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6450-01-P

DEPARTMENT OF ENERGY

10 CFR Part 430

[Docket Number EERE–2008–BT–STD–0005]

RIN: 1904-AB57

Energy Conservation Program: Energy Conservation Standards for Battery Chargers

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" or in context, "the Act"), 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" or, in context, "the Department") to determine whether Federal energy conservation standards for a particular type of product or equipment would be technologically feasible and economically justified, and would save a significant amount of energy. On March 27, 2012, DOE published a notice of proposed rulemaking ("NOPR") to establish energy conservation standards for battery chargers. Responding to stakeholder comments, DOE updated its analysis and revised its proposed approach, resulting in a supplemental notice of proposed rulemaking ("SNOPR") published on September 1, 2015. After considering all the stakeholder comments responding to the SNOPR, DOE is adopting the

proposed energy conservation standards for battery chargers in this final rule. DOE has determined that these standards will result in the significant conservation of energy and are technologically feasible and economically justified.

DATES: The effective date of this rule is **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. Compliance with the adopted standards established for battery chargers in this final rule is required starting on **[INSERT DATE TWO YEARS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].**

ADDRESSES: The docket, 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, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

A link to the docket web page can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2008-BT-STD-0005. The www.regulations.gov web page will contain instructions on how to access all documents, including public comments, in the docket.

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

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SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Final Rule

Title III, Part B[1] of the Energy Policy and Conservation Act of 1975 ("EPCA" or, in context, "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 document.

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 the 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 (1) a notice of determination that standards for the product do not need to be amended or (2) a notice of proposed rulemaking including new proposed energy conservation standards. (42 U.S.C. 6295(m)(1))

DOE had previously proposed to establish new energy conservation standards for battery chargers in March 2012. See 77 FR 18478 (March 27, 2012). Since the publication of that proposal, the State of California finalized new energy conservation standards for battery chargers sold within that State. See 45Z Cal. Reg. 1663, 1664 (Nov. 9, 2012) (summarizing proposed regulations and their final effective dates). Those new standards were not factored into DOE's analysis supporting its initial battery charger proposal. To assess whether DOE's proposal would

[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).

satisfy the requirements under 42 U.S.C. 6295, DOE revisited its analysis in light of these new California standards. Consequently, DOE proposed new energy conservation standards for battery chargers in September 2015. See 80 FR 80 FR 52850. (September 1, 2015). After evaluating the comments it received, DOE is adopting the energy conservation standards for battery chargers proposed in the SNOPR. These standards will apply to all products listed in Table I-1 and manufactured in, or imported into, the United States starting on **[INSERT DATE TWO YEARS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. This lead-in period, which is consistent with DOE's proposal, is based on information provided by commenters as well as research conducted by DOE with respect to the efforts made by battery charger manufacturers in response to the CEC energy conservation standards -- both of which suggest that a two-year period would be sufficient to enable manufacturers to readily meet the standards adopted in this rule.

Table I-1 Energy Conservation Standards for Battery Chargers (Compliance Starting [INSERT DATE TWO YEARS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER])

Product Class	Product Class Description	Battery Energy	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, UEC = 1.42 kWh/y E_{batt} ≥ 10 Wh, UEC = 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

A. Benefits and Costs to Consumers

Table I-2 presents DOE's evaluation of the economic impacts of the adopted standards on consumers of battery chargers, 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 battery chargers, which is estimated to be between 3.5 and 9.7 years, depending on product class ("PC") (see section IV.F.6).

Table I-2 Impacts of Adopted Energy Conservation Standards on Consumers of Battery Chargers

Product Class	Average LCC Savings (2013$)	Simple Payback Period (years)	Average Lifetime (years)
PC 1 - Low E, Inductive	0.71	1.5	5.0
PC 2 - Low E, Low Voltage	0.07	0.6	4.0
PC 3 - Low E, Medium Voltage	0.08	0.8	4.9
PC 4 - Low E, High Voltage	0.11	1.4	3.7
PC 5 - Medium E, Low Voltage	0.84	2.7	4.0
PC 6 - Medium E, High Voltage	1.89	1.1	9.7
PC 7 - High E	51.06	0.0	3.5

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

[3] The average LCC savings are measured relative to the efficiency distribution in the no-standards case, which depicts the market in the compliance year in the absence of standards (see section IV.F.9). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline model (see section IV.C.1).

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 (2015 to 2047). Using a real discount rate of 9.1 percent, DOE estimates that the INPV for manufacturers of battery chargers in the no-standards case is $79.9 billion in 2013$. Under the adopted standards, DOE expects that manufacturers may lose up to 0.7 percent of this INPV, which is approximately $529 million. Additionally, based on DOE's interviews with the domestic manufacturers of battery chargers, DOE does not expect significant impacts on manufacturing capacity or loss of employment for the industry as a whole to result from the standards for battery chargers.

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

C. National Benefits and Costs[4]

DOE's analyses indicate that the adopted energy conservation standards for battery chargers would save a significant amount of energy. Relative to the case without new standards, the lifetime energy savings for battery chargers purchased in the 30-year period that begins in the anticipated year of compliance with the standards (2018–2047), amount to 0.173 quadrillion British thermal units ("Btu"), or "quads."[5] This represents a savings of 11.2 percent relative to

[4] All monetary values in this section are expressed in 2013 dollars and, where appropriate, are discounted to 2015 unless explicitly stated otherwise. Energy savings in this section refer to the full-fuel-cycle savings (see section IV.H for discussion).

[5] A quad is equal to 10^{15} Btu. 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.

the energy use of these products in the case without adopted standards (referred to as the "no-standards case").

The cumulative net present value ("NPV") of total consumer costs and savings of the standards for battery chargers ranges from $0.6 billion (at a 7-percent discount rate) to $1.2 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 battery chargers purchased in 2018–2047.

In addition, the standards for battery chargers are projected to yield significant environmental benefits. DOE estimates that the standards would result in cumulative greenhouse gas ("GHG") emission reductions (over the same period as for energy savings) of 10.79 million metric tons (Mt)[6] of carbon dioxide (CO_2), 6.58 thousand tons of sulfur dioxide (SO_2), 18.83 thousand tons of nitrogen oxides (NO_X), 43.6 thousand tons of methane (CH_4), 0.136 thousand tons of nitrous oxide (N_2O), and 0.024 tons of mercury (Hg).[7] The cumulative reduction in CO_2 emissions through 2030 amounts to 4.4 Mt, which is equivalent to the emissions resulting from the annual electricity use of approximately 600,000 homes.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the "Social Cost of Carbon" or "SCC") developed by a Federal

[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-standards-case, which reflects key assumptions in the Annual Energy Outlook 2015 (AEO 2015) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2014.

interagency working group.[8] The derivation of the SCC values is discussed in section IV.L. Using discount rates appropriate for each set of SCC values (see Table I-3), DOE estimates that the net present monetary value of the CO_2 emissions reduction (not including CO_2-equivalent emissions of other gases with global warming potential) is between $0.086 billion and $1.121 billion, with a value of $0.370 billion using the central SCC case represented by $40.0/t in 2015. DOE also estimates that the net present monetary value of the NO_X emissions reduction to be $20.84 million at a 7-percent discount rate, and $41.55 million at a 3-percent discount rate.[9]

Table I-3 summarizes the economic benefits and costs expected to result from the adopted standards for battery chargers.

[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. Available at https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf.

[9] DOE estimated the monetized value of NOX 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, 136 S.Ct. 999 (2016) (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. DOE is primarily using a national benefit-per-ton estimate for NOX 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.

Table I-3 Summary of Economic Benefits and Costs of Adopted Energy Conservation Standards for Battery Chargers (TSL 2)*

Category	Present Value Billion 2013$	Discount Rate
Benefits		
Consumer Operating Cost Savings	0.7	7%
	1.4	3%
CO_2 Reduction Monetized Value ($12.2/t case)**	0.1	5%
CO_2 Reduction Monetized Value ($40.0/t case)**	0.4	3%
CO_2 Reduction Monetized Value ($62.3/t case)**	0.6	2.5%
CO_2 Reduction Monetized Value ($117/t case)**	1.1	3%
NO_X Reduction Monetized Value†	0.02	7%
	0.04	3%
Total Benefits††	1.1	7%
	1.8	3%
Costs		
Consumer Incremental Installed Costs	0.1	7%
	0.2	3%
Total Net Benefits		
Including Emissions Reduction Monetized Value††	1.0	7%
	1.6	3%

* This table presents the costs and benefits associated with battery chargers shipped in 2018−2047. These results include benefits to consumers which accrue after 2047 from the products purchased in 2018−2047. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.
** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor. The value for NOx is the average of high and low values found in the literature.
† 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: http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.) See section IV.L.2 for further discussion. DOE is primarily using a 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.
†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.0/t case).

The benefits and costs of the adopted standards for battery chargers sold in 2018-2047 can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from consumer operation of products that meet the new standards (consisting primarily of operating cost savings from using less energy, minus increases in product purchase prices and installation costs, which is another way of representing consumer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[10]

Although combining the values of operating savings and CO_2 emission reductions provides a useful perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, whereas the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of battery chargers shipped in 2018–2047. Because CO_2 emissions have a very long residence time in the atmosphere,[11] the SCC values in future years reflect future CO_2-emissions impacts that continue beyond 2100.

[10] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2015, 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 2015. 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-5. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year, which yields the same present value.

[11] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ (2005), "Correction to 'Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming,'" J. Geophys. Res. 110. pp. D14105.

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 SCC series that has a value of $40.0/t in 2015, the estimated cost of the standards in this rule is $9 million per year in increased equipment costs, while the estimated annual benefits are $68 million per year in reduced equipment operating costs, $20 million in CO_2 reductions, and $1.92 million in reduced NO_X emissions. In this case, the net benefit amounts to $81 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series has a value of $40.5/t in 2015, the estimated cost of the standards is $10 million per year in increased equipment costs, while the estimated annual benefits are $75 million per year in reduced operating costs, $20 million in CO_2 reductions, and $2.25 million in reduced NO_X emissions. In this case, the net benefit amounts to $88 million per year.

Table I-4 Annualized Benefits and Costs of Standards for Battery Chargers (TSL 2)

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Consumer Operating Cost Savings	7%	68	68	69
	3%	75	74	76
CO_2 Reduction Monetized Value ($12.2/t case)**	5%	6	6	6
CO_2 Reduction Monetized Value ($40.0/t case)**	3%	20	20	20
CO_2 Reduction Monetized Value ($62.3/t case)**	2.5%	29	29	29
CO_2 Reduction Monetized Value ($117/t case)**	3%	61	61	61
NO_X Reduction Monetized Value†	7%	1.92	1.92	4.34
	3%	2.25	2.25	5.13
Total Benefits††	7% plus CO_2 range	76 to 131	76 to 131	80 to 134
	7%	90	90	94
	3% plus CO_2 range	82 to 136	82 to 136	83 to 138
	3%	97	97	101
Costs				
Consumer Incremental Product Costs	7%	9	9	6
	3%	10	10	6
Net Benefits				
Total††	7% plus CO_2 range	67 to 122	67 to 121	73 to 128
	7%	81	81	87
	3% plus CO_2 range	74 to 128	73 to 128	81 to 136
	3%	88	87	95

* This table presents the annualized costs and benefits associated with battery chargers shipped in 2018−2047. These results include benefits to consumers which accrue after 2047 from the products purchased in 2018−2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the Annual Energy Outlook for 2015 ("AEO 2015") Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Additionally, the High Benefits Estimates include a price trend on the incremental product costs.

** The CO_2 values represent global monetized values of the SCC, in 2013$ per metric ton (t), in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor. The value for NOx is the average of high and low values found in the literature.
† DOE estimated the monetized value of NOx 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: http://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 a national benefit-per-ton estimate 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 DOE's High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al., 2011), which are nearly two-and-a-half times larger than those from the ACS study.
†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3-percent discount rate ($40.0/t case). 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 document.

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. Generally, battery chargers are power conversion devices that transform input voltage to a suitable voltage for the battery they are powering. A portion of the energy that flows into a battery charger flows out to a battery and, thus, cannot be considered to be consumed by the battery charger.

A. Authority

Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles,[12] a program covering most major household appliances (collectively referred to as "covered products"). Battery chargers are among the products affected by these provisions.

Section 309 of the Energy Independence and Security Act ("EISA 2007") amended EPCA by directing DOE to prescribe, by rule, definitions and test procedures 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 to determine that no energy conservation standard is technologically feasible and economically justified. (42 U.S.C. 6295(u)(1)(E))

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

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

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 procedures as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for battery chargers appear 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 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)-(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 the Energy Independence and Security Act of 2007 ("EISA 2007"), Public Law 110-140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)-(B)) DOE's current test procedures and new standards adopted in this final rule for battery chargers address standby mode and off mode energy use.

Section 135 of the Energy Policy Act of 2005 ("EPACT 2005"), Public Law 109-58 (Aug. 8, 2005), amended sections 321 (42 U.S.C. 6291) and 325 (42 U.S.C. 6295) of EPCA by defining the term "battery charger." That provision also directed DOE to prescribe definitions and test procedures related to the energy consumption of battery chargers and to issue a final rule that determines whether to set energy conservation standards for battery chargers or classes of battery chargers. (42 U.S.C. 6295(u)(1)(A) and (E))

B. Background

1. Current Standards

Currently, there are no Federal energy conservation standards for battery chargers.

2. History of Standards Rulemaking for Battery Chargers

On December 8, 2006, consistent with EPACT 2005, DOE published a final rule that prescribed test procedures for a variety of products. 71 FR 71340, 71365-71375. That rule, which was codified in multiple sections of the CFR, included a definition and test procedures for battery chargers. The test procedures for these products are found in 10 CFR part 430, Subpart B, Appendix Y ("Uniform Test Method for Measuring the Energy Consumption of Battery Chargers").

On December 19, 2007, Congress enacted EISA 2007. Section 309 of EISA 2007 amended section 325(u)(1)(E) of EPCA by directing DOE to issue a final rule that prescribes energy conservation standards for battery chargers or classes of battery chargers or to determine that no energy conservation standard is technologically feasible and economically justified. (42 U.S.C. 6295(u)(1)(E))

EISA 2007 (section 310) also established definitions for active, standby, and off modes, and directed DOE to amend its test procedures for battery chargers to include a means to measure the energy consumed in standby mode and off mode. (42 U.S.C. 6295(gg)(2)(B)(i)) Consequently, DOE published a final rule incorporating standby- and off-mode measurements into the DOE test procedures for battery chargers. 74 FR 13318, 13334-13336 (March 27, 2009). Additionally, DOE amended the test procedures for battery chargers to include an active mode measurement. 76 FR 31750 (June 1, 2011).

DOE initiated its current rulemaking effort for these products by issuing the Energy Conservation Standards Rulemaking Framework Document for Battery Chargers and External Power Supplies (the Framework Document). See http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0005. The Framework Document explained the issues, analyses, and process DOE anticipated using to develop energy conservation standards for those products. DOE also published a notice announcing the availability of the Framework Document, announcing a public meeting to discuss the proposed analytical framework, and inviting written comments concerning the development of standards for battery chargers and external power supplies ("EPSs"). 74 FR 26816 (June 4, 2009). DOE held the Framework Document public meeting on July 16, 2009. Manufacturers, trade associations, environmental advocates, regulators, and other interested parties attended the meeting and submitted comments.

On September 15, 2010, after having considered comments from interested parties, gathered additional information, and performed preliminary analyses for the purpose of developing potential amended energy conservation standards for Class A EPSs and new energy conservation standards for battery chargers and non-Class A EPSs, DOE announced a public meeting and the availability of a preliminary technical support document (“preliminary TSD”). 75 FR 56021. The preliminary TSD is available at:

http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0031. The preliminary TSD discussed the comments DOE received at the framework stage of this rulemaking and described the actions DOE took in response to those comments. That document also described in detail the analytical framework DOE used, and the content and results of DOE's preliminary analyses. *Id*. at 56023-56024. DOE convened the public meeting to discuss and receive comments on: (1) the product classes DOE analyzed, (2) the analytical framework, models, and tools that DOE was using to evaluate potential standards, (3) the results of the preliminary analyses performed by DOE, (4) potential standard levels that DOE might consider, and (5) other issues participants believed were relevant to the rulemaking. *Id*. at 56021 and 56024. DOE also invited written comments on these matters. The public meeting took place on October 13, 2010. Many interested parties participated, twelve of whom submitted written comments during the comment period; two additional parties filed comments following the close of the formal comment period.

After considering all of these comments, DOE published its notice of proposed rulemaking ("NOPR"). 77 FR 18478 (March 27, 2012). DOE also released the NOPR technical support document ("TSD"), which incorporated the analyses DOE conducted and accompanying technical documentation. The TSD included the LCC spreadsheet, the national impact analysis ("NIA") spreadsheet, and the manufacturer impact analysis ("MIA") spreadsheet—all of which are available at: http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0005-0070. In the March 2012 NOPR, DOE proposed establishing energy conservation standards for battery chargers according to the following classes:

Table II-1 NOPR Proposed Energy Conservation Standards for Battery Chargers

Product Class	Product Class Description	Proposed Standard as a Function of Battery Energy (kWh/yr)
1	Low-Energy, Inductive	3.04
2	Low-Energy, Low-Voltage	$0.2095 * (E_{batt}) + 5.87$
3	Low-Energy, Medium-Voltage	For $E_{batt} < 9.74$ Wh, 4.68; For $E_{batt} \geq 9.74$ Wh, $= 0.0933 * (E_{batt}) + 3.77$
4	Low-Energy, High-Voltage	For $E_{batt} < 9.71$ Wh, 9.03; For $E_{batt} \geq 9.71$ Wh, $= 0.2411 * (E_{batt}) + 6.69$
5	Medium-Energy, Low-Voltage	For $E_{batt} < 355.18$ Wh, 20.06; For $E_{batt} \geq 355.18$ Wh, $= 0.0219 * (E_{batt}) + 12.28$
6	Medium-Energy, High-Voltage	For $E_{batt} < 239.48$ Wh, 30.37; For $E_{batt} \geq 239.48$ Wh, $= 0.0495 * (E_{batt}) + 18.51$
7	High-Energy	$0.0502 * (E_{batt}) + 4.53$
8	Low-Voltage DC Input	$0.1140 * (E_{batt}) + 0.42$; For $E_{batt} < 1.17$ Wh, 0.55 kWh/yr
9	High-Voltage DC Input	No Standard.
10a	AC Output, VFD (Voltage and Frequency Dependent)	For Ebatt < 37.2 Wh, 2.54; For Ebatt ≥ 37.2 Wh, $0.0733 * (E_{batt}) – 0.18$
10b	AC Output, VI (Voltage Independent)	For Ebatt < 37.2 Wh, 6.18; For Ebatt ≥ 37.2 Wh, $0.0733 * (E_{batt}) + 3.45$

In the March 2012 NOPR, DOE identified 24 specific issues on which it sought the comments and views of interested parties. *Id*. at 18642–18644. In addition, DOE also specifically requested comments and data that would allow DOE to clarify certain issues and potential solutions to address them. DOE also held a public meeting in Washington, DC, on May 2, 2012, to receive public comments on its proposal. DOE also received many written comments responding to the March 2012 NOPR. All commenters, along with their corresponding abbreviations and organization type, are listed in Table II-2 of this section.

Table II-2 List of NOPR Commenters

Organization	Abbreviation	Organization Type	Comment
Actuant Electric	Actuant Electric	Manufacturer	146
ARRIS Group, Inc.	ARRIS Broadband	Manufacturer	90
Appliance Standards Awareness Project	ASAP	Energy Efficiency Advocates	162

Organization	Abbreviation	Organization Type	Comment
ASAP, ASE, ACEEE, CFA, NEEP, and NEEA	ASAP, et al.	Energy Efficiency Advocates	136
Association of Home Appliance Manufacturers	AHAM	Industry Trade Association	124
Brother International Corporation	Brother International	Manufacturer	111
California Building Industry Association	CBIA	Industry Trade Association	126
California Energy Commission	California Energy Commission	State Entity	117
California Investor-Owned Utilities	CA IOUs	Utilities	138
City of Cambridge, MA	City of Cambridge, MA	Local Government	155
Cobra Electronics Corporation	Cobra Electronics	Manufacturer	130
Consumer Electronics Association	CEA	Industry Trade Association	106
Delta-Q Technologies Corp.	Delta-Q Technologies	Manufacturer	113
Duracell	Duracell	Manufacturer	109
Earthjustice	Earthjustice	Energy Efficiency Advocates	118
ECOVA	ECOVA	Private Entity	97
Energizer	Energizer	Manufacturer	123
Flextronics Power	Flextronics	Manufacturer	145
GE Healthcare	GE Healthcare	Manufacturer	142
Information Technology Industry Council	ITI	Industry Trade Association	131
Korean Agency for Technology and Standards	Republic of Korea	Foreign Government	148
Lester Electrical	Lester	Manufacturer	87, 139
Microsoft Corporation	Microsoft	Manufacturer	110
Motorola Mobility, Inc.	Motorola Mobility	Manufacturer	121
National Electrical Manufacturers Association	NEMA	Industry Trade Association	134
Natural Resources Defense Council	NRDC	Energy Efficiency Advocate	114
Nebraska Energy Office	Nebraska Energy Office	State Government	98
Nintendo of America Inc.	Nintendo of America	Manufacturer	135
Nokia Inc.	Nokia	Manufacturer	132
Northeast Energy Efficiency Partnerships	NEEP	Energy Efficiency Advocate	144, 160

Organization	Abbreviation	Organization Type	Comment
Panasonic Corporation of North America	Panasonic	Manufacturer	120
PG&E	PG&E	Utility	16
PG&E and SDG&E	PG&E and SDG&E	Utilities	163
Philips Electronics	Philips	Manufacturer	128
Power Sources Manufacturers Association	PSMA	Industry Trade Association	147
Power Tool Institute, Inc.	PTI	Industry Trade Association	133
Power Tool Institute, Inc., Association of Home Appliance Manufacturers, Consumer Electronics Association	PTI, AHAM, CEA	Industry Trade Association	161
NOPR Public Meeting Transcript, various parties	Pub. Mtg. Tr.	Public Meeting	104
Representatives of Various State Legislatures	States	State Government	159
Salcomp Plc	Salcomp Plc	Manufacturer	73
Schneider Electric	Schneider Electric	Manufacturer	119
Schumacher Electric	Schumacher Electric	Manufacturer	143
Southern California Edison	SCE	Utility	164
Telecommunications Industry Association	TIA	Industry Trade Association	127
Wahl Clipper Corporation	Wahl Clipper	Manufacturer	153

Of particular interest to commenters was the potential interplay between DOE's proposal and a competing battery charger energy efficiency requirement that had been approved by the California Energy Commission ("the CEC") on January 12, 2012. (The CEC is California's primary energy policy and planning agency.) The CEC standards, which took effect on February 1, 2013,[13] created an overlap between the classes of battery chargers covered by the CEC rule and those classes of battery chargers DOE proposed to regulate in the March 2012 NOPR. Additionally, the standards proposed by DOE differed from the ones issued by the CEC, with

[13] http://www.energy.ca.gov/appliances/battery_chargers/.

some being more stringent and others being less stringent than the CEC standards. To better understand the impact of the CEC standards on the battery charger market in the U.S., DOE published a request for information ("RFI") on March 26, 2013 that sought stakeholder comment on a variety of issues related to the CEC standards. 78 FR 18253.

Table II-3 List of RFI Commenters

Organization	Abbreviation	Organization Type	Comment
AHAM, CEA, PTI, TIA Joint Comments	AHAM, et al.	Industry Trade Association	203
Alliance for Wireless Power	A4WP	Standard Development Organization	196
ASAP, NRDC, ACEEE, CFA, NCLC, NEEA, NPCC Joint Comments	ASAP, NRDC, ACEEE, CFA, NCLC, NEEA, NPCC	Energy Efficiency Advocates	206
Association of Home Appliance Manufacturers	AHAM	Industry Trade Association	202
Brother International Corporation	Brother International	Manufacturer	204
California Energy Commission	California Energy Commission	State Entity	199
California IOUs	CA IOUs	Utilities	197
Consumer Electronics Association	CEA	Industry Trade Association	208
Dual-Lite, a division of Hubbell Lighting	Dual-Lite	Manufacturer	189
Energizer Holdings	Energizer	Manufacturer	213
Garmin International	Garmin	Manufacturer	194
Information Technology Industry Council	ITI	Industry Trade Association	201
Ingersoll Rand (Club Car)	Ingersoll Rand	Manufacturer	195
Jerome Industries, a subsidiary of Astrodyne	Jerome	Manufacturer	191
Mercury Marine	Mercury	Manufacturer	212
National Marine Manufacturers Association	NMMA	Industry Trade Association	190
NEEA and NPCC	NEEA and NPCC	Industry Trade Association	200
P&G (Duracell)	Duracell	Manufacturer	193
Panasonic	Panasonic	Manufacturer	210

Organization	Abbreviation	Organization Type	Comment
Philips	Philips	Manufacturer	198
Power Tool Institute	PTI	Industry Trade Association	207
Schneider Electric	Schneider Electric	Manufacturer	211
Schumacher Electric	Schumacher Electric	Manufacturer	192
Telecommunications Industry Association	TIA	Industry Trade Association	205

Many of these RFI comments reiterated the points that commenters made in response to the NOPR. Additionally, many commenters listed in the table above indicated that there was evidence that the market had accepted the CEC standards and that technology improvements were made to meet the CEC standards at costs aligned with DOE's estimates in the March 2012 NOPR. (See AHAM et al., No. 203 at p. 5) Some manufacturers argued that while some of their units are CEC-compliant, they continue to sell non-compliant units in other parts of the U.S. for various reasons associated with cost. (See Schumacher Electric, No. 192 at p. 2) DOE addressed these comments by updating and revising its analysis in the September 2015 SNOPR by considering, among other things, the impacts attributable to the standards issued by the CEC. Specifically, based on the responses to the RFI, DOE collected additional data on new battery chargers identified in the CEC database as being compliant with the CEC standards. These data supplemented DOE's earlier analysis from the March 2012 NOPR. DOE's analysis and testing of units within the CEC database showed that many battery chargers are CEC-compliant. The teardown and economic analysis incorporating these units also showed that setting standards that approximated the CEC standards were technologically feasible and economically justified for the U.S. as a whole. Therefore, the SNOPR outlined standards that were approximately equivalent, or where justified, more stringent than the CEC standards. The revisions to the analysis, which addressed the comments received from stakeholders in response to DOE's RFI, are explained in the analysis sections below and summarized in Table II-4.

In addition to updating its proposal to account for the impact of the CEC standards, DOE made several other changes in preparing these revised standards – including adjusting its analyses in line with updated information and data. These post-NOPR changes are presented in Table II-4.

Table II-4 Summary of Significant Changes between NOPR and SNOPR

Item	NOPR	Changes for SNOPR
Proposed Standard Levels		
Proposed Standard for PC 1	= 3.04	No Change
Proposed Standard for PC 2	= 0.2095(E_{batt}) + 5.87	0.1440(E_{batt}) + 2.95
Proposed Standard for PC 3	For E_{batt} < 9.74 Wh, = 4.68 For $E_{batt} \geq$ 9.74 Wh, = 0.0933(E_{batt}) + 3.77	For E_{batt} < 10Wh, = 1.42; $E_{batt} \geq$ 10 Wh, 0.0255(E_{batt}) + 1.16
Proposed Standard for PC 4	For E_{batt} < 9.71 Wh, = 9.03 For $E_{batt} \geq$ 9.71 Wh, = 0.2411(E_{batt}) + 6.69	0.11(E_{batt}) + 3.18
Proposed Standard for PC 5	For E_{batt} < 355.18 Wh, = 20.06 For $E_{batt} \geq$ 355.18 Wh, = 0.0219(E_{batt}) + 12.28	For E_{batt} < 19 Wh, 1.32 kWh/yr; For $E_{batt} \geq$ 19 Wh, 0.0257(E_{batt}) + .815
Proposed Standard for PC 6	For E_{batt} < 239.48 Wh, = 30.37 For $E_{batt} \geq$ 239.48 Wh, = 0.0495(E_{batt}) + 18.51	For E_{batt} < 18 Wh, 3.88 kWh/yr; For $E_{batt} \geq$ 18 Wh, 0.0778(E_{batt}) + 2.4
Proposed Standard for PC 7	= 0.0502(E_{batt}) + 4.53	No Change
Proposed Standard for PC 8	= 0.1140(E_{batt})+ 0.42 For Ebatt < 1.17 Wh, = 0.55 kWh/yr	Removed, covered under PC 2 proposed standards
Proposed Standard for PC 9	No Standard	No Change
Proposed Standard for PC 10a	For Ebatt < 37.2 Wh, = 2.54 For Ebatt ≥ 37.2 Wh, = 0.0733(Ebatt) – 0.18	Deferred to Future Rulemaking
Proposed Standard for PC 10b	For Ebatt < 37.2 Wh, = 6.18 For Ebatt ≥ 37.2 Wh, = 0.0733(Ebatt) + 3.45	Deferred to Future Rulemaking
Changes in Analysis		
Engineering Analysis - Representative Units	Combination of test data and manufacturer inputs	Used new or updated units in PC 2, PC 3, PC 4, and PC 5, while keeping the same representative units for PC 1, PC 6, and PC 7 and same Max Tech units for all PCs
Usage Profiles	Weighted average of application specific usage	PC 2, PC 3, PC 4, PC 5, and PC 6 usage profiles updated based on new shipment data (See Section IV.F.3)
Efficiency Distributions	From Market Assessment	Obtained from the CEC's database of Small Battery Chargers

DOE announced that it will investigate the potential benefits and burdens of Federal efficiency standards for Computers and Battery Backup Systems in a Framework Document[14] published on July 11, 2014. DOE had planned to include uninterruptible power supplies ("UPSs") within the scope of coverage of that rulemaking effort and as a result, DOE did not consider these products within the scope of the battery chargers rulemaking. However, since the publication of the SNOPR and Computer and Battery Backup Systems Framework document, DOE, after consideration of stakeholder comments, is now considering including UPSs within the scope of its battery charger regulations. Accordingly, DOE published a Notice of Proposed Test Procedure for Battery Chargers proposing specific testing requirements for UPSs issued April 29, 2016. DOE is not finalizing standards for UPSs at this time, but will continue to conduct rulemaking activities to consider test procedures and energy conservation standards for UPSs as part of ongoing and future battery charger rulemaking proceedings.

Lastly, in the September 2015 SNOPR, DOE identified 10 specific issues on which it sought comments and views of interested parties. *Id*. at 52931–52932. DOE also held a public meeting in Washington, DC, on September 15, 2015, to receive public comments on its revised proposal. DOE also received written comments responding to the September 2015 SNOPR, which are further presented and addressed throughout this document. All commenters, along with their corresponding abbreviations and organization type, are listed in Table II-5 of this Preamble.

