adopted energy conservation standards for UPSs.[57] These energy conservation standards include distribution transformers [58], electric motors,[59] external power supplies,[60] metal halide lamp fixtures,[61] walk-in coolers and freezers,[62] battery chargers,[63] general service fluorescent lamps,[64] ceiling fan light kits,[65] dehumidifiers,[66] and single package vertical air conditioners and single package vertical heat pumps.[67]

The compliance dates and expected industry conversion costs of relevant energy conservation standards are presented in Table V–18. Included in the table are Federal regulations that have compliance dates three (and six) years before or after the UPS compliance date.

TABLE V–18—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING UNINTERRUPTIBLE POWER SUPPLY MANUFACTURERS

| Federal energy conservation standards | Number of manufacturers * | Number of manufacturers from this rule affected ** | Compliance date | Estimated total industry conversion expense | Estimated total industry conversion expense as percentage of revenue *** |
|---|---|---|---|---|---|
| Distribution Transformers, 78 FR 23336 (April 18, 2013). | 38 | 3 | 2016 | $60.9 Million (2011$) | <1.0 |
| Electric Motors, 79 FR 30933 (May 29, 2014). | 7 | 2 | 2016 | $84.6 Million (2013$) | 1.2 |
| External Power Supplies, 79 FR 7846 (February 10, 2014). | 243 | 6 | 2016 | $43.4 Million (2012$) | 2.3 |
| Residential Central Air Conditioners and Heat Pumps, 76 FR 37408 (June 27, 2011). | 39 | 1 | 2016 | $44.0 Million (2009$) | 0.1 |
| Metal Halide Lamp Fixtures, 79 FR 7745 (February 10, 2014). | 101 | 5 | 2017 | $25.7 Million (2012$) | 2.3 |
| Battery Chargers, 81 FR 38266 (June 13, 2016). | 107 | 3 | 2018 | $19.5 Million (2013$) | <1.0 |
| General Service Fluorescent Lamps, 80 FR 4041 (January 26, 2015). | 55 | 2 | 2018 | $26.6 Million (2013$) | <1.0 |
| Ceiling Fan Light Kits, 81 FR 580 (January 06, 2016). | 67 | 2 | 2019 | $18.9–$17.0 Million (2014$) | 2.0 to 1.8 |
| Dehumidifiers, 80 FR 38338 (June 13, 2016). | 25 | 1 | 2019 | $52.5 Million (2014$) | 4.5 |
| Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps, 80 FR 57438 (September 23, 2015). | 9 | 1 | 2019 | $9.2 Million (2014$) | 1.9 |

[57] See the ‡ footnote in Table V–18 for more information on the timeframe examined as part of the cumulative regulatory burden analysis.

[58] Energy conservation standards for distribution transformers became effective on January 1, 2016. 78 FR 23336. [Docket Number EERE–2010–BT–STD–0048]

[59] Energy conservation standards for electric motors became effective on June 1, 2016. 79 FR 30933. [Docket Number EERE–2010–BT–STD–0027]

[60] Energy conservation standards for external power supplies became effective on February 10, 2016. 79 FR 7846. [Docket Number EERE–2008–BT–STD–0005]

[61] Energy conservation standards for metal halide lamp fixtures will become effective on February 10, 2017. 79 FR 7745. [Docket Number EERE–2009–BT–STD–0018]

[62] Energy conservation standards for walk-in coolers and freezers estimated to become effective on September 16, 2019. 81 FR 62980. [Docket Number EERE–2015–BT–STD–0016]

[63] Energy conservation standards for battery chargers will become effective on June 13, 2018. 81 FR 38266. [Docket Number EERE–2008–BT–STD–0005]

[64] Energy conservation standards for general service fluorescent lamps will become effective on January 26, 2018. 80 FR 4041 [Docket Number EERE–2011–BT–STD–0006]

[65] Energy conservation standards for ceiling fan light kits will become effective on January 7, 2019. 81 FR 580. [Docket Number EERE–2012–BT–STD–0045]

[66] Energy conservation standards for dehumidifiers will become effective on June 13, 2019. 80 FR 38338. [Docket Number EERE–2012–BT–STD–0027]

[67] Energy conservation standards for single package vertical air conditioners and single package vertical heat pumps will become effective on September 23, 2019. 80 FR 57438. [Docket Number EERE–2012–BT–STD–0041]

TABLE V–18—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING UNINTERRUPTIBLE POWER SUPPLY MANUFACTURERS—Continued

| Federal energy conservation standards | Number of manufacturers * | Number of manufacturers from this rule affected ** | Compliance date | Estimated total industry conversion expense | Estimated total industry conversion expense as percentage of revenue *** |
|---|---|---|---|---|---|
| Walk-In Coolers and Freezers, 81 FR 62980 (September 16, 2016). | 64 | 1 | 2019 † | $16.2 Million (2015$) | 1.7 |
| Fluorescent Lamp Ballasts, 76 FR 70548 (November 14, 2011) ‡. | 41 | 2 | 2014 | $74.0 Million (2010$) | 2.7 |
| Small Electric Motors, 75 FR 10874 (March 9, 2010) ‡. | 5 | 1 | 2015 | $51.3 Million (2009$) | 3.1 |
| Residential Water Heaters, 75 FR 20112 (April 16, 2010) ‡. | 39 | 1 | 2015 | $17.5 Million (2009$) | 4.9 |

* The number of manufacturers listed in the final rule for the energy conservation standard that is contributing to cumulative regulatory burden.

** The number of manufacturers producing UPSs that are affected by the listed energy conservation standards.

*** This column presents conversion costs as a percentage of cumulative revenue for the industry during the conversion period. The conversion period is the timeframe over which manufacturers must make conversion costs investments and lasts from the announcement year of the final rule to the standards year of the final rule. This period typically ranges from 3 to 5 years, depending on the energy conservation standard.

† The final rule for this energy conservation standard has not been published. The data points in the table are estimates from the pre-publication stage.

