DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2015–BT–STD–0016]

RIN 1904–AD59

Energy Conservation Program: Energy Conservation Standards for Walk-In Cooler and Freezer Refrigeration Systems

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

ACTION: Final rule.

SUMMARY: The Energy Policy and Conservation Act of 1975 (''EPCA''), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including walk-in coolers and walk-in freezers. This final rule details a series of energy conservation standards pertaining to certain discrete classes of refrigeration systems used in this equipment. These standards, which are consistent with recommendations presented by a working group that included refrigeration system manufacturers, installers, and energy efficiency advocates, have been determined to result in the significant conservation of energy and achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified.

DATES: The effective date of this rule is September 8, 2017. Compliance with the standards established for WICF refrigeration systems in this final rule is required on and after July 10, 2020.

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

The docket web page can be found at *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=56.* The docket web page contains simple instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact the Appliance and Equipment Standards Program staff at (202) 586–6636 or by email: *WICF2015STD0016@ee.doe.gov.*

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SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Final Rule

Title III, Part C [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] The Act, and its numerous amendments, reaches a variety of products and equipment that the Department of Energy (''DOE'') must treat as covered products and equipment (and thus that are subject to regulation). Among the types of covered equipment that DOE must regulate are walk-in coolers and walk-in freezers (collectively, ''WICFs'' or ''walk-ins''). Included within this regulatory scope are the refrigeration systems used in this equipment, such as low-temperature dedicated condensing systems and both medium- and low-temperature unit coolers,[3] the subjects of this rulemaking.

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6313(f)(4)(A)) Furthermore, the new or amended standard must result in significant conservation of energy. (42 U.S.C. 6316(a) and 6295(o)(3)(B))

In accordance with these and other statutory provisions discussed in this document, DOE is adopting energy conservation standards for the following classes of WICF refrigeration systems: Low-temperature dedicated condensing refrigeration systems and both medium- and low-temperature unit coolers. These standards that will be in addition to the standards that DOE has already promulgated for medium-temperature dedicated condensing refrigeration systems. See 10 CFR 431.306(e) as amended by 80 FR 69837 (November 12, 2015). The adopted standards, which are expressed in terms of an annual walk-in energy factor (''AWEF''), are shown in Table I–1. AWEF is an annualized refrigeration efficiency metric that expresses the ratio of the heat load that a system can reject (in Btus) to the energy required to reject that load (in watt-hours). These standards apply to all applicable WICF refrigeration systems listed in Table I–1 and manufactured in, or imported into, the United States starting on the compliance date specified at the beginning of this document and in the regulatory text that follows this discussion.

TABLE I–1—ENERGY CONSERVATION STANDARDS FOR WICF REFRIGERATION SYSTEMS

Equipment class	Minimum AWEF (Btu/W-h) *
Dedicated Condensing System—Low, Indoor with a Net Capacity (q_{net}) of:	
<6,500 Btu/h	$9.091 \times 10^{-5} \times q_{net} + 1.81$.
≥6,500 Btu/h	2.40.
Dedicated Condensing System—Low, Outdoor with a Net Capacity (q_{net}) of:	
<6,500 Btu/h	$6.522 \times 10^{-5} \times q_{net} + 2.73$.
≥6,500 Btu/h	3.15.
Unit Cooler—Medium	9.00.
Unit Cooler—Low with a Net Capacity (q_{net}) of:	
<15,500 Btu/h	$1.575 \times 10^{-5} \times q_{net} + 3.91$.
≥15,500 Btu/h	4.15.

* Where q_{net} is net capacity as determined in accordance with 10 CFR 431.304 and certified in accordance with 10 CFR part 429.

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

[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).

[3] In previous proceedings, most notably the June 2014 final rule, DOE used the terminology ''multiplex condensing'' (abbreviated ''MC'') to refer to the class of equipment represented by a unit cooler, which for purposes of testing and certification is rated as though it would be connected to a multiplex condensing system. In a separate test procedure rulemaking, DOE has changed the terminology to better reflect the equipment itself, which consists of a unit cooler sold without a condensing unit, and which can ultimately be used in either a multiplex condensing or dedicated condensing application. Accordingly, in this document, DOE has changed the class name from ''multiplex condensing'' to ''unit cooler'' and the class abbreviation from ''MC'' to ''UC.''