[14] http://www.regulations.gov/#!documentDetail;D=EERE-2014-BT-STD-0025-0001

Table II-5 List of SNOPR Commenters

Organization	Abbreviation	Organization Type	Comment
ARRIS Group, Inc. and Cisco Systems, Inc.	ARRIS and Cisco	Manufacturer	250
Association of Home Appliance Manufacturers	AHAM	Standard Development Organization	246
California Energy Commission	CEC	State Agency	241
California Investor Owned Utilities	CA IOUs	Utility Association	251
Delta-Q Technologies Corp.	Delta-Q Technologies	Manufacturer	238
Environmental Defense Fund, Institute for Policy Integrity at NYU School of Law, Natural Resources Defense Council, Union of Concerned Scientists	EDF, Institute for Policy Integrity, NRDC, UCS	Energy Efficiency Advocacy Group	239
Information Technology Industry Council	ITI	Trade Association	248
Ingersoll Rand	Ingersoll Rand	Manufacturer	240
iRobot Corporation	iRobot	Manufacturer	237
National Electrical Manufacturers Association	NEMA	Trade Association	246
Natural Resources Defense Council, Appliance Standards Awareness Project, Northwest Energy Efficiency Alliance	NRDC, ASAP, NEEA	Energy Efficiency Advocate Group	252
Philips Electronics North America Corporation	Philips	Manufacturer	245
People's Republic of China	P. R. China	Foreign Government	254
Power MergerCo, Inc.	Power MergerCo	Standard Development Organization	247
Power Tool Institute, Inc.	PTI	Trade Association	244
Schneider Electric	Schneider	Manufacturer	253
SNOPR Public Meeting Transcript, various parties	Pub. Mtg. Tr.	Public Meeting	234
U.S. Chamber of Commerce, ACC, ACCCI, AF&PA, AFPM, API, BIA, CIBO, NAM, NMA, NOPA, PCA	U.S. Chamber of Commerce, et. al.	Trade Association	242
Wahl Clipper Corporation	Wahl Clipper	Manufacturer	243

After considering and responding to all comments submitted by these stakeholders, DOE is adopting the proposed standards for battery chargers from the SNOPR in this final rule. Table II-6 of this Preamble presents major changes between the SNOPR and the final rule.

Table II-6 Summary of Significant Changes between SNOPR and Final Rule

Item	SNOPR	Changes for Final Rule
Standard for PC 1	= 3.04	No Change
Standard for PC 2	$0.1440(E_{batt}) + 2.95$	No Change
Standard for PC 3	For E_{batt} < 10Wh, = 1.42; $E_{batt} \geq$ 10 Wh, $0.0255(E_{batt}) + 1.16$	No Change
Standard for PC 4	$0.11(E_{batt}) + 3.18$	No Change
Standard for PC 5	For E_{batt} < 19 Wh, 1.32 kWh/yr; For $E_{batt} \geq$ 19 Wh, $0.0257(E_{batt}) + .815$	$0.0257(E_{batt}) + .815$ (Removed Boundary Condition)
Standard for PC 6	For E_{batt} < 18 Wh, 3.88 kWh/yr; For $E_{batt} \geq$ 18 Wh, $0.0778(E_{batt}) + 2.4$	$0.0778(E_{batt}) + 2.4$ (Removed Boundary Condition)
Standard for PC 7	$= 0.0502(E_{batt}) + 4.53$	No Change
Standard for PC 8	Removed, covered under PC 2 proposed standards	No Change
Standard for PC 9	No Standard	No Change
Standard for PC 10a	No Standard	No Change
Standard for PC 10b	No Standard	No Change

III. General Discussion

DOE developed this final rule after considering verbal and written comments, data, and information from interested parties that represent a variety of interests. The following discussion addresses issues raised by these commenters.

A. Test Procedure

Prior to the publication of the SNOPR regarding energy conservation standards for battery chargers, DOE also published a NOPR proposing to clarify certain aspects related to the battery charger test procedure. These revisions include harmonizing with the instrumentation resolution and uncertainty requirements of the second edition of the International Electrotechnical Commission ("IEC") 62301 standard for standby power measurements, updates to the battery selection criteria for multi-voltage, multi-capacity battery chargers to eliminate ambiguity, exclusion of back-up battery chargers from scope, a provision for the conditioning of lead acid batteries prior to testing and updates to the requirements for certification and enforcement testing of battery chargers. DOE has since finalized the proposed revisions and has updated the test procedures for battery chargers in Appendix Y to 10 CFR part 430 subpart B. DOE notes that none of the amendments to the battery charger test procedure will have an impact on the standards adopted in this document and advises stakeholders to review them in Appendix Y to 10 CFR part 430 subpart B.[15]

B. Product Classes and Scope of Coverage

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

[15] DOE notes that its procedures found at 10 CFR 430, subpart C, appendix A provide general procedures, interpretations, and policies to guide DOE in the consideration and promulgation of new or revised efficiency standards under EPCA for consumer products. While these procedures are a general guide to the steps DOE typically follows in promulgating energy conservation standards, appendix A recognizes that DOE can and will, on occasion deviate from the typical process. Accordingly, to the extent that such deviation may occur, such as with the publication timing of the relevant test procedure and standards final rule notices, DOE has concluded that there is no basis to delay the final rule adopting standards for battery chargers.

C. Federal Preemption and Compliance Date

Since the publication of its SNOPR regarding energy conservation standards for battery chargers, DOE has received several stakeholder comments related to Federal preemption of the CEC's standards for battery chargers and the compliance date of any new Federal energy conservation standards that DOE may adopt for these products. First, NRDC argued that DOE's adoption of the SNOPR standards as a final rule will preempt CEC's standard for UPSs, which, in its view, will result in a loss of potential energy savings. NRDC specifically requested either the removal of UPSs from covered products under this rulemaking or the adoption of standards proposed in the NOPR for UPSs. NRDC also requested that any final rule issued by DOE clarify the application of Federal preemption in such a way to ensure that UPSs will remain covered under the CEC standards until DOE sets standards for these devices. (NRDC, Pub. Mtg. Tr., No. 234, p. 22-24) Additionally, NEEA inquired if State standards for battery chargers are preempted at the publication of Federal final rule or when the Federal final rule becomes effective. (NEEA, Pub. Mtg. Tr., No. 234, p. 24-25) ITI submitted comments emphasizing the need for clarity in the scope of both the test procedures and energy conservation standards for battery chargers in terms of Federal preemption. (ITI, No. 248, p. 1) Similarly, iRobot recommended that DOE add clarifying language in this rulemaking stating that all battery chargers will be covered regardless of connectivity or use except where explicitly exempted. In iRobot's view, if a category of battery charger is not covered, preemption would not apply and States could then develop their own efficiency standards. (iRobot, No. 237, p. 1) PTI inquired whether Product Class 9 is still subject to Federal preemption even if DOE is proposing a no-standard standard for it. (PTI, Pub. Mtg. Tr., No. 234, p. 19).

DOE notes that under 42 U.S.C. 6295(ii), the preemption of any State or local energy conservation standard that has already been prescribed or enacted for battery chargers prior to DOE's issuance of energy conservation standards for these products shall not apply until the DOE standards take effect. In DOE's view, the standards for these products do not take effect until the compliance date has been reached. Accordingly, the CEC standards, along with any other State or local standards, including for back-up battery chargers and UPSs, prescribed or enacted before publication of this final rule, will not be preempted until the compliance date of Federal energy conservation standards for battery chargers -- in this case, 2018. (42 U.S.C. 6295(ii)(1)).

DOE also received stakeholder comments on the compliance date of energy conservation standards for battery chargers. AHAM supported a compliance date of two (2) years after the publication of any final rule establishing energy conservation standards for battery chargers provided that the adopted levels do not exceed EL 1 for PC 1, and EL 2 for PCs 2,3, and 4. If DOE adopts anything more stringent than these levels, AHAM requested that a second SNOPR be issued seeking comments on the newly proposed levels and accompanying compliance date. Lastly, in the absence of an opportunity to comment on levels other than EL 2 for PCs 2, 3, 4 and EL 0 or EL 1 for PC 1, AHAM opposed a compliance date lead-time of only two years but offered no alternative and accompanying rationale for DOE to consider. (AHAM, No. 249, p. 4)

DOE has made an effort to consider candidate standards levels for battery chargers that closely approximate the CEC standards and as a result, for PCs 2 through 6, the standards DOE is adopting for these classes are approximately equivalent to the corresponding CEC standards.

DOE's efficiency distribution analysis for the SNOPR also shows that 95 percent of battery chargers sold in the United States already meet the CEC standards. Therefore, for PCs 2 through 6, a vast majority (95 percent) of the battery chargers sold in the United States will already comply with the standards DOE is adopting for these battery charger classes.

For PCs 1 and 7, DOE is adopting standards more stringent than the comparable CEC standards. These more stringent levels were determined to be both technically feasible and economically justified under DOE's detailed analysis. This analysis also indicates that the battery charger industry is characterized by rapid product development lifecycles. These rapid development lifecycles have led DOE to conclude that a two-year lead-time is sufficient to enable manufacturers of battery chargers that do not currently comply with the standards that DOE is adopting in this rule (i.e. PCs 1 and 7 and the remaining 5 percent of battery chargers falling under PCs 2 through 6 that do not meet the current CEC standards) to satisfy these new standards by the time the 2018 compliance date is reached.

D. Technological Feasibility

The following sections address the manner in which DOE assessed the technological feasibility of the new standards adopted in this final rule. Energy conservation standards promulgated by DOE must be technologically feasible.

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. See, e.g. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i) (providing that "technologies incorporated in commercially-available products or in working prototypes will be considered technologically feasible.").

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. See 10 CFR part 430, subpart C, appendix A, section 4(a)(4). 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 ("EL"). Section I.B of this notice discusses the results of the screening analysis for battery chargers, 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 TSD.

Additionally, DOE notes that it has received no comments from interested parties regarding patented technologies and proprietary designs that would inhibit manufacturers from achieving the energy conservation standards contained in its September 2015 supplemental proposal, which this rule adopts. At this time, based on the information analyzed and relied on in support of this rulemaking, DOE believes that the standards adopted in this rule will not require the use of any such technologies.

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 battery chargers by examining a variety of relevant sources of information, including the design parameters used by the most efficient products available on the market, conducting interviews with manufacturers, vetting available manufacturer data with subject matter experts, and obtaining public feedback on DOE's analytical results.

In preparing this final rule, which incorporates into its analysis the max-tech levels for the seven product classes initially addressed in DOE's preliminary analysis, DOE developed a means to create max-tech levels for those classes that were previously not assigned max-tech levels. For the product classes that DOE had previously not generated max-tech efficiency levels, DOE used multiple approaches to develop levels for these classes. During the NOPR phase, DOE solicited manufacturers for information and extrapolated performance parameters from its best-in-market efficiency levels. Extrapolating from the best-in-market performance efficiency levels required an examination of the devices. From this examination, DOE determined which design options could be applied and what effects they would likely have on the various battery charger performance parameters. (See Chapter 5, Section 5.4 of the accompanying final rule TSD.) Table III-1 of this Preamble shows the reduction in energy consumption when increasing efficiency from the no-standards to the max-tech efficiency level.

Table III-1. Reduction in Energy Consumption at Max-Tech for Battery Chargers

Product Class	Max-Tech Unit Energy Consumption (kWh/yr)	Reduction of Energy Consumption Relative to the No-Standards Case (Percentage)
1 (Low-Energy, Inductive)	1.29	85
2 (Low-Energy, Low-Voltage)	1.11	79
3 (Low-Energy, Medium-Voltage)	0.70	80
4 (Low-Energy, High-Voltage)	3.05	75
5 (Medium-Energy, Low-Voltage)	9.45	89
6 (Medium-Energy, High-Voltage)	16.79	86
7 (High-Energy)	131.44	48

Additional discussion of DOE’s max-tech efficiency levels can be found in the discussion of efficiency levels ("ELs") in Section IV.C.4. Specific details regarding which design options were considered for the max-tech efficiency levels (and all other ELs) can be found in Chapter 5, Section 5.4 of the accompanying final rule TSD, which has been developed as a stand-alone document for this final rule and supports all of the standard levels adopted.

E. Energy Savings

1. Determination of Savings

For each trial standard level ("TSL"), DOE projected energy savings from application of the TSL to battery chargers purchased in the 30-year period that begins in the year of compliance with any adopted standards (2018–2047). The savings are measured over the entire lifetime of products purchased in the 30-year analysis period.[16] DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the no-standards case. The no-standards case represents a projection of energy consumption in the absence of new energy conservation standards, and considers market forces and policies that may affect future demand for more efficient products.

DOE used its national impact analysis ("NIA") spreadsheet models to estimate energy savings from potential new standards for battery chargers. The NIA spreadsheet model (described in section I.H of this notice) calculates savings in site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE calculates national energy savings on an annual basis in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. To calculate primary energy savings from site electricity savings, DOE derives annual conversion factors from data provided in the Energy Information Administration's ("EIA") most recent Annual Energy Outlook (AEO).

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

In addition to primary energy savings, DOE also calculates full-fuel-cycle ("FFC") energy savings. As discussed in DOE's statement of policy and notice of policy amendment, 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. 76 FR 51281 (August 18, 2011), as amended at 77 FR 49701 (August 17, 2012). 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, see section IV.H.6.

2. Significance of Savings

To adopt 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.

F. Economic Justification

1. Specific Criteria

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

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential new standard on manufacturers, DOE conducts an 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 (i.e. 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 PBP (i.e. the payback period) associated with new 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 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 the new 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 standards. DOE's LCC and PBP analysis is discussed in further detail in section I.F.

c. Energy Savings

Although the 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 I.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 final rule would not reduce the utility or performance of the products under consideration in this rulemaking. DOE received no comments that these standards would increase battery charger size and reduce their convenience, increase the length of time to charge a product, shorten the intervals between chargers, or cause any other significant adverse impacts on consumer utility.

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 DOE's adoption of a given 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)) DOE followed this requirement after publication of the March 2012 NOPR. DOE transmitted a copy of its proposed rule to the Attorney General with a request that the Department of Justice (DOJ) provide its determination on this issue. DOE also provided DOJ with a copy of its supplemental proposal in September 2015. DOE received no adverse comments from DOJ regarding either proposal.

f. Need for National Energy Conservation

In general, the energy savings from new standards are likely to provide improvements to the security and reliability of the Nation's energy system. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) Consistent with this result, the energy savings from the adopted standards are also 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 M.

Additionally, apart from the savings described above, the adopted standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section I.K; the emissions impacts are reported in section 6 of this notice. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section I.L.

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 interested parties submit 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 new (or amended) energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section V.B.1.c of this final rule.

G. General Comments

During the September 15, 2015, public meeting, and in subsequent written comments responding to the SNOPR, 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

In response to the standard level proposed for product class ("PC") 1, AHAM suggested that DOE update its analysis by further interviewing manufacturers and conducting more testing. AHAM suggested setting a standard at CSL 0. (AHAM, No. 249, p. 4) Philips did not support DOE's proposed standard for PC 1 and asserted that the standard for inductive chargers in PC 1 should be less stringent than for direct connect chargers in PC 2. (Philips, No. 245, p. 2) DOE notes that its analysis is based on the latest available data, which includes manufacturer interviews, testing, and product tear downs. DOE's analysis shows that the standard levels adopted for each product class are economically justified. PC 1 has only two applications, whereas PC 2 has many applications with a variety of usage profiles. The standard for PC 1 that DOE is adopting in this final rule specifically targets the two analyzed applications of PC 1 to capture maximum energy savings while being technically feasible and economically justified for both applications. The standard for PC 2 that DOE is adopting in this final rule covers numerous applications and captures maximum energy savings while being technically feasible and economically justified for all applications, which have varying levels of fixed energy loss. Stakeholders did not provide DOE with any additional data that could be used to update the analysis.

In response to the standard level proposed for PC 2, the CEC, CA IOUs, NRDC, ASAP, and NEEA urged DOE to consider setting a standard at CSL 2 instead of CSL 1, based on the LCC results for PC 2. (CEC, No. 241, p. 2-3; CA IOUs, No. 251, p. 2-4; NRDC, ASAP, NEEA, No. 252, p. 4-6) In contrast, AHAM, PTI, and ITI supported DOE's proposal of CSL 1 for PC 2. (AHAM, No. 249, p. 2-3; PTI, No. 244, p. 2; ITI, No. 248, p. 5)

In response to the standard levels proposed for PCs 4, 5, and 6, Ingersoll Rand supported DOE's proposed standard levels. (Ingersoll Rand, No. 240, p. 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.

With regard to PC 2 specifically, DOE notes that the SNOPR analysis showed that the distribution of impacts at CSL 2 is such that a small proportion of consumers experience a very positive LCC result, skewing the average to appear nearly as favorable as CSL 1, despite significantly more consumers being negatively impacted. Additionally, the application-specific LCC results for PC 2 show that half of all applications analyzed, including the two applications with the largest shipments (smartphones and mobile phones), have negative average LCC results. At CSL 1, no application in PC 2 has a negative average LCC. Finally, in the SNOPR consumer subgroup analysis, DOE identified the small business subgroup as being negatively impacted by a standard set at CSL 2 for PC 2, whereas no subgroup is negatively impacted by a standard set at CSL 1. For these reasons, DOE determined that CSL 2 for PC 2 was not economically justified in the SNOPR. DOE's analysis and determination have not changed for the final rule. Results are discussed further in section V of this document and in Chapter 11 of the final rule TSD.

IV. Methodology and Discussion

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

DOE used several analytical tools to estimate the impact of the standards considered in this document. First, DOE used a spreadsheet that calculates the LCC and PBP of the new energy conservation standards. Second, the NIA uses a second spreadsheet that provides shipments forecasts and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. Third, DOE uses the Government Regulatory Impact Model ("GRIM") to assess manufacturer impacts of potential standards. These three spreadsheet tools are available in the docket for this rulemaking: http://www.regulations.gov/#!docketDetail;D=EERE-2008-BT-STD-0005. Additionally, DOE used output from the latest version of EIA's Annual Energy Outlook ("AEO"), a widely known energy forecast for the United States, for the emissions and utility impact analyses.

A. Market and Technology Assessment

When beginning an energy conservation standards rulemaking, 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 battery chargers. See chapter 3 of the final rule TSD for further discussion of the market and technology assessment.

1. Products Included in this Rulemaking

This section addresses the scope of coverage for this final rule and details which products are subject to the standards adopted in this document. The comments DOE received on the scope of these standards are also summarized and addressed in this section.

A battery charger is a device that charges batteries for consumer products, including battery chargers embedded in other consumer products. (42 U.S.C. 6291(32)) Functionally, a battery charger is a power conversion device used to transform input voltage to a suitable voltage for charging the battery. Battery chargers are used in conjunction with other end-use consumer products, such as cell phones and digital cameras. However, the battery charger definition prescribed by Congress is not limited solely to products that are only powered from AC mains (or "mains") -- i.e. products that plug into a wall outlet. Further, battery chargers may be wholly embedded in another consumer product, wholly separate from another consumer product, or partially inside and partially outside another consumer product. While devices that meet the statutory definition are within the scope of this rulemaking, DOE is not setting standards for all battery chargers. The following subsections summarize and address stakeholder comments received on the SNOPR regarding the scope of this rulemaking.

a. Consumer Products

EPCA defines a consumer product as any article of a type that consumes or is designed to consume energy and which, to any significant extent, is distributed in commerce for personal use or consumption by individuals without regard to whether such article of such type is in fact distributed in commerce for personal use or consumption by an individual. See 42 U.S.C. 6291(1). Manufacturers of battery chargers are advised to use this definition (in conjunction with the battery charger definition) to determine whether a given device is subject to the battery charger standards adopted in this final rule. Consistent with these definitions, any battery charger that is of a type that is capable of charging batteries for a consumer product is considered a covered product and possibly subject to DOE's energy conservation standards, without regard to whether that battery charger was in fact distributed in U.S. commerce to operate a consumer product. Only those battery chargers that have identifiable design characteristics that would make them incapable of charging batteries for a consumer product would be considered to not meet EPCA's definition of a battery charger. DOE considers the inability of a battery charger to operate using residential mains power – Standard 110-120 VAC, 60 Hz input – as an identifiable design characteristic when considering whether a battery charger is not capable of charging the batteries of a consumer product.

DOE received comments on the SNOPR from Delta Q requesting that DOE follow the CEC's lead in setting energy conservation standards for non-consumer and high-power (above 2 kW input power or with higher input voltages) battery chargers. Delta Q also suggested that DOE explicitly specify that the CEC's standards for non-consumer and high-power battery chargers will not be preempted in case DOE decides not to regulate these battery chargers.

(Delta Q, No. 238, p. 2) DOE's authority to establish energy conservation standards for battery chargers comes from Title III, Part B of EPCA, which empowers DOE to establish energy conservation standards for consumer products other than automobiles. As such, DOE does not have the statutory authority to establish energy conservation standards for battery chargers that do not meet the definition prescribed by EPCA. See 42 U.S.C. 6291(1). Furthermore, this final rule does not set, nor does it rely on, minimum or maximum input power restrictions for its scope of covered consumer products. A product that meets the definition of a battery charger as stated in 10 CFR 430.2 (and that charges a product that is consistent with EPCA's consumer product definition) is a covered product under the scope of this rulemaking and subject to Federal preemption in a manner consistent with 42 U.S.C. 6295(ii) and 6297. DOE notes that some of the products that meet these conditions can also be employed in commercial applications and as such, DOE's analysis has taken into consideration the impact of this regulation on commercial entities that are affected by it.

b. Basic Model of Battery Charger

This rule requires manufacturers to certify compliance of the basic models of their battery chargers to the energy conservation standards DOE is adopting. In response to the SNOPR, DOE received comments from AHAM highlighting that the definition of basic model in 10 CFR 430.2 indicates that manufacturers may group into one basic model products having "essentially identical electrical, physical, and functional…characteristics that affect…energy efficiency". AHAM requested DOE to expressly indicate in this rulemaking or in the definition of basic model that in determining whether a product has the same electrical or physical characteristics that affect energy efficiency, the battery charging phase is the relevant phase, not the usage phase. (AHAM. No. 249, p. 7)

DOE believes it is sufficiently unambiguous that a basic model as defined in 10 CFR 430.2 applies solely to the covered product, regardless of whether or not that product is embedded in another end-use product. Since the energy conservation standards set forth in this final rule pertains only to battery chargers, it is the charging components that must meet the criteria of a basic model as defined in 10 CFR 430.2.

c. Wireless Power

Although DOE's May 15, 2014 NODA (79 FR 27774) sought input on wireless charging stations that are specifically designed to operate in dry environments, DOE did not explicitly consider these products when first developing the battery charger test procedures. In the battery charger test procedure NOPR, DOE stated that it planned to address wireless chargers designed for dry environments in a separate rulemaking. See 80 FR 46855 (August 6, 2015). DOE received comments on the SNOPR from ITI and Power MergerCo requesting that DOE promptly issue a determination for wireless charging systems such that, under section 6295(o)(3)(B), establishment of energy conservation standards for wireless charging systems designed to operate in dry environments will not result in significant conservation of energy or that the establishment of such a standard is not technologically feasible or economically justified at this time. (ITI, No. 248, p. 3, Power MergerCo, No. 247, p. 4) Similarly, DOE received comments from iRobot recommending that DOE expressly state that PCs 2 through 7 are specific to galvanic coupled battery chargers. (iRobot, No. 237, p. 1)

DOE reiterates that only battery chargers with inductive connections that are designed to operate in wet conditions are addressed by the standards laid out for PC 1 devices in this final rule. In making this determination, DOE considered the loss of utility and performance likely to result from the promulgation of a standard for a nascent technology such as wireless charging. This approach allows DOE to set standards for the mature technology found in electric toothbrushes while avoiding unintentional restrictions on the development of new inductively-charged products. In response to iRobot's comment, DOE interprets 'Non-galvanic coupled' chargers to be wireless battery chargers. As such, wireless battery chargers that do not meet the scope of PC 1 will not be subject to any other standard adopted in this final rule.

d. USB-Charged Devices

DOE received comments on the SNOPR from ITI claiming there are a number of USB-charged devices peripheral to computers, televisions and other consumer products where the burden of testing and certifying the products exceeds any possible energy efficiency benefits. ITI argued these USB-charged devices are not dependent on AC mains input and will have significant margins when compared to battery chargers covered under the regulation with alternating current/direct current ("AC/DC") power supplies. In its view, regulation of these products at either the federal or state level would not be economically justified. (ITI, No. 248, p. 4)

The peripheral USB-charged devices mentioned by ITI fall both into Product Classes 2 and 8. While PC 8 covers products that require a DC input, these devices can also be operated using an EPS, which reclassifies these products as having an AC input and DC output and essentially also places them into PC 2. As described in the SNOPR, DOE has determined that there are no products falling into PC 8 that do not also fall into PC 2 and that the battery chargers previously analyzed in PC 8 do not technically or functionally differ from those found in PC 2. ITI's claim that these USB-charged devices are not dependent on mains input is true but it does not refute DOE's determination that these devices can be operated using an EPS. Furthermore, DOE's battery charger test procedure requires that all battery chargers be tested using an external power supply, and provides sufficient instructions in section 3.4 (c) of Appendix Y to Subpart B of Part 430 in the event the required external power supply is either not packaged with the battery charger or a suitable one is not recommended by the manufacturer. The test procedure indicates that in such an event, the battery charger shall be tested with either 5.0V DC for products drawing power from a computer USB port or the mid-point of the rated input voltage range for all other products. Hence, the peripheral devices in ITI's comment will be tested using an EPS, which makes them comparable to all other battery chargers using an EPS, and subject to the standard adopted for PC 2. Furthermore, DOE's engineering, manufacturer impact and national impact analyses show that the adopted standard for PC 2 is technologically feasible and economically justified.

e. Spare and Replacement Parts for Battery Chargers

ITI asked that DOE provide a 7-year exemption for spare and replacement parts for battery chargers once the final rule is issued. ITI argued that the requested exemption will allow manufacturer compliance with State parts retention laws and avoid premature disposal of functional equipment already in the marketplace. (ITI, No. 248, p. 4) Congress has not provided any exemptions for spare and replacement parts for battery chargers nor has Congress given DOE the authority to do so as it did with EPSs. See EPS Service Parts Act of 2014, Public Law 113-263 (December 18, 2014) (codified in relevant part at 42 U.S.C. 6295(u)(5)). Furthermore, in the case of battery chargers embedded in end-use products, it is not clear which applications would be involved. Therefore, DOE is unable to provide any exemptions for spare and replacement parts for battery chargers.

f. Medical Products

In the SNOPR, DOE decided to refrain from setting standards for medical devices that require Federal Food and Drug Administration ("FDA") listing and approval as a life-sustaining or life-supporting device in accordance with section 513 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360(c)). While setting standards for these devices may yield energy savings, DOE also wishes to avoid any action that could potentially impact their reliability and safety. In the absence of sufficient data and stakeholder comments on this issue, and consistent with DOE's obligation to consider such adverse impacts when identifying and screening design options for improving the efficiency of a product, DOE is finalizing its decision of refraining from setting standards for medical device battery chargers that require FDA listing and approval as a life-sustaining or life-supporting device at this time.

2. Market Assessment

To characterize the market for battery chargers, DOE gathered information on the products that use them. DOE refers to these products as end-use consumer products or battery charger "applications." This method was chosen for two reasons. First, battery chargers are nearly always bundled with, or otherwise intended to be used with, a given application; therefore, the demand for applications drives the demand for battery chargers. Second, because most battery chargers are not stand-alone products, their shipments, lifetimes, usage profiles, and power requirements are all determined by the associated application.

DOE analyzed the products offered by online and brick-and-mortar retail outlets to determine which applications use battery chargers and which battery charger technologies are most prevalent. The list of applications analyzed and a full explanation of the market assessment methodology can be found in chapter 3 of the accompanying final rule TSD.

While DOE identified the majority of battery charger applications, some may not have been included in the NOPR analysis. This is due in part because the battery chargers market is dynamic and constantly evolving. As a result, some applications that use a battery charger were not initially found because they either made up an insignificant market share or were introduced to the market after the NOPR analysis was conducted. The battery chargers for any other applications not explicitly analyzed in the market assessment would still be subject to the proposed standards as long as they fall into one of the battery charger classes outlined in Table I-1. That is, DOE's omission of any particular battery charger application from its analysis is not, by itself, an indication that the battery charger that powers that application is not subject to the battery chargers standards.

DOE relied on published market research to estimate base-year shipments for all applications. In the NOPR, DOE estimated that in 2009, a total of 437 million battery chargers were shipped for final sale in the United States. For the final rule, DOE conducted additional research and updated its shipments estimates to provide shipments data for 2011. Where more recent data were available, DOE updated the shipments data based on the more recent shipments data collected. Where more recent information could not be found, DOE derived the 2011 shipments value based on the 2009 estimates, and used its shipments model as described in section IV.G.1 to project the 2009 shipments to 2011. In 2011, DOE estimated that a total of 506 million battery chargers units were shipped. The complete shipment analysis can be found in Chapter 9 of the final rule TSD.

3. Product Classes

When necessary, DOE divides covered products into classes by the type of energy used, the capacity of the product, and any other performance-related feature that could justify different standard levels, such as features affecting consumer utility. (42 U.S.C. 6295(q)) DOE then conducts its analysis and considers establishing or amending standards to provide separate standard levels for each product class.