‡ Consistent with Chapter 12 of the TSD, DOE has assessed whether this rule will have significant impacts on manufacturers that are also subject to significant impacts from other EPCA rules with compliance dates within three years of this rule's compliance date. However, DOE recognizes that a manufacturer incurs costs during some period before a compliance date as it prepares to comply, such as by revising product designs and manufacturing processes, testing products, and preparing certifications. As such, to illustrate a broader set of rules that may also create additional burden on manufacturers, DOE has included additional rules with compliance dates that fall within six years of the compliance date of this rule by expanding the timeframe of potential cumulative regulatory burden. Note that the inclusion of any given rule in this Table does not indicate that DOE considers the rule to contribute significantly to cumulative impact. DOE has chosen to broaden its list of rules in order to provide additional information about its rulemaking activities. DOE will continue to evaluate its approach to assessing cumulative regulatory burden for use in future rulemakings to ensure that it is effectively capturing the overlapping impacts of its regulations. DOE plans to seek public comment on the approaches it has used here (*i.e.,* both the 3 and 6 year timeframes from the compliance date) in order to better understand at what point in the compliance cycle manufacturers most experience the effects of cumulative and overlapping burden from the regulation of multiple products.

DOE discusses these and other requirements and includes the full details of the cumulative regulatory burden analysis in chapter 12 of the final rule TSD. DOE will continue to evaluate its approach to assessing cumulative regulatory burden for use in future rulemakings to ensure that it is effectively capturing the overlapping impacts of its regulations. DOE plans to seek public comment on the approaches it has used here (*i.e.,* both the 3 and 6 year timeframes from the compliance date) in order to better understand at what point in the compliance cycle manufacturers most experience the effects of cumulative and overlapping burden from the regulation of multiple product classes.

3. National Impact Analysis

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

a. Significance of Energy Savings

To estimate the energy savings attributable to potential new standards for UPSs, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2019–2048). Table V–19 presents DOE's projections of the national energy savings for each TSL considered for UPSs. The savings were calculated using the approach described in section IV.H.2 of this final rule.

TABLE V–19—CUMULATIVE NATIONAL ENERGY SAVINGS FOR UPSS; 30 YEARS OF SHIPMENTS

[2019–2048]

| | Trial standard level | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | (quads) | | | |
| Primary energy | 0.90 | 1.1 | 1.2 | 2.9 |
| FFC energy | 0.94 | 1.2 | 1.3 | 3.0 |

OMB Circular A–4 [68] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[69] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to UPSs. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V–20. The impacts are counted over the lifetime of UPSs purchased in 2019–2048.

TABLE V–20—CUMULATIVE NATIONAL ENERGY SAVINGS FOR UPSS; 9 YEARS OF SHIPMENTS

[2019–2048]

| | Trial standard level | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | (quads) | | | |
| Primary energy | 0.21 | 0.26 | 0.28 | 0.66 |
| FFC energy | 0.21 | 0.27 | 0.30 | 0.69 |

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the TSLs considered for UPSs. In accordance with OMB's guidelines on regulatory analysis,[70] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V–21 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2019–2048.

TABLE V–21—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR UPSS; 30 YEARS OF SHIPMENTS

[2019–2048]

| Discount rate (percent) | Trial standard level | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | (billion 2015$) | | | |
| 3 | 3.0 | 2.5 | 0.75 | −53 |
| 7 | 1.3 | 1.0 | 0.03 | −30 |

The NPV results based on the aforementioned 9-year analytical period are presented in Table V–22. The impacts are counted over the lifetime of products purchased in 2019–2048. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V–22—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR UPSS; 9 YEARS OF SHIPMENTS

[2019–2048]

| Discount rate (percent) | Trial standard level | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | (billion 2015$) | | | |
| 3 | 0.97 | 0.84 | 0.30 | −16 |
| 7 | 0.61 | 0.48 | 0.05 | −13 |

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

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

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

c. Indirect Impacts on Employment

DOE expects that amended energy conservation standards for UPSs will reduce energy expenditures for consumers of those products, with the resulting net savings being redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.N of this document, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes (2019–2025), where these uncertainties are reduced.

The results suggest that the adopted standards are likely to have a negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 16 of the final rule TSD presents detailed results regarding anticipated indirect employment impacts.

4. Impact on Utility or Performance of Products

As discussed in section IV.C of this final rule, DOE has concluded that the standards adopted in this final rule will not lessen the utility or performance of UPSs under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the adopted standards.

5. Impact of Any Lessening of Competition

DOE considered any lessening of competition that would be likely to result from new UPS standards. As discussed in section III.D.1.e, EPCA directs the Attorney General of the United States (Attorney General) to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination in writing to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) To assist the Attorney General in making this determination, DOE provided DOJ with copies of the August 2016 NOPR and the TSD for review. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for UPSs are unlikely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

6. Need of the Nation To Conserve Energy

Enhanced energy efficiency, where economically justified, improves the Nation's energy security, strengthens the economy, and reduces the environmental impacts (costs) of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. As a measure of this reduced demand, chapter 15 in the final rule TSD presents the estimated reduction in generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from potential energy conservation standards for UPSs is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V–23 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The emissions were calculated using the multipliers discussed in section IV.K of this document. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD.

TABLE V–23—CUMULATIVE EMISSIONS REDUCTION FOR UPSS SHIPPED IN 2019–2048

| | Trial standard level | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| **Power Sector Emissions** | | | | |
| $CO_2$ (*million metric tons*) | 46 | 58 | 64 | 148 |
| $SO_2$ (*thousand tons*) | 39 | 48 | 54 | 125 |
| $NO_X$ (*thousand tons*) | 25 | 31 | 34 | 79 |
| Hg (*tons*) | 0.13 | 0.16 | 0.18 | 0.41 |
| $CH_4$ (*thousand tons*) | 5.0 | 6.2 | 7.0 | 16 |
| $N_2O$ (*thousand tons*) | 0.72 | 0.89 | 0.99 | 2.3 |
| **Upstream Emissions** | | | | |
| $CO_2$ (*million metric tons*) | 2.6 | 3.2 | 3.6 | 8.3 |
| $SO_2$ (*thousand tons*) | 0.31 | 0.39 | 0.43 | 1.0 |
| $NO_X$ (*thousand tons*) | 38 | 47 | 52 | 122 |
| Hg (*tons*) | 0.00 | 0.00 | 0.00 | 0.00 |
| $CH_4$ (*thousand tons*) | 233 | 290 | 322 | 749 |
| $N_2O$ (*thousand tons*) | 0.02 | 0.02 | 0.02 | 0.06 |
| **Total FFC Emissions** | | | | |
| $CO_2$ (*million metric tons*) | 49 | 61 | 68 | 156 |
| $SO_2$ (*thousand tons*) | 39 | 49 | 54 | 126 |
| $NO_X$ (*thousand tons*) | 63 | 78 | 87 | 201 |
| Hg (*tons*) | 0.13 | 0.16 | 0.18 | 0.41 |
| $CH_4$ (*thousand tons*) | 238 | 296 | 329 | 765 |
| $N_2O$ (*thousand tons*) | 0.73 | 0.91 | 1.0 | 2.3 |

As part of the analysis for this rule, DOE estimated monetary benefits likely to result from the reduced emissions of $CO_2$ that DOE estimated for each of the considered TSLs for UPSs. As discussed in section 0 of this document, for $CO_2$, DOE used the most recent values for the SC-$CO_2$ developed by an interagency process. The four sets of SC-$CO_2$ values correspond to the average values from distributions that use a 5-percent discount rate, a 3-percent discount rate, a 2.5-percent discount rate, and the 95th-percentile values from a distribution that uses a 3-percent discount rate. The actual SC-$CO_2$ values used for emissions in each year are presented in appendix 14A of the final rule TSD.