In various places in this document, DOE will use the following acronyms to denote the equipment classes of walk-in refrigeration systems that are subject to this rulemaking:

—DC.L.I. (dedicated condensing, low-temperature, indoor unit)
—DC.L.O (dedicated condensing, low-temperature, outdoor unit)
—UC.L. (unit cooler, low-temperature)
—UC.M. (unit cooler, medium-temperature)

For reference, DOE will use the following acronyms to denote the two equipment classes of walk-in refrigeration systems which are not subject to this rulemaking but for which standards were established in the previous WICF rulemaking:

—DC.M.I (dedicated condensing, medium-temperature, indoor unit)
—DC.M.O (dedicated condensing, medium-temperature, outdoor unit)

A. Benefits and Costs to Consumers

Table I–2 presents DOE's evaluation of the economic impacts of the adopted standards on consumers of the considered WICF refrigeration systems (*i.e.,* medium- and low-temperature unit coolers and dedicated condensing low-temperature systems), as measured by the average life-cycle cost (''LCC'') savings and the simple payback period (''PBP'').[4] DOE's analysis demonstrates that the projected average LCC savings are positive for all considered equipment classes, and the projected PBP is less than the average lifetime of the considered WICF refrigeration systems, which is estimated to be 11 years (see section IV.F).

TABLE I–2—IMPACTS OF ADOPTED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF WICF REFRIGERATION SYSTEMS

[TSL 3]

Equipment class	Application	Design path	Average life-cycle cost savings (2015$)	Simple payback period (years)
DC.L.I	Dedicated, Indoor	Condensing Unit Only *	1,272	1.5
	Dedicated, Indoor	Field—Paired **	1,397	1.5
	Dedicated, Indoor	Unit Cooler Only †	135	4.8
DC.L.O	Dedicated, Outdoor	Condensing Unit Only	2,839	1.2
	Dedicated, Outdoor	Field—Paired	3,294	1.4
	Dedicated, Outdoor	Unit Cooler Only	288	4.5
UC.L	Multiplex	Unit Cooler Only	$74	7.6
UC.M	Dedicated, Indoor	Unit Cooler Only	89	1.4
UC.M	Dedicated, Outdoor	Unit Cooler Only	87	1.8
UC.M	Multiplex	Unit Cooler Only	75	3.0

Note: DOE separately considers the impacts of unit cooler standards when the unit cooler is combined in an application with dedicated condensing equipment versus multiplex condensing equipment. In addition to low-temperatures unit coolers and dedicated condensing equipment DOE is examining the impacts of unit coolers that are combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O). DOE is not establishing standards for the latter, as they are covered by the June 2014 final rule and were not vacated by the Fifth Circuit order discussed below.

* Condensing Unit Only (CU-Only): This analysis evaluates standard levels applied to a condensing unit for a scenario in which a new condensing unit is installed to replace a failed condensing unit, but the existing baseline unit cooler is not replaced. See section IV.G.1.b for more details.

** Field-Paired (FP): This analysis evaluates a scenario in which both a new condensing unit and a new unit cooler are installed as paired equipment in the field. See section IV.G.1.a for more details.

† Unit Cooler Only (UC-Only): This analysis evaluates standard levels applied to a unit cooler for a scenario in which a new unit cooler is installed to replace a failed unit cooler, but the existing baseline condensing unit (or multiplex system) is not replaced. See section IV.G.1.c for more details.

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

B. Impact on Manufacturers

The industry net present value (''INPV'') is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2016–2049). Using a real discount rate of 10.2 percent, DOE estimates that the INPV for manufacturers of WICF refrigeration systems in the case without amended standards is $97.9 million in 2015$. Under the adopted standards, DOE expects the change in INPV to range from −14.6 percent to −6.3 percent, which is approximately −$14.3 million to −$6.1 million. In order to bring products into compliance with standards, DOE expects the industry to incur total conversion costs of $18.7 million.