DOE created 11 product classes for battery chargers based on various electrical characteristics shared by particular groups of products. As these electrical characteristics change, so does the utility and efficiency of the devices.

a. Product Class 1

DOE has received stakeholder comments on the SNOPR from PTI, OPEI and iRobot expressing concerns regarding the range of PC 1. PTI, OPEI and iRobot noted that all the products evaluated for the establishment of an energy conservation standard for PC 1 fell in the low range of battery energy (0.5Wh to 1.8Wh); yet, the proposed standard based upon the evaluation of these low battery energy products extends to 100Wh, which, in their view, raised questions regarding the proposed standard. These stakeholders expressed further concern that the proposed standard for PC 1 can potentially undermine the development of new inductively-charged products with battery energies greater than those of electric toothbrushes. (PTI and OPEI, No. 244, p. 3, iRobot, No. 237, p. 2)

PC 1 covers battery chargers with low battery energy and inductive charging capability, which is a utility-related characteristic designed to promote safe and clean operation of a battery charger in a wet environment. In a wet environment, these inductive battery chargers ensure that the user is isolated from AC mains by transferring power to the battery through induction rather than conduction. When developing the energy conservation standard for PC 1, DOE considered two applications -- electric toothbrushes and water jets. DOE believes that the technology deployed in these two applications are sufficiently mature, such that establishing an energy conservation standard for them would not hinder their further technological development. DOE was not able to identify any other battery charger application specifically designed for wet environments. While DOE primarily found devices in these two applications with battery energies ranging from 0.5 to 1.8 Wh, the CEC database of compliant small battery chargers includes electric toothbrushes with battery energies up to 3.84 Wh. An overall analysis of the electric toothbrush marketplace and existing battery technology leads DOE to believe that the battery energy of electric toothbrushes will not exceed 5 Wh. Therefore, DOE agrees with the stakeholder concern that the proposed range for the PC 1 standard may unintentionally undermine the development of new 1:1 inductively-charged products with battery energies greater than those of electric toothbrushes. To mitigate this risk, DOE is limiting the range of PC 1 to less than and equal to 5 Wh. This approach allows DOE to focus its efforts on setting standards for the mature technology already found in electric toothbrushes and water jets without unintentionally imposing restrictions on the development of new inductively-charged products.

b. Product Classes 5 and 6

DOE received comments during the SNOPR public meeting held on September 15, 2015 as well as written comments from the People's Republic of China seeking to clarify the boundary conditions for the proposed standards for PCs 5 and 6. Specifically, the SNOPR proposed boundary conditions at 19Wh and 18Wh (so that a different unit energy consumption ("UEC") equation was used for battery chargers above and below the respected boundary condition) for PCs 5 and 6, respectively, while the product classes themselves only cover products having battery energies greater than 100Wh. (Philips Chloride, Pub. Mtg. Tr., No. 234, p. 12-13; P. R. China, No. 254, p. 3)

DOE generated boundary conditions for its conservation standards to fix the UEC requirement below a certain threshold of battery energy and recognized that below these thresholds the fixed components of the UEC equation, such as maintenance mode power, become an increasingly bigger percentage of the device's overall power consumption that may not diminish with decreasing battery energy. Including these boundary conditions allows DOE to account for the fact that even if the battery energy approaches zero, the device will continue to consume a finite amount of non-zero power. Accordingly, these boundary conditions help create better fitting equations and enable DOE to promulgate standards that more accurately reflect the characteristics of a given product class.

For PCs 5 and 6, the derived boundary conditions begin at 19 Wh and 18 Wh respectively. However, in response to the comments received, DOE recognizes that PCs 5 and 6 cover battery chargers with battery energies ranging from 100 – 3000 Wh and that the boundary conditions at 19 Wh and 18 Wh for these two classes become unnecessary and will never be used. While the presence of these boundary conditions does not affect covered products in PC 5 and 6, DOE realizes that it may lead to misinterpretation and ambiguity. Therefore, DOE is removing these boundary conditions from the final rule.

c. Product Classes 8, 9, 10a, and 10b

Compared to the NOPR, DOE reduced the number of product classes for which it is adopting energy conservation standards in this final rule. Specifically, DOE is not adopting standards for battery chargers falling into PCs 8, 9, 10a, and 10b as initially proposed in its NOPR. DOE chose to reduce the number of affected classes in response to comments on the SNOPR from ITI, Schneider, NRDC, ASAP and NEEA opposing the exclusion of PCs 8, 9 and 10 from the scope of this rulemaking. ITI expressed concern regarding DOE's unknown future plans for regulating products in these classes and about the potential loss of energy savings resulting from the exclusion of PCs 8, 9 and 10. (ITI, No. 248, p. 1) Schneider requested that DOE adopt the energy conservation standards set by the CEC for PCs 10a and 10b, and in particular, a no-standards standard for PC 10b. (Schneider, No. 253, p. 1) Additionally, the CEC, NRDC, ASAP and NEEA requested DOE to explicitly exclude PCs 10a and 10b from the scope of this rulemaking rather than setting a no-standards standard for these product classes. These stakeholders argued that this approach will prevent confusion regarding coverage of PCs 10a and 10b, and avoid potential backsliding on energy savings from standards set by the CEC. (CEC, No. 241, p. 4-5, NRDC, ASAP, NEEA, No, 252, p. 3-4)

DOE notes that products falling into PC 8 from the NOPR are still covered under the scope of this rulemaking and subject to the standards adopted in this rule. DOE has determined that the battery chargers previously analyzed in PC 8 do not technically differ from those found in PC 2 and that there are no products falling into PC 8 that do not also fall into PC 2. For this reason, DOE has combined all previously analyzed products, and related shipments in PC 8 with PC 2. Consequently, what were previously PC 8 devices are now subject only to the energy conservation standard of PC 2.

Regarding the absence of a standard for PC 9, DOE directs the reader to the March 2012 NOPR LCC results where DOE ran a number of analyses in an attempt to ascertain whether an appropriate efficiency level could be created for PC 9. The engineering and LCC analyses found no efficiency level to exhibit positive LCC savings and DOE has not received any evidence since that time suggesting otherwise. This fact, combined with the minimal UECs found for products in this category indicated that setting a standard for PC 9 at this time would not be economically justifiable under the framework set out by EPCA. As such, DOE has determined that the legal requirements necessary for setting standards for PC 9 could not be met. While products falling into this category are still covered under the scope of this rulemaking and are subject to federal preemption, DOE is not promulgating a standard for chargers that would have fallen into PC 9 at this time.

Lastly, DOE has determined that the current battery charger test procedure does not adequately capture the energy consumption of products in PCs 10a and 10b, which include UPSs. DOE has proposed to amend the test procedure for battery chargers to include a specific test for UPSs to capture their energy consumption. Issued April 29, 2016 UPS TP NOPR. DOE will not establish a standard for Product Class 10a and 10b until a test procedure for these products has been prescribed.

DOE received further comments on the SNOPR from Emerson, ITI, NEMA and Schneider requesting DOE to ensure that direct current UPSs are not unintentionally regulated under PC 7 if UPSs are excluded from the scope of this rulemaking. (Emerson, Pub. Mtg. Tr., No. 234, p. 24; ITI, No. 248, p. 4; NEMA, No. 246 p. 2; Schneider, No. 253, p. 1) Direct current ("DC") UPSs meet the definition of uninterruptible power supplies proposed in the battery charger test procedure NOPR, which proposed a specific test for UPSs. Under that proposal, the existing testing requirements for battery chargers would apply to battery chargers other than UPSs, and separate testing requirements would apply to UPSs. Issued April 29, 2016 UPS TP NOPR DOE will not establish standards for UPSs until a test procedure for these products has been prescribed.

4. Technology Assessment

In the technology assessment, DOE identifies technology options that appear to be feasible for improving product efficiency. This assessment provides the technical background and structure on which DOE bases its screening and engineering analyses. The following discussion provides an overview of the technology assessment for battery chargers. Chapter 3 of the final rule TSD provides additional detail and descriptions of the basic construction and operation of battery chargers, followed by a discussion of technology options to improve their efficiency and power consumption in various modes.

a. Battery Charger Modes of Operation and Performance Parameters

DOE found that there are five modes of operation in which a battery charger can operate at any given time -- active (or charge) mode, maintenance mode, no-battery (or standby) mode, off mode, and unplugged mode. During active mode, a battery charger is charging a depleted battery, equalizing its cells, or performing functions necessary for bringing the battery to the fully charged state. In maintenance mode, the battery is plugged into the charger, has reached full charge, and the charger is performing functions intended to keep the battery fully charged while protecting it from overcharge. No-battery mode involves a battery charger plugged into AC mains but without a battery connected to the charger. Off mode is similar to no-battery mode but with all manual on-off switches turned off. Finally, during unplugged mode, the battery charger is disconnected from mains and not consuming any electrical power.[17]

[17] Active mode, maintenance mode, standby mode, and off mode are all explicitly defined by DOE in Appendix Y to Subpart B of Part 430 – Uniform Test Method for Measuring the Energy Consumption of Battery chargers.

For each battery charger mode of operation, DOE's battery charger test procedures have a corresponding test that is performed that outputs a metric for energy consumption in that mode. The tests to obtain these metrics are described in greater detail in DOE's battery charger test procedures. When performing a test in accordance with these procedures, certain items play a key role in evaluating the efficiency performance of a given battery charger – 24-hour energy, maintenance mode power, no-battery mode power, and off-mode power. (10 CFR Part 430 Appendix Y to Subpart B)

First, there is the measured 24-hour energy of a given charger. This quantity is defined as the power consumption integrated with respect to the time of a fully metered charge test that starts with a fully depleted battery. In other words, this is the energy consumed to fully charge and maintain at full charge a depleted battery over a period that lasts 24 hours or the length of time needed to charge the tested battery plus 5 hours, whichever is longer in duration. Next, is maintenance mode power, which is a measurement of the average power consumed while a battery charger is in maintenance mode. No-battery (or standby) mode power is the average power consumed while a battery charger is in no-battery or standby mode (only if applicable).[18] Off-mode power is the average power consumed while an on-off switch-equipped battery charger is in off mode (i.e. with the on-off switch set to the "off" position). Finally, unplugged mode power consists of the average power consumed while the battery charger is not physically connected to a power source. (This quantity is always 0.)

[18] If the product contains integrated power conversion and charging circuitry, but is powered through a non-detachable AC power cord or plug blades, then no part of the system will remain connected to mains, and standby mode measurement is not applicable. (Section 5.11.d "Standby Mode Energy Consumption Measurement, CFR Part 430 Appendix Y to Subpart B).

Additional discussion on how these parameters are derived and subsequently combined with assumptions about usage in each mode of operation to obtain a value for the UEC is discussed below in section IV.C.2.

b. Battery Charger Technology Options

Since most consumer battery chargers contain an AC to DC power conversion stage, similar to that found in an EPS, DOE examined many of the same technology options for battery chargers as it did for EPSs in the EPS final rule. See 79 FR 7845 (Feb. 10, 2014). The technology options used to decrease EPS no-load power can decrease battery charger energy consumption in no-battery and maintenance modes (and off mode, if applicable), while those options used to increase EPS conversion efficiency can decrease battery charger energy consumption in active and maintenance modes.

DOE considered many technology options for improving the active-mode charging efficiency as well as the no-battery and maintenance modes of battery chargers. The following list, organized by charger type, describes technology options that DOE evaluated during the NOPR, the SNOPR and again in this final rule. Although many of these technology options could be used in both fast and slow chargers, doing so may be impractical due to the cost and benefits of each option for the two types of chargers.[19] Therefore, in the list below, the options are grouped with the charger type where they would be most practical.

[19]The distinction between the two types of battery chargers is based on the charge rate (also referred to as C-rate). DOE considers battery chargers with charge rates less than 0.2C to be slow chargers and anything above that rate to be fast chargers. Please refer to Chapter 3 of the accompanying Technical Support Document for further detail.

Slow charger technology options include:

- *Improved Cores*: The efficiency of line-frequency transformers, which are a component of the power conversion circuitry of many slow chargers, can be improved by replacing their cores with ones made of lower-loss steel.

- *Termination*: Substantially decreasing the charge current to the battery after it has reached full charge, either by using a timer or sensor, can significantly decrease maintenance-mode power consumption.

- *Elimination/Limitation of Maintenance Current*: Constant maintenance current is not required to keep a battery fully charged. Instead, the battery charger can provide current pulses to "top off" the battery as needed.

- *Elimination of No-Battery Current*: A mechanical AC line switch inside the battery charger "cup" automatically disconnects the battery charger from the mains supply when the battery is removed from the charger.

- *Switched-Mode Power Supply*: To increase efficiency, line-frequency (or linear) power supplies can be replaced with switched-mode EPSs, which greatly reduce the biggest sources of loss in a line-frequency EPS -- the transformer.

Fast charger technology options include:

- *Low-Power Integrated Circuits*: The efficiency of the battery charger's switched-mode power supply can be further improved by substituting low-power integrated circuit ("IC") controllers for traditional IC controllers.

- *Elimination/Limitation of Maintenance Current*: See above.

- *Schottky Diodes and Synchronous Rectification*: Both line-frequency and switched-mode EPSs use diodes to rectify output voltage. Schottky diodes and synchronous rectification can replace standard diodes to reduce rectification losses, which are increasingly significant at low voltage.

- *Elimination of No-Battery Current*: See above.

- *Phase Control to Limit Input Power*: Even when a typical battery charger is not delivering its maximum output current to the battery, its power conversion circuitry continues to draw significant power. A phase control circuit, like the one present in most common light dimmers, can be added to the primary side of the battery charger power supply circuitry to limit input current in lower-power modes.

An in-depth discussion of these technology options can be found in Chapter 3 of the accompanying final rule TSD.

B. Screening Analysis

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

1. Technological feasibility. DOE considers technologies incorporated in commercial products or in working prototypes to be technologically feasible.

2. Practicability to manufacture, install, and service. If mass production and reliable installation and servicing of a technology in commercially-available consumer products

could be achieved on the scale necessary to serve the relevant market at the time the standard comes into effect, then DOE considers that technology practicable to manufacture, install, and service.

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 DOE determines that a technology will have significant adverse impacts on health or safety, it will not consider this technology further.

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

For battery chargers, after considering the four criteria, DOE screened out:

1. Non-inductive chargers for use in wet environments because of potential adverse impacts on safety;
2. Capacitive reactance because of potential adverse impacts on safety; and
3. Lowering charging current or increasing battery voltage because of potential adverse impacts on product utility to consumers.

For additional details, please see Chapter 4 of the final rule TSD.

C. Engineering Analysis

In the engineering analysis (detailed in Chapter 5 of the final rule TSD), DOE establishes the relationship between the manufacturer selling price ("MSP") and increases in battery charger efficiency. The efficiency values range from that of an inefficient battery charger sold today (i.e., the no-standards case) to the maximum technologically feasible efficiency level. For each efficiency level examined, DOE determines the MSP; this relationship is referred to as a cost-efficiency curve.

DOE structured its engineering analysis around two methodologies: (1) a “test and teardown” approach, which involves testing products for efficiency and determining cost from a detailed bill of materials (“BOM”) derived from tear-downs and (2) the efficiency-level approach, where the cost of achieving increases in energy efficiency at discrete levels of efficiency are estimated using information gathered in manufacturer interviews that was supplemented and verified through technology reviews and subject matter experts (“SMEs”). When analyzing the cost of each EL—whether based on existing or theoretical designs—DOE differentiates the cost of the battery charger from the cost of the associated end-use product.

When developing the engineering analysis for battery chargers, DOE selected representative units for each product class. For each representative unit, DOE tested a number of different products. After examining the test results, DOE selected ELs that set discrete levels of improved battery charger performance in terms of energy consumption. Subsequently, for each EL, DOE used either teardown data or information gained from manufacturer interviews to generate costs corresponding to each EL for each representative unit. Finally, for each product class, DOE developed scaling relationships using additional test results and generated UEC equations based on battery energy.

The following sections discuss the engineering analysis in detail. Submitted comments regarding the various aspects of the analysis are noted in each section.

1. Representative Units

For each product class, DOE selected a representative unit on which it conducted its engineering analysis and developed a cost-efficiency curve. The representative unit is meant to be an idealized battery charger typical of those used with high-volume applications in its product class. Because results from the analysis of these representative units would later be extended, or applied to other units in each respective product class, DOE selected high-volume and/or high-energy-consumption applications that use batteries that are typically found across battery chargers in the given product class. The analysis of these battery chargers is pertinent to all the applications in the product class under the assumption that all battery chargers with the same battery voltage and energy provide similar utility to the user, regardless of the actual end-use product with which they work. Table IV-1 shows the representative units for each product class that DOE analyzed.

Table IV-1 Battery Charger Representative Units for Each Product Class

Product class #	Input / Output Type	Battery Energy (Wh)	Special Characteristic or Battery Voltage	Rep. Unit Battery Voltage (V)	Rep. Unit Battery Energy (Wh)
1	AC In, DC Out	≤10	Inductive Connection	3.6	1.5
2		< 100	< 4 V	2.4	1
3			4–10 V	7.2	10
4			> 10 V	12	20
5		100–3000	< 20 V	12	800
6			≥ 20 V	24	400
7		> 3000	-	48	3,750

During the public meeting for the SNOPR, Dell inquired whether DOE looked at multi-voltage, multi-capacity battery chargers when selecting representative units. (Dell, Pub. Mtg. Tr., No. 234, p. 50-51) DOE confirms that in the course of the engineering analysis, several lithium and nickel multi-voltage, multi-capacity battery chargers were tested, torn down and compared against similar single-voltage units. The recently amended battery charger test procedure prescribes that a multi-voltage charger be tested at its highest output power, which is also its most efficient operating point. Issued May 6, 2016. At this level, DOE could not find any appreciable difference in efficiency between the multi-voltage, multi-capacity units versus single-voltage devices operating at similar output powers and employing similar power conversion and charge termination technology. Additional details on the battery charger representative units can be found in Chapter 5 of the accompanying final rule TSD.

2. Battery Charger Efficiency Metric

In the NOPR and SNOPR regarding energy conservation standards for battery chargers, DOE introduced and used the UEC metric to represent the efficiency of battery chargers. AHAM supported the use of UEC as a single metric to represent the energy consumption of battery chargers, (AHAM, No. 249, p. 4-5), but Ingersoll Rand opposed it. In particular, Ingersoll Rand argued that the usage of battery chargers is highly dependent on the target market for a given product and varies across segments, which makes the determination of product efficiency levels, and possibly even class definitions, unnecessarily difficult. Ingersoll Rand recommended that DOE adopt the metrics used by the CEC, as manufacturers are already familiar with the CEC metrics and it would, in its view, be easier to implement and enforce standards based on those metrics. (Ingersoll Rand, No. 240, p. 2-3)

EPCA requires DOE to regulate standby and off modes in a single metric unless it is technically infeasible to do so. See 42 U.S.C. 6295(gg)(3). Standby mode, as defined by 42 U.S.C. 6295(gg)(3), occurs when the energy-consuming product is connected to the mains and offers user-oriented or protective functions such as facilitating the activation or deactivation of other functions (including active mode) by a remote switch (including remote control), internal sensor, or timer. See 42 U.S.C. 6295(gg)(1)(A)(iii). Maintenance mode, as used in this final rule, meets the statutory definition of standby mode and DOE must incorporate maintenance and off mode into a single metric. The CEC standards for small battery charger systems use two standards for regulation. The first standard collectively regulates the maximum 24-hour charge and maintenance energy and the second standard collectively regulates the maximum maintenance mode and standby mode power. Hence, adopting the CEC approach would be inconsistent with the single metric approach laid out by Congress, as the CEC uses two standards that both separately incorporate maintenance mode.

Further, DOE notes that aggregating the performance parameters of battery chargers into one metric and applying a usage profile will allow manufacturers more flexibility in terms of improving performance during the modes of operation that will be the most beneficial to their consumers rather than being required to improve the performance in each mode of operation, some of which may not provide any appreciable benefit. For example, in certain cases, a power tool battery charger may be in standby mode, also referred to as the no-battery mode in this final rule, for longer periods of time during the day than a battery charger used for a cordless house phone, which is likely to spend a significant portion of every day in maintenance mode. Consequently, in light of these differences, consumers would see greater energy savings if power tool battery charger manufacturers improved standby mode efficiency and home phone battery charger manufacturers improved maintenance mode efficiency. Because the UEC metric is indifferent to how a manufacturer implements changes to improve efficiency, a manufacturer can tailor its battery chargers to better fit the individual conditions that its particular charger is likely to face. For these reasons, DOE is adopting the UEC metric in this final rule to help ensure that manufacturers have sufficient flexibility in improving the energy efficiency performance of their battery chargers.

3. Calculation of Unit Energy Consumption

UEC is based on a calculation designed to give the total annual amount of energy lost by a battery charger from the time spent in each mode of operation. The UEC of a battery charger basic model is calculated using one of the following equations:

Primary Equation:

$$\mathrm{UEC} = 365\left(\mathrm{n}(\mathrm{E}_{24} - 5\mathrm{P}_{\mathrm{m}} - \mathrm{E}_{\mathrm{batt}})\frac{24}{\mathrm{t}_{\mathrm{cd}}} + \left(\mathrm{P}_{\mathrm{m}}(\mathrm{t}_{\mathrm{a\&}m} - (\mathrm{t}_{\mathrm{cd}} - 5)\mathrm{n})\right) + (\mathrm{P}_{\mathrm{sb}}\mathrm{t}_{\mathrm{sb}}) + (\mathrm{P}_{\mathrm{off}}\mathrm{t}_{\mathrm{off}})\right)$$

Secondary Equation:

For some battery chargers, the equation described above is not appropriate and an alternative calculation is necessary. Specifically, in cases where the charge test duration (as determined according to section 5.2 of Appendix Y to Subpart B of Part 430) minus 5 hours multiplied by the number of charges per day (n) is greater than the time assumed in active and maintenance mode ($t_{a\&m}$), an inconsistency is seen between the measurements for the test product and DOE's usage profile assumptions. To avoid this inconsistency, DOE requires that the following secondary equation be used to calculate UEC for such devices at the threshold:

$$\mathrm{UEC} = 365\left(\mathrm{n}(\mathrm{E}_{24} - 5\mathrm{P}_{\mathrm{m}} - \mathrm{E}_{\mathrm{batt}})\frac{24}{(\mathrm{t}_{\mathrm{cd}} - 5)} + (\mathrm{P}_{\mathrm{sb}}\mathrm{t}_{\mathrm{sb}}) + (\mathrm{P}_{\mathrm{off}}\mathrm{t}_{\mathrm{off}})\right)$$

The threshold criteria to determine when to use the secondary equation itself can be summarized as follows:

$$t_{cd} - 5 > \frac{t_{a\&m}}{n}$$

In the battery charger NOPR from 2012, DOE calculated and published the threshold Charge Time ($t_{a\&m}/n$) for each product class. These values were brought forward unchanged from the NOPR to the September 2015 SNOPR. DOE has since revisited these published numbers and discovered calculation and rounding errors in computing the threshold value ($t_{a\&m}/n$). While the final presented values for Threshold Charge Time ($t_{a\&m}/n$) were calculated using unrounded numbers, the values for $t_{a\&m}$ and n were shown in rounded form. This left the reader unable to replicate the final values themselves using the above equation. Therefore, DOE has updated the table to present final values that are properly calculated according to the threshold equation without any rounding errors. For PC 2, there was a typographical error which has also been corrected. The difference between the previously published values and what the values should have been is shown in Table IV-2 below. It is important to note that neither the criteria used nor the values for $t_{a\&m}$ or n has changed. DOE has corrected the tables in this final rule.

Table IV-2 Threshold Charge Times

Product Class	$T_{a\&m}$ (Time spent in Active and Maintenance mode	n (number of full charges per day)	Incorrectly calculated SNOPR Threshold Charge Time (hr)	Correctly calculated Final Rule Threshold Charge Time (hr)
1	20.66	0.15	135.41	137.73
2	7.82	0.54	19.00	14.48
3	6.42	0.1	67.21	64.20
4	16.84	0.5	33.04	33.68
5	6.52	0.11	56.83	59.27
6	17.15	0.34	50.89	50.44
7	8.14	0.32	25.15	25.44

In the battery charger energy conservation standards SNOPR, DOE proposed to add the above mentioned UEC equations and the associated battery charger usage profiles in 10 CFR 430.32(z). See 80 FR 52932. However, as explained in the recent battery charger test procedure final rulemaking, DOE is instead including the above mentioned UEC equations and the associated battery charger usage profiles in the battery charger test procedure codified at appendix Y to subpart B of 10 CFR part 430. Issued May 6, 2016.

4. Battery Charger Efficiency Levels

After selecting its representative units for battery chargers, DOE examined the cost-efficiency relationship of each representative unit to evaluate the viability of potential energy efficiency standards. As described in the technology assessment and screening analysis, there are numerous design options available for improving efficiency and each incremental technology improvement increases the battery charger efficiency along a continuum. The engineering analysis develops cost estimates for several ELs along that continuum.

ELs are often based on (1) efficiencies already available in the market; (2) voluntary specifications or mandatory standards that cause manufacturers to develop products at particular efficiency levels; and (3) the maximum technologically feasible level.[20]

Currently, there are no federal energy conservation standards for battery chargers. Therefore, DOE based the ELs for its battery charger engineering analysis on the efficiencies obtainable through the design options presented previously (see section IV.A). These options are readily seen in various commercially-available units. DOE selected commercially-available battery chargers at the representative-unit battery voltage and energy levels from the high-volume applications identified in the market survey. DOE then tested these units in accordance

[20] The "max-tech" level represents the most efficient design that is commercialized or has been demonstrated in a prototype with materials or technologies available today. "Max-tech" is not constrained by economic justification, and is typically the most expensive design option considered in the engineering analysis.

with the DOE battery charger test procedure. See 71 FR 31750 (June 1, 2011). For each representative unit, DOE then selected ELs to correspond to the efficiency of battery charger models that were comparable to each other in most respects, but differed significantly in UEC (i.e. efficiency).

In general, for each representative unit, DOE chose the no-standards case (EL 0) unit to be the one with the highest calculated unit energy consumption, and the best-in-market (EL 2) to be the one with the lowest. Where possible, the energy consumption of an intermediate model was selected as the basis for EL 1 to provide additional resolution to the analysis.

Unlike the previous three ELs, EL 3 was not based on an evaluation of the efficiency of individual battery charger units in the market, since battery chargers with maximum technologically feasible efficiency levels are not commercially-available due to their high cost. Where possible, DOE analyzed manufacturer estimates of max-tech costs and efficiencies. In some cases, manufacturers were unable to offer any insight into efficiency levels beyond the best ones currently available in the market. Therefore, DOE projected the efficiency of a max-tech unit by estimating the impacts of adding any remaining energy efficiency design options to the EL unit analyzed.

In analyzing potential efficiency levels, DOE examined, among other things, the California standards for small battery chargers,[21] which are based on two metrics -- one for 24-

[21] The term “small battery charger system” is defined by the CEC as a battery charger system “with a rated input power of 2 kW or less, and includes golf car battery charger systems regardless of the output power.” 20 Cal. Code 1602(w) (2014).

hour energy use and one for the combined maintenance mode and standby mode power usage. Using the usage profiles it developed to translate these standards into a UEC value, DOE compared its ELs with the California levels and found that, in most cases, the California standards generally corresponded closely with one of DOE's ELs for each product class when the standards were converted into a UEC value (using DOE's usage profile assumptions). However, once compliance with the CEC standards was required, DOE again analyzed the market and found new technology options that have been widely adopted by battery charger manufacturers to meet the CEC standards. DOE accounted for these results and the changes in technology within the marketplace when developing ELs for each product class. This methodology is outlined in more detail in Chapter 5 of the accompanying TSD.

Table IV-3 below shows which EL aligns most closely with the California standards for each product class.

Table IV-3 ELs Approximate to California Standards

Product Class	EL Approximate to CEC Standard
1 (Low-Energy, Inductive)	EL 0
2 (Low-Energy, Low-Voltage)	EL 1
3 (Low-Energy, Medium-Voltage)	EL 1
4 (Low-Energy, High-Voltage)	EL 1
5 (Medium-Energy, Low-Voltage)	EL 2
6 (Medium-Energy, High-Voltage)	EL 2
7 (High-Energy)	EL 1

With the exception of the max tech level, the ELs presented in the March 2012 NOPR for all product classes were based on commercially-available products and the costs to reach these levels were independently verified by manufacturers and subject matter experts. For the SNOPR and this final rule, DOE attempted to align at least one EL in each product class subject to this final rule as closely as possible to the CEC standards to address comments to the NOPR suggesting that DOE create a new EL that more closely aligns with the CEC levels.

DOE has also received stakeholder comments from PTI and OPEI expressing concern that multi-port battery chargers are not treated any differently than single-port battery chargers under the proposed standard levels, which according to these commenters, creates disincentive for more efficient multi-port battery chargers. PTI and OPEI recommended that DOE provide an allowance of 0.25W per additional port in standby power for multi-port battery chargers. PTI and OPEI further noted that the above requested allowance in standby power for multi-port battery chargers equates to 0.08 kWh/yr increase in the proposed standard levels for PC 4. (PTI and OPEI, No. 244, p. 3) In DOE's engineering analysis, DOE evaluated, tested and performed tear downs on numerous multi-port battery chargers but did not find sufficient reason to treat multi-port battery chargers differently from single-port battery chargers. The adopted standards for these products already accommodate multi-port battery chargers because they scale with the battery energy of the additional batteries that may be charged with multi-port battery chargers. Further, the increase in UEC resulting from the recommended allowance in standby power is minute and will not have a significant impact on the represented value of UEC for multi-port battery chargers. As such, DOE is not adopting the additional allowance suggested by PTI and OPEI.

5. Manufacturer Interviews

The engineering analysis also relies in part on information obtained through interviews with several battery charger manufacturers. These manufacturers consisted of companies that manufacture battery chargers and original equipment manufacturers ("OEMs") of battery-operated products who package (and sometimes design, manufacture, and package) battery chargers with their end-use products. DOE followed this interview approach to obtain data on the possible efficiencies and resultant costs of consumer battery chargers. Aggregated information from these interviews is provided in Chapter 5 of the final rule TSD. The interviews also provided manufacturer inputs and comments in preparing the manufacturer impact analysis, which is discussed in detail in section IV.J.

DOE attempted to obtain teardown results for all of its product classes, but encountered difficulties in obtaining useful and accurate teardown results for one of its products classes -- namely, PC 1 (e.g., electric toothbrushes). For this product class, DOE relied heavily on information obtained from manufacturer interviews. DOE found that when it attempted to teardown PC 1 devices, most contained potting (i.e., material used to waterproof internal electronics). Removal of the potting also removed the identifying markings that IHS Technology (formerly i-Suppli) -- DOE's technical consultant -- needed to estimate a cost for the components. As a result, manufacturer interview data helped furnish the necessary information to assist DOE in estimating these costs.

6. Design Options

Design options are technology options that remain viable for use in the engineering analysis after applying the screening criteria as discussed above in section IV.B. DOE notes that all technology options that are not eliminated in the screening analysis (see section IV.B) become design options that are considered in the engineering analysis. Most ELs, except for those related to max-tech units and chargers falling into product classes for which DOE did not tear down units (i.e. PC 1 and PC 6), are based on actual teardowns of units manufactured and sold in today's battery charger market. Consequently, DOE did not control which design options were used at each EL. No technology options were preemptively eliminated from use with a particular product class. Similarly, if products are being manufactured and sold using these technology options, that fact indicates that the use of these options is unlikely to cause any significant loss in utility, such as an extremely limited operating temperature range or shortened cycle-life. Accordingly, the available facts indicate that all ELs can be met with technologies that are technologically feasible and that fit the intended application. Details on the technology associated with each EL can be found in Chapter 5 of the accompanying final rule TSD.

For the max-tech designs, which are not commercially-available, DOE developed these levels in part with a focus on maintaining product utility as projected energy efficiency improved. Although some features, such as decreased charge time, were considered as added utilities, DOE did not assign any monetary value to such features. Additionally, DOE did not assume that such features were undesirable, particularly if the incremental improvement in performance causes a significant savings in energy costs. Finally, to the extent possible, DOE considered durability, reliability, and other performance and utility-related features that affect consumer behavior. See final rule TSD, Chapter 5 for additional details.