Table V–24 presents the global value of $CO_2$ emissions reductions at each TSL. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values; these results are presented in chapter 14 of the final rule TSD.

TABLE V–24—PRESENT VALUE OF $CO_2$ EMISSIONS REDUCTION FOR UPSS SHIPPED IN 2019–2048

| TSL | SC-$CO_2$ case | | | |
|---|---|---|---|---|
| | 5% Discount rate, average | 3% Discount rate, average | 2.5% Discount rate, average | 3% Discount rate, 95th percentile |
| | (million 2015$) | | | |
| 1 | 375 | 1,659 | 2,612 | 5,050 |
| 2 | 467 | 2,065 | 3,251 | 6,286 |
| 3 | 521 | 2,301 | 3,621 | 7,003 |
| 4 | 1,189 | 5,280 | 8,322 | 16,080 |

DOE is well aware that scientific and economic knowledge about the contribution of $CO_2$ and other GHG emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed on reduced $CO_2$ emissions in this rulemaking is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in $CO_2$ and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. Consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this rule the most recent values resulting from the interagency review process. DOE notes, however, that the adopted standards would be economically justified even without inclusion of monetized benefits of reduced GHG emissions.

DOE also estimated the monetary value of the economic benefits associated with $NO_X$ emissions reductions anticipated to result from the considered TSLs for UPSs. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V–25 presents the present values for $NO_X$ emissions reductions for each TSL calculated using 7-percent and 3-percent discount rates. This table presents results that use the low dollar-per-ton values, which reflect DOE's primary estimate.

TABLE V–25 PRESENT VALUE OF $NO_X$ EMISSIONS REDUCTION FOR UPSS SHIPPED IN 2019–2048 *

| TSL | SC-$CO_2$ case | | | |
|---|---|---|---|---|
| | 5% Discount rate, average | 3% Discount rate, average | 2.5% Discount rate, average | 3% Discount rate, 95th percentile |
| | (million 2015$) | | | |
| 1 | 122 | 55 | | |
| 2 | 152 | 69 | | |
| 3 | 170 | 78 | | |
| 4 | 386 | 174 | | |

* Results are based on the low benefit-per-ton values.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) No other factors were considered in this analysis.

8. Summary of National Economic Impacts

Table V–26 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced $CO_2$ and $NO_X$ emissions to the NPV of consumer savings calculated for each TSL considered in this rulemaking.

TABLE V–26—CONSUMER NPV COMBINED WITH PRESENT VALUE OF BENEFITS FROM $CO_2$ AND $NO_X$ EMISSIONS REDUCTIONS

| TSL | Consumer NPV and low $NO_X$ values at 3% discount rate added with: | | | |
|---|---|---|---|---|
| | $CO_2$ 5% discount rate, average case | $CO_2$ 3% discount rate, average case | $CO_2$ 2.5% discount rate, average case | $CO_2$ 3% discount rate, 95th percentile case |
| | (billion 2015$) | | | |
| 1 | 3.5 | 4.8 | 5.7 | 8.1 |
| 2 | 3.2 | 4.8 | 5.9 | 9.0 |
| 3 | 1.4 | 3.2 | 4.5 | 7.9 |
| 4 | −52 | −48 | −45 | −37 |
| TSL | Consumer NPV and low $NO_X$ values at 7% discount rate added with: | | | |
| | $CO_2$ 5% discount rate, average case | $CO_2$ 3% discount rate, average case | $CO_2$ 2.5% discount rate, average case | $CO_2$ 3% discount rate, 95th percentile case |
| | (billion 2015$) | | | |
| 1 | 1.8 | 3.1 | 4.0 | 6.4 |
| 2 | 1.6 | 3.2 | 4.4 | 7.4 |
| 3 | 0.63 | 2.4 | 3.7 | 7.1 |
| 4 | −29 | −25 | −22 | −14 |

The national operating cost savings are domestic U.S. monetary savings that occur as a result of purchasing the covered UPSs, and are measured for the lifetime of products shipped in 2019–2048. The benefits associated with reduced $CO_2$ emissions achieved as a result of the adopted standards are also calculated based on the lifetime of UPSs shipped in 2019–2048. However, the $CO_2$ reduction is a benefit that accrues globally. Because $CO_2$ emissions have a very long residence time in the atmosphere, the SC-$CO_2$ values for future emissions reflect climate-related impacts that continue through 2300.

*C. Conclusion*

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

For this final rule, DOE considered the impacts of new standards for UPSs at each TSL, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader as DOE discusses the benefits and/or burdens of each TSL, tables in this section present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on identifiable subgroups of consumers who may be disproportionately affected by a national standard and impacts on employment.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases; (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (for example, between renters and owners, or builders and purchasers). Having less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways. First, if consumers forego the purchase of a product in the standards case, this decreases sales for product manufacturers, and the impact on manufacturers attributed to lost revenue is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a standard decreases the number of products purchased by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides estimates of shipments and changes in the volume of product purchases in chapter 9 of the final rule TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income.[71]

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE is committed to developing a framework that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards. DOE has posted a paper that discusses the issue of consumer welfare impacts of appliance energy conservation standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[72] DOE welcomes comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for UPSs Standards

Table V–27 and Table V–28 summarize the quantitative impacts estimated for each TSL for UPSs. The national impacts are measured over the lifetime of UPSs purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2019–2048). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. The efficiency levels contained in each TSL are described in section V.A of this final rule.