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

C. National Benefits and Costs [5]

DOE's analyses indicate that the adopted energy conservation standards for the considered WICF refrigeration systems would save a significant amount of energy. Relative to the case without adopting the standards, the lifetime energy savings for the considered WICF refrigeration systems purchased in the 30-year period that begins in the anticipated year of compliance with the standards (2020–2049), amount to 0.9 quadrillion British thermal units (''Btu''), or quads.[6] This represents a savings of 24 percent relative to the energy use of these

[4] The average LCC savings are measured relative to the efficiency distribution in the no-new-standards case, which depicts the market in the compliance year in the absence of standards (see section IV.F.9). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to baseline equipment (see section IV.CD.7)

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

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

products in the case without standards (referred to as the ''no-new-standards case'').

The cumulative net present value (''NPV'') of total consumer benefits of the standards for the considered WICF refrigeration systems ranges from $1.4 billion (at a 7-percent discount rate) to $3.2 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased equipment costs for the considered WICF refrigeration systems purchased in 2020–2049.

In addition, the adopted standards for the considered WICF refrigeration systems are projected to yield significant environmental benefits. DOE estimates that the standards will result in cumulative emission reductions (over the same period as for energy savings) of 46 million metric tons (Mt)[7] of carbon dioxide (CO_2), 36 thousand tons of sulfur dioxide (SO_2), 58 tons of nitrogen oxides (NO_X), 218 thousand tons of methane (CH_4), 0.7 thousand tons of nitrous oxide (N_2O), and 0.1 tons of mercury (Hg).[8] The estimated cumulative reduction in CO_2 emissions through 2030 amounts to 7.4 Mt, which is equivalent to the emissions resulting from the annual electricity use of more than 783 thousand homes.

The value of the CO_2 reduction is calculated using a range of values per metric ton (t) of CO_2 (otherwise known as the ''social cost of CO_2,'' or ''SC-CO_2'') developed by a Federal interagency working group.[9] The derivation of the SC-CO2 values is discussed in section IV.M.1. Using discount rates appropriate for each set of SC-CO_2 values, DOE estimates that the present value of the CO_2 emissions reduction is between $0.3 billion and $4.5 billion, with a value of $1.5 billion using the central SC-CO_2 case represented by $47.4/metric ton (t) in 2020.

DOE also calculated the value of the reduction in emissions of methane and nitrous oxide, using values for the social cost of methane (''SC-CH_4'') and the social cost of nitrous oxide (''SC-N_2O'') recently developed by the interagency working group.[10] See section IV.L.2 for a description of the methodology and the values used for DOE's analysis. The estimated present value of the methane emissions reduction is between $0.1 billion and $0.6 billion, with a value of $0.2 billion using the central SC-CH_4 case, and the estimated present value of the SC-N_2O emissions reduction is between $0.002 billion and $0.02 billion, with a value of $0.01 billion using the central SC-N_2O case. In this rule, DOE uses the term ''greenhouse gases'' (''GHGs'') to refer to carbon dioxide, methane, and nitrous oxide.

DOE also estimates the present value of the NO_X emissions reduction to be $0.10 billion using a 7-percent discount rate, and $0.04 billion using a 3-percent discount rate.[11] DOE is still investigating appropriate valuation of the reduction in other emissions, and therefore did not include any such values for those emissions in the analysis for this final rule. Because the inclusion of such values would only increase the already positive net benefit of the new standards, however, it would not affect the outcome of this rulemaking.

Table I–3 summarizes the economic benefits and costs expected to result from the adopted standards for the considered WICF refrigeration systems.

TABLE I–3—SELECTED CATEGORIES OF ECONOMIC BENEFITS AND COSTS OF ADOPTED ENERGY CONSERVATION STANDARDS FOR THE CONSIDERED WICF REFRIGERATION SYSTEMS

[TSL 3] *

Category	Present value (billion 2015$)	Discount rate (percent)
Benefits		
Consumer Operating Cost Savings	1.7	7
	3.8	3
GHG Reduction (using avg. social costs at 5% discount rate) **	0.4	5
GHG Reduction (using avg. social costs at 3% discount rate) **	1.7	3
GHG Reduction (using avg. social costs at 2.5% discount rate) **	2.7	2.5
GHG Reduction (using 95th percentile social costs at 3% discount rate) **	5.1	3
NO_X Reduction †	0.0	7
	0.1	3
Total Benefits ‡	3.5	7
	5.6	3

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

[8] DOE calculated emissions reductions relative to the no-new-standards-case, which reflects key assumptions in the *Annual Energy Outlook 2016* (*AEO2016*). *AEO2016* represents current federal and state legislation and final implementation of regulations as of the end of February 2016. See section IV.L fur further discussion of *AEO2016* assumptions that effect air pollutant emissions.