7. Cost Model

This final rule continues to apply the same approach used in the SNOPR, NOPR and preliminary analysis to generate the MSPs for the engineering analysis. For those product classes other than PC 1, DOE's MSPs rely on the teardown results obtained from IHS Technology. The bills of materials provided by IHS Technology were multiplied by a markup based on product class. For those product classes for which DOE could not estimate MSPs using the IHS Technology teardowns -- i.e. PC 1 -- DOE relied on aggregate manufacturer interview data. Additional details regarding the cost model and the markups assumed for each product class are presented in Chapter 5 of the final rule TSD. DOE's cost estimates reflect real world costs and have been updated where necessary for the final rule. The Department did not receive any further stakeholder comments on this aspect of its analysis.

8. Battery Charger Engineering Results

The results of the engineering analysis are reported as cost-efficiency data (or "curves") in the form of MSP (in dollars) versus unit energy consumption (in kWh/yr). These data form the basis for this final rule's analyses and this section illustrates the results that DOE obtained for all seven product classes in its engineering analysis. The Department did not receive any stakeholder comments on this aspect of its analysis.

a. Product Class 1

No changes were made to the engineering results for PC 1 since the publication of the SNOPR. These results are shown below in Table IV-4 More details on these engineering analysis results can be found in Chapter 5 of the final rule TSD.

Table IV-4 Product Class 1 (Inductive Chargers) Engineering Analysis Results

	EL 0	EL 1	EL 2	EL 3
EL Description	Baseline	Intermediate	Best in Market	Max Tech
24-Hour Energy (Wh)	26.7	19.3	10.8	5.9
Maintenance Mode Power (W)	1.2	0.8	0.4	0.2
No-Battery Mode Power (W)	0.5	0.4	0.2	0.1
Off-Mode Power (W)	0.0	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	8.73	6.10	3.04	1.29
MSP [$]	$2.05	$2.30	$2.80	$6.80

b. Product Class 2

No changes were made to the engineering results for PC 2 since the publication of the SNOPR. These results are shown below in Table IV-5. More details on these engineering analysis results can be found in Chapter 5 of the final rule TSD.

Table IV-5 Product Class 2 (Low-Energy, Low-Voltage) Engineering Analysis Results

	EL 0	EL 1	EL 2	EL 3	EL 4
EL Description	Baseline	Intermediate	2^{nd} Intermediate	Best in Market	Max Tech
24-Hour Energy (Wh)	25.79	13.6	8.33	8.94	6.90
Maintenance Mode Power (W)	1.1	0.5	0.13	0.1	0.04
No-Battery Mode Power (W)	0.3	0.3	0.03	0.02	0.10
Off-Mode Power (W)	0.0	0.0	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	5.33	3.09	1.69	1.58	1.11
MSP [$]	$1.16	$1.20	$1.49	$2.43	$4.31

c. Product Class 3

No changes were made to the engineering results for PC 3 since the publication of the SNOPR. These results are shown below in Table IV-6. More details on these engineering analysis results can be found in Chapter 5 of the final rule TSD.

Table IV-6 Product Class 3 (Low-Energy, Medium-Voltage) Engineering Analysis Results

	EL 0	EL 1	EL 2	EL 3
EL Description	Baseline	Intermediate	Best in Market	Max Tech
24-Hour Energy (Wh)	42.60	28.00	17.0	15.9
Maintenance Mode Power (W)	1.70	0.50	0.26	0.26
No-Battery Mode Power (W)	0.30	0.30	0.20	0.20
Off-Mode Power (W)	0.0	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	3.65	1.42	0.74	0.70
MSP [$]	$1.12	$1.20	$4.11	$5.51

d. Product Class 4

No changes were made to the engineering results for PC 4 since the publication of the SNOPR. These results are shown below in Table IV-7. More details on these engineering analysis results can be found in Chapter 5 of the final rule TSD.

Table IV-7 Product Class 4 (Low-Energy, High-Voltage) Engineering Analysis Results

	EL 0	EL 1	EL 2	EL 3
EL Description	Baseline	Intermediate	Best in Market	Max Tech
24-Hour Energy (Wh)	60.75	44.00	29.30	27.2
Maintenance Mode Power (W)	2.40	0.50	0.50	0.4
No-Battery Mode Power (W)	0.30	0.30	0.50	0.3
Off-Mode Power (W)	0.0	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	12.23	5.38	3.63	3.05
MSP [$]	$1.79	$2.60	$5.72	$18.34

e. Product Class 5

No changes were made to the engineering results for PC 5 since the publication of the SNOPR. These results are shown below in Table IV-8. More details on these engineering analysis results can be found in Chapter 5 of the final rule TSD.

Table IV-8 Product Class 5 (Medium-Energy, Low-Voltage) Engineering Analysis Results

	EL 0	EL 1	EL 2	EL 3
EL Description	Baseline	Intermediate	Best in Market	Max Tech
24-Hour Energy (Wh)	2036.9	1647.3	1292.00	1025.64
Maintenance Mode Power (W)	21.2	11.9	0.50	0.0
No-Battery Mode Power (W)	20.1	11.6	0.30	0.0
Off-Mode Power (W)	0.0	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	84.60	56.09	21.39	9.11
Incremental MSP [$]	$18.48	$21.71	$26.81	$127.00

f. Product Class 6

No changes were made to the engineering results for PC 6 since the publication of the SNOPR. These results are shown below in Table IV-9. More details on these engineering analysis results can be found in Chapter 5 of the final rule TSD.

Table IV-9 Product Class 6 (Medium-Energy, High-Voltage) Engineering Analysis Results

	EL 0	EL 1	EL 2	EL 3
EL Description	Baseline	Intermediate	Best in Market	Max Tech
24-Hour Energy (Wh)	891.6	786.1	652.00	466.20
Maintenance Mode Power (W)	10.6	6.0	0.50	0.0
No-Battery Mode Power (W)	10.0	5.8	0.30	0.0
Off-Mode Power (W)	0.0	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	120.60	81.72	33.53	8.15
Incremental MSP [$]	$18.48	$21.71	$26.81	$127.00

g. Product Class 7

For PC 7, DOE's SNOPR contained a typographical error that presented the proposed standard for PC 7 as "0.502 * E_{Batt} + 4.53" rather than "0.0502 * E_{Batt} + 4.53." The SNOPR TSD, along with the earlier NOPR and SNOPR public meeting presentations, all contained the correct standard. DOE's analyses were all based on the correct standard. DOE acknowledges this typographical error and reiterates that the adopted standard for PC 7 is "0.0502 * E_{Batt} + 4.53". The engineering results for PC 7 are shown below in Table IV-10.

Table IV-10 Product Class 7 (High-Energy) Engineering Analysis Results

	EL 0	EL 1	EL 2
EL Description	Baseline	Intermediate	Max Tech
24-Hour Energy (Wh)	5884.2	5311.1	4860.0
Maintenance Mode Power (W)	10.0	3.3	2.6
No-Battery Mode Power (W)	0.0	1.5	0.0
Off-Mode Power (W)	0.0	0.0	0.0
Unit Energy Consumption (kWh/yr)	255.05	191.74	131.44
Incremental MSP [$]	$88.07	$60.86	$164.14

9. Scaling of Battery Charger Efficiency Levels

In preparing its standards for products within a product class (which would address all battery energies and voltages falling within that class), DOE used a UEC-based scaling approach. After developing the engineering analysis results for the representative units, DOE had to determine a methodology for extending the UEC at each EL to all other ratings not directly analyzed for a given product class. In the NOPR, DOE proposed making UEC a function of battery energy. DOE also indicated that it based this proposed UEC function on the test data that had been obtained up through the NOPR. See 77 FR 18478.

For PCs 2-7, DOE created equations for UEC that scale with battery energy. Specifically, as explained in the recent battery charger test procedure final rulemaking, the maximum allowed UEC for PCs 2-7 scales with the rated battery discharge energy, as determined by the statistical requirements outlined in 10 CFR 429.39(a). See Issued May 6,

2016. In contrast, for PC 1, each EL was represented by one flat, nominal standard. For this product class, DOE found in testing that the UEC did not vary with battery energy or voltage. As a result, while DOE opted to maintain its approach from the NOPR to adopt a constant standard across all battery energies for PC 1, the analysis limited the scope of the product class to battery energies of less than or equal to 5 Wh.

DOE generated boundary conditions for its efficiency levels to make the UEC requirement constant below a certain threshold of battery energy. Including these boundary conditions allows DOE to account for the fact that even if the battery energy approaches zero, the battery charger will continue to consume a finite amount of non-zero power. As explained in section IV.A.3.b, DOE notes that PCs 5 and 6 cover battery chargers with battery energies ranging from 100 – 3000 Wh and that the boundary conditions at 19 Wh and 18 Wh for these two PCs become unnecessary and will never be used. While the presence of these boundary conditions does not affect covered products in PCs 5 and 6, DOE realizes that it may lead to misinterpretation and ambiguity. Therefore, DOE is removing these boundary conditions from the final rule.

For additional details and the exact EL equations developed for each product class, please see Chapter 5 in the accompanying final rule TSD.

D. Markups Analysis

The markups analysis develops appropriate markups in the distribution chain to convert the MSP estimates derived in the engineering analysis to consumer prices. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin. Given the variety of products that use battery chargers, distribution varies depending on the product class and application. As such, similar to the approach used in the NOPR, DOE assumed that the dominant path to market establishes the retail price and, thus, the markup for a given application. The markups applied to end-use products that use battery chargers are approximations of the battery charger markups.

In the case of battery chargers, the dominant path to market typically involves an end-use product manufacturer (i.e., an OEM) and retailer. DOE developed OEM and retailer markups by examining annual financial filings, such as Securities and Exchange Commission ("SEC") 10-K reports, from more than 80 publicly-traded OEMs, retailers, and distributors engaged in the manufacturing and/or sales of consumer applications that use battery chargers.

DOE calculated two markups for each product in the markups analysis. A markup applied to the baseline component of a product's cost (referred to as a baseline markup) and a markup applied to the incremental cost increase that would result from energy conservation standards (referred to as an incremental markup). The incremental markup relates the change in the MSP of higher-efficiency models (the incremental cost increase) to the change in the retailer's selling price.

In response to the SNOPR, AHAM objected to DOE's use of incremental markups in its analysis. (AHAM, No. 249, p. 6) DOE recognizes that retailers may seek to preserve margins. However, DOE's approach assumes that appliance retail markets are reasonably competitive, so that an increase in the manufacturing cost of appliances is not likely to contribute to a proportionate rise in retail profits, as would be expected to happen if markups remained constant. DOE's methodology for estimating markups is based on a mix of economic theory, consultation with industry experts, and data from appliance retailers.[22] In conducting research, DOE has found that empirical evidence is lacking with respect to appliance retailer markup practices when a product increases in cost (due to increased efficiency or other factors). DOE understands that real-world retailer markup practices vary depending on market conditions and on the magnitude of the change in cost of goods sold associated with an increase in appliance efficiency. DOE acknowledges that detailed information on actual retail practices would be helpful in evaluating changes in markups on products after appliance standards take effect. For this rulemaking, DOE requested data from stakeholders in support of alternative approaches to markups, as well as any data that shed light on actual practices by retailers; however, no such data were provided. Thus, DOE's analysis continues using an approach that is consistent with the conventionally-accepted economic theory of firm behavior in competitive markets.

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

[22] An extensive discussion of the methodology and justification behind DOE's general approach to markups calculation is presented in Larry Dale, et al., "An Analysis of Price Determination and Markups in the Air-Conditioning and Heating Equipment Industry." LBNL-52791 (2004). Available for download at <http://eetd.lbl.gov/sites/all/files/an_analysis_of_price_determiniation_and_markups_in_the_air_conditioning_and_heating_equipment_industry_lbnl-52791.pdf>

E. Energy Use Analysis

The energy use analysis estimates the range of energy use of battery chargers in the field, i.e., as they are actually used by consumers. The energy use analysis provides the basis for the other analyses DOE uses when assessing the costs and benefits of setting standards for a given product. Particularly dependent on the energy analysis are assessments of the energy savings and the savings in consumer operating costs that could result from the adoption of new standards.

Battery chargers are power conversion devices that transform input voltage to a suitable voltage for the battery they are powering. A portion of the energy that flows into a battery charger flows out to a battery and, thus, cannot be considered to be consumed by the battery charger. However, to provide the necessary output power, other factors contribute to the battery charger energy consumption, e.g., internal losses and overhead circuitry.[23] Therefore, the traditional method for calculating energy consumption -- by measuring the energy a product draws from mains while performing its intended function(s) -- is not appropriate for a battery charger because that method would not factor in the energy delivered by the battery charger to the battery, and would overstate the battery charger's energy consumption. Instead, DOE considered energy consumption to be the energy dissipated by the battery chargers (losses) and not delivered to the battery as a more accurate means to determine the energy consumption of these products. Once the energy and power requirements of those batteries were determined, DOE considered them fixed, and DOE focused its analysis on how standards would affect the energy consumption of the battery chargers themselves.

[23] Internal losses are energy losses that occur during the power conversion process. Overhead circuitry refers to circuits and other components of the battery charger, such as monitoring circuits, logic circuits, and LED indicator lights, that consume power but do not directly contribute power to the end-use application.

Applying a single usage profile to each application, DOE calculated the unit energy consumption for battery chargers. In addition, as a sensitivity analysis, DOE examined the usage profiles of multiple user types for applications where usage varies widely (for example, a light user and a heavy user).

In response to the SNOPR, AHAM noted that as efficiency levels increase, infrequently used products such as shavers, trimmers, and toothbrushes may only be charged once per month or less. (AHAM, No. 249, p. 5) DOE has based its estimate of usage profiles and efficiency distributions on responses from the manufacturer interviews, as well as on best available data, for each application and product class. Based on this information, the usage profiles used in the analysis provide a reasonable average usage approximation of the products falling within each product class and application. As a result, DOE did not change these usage profiles for the final rule.

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

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential battery charger energy conservation standards. 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-standards case, which reflects the estimated efficiency distribution of battery chargers 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 consumers. For each sampled consumer, DOE determined the energy consumption for the battery charger and the appropriate electricity price. By developing a representative sample of consumers, the analysis captured the variability in energy consumption and energy prices associated with the use of battery chargers.

Inputs to the calculation of total installed cost include the cost of the product—which includes MSPs, 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, which incorporates Crystal Ball™ (a commercially-available software program), 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 battery charger user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 consumers per simulation run.

DOE calculated the LCC and PBP for all consumers as if each were to purchase a new product in the expected year of compliance with new standards. Any national standards would apply to battery chargers manufactured two years after the publication of the final standard.

Therefore, for purposes of its analysis, DOE used 2018 as the first year of compliance with new standards.

Table IV-11 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 the inputs made to the LCC and PBP analyses are contained in chapter 8 of the final rule TSD and its appendices.

Table IV-11 Summary of Inputs and Methods for the LCC and PBP Analysis*

Inputs	Source/Method
Product Cost	Derived from the Engineering Analysis through manufacturer interviews and test/teardown results. Adjusted component breakdowns and prices based on updated cost data from IHS Technology and SME feedback for Product Classes 2 through 6.
Markups	Considered various distribution channel pathways for different applications. Applied a reduced "incremental" markup to the portion of the product price exceeding the baseline price.
Sales Tax	Derived weighted-average tax values for each Census division and large State using data provided by the Sales Tax Clearinghouse.
Installation Costs	Assumed to be zero.
Annual Energy Use	Determined for each application based on battery characteristics and usage profiles.
Energy Prices	Price: Based on EIA's 2012 Form EIA-861 data. Separated top tier and peak time-of-use consumers into separate subgroup analyses. Variability: Regional energy prices determined for 13 regions. DOE also considered subgroup analyses using electricity prices for low-income consumers and top tier marginal price consumers.
Energy Price Trends	Based on AEO 2015 price forecasts.
Repair and Maintenance Costs	Assumed to be zero.
Product Lifetime	Determined for each application based on multiple data sources.
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.
Sectors Analyzed	All reference case results represent a weighted average of the residential and commercial sectors.
Base Case Market Efficiency Distribution	Where possible, DOE derived market efficiency distributions for specific applications within a product class.
Compliance Date	2018.

* 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.

The following sections discuss the LCC and PBP analyses in detail. Submitted comments regarding the various aspects of the analyses are noted in each section.

1. Product Cost

a. Manufacturer Selling Price

In the preliminary analysis, DOE used a combination of test and teardown results and manufacturer interview results to develop MSPs. DOE conducted tests and teardowns on a large number of additional units and applications for the NOPR, and incorporated these findings into the MSP. For the SNOPR, DOE adjusted component breakdowns and prices based on updated cost data from IHS Technology (formerly i-Suppli) and SME feedback for Product Classes 2, 3, 4, 5 and 6. DOE adjusted its MSPs based on these changes. DOE retained the SNOPR prices in the final rule. Further detail on the MSPs can be found in chapter 5 of the final rule TSD.

Examination of historical price data 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 "learning" or "experience" curves. On February 22, 2011, DOE published a 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 (such as battery chargers), DOE would consider these data to forecast future trends.

To forecast a price trend for the NOPR, DOE considered the experience curve approach, in which an experience rate parameter is derived using two historical data series on price and cumulative production. But in the absence of historical shipments of battery chargers and sufficient historical Producer Price Index ("PPI") data for small electrical appliance manufacturing from the U.S. Department of Labor's Bureau of Labor Statistics ("BLS"),[24] DOE could not use this approach. This situation is partially due to the nature of battery charger designs. Battery chargers are made up of many electrical components whose size, cost, and performance rapidly change, which leads to relatively short design lifetimes. DOE also considered performing an exponential fit on the deflated AEO's Projected Price Indices that most narrowly include battery chargers. However, DOE believes that these indices are too broad to accurately capture the trend for battery chargers. Furthermore, battery chargers are not typical consumer products; they more closely resemble commodities that OEMs purchase.

Given the uncertainty involved with these products, DOE did not incorporate product price changes into either the NOPR or SNOPR analyses and is not including them in the final rule. For the NIA, DOE also analyzed the sensitivity of results to two alternative battery charger price forecasts. Appendix 10-B of the final rule TSD describes the derivation of alternative price forecasts.

In response to the SNOPR, AHAM supported DOE's use of a constant price index to project future battery charger prices. (AHAM, No. 249, p. 6) No other comments were received.

[24] Series ID PCU33521-33521; http://www.bls.gov/ppi/

b. Markups

DOE applies a series of markups to the MSP to account for the various distribution chain markups applied to the analyzed product. These markups are evaluated for each application individually, depending on its path to market. Additionally, DOE splits its markups into "baseline" and "incremental" markups. The baseline markup is applied to the entire MSP of the baseline product. The incremental markups are then applied to the marginal increase in MSP over the baseline's MSP. Further detail on the markups can be found in chapter 6 of the final rule TSD.

c. Sales Tax

As in the NOPR, DOE obtained State and local sales tax data from the Sales Tax Clearinghouse. The data represented weighted averages that include county and city rates. DOE used the data to compute population-weighted average tax values for each Census division and four large States (New York, California, Texas, and Florida). For the final rule, DOE retained this methodology and used sales tax data from the Sales Tax Clearinghouse.[25] As in the SNOPR, DOE also obtained population estimates from the U.S. Census Bureau for the final rule.[26]

[25] Sales Tax Clearinghouse, Aggregate State Tax Rates. https://thestc.com/STRates.stm.

[26] The U.S. Census Bureau. Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2013. http://www.census.gov/popest/data/state/totals/2013/tables/NST-EST2013-01.xls.

d. Product Price Forecast

As noted in section IV.F.1, to derive its central estimates DOE assumed no change in battery charger prices over the 2018-2047 period. In addition, DOE conducted a sensitivity analysis using two alternative price trends based on AEO price indices. These price trends, and the NPV results from the associated sensitivity cases, are described in appendix 10-B of the final rule TSD.

2. Installation Cost

As detailed in the SNOPR, DOE considered installation costs to be zero for battery chargers because installation would typically entail a consumer simply unpacking the battery charger from the box in which it was sold and connecting the device to mains power and its associated battery. See 80 FR at 52885. Because the cost of this "installation" (which may be considered temporary, as intermittently used devices might be unplugged for storage) is not quantifiable in dollar terms, DOE considered the installation cost to be zero.

3. Annual Energy Consumption

The final rule analysis uses the same approach for determining UECs as the approach used in the SNOPR. The UEC was determined for each application based on battery characteristics and usage profiles. Further detail on the UEC calculations can be found in section IV.E of this notice and in chapter 7 of the final rule TSD.

4. Energy Prices

DOE determined energy prices by deriving regional average prices for 13 geographic areas consisting of the nine U.S. Census divisions, with four large States (New York, Florida, Texas, and California) treated separately. The derivation of prices was based on the then-latest available EIA data (2012). For the final rule analysis, DOE used updated data from EIA's Annual Energy Outlook (AEO) 2015 to project electricity prices to the end of the product lifetime,[27] which contained reference, high- and low-economic-growth scenarios.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance while maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in product efficiency produce no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products. In the final rule analysis, DOE did not include repair or maintenance costs for battery chargers. DOE recognized that in some cases the service life of a stand-alone battery charger typically exceeds that of the consumer product it powers. Furthermore, DOE noted that the cost to repair the battery charger might exceed the initial purchase cost, as these products are relatively low-cost items. Thus, DOE estimated that it would be extremely unlikely that a consumer would incur repair or maintenance costs for a battery charger -- the charger would more likely be discarded and a new one purchased to replace it. Further discussion on repair and maintenance costs can be found in chapter 8 of the final rule TSD.

[27] U.S. Department of Energy. Energy Information Administration. Annual Energy Outlook 2015. May, 2015. Washington, D.C. http://www.eia.gov/forecasts/aeo/.

6. Product Lifetime

For the final rule analysis, DOE considered the lifetime of a battery charger to start from the moment it is purchased for end-use up until the time when it is permanently retired from service. Because the typical battery charger is purchased for use with a single associated application, DOE assumed that it would remain in service for as long as the application does. Even though many of the technology options to improve battery charger efficiencies may result in an increased useful life for the battery charger, the lifetime of the battery charger is still directly tied to the lifetime of its associated application. The typical consumer will not continue to use a battery charger once its application has been discarded. For this reason, DOE used the same lifetime estimate for the baseline and standard level designs of each application for the LCC and PBP analyses. Further detail on product lifetimes and how they relate to applications can be found in chapter 3 of the final rule TSD.

7. Discount Rates

The final rule analysis derived residential discount rates by identifying all possible debt or asset classes that might be used to purchase and operate products, including household assets that might be affected indirectly. DOE estimated the average shares of the various debt and equity classes in the average U.S. household equity and debt portfolios using data from the Survey of Consumer Finances from 1989 to 2010.[28] DOE used the mean share of each class across the seven sample years as a basis for estimating the effective financing rate for products.

[28] The Federal Reserve Board, Survey of Consumer Finances. Available at: http://www.federalreserve.gov/pubs/oss/oss2/scfindex.html

DOE estimated interest or return rates associated with each type of equity using data from the U.S. Federal Reserve[29] and Damodaran. The analysis calculates the risk-free rate using a 40-year average return on 10-year U.S. Treasury notes, as reported by the U.S. Federal Reserve, and the equity risk premium using the geometric average return on the S&P 500 over a 40-year time period. The mean real effective rate across the classes of household debt and equity, weighted by the shares of each class, was 5.2 percent.

For the commercial sector, DOE derived the discount rate from the cost of capital of publicly-traded firms that manufacture products that involve the purchase of battery chargers. To obtain an average discount rate value for the commercial sector, DOE used the share of each industry category in total paid employees provided by BLS,[30] as well as employment data from both the U.S. Office of Personnel Management[31] and the U.S. Census Bureau.[32] By multiplying the discount rate for each industry category by its share of paid employees, DOE derived a commercial discount rate of 5.1 percent.

For further details on discount rates, see chapter 8 and appendix 8D of the final rule TSD.

[29] The Federal Reserve Board, Statistical Releases and Historical Data, Selected Interest Rates (Daily) – H.15. http://www.federalreserve.gov/releases/H15/data.htm.

[30] U.S. Bureau of Labor Statistics. Labor Force Statistics from the Current Population Survey. Table 17 –Employed persons by Industry, Sex, Race, and Occupation. http://www.bls.gov/cps/cpsaat17.pdf.

[31] U.S. Office of Personnel Management. Federal Employment Reports. Historical Federal Workforce Tables. http://www.opm.gov/policy-data-oversight/data-analysis-documentation/federal-employment-reports/historical-tables/total-government-employment-since-1962.

[32] U.S. Census Bureau. Government Employment and Payroll. 2012 State and Local Government. http://www2.census.gov/govs/apes/12stlall.xls.

8. Sectors Analyzed

The final rule analysis included an examination of a weighted average of the residential and commercial sectors as the reference case scenario. Additionally, all application inputs were specified as either residential or commercial sector data. Using these inputs, DOE then sampled each application based on its shipment weighting and used the appropriate residential or commercial inputs based on the sector of the sampled application. This approach provided specificity as to the appropriate input values for each sector, and permitted an examination of the LCC results for a given product class in total. For further details on sectors analyzed, see chapter 8 of the final rule TSD.

9. Efficiency Distribution in the No-Standards Case

For purposes of conducting the LCC analysis, DOE analyzed ELs relative to a no-standards case (i.e., a case without Federal energy conservation standards). This analysis required an estimate of the distribution of product efficiencies in the no-standards case (i.e., what consumers would have purchased in 2018 in the absence of Federal standards). Rather than analyzing the impacts of a particular standard level assuming that all consumers will purchase products at the baseline efficiency level, DOE conducted the analysis by taking into account the breadth of product energy efficiencies that consumers are expected to purchase under the no-standards case.

DOE derived base case market efficiency distributions that were specific to each application where it had sufficient data to do so. This approach helped to ensure that the market distribution for applications with fewer shipments was not disproportionately skewed by the market distribution of the applications with the majority of shipments. DOE factored into its efficiency distributions the current efficiency regulations in California. See section IV.G.3. See chapter 8 of the final rule TSD for further information on the derivation of the efficiency distributions.

10. Compliance Date

The compliance date is the date when a new standard becomes operative, i.e., the date by which battery charger manufacturers must manufacture products that comply with the standard. There are no requirements for the compliance date for battery charger standards, but DOE has chosen to provide a two-year lead-time period for manufacturers to comply with these standards for two reasons. First, manufacturers are already complying with the current CEC standards, which serve as the basis for a majority of the standards being adopted in this rule. As a result, because affected manufacturers are already meeting these levels, that fact suggests that a two-year time frame would be reasonable. Second, this time-frame is consistent with the one that DOE initially proposed to apply for external power supplies, which were previously bundled together with battery chargers as part of DOE's initial efforts to regulate both of these products. DOE calculated the LCCs for all consumers as if each would purchase a new product in the year that manufacturers would be required to meet the new standard (2018). However, DOE bases the cost of the equipment on the most recently available data, with all dollar values expressed in 2013$.

As discussed in Section III.C, DOE received one comment from AHAM regarding the proposed compliance date. AHAM supported a compliance date of two (2) years after the publication of any final rule establishing energy conservation standards for battery chargers provided that the adopted levels do not exceed EL 1 for PC 1, and EL 2 for PCs 2,3, and 4. As discussed in Section III.C, DOE's analysis shows that the battery charger industry is characterized by rapid product development lifecycles. These rapid development lifecycles have led DOE to conclude that a two-year lead-time is sufficient to enable manufacturers of battery chargers that do not currently comply with the standards that DOE is adopting in this rule to satisfy these new standards by the time the 2018 compliance date is reached.

11. 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 from 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 energy price trends and discount rates are not needed; only energy prices for the year the standard becomes required for compliance (2018 in this case) are needed.

As noted above, EPCA 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 forecast for the year in which compliance with the new standards would be required.

G. Shipments Analysis

Projections of product shipments are needed to forecast the impacts that standards are likely to have on the Nation. DOE develops shipment projections based on an analysis of key market drivers for each considered product. In DOE's shipments model, shipments of products were calculated based on current shipments of product applications powered by battery chargers. The inventory model takes an accounting approach, tracking remaining shipments and the vintage of units in the existing stock for each year of the analysis period.

Based on comments received on the Preliminary Analysis, DOE conducted a sensitivity analysis to examine how increases in end-use product prices resulting from standards might affect shipment volumes. To DOE's knowledge, elasticity estimates are not readily available in existing literature for battery chargers, or the end-use consumer products that DOE is analyzing in this rulemaking. Because some applications using battery chargers could be considered more discretionary than major home appliances, which have an estimated relative price elasticity of -

0.34,[33] DOE believed a higher elasticity of demand was possible. In its sensitivity analysis, DOE assumed a price elasticity of demand of -1, meaning a given percentage increase in the final product price would be accompanied by that same percentage decrease in shipments.

Even under this relatively high assumption for price elasticity of demand, DOE's battery charger standards are unlikely to have a significant effect on the shipment volumes of those battery charger applications mentioned by stakeholders, with forecasted effects ranging from a decrease of 0.004 percent for electric shavers to a decrease of 0.1 percent for do-it-yourself ("DIY") power tools with detachable batteries. Results for all battery charger applications are contained in appendix 9A to the final rule TSD. The corresponding impacts on national energy savings ("NES") and NPV are included in appendix 10A. The following sections discuss the shipments analysis in detail. Submitted comments regarding the various aspects of the analysis are noted in each section.

1. Shipment Growth Rate

As in the SNOPR, DOE based its shipments projections such that the per-capita consumption of battery chargers will remain steady over time, and that the overall number of individual units that use battery chargers will grow at the same rate as the U.S. population.

The final rule analysis estimated future market size while assuming no change in the per-capita battery charger purchase rate by using the projected population growth rate as the

[33] Dale, L. and S. Fujita. (2008) "An Analysis of the Price Elasticity of Demand for Household Appliances". Lawrence Berkeley National Laboratory: Berkeley, CA. Report No. LBNL-326E. Available at: https://ees.lbl.gov/publications/analysis-price-elasticity-demand

compound annual market growth rate. Population growth rate values were obtained from the U.S. Census Bureau 2012 National Projections. DOE took the average annual population growth rate, 0.62 percent, and applied this rate to all battery charger product classes. In its shipment forecasts, DOE projects that by 2018, shipments of battery chargers will be 4.4% percent greater than they were in 2011. For more information on shipment projections, see chapter 9 of the final rule TSD.

In response to the SNOPR, NRDC, ASAP, and NEEA commented that DOE's shipments projections based on population growth are unrealistically low, and that DOE should reconsider its approach and assumptions. (NRDC, ASAP, NEEA, No. 252, p. 6-7) DOE disagrees that its shipment projections are unrealistic. While some applications that use battery chargers are experiencing higher than average growth, the product classes are very broad and include many applications that are not experiencing the same level of growth or are declining. To avoid overstating the benefits of standards on battery chargers, DOE retained the more measured approach used in the SNOPR for the final rule.

2. Product Class Lifetime

For the final rule, DOE calculated product class lifetime profiles using the percentage of shipments of applications within a given product class, and the lifetimes of those applications. These values were combined to estimate the percentage of units of a given vintage remaining in use in each year following the initial year in which those units were shipped and placed in service.