TABLE V–27—SUMMARY OF ANALYTICAL RESULTS FOR UPSS TSLS: NATIONAL IMPACTS

| Category | TSL 1 | TSL 2 | TSL 3 | TSL 4 |
|---|---|---|---|---|
| **Cumulative FFC National Energy Savings (quads)** | | | | |
| quads | 0.94 | 1.2 | 1.3 | 3.0. |
| **NPV of Consumer Costs and Benefits (billion 2015$)** | | | | |
| 3% discount rate | 3.0 | 2.5 | 0.75 | −53. |
| 7% discount rate | 1.3 | 1.0 | 0.03 | −30. |
| **Cumulative FFC Emissions Reduction** | | | | |
| $CO_2$ (*million metric tons*) | 49 | 61 | 68 | 156. |
| $SO_2$ (*thousand tons*) | 39 | 49 | 54 | 126. |
| $NO_X$ (*thousand tons*) | 63 | 78 | 87 | 201. |
| Hg (*tons*) | 0.13 | 0.16 | 0.18 | 0.41. |
| $CH_4$ (*thousand tons*) | 238 | 296 | 329 | 765. |
| $N_2O$ (*thousand tons*) | 0.73 | 0.91 | 1.0 | 2.3. |
| **Value of Emissions Reduction** | | | | |
| $CO_2$ (*billion 2015$*) ** | 0.375 to 5.050 | 0.467 to 6.286 | 0.521 to 7.003 | 1.189 to 16.080. |
| $NO_X$—3% discount rate (*million 2015$*) | 122 | 152 | 170 | 386. |
| $NO_X$—7% discount rate (*million 2015$*) | 55 | 69 | 78 | 174. |

Parentheses indicate negative (−) values.
* $CO_2eq$ is the quantity of $CO_2$ that would have the same global warming potential (GWP).
** Range of the economic value of $CO_2$ reductions is based on estimates of the global benefit of reduced $CO_2$ emissions.

TABLE V–28—SUMMARY OF ANALYTICAL RESULTS FOR UPS TSLS: MANUFACTURER AND CONSUMER IMPACTS

| Category | TSL 1 * | TSL 2 * | TSL 3 * | TSL 4 * |
|---|---|---|---|---|
| **Manufacturer Impacts** | | | | |
| Industry NPV (million 2015$) (No-standards case INPV = 2,575) | 2,167 − 2,737 | 1,939 − 2,832 | 1,599 − 2,964 | (691) − 7,376. |
| Industry NPV (% change) | (15.9) − 6.3 | (24.7) − 10.0 | (37.9) − 15.1 | (126.8) − 186.4. |
| **Consumer Average LCC Savings (2015$)** | | | | |
| 10a (VFD UPSs) | 32 | 32 | (4) | (12). |
| 10b (VI UPSs) | 12 | 4 | 4 | (396). |
| 10c (VFI UPSs) | 36 | 36 | 36 | (388). |
| Shipment-Weighted Average * | 25 | 21 | 3 | (205). |
| **Consumer Simple PBP (years)** | | | | |
| 10a (VFD UPSs) | 0.0 | 0.0 | 2.6 | 3.8. |
| 10b (VI UPSs) | 3.7 | 4.6 | 4.6 | 36. |
| 10c (VFI UPSs) | 4.4 | 4.4 | 4.4 | 18. |

[71] P.C. Reiss and M.W. White. Household Electricity Demand, Revisited. *Review of Economic Studies*. 2005. 72(3): pp. 853–883. doi: 10.1111/0034–6527.00354.

[72] Sanstad, A. H. *Notes on the Economics of Household Energy Consumption and Technology Choice.* 2010. Lawrence Berkeley National Laboratory. *https://www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf.*

TABLE V–28—SUMMARY OF ANALYTICAL RESULTS FOR UPS TSLS: MANUFACTURER AND CONSUMER IMPACTS—Continued

| Category | TSL 1 * | TSL 2 * | TSL 3 * | TSL 4 * |
|---|---|---|---|---|
| Shipment-Weighted Average * | 1.9 | 2.3 | 3.6 | 18. |
| **Percent of Consumers that Experience a Net Cost** | | | | |
| 10a (VFD UPSs) | 0 | 0 | 51 | 80. |
| 10b (VI UPSs) | 9 | 50 | 50 | 100. |
| 10c (VFI UPSs) | 2 | 2 | 2 | 99. |
| Shipment-Weighted Average * | 4 | 20 | 45 | 90. |

Parentheses indicate negative (−) values.
* Weighted by shares of each product class in total projected shipments in 2019.

DOE first considered TSL 4, which represents the max-tech efficiency levels. TSL 4 would save an estimated 3.0 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be -$30 billion using a discount rate of 7 percent, and −$53 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 156 Mt of $CO_2$, 126 thousand tons of $SO_2$, 201 thousand tons of $NO_X$, 0.41 tons of Hg, 765 thousand tons of $CH_4$, and 2.3 thousand tons of $N_2O$. The estimated monetary value of the $CO_2$ emissions reduction at TSL 4 ranges from $1.2 billion to $16 billion. The estimated monetary value of the $NO_X$ emissions reduction at TSL 4 is $174 million using a 7-percent discount rate and $386 million using a 3-percent discount rate.

At TSL 4, the average LCC impact is a savings of −$12 for VFD UPSs, −$396 for VI UPSs, and −$388 for VFI UPSs. The simple payback period is 3.8 years for VFD UPSs, 36 years for VI UPSs, and 18 years for VFI UPSs. The fraction of consumers experiencing a net LCC cost is 80 percent for VFD UPSs, 100 percent for VI UPSs, and 99 percent for VFIs.

At TSL 4, the projected change in INPV ranges from a decrease of $3,266 million to an increase of $4,801 million, which corresponds to a decrease of 126.8 percent to an increase of 186.4 percent.

The Secretary concludes that at TSL 4 for UPSs, the benefits of energy savings, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the negative NPV of consumer benefits, economic burden on some consumers, and the potentially significant reduction in INPV. Consequently, the Secretary has concluded that TSL 4 is not economically justified.

DOE then considered TSL 3, which would save an estimated 1.3 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $0.03 billion using a discount rate of 7 percent, and $0.75 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 68 Mt of $CO_2$, 54 thousand tons of $SO_2$, 87 thousand tons of $NO_X$, 0.18 tons of Hg, 329 thousand tons of $CH_4$, and 1.0 thousand tons of $N_2O$. The estimated monetary value of the $CO_2$ emissions reduction at TSL 3 ranges from $0.52 billion to $7.0 billion. The estimated monetary value of the $NO_X$ emissions reduction at TSL 3 is $78 million using a 7-percent discount rate and $170 million using a 3-percent discount rate.

At TSL 3, the average LCC impact is a savings of −$4 for VFD UPSs, $4 for VI UPSs, and $36 for VFI UPSs. The simple payback period is 2.6 years for VFD UPSs, 4.6 years for VI UPSs, and 4.4 years for VFI UPSs. The fraction of consumers experiencing a net LCC cost is 51 percent for VFD UPSs, 50 percent for VI UPSs, and 2 percent for VFIs.