[9] 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. *www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf.*

[10] United States Government—Interagency Working Group on Social Cost of Greenhouse Gases. Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide. August 2016. *www.whitehouse.gov/sites/default/files/omb/inforeg/august_2016_sc_ch4_sc_n2o_addendum_final_8_26_16.pdf.*

[11] DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.* See section IV.L.3 for further discussion. *The U.S. Supreme Court has stayed the rule implementing the Clean Power Plan until the current litigation against it concludes. Chamber of Commerce, et al.* v. *EPA, et al., Order in Pending Case, 577 U.S.* __, *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. To be conservative,* DOE is primarily using a lower national benefit-per-ton estimate for NO_X emitted from the Electricity Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011), the values would be nearly two-and-a-half times larger.

TABLE I–3—SELECTED CATEGORIES OF ECONOMIC BENEFITS AND COSTS OF ADOPTED ENERGY CONSERVATION STANDARDS FOR THE CONSIDERED WICF REFRIGERATION SYSTEMS—Continued

[TSL 3] *

Category	Present value (billion 2015$)	Discount rate (percent)
Costs		
Consumer Incremental Installed Costs	0.3 0.6	7 3
Total Net Benefits		
Including GHG and NO_X Reduction Monetized Value ‡	3.1 5.0	7 3

* This table presents the costs and benefits associated with considered WICF refrigeration systems shipped in 2020–2049. These results include benefits to consumers which accrue after 2049 from the products shipped in 2020–2049. The incremental installed costs include incremental equipment cost as well as installation costs. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the adopted standards, some of which may be incurred in preparation for the rule. The GHG reduction benefits are global benefits due to actions that occur domestically.

** The interagency group selected four sets of SC-CO_2, SC-CH_4, and SC-N_2O values for use in regulatory analyses. Three sets of values are based on the average social costs from the integrated assessment models, at discount rates of 5 percent, 3 percent, and 2.5 percent. The fourth set, which represents the 95th percentile of the social cost distributions calculated using a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the social cost distributions. The social cost values are emission year specific. See section IV.L.1 for more details.

† DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis*.) See section IV.M.3 for further discussion. *To be conservative,* DOE is primarily using a national benefit-per-ton estimate for NO_X emitted from the electricity generation sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011), the values would be nearly two-and-a-half times larger.

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

The benefits and costs of the adopted standards, for the considered WICF refrigeration systems sold in 2020–2049, can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are (1) the reduced consumer operating costs, minus (2) the increases in product purchase prices and installation costs, plus (3) the value of the benefits of GHG and NO_X emission reductions, all annualized.[12]

The national operating cost savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered products and are measured for the lifetime of the considered WICF refrigeration systems shipped in 2020–2049. The benefits associated with reduced GHG emissions achieved as a result of the adopted standards are also calculated based on the lifetime of WICF refrigeration systems shipped in 2020–2049. Because CO_2 emissions have a very long residence time in the atmosphere, the SC-CO_2 values for CO_2 emissions in future years reflect impacts that continue through 2300. The CO_2 reduction is a benefit that accrues globally. DOE maintains that consideration of global benefits is appropriate because of the global nature of the climate change problem.

Estimates of annualized benefits and costs of the adopted standards are shown in Table I–4. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than GHG reductions (for which DOE used average social costs with a 3-percent discount rate),[13] the estimated cost of the adopted standards for the considered WICF refrigeration systems is $34 million per year in increased equipment costs, while the estimated annual benefits are $169 million in reduced equipment operating costs, $95 million in GHG reductions, and $4.2 million in reduced NO_X emissions. In this case, the net benefit amounts to $234 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the adopted standards for the considered WICF refrigeration systems is $36 million per year in increased equipment costs, while the estimated annual benefits are $213 million in reduced equipment operating costs, $95 million in GHG reductions, and $5.8 million in reduced NO_X emissions. In this case, the net benefit amounts to $279 million per year.

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

[13] DOE used average social costs with a 3-percent discount rate because these values are considered as the ''central'' estimates by the interagency group.