For more information on the calculation of product class lifetime profiles, see chapter 10 of the final rule TSD.

3. Forecasted Efficiency in the No-Standards Case and Standards Cases

A key component of the NIA is the trend in energy efficiency forecasted for the no-standards case (without new standards) and each of the standards cases. To project the trend in efficiency over the entire forecast period, DOE considered recent standards, voluntary programs such as ENERGY STAR, and other trends.

For battery charger efficiency trends, DOE considered three key factors: European standards, the EPA's ENERGY STAR program, and the battery charger standards that took effect on February 1, 2013, in California.

The EU included battery chargers in a preparatory study on eco-design requirements that it published in January 2007.[34] However, it has still not yet announced plans to regulate battery chargers. Thus, DOE did not adjust the efficiency distributions that it calculated for battery chargers between the present-day and the compliance date in 2018 to account for European standards.

DOE examined the ENERGY STAR voluntary program for battery charging systems and found that as of October 19, 2012, less than 350 battery charging systems had been qualified as

[34] Available here: http://www.eceee.org/ecodesign/products/battery_chargers/Final_Report_Lot7

ENERGY STAR-rated products.[35] DOE recognizes that unforeseen new or revised energy efficiency specifications are a possibility and that these factors would impact the distribution of efficiency in the market. It is also possible that DOE's battery charger standards could cause other organizations to tighten their efficiency specifications as well. However, EPA's ENERGY STAR program for battery chargers ended on December 30, 2014, and the ENERGY STAR label is no longer available for this product category.[36] Thus, DOE did not adjust its battery charger efficiency distributions to account for any potential market effects of a future ENERGY STAR program.

DOE estimated the no-standards case efficiency distributions for the base year 2013 in the original battery charger March 2012 NOPR and updated the distributions based on new market conditions for the base year 2018 in the September 2015 SNOPR. The SNOPR efficiency distribution remains unchanged for this final rule.

The CEC battery charger standards that took effect in 2013, affect most, if not all, of the battery chargers within the scope of DOE's rulemaking. In the SNOPR analysis, DOE assumed that the CEC standards, effective since February 1, 2013, had moved the market not just in California, but nationally as well. To reach this conclusion, DOE solicited stakeholder comments through a Request for Information published on March 26, 2013, conducted additional manufacturer interviews, and performed its own examination of the efficiency of products sold nationally. See 78 FR 18253. In response to the RFI, many commenters indicated that there was

[35] EPA, "Qualified Product (QP) List for ENERGY STAR Qualified Battery Charging Systems." Retrieved on October 18, 2012 from http://downloads.energystar.gov/bi/qplist/Battery_Charging_Systems_Product_List.xls?5728-8a42.

[36] https://www.energystar.gov/sites/default/files/specs//BCS%20Final%20Decision%20Sunset%20Memo.pdf

evidence that the market had accepted the CEC standards and that technology improvements were already being incorporated to meet the CEC standards. DOE found products available for sale in physical locations outside of California and available for sale online that met CEC standards, each of which also displayed the accompanying CEC mark. Finally, additional manufacturer interviews supported the view that the majority of products sold in California (and thus meeting CEC standards) were sold nationally as well.

Therefore, DOE re-developed its efficiency distribution analysis, and based it on the CEC database[37] of certified small battery chargers (downloaded in November 2014 and containing 12652 unique models). Each model was assigned an appropriate product class and application based on its battery characteristics. Application-specific efficiency distributions were then developed using the reported energy performance for each model in that application. If an application had less than 20 identified models, it was assigned the efficiency distribution of the overall product class. Due to slight variations between the CEC and DOE metrics, products were conservatively assigned to the higher efficiency level (EL) (in order to not overstate savings) when their UECs were within 5% of the next highest EL compliance line compared to the distance between the compliance lines of the higher and lower ELs.

DOE's analysis acknowledges, however, that units not complying with CEC standards can still be sold outside of California, but assumes the percentage of such units is small. For this analysis, DOE conservatively assumed 5% of units sold nationally do not meet CEC standards. Without this assumption, DOE's analysis would likely significantly overestimate the energy

[37] http://www.appliances.energy.ca.gov/AdvancedSearch.aspx

savings resulting from the adoption of energy conservation standards for battery chargers by not sufficiently accounting for the fraction of the market that is already utilizing more efficient technology. This assumption is further motivated by manufacturers' input that the majority of products sold in California are sold nationally as well. To implement this assumption, each application's efficiency distribution, derived from CEC data, was multiplied by 95%, and then 5% was added to the EL below the CEC approximate EL. These became the no-standards case efficiency distributions shown in the table below. DOE did not find or receive any data showing consistent long-term efficiency improvement trends for battery chargers, in the absence of regulatory actions. As a result, no further changes in the base-case efficiency distributions were assumed to occur after the first year of the analysis. For reference, Table IV-12 below also lists the tested UECs defining each EL from the final rule engineering analysis and the estimated shipments in 2018 from the final rule shipments analysis.

Table IV-12 No-Standards Case Final Rule Efficiency Distributions in 2018

No-Standards Case Efficiency Distributions in 2018							Estimated Shipments in 2018
Product Class		EL 0	EL 1	EL 2	EL 3	EL 4	
1	Efficiency Distribution	7%	56%	33%	4%	N/A	15,772,035
	UEC	8.73	6.1	3.04	1.29	N/A	
2	Efficiency Distribution	9%	42%	9%	15%	25%	400,052,285
	UEC	5.33	3.09	1.69	1.58	1.11	
3	Efficiency Distribution	6%	35%	2%	58%	N/A	27,088,679
	UEC	3.65	1.42	0.74	0.7	N/A	
4	Efficiency Distribution	6%	8%	12%	74%	N/A	80,146,173
	UEC	12.23	5.38	3.63	3.05	N/A	
5	Efficiency Distribution	0%	5%	95%	0%	N/A	4,717,743
	UEC	88.1	58.3	21.39	9.45	N/A	
6	Efficiency Distribution	0%	5%	95%	0%	N/A	668,489
	UEC	120.71	81.82	33.53	16.8	N/A	
7	Efficiency Distribution	80%	20%	0%	N/A	N/A	238,861

	UEC	255.05	191.74	131.44	N/A	N/A	
8	Efficiency Distribution	No standards adopted					
	UEC						
9	Efficiency Distribution						
	UEC						
10	Efficiency Distribution						
	UEC						

To support the assumption that 95% of the national market meets the CEC standard levels, DOE examined the top-selling products for various battery charger applications at several national online and brick & mortar retailers (with an online portal). These data represent products sold not just in California, but available nationally. DOE focused its search on the top-selling 20 products (separately for each retailer) in applications with the highest shipments. DOE also looked at products in a variety of product classes. The applications examined cover over 50% of all battery charger shipments. If the battery charger model number was found in the CEC's database of certified products, or if the product was available for sale or pick-up in a physical store in California, then the product was assumed to meet CEC standard levels. Over 90% of products in each application examined met CEC standard levels (these results are lower bounds since battery charger model numbers were not always available). These results are therefore consistent with DOE's assumption that 95% of the national market for battery chargers meets the CEC standards. Table IV-13 below summarizes the results of DOE's market examination.

Table IV-13 Summary of DOE Market Examination of CEC Units by Application

Application	Product Class	Percentage of Total BC Shipments in Application	Retailers Examined*	Percentage of Models Examined in CEC Database or Sold in California
Smartphones	2	21%	Amazon, Best Buy, Sears	100%

Media Tablets	2	8%	Amazon, Best Buy, Sears	93%
MP3 Players	2	8%	Amazon, Best Buy, Sears	93%
Notebook Computers	4	8%	Amazon, Best Buy, Sears	93%
Digital Cameras	2	6%	Amazon, Best Buy, Sears	97%
Power Tools (includes DIY and professional)	2, 3, 4	2%	Amazon, Home Depot, Sears	90%
Toy Ride-On Vehicles	3, 5	1%	Walmart, Toys R Us	93%

See chapter 9 of the final rule TSD for more details on the development of no-standards case efficiency distributions.

To estimate efficiency trends in the standards cases, DOE has used "roll-up" and/or "shift" scenarios in its standards rulemakings. Under the "roll-up" scenario, DOE assumes: (1) product efficiencies in the base case that do not meet the standard level under consideration would "roll-up" to meet the new standard level; and (2) product efficiencies above the standard level under consideration would not be affected. Under the "shift" scenario, DOE reorients the distribution above the new minimum energy conservation standard. For this rule, DOE used the "roll-up" scenario.

For further details about the forecasted efficiency distributions, see chapter 9 of the final rule TSD.

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 standards at specific efficiency levels.[38] ("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 forecasted the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of battery chargers sold from 2018 through 2047.

DOE evaluates the impacts of new standards by comparing a case without such standards with standards-case projections. The no-standards case characterizes energy use and consumer costs for each product class in the absence of new 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-standards case with projections characterizing the market for each product class if DOE adopted new 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.

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

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-14 summarizes the inputs and methods DOE used for the NIA analysis for the final rule. Discussion of these inputs and methods follows the table. See chapter 10 of the final rule TSD for further details.

The following sections discuss the national impacts analysis in detail. Submitted comments regarding the various aspects of the analysis are noted in each section.

Table IV-14 Summary of Inputs and Methods for the National Impact Analysis

Inputs	**Method**
Shipments	Annual shipments from shipments model. Shipment growth rate is 0.62 percent annually using population growth projections from U.S. Census.
Compliance Date of Standard	2018.
Efficiency Trends	No-Standards case: Efficiency distributions remain unchanged throughout the forecast period Standard cases: "Roll-up" scenario.
Annual Energy Consumption per Unit	Annual shipment weighted-average marginal energy consumption values for each product class.
Total Installed Cost per Unit	Annual weighted-average values are a function of cost at each TSL.
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	Assumed to be zero.
Energy Prices	AEO 2015 forecasts (to 2040) and extrapolation beyond.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on AEO 2015.
Discount Rate	3% and 7%.
Present Year	2015.

1. Product Price Trends

As noted in section IV.F.1, DOE assumed no change in battery charger pricing over the 2018-2047 period in the reference case. DOE acknowledges that it is difficult to predict the consumer electronics market far in advance. To derive a price trend for battery chargers, DOE did not have any historical shipments data or sufficient historical Producer Price Index (PPI) data for the small electrical appliance manufacturing industry from BLS.[39] Therefore, DOE examined a projection based on the price indices that were projected for AEO 2015. DOE performed an exponential fit on two deflated projected price indices that may include the products of which battery chargers are components: information equipment (Chained price

[39] Series ID PCU33521-33521; http://www.bls.gov/ppi/

index—investment in non-residential equipment and software—information equipment), and consumer durables (Chained price index—other durable goods). However, DOE believes that these indices are too broad to accurately capture the trend for battery chargers. Furthermore, most battery chargers are unlike typical consumer products in that they are typically not purchased independently by consumers. Instead, they are similar to other commodities and typically bundled with end-use products.

Given the above considerations, DOE decided to use a constant price assumption as the default price factor index to project future battery charger prices in 2018 and out to 2047. While a more conservative method, following this approach helped ensure that DOE did not understate the incremental impact of standards on the consumer purchase price. Thus, DOE's product prices forecast for the LCC, PBP, and NIA analyses for the final rule were held constant for each efficiency level in each product class. DOE also conducted a sensitivity analysis using alternative price trends based on AEO indices. These price trends, and the NPV results from the associated sensitivity cases, are described in Appendix 10B of the final rule TSD.

2. Unit Energy Consumption and Savings

DOE uses the efficiency distributions for the no-standards case along with the annual unit energy consumption values to estimate shipment-weighted average unit energy consumption under the no-standards and standards cases, which are then compared against one another to yield unit energy savings values for each considered efficiency level.

As discussed in section IV.G.3, DOE assumed that energy efficiency will not improve after 2018 in the base case. Therefore, the projected UEC values in the analysis, as well as the unit energy savings values, do not vary over time. Consistent with the roll-up scenario, the analysis assumes that manufacturers would respond to a standard by improving the efficiency of underperforming products but not those that already meet or exceed the standard.

For further details on the calculation of unit energy savings for the NIA, see chapter 10 of the final rule TSD.

3. Unit Costs

DOE uses the efficiency distributions for the no-standards case along with the unit cost values to estimate shipment-weighted average unit costs under the no-standards and standards cases, which are then compared against one another to give incremental unit cost values for each TSL. For further details on the calculation of unit costs for the NIA, see chapter 10 of the final rule TSD.

4. Repair and Maintenance Cost per Unit

DOE assumed repair and maintenance costs to be zero. For further discussion of this issue, see section IV.F.5 above.

5. Energy Prices

While the focus of this rulemaking is on consumer products found in the residential sector, DOE is aware that many products that employ battery chargers are located within commercial buildings. Given this fact, the final rule analysis relied on calculated energy cost savings from such products using commercial sector electricity rates, which are lower in value than residential sector rates. DOE used this approach to avoid overstating energy cost savings in calculating the NPV.

In order to determine the energy usage split between the residential and commercial sectors, DOE first separated products into residential-use and commercial-use categories. Then, for each product class, using shipment values for 2018, average lifetimes, and base-case unit energy consumption values, DOE calculated the approximate annual energy use split between the two sectors. DOE applied the resulting ratio to the electricity pricing to obtain a sector-weighted energy price for each product class. This ratio was held constant throughout the period of analysis.

To estimate energy prices in future years, DOE multiplied the average regional energy prices by the forecast of annual national-average residential energy price changes in the Reference case from AEO, which 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. As part of the NIA, DOE also analyzed scenarios that used inputs from the AEO Low Economic Growth and High Economic Growth cases. Those cases have higher and lower energy price trends compared to the Reference case. NIA results based on these cases are presented in appendix 10A of the final rule TSD.

For further details on the determination of energy prices for the NIA, see chapter 10 of the final rule TSD.

6. National Energy Savings

The national energy savings analysis involves a comparison of national energy consumption of the considered products in each potential standards case (TSL) with consumption in the case with no new 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-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 AEO 2015. 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 FFC -- i.e. full-fuel-cycle -- measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that

EIA's National Energy Modeling System ("NEMS") is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector[40] that EIA uses to prepare its Annual Energy Outlook. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the final rule TSD.

7. 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 savings in operating costs; and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-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 forecast 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.

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.[41] The discount rates for the

40 For more information on NEMS, refer to The National Energy Modeling System: An Overview, DOE/EIA–0581 (98) (Feb.1998) (Available at: http://www.eia.gov/oiaf/aeo/overview/).
41 United States Office of Management and Budget. Circular A-4: Regulatory Analysis," (Sept. 17, 2003), section E (Available at: www.whitehouse.gov/omb/memoranda/m03-21.html).

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.

For further details about the calculation of net present value, see chapter 10 of the final rule TSD.

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 national standard. 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 the following consumer subgroups of interest -- low-income consumers, small businesses, top tier electricity price consumers, peak time-of-use electricity price consumers, and consumers of specific applications within a product class. For each subgroup, DOE considered variations on the standard inputs to the general LCC model.

For further details on the consumer subgroup analysis, see chapter 11 of the final rule TSD.

J. Manufacturer Impact Analysis

DOE conducted an MIA on battery charger applications to estimate the financial impact of new energy conservation standards on this industry. The MIA is both a quantitative and qualitative analysis. As noted earlier, the quantitative part of the MIA relies on the GRIM, an industry cash flow model customized for battery charger applications covered in this rulemaking. The key MIA output is industry net present value, or INPV. DOE used the GRIM to calculate cash flows using standard accounting principles and to compare the difference in INPV between the no-standards case and various TSLs (the standards cases). The difference in INPV between the no-standards and standards cases represents the financial impact of the new standards on battery chargers application manufacturers. Different sets of assumptions (scenarios) produce different results.

DOE calculated the MIA impacts of new energy conservation standards by creating a GRIM for battery charger application manufacturers. In the GRIM, DOE grouped similarly impacted products to better analyze the effects that the new standards will have on the industry. DOE presented the battery charger application impacts by the major product class groupings for which TSLs were selected (PC 1; PCs 2, 3, and 4; PCs 5 and 6; and PC 7). When appropriate, DOE also presented the results for differentially-impacted industries within and across those groupings. This is necessary because a given industry, depending upon how narrowly it is defined, may span several product classes. By segmenting the results into these similar industries, DOE can discuss how subgroups of battery charger application manufacturers will be impacted by new energy conservation standards.

DOE outlined its complete methodology for the MIA in the SNOPR. 80 FR at 52893-96 DOE did not receive any comments on the MIA methodology from the SNOPR and did not change the methodology used in the SNOPR in this final rule. The complete MIA is also presented in chapter 12 of the final rule TSD.

The following sections discuss the manufacturer impacts analysis in detail. Submitted comments regarding the various aspects of the analysis are noted in each section.

1. Manufacturer Production Costs

The engineering analysis analyzes how changes in battery charger efficiency impact the manufacturer production cost ("MPC") of a battery charger application. DOE used two critical inputs to calculate the impacts of battery charger standards on battery charger application manufacturers. The first input is the price a battery charger application manufacturer charges to sell its application to its first customer. This is called the MSP of the battery charger application and is used to calculate battery charger application manufacturers' revenue. The second input is the cost battery charger application manufacturers incur for the range of analyzed battery chargers used in their applications. This input impacts the MPC of the battery charger application.

For the first input, the battery charger application MSP, DOE determined representative retail prices for each application by surveying popular online retailer websites to sample a number of price points of the most commonly-sold products for each application. The price of each application can vary greatly depending on many factors (such as the features of each individual product). For each application, DOE used the average application price found in the product survey. DOE then discounted this representative retail price back to the application MSP using the retail markups derived from annual SEC 10-K reports in the Markups Analysis, as discussed in section I.D.

DOE calculated the second input, the price of the battery charger itself at each EL, in the engineering analysis. In this analysis, DOE calculated a separate cost efficiency curve for each of the seven battery charger product classes. Based on product testing data, tear-down data, and manufacturer feedback, DOE created a BOM at the original device manufacturer-level to which markups were applied to calculate the MSP of the battery charger at each EL. DOE then allocated the battery charger MSPs of each product class to all the applications within each product class. In this way, DOE arrived at the cost to the application OEM of the battery charger for each application.

DOE used the same MPCs in this final rule analysis that were used in the SNOPR analysis.

2. Shipment Projections

DOE estimated total domestic shipments of each analyzed application for 2015 that is sold with a battery charger. DOE then distributed the associated shipments among the seven product classes. See chapter 12 of the final rule TSD for a complete list of the applications DOE included in each of the seven product classes. In the GRIM, DOE used the battery charger shipment projections from 2015 to 2047 that were generated by the shipment analysis. See chapter IV.G for a complete description of the shipment analysis.

DOE used the same shipment projections in this final rule analysis that were used in the SNOPR analysis.

3. Markup Scenarios

The revenue DOE calculates for the battery charger GRIM is the revenue generated from the sale of the application that incorporates the covered battery charger. It is the revenue earned by the OEM on the sale of the product to the OEM's first customer (e.g., usually the retailer). After calculating the average retail price from the product price survey as discussed in section IV.J.1. DOE discounted the price by the appropriate retailer markup (calculated in the market and technology assessment) to calculate the per-unit revenue the OEM generates for each application. To calculate the potential impacts on manufacturer profitability in the standards case, DOE analyzed how the incremental costs of more efficient battery chargers would impact this revenue stream on an application-by-application basis.

DOE acknowledges that new standards have the potential to increase product prices and disrupt manufacturer profitability, particularly as the market transitions to meet new energy conservation standards. This change could force manufacturers to alter their markups on products as a result of new energy conservation standards. To account for this uncertainty, DOE analyzes three profitability, or manufacturer markup, scenarios in the GRIM: the flat markup scenario, the pass-through markup scenario, and the ‘constant price markup scenario.

DOE used the same markup scenarios in this final rule analysis that were used in the SNOPR analysis.

4. Capital and Product Conversion Costs

New energy conservation standards will cause manufacturers to incur one-time conversion costs to bring their production facilities and product designs into compliance with the 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 so that new product designs can be fabricated and assembled. Product conversion costs are one-time investments in research, development, testing, marketing, and other non-capitalized costs focused on making product designs comply with the new energy conservation standards.

DOE used the same product and capital conversion costs in this final rule analysis that were used in the SNOPR analysis.

5. Comments from Interested Parties

Several stakeholders commented on DOE's SNOPR MIA. These comments were made either in writing during the comment period following the publication of the battery charger SNOPR in the Federal Registry or during the SNOPR public meeting for battery chargers.

a. Manufacturer Interviews

AHAM noted that DOE did not conduct manufacturer interviews in the three-year period between the NOPR and SNOPR. It suggested interviews during this period would have allowed DOE to seek further information on new efficiency levels. (AHAM, No. 249 at p. 3) DOE notes that even though no new manufacturer interviews were conducted during the period between the NOPR and SNOPR, the stakeholder feedback DOE received in response to the NOPR led DOE to conduct further analyses on new and upcoming battery charger technologies. The results of those efforts are reflected in the modified product class list and the change in TSL to EL mappings for PCs 2, 3, and 4 between the NOPR and the SNOPR.

b. TSL to EL Mapping

Some manufacturers expressed strong support for the proposed TSL to EL mapping and standard of EL 1 for PCs 2, 3, and 4 in the SNOPR. In their view, performing an MIA along these mappings accurately reflects the nature of the products covered. (PTI, No. 244 at p. 2) (ITI, No. 248 at p. 5) (AHAM, No. 249 p. 2, 3) AHAM raised concerns about DOE remapping the TSL to EL for PCs 2, 3, and 4. AHAM pointed out remapping would necessitate further manufacturer interviews and require DOE to redo its analysis, which would cause further delays in the regulatory process. It suggested DOE retain the TSL to EL mapping proposed in the SNOPR. (AHAM, No. 249 at p. 3) AHAM pointed out that setting standards higher than the proposed EL 1 for PC 2 in the SNOPR would disadvantage manufacturers of shavers and other applications much greater than manufacturers of products such as smartphones. (AHAM, No. 249 at p. 3)

Other interested parties suggested modifying the TSL to EL mapping and increasing the stringency of the standard proposed in the SNOPR from EL 1 to EL 2 for PC 2. These interested parties suggested that a higher standard for PC 2 will be economically justified and increase energy savings. (CA IOUs, No. 251 at pp. 2-4) (CEC, No. 241 at pp. 2-3) (NRDC, ASAP, NEEA, No. 252 at p. 4-6) DOE is retaining the TSL to EL mapping for PCs 2, 3, and 4 proposed in the SNOPR as they use generally similar technology options and cover the exact same range of battery energies, as discussed in section V.A.

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 AEO 2015. The methodology is described in chapter 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.[42] 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.

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying each ton of gas by the gas' global warming potential (GWP) over a 100-year time horizon. Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,[43] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

The AEO incorporates the projected impacts of existing air quality regulations on emissions. AEO 2015 generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of

42 Available at: http://www.epa.gov/climateleadership/inventory/ghg-emissions.html.
43 IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Chapter 8.

October 31, 2014. 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 (D.C.). (42 U.S.C. 7651 et seq.) SO_2 emissions from 28 eastern States and D.C. 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.[44] In 2011, EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (August 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR,[45] 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.[46] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR.[47] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.

44 See North Carolina v. EPA, 550 F.3d 1176 (D.C. Cir. 2008); North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008).
45 See EME Homer City Generation, LP v. EPA, 696 F.3d 7, 38 (D.C. Cir. 2012), *cert. granted*, 81 U.S.L.W. 3567, 81 U.S.L.W. 3696, 81 U.S.L.W. 3702 (U.S. June 24, 2013) (No. 12-1182).
46 See EPA v. EME Homer City Generation, 134 S.Ct. 1584, 1610 (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.
47 See Georgia v. EPA, Order (D. C. Cir. filed October 23, 2014) (No. 11-1302).

EIA was not able to incorporate CSAPR into AEO 2015, so it assumes implementation of CAIR. Although DOE's analysis used emissions factors that assume that CAIR, not CSAPR, is the regulation in force, the difference between CAIR and CSAPR is not significant for the purpose of DOE's analysis of emissions impacts from energy conservation standards.

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 rulemakings, 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 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. AEO 2015 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 CAIR, 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.[48] Therefore, DOE believes that energy conservation standards will generally reduce SO_2 emissions in 2016 and beyond.

CAIR established a cap on NO_X emissions in 28 eastern States and the District of Columbia.[49] Energy conservation standards are expected to have little effect on NO_X emissions in those States covered by CAIR 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 AEO 2015, which incorporates the MATS.

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[48] DOE notes that the Supreme Court recently remanded EPA's 2012 rule regarding national emission standards for hazardous air pollutants from certain electric utility steam generating units. See Michigan v. EPA (Case No. 14-46, 2015). DOE has tentatively determined that the remand of the MATS rule does not change the assumptions regarding the impact of energy efficiency standards on SO_2 emissions. Further, while the remand of the MATS rule may have an impact on the overall amount of mercury emitted by power plants, it does not change the impact of the energy efficiency standards on mercury emissions. DOE will continue to monitor developments related to this case and respond to them as appropriate.

[49] CSAPR also applies to NO_X and it would supersede the regulation of NO_X under CAIR. As stated previously, the current analysis assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR with regard to DOE's analysis of NO_X emissions is slight.

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 forecast period for each TSL. This section summarizes the basis for the monetary values used for each of these 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 carbon (SCC) 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 SCC 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 SCC are provided in dollars per metric ton of CO_2. A domestic SCC 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 SCC value is meant to reflect the value of damages worldwide.

Under section 1(b) 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 SCC 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 SCC 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 SCC 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 SCC 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[50] points out

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

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, SCC estimates can be useful in estimating the social benefits of reducing CO_2 emissions. The agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC 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 interagency process 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.

b. Development of Social Cost of Carbon Values

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 SCC 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: global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules.

c. Current Approach and Key Assumptions

After the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC 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 SCC: 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 SCC 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 interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SCC 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 SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[51] although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV-15 presents the values in the 2010 interagency group report,[52] which is reproduced in appendix 14A of the final rule TSD.

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[51] 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.

[52] Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government (February 2010) (Available at: www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf).

Table IV-15 Annual SCC Values from 2010 Interagency Report, 2010–2050 (2007$ per metric ton CO2)

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

The SCC values used for this notice were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature, as described in the 2013 update from the interagency working group (revised July 2015).[53]

Table IV-16 shows the sets of SCC estimates from the latest interagency update in 5-year increments from 2010 to 2050. The full set of annual SCC estimates between 2010 and 2050 is reported in appendix 14B of the final rule TSD. The central value that emerges is the average SCC across models at the 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

Table IV-16 Annual SCC Values from 2013 Interagency Update (Revised July 2015), 2010–2050 (2007$ per metric ton CO_2)

Year	Discount Rate			
	5%	3%	2.5%	3%

[53] Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised July 2015) (Available at: http://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf).

	Average	Average	Average	95th percentile
2010	10	31	50	86
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 SCC 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 interagency process to estimate the SCC. 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.[54]

[54] In November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SCC estimates. 78 FR 70586. In July 2015 OMB published a detailed summary and formal response to the many comments that were received. 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.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report (revised July 2015), adjusted to 2013$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of SCC cases specified, the values for emissions in 2015 were $12.2, $40.0, $62.3, and $117 per metric ton avoided (values expressed in 2013$). DOE derived values after 2050 based on the trend in 2010-2050 in each of the four cases.

DOE multiplied the CO_2 emissions reduction estimated for each year by the SCC 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 SCC values in each case.

In response to the SNOPR, the U.S. Chamber of Commerce objected to the use of the SCC until more rigorous review is available. (U.S. Chamber of Commerce, No. 242, p. 4) AHAM commented that 2010 values of SCC should be used until a complete review of the 2013 values is completed. (AHAM, No. 249, p. 6) In contrast, EDF and UCS supported DOE's use of the Interagency Working Group estimates of SCC. (EDF, UCS, No. 239, p. 21-22)

In response, in conducting the interagency process that developed the SCC 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 SCC estimates. These uncertainties and model differences are discussed in the interagency working group's reports, which are reproduced in appendix 14A and 14B of the final rule TSD, 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 SCC 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 SCC values were published in the peer-reviewed literature (see appendix 14B of the final rule TSD for discussion). 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 SCC have been developed over many years, using the best science available, and with input from the public. In November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SCC estimates. 78 FR 70586. In July 2015, OMB published a detailed summary and formal response to the many comments that were received.[55] DOE stands ready to work with OMB and the other members of the interagency working group on further review and revision of the SCC estimates as appropriate.

2. Social Cost of Other Air Pollutants

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

[55] https://www.whitehouse.gov/blog/2015/07/02/estimating-benefits-carbon-dioxide-emissions-reductions. OMB also stated its intention to seek independent expert advice on opportunities to improve the estimates, including many of the approaches suggested by commenters.

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.[56] The report includes high and low values for NO_X (as $PM_{2.5}$) for 2020, 2025, and 2030 discounted at 3 percent and 7 percent; these values are presented in chapter 14 of the final rule TSD. DOE primarily relied upon the low estimates to be conservative.[57] DOE assigned values for 2021-2024 and 2026-2029 using, respectively, the values for 2020 and 2025. DOE assigned values after 2030 using the value for 2030. DOE developed values specific to the end-use category for battery chargers using a method described in appendix 14C.

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 will continue to evaluate the monetization of avoided NO_x emissions and will make any appropriate updates in energy conservation standards rulemakings.

[56] 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), 136 S.Ct. 999 (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.

[57] 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 further description of the studies mentioned above.)

DOE is evaluating appropriate monetization of avoided SO_2 and Hg 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 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 AEO 2015. 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. DOE uses published side cases to estimate the marginal impacts of reduced energy demand on the utility sector. These marginal factors are estimated based on the changes to electricity sector generation, installed capacity, fuel consumption and emissions in the AEO Reference case and various side cases. Details of the methodology are provided in the appendices to chapter 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, 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 new energy conservation standards.

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 end-users on energy; (2) reduced spending on new energy supplies by the utility industry; (3) increased consumer spending on new products to which the new standards apply; 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 BLS.[58] 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

[58] Data on industry employment, hours, labor compensation, value of production, and the implicit price deflator for output for these industries are available upon request by calling the Division of Industry Productivity Studies (202-691-5618) or by sending a request by e-mail to dipsweb@bls.gov.

economy.[59] 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 3.1.1 ("ImSET").[60] 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

[59] See Bureau of Economic Analysis, Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II), U.S. Department of Commerce (1992).
[60] J. M. Roop, M. J. Scott, and R. W. Schultz, ImSET 3.1: Impact of Sector Energy Technologies, PNNL-18412, Pacific Northwest National Laboratory (2009) (Available at: www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf).

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 generated results for near-term timeframes, where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the final rule TSD.