At TSL 3, the projected change in INPV ranges from a decrease of $976 million to an increase of $389 million, which corresponds to a decrease of 37.9 percent to an increase of 15.1 percent.

The Secretary concludes that at TSL 3 for UPSs, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden on some consumers, and the potential reduction in INPV. Consequently, the Secretary has concluded that TSL 3 is not economically justified.

DOE then considered TSL 2, which would save an estimated 1.2 quads of energy, an amount DOE considers significant. Under TSL 2, the NPV of consumer benefit would be $1.0 billion using a discount rate of 7 percent, and $2.5 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 61 Mt of $CO_2$, 49 thousand tons of $SO_2$, 78 thousand tons of $NO_X$, 0.16 tons of Hg, 296 thousand tons of $CH_4$, and 0.91 thousand tons of $N_2O$. The estimated monetary value of the $CO_2$ emissions reduction at TSL 2 ranges from $0.47 billion to $6.3 billion. The estimated monetary value of the $NO_X$ emissions reduction at TSL 3 is $69 million using a 7-percent discount rate and $152 million using a 3-percent discount rate.

At TSL 2, the average LCC impact is a savings of $32 for VFD UPSs, $4 for VI UPSs, and $36 for VFI UPSs. The simple payback period is 0.0 [73] years for VFD UPSs, 4.6 years for VI UPSs, and 4.4 years for VFI UPSs. The fraction of consumers experiencing a net LCC cost is 0 percent for VFD UPSs, 50 percent for VI UPSs, and 2 percent for VFIs.

At TSL 2, the projected change in INPV ranges from a decrease of $636 million to an increase of $257 million, which corresponds to a decrease of 24.7 percent to an increase of 10.0 percent.

The Secretary concludes that at TSL 2 for UPSs, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the economic burden on some consumers and the potential reduction in manufacturer INPV. Consequently, the Secretary has concluded that TSL 2 is not economically justified.

DOE then considered TSL 1, which would save an estimated 0.94 quads of energy, an amount DOE considers significant. Under TSL 1, the NPV of consumer benefit would be $1.3 billion using a discount rate of 7 percent, and $3.0 billion using a discount rate of 3 percent.

[73] The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

The cumulative emissions reductions at TSL 1 are 49 Mt of $CO_2$, 39 thousand tons of $SO_2$, 63 thousand tons of $NO_X$, 0.13 tons of Hg, 238 thousand tons of $CH_4$, and 0.73 thousand tons of $N_2O$. The estimated monetary value of the $CO_2$ emissions reduction at TSL 1 ranges from $0.37 billion to $5.0 billion. The estimated monetary value of the $NO_X$ emissions reduction at TSL 1 is $55 million using a 7-percent discount rate and $122 million using a 3-percent discount rate.

At TSL 1, the average LCC impact is a savings of $32 for VFD UPSs, $12 for VI UPSs, and $36 for VFI UPSs. The simple payback period is 0.0 [74] years for VFD UPSs, 3.7 years for VI UPSs, and 4.4 years for VFI UPSs. The fraction of consumers experiencing a net LCC cost is 0 percent for VFD UPSs, 9 percent for VI UPSs, and 2 percent for VFIs.

At TSL 1, the projected change in INPV ranges from a decrease of $409 million to an increase of $163 million, which corresponds to a decrease of 15.9 percent to an increase of 6.3 percent.

After considering the analysis and weighing the benefits and burdens, the Secretary has concluded that at TSL 1 for UPSs, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, the estimated monetary value of the emissions reductions, and positive average LCC savings would outweigh the negative impacts on some consumers and on manufacturers, including the conversion costs that could result in a reduction in INPV. Accordingly, the Secretary has concluded that TSL 1 would offer the maximum improvement in efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy.

Therefore, based on the above considerations, DOE adopts the energy conservation standards for UPSs at TSL 1. The adopted energy conservation standards for UPSs, which are expressed in average load adjusted efficiency, are shown in Table V–29.

TABLE V–29—ENERGY CONSERVATION STANDARDS FOR UPSS

| UPS product class | Rated output power | Minimum efficiency |
|---|---|---|
| Voltage and Frequency Dependent | $0W < P_{rated} \leq 300\ W$ | $-1.20E{-}06 * P_{rated}^2 + 7.17E{-}04 * P_{rated} + 0.862$. |
| | $300\ W < P_{rated} \leq 700\ W$ | $-7.85E{-}08 * P_{rated}^2 + 1.01E{-}04 * P_{rated} + 0.946$. |
| | $P_{rated} > 700\ W$ | $-7.23E{-}09 * P_{rated}^2 + 7.52E{-}06 * P_{rated} + 0.977$. |
| Voltage Independent | $0W < P_{rated} \leq 300\ W$ | $-1.20E{-}06 * P_{rated}^2 + 7.19E{-}04 * P_{rated} + 0.863$. |
| | $300\ W < P_{rated} \leq 700\ W$ | $-7.67E{-}08 * P_{rated}^2 + 1.05E{-}04 * P_{rated} + 0.947$. |
| | $P_{rated} > 700\ W$ | $-4.62E{-}09 * P_{rated}^2 + 8.54E{-}06 * P_{rated} + 0.979$. |
| Voltage and Frequency Independent | $0W < P_{rated} \leq 300\ W$ | $-3.13E{-}06 * P_{rated}^2 + 1.96E{-}03 * P_{rated} + 0.543$. |
| | $300\ W < P_{rated} \leq 700\ W$ | $-2.60E{-}07 * P_{rated}^2 + 3.65E{-}04 * P_{rated} + 0.764$. |
| | $P_{rated} > 700\ W$ | $-1.70E{-}08 * P_{rated}^2 + 3.85E{-}05 * P_{rated} + 0.876$. |

2. Annualized Benefits and Costs of the Adopted Standards

The benefits and costs of the adopted standards can also be expressed in terms of annualized values. The annualized net benefit is (1) the annualized national economic value (expressed in 2015$) of the benefits from operating products that meet the adopted standards (consisting primarily of operating cost savings from using less energy), minus increases in product purchase costs, and (2) the annualized monetary value of the benefits of $CO_2$ and $NO_X$ emission reductions.

Table V–30 shows the annualized values for UPSs under TSL 2, expressed in 2015$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for benefits and costs other than $CO_2$ reductions (for which DOE used a 3-percent discount rate along with the average SC-$CO_2$ series corresponding to a value of $47.4/t in 2020 (2015$)), the estimated cost of the adopted standards for UPSs is $131 million per year in increased equipment costs, while the estimated benefits are $255 million per year in reduced equipment operating costs, $90 million per year in $CO_2$ reductions, and $5.1 million per year in reduced $NO_X$ emissions. In this case, the net benefit would amount to $219 million per year.

Using a 3-percent discount rate for all benefits and costs and the average SC-$CO_2$ series corresponding to a value of $47.4/t in 2020 (2015$), the estimated cost of the adopted standards for UPSs is $140 million per year in increased equipment costs, while the estimated annual benefits are $301 million in reduced operating costs, $90 million in $CO_2$ reductions, and $6.6 million in reduced $NO_X$ emissions. In this case, the net benefit would amount to $257 million per year.

TABLE V–30—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS (TSL 1) FOR UPSS

| | Discount rate | Primary estimate | Low-net-benefits estimate | High-net-benefits estimate |
|---|---|---|---|---|
| | | (million 2015$/year) | | |
| **Benefits** | | | | |
| Consumer Operating Cost Savings | 7% | 255 | 231 | 284. |
| | 3% | 301 | 270 | 341. |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 5% discount rate) ** | 5% | 27 | 24 | 30. |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 3% discount rate) ** | 3% | 90 | 80 | 101. |
| $CO_2$ Reduction (using avg. SC-$CO_2$ at 2.5% discount rate) ** | 2.5% | 131 | 116 | 148. |

[74] The payback period is 0 due to the negative incremental cost at this efficiency level. More expensive and less efficient baseline units continue to exist in the market, likely because some consumers are familiar with their well-established performance. These consumers are reluctant to purchase newer, more efficient products that are just as reliable because they are unfamiliar with them. See section IV.C.3 for more details.

TABLE V–30—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS (TSL 1) FOR UPSS—Continued

| | Discount rate | Primary estimate | Low-net-benefits estimate | High-net-benefits estimate |
|---|---|---|---|---|
| | | (million 2015$/year) | | |
| $CO_2$ Reduction (using 95th percentile SC-$CO_2$ at 3% discount rate) **. | 3% | 273 | 242 | 308. |
| $NO_X$ Reduction † | 7% | 5.1 | 4.6 | 13. |
| | 3% | 6.6 | 5.9 | 17. |
| Total Benefits ‡ | 7% plus $CO_2$ range | 287 to 533 | 260 to 478 | 327 to 606. |
| | 7% | 349 | 316 | 398. |
| | 3% plus $CO_2$ range | 335 to 581 | 300 to 519 | 388 to 666. |
| | 3% | 397 | 356 | 459. |
| **Costs** | | | | |
| Consumer Incremental Product Costs | 7% | 131 | 118 | 145. |
| | 3% | 140 | 124 | 157. |
| **Net Benefits** | | | | |
| Total ‡ | 7% plus $CO_2$ range | 156 to 402 | 142 to 361 | 182 to 460. |
| | 7% | 219 | 198 | 253. |
| | 3% plus $CO_2$ range | 195 to 441 | 176 to 394 | 231 to 509. |
| | 3% | 257 | 231 | 302. |

* This table presents the annualized costs and benefits associated with UPSs shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the UPSs purchased from 2019–2048. The incremental installed costs include incremental equipment cost as well as installation costs. The results account for the incremental variable and fixed costs incurred by manufacturers due to the proposed standards, some of which may be incurred in preparation for the rule. The $CO_2$ reduction benefits are global benefits due to actions that occur nationally. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO 2016* No-CPP case, Low Economic Growth case, and High Economic Growth case, respectively. Shipment projections are also scaled based on the GDP index in the Low and High Economic Growth cases. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

** The $CO_2$ reduction benefits are calculated using four different sets of SC-$CO_2$ values. The first three use the average SC-$CO_2$ calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The fourth represents the 95th percentile of the SC-$CO_2$ distribution calculated using a 3-percent discount rate. The SC-$CO_2$ values are emission year specific. See section IV.L.1 for more details.

† DOE estimated the monetized value of $NO_X$ emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 for further discussion. For the Primary Estimate and Low Net Benefits Estimate, DOE used national benefit-per-ton estimates for $NO_X$ emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). For the High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011); these are nearly two-and-a-half times larger than those from the ACS study.

‡ Total Benefits for both the 3-percent and 7-percent cases are presented using the average SC-$CO_2$ with 3-percent discount rate. In the rows labeled "7% plus $CO_2$ range" and "3% plus $CO_2$ range," the operating cost and $NO_X$ benefits are calculated using the labeled discount rate, and those values are added to the full range of $CO_2$ values.

## VI. Procedural Issues and Regulatory Review

### *A. Review Under Executive Orders 12866 and 13563*

Section 1(b)(1) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that the adopted standards for UPSs are intended to address are as follows:

(1) Insufficient information and the high costs of gathering and analyzing relevant information leads some consumers to miss opportunities to make cost-effective investments in energy efficiency.

(2) In some cases the benefits of more efficient equipment are not realized due to misaligned incentives between purchasers and users. An example of such a case is when the equipment purchase decision is made by a building contractor or building owner who does not pay the energy costs.

(3) There are external benefits resulting from improved energy efficiency of products or equipment that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection and national energy security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming. DOE attempts to qualify some of the external benefits through use of social cost of carbon values.

The Administrator of the Office of Information and Regulatory Affairs (OIRA) in the OMB has determined that the regulatory action in this document is a significant regulatory action under section (3)(f) of Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(B) of the Order, DOE has provided to OIRA: (i) The text of the draft regulatory action, together with a reasonably detailed description of the need for the regulatory action and an explanation of how the regulatory action will meet that need; and (ii) an assessment of the potential costs and benefits of the regulatory action, including an explanation of the manner in which the regulatory action is consistent with a statutory mandate. DOE has included these documents in the rulemaking record.

In addition, the Administrator of OIRA has determined that the regulatory action is an ''economically'' significant regulatory action under section (3)(f)(1) of Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(C) of the Order, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the regulatory action, together with, to the extent feasible, a quantification of those costs; and an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation, and an explanation why the planned regulatory action is preferable to the identified potential alternatives. These assessments can be found in the technical support document for this rulemaking.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011. 76 FR 3281, Jan. 21, 2011. E.O. 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, OIRA has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that this final rule is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs.