O. Marking Requirements

In the SNOPR regarding energy conservation standards for battery chargers, DOE declined to propose marking requirements for battery chargers. DOE received comments from AHAM supporting its decision to refrain from setting marking requirements for battery chargers. (AHAM, No. 249, p. 5) However, DOE also received comments from CEC, NRDC, ASAP, NEEA and Delta Q requesting that marking requirements be established for battery chargers. The CEC argued that a required mark will make it easier to gauge compliance with DOE's energy conservation standards for battery chargers and make alignment with international standards possible. (CEC, No. 241, p. 3-4) NRDC, ASAP and NEEA asserted that a required marking would facilitate standards enforcement, help identify non-compliant products, and drive accountability from the retailer throughout the supply-chain. (NRDC, ASAP, NEEA, No. 252, p. 6) Delta Q advised DOE to either adopt the CEC's "BC" product mark or pre-empt it with an alternate mark to avoid a scenario where two marks are required. (Delta Q, No. 238, p. 2)

As discussed in the SNOPR's response to stakeholder comments received on the NOPR, mandating a marking requirement for battery chargers does not offer significant benefits in terms of gauging compliance with, or facilitating enforcement of, DOE's energy conservation standards for battery chargers. Manufacturers of battery chargers must certify compliance with applicable DOE's energy conservation standards using the Compliance Certification Management System ("CCMS") as a condition of sale in the United States, which effectively holds manufacturers accountable for ensuring compliance of their covered products. As a result, battery charger compliance with DOE's standards can be as easily verified using DOE's compliance certification database, rendering a compliance mark on the product redundant and an unnecessary burden to manufacturers. Therefore, DOE is not mandating any marking requirements for battery chargers in this final rule.

P. Reporting Requirements

Manufacturers (which includes importers), as defined in 42 U.S.C. § 6291(10), will be required to report the applicable certification data to the Department through DOE's CCMS on or before the compliance date of the standards finalized in this rulemaking.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for battery chargers. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for battery chargers, 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 notice.

A. Trial Standard Levels

DOE analyzed the benefits and burdens of four TSLs for battery chargers. 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 for battery chargers. TSL 4 represents the maximum technologically feasible ("max-tech") improvements in energy efficiency for all product classes. While DOE examined most product classes individually, there were two groups of product classes that use generally similar technology options and cover the exact same range of battery energies. Because of this situation, DOE grouped all three low-energy, non-inductive, product classes (i.e., 2, 3, and 4) together and examined the results. Similarly, DOE grouped the two medium energy product classes, PCs 5 and 6, together when it examined those results.

Table V-1 Trial Standard Levels for Battery Chargers

Product Class	Trial Standard Level			
	TSL 1	TSL 2	TSL 3	TSL 4
PC 1 - Low E, Inductive	EL 1	EL 2	EL 2	EL 3
PC 2 - Low E, Low Voltage	EL 1	EL 1	EL 2	EL 4
PC 3 - Low E, Medium Voltage	EL 1	EL 1	EL 2	EL 3
PC 4 - Low E, High Voltage	EL 1	EL 1	EL 2	EL 3
PC 5 - Medium E, Low Voltage	EL 1	EL 2	EL 3	EL 3
PC 6 - Medium E, High Voltage	EL 1	EL 2	EL 3	EL 3
PC 7 - High E	EL 1	EL 1	EL 2	EL 2

For battery charger PC 1 (low-energy, inductive), DOE examined trial standard levels corresponding to each of three ELs developed in the engineering analysis. TSL 1 is an intermediate level of performance above the baseline. TSLs 2 and 3 are equivalent to the best-in-market and corresponds to the maximum consumer NPV. TSL 4 is the max-tech level and corresponds to the greatest NES.

For its second set of TSLs, which covers PCs 2 (low-energy, low-voltage), 3 (low-energy, medium-voltage), and 4 (low-energy, high-voltage), DOE examined four TSLs of different combinations of the various efficiency levels found for each product class in the engineering analysis. In this grouping, TSLs 1 and 2 are intermediate efficiency levels above the baseline for each product class and corresponds to the maximum consumer NPV. TSL 3 corresponds to an incremental efficiency level below best-in-market for PC 2, and the best-in-market efficiency level for PCs 3 and 4. Finally, TSL 4 corresponds to the max-tech efficiency level for all product classes and therefore, the maximum NES. Note that for PC 2 only, EL 3 (corresponding to a best-in-market efficiency level) was not analyzed in a given TSL due to the negative LCC savings results for this product class at EL 3 and the fact that only four TSLs were analyzed.

DOE's third set of TSLs corresponds to the grouping of PCs 5 (medium-energy, low-voltage) and 6 (medium-energy, high-voltage). For both product classes, TSL 1 is an intermediate efficiency level above the baseline. TSL 2 corresponds to the best-in-market efficiency level for both product classes and is the level with the highest consumer NPV. Finally, TSLs 3 and 4 correspond to the max-tech efficiency level for both product classes and the maximum NES.

For PC 7 (high-energy), DOE examined only two ELs because of the paucity of products available on the market. TSLs 1 and 2 correspond to an efficiency level equivalent to the best-in-market and maximizes consumer NPV. TSLs 3 and 4 comprise the max-tech level corresponding to the level with the maximum NES.

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on battery charger consumers by looking at the effects potential standards at each TSL would have on the LCC and PBP. DOE also examined the impacts of potential standards on 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-15 show the LCC and PBP results for the TSL efficiency levels 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-standards case in the compliance year (see section IV.F.10 of this notice).

Table V-2: Average LCC and PBP Results by TSL for Product Class 1

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	4.39	1.08	4.71	9.10	--	5.0
1	1	4.72	0.76	3.29	8.01	1.1	5.0
2	2	5.37	0.38	1.64	7.01	1.5	5.0
3	2	5.37	0.38	1.64	7.01	1.5	5.0
4	3	10.62	0.16	0.69	11.32	7.4	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 (EL 0) product.

Table V-3: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 1

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	0.0	0.08
2	2	0.0	0.71
3	2	0.0	0.71
4	3	96.3	-3.44

* The calculation includes households with zero LCC savings (no impact).

Table V-4: Average LCC and PBP Results by TSL for Product Class 2

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	2.62	0.43	1.43	4.05	--	4.0
1	1	2.68	0.27	0.86	3.54	0.6	4.0
2	1	2.68	0.27	0.86	3.54	0.6	4.0
3	2	3.11	0.16	0.45	3.57	2.5	4.0
4	4	7.31	0.11	0.31	7.62	19.5	4.0

Table V-5: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 2

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	1.2	0.07
2	1	1.2	0.07
3	2	33.1	0.06
4	4	73.8	-2.79

Table V-6: Average LCC and PBP Results by TSL for Product Class 3

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	2.59	0.52	2.30	4.89	--	4.9
1	1	2.70	0.18	0.82	3.52	0.8	4.9
2	1	2.70	0.18	0.82	3.52	0.8	4.9
3	2	6.84	0.10	0.43	7.27	21.6	4.9
4	3	8.83	0.09	0.41	9.24	31.2	4.9

Table V-7: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 3

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	0.6	0.08
2	1	0.6	0.08
3	2	39.0	-1.36
4	3	40.8	-2.17

Table V-8: Average LCC and PBP Results by TSL for Product Class 4

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	3.75	1.61	5.62	9.37	--	3.7
1	1	4.89	0.67	2.28	7.17	1.4	3.7
2	1	4.89	0.67	2.28	7.17	1.4	3.7
3	2	9.29	0.45	1.55	10.84	5.2	3.7
4	3	27.06	0.38	1.30	28.36	20.7	3.7

Table V-9: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 4

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	1.3	0.11
2	1	1.3	0.11
3	2	12.6	-0.38
4	3	25.8	-4.91

Table V-10: Average LCC and PBP Results by TSL for Product Class 5

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	46.58	11.68	68.85	115.43	--	4.0
1	1	51.37	7.74	45.38	96.75	2.3	4.0
2	2	58.94	2.87	16.36	75.30	2.7	4.0
3	3	207.68	1.26	7.10	214.77	29.1	4.0
4	3	207.68	1.26	7.10	214.77	29.1	4.0

Table V-11: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 5

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	0.0	0.00
2	2	0.6	0.84
3	3	99.7	-138.63
4	3	99.7	-138.63

Table V-12: Average LCC and PBP Results by TSL for Product Class 6

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	45.39	15.93	113.08	158.47	--	9.7
1	1	50.14	10.81	77.60	127.74	1.0	9.7
2	2	57.64	4.45	33.33	90.98	1.1	9.7
3	3	205.07	2.24	16.94	222.01	12.5	9.7
4	3	205.07	2.24	16.94	222.01	12.5	9.7

Table V-13: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 6

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	0.0	0.00
2	2	0.0	1.89
3	3	100.0	-129.15
4	3	100.0	-129.15

Table V-14: Average LCC and PBP Results by TSL for Product Class 7

TSL	EL	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	0	221.94	29.42	95.03	316.97	--	3.5
1	1	181.55	22.09	70.81	252.36	0.0	3.5
2	1	181.55	22.09	70.81	252.36	0.0	3.5
3	2	334.87	15.14	48.60	383.47	8.1	3.5
4	2	334.87	15.14	48.60	383.47	8.1	3.5

Table V-15: Average LCC Savings Relative to the Base-Case Efficiency Distribution for Product Class 7

TSL	EL	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* 2013$
1	1	0.0	51.06
2	1	0.0	51.06
3	2	100.0	-80.05
4	2	100.0	-80.05

The LCC results for battery chargers depend on the product class being considered. See Table V-2 through Table V-15. LCC savings results for PC 1 are positive through TSL 3. For the low-energy product classes (PCs 2, 3, and 4), LCC results are positive through TSL 2 and become negative at TSL 3, with PC 2 becoming negative at TSL 4. The medium-energy product classes (PCs 5 and 6) are positive through TSL 2 but become negative at TSL 3. The high-energy product class (PC 7) has positive LCC savings through TSL 2, and then becomes negative at TSL 3.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs for low-income consumers, small businesses, residential top tier electricity price consumers, time-of-use peak electricity price consumers, and consumers of specific applications. LCC and PBP results for consumer subgroups are presented in Table V-16 through Table V-22. The abbreviations are described after Table V-22. The ensuing discussion presents the most significant results from the LCC subgroup analysis.

Table V-16: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 1

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	**LI**	**SB**	**TT**	**P-TOU**	**All**	**LI**	**SB**	**TT**	**P-TOU**	**All**
1	0.08	0.00	0.26	0.39	0.08	1.1	0.0	0.3	0.2	1.1
2	0.71	0.00	2.88	4.31	0.71	1.5	0.0	0.5	0.3	1.5
3	0.71	0.00	2.88	4.31	0.71	1.5	0.0	0.5	0.3	1.5
4	(3.46)	0.00	0.44	3.00	(3.44)	7.4	0.0	2.3	1.6	7.4

Table V-17: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 2

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	**LI**	**SB**	**TT**	**P-TOU**	**All**	**LI**	**SB**	**TT**	**P-TOU**	**All**
1	0.06	0.08	0.17	0.29	0.07	0.5	0.6	0.2	0.1	0.6
2	0.06	0.08	0.17	0.29	0.07	0.5	0.6	0.2	0.1	0.6
3	0.05	(0.01)	0.58	0.96	0.06	2.4	3.8	0.9	0.6	2.5
4	(2.76)	(3.29)	(2.05)	(1.56)	(2.79)	18.6	25.2	6.9	4.8	19.5

Table V-18: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 3

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	**LI**	**SB**	**TT**	**P-TOU**	**All**	**LI**	**SB**	**TT**	**P-TOU**	**All**
1	0.07	0.14	0.23	0.36	0.08	0.8	0.2	0.2	0.2	0.8
2	0.07	0.14	0.23	0.36	0.08	0.8	0.2	0.2	0.2	0.8
3	(1.38)	(1.10)	(0.86)	(0.43)	(1.36)	22.0	4.8	6.9	4.8	21.6
4	(2.19)	(1.85)	(1.65)	(1.20)	(2.17)	31.3	6.6	10.0	7.0	31.2

Table V-19: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 4

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	LI	SB	TT	P-TOU	All	LI	SB	TT	P-TOU	All
1	0.15	0.06	0.57	0.68	0.11	0.9	1.5	0.3	0.3	1.4
2	0.15	0.06	0.57	0.68	0.11	0.9	1.5	0.3	0.3	1.4
3	(0.49)	(0.27)	0.07	0.53	(0.38)	4.0	5.5	1.2	1.1	5.2
4	(5.80)	(3.83)	(5.07)	(3.79)	(4.91)	15.6	21.7	4.7	4.3	20.7

Table V-20: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 5

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	LI	SB	TT	P-TOU	All	LI	SB	TT	P-TOU	All
1	0.00	0.00	0.00	0.00	0.00	2.3	0.0	0.8	0.5	2.3
2	0.84	0.00	3.14	4.64	0.84	2.7	0.0	0.9	0.6	2.7
3	(138.81)	0.00	(118.82)	(105.75)	(138.63)	29.1	0.0	9.8	6.8	29.1
4	(138.81)	0.00	(118.82)	(105.75)	(138.63)	29.1	0.0	9.8	6.8	29.1

Table V-21: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 6

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	LI	SB	TT	P-TOU	All	LI	SB	TT	P-TOU	All
1	0.00	0.00	0.00	0.00	0.00	1.0	0.0	0.3	0.2	1.0
2	1.87	0.00	6.24	9.10	1.89	1.1	0.0	0.4	0.3	1.1
3	(129.38)	0.00	(93.98)	(70.73)	(129.15)	12.6	0.0	4.0	2.8	12.5
4	(129.38)	0.00	(93.98)	(70.73)	(129.15)	12.6	0.0	4.0	2.8	12.5

Table V-22: Comparison of LCC Savings and PBP for Consumer Subgroups and All Households for Product Class 7

	Average Life-Cycle Cost Savings (2013$)					Simple Payback Period (years)				
TSL	LI	SB	TT	P-TOU	All	LI	SB	TT	P-TOU	All
1	51.88	49.36	89.56	116.93	51.06	0.0	0.0	0.0	0.0	0.0
2	51.88	49.36	89.56	116.93	51.06	0.0	0.0	0.0	0.0	0.0
3	(93.28)	(82.08)	(39.75)	62.98	(80.05)	20.1	8.0	6.4	1.6	8.1
4	(93.28)	(82.08)	(39.75)	62.98	(80.05)	20.1	8.0	6.4	1.6	8.1

Where:

LI = Low-income consumers

SB = Small businesses

TT = Top tier electricity price consumers

P-TOU = Peak time-of-use electricity price consumers

All = Entire population

Low-Income Consumers

For low-income consumers, the LCC impacts and PBPs are different from the general population. As part of this subgroup analysis, DOE considers only the residential sector, and uses an adjusted population distribution from the reference case scenario. Using 2009 RECS data, DOE determined that low-income consumers have a different population distribution than the general population. To account for this difference, DOE adjusted population distributions for each region analyzed according to the shift between general and low-income populations.

The LCC savings and PBPs of low-income consumers are similar to that of the total population of consumers. In general, low-income consumers experience slightly reduced LCC savings, with the exceptions of TSL 4 of Product Class 2 and TSLs 1 and 2 of PCs 4 and 7. None of the changes in LCC savings move a TSL from positive to negative LCC savings, or vice versa.

Small Businesses

For small business customers, the LCC impacts and PBPs are different from the general population. This subgroup analysis considers only the commercial sector, and uses an adjusted discount rate from the reference case scenario. DOE found that small businesses typically have a cost of capital that is 4.16 percent higher than the industry average, which was applied to the discount rate for the small business consumer subgroup analysis.

The small business consumer subgroup LCC results are not directly comparable to the reference case LCC results because this subgroup only considers commercial applications. In the reference case scenario, the LCC results are strongly influenced by the presence of residential applications, which typically comprise the majority of application shipments. Note that PCs 1, 5, and 6 have no results for small businesses because there are no commercial applications for these product classes. No LCC results that were positive for all consumers become negative in the small business subgroup analysis, with the exception of PC 2, which became -$0.01 at TSL 3. No negative LCC results for all consumers became positive for small businesses. These observations indicate that small business consumers would experience similar LCC impacts as the general population.

Top Tier Electricity Price Consumers

For top tier electricity price consumers, the LCC impacts and PBPs are different from the general population. Tiered pricing is generally only used for residential electricity rates, so the analysis for this subgroup only considers the residential sector. With tiered pricing (also known as inclining block rates), the price of electricity increases in discrete steps as overall electricity consumption increases. For example, the price of electricity can differ between the first 100 kWh of consumption, and the next 100 kWh of consumption, in a given billing cycle. Under such pricing systems, a consumer's marginal electricity price can be significantly higher than the national average. DOE researched upper tier inclined marginal block rates for the electricity, resulting in a price of $0.359 per kWh.

Consumers in the top tier electricity price bracket generally experience greater LCC savings than those in the reference case scenario. This result occurs because these consumers pay more for their electricity than other consumers, and, therefore, experience greater savings when using products that are more energy efficient. This subgroup analysis changed the negative LCC savings for PC 1 at TSL 4 and PC 4 at TSL 3 to positive LCC savings.

Peak Time-of-Use Electricity Price Consumers

For peak time-of-use electricity price consumers (i.e. those electricity consumers who purchase electricity at peak rates, depending on either the time of day or season), the LCC impacts and PBPs are different from the general population. Time-of-use pricing is available for both residential and commercial electricity rates, so both sectors were considered. DOE researched upper tier inclined marginal block rates for electricity, resulting in adjusted electricity prices of $0.514 per kWh for residential and $0.494 for commercial consumers.

This subgroup analysis increased the LCC savings of most of the representative units significantly. This subgroup analysis changed the following negative LCC results to positive savings: PC 1 at TSL 4, PC 4 at TSL 3, and PC 7 at TSLs 3 and 4. Some product classes would still have negative LCC savings, which indicates that these classes have increasing installed costs (purchase price plus installation costs, the latter of which are assumed to be zero) at higher TSLs that cannot be overcome through operating cost savings using peak time-of-use electricity prices.

Consumers of Specific Applications

DOE performed an LCC and PBP analysis on every application within each product class. This subgroup analysis used each application's specific inputs for lifetime costs, markups, base case market efficiency distribution, and UEC. Many applications in each product class experienced LCC impacts and PBPs that were different from the average results across the product class. Because of the large number of applications considered in the analysis, some of which span multiple product classes, DOE did not present application-specific LCC results here. Detailed results on each application are available in chapter 11 of the final rule TSD.

DOE noted a few trends highlighted by the application-specific subgroup. For PC 2, the top two application LCC savings representing 46 percent of shipments are negative beyond TSL 1, but frequently-used applications within that class -- e.g., answering machines, cordless phones, and home security systems -- experience positive LCC savings. Because these applications have significantly positive LCC savings, they balance out the negative savings from the top two applications. Some PC 4 applications at TSLs 1 through 3 featured results that were positive where the shipment-weighted results were negative, or vice versa. However, shipments and magnitude of the LCC savings were not enough to change the overall direction (positive or negative) of the weighted average. In the other battery charger product classes, the individual application results reflected the same trend as the overall results for the product class. See chapter 11 of the final rule TSD for further detail.

c. Rebuttable Presumption Payback

As discussed in section III.F, 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 battery chargers. 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-23 presents the rebuttable-presumption payback periods for the considered TSLs. 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-23 shows considered TSLs for the battery charger product classes where the rebuttable presumption PBPs show they are economically justified.

Table V-23: Trial Standard Levels with Rebuttable Payback Period Less Than Three Years

Product Class	Description	Trial Standard Level	Candidate Standard Level	Rebuttable Presumption PBP years
1	Low-Energy, Inductive	1	1	1.1
		2	2	1.5
		3	2	1.5
2	Low-Energy, Low-Voltage	1	1	0.6
		2	1	0.6
		3	2	2.5
3	Low-Energy, Medium-Voltage	1	1	0.8
		2	1	0.8
4	Low-Energy, High-Voltage	1	1	1.4
		2	1	1.4
5	Medium-Energy, Low-Voltage	1	1	2.3
		2	2	2.7
6	Medium-Energy, High-Voltage	1	1	1.0
		2	2	1.1
7	High-Energy	1	1	0.0
		2	1	0.0

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of new energy conservation standards on manufacturers of battery charger applications. The section below describes the expected impacts on manufacturers at each TSL. Chapter 12 of the final rule TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

The INPV results refer to the difference in industry value between the no-standards case and the standards cases, which DOE calculated by summing the discounted industry cash flows from the reference year (2015) through the end of the analysis period. The discussion also notes the difference in the annual cash flow between the no-standards case and the standards cases in the year before the compliance date of new energy conservation standards. This figure provides a proxy for the magnitude of the required conversion costs, relative to the cash flow generated by the industry in the no-standards case.

DOE reports INPV impacts at each TSL for the four product class groupings. When appropriate, DOE also discusses the results for groups of related applications that would experience impacts significantly different from the overall product class group to which they belong.

In general, two major factors drive the INPV results: (1) the relative difference between a given application's MSP and the incremental cost of improving its battery charger; and (2) the dominant no-standards case battery charger technology that a given application uses, which is approximated by the application’s efficiency distribution.

With respect to the first factor, the higher the MSP of the application relative to the battery charger cost, the lower the impacts of battery charger standards on OEMs of the application. For example, an industry that sells an application for $500 would be less affected by a $2 increase in battery charger costs than one that sells its application for $10. On the second factor regarding the no-standards case efficiency distribution, some industries, such as producers of laptop computers, already incorporate highly efficient battery chargers. Therefore, a higher standard would be unlikely to impact the laptop industry as it would other applications using baseline technology in the same product class.

DOE analyzed three markup scenarios—constant price, pass-through, and flat markup. The constant price scenario analyzes the situation in which application manufacturers are unable to pass on any incremental costs of more efficient battery chargers to their customers. This scenario generally results in the most significant negative impacts because no incremental costs added to the application—whether driven by higher battery charger component costs or depreciation of required capital investments—can be recouped.

In the pass-through scenario, DOE assumes that manufacturers are able to pass the incremental costs of more efficient battery chargers through to their customers, but not with any markup to cover overhead and profit. Therefore, though less severe than the constant price scenario in which manufacturers absorb all incremental costs, this scenario results in negative cash flow impacts due to margin compression and greater working capital requirements.

Finally, DOE considers a flat markup scenario to analyze the upper bound (least severe) of profitability impacts. In this scenario, manufacturers are able to maintain their no-standards case gross margin, as a percentage of revenue, at higher ELs, despite the higher product costs associated with more efficient battery chargers. In other words, manufacturers can fully pass on—and markup—the higher incremental product costs associated with producing more efficient battery chargers.

Product Class 1

Table V-24 through Table V-27 summarize information related to the analysis performed to project the potential impacts on Product Class 1 battery charger application manufacturers.

Table V-24 Applications in Product Class 1

Product Class 1
Rechargeable Toothbrushes
Rechargeable Water Jets

Table V-25 Manufacturer Impact Analysis for Product Class 1 Battery Charger Applications – Flat Markup Scenario

	Units	**No-Standards Case**	**Trial Standard Level**			
			1	**2**	**3**	**4**
INPV	2013$ Millions	497	497	496	496	519
Change in INPV	2013$ Millions	-	0	(1)	(1)	22
	(%)	-	0.0	(0.1)	(0.1)	4.5
Product Conversion Costs	2013$ Millions	-	0.1	1.7	1.7	5.1
Capital Conversion Costs	2013$ Millions	-	0.0	1.5	1.5	2.3
Total Investment Required	2013$ Millions	-	0.1	3.2	3.2	7.4

Table V-26 Manufacturer Impact Analysis for Product Class 1 Battery Charger Applications – Pass-Through Markup Scenario

	Units	**No-Standards Case**	**Trial Standard Level**			
			1	**2**	**3**	**4**
INPV	2013$ millions	497	491	470	470	348
Change in INPV	2013$ millions	-	(6)	(27)	(27)	(149)
	(%)	-	(1.1)	(5.4)	(5.4)	(29.9)
Product Conversion Costs	2013$ millions	-	0.1	1.7	1.7	5.1
Capital Conversion Costs	2013$ millions	-	0.0	1.5	1.5	2.3
Total Investment Required	2013$ millions	-	0.1	3.2	3.2	7.4

Table V-27 Manufacturer Impact Analysis for Product Class 1 Battery Charger Applications – Constant Price Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	**2**	**3**	**4**
INPV	2013$ millions	497	478	412	412	122
Change in INPV	2013$ millions	-	(18)	(84)	(84)	(375)
	(%)	-	(3.7)	(16.9)	(16.9)	(75.5)
Product Conversion Costs	2013$ millions	-	0.1	1.7	1.7	5.1
Capital Conversion Costs	2013$ millions	-	0.0	1.5	1.5	2.3
Total Investment Required	2013$ millions	-	0.1	3.2	3.2	7.4

PC 1 has only two applications: rechargeable toothbrushes and water jets. Rechargeable toothbrushes represent over 99 percent of the PC 1 shipments. DOE found the majority of these models include Ni-Cd battery chemistries, although products with NiMH and Li-ion chemistries exist in the market. During interviews, manufacturers indicated that energy efficiency was not a primary selling point in this market. As a consequence, manufacturers expect that stringent standards would likely impact the low-end of the market, where price competition is most fierce and retail selling prices are lowest.

TSL 1 sets the efficiency level at EL 1 for PC 1. At TSL 1, DOE estimates impacts on the change in INPV to range from -$18 million to less than one million dollars, or a change in INPV of -3.7 percent to less than 0.1 percent. At TSL 1, industry free cash flow (operating cash flow minus capital expenditures) is estimated to decrease by less than one million dollars, which corresponds to less than one percent in 2017, the year leading up to new energy conservation standards.

Percentage impacts on INPV are slightly negative at TSL 1. DOE does not anticipate that PC 1 battery charger application manufacturers would lose a significant portion of their INPV at this TSL. DOE projects that in the expected year of compliance, 2018, 93 percent of all PC 1 battery charger applications would meet or exceed the efficiency levels required at TSL 1. Consequently, DOE expects conversion costs to be small at TSL 1, since so many applications already meet or exceed this requirement.

TSL 2 and TSL 3 set the efficiency level at EL 2 for PC 1. At TSL 2 and TSL 3, DOE estimates impacts on the change in INPV to range from -$84 million to -$1 million, or a change in INPV of -16.9 percent to -0.1 percent. At TSL 2 and TSL 3, industry free cash flow is estimated to decrease to $38 million, or a decrease of 4 percent, compared to the no-standards case value of $39 million in 2017.

Percentage impacts on INPV range from slightly negative to moderately negative at these TSLs. DOE does not anticipate that PC 1 battery charger application manufacturers would lose a significant portion of their INPV at these TSLs. DOE projects that in the expected year of compliance, 2018, 37 percent of all PC 1 battery charger applications would meet or exceed the efficiency levels required at TSL 2 and TSL 3. DOE expects conversion costs to increase from $0.1 million at TSL 1 to $3.2 million at TSL 2 and TSL 3. This is still a relatively modest amount compared to the no-standards case INPV of $497 million and annual cash flow of $39 million for PC 1 battery charger applications.

TSL 4 sets the efficiency level at EL 3 for PC 1. This represents max-tech for PC 1. At TSL 4, DOE estimates impacts on the change in INPV to range from -$375 million to $22 million, or a change in INPV of -75.5 percent to 4.5 percent. At TSL 4, industry free cash flow is estimated to decrease to $36 million, or a decrease of 8 percent, compared to the no-standards case value of $39 million in 2017.

Percentage impacts on INPV range from significantly negative to slightly positive at TSL 4. DOE anticipates that some PC 1 battery charger application manufacturers could lose a significant portion of their INPV at TSL 4. DOE projects that in the expected year of compliance, 2018, 4 percent of all PC 1 battery charger applications would meet the efficiency levels required at TSL 4. DOE expects conversion costs to increase from $3.2 million at TSL 2 and TSL 3 to $7.4 million at TSL 4. This is still relatively a modest amount compared to the no-standards case INPV of $497 million and annual cash flow of $39 million for PC 1 battery charger applications. At TSL 4, the battery charger MPC increases to $6.80 compared to the baseline MPC value of $2.05. This represents a moderate increase in the application price when compared to the shipment-weighted average application MPC of $40.06.

Product Classes 2, 3, and 4

The following tables (Table V-28 through Table V-34) summarize information related to the analysis performed to project the potential impacts on manufacturers of devices falling into PCs 2, 3, and 4.

Table V-28 Applications in Product Classes 2, 3, and 4

Product Class 2	Product Class 3	Product Class 4
Answering Machines	Air Mattress Pumps	DIY Power Tools (External)
Baby Monitors	Blenders	Flashlights/Lanterns
Beard and Moustache Trimmers	Camcorders	Handheld Vacuums
Bluetooth Headsets	DIY Power Tools (External)	Netbooks
Can Openers	DIY Power Tools (Integral)	Notebooks
Consumer Two-Way Radios	Handheld Vacuums	Portable Printers
Cordless Phones	LAN Equipment	Professional Power Tools
Digital Cameras	Mixers	Rechargeable Garden Care Products
DIY Power Tools (Integral)	Portable DVD Players	Robotic Vacuums
E-Books	Portable Printers	Stick Vacuums
Hair Clippers	RC Toys	Universal Battery Chargers
Handheld GPS	Stick Vacuums	
Home Security Systems	Toy Ride-On Vehicles	
In-Vehicle GPS	Universal Battery Chargers	
Media Tablets	Wireless Speakers	
Mobile Internet Hotspots		
Mobile Phones		
MP3 Players		
MP3 Speaker Docks		
Personal Digital Assistants		
Portable Video Game Systems		
Shavers		
Smartphone		
Universal Battery Chargers		
Video Game Consoles		
Wireless Headphones		

Table V-29 Manufacturer Impact Analysis for Product Class 2, 3, and 4 Battery Charger Applications – Flat Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	**2**	**3**	**4**
INPV	2013$ millions	76,791	76,782	76,782	76,774	77,290
Change in INPV	2013$ millions	-	(10)	(10)	(17)	499
	(%)	-	(0.0)	(0.0)	(0.0)	0.6
Product Conversion Costs	2013$ millions	-	11.5	11.5	90.1	280.5
Capital Conversion Costs	2013$ millions	-	1.8	1.8	25.6	67.3
Total Investment Required	2013$ millions	-	13.4	13.4	115.7	347.8

Table V-30 Manufacturer Impact Analysis for Product Class 2, 3, and 4 Battery Charger Applications – Pass-Through Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	**2**	**3**	**4**
INPV	2013$ millions	76,791	76,740	76,740	76,322	71,407
Change in INPV	2013$ millions	-	(51)	(51)	(469)	(5,384)
	(%)	-	(0.1)	(0.1)	(0.6)	(7.0)
Product Conversion Costs	2013$ millions	-	11.5	11.5	90.1	280.5
Capital Conversion Costs	2013$ millions	-	1.8	1.8	25.6	67.3
Total Investment Required	2013$ millions	-	13.4	13.4	115.7	347.8

Table V-31 Manufacturer Impact Analysis for Product Class 2, 3, and 4 Battery Charger Applications – Constant Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	**2**	**3**	**4**
INPV	2013$ millions	76,791	76,650	76,650	75,392	62,307
Change in INPV	2013$ millions	-	(141)	(141)	(1,400)	(14,484)
	(%)	-	(0.2)	(0.2)	(1.8)	(18.9)
Product Conversion Costs	2013$ millions	-	11.5	11.5	90.1	280.5
Capital Conversion Costs	2013$ millions	-	1.8	1.8	25.6	67.3
Total Investment Required	2013$ millions	-	13.4	13.4	115.7	347.8

Taken together, PCs 2, 3, and 4 include the greatest number of applications and account for approximately 96 percent of all battery charger application shipments in 2018, the anticipated compliance year for new energy conservation standards.