*B. Review Under the Regulatory Flexibility Act*

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (FRFA) for any final rule where the agency was first required by law to publish a proposed rule for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (*http://energy.gov/gc/office-general-counsel*). DOE certified in the August 2016 NOPR that the adopted standards will not have a significant economic impact on a substantial number of small entities, and the preparation of an FRFA is not warranted. The factual basis for this certification is discussed in the following section.

For manufacturers of UPSs, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. See 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at *https://www.sba.gov/sites/default/files/files/Size_Standards_Table.pdf.*

UPS manufacturing is classified under NAICS 335999, ''All Other Miscellaneous Electrical Equipment and Component Manufacturing.'' The SBA sets a threshold of 500 employees or less for an entity to be considered as a small business manufacturer of those product classes.

To estimate the number of companies that could be small businesses that manufacture UPSs covered by this rulemaking, DOE conducted a market survey using publicly available information. DOE first attempted to identify all potential UPS manufacturers by researching certification databases (*e.g.,* EPA's ENERGY STAR [75]), retailer websites, individual company websites, and the SBA's database. DOE then attempted to gather information on the location and number of employees to determine if these companies met SBA's definition of a small business for each potential UPS manufacturer by reaching out directly to those potential small businesses and using market research tools (*i.e.,* Hoover's reports), and company profiles on public websites (*i.e.,* Manta, Glassdoor, and Linkedin). DOE also asked stakeholders and industry representatives if they were aware of any small businesses during manufacturer interviews. DOE used information from these sources to create a list of companies that potentially manufacture UPSs and would be impacted by this rulemaking. DOE screened out companies that do not offer products affected by this final rule, do not meet the definition of a ''small business,'' are completely foreign owned and operated, or do not manufacture UPSs in the United States.

DOE initially identified a total of 48 potential companies that sell UPSs in the United States. Of these, DOE estimated that 12 were small businesses in the August 2016 NOPR. After reviewing publicly available information, such as Hoovers [76] and individual company websites for these potential small UPS businesses, DOE determined that none of these companies manufacture UPSs in the United States and therefore are not directly impacted by this rulemaking. All 12 small businesses that sell, but do not manufacturer UPSs in the United States, also sell products outside the scope of this rulemaking. Additionally, DOE estimates that 10 of the 12 small businesses selling UPSs receive the majority of their revenue from products not covered by this rulemaking. Subsequently, DOE does not believe this regulation will put small businesses in the U.S. that purchase UPSs from foreign manufacturers at a competitive disadvantage in the marketplace. These small UPS companies are not responsible for the conversion costs to comply with standards because the companies do not own the manufacturing facilities and tooling used to produce UPSs. DOE believes that these small UPS businesses may be able to pass through the majority of the incremental MPCs of these more

[75] ENERGY STAR. Energy Star Certified Products. Last accessed May 4, 2015. *http://www.energystar.gov/.*

[76] *http://www.hoovers.com/.*

efficient UPSs to their customers. It is also possible that small businesses purchasing compliant UPSs may see an increase in costs as a result of the rule. See section IV.J.2.d for further discussion on the manufacturer markup scenarios modeled for this rulemaking and their impacts on manufacturer profitability.

Schneider commented that compliance with adopted UPS standards would make it difficult for new manufacturers, especially smaller manufacturers, to enter the UPS market (Schneider Electric, No. 0017 at p. 21). The UPS industry, as covered by the scope of this rulemaking, presents barriers to entry for any new market participant, large or small. In addition to the high startup cost of producing cost-competitive UPSs, the large number of existing UPS manufacturers limits opportunities for new market entrants to gain market share. As a result, DOE does not believe that it would be more or less feasible to enter the UPS market, due to this rulemaking.

Based on DOE's determination that there are no domestic small UPS manufacturers, that companies making UPSs sourced from foreign components would not be responsible for the conversion costs, and that companies making UPSs would be able to pass on the potential increases in MPCs associated with adopted UPS standards, DOE previously certified in the August 2016 NOPR that the adopted standards will not have a significant economic impact on a substantial number of small entities. The factual basis for this certification has not changed.

*C. Review Under the Paperwork Reduction Act*

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

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

*D. Review Under the National Environmental Policy Act of 1969*

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. (See 10 CFR part 1021, App. B, B5.1(b); 1021.410(b) and App. B, B(1)–(5).) The rule fits within this category of actions because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this rule. DOE's CX determination for this rule is available at *http://energy.gov/nepa/categorical-exclusion-cx-determinations-cx.*

*E. Review Under Executive Order 13132*

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) Therefore, no further action is required by Executive Order 13132.

*F. Review Under Executive Order 12988*

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

*G. Review Under the Unfunded Mandates Reform Act of 1995*

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

DOE has concluded that this final rule may require expenditures of $100 million or more in any one year by the private sector. Such expenditures may include (1) investment in research and development and in capital expenditures by UPSs manufacturers in the years between the final rule and the compliance date for the new standards and (2) incremental additional expenditures by consumers to purchase higher-efficiency UPSs, starting at the compliance date for the applicable standard.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the final rule. (2 U.S.C. 1532(c)) The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The **SUPPLEMENTARY INFORMATION** section of this document and the TSD for this final rule respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. (2 U.S.C. 1535(a)) DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(m), this final rule establishes new energy conservation standards for UPSs that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified, as required by 42 U.S.C. 6295(o)(2)(A) and 42 U.S.C. 6295(o)(3)(B). A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this final rule.

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

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

*I. Review Under Executive Order 12630*

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

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

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

*K. Review Under Executive Order 13211*

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

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

*L. Review Under the Information Quality Bulletin for Peer Review*

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

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and prepared a report describing that peer review.[77] Generation of this report involved a rigorous, formal, and documented

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

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.

*M. Congressional Notification*

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule prior to its effective date. The report will state that it has been determined that the rule is a ''major rule'' as defined by 5 U.S.C. 804(2).

## VII. Approval of the Office of the Secretary

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

## List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, Reporting and recordkeeping requirements, and Small businesses.

Issued in Washington, DC, on December 28, 2016.

**David J. Friedman,**

*Acting Assistant Secretary, Energy Efficiency and Renewable Energy.*

**Note:** DOE is publishing this document concerning uninterruptible power supplies to comply with an order from the U.S. District Court for the Northern District of California in the consolidated cases of *Natural Resources Defense Council, et al.* v. *Perry and People of the State of California et al.* v. *Perry*, Case No. 17–cv–03404–VC, as affirmed by the U.S. Court of Appeals for the Ninth Circuit in the consolidated cases Nos. 18–15380 and 18–15475. DOE reaffirmed the original signature and date in the Energy Conservation Standards implementation of the court order published elsewhere in this issue of the **Federal Register**. This document is substantively identical to the signed document. DOE had previously posted to its website but has been edited and formatted in conformance with the publication requirements for the **Federal Register** and CFR to ensure the document can be given legal effect.