TSL 1 and TSL 2 set the efficiency level at EL 1 for all product classes in this grouping. At TSL 1 and TSL 2, DOE estimates impacts on the change in INPV to range from -$141 million to -$10 million, or a change in INPV of -0.2 percent to less than -0.1 percent. At TSL 1 and TSL 2, industry free cash flow is estimated to decrease to $6,018 million, or a decrease of under one percent, compared to the no-standards case value of $6,024 million in 2017.

Percentage impacts on INPV are slightly negative at TSL 1 and TSL 2. DOE does not anticipate that most PC 2, 3, and 4 battery charger application manufacturers would lose a significant portion of their INPV at TSL 1 or TSL 2. DOE projects that in the expected year of compliance, 2018, 91 percent of all PC 2 battery charger applications, 94 percent of all PC 3 battery charger applications, and 94 percent of all PC 4 battery charger applications would meet or exceed the efficiency levels required at TSL 1 and TSL 2. Consequently, DOE expects conversion costs to be small at TSL 1 and TSL 2, approximately $13.4 million since so many applications already meet or exceed this requirement.

TSL 3 sets the efficiency level at EL 2 for all product classes in this grouping. At TSL 3, DOE estimates impacts on the change in INPV to range from -$1,400 million to -$17 million, or a change in INPV of -1.8 percent to less than -0.1 percent. At TSL 3, industry free cash flow is estimated to decrease to $5,973 million, or a decrease of 1 percent, compared to the no-standards case value of $6,024 million in 2017.

Percentage impacts on INPV are slightly negative at this TSL. DOE does not anticipate that most PC 2, 3, and 4 battery charger application manufacturers would lose a significant portion of their INPV at this TSL. DOE projects that in the expected year of compliance, 2018, 49 percent of all PC 2 battery charger applications, 60 percent of all PC 3 battery charger applications, and 86 percent of all PC 4 battery charger applications would meet or exceed the efficiency levels required at TSL 3. DOE expects conversion costs to increase from $13.4 million at TSL 1 and TSL 2 to $115.7 million at TSL 3. This represents a relatively modest amount compared to the no-standards case INPV of $76.8 billion and annual cash flow of $6.02 billion for PC 2, 3, and 4 battery charger applications.

TSL 4 sets the efficiency level at EL 3 for PCs 3 and 4 and EL 4 for PC 2. These efficiency levels represent max-tech for all the product classes in this grouping. At TSL 4, DOE estimates impacts on the change in INPV to range from -$14.48 billion to $499 million, or a change in INPV of -18.9 percent to 0.6 percent. At TSL 4, industry free cash flow is estimated to decrease to $5.87 billion, or a decrease of 3 percent, compared to the no-standards case value of $6.02 billion in 2017.

Percentage impacts on INPV range from moderately negative to slightly positive at TSL 4. DOE anticipates that some PC 2, 3, and 4 battery charger application manufacturers could lose a significant portion of their INPV at TSL 4. DOE projects that in the expected year of compliance, 2018, 25 percent of all PC 2 battery charger applications, 58 percent of all PC 3 battery charger applications, and 74 percent of all PC 4 battery charger applications would meet the efficiency levels required at TSL 4.

DOE expects conversion costs to significantly increase from $115.7 million at TSL 3 to $347.8 million at TSL 4. At TSL 4, the PC 2 battery charger MPC increases to $4.31 compared to the baseline MPC value of $1.16. This represents a small application price increase considering that the shipment-weighted average PC 2 battery charger application MPC is $127.73. For PC 3, the MPC increases to $5.51 compared to the baseline MPC value of $1.12. This estimate also represents a small application price increase since the shipment-weighted average PC 3 battery charger application MPC is $61.11. For PC 4, the battery charger MPC increases to $18.34 compared to the baseline battery charger MPC of $1.79. While DOE recognizes that this projected increase of $16.55 in the battery charger MPC from the baseline to the max-tech may seem significant, its impact is modest when compared to the shipment-weighted average PC 4 battery charger application MPC of $192.40 – in essence, it represents an 8.6 percent increase in the average battery charger application MPC.

These product classes also include a wide variety of applications, characterized by differing shipment volumes, no-standards case efficiency distributions, and MSPs. Because of this variety, this product class grouping, more than any other, requires a greater level of disaggregation to evaluate specific industry impacts. Presented only on a product class basis, industry impacts are effectively shipment-weighted and mask impacts on certain industry applications that vary substantially from the aggregate results. Therefore, in addition to the overall product class group results, DOE also presents results by industry subgroups—consumer electronics, power tools, and small appliances—in the pass-through scenario, which approximates the mid-point of the potential range of INPV impacts. These results highlight impacts at various TSLs.

As discussed in the previous section, these aggregated results can mask differentially-impacted industries and manufacturer subgroups. Nearly 90 percent of shipments in PCs 2, 3 and 4 fall under the broader consumer electronics category, with the remaining share split between small appliances and power tools. Consumer electronics applications have a much higher shipment-weighted average MPC ($147.29) than the other product categories ($58.32 for power tools and $43.63 for small appliances). Consequently, consumer electronics manufacturers are better able to absorb higher battery charger costs than small appliance and power tool manufacturers. Further, consumer electronics typically incorporate higher efficiency battery chargers already, while small appliances and power tool applications tend to cluster around baseline and EL 1 efficiencies. These factors lead to proportionally greater impacts on small appliance and power tool manufacturers in the event they are not able to pass on and markup higher battery charger costs.

Table V-32 through Table V-34 present INPV impacts in the pass-through markup scenario for consumer electronic, power tool, and small appliance applications, respectively. The results indicate manufacturers of power tools and small appliances would face disproportionately adverse impacts, especially at the higher TSLs, as compared to consumer electronics manufacturers and the overall product group's results (shown in Table V-29 through Table V-31), if they are not able to mark up the incremental product costs.

Table V-32 Manufacturer Impact Analysis for Product Class 2, 3, and 4 Battery Charger Applications – Pass-Through Markup Scenario – Consumer Electronics

	Units	No-Standards Case	Trial Standard Level			
			1	**2**	**3**	**4**
INPV	2013$ millions	73,840	73,805	73,805	73,511	69,568
Change in INPV	2013$ millions	-	(36)	(36)	(329)	(4,272)
	(%)	-	(0.0)	(0.0)	(0.4)	(5.8)
Product Conversion Costs	2013$ millions	-	10.2	10.2	77.6	242.2
Capital Conversion Costs	2013$ millions	-	1.7	1.7	20.0	56.3
Total Investment Required	2013$ millions	-	11.9	11.9	97.6	298.5

Table V-33 Manufacturer Impact Analysis for Product Class 2, 3, and 4 Battery Charger Applications – Pass-Through Markup Scenario – Power Tools

	Units	No-Standards Case	Trial Standard Level			
			1	**2**	**3**	**4**
INPV	2013$ millions	2,190	2,179	2,179	2,102	1,351
Change in INPV	2013$ millions	-	(11)	(11)	(88)	(839)
	(%)	-	(0.5)	(0.5)	(4.0)	(38.3)
Product Conversion Costs	2013$ millions	-	0.9	0.9	7.3	22.3
Capital Conversion Costs	2013$ millions	-	0.0	0.0	3.3	5.5
Total Investment Required	2013$ millions	-	1.0	1.0	10.6	27.8

Table V-34 Manufacturer Impact Analysis for Product Class 2, 3, and 4 Battery Charger Applications – Pass-Through Markup Scenario – Small Appliances

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	761	756	756	709	487
Change in INPV	2013$ millions	-	(5)	(5)	(52)	(273)
	(%)	-	(0.6)	(0.6)	(6.8)	(35.9)
Product Conversion Costs	2013$ millions	-	0.4	0.4	5.1	16.0
Capital Conversion Costs	2013$ millions	-	0.1	0.1	2.4	5.5
Total Investment Required	2013$ millions	-	0.5	0.5	7.5	21.5

Product Classes 5 and 6

The following tables (Table V-35 through Table V-38) summarize information related to the analysis performed to project the potential impacts on manufacturers of devices falling into PCs 5 and 6.

Table V-35 Applications in Product Classes 5 and 6

Product Class 5	Product Class 6
Marine/Automotive/RV Chargers	Electric Scooters
Mobility Scooters	Lawn Mowers
Toy Ride-On Vehicles	Motorized Bicycles
Wheelchairs	Wheelchairs

Table V-36 Manufacturer Impact Analysis for Product Class 5 and 6 Battery Charger Applications – Flat Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	1,493	1,493	1,493	2,065	2,065
Change in INPV	2013$ millions	-	0	0	572	572
	(%)	-	0.0	0.0	38.3	38.3
Product Conversion Costs	2013$ millions	-	0.0	1.1	33.1	33.1
Capital Conversion Costs	2013$ millions	-	0.0	0.2	6.4	6.4
Total Investment Required	2013$ millions	-	0.0	1.3	39.6	39.6

Table V-37 Manufacturer Impact Analysis for Product Class 5 and 6 Battery Charger Applications – Pass-Through Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	1,493	1,491	1,370	878	878
Change in INPV	2013$ millions	-	(2)	(123)	(615)	(615)
	(%)	-	(0.2)	(8.2)	(41.2)	(41.2)
Product Conversion Costs	2013$ millions	-	0.0	1.1	33.1	33.1
Capital Conversion Costs	2013$ millions	-	0.0	0.2	6.4	6.4
Total Investment Required	2013$ millions	-	0.0	1.3	39.6	39.6

Table V-38 Manufacturer Impact Analysis for Product Class 5 and 6 Battery Charger Applications – Constant Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	1,493	1,486	1,145	586	586
Change in INPV	2013$ millions	-	(7)	(348)	(907)	(907)
	(%)	-	(0.5)	(23.3)	(60.8)	(60.8)
Product Conversion Costs	2013$ millions	-	0.0	1.1	33.1	33.1
Capital Conversion Costs	2013$ millions	-	0.0	0.2	6.4	6.4
Total Investment Required	2013$ millions	-	0.0	1.3	39.6	39.6

Product Classes 5 and 6 together comprise seven unique applications. Toy ride-on vehicles represent over 70 percent of the Product Class 5 and 6 shipments. DOE found that all PC 5 and 6 shipments are at either EL 1 or EL 2. The battery charger cost associated with each EL is the same for PC 5 and 6 applications, but the energy usage profiles are different.

TSL 1 sets the efficiency level at EL 1 for Product Classes 5 and 6. At TSL 1, DOE estimates impacts on the change in INPV to range from -$7 million to no change at all, or a change in INPV of -0.5 percent to no change at all. At TSL 1, industry free cash flow is estimated to remain at $117 million in 2017.

Percentage impacts on INPV range from slightly negative to unchanged at TSL 1. DOE does not anticipate that PC 5 and 6 battery charger application manufacturers would lose a significant portion of their INPV at TSL 1. DOE projects that in the expected year of compliance, 2018, all PC 5 and 6 battery charger applications would meet or exceed the efficiency levels required at TSL 1. Consequently, DOE does not expect there to be any conversion costs at TSL 1.

TSL 2 sets the efficiency level at EL 2 for PCs 5 and 6. At TSL 2, DOE estimates impacts on the change in INPV to range from -$348 million to less than one million dollars, or a change in INPV of -23.3 percent to less than 0.1 percent. At TSL 2, industry free cash flow is estimated to decrease to $117 million, or a decrease of less than one percent, compared to the no-standards case value of $117 million in 2017.

Percentage impacts on INPV range from moderately negative to slightly positive at TSL 2. DOE projects that in the expected year of compliance, 2018, 95 percent of all PC 5 battery charger applications and 95 percent of all PC 6 battery charger applications would meet or exceed the efficiency levels required at TSL 2. DOE expects conversion costs to slightly increase to $1.3 million at TSL 2.

TSL 3 and TSL 4 set the efficiency level at EL 3 for PCs 5 and 6. This efficiency level represents max-tech for PCs 5 and 6. At TSL 3 and TSL 4, DOE estimates impacts on the change in INPV to range from -$907 million to $572 million, or a change in INPV of -60.8 percent to 38.3 percent. At TSL 3 and TSL 4, industry free cash flow is estimated to decrease to $100 million, or a decrease of 15 percent, compared to the no-standards case value of $117 million in 2017.

Percentage impacts on INPV range from significantly negative to significantly positive at TSL 3 and TSL 4. This large INPV range is related to the significant increase in battery charger MPC required at TSL 3 and TSL 4. DOE believes that as MPC significantly increases manufacturers will have greater difficulty in marking up prices to reflect these incremental costs. This would imply that the negative INPV impact is a more realistic scenario than the positive INPV impact scenario. DOE anticipates that most PC 5 and 6 battery charger application manufacturers could lose a significant portion of their INPV at TSL 3 and TSL 4. DOE projects that in the expected year of compliance, 2018, no PC 5 or 6 battery charger applications would meet the efficiency levels required at TSL 3 and TSL 4. DOE expects conversion costs to significantly increase from $1.3 million at TSL 2 to $39.6 million at TSL 3 and TSL 4. At TSL 3 and TSL 4, the PC 5 and 6 battery charger MPC increases to $127.00 compared to the baseline battery charger MPC value of $18.48. This represents a huge application price increase considering that the shipment-weighted average PC 5 and 6 battery charger application MPC in the no-new standards case is $131.14 and $262.21 respectively.

<u>Product Class 7</u>

The following tables (Table V-39 through Table V-42) summarize information related to the analysis performed to project the potential impacts on manufacturers of devices falling into PC 7.

Table V-39 Applications in Product Class 7

Product Class 7
Golf Cars

Table V-40 Manufacturer Impact Analysis for Product Class 7 Battery Charger Applications – Flat Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	1,124	1,116	1,116	1,143	1,143
Change in INPV	2013$ millions	-	(8)	(8)	20	20
	(%)	-	(0.7)	(0.7)	1.7	1.7
Product Conversion Costs	2013$ millions	-	1.3	1.3	3.3	3.3
Capital Conversion Costs	2013$ millions	-	0.4	0.4	1.8	1.8
Total Investment Required	2013$ millions	-	1.7	1.7	5.1	5.1

Table V-41 Manufacturer Impact Analysis for Product Class 7 Battery Charger Applications – Pass-Through Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	1,124	1,134	1,134	1,091	1,091
Change in INPV	2013$ millions	-	11	11	(32)	(32)
	(%)	-	0.9	0.9	(2.9)	(2.9)
Product Conversion Costs	2013$ millions	-	1.3	1.3	3.3	3.3
Capital Conversion Costs	2013$ millions	-	0.4	0.4	1.8	1.8
Total Investment Required	2013$ millions	-	1.7	1.7	5.1	5.1

Table V-42 Manufacturer Impact Analysis for Product Class 7 Battery Charger Applications – Constant Markup Scenario

	Units	No-Standards Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ millions	1,124	1,168	1,168	998	998
Change in INPV	2013$ millions	-	44	44	(126)	(126)
	(%)	-	3.9	3.9	(11.2)	(11.2)
Product Conversion Costs	2013$ millions	-	1.3	1.3	3.3	3.3
Capital Conversion Costs	2013$ millions	-	0.4	0.4	1.8	1.8
Total Investment Required	2013$ millions	-	1.7	1.7	5.1	5.1

Golf cars are the only application in PC 7. Approximately 80 percent of the market incorporates baseline battery charger technology – the remaining 20 percent employs technology that meets the efficiency requirements at EL 1. The cost of a battery charger in PC 7, though higher relative to other product classes, remains a small portion of the overall selling price of a golf car. This analysis, however, focuses on the application manufacturer (OEM). DOE identified one small U.S. manufacturer of golf car battery chargers. The impacts of standards on small businesses is addressed in the Regulatory Flexibility Analysis (see section VII.B for the results of that analysis).

TSL 1 and TSL 2 set the efficiency level at EL 1 for PC 7. At TSL 1 and TSL 2, DOE estimates impacts on the change in INPV to range from -$8 million to $44 million, or a change in INPV of -0.7 percent to 3.9 percent. At TSL 1 and TSL 2, industry free cash flow is estimated to decrease to $87 million, or a decrease of 1 percent, compared to the no-standards case value of $88 million in 2017.

Percentage impacts on INPV range from slightly negative to slightly positive at TSL 1 and TSL 2. DOE does not anticipate that PC 7 battery charger application manufacturers, the golf car manufacturers, would lose a significant portion of their INPV at this TSL. DOE projects that in the expected year of compliance, 2018, 20 percent of all PC 7 battery charger applications would meet or exceed the efficiency levels required at TSL 1 and TSL 2. DOE expects conversion costs to be $1.7 million at TSL 1 and TSL 2.

TSL 3 and TSL 4 set the efficiency level at EL 2 for PC 7. This represents max-tech for PC 7. At TSL 3 and TSL 4, DOE estimates impacts on the change in INPV to range from -$126 million to $20 million, or a change in INPV of -11.2 percent to 1.7 percent. At TSL 3 and TSL 4, industry free cash flow is estimated to decrease to $86 million, or a decrease of 3 percent, compared to the no-standards case value of $88 million in 2017.

Percentage impacts on INPV range from moderately negative to slightly positive at TSL 3 and TSL 4. DOE projects that in the expected year of compliance, 2018, no PC 7 battery charger applications would meet the efficiency levels required at TSL 3 and TSL 4. DOE expects conversion costs to increase from $1.7 million at TSL 1 and TSL 2 to $5.1 million at TSL 3 and TSL 4. This represents a relatively modest amount compared to the no-standards case INPV of $1,124 million and annual cash flow of $88 million for PC 7 battery charger applications. At TSL 3 and TSL 4 the battery charger MPC increases to $164.14 compared to the baseline battery charger MPC value of $88.07. This change represents only a moderate increase in the application price since the shipment-weighted average application MPC is $2,608.09.

b. Impacts on Employment

DOE attempted to quantify the number of domestic workers involved in battery charger production. Based on manufacturer interviews and reports from vendors such as Hoovers, Dun and Bradstreet, and Manta, the vast majority of all small appliance and consumer electronic applications are manufactured abroad. When looking specifically at the battery charger component, which is typically designed by the application manufacturer but sourced for production, the same dynamic holds to an even greater extent. That is, in the rare instance when an application's production occurs domestically, it is very likely that the battery charger component is still produced and sourced overseas. For example, DOE identified several power tool applications with some level of domestic manufacturing. However, based on more detailed information obtained during interviews, DOE believes the battery charger components for these applications are sourced from abroad.

Also, DOE was able to find a few manufacturers of medium and high-power applications with facilities in the U.S. However, only a limited number of these companies produce battery chargers domestically for these applications. Therefore, based on manufacturer interviews and DOE's research, DOE believes that golf cars are the only application with U.S.-based battery charger manufacturing. Any change in U.S. production employment due to new battery charger energy conservation standards is likely to come from changes involving these particular products

At the adopted efficiency levels, domestic golf car manufacturers will need to decide whether to attempt to manufacture more efficient battery chargers in-house and try to compete with a greater level of vertical integration than their competitors, move production to lower-wage regions abroad, or outsource their battery charger manufacturing. Based on available data, DOE believes one of the latter two strategies would be more likely for domestic golf car manufacturers. DOE describes the major implications for golf car employment in section VII.B because the major domestic manufacturer is also a small business manufacturer. DOE does not anticipate any major negative changes in the domestic employment of the design, technical support, or other departments of battery charger application manufacturers located in the U.S. in response to new energy conservation standards. Standards may require some companies to redesign their battery chargers, change marketing literature, and train some technical and sales support staff. However, during interviews, manufacturers, when asked if their domestic employment levels would change due to new standards, generally agreed these changes would not lead to positive or negative changes in employment, outside of the golf car battery charger industry.

c. Impacts on Manufacturing Capacity

DOE does not anticipate that the standards adopted by this final rule would adversely impact manufacturer capacity. The battery charger application industry is characterized by rapid product development lifecycles. DOE believes a compliance date of two years after the publication of the final rule would provide sufficient time for manufacturers to ramp up capacity to meet the adopted standards for battery chargers.

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop an industry cash-flow estimate is not adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. DOE addressed manufacturer subgroups in the MIA, by breaking out manufacturers by application grouping (consumer electronics, small appliances, power tools, and high energy application). Because certain application groups are disproportionately impacted compared to the overall product class groupings, DOE reports those manufacturer application group results individually so they can be considered as part of the overall MIA. For the results of this manufacturer subgroup, see section V.B.2.a.

DOE also identified small businesses as a manufacturer subgroup that could potentially be disproportionally impacted. DOE discusses the impacts on the small business subgroup in the regulatory flexibility analysis, section VI.B.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the regulatory actions of other Federal agencies and States that affect the manufacturers of a covered product or equipment. DOE believes that 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 recent or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to product efficiency.

For the cumulative regulatory burden analysis, DOE looks at other regulations that could affect battery charger application manufacturers that will take effect approximately three years before or after the compliance date of new energy conservation standards for these products. The compliance years and expected industry conversion costs of relevant new energy conservation standards are indicated in Table V-43.

Table V-43 Other DOE Regulations Potentially Affecting Battery Charger Application Manufacturers

Federal Energy Conservation Standards	Approximate Compliance Date	Estimated Total Industry Conversion Expense
External Power Supplies 79 FR 7846 (February 10, 2014)	2016	$43.4 million (2012$)
Computer and Battery Backup Systems	2019*	N/A†

* The dates listed are an approximation. The exact dates are pending final DOE action.
† For energy conservation standards for rulemakings awaiting DOE final action, DOE does not have a finalized estimated total industry conversion cost.

DOE is aware that the CEC already has energy conservation standards in place for battery chargers. As of the compliance date for the standards established in this rule is reached, the CEC standards will be preempted. Therefore, DOE did not consider the CEC standards as contributing to the cumulative regulatory burden of this rulemaking.

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings attributable to potential standards for battery chargers, DOE compared their energy consumption under the no-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 new standards (2018-2047). Table V-44 and Table V-45 present DOE’s projections of the national energy savings for each TSL considered for battery chargers. The savings were calculated using the approach described in section IV.H of this document.

Table V-44 Battery Chargers: Cumulative Primary National Energy Savings for Products Shipped in 2018–2047 (quads)

Product Class	Trial Standard Level			
	1	2	3	4
1	0.004	0.048	0.048	0.086
2, 3, 4	0.088	0.088	0.311	0.428
5, 6	0.000	0.017	0.132	0.132
7	0.012	0.012	0.027	0.027

Table V-45 Battery Chargers: Cumulative FFC National Energy Savings for Products Shipped in 2018–2047 (quads)

Product Class	Trial Standard Level			
	1	2	3	4
1	0.004	0.050	0.050	0.090
2, 3, 4	0.092	0.092	0.325	0.448
5, 6	0.000	0.018	0.138	0.138
7	0.013	0.013	0.028	0.028

OMB Circular A-4[61] 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 nine, rather than 30, years of product shipments. The choice of a nine-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.[62] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product

61 U.S. Office of Management and Budget, "Circular A-4: Regulatory Analysis" (Sept. 17, 2003) (Available at: http://www.whitehouse.gov/omb/circulars_a004_a-4/).

62 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 consumer products, the compliance period is 5 years rather than 3 years.

manufacturing cycles, or other factors specific to battery chargers. 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 nine-year analytical period are presented in Table V-46. The impacts are counted over the lifetime of battery chargers purchased in 2018–2026.

Table V-46 Battery Chargers: Cumulative FFC National Energy Savings for Products Shipped in 2018–2026 (quads)

Product Class	Trial Standard Level			
	1	2	3	4
1	0.001	0.015	0.015	0.027
2, 3, 4	0.028	0.028	0.098	0.136
5, 6	0.000	0.005	0.041	0.041
7	0.004	0.004	0.008	0.008

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 battery chargers. In accordance with OMB's guidelines on regulatory analysis,[63] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V-47 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2018–2047.

[63] U.S. Office of Management and Budget, "Circular A-4: Regulatory Analysis," section E, (Sept. 17, 2003) (Available at: http://www.whitehouse.gov/omb/circulars_a004_a-4/).

Table V-47 Battery Chargers: Cumulative Net Present Value of Consumer Benefits for Products Shipped in 2018–2047 (2013$ billions)

Discount Rate	Trial Standard Level			
	1	**2**	**3**	**4**
		Billion 2013$		
3 percent	0.9	1.2	-16.2	-47.9
7 percent	0.5	0.6	-9.5	-27.9

The NPV results based on the aforementioned 9-year analytical period are presented in Table V-48. The impacts are counted over the lifetime of products purchased in 2018–2026. 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-48 Battery Chargers: Cumulative Net Present Value of Consumer Benefits for Products Shipped in 2018–2026 (2013$ billions)

Discount Rate	Trial Standard Level			
	1	**2**	**3**	**4**
	Billion 2013$			
3 percent	0.3	0.4	-6.2	-18.1
7 percent	0.2	0.3	-4.8	-14.1

c. Indirect Impacts on Employment

DOE expects energy conservation standards for battery chargers to reduce energy bills 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 in this rulemaking. 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, 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

Based on testing conducted in support of this rule, DOE has concluded that the standards adopted in this final rule would not reduce the utility or performance of the battery chargers under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the adopted standards. DOE has also declined to adopt battery charger marking requirements as part of this final rule, providing manufacturers with more flexibility in the way that they design, label, and market their products.

5. Impact of Any Lessening of Competition

DOE has also considered any lessening of competition this is likely to result from the adopted standards. The Attorney General of the United States (Attorney General) determines the impact, if any, of any lessening of competition likely to result from a proposed standard and is required 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)(i)(V) and (B)(ii))

To assist the Attorney General in making this determination, DOE provided the Department of Justice ("DOJ") with copies of the SNOPR and the accompanying SNOPR TSD for review. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for battery chargers 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-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from standards for battery chargers is expected to yield environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases. Table V-49 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The table includes both power sector emissions and upstream emissions. The emissions were calculated using the multipliers discussed in section IV.K. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD. The energy conservation standards established by this rule are economically justified under EPCA with regard to the added benefits achieved through reduced emissions of air pollutants and greenhouse gases.

Table V-49 Battery Chargers: Cumulative Emissions Reduction for Products Shipped in 2018- 2047

	Trial Standard Level			
	1	2	3	4
Power Sector Emissions				
CO_2 (million metric tons)	6.49	10.25	32.08	41.78
SO_2 (thousand tons)	4.10	6.48	20.29	26.44
NO_X (thousand tons)	7.02	11.09	34.68	45.16
Hg (tons)	0.015	0.024	0.075	0.098
CH_4 (thousand tons)	0.582	0.919	2.877	3.749
N_2O (thousand tons)	0.083	0.131	0.409	0.533
Upstream Emissions				
CO_2 (million metric tons)	0.342	0.542	1.697	2.209
SO_2 (thousand tons)	0.064	0.102	0.318	0.415
NO_X (thousand tons)	4.89	7.75	24.26	31.57
Hg (tons)	0.000	0.000	0.001	0.001
CH_4 (thousand tons)	27.0	42.7	133.8	174.1
N_2O (thousand tons)	0.003	0.005	0.016	0.021
Total FFC Emissions				
CO_2 (million metric tons)	6.83	10.79	33.77	43.99
SO_2 (thousand tons)	4.17	6.58	20.61	26.86
NO_X (thousand tons)	11.91	18.83	58.94	76.73
Hg (tons)	0.015	0.024	0.076	0.099
CH_4 (thousand tons)	27.6	43.6	136.6	177.8
CH_4 (thousand tons CO_2eq)*	772	1222	3826	4979
N_2O (thousand tons)	0.086	0.136	0.424	0.553
N_2O (thousand tons CO_2eq)*	22.7	35.9	112.5	146.6

* CO_2eq is the quantity of CO_2 that would have the same GWP.

As part of the analysis for this rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the considered TSLs for battery chargers. As discussed in section IV.L of this document, for CO_2, DOE used recent values for the SCC developed by an interagency process. The four sets of SCC values for CO_2 emissions reductions in 2015 resulting from that process (expressed in 2013$) are represented by $12.2/metric ton (the average value from a distribution that uses a 5-percent discount rate), $40.0/metric ton (the average value from a distribution that uses a 3-percent discount rate), $62.3/metric ton (the average value from a distribution that uses a 2.5-percent discount rate), and $117/metric ton (the 95th-percentile value from a distribution that uses a 3-percent discount rate). The values for later years are higher due to increasing damages (public health, economic and environmental) as the projected magnitude of climate change increases.

Table V-50 presents the global value of CO_2 emissions reductions at each TSL. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. 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-50 Battery Chargers: Estimates of Global Present Value of CO_2 Emissions Reduction for Products Shipped in 2018–2047

TSL	SCC Case*			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
	Million 2013$			
Power Sector Emissions				
1	51.9	223.6	350.4	676.9
2	81.5	351.9	551.8	1065.8
3	254.2	1099.4	1724.3	3329.9
4	331.4	1432.8	2246.9	4339.5
Upstream Emissions				
1	2.7	11.6	18.3	35.3
2	4.2	18.4	28.9	55.7
3	13.1	57.4	90.2	174.2
4	17.1	74.8	117.5	226.8
Total FFC Emissions				
1	54.6	235.3	368.7	712.2
2	85.7	370.3	580.6	1121.5
3	267.3	1156.8	1814.5	3504.1
4	348.6	1507.6	2364.4	4566.3

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.2, $40.0, $62.3, and $117 per metric ton (2013$).

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. However, 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 and analyses resulting from the interagency review process.

DOE also estimated the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from the considered TSLs for battery chargers. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V-51 presents the cumulative present values for NO_X emissions for each TSL calculated using 7-percent and 3-percent discount rates. This table presents values that use the low dollar-per-ton values, which reflect DOE's primary estimate. Results that reflect the range of NO_X dollar-per-ton values are presented in Table V.53.

Table V-51 Battery Chargers: Estimates of Present Value of NO_X Emissions Reduction for Products Shipped in 2018–2047

TSL	3% discount rate	7% discount rate
	Million 2013$	
Power Sector Emissions		
1	15.7	8.0
2	24.6	12.5
3	76.7	38.8
4	99.9	50.6
Upstream Emissions		
1	10.8	5.4
2	17.0	8.4
3	52.9	26.0
4	69.0	33.9
Total FFC Emissions		
1	26.5	13.4
2	41.6	20.8
3	129.6	64.8
4	168.9	84.6

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. As for those particular battery chargers that DOE is declining to regulate at this time, the reasons underlying that decision are discussed above.

8. Summary of National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the consumer savings calculated for each TSL considered in this rulemaking. Table V-52 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of consumer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and 3-percent discount rate. The CO_2 values used in the columns of each table correspond to the four sets of SCC values discussed above.

Table V-52 Battery Chargers: Net Present Value of Consumer Savings Combined with Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions

TSL	Consumer NPV at 3% Discount Rate added with:			
	SCC Case $12.2/t and 3% Low NO_X Values	SCC Case $40.0/t and 3% Low NO_X Values	SCC Case $62.3/t and 3% Low NO_X Values	SCC Case $117/t and 3% Low NO_X Values
	Billion 2013$			
1	0.9	1.1	1.3	1.6
2	1.3	1.6	1.8	2.4
3	-15.8	-14.9	-14.3	-12.6
4	-47.4	-46.3	-45.4	-43.2
TSL	Consumer NPV at 7% Discount Rate added with:			
	SCC Case $12.2/t and 7% Low NO_X Values	SCC Case $40.0/t and 7% Low NO_X Values	SCC Case $62.3/t and 7% Low NO_X Values	SCC Case $117/t and 7% Low NO_X Values
	Billion 2013$			
1	0.5	0.7	0.8	1.2
2	0.7	1.0	1.2	1.8
3	-9.2	-8.3	-7.7	-6.0
4	-27.5	-26.3	-25.5	-23.3

In considering the above results, two issues are relevant. First, the national operating cost savings are domestic U.S. monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in

2018 to 2047. Because CO_2 emissions have a very long residence time in the atmosphere,[64] the SCC values in future years reflect future climate-related impacts that continue beyond 2100.

C. Conclusion

When considering standards, the new or amended energy conservation 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 battery chargers 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.

[64] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ, "Correction to 'Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming,'" J. Geophys. Res. 110. pp. D14105 (2005).

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 regulatory option 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.[65]

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.[66] 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.

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[65] P.C. Reiss and M.W. White, Household Electricity Demand, Revisited, Review of Economic Studies (2005) 72, 853–883.

[66] Alan Sanstad, Notes on the Economics of Household Energy Consumption and Technology Choice. Lawrence Berkeley National Laboratory (2010) (Available online at: http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf).

1. Benefits and Burdens of TSLs Considered for Battery Charger Standards

Table V-53 and Table V-54 summarize the quantitative impacts estimated for each TSL for battery chargers. The efficiency levels contained in each TSL are described in section V.B of this document.

Table V-53 Battery Chargers: Summary of National Impacts

Category	**TSL 1**	**TSL 2**	**TSL 3**	**TSL 4**
Cumulative FFC Energy Savings quads				
	0.109	0.173	0.540	0.703
NPV of Consumer Costs and Benefits 2013$ billion				
3% discount rate	0.9	1.2	-16.2	-47.9
7% discount rate	0.5	0.6	-9.5	-27.9
Cumulative FFC Emissions Reduction				
CO_2 million metric tons	6.83	10.79	33.77	43.99
SO_2 thousand tons	4.17	6.58	20.61	26.86
NO_X thousand tons	11.91	18.83	58.94	76.73
Hg tons	0.015	0.024	0.076	0.099
CH_4 thousand tons	27.6	43.6	136.6	177.8
CH_4 thousand tons CO_2eq*	772	1222	3826	4979
N_2O thousand tons	0.086	0.136	0.424	0.553
N_2O thousand tons CO_2eq*	22.7	35.9	112.5	146.6
Value of Emissions Reduction				
CO_2 2013$ billion**	0.055 to 0.712	0.086 to 1.121	0.267 to 3.504	0.349 to 4.566
NO_X – 3% discount rate 2013$ million	26.5 to 60.4	41.6 to 94.7	129.6 to 295.4	168.9 to 385.1
NO_X – 7% discount rate 2013$ million	13.4 to 30.3	20.8 to 47.0	64.8 to 146.0	84.6 to 190.7

Parentheses indicate negative (-) values.

* CO_2eq is the quantity of CO_2 that would have the same 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-54 Battery Chargers: Summary of Manufacturer and Consumer Impacts

Category	TSL 1*	TSL 2*	TSL 3*	TSL 4*
Manufacturer Impacts				
Industry NPV (2013$ million) (No-standards case INPV = 79,904)	79,782 – 79,887	79,375 – 79,887	77,387 – 80,479	64,012 – 81,017
Industry NPV (% change)	(0.2) - (0.0)	(0.7) - (0.0)	(3.2) - 0.7	(19.9) - 1.4
Consumer Average LCC Savings (2013$)				
PC 1 - Low E, Inductive*	0.08	0.71	0.71	(3.44)
PC 2 - Low E, Low-Voltage	0.07	0.07	0.06	(2.79)
PC 3 - Low E, Medium-Voltage	0.08	0.08	(1.36)	(2.17)
PC 4 - Low E, High-Voltage	0.11	0.11	(0.38)	(4.91)
PC 5 - Medium E, Low-Voltage*	0.00	0.84	(138.63)	(138.63)
PC 6 - Medium E, High-Voltage*	0.00	1.89	(129.15)	(129.15)
PC 7 - High E	51.06	51.06	(80.05)	(80.05)
Consumer Simple PBP (years)				
PC 1 - Low E, Inductive*	1.1	1.5	1.5	7.4
PC 2 - Low E, Low-Voltage	0.6	0.6	2.5	19.5
PC 3 - Low E, Medium-Voltage	0.8	0.8	21.6	31.2
PC 4 - Low E, High-Voltage	1.4	1.4	5.2	20.7
PC 5 - Medium E, Low-Voltage*	2.3	2.7	29.1	29.1
PC 6 - Medium E, High-Voltage*	1.0	1.1	12.5	12.5
PC 7 - High E	0.0	0.0	8.1	8.1
% of Consumers that Experience Net Cost				
PC 1 - Low E, Inductive*	0.0	0.0	0.0	96.3
PC 2 - Low E, Low-Voltage	1.2	1.2	33.1	73.8
PC 3 - Low E, Medium-Voltage	0.6	0.6	39.0	40.8
PC 4 - Low E, High-Voltage	1.3	1.3	12.6	25.8
PC 5 - Medium E, Low-Voltage*	0.0	0.6	99.7	99.7
PC 6 - Medium E, High-Voltage*	0.0	0.0	100.0	100.0
PC 7 - High E	0.0	0.0	100.0	100.0

* Parentheses indicate negative (-) values.

DOE first considered TSL 4, which represents the max-tech efficiency levels. TSL 4 would save 0.703 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be -$27.9 billion using a discount rate of 7 percent, and -$47.9 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 43.99 Mt of CO_2, 76.73 thousand tons of NO_X, 26.86 thousand tons of SO_2, 0.099 ton of Hg, 177.8 thousand tons of CH_4, and 0.553 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 4 ranges from $0.349 billion to $4.566 billion.

At TSL 4, the average LCC impact is a cost of $3.44 for PC 1, $2.79 for PC 2, $2.17 for PC 3, $4.91 for PC 4, $138.63 for PC 5, $129.15 for PC 6, and $80.05 for PC 7. The simple payback period is 7.4 years for PC 1, 19.5 years for PC 2, 31.2 years for PC 3, 20.7 years for PC 4, 29.1 years for PC 5, 12.5 years for PC 6, and 8.1 years for PC 7. The fraction of consumers experiencing a net LCC cost is 96.3 percent for PC 1, 73.8 percent for PC 2, 40.8 percent for PC 3, 25.8 percent for PC 4, 99.7 percent for PC 5, 100 percent for PC 6, and 100 percent for PC 7.

At TSL 4, the projected change in INPV ranges from a decrease of $15,892 million to an increase of $1,113 million, equivalent to -19.9 percent and 1.4 percent, respectively.

The Secretary concludes that at TSL 4 for battery chargers, the benefits of energy savings, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the economic burden on consumers (demonstrated by a negative NPV and LCC for all product classes), and the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a large reduction in INPV. Consequently, the Secretary has concluded that TSL 4 is not economically justified.

DOE then considered TSL 3. TSL 3 would save 0.540 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be -$9.5 billion using a discount rate of 7 percent, and -$16.2 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 33.77 Mt of CO_2, 58.94 thousand tons of NO_X, 20.61 thousand tons of SO_2, 0.076 ton of Hg, 136.6 thousand tons of CH_4, and 0.424 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 3 ranges from $0.267 billion to $3.504 billion.

At TSL 3, the average LCC impact is a savings of $0.71 for PC 1 and $0.06 for PC 2, and a cost of $1.36 for PC 3, $0.38 for PC 4, $138.63 for PC 5, $129.15 for PC 6, and $80.05 for PC 7. The simple payback period is 1.5 years for PC 1, 2.5 years for PC 2, 21.6 years for PC 3, 5.2 years for PC 4, 29.1 years for PC 5, 12.5 years for PC 6, and 8.1 years for PC 7. The fraction of consumers experiencing a net LCC cost is 0.0 percent for PC 1, 33.1 percent for PC 2, 39.0 percent for PC 3, 12.6 percent for PC 4, 99.7 percent for PC 5, 100 percent for PC 6, and 100 percent for PC 7.

At TSL 3, the projected change in INPV ranges from a decrease of $2,517 million to an increase of $574 million, equivalent to -3.2 percent and 0.7 percent, respectively.

The Secretary concludes that at TSL 3 for battery chargers, the benefits of energy savings, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the economic burden on consumers (demonstrated by a negative NPV and LCC for most product classes), and the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a large reduction in INPV. Consequently, the Secretary has concluded that TSL 3 is not economically justified.

DOE then considered TSL 2. TSL 2 would save 0.173 quads of energy, an amount DOE considers significant. Under TSL 2, the NPV of consumer benefit would be $0.6 billion using a discount rate of 7 percent, and $1.2 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 10.79 Mt of CO_2, 18.83 thousand tons of NO_X, 6.58 thousand tons of SO_2, 0.024 ton of Hg, 43.6 thousand tons of CH_4, and 0.136 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 2 ranges from $0.086 billion to $1.121 billion.

At TSL 2, the average LCC impact is a savings of $0.71 for PC 1, $0.07 for PC 2, $0.08 for PC 3, $0.11 for PC 4, $0.84 for PC 5, $1.89 for PC 6, and $51.06 for PC 7. The simple payback period is 1.5 years for PC 1, 0.6 years for PC 2, 0.8 years for PC 3, 1.4 years for PC 4, 2.7 years for PC 5, 1.1 years for PC 6, and 0.0 years for PC 7. The fraction of consumers experiencing a net LCC cost is 0.0 percent for PC 1, 1.2 percent for PC 2, 0.6 percent for PC 3, 1.3 percent for PC 4, 0.6 percent for PC 5, 0.0 percent for PC 6, and 0.0 percent for PC 7.

At TSL 2, the projected change in INPV ranges from a decrease of $529 million to a decrease of $18 million, equivalent to -0.7 percent and less than -0.1 percent, respectively.

The Secretary concludes that at TSL 2 for battery chargers, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the CO_2 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 for manufacturers.

After considering the analysis and the benefits and burdens of TSL 2, the Secretary concludes that this TSL will offer the maximum improvement in efficiency that is technologically feasible and economically justified, and will result in the significant conservation of energy. Therefore, based on the above considerations, DOE is adopting energy conservation standards for battery chargers at TSL 2. The energy conservation standards for battery chargers are shown in Table V-55.

Table V-55 Adopted Energy Conservation Standards for Battery Chargers

Product Class	Description	Maximum Unit Energy Consumption (kWh/yr)
1	Low-Energy, Inductive	3.04
2	Low-Energy, Low-Voltage	0.1440* E_{batt} + 2.95
3	Low-Energy, Medium-Voltage	For E_{batt} < 10Wh, UEC = 1.42 kWh/y E_{batt} ≥ 10 Wh, UEC = 0.0255 * E_{batt} + 1.16
4	Low-Energy, High-Voltage	=0.11 * E_{batt} + 3.18
5	Medium-Energy, Low-Voltage	0.0257 * E_{batt} + .815
6	Medium-Energy, High-Voltage	0.0778 * E_{batt} + 2.4
7	High-Energy	= 0.0502(E_{batt}) + 4.53

2. Summary of 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 the sum of: (1) the annualized national economic value (expressed in 2013$) 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.[67]

Table V-56 shows the annualized values for battery chargers under TSL 2, expressed in 2013$. 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 SCC series corresponding to a value of $40.0/ton in 2015 (2013$)), the estimated cost of the adopted standards for battery chargers is $9 million per year in increased equipment costs, while the estimated benefits are $68 million per year in reduced equipment operating costs, $20 million per year in CO_2 reductions, and $1.92 million per year in reduced NO_X emissions. In this case, the net benefit amounts to $81 million per year.

Using a 3-percent discount rate for all benefits and costs and the average SCC series corresponding to a value of $40.0/ton in 2015 (in 2013$), the estimated cost of the adopted standards for battery chargers is $10 million per year in increased equipment costs, while the estimated annual benefits are $75 million in reduced operating costs, $20 million in CO_2 reductions, and $2.25 million in reduced NO_X emissions. In this case, the net benefit amounts to $88 million per year.

[67] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2014, 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 (2020, 2030, etc.), and then discounted the present value from each year to 2015. 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. 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.

Table V-56 Annualized Benefits and Costs of Adopted Standards (TSL 2) for Battery Chargers

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	68	68	69
	3%	75	74	76
CO_2 Reduction Monetized Value ($12.2/t case)**	5%	6	6	6
CO_2 Reduction Monetized Value ($40.0/t case)**	3%	20	20	20
CO_2 Reduction Monetized Value ($62.3/t case)**	2.5%	29	29	29
CO_2 Reduction Monetized Value ($117/t case)**	3%	61	61	61
NO_X Reduction Monetized Value†	7%	1.92	1.92	4.34
	3%	2.25	2.25	5.13
Total Benefits††	7% plus CO_2 range	76 to 131	76 to 131	80 to 134
	7%	90	90	94
	3% plus CO_2 range	83 to 138	83 to 137	87 to 142
	3%	97	97	101
Costs				
Consumer Incremental Product Costs	7%	9	9	6
	3%	10	10	6
Net Benefits				
Total††	7% plus CO_2 range	67 to 122	67 to 121	73 to 128
	7%	81	81	87
	3% plus CO_2 range	74 to 128	73 to 128	81 to 136
	3%	88	87	95

* This table presents the annualized costs and benefits associated with battery chargers shipped in 2018−2047. These results include benefits to consumers which accrue after 2047 from the products purchased in 2018−2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the AEO 2015 Reference case, Low Estimate, and High Estimate, respectively. Additionally, the High Benefits Estimates include a price trend on the incremental product costs.
** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor. The value for NOx is the average of high and low values found in the literature.
† DOE estimated the monetized value of NOx emissions reductions 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: http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.) See section IV.L.2 for further discussion. For DOE's Primary Estimate and Low Net Benefits Estimate, the agency used a national benefit-per-ton estimate for particulate matter emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski et al., 2009). For DOE's High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al., 2011), which are nearly two-and-a-half times larger than those from the ACS study.
†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with 3-percent discount rate ($40.0/t case). 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 battery chargers 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 appliances 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.

In addition, DOE has determined that this regulatory action is not a "significant regulatory action" under Executive Order 12866. Therefore, DOE did not present for review to the Office of Information and Regulatory Affairs (OIRA) in the OMB the draft rule and other documents prepared for this rulemaking, including a regulatory impact analysis (RIA).

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011. (76 FR 3281, Jan. 21, 2011) EO 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 and that net benefits are maximized.

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 rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order

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

1. Description of the Need for and Objectives of, the Rule

A description of the need for, and objectives of, the rule is set forth elsewhere in the preamble and not repeated here.

2. Description of Significant Issues Raised by Public Comment

DOE received no comments specifically on the initial regulatory flexibility analysis prepared for this rulemaking. Comments on the economic impacts of the rule are discussed elsewhere in the preamble and did not necessitate changes to the analysis required by the Regulatory Flexibility Act.

3. Description of Comments Submitted by the Small Business Administration

The Small Business Administration did not submit comments on DOE’s earlier proposal detailing the standards that DOE is adopting in this rule.

4. Description on Estimated Number of Small Entities Regulated

a. Methodology for Estimating the Number of Small Entities

For manufacturers of battery chargers, the 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. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at http://www.sba.gov/sites/default/files/files/Size_Standards_Table.pdf. Battery charger 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 for this category.

To estimate the number of companies that could be small business manufacturers of products covered by this rulemaking, DOE conducted a market survey using available public information to identify potential small battery charger manufacturers. DOE's research involved industry trade association membership directories, product databases, individual company websites, and the SBA's Small Business Database to create a list of every company that could potentially manufacture products covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers during manufacturer interviews and at previous DOE public meetings. DOE contacted companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered battery chargers. DOE screened out companies that did not offer products covered by this rulemaking, did not meet the definition of a "small business," or are foreign-owned and operated.

Based on this screening, DOE identified several companies that could potentially manufacture battery chargers covered by this rulemaking. DOE eliminated most of these companies from consideration as small business manufacturers based on a review of product literature and websites. When those steps yielded inconclusive information, DOE contacted the companies directly. As part of these efforts, DOE identified Lester Electrical, Inc. (Lincoln, Nebraska), a manufacturer of golf car battery chargers, as the only small business that appears to produce covered battery chargers domestically.

b. Manufacturer Participants

Before issuing the NOPR for this rulemaking, DOE contacted the potential small business manufacturers of battery chargers it had identified. One small business consented to being interviewed during the MIA interviews which were conducted prior to the publication of the NOPR. DOE also obtained information about small business impacts while interviewing large manufacturers.

c. Industry Structure

With respect to battery chargers, industry structure is typically defined by the characteristics of the industry of the application(s) for which the battery chargers are produced. In the case of the small business DOE identified, however, the battery charger itself is the product the small business produces. That is, the company does not also produce the applications with which the battery charger is intended to be used – in this case, battery chargers predominantly intended for golf cars (PC 7).

A high level of concentration exists in the market for battery chargers used for golf cars. Two golf car battery charger manufacturers account for the vast majority of the golf car battery charger market and each have a similar share. Both competitors in the golf car battery charger market are, in terms of the number of their employees, small entities: one is foreign-owned and operated, while the other is a domestic small business, as defined by SBA. Despite this concentration, there is considerable competition for three main reasons. First, each golf car battery charger manufacturer sells into a market that is almost as equally concentrated: three golf car manufacturers supply the majority of the golf cars sold domestically and none of them manufactures golf car battery chargers. Second, while there are currently only two major suppliers of golf car battery chargers to the domestic market, the constant prospect of potential entry from other foreign countries has ceded substantial buying power to the three golf car OEMs. Third, golf car manufacturers can choose not to build electric golf cars (eliminating the need for the battery charger) by opting to build gas-powered products. DOE examines a price elasticity sensitivity scenario for this in appendix 12-B of the final rule TSD to assess this possibility. Currently, roughly three-quarters of the golf car market is electric-based, with the remainder gas-powered.

The majority of industry shipments flow to the "fleet" segment -- i.e., battery chargers sold to golf car manufacturers who then lease the cars to golf courses. Most cars are leased for the first few years before being sold to smaller golf courses or other individuals for personal use. A smaller portion of golf cars are sold as new through dealer distribution.

Further upstream, approximately half of the battery chargers intended for golf car use is manufactured domestically, while the other half is foreign-sourced. During the design cycle of the golf car, the battery charger supplier and OEM typically work closely together when designing the battery charger.

The small business manufacturer is also a relatively smaller player in the markets for wheelchair and industrial lift battery chargers. Most wheelchair battery chargers and the wheelchairs themselves are manufactured overseas. Three wheelchair manufacturers supply the majority of the U.S. market, but do not have domestic manufacturing. DOE does not anticipate the adopted standard to have a negative impact on motorized wheelchair operations because the standard for PC 5 inherently scales with battery energy. Irrespective of the size of the battery used in wheelchair applications, charge current will only terminate when the battery has reached a predetermined max voltage and is fully charged. DOE therefore has no reason to believe that compliant chargers would undercharge certain types of batteries and affect a wheelchairs runtime and performance. Further, battery chargers at the adopted standard already exists in the marketplace and these battery chargers have shown to charge wheelchair batteries effectively.

d. Comparison Between Large and Small Entities

As discussed in the previous section, there are two major suppliers in the golf car battery charger market. Both are small entities, although one is foreign-owned and operated and does not qualify as a small business per the SBA definition. These two small entities have a similar market share and sales volumes. DOE did not identify any large businesses with which to compare the projected impacts on small businesses.

5. Description and Estimate of Compliance Requirements

The U.S.-owned small business DOE identified manufactures battery chargers for golf cars (PC 7). DOE anticipates the adopted rule will require both capital and product conversion costs to achieve compliance. The ELs adopted for PCs 5, 6, and 7 will drive different levels of small business impacts. The compliance costs associated with the adopted TSLs are present in Table VI-1 through Table VI-3.

DOE does not expect the adopted TSL to require significant capital expenditures. Although some new assembly equipment and tooling would be required, the magnitude of these expenditures would be unlikely to cause significant adverse financial impacts. PC 7 drives the majority of these costs. See Table VI-1 for the estimated capital conversion costs for a typical small business.

Table VI-1 Estimated Capital Conversion Costs for a Small Business

Product Class and Estimated Capital Conversion Cost	TSL 1	TSL 2*	TSL 3	TSL 4
Product Classes 5 and 6	EL 1	EL 2	EL 3	EL 3
Product Class 7	EL 1	EL 1	EL 2	EL 2
Estimated Capital Conversion Costs (2013$)	$0.1	$0.1	$0.2	$0.2

*This is the TSL adopted in this final rule.

The product conversion costs associated with standards are more significant for the small business manufacturer than the projected capital conversion costs. TSL 2 for PC 7 reflects a technology change from a linear battery charger or less efficient high-frequency design battery charger at the baseline to a more efficient switch-mode or high-frequency design battery charger. This change would require manufacturers that produce linear or less efficient high-frequency design battery chargers to invest in the development of a new product design, which would require investments in engineering resources for R&D, testing and certification, and marketing and training changes. Again, the level of expenditure at each TSL is driven almost entirely by the changes required for PC 7 at each TSL. Additionally, based on market research conducted during the analysis period of this final rule, DOE has found that manufacturers (including those based domestically) who previously sold exclusively, or primarily, linear battery chargers, are now selling switch-mode battery chargers, which are capable of charging batteries equal to similar batteries charged by linear battery chargers offered by the same manufacturer. See **Table** VI-2 for the estimated product conversion costs for a typical small business.

Table VI-2 **Estimated Product Conversion Costs for a Small Business**

Product Class and Estimated Product Conversion Cost	**TSL 1**	**TSL 2***	**TSL 3**	**TSL 4**
Product Classes 5 and 6	EL 1	EL 2	EL 3	EL 3
Product Class 7	EL 1	EL 1	EL 2	EL 2
Estimated Product Conversion Costs (2013$)	$1.8	$2.0	$5.1	$5.1

*This is the TSL adopted in this rulemaking.

Table VI-3 displays the total capital and product conversion costs associated with each TSL.

Table VI-3 Estimated Total Conversion Costs for a Small Business

Product Class and Estimated Total Conversion Cost	**TSL 1**	**TSL 2***	**TSL 3**	**TSL 4**
Product Classes 5 and 6	EL 1	EL 2	EL 3	EL 3
Product Class 7	EL 1	EL 1	EL 2	EL 2
Estimated Total Conversion Costs (2013$)	$1.9	$2.1	$4.3	$4.3

* This is the TSL adopted in this final rule rulemaking.

Based on its engineering analysis, manufacturer interviews and public comments, DOE believes TSL 2 for PC 7 would establish an efficiency level that standard linear battery chargers could not cost-effectively achieve. Not only would the size and weight of such chargers potentially conflict with end-user preferences, but the additional steel and copper requirements would make such chargers cost-prohibitive in the marketplace. Baseline linear designs are already significantly more costly to manufacture than the more-efficient switch-mode designs, as DOE's cost efficiency curve shows in the engineering section (see Table IV-10).

While several battery chargers manufactured by the one small business DOE identified would need to be modified to meet the adopted standards for PC 7, this manufacturer also sells several switch-mode battery chargers. Therefore, DOE anticipates that this manufacturer could comply with the proposal by modifying their existing switch-mode battery charger specifications. This would require significantly fewer R&D resources than completely redesigning all of their production line. Additionally, DOE acknowledges that some or all existing domestic linear battery charger manufacturing could be lost due to the adopted standards, since it is likely that switch-mode battery charger manufacturing would take place abroad.

6. Description of Steps Taken to Minimize Impacts to Small Businesses

The discussion in the previous sections analyzes impacts on small business that would result from the other TSLs DOE considered. Though TSLs lower than the adopted TSL are expected to reduce the impacts on small entities, DOE is required by EPCA to establish standards that achieve the maximum improvement in energy efficiency that are technically feasible and economically justified, and result in a significant conservation of energy. Once DOE determines that a particular TSL meets those requirements, DOE adopts that TSL in satisfaction of its obligations under EPCA.

With respect to TSL 4, DOE estimates that while there would be an additional 0.525 quads of energy savings at TSL 4 compared to the adopted standards, TSL 2, it would cause consumers to lose $27.9 billion using a 7-percent discount rate or $47.9 billion using a 3-percent discount rate, compared to consumers saving $0.6 billion using a 7-percent discount rate or saving $1.2 billion using a 3 percent discount rate at the adopted standards, TSL 2. Also, manufacturers could lose up to 19.9 percent of their INPV at TSL 4. DOE determined that the additional high cost to consumers and the potential reduction in manufacturer INPV, would outweigh the potential energy savings benefits. For TSL 3, DOE estimates that while there would be an additional 0.364 quads of energy savings at TSL 3 compared to the adopted standards, TSL 2, it would cause consumers to lose $9.5 billion using a 7-percent discount rate or $16.2 billion using a 3-percent discount rate, compared to consumers saving $0.6 billion using a 7-percent discount rate or saving $1.2 billion using a 3 percent discount rate at the adopted standards, TSL 2. Also manufacturers could lose up to 3.2 percent of their INPV at TSL 3. DOE determined that the additional cost to consumers and the potential reduction in manufacturer INPV, would outweigh the potential energy savings benefits.

In addition, while TSL 1 would reduce the impacts on small business manufacturers, it would come at the expense of a significant reduction in energy savings and NPV benefits to consumers, achieving 36 percent lower energy savings and 17 to 25 percent less NPV benefits to consumers compared to the energy savings and NPV benefits at TSL 2.

EPCA requires DOE to establish standards at the level that would achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. Based on its analysis, DOE concluded that TSL 2 achieves the maximum improvement in energy efficiency that is technologically feasible and economically justified. Therefore, DOE did not establish standards at the levels considered at TSL 3 and TSL 4 because DOE determined that they were not economically justified. DOE's analysis of economic justification considers impacts on manufacturers, including small businesses. While TSL 1 would reduce the impacts on small business manufacturers, EPCA prohibits DOE from adopting TSL 1.

In summary, DOE concluded that establishing standards at TSL 2 balances the benefits of the energy savings and the NPV benefits to consumers at TSL 2 with the potential burdens placed on battery charger application manufacturers, including small business manufacturers. Accordingly, DOE did not adopt any of the other TSLs considered in the analysis, or the other policy alternatives detailed as part of the regulatory impacts analysis included in chapter 17 of the final rule TSD.

Additional compliance flexibilities may be available through other means. EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. Additionally, Section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent "special hardship, inequity, or unfair distribution of burdens" that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details.

C. Review Under the Paperwork Reduction Act

Manufacturers of battery chargers 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 battery chargers, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including battery chargers. 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 this rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 (Actions to conserve energy or water) 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://cxnepa.energy.gov/.

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 battery charger 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 battery chargers, 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(d), (f), and (o), this final rule establishes energy conservation standards for battery chargers that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. 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 (Public Law 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 energy conservation standards for battery chargers, 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 FR 2667.

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The "Energy Conservation Standards Rulemaking Peer Review Report" dated February 2007 has been disseminated and is available at the following web site: www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.

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 May 6, 2016.

David Friedman
Principal Deputy Assistant Secretary
Energy Efficiency and Renewable Energy

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) to read as follows:

§ 430.32 Energy and water conservation standards and their effective dates.

* * * * *

(z) Battery Chargers. (1) Battery chargers manufactured on or after [INSERT 2 YEARS AFTER PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER], must have a unit energy consumption (UEC) less than or equal to the prescribed "Maximum UEC" standard when using the equations for the appropriate product class and corresponding rated battery energy as shown in the following table:

<table>
<tr><th>Product Class</th><th>Product Class Description</th><th>Rated Battery Energy (Ebatt**)</th><th>Special Characteristic or Battery Voltage</th><th>Maximum UEC (kWh/yr) (as a function of Ebatt**)</th></tr>
<tr><td>1</td><td>Low-Energy</td><td>≤ 5 Wh</td><td>Inductive Connection*</td><td>3.04</td></tr>
<tr><td>2</td><td>Low-Energy, Low-Voltage</td><td rowspan="2">< 100 Wh</td><td>< 4 V</td><td>0.1440 * E_{batt} + 2.95</td></tr>
<tr><td>3</td><td>Low-Energy, Medium-Voltage</td><td>4 – 10 V</td><td>For E_{batt} < 10 Wh,
1.42 kWh/y
$E_{batt} \geq$ 10 Wh,</td></tr>
</table>

				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

* Inductive connection and designed for use in a wet environment (e.g. electric toothbrushes)

**E_{batt} = Rated battery energy as determined in 10 CFR Part 429.39(a)

Appendix

[The following letter from the Department of Justice will not appear in the Code of Federal Regulations.]

DEPARTMENT OF JUSTICE

Antitrust Division

WILLIAM J. BAER

Assistant Attorney General

Main Justice Building, 950 Pennsylvania Avenue, N.W., Washington, D.C. 20530-0001, (202) 514-2401 / (202) 616-2645 (Fax)

October 30, 2015.

Anne Harkavy

Deputy General Counsel for Litigation, Regulation and Enforcement,

U.S. Department of Energy, Washington, D.C. 20585.

Dear Deputy General Counsel Harkavy: I am responding to your September 1, 2015, letter seeking views of the Attorney General about the impact on competition of proposed energy conservation standards for battery chargers. Your request was submitted under Section 325(o)(2)(B)(i)(V), which required the Attorney General to make determination of the impact of any lessening of competition this 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 Supplemental Notice of Proposed Rulemaking (80 Fed. Reg. 52,850, Sep. 1, 2015) and the related Technical Support Documents. We have also reviewed information presented at the public meeting held on the proposed standards on September 15, 2015.

Based on this review, our conclusion is that the proposed energy conservation standards for battery chargers are unlikely to have a significant adverse impact on competition.

Sincerely,

William J. Baer