**Editorial Note:** This document was received for publication by the Office of the Federal Register on December 3, 2019.

For the reasons set forth in the preamble, DOE amends part 430 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

## PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 1. The authority citation for part 430 continues to read as follows:

**Authority:** 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 2. Section 430.32 is amended by adding paragraph (z)(3) to read as follows:

### § 430.32 Energy and water conservation standards and their compliance dates.

* * * * *

(z) * * *

(3) All uninterruptible power supplies (UPS) manufactured on and after January 10, 2022, that utilize a NEMA 1–15P or 5–15P input plug and have an AC output shall have an average load adjusted efficiency that meets or exceeds the values shown in the table in this paragraph (z)(3) based on the rated output power ($P_{rated}$) of the UPS.

| Battery charger product class | Rated output power | Minimum efficiency |
|---|---|---|
| 10a (VFD UPSs) | $0 W < P_{rated} \leq 300 W$ | $-1.20E{-}06 * P^2_{rated} + 7.17E{-}04 * P_{rated} + 0.862$. |
| | $300 W < P_{rated} \leq 700 W$ | $-7.85E{-}08 * P^2_{rated} + 1.01E{-}04 * P_{rated} + 0.946$. |
| | $P_{rated} > 700 W$ | $-7.23E{-}09 * P^2_{rated} + 7.52E{-}06 * P_{rated} + 0.977$. |
| 10b (VI UPSs) | $0 W P_{rated} \leq 300 W$ | $-1.20E{-}06 * P^2_{rated} + 7.19E{-}04 * P_{rated} + 0.863$. |
| | $300 W < P_{rated} \leq 700 W$ | $-7.67E{-}08 * P^2_{rated} + 1.05E{-}04 * P_{rated} + 0.947$. |
| | $P_{rated} \leq 700 W$ | $-4.62E{-}09 * P^2_{rated} + 8.54E{-}06 * P_{rated} + 0.979$. |
| 10c (VFI UPSs) | $0 W < P_{rated} \leq 300 W$ | $-3.13E{-}06 * P^2_{rated} + 1.96E{-}03 * P_{rated} + 0.543$. |
| | $P_{rated} \leq 700 W$ | $-2.60E{-}07 * P_{2rated} + 3.65E{-}04 * P_{rated} + 0.764$. |
| | $P_{rated} \leq 700 W$ | $-1.70E{-}08 * P^2_{rated} + 3.85E{-}05 * P_{rated} + 0.876$. |

* * * * *

**Note:** The following letter will not appear in the Code of Federal Regulations.

U.S. Department of Justice
Antitrust Division

Renata B. Hesse,

Acting Assistant Attorney General.

Main Justice Building, 950 Pennsylvania Avenue NW, Washington, DC 20530–0001, (202) 514–2401/(202) 616–2645 (Fax)

October 13, 2016

Anne Harkavy,

Deputy General Counsel for Litigation, Regulation and Enforcement.

1000 Independence Ave. SW, U.S. Department of Energy, Washington, DC 20585

Re: *Doc. No. EERE–2016–BT–STD–0022*

Dear Deputy General Counsel Harkavy:

I am responding to your August 8, 2016, letter seeking the views of the Attorney General about the potential impact on competition of proposed energy conservation standards for uninterruptible power supplies.

Your request was submitted under Section 325(o)(2)(B)(i)(V) of the Energy Policy and Conservation Act, as amended (ECPA), 42 U.S.C. 6295(o)(2)(B)(i)(V), which requires the Attorney General to make a determination of the impact of any lessening of competition that is likely to result from the imposition of proposed energy conservation standards. The Attorney General's responsibility for responding to requests from other departments about the effect of a program on competition has been delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR 0.40(g).

In conducting its analysis, the Antitrust Division examines whether a proposed standard may lessen competition, for example, by substantially limiting consumer choice or increasing industry concentration. A lessening of competition could result in higher prices to manufacturers and consumers.

We have reviewed the proposed standards contained in the Notice of Proposed Rulemaking (81 FR 52196, Aug. 5, 2016) and the related Technical Support Documents. We also monitored the public meeting held on the proposed standards on September 16, 2016, reviewed supplementary information submitted to the Attorney General by the Department of Energy and public comments submitted in connection with this proceeding, and conducted interviews with industry representatives.

Based on the information currently available, we do not believe that the proposed energy conservation standards for uninterruptible power supplies are likely to have a significant adverse effect on competition. This conclusion is subject to some uncertainty, however, in part because manufacturers of uninterruptible power supplies have indicated that a large number of current products will not be able to immediately comply with the new standards and thus will likely be removed from the market. Nonetheless, we currently have no reason to believe that this will result in any particular manufacturer either exiting the market or gaining or increasing its market power and thereby harming competition.

Sincerely,

Renata B. Hesse,

Acting Assistant Attorney General.

[FR Doc. 2019–26354 Filed 1–9–20; 8:45 am]

**BILLING CODE 6450–01–P**

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## DEPARTMENT OF ENERGY

### 10 CFR Parts 429 and 431

**[Docket Number EERE–2013–BT–STD–0040]**

**RIN 1904–AC83**

## Energy Conservation Program: Energy Conservation Standards for Air Compressors

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

**ACTION:** Final rule.

**SUMMARY:** The Energy Policy and Conservation Act of 1975, as amended (''EPCA''), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment. EPCA also authorizes DOE to establish standards for certain other types of industrial equipment, including air compressors. Such standards must be technologically feasible and economically justified, and must save a significant amount of energy. In this final rule, DOE is adopting new energy conservation standards for air compressors. It has determined that the adopted energy conservation standards for these products would result in significant conservation of energy, and are technologically feasible and economically justified.

**DATES:** The effective date of this rule is March 10, 2020. Compliance with the new standards established for compressors in this final rule is required on and after January 10, 2025.

**ADDRESSES:** The docket for this rulemaking, which includes **Federal Register** notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at *www.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 web page can be found at: *www.regulations.gov/docket?D=EERE-2013-BT-STD-0040.* The docket web page 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 the Appliance and Equipment Standards Program staff at (202) 586–6636 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

**FOR FURTHER INFORMATION CONTACT:** James Raba, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–8654. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Mary Greene, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–1817. Email: *Mary.Greene@hq.doe.gov.*

**SUPPLEMENTARY INFORMATION:**

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