TABLE I–4—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS (TSL 3) FOR CONSIDERED WICF REFRIGERATION SYSTEMS

	Discount rate (percent)	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
		Million 2015$/year		
Benefits				
Consumer Operating Cost Savings	7	169.3	158.4	183.0.
	3	213.4	196.9	233.9.
GHG Reduction (using avg. social costs at 5% discount rate) **.	5	29.8	27.2	32.4.
GHG Reduction (using avg. social costs at 3% discount rate) **.	3	95.3	86.7	104.0.
GHG Reduction (using avg. social costs at 2.5% discount rate) **.	2.5	137.7	125.1	150.4.
GHG Reduction (using 95th percentile social costs at 3% discount rate) **.	3	285.8	259.8	311.9.
NO_X Reduction †	7	4.2	3.9	10.1.
	3	5.8	5.3	14.3.
Total Benefits ††	7 plus GHG range	203 to 459	190 to 422	225 to 505.
	7	269	249	297.
	3 plus GHG range	249 to 505	229 to 462	281 to 560.
	3	314	289	352.
Costs				
Consumer Incremental Equipment Costs	7	34	36	33.
	3	36	38	34.
Net Benefits				
Total ††	7 plus GHG range	169 to 425	154 to 386	192 to 472.
	7	234	213	264.
	3 plus GHG range	213 to 469	192 to 424	247 to 526.
	3	279	251	318.

* This table presents the annualized costs and benefits associated with the considered WICF refrigeration systems shipped in 2020–2049. These results include benefits to consumers which accrue after 2049 from the WICF refrigeration systems purchased from 2020–2049. The incremental installed costs include incremental equipment cost as well as installation costs. The results account for the incremental variable and fixed costs incurred by manufacturers due to the adopted standards, some of which may be incurred in preparation for the rule. The GHG reduction benefits are global benefits due to actions that occur nationally. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices and real GDP from the *AEO2016* No-CPP case, a Low Economic Growth case, and a High Economic Growth case, respectively. In addition, incremental product costs reflect constant prices in the Primary Estimate, a low decline rate in the Low Benefits Estimate, and a high decline rate in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.G. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding. The equipment price projection is described in section IV.G.2 of this document and chapter 8 of the final rule technical support document (TSD). In addition, DOE used estimates for equipment efficiency distribution in its analysis based on national data supplied by industry. Purchases of higher efficiency equipment are a result of many different factors unique to each consumer including boiler heating loads, installation costs, site environmental consideration, and others. For each consumer, all other factors being the same, it would be anticipated that higher efficiency purchases in the baseline would correlate positively with higher energy prices. To the extent that this occurs, it would be expected to result in some lowering of the consumer operating cost savings from those calculated in this rule.

** The interagency group selected four sets of SC-CO_2 SC-CH_4, and SC-N_2O values for use in regulatory analyses. Three sets of values are based on the average social costs from the integrated assessment models, at discount rates of 5 percent, 3 percent, and 2.5 percent. The fourth set, which represents the 95th percentile of the social cost distributions calculated using a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the social cost distributions. The social cost values are emission year specific. See section IV.L for more details.

† DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.M.3 for further discussion. For the Primary Estimate and Low Net Benefits Estimate, DOE used national benefit-per-ton estimates for NO_X emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). For the High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011); these are nearly two-and-a-half times larger than those from the ACS study.

†† Total Benefits for both the 3-percent and 7-percent cases are presented using the average social costs with 3-percent discount rate. In the rows labeled "7% plus GHG range" and "3% plus GHG 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 social cost values.

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 WICF refrigeration systems.

A. Authority

Title III, Part C of EPCA, as amended, includes the refrigeration systems used in walk-ins that are the subject of this rulemaking. (42 U.S.C. 6291–6309) EPCA, as amended, prescribed certain prescriptive energy conservation standards for these equipment (42 U.S.C. 6313(f)), and directs DOE to conduct future rulemakings to establish performance-based energy conservation standards and to later determine whether those standards should be amended. (42 U.S.C. 6313(f)(4)(A), (5)) Under 42 U.S.C. 6295(m), which applies to walk-ins through 42 U.S.C. 6316(a), the agency must periodically review its already established energy conservation standards for a covered product no later than 6 years from the issuance of a final rule establishing or amending a standard for a covered product.

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. Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and (r) and 6316(a)) Manufacturers of covered equipment must use the prescribed DOE test procedure as the basis for certifying to DOE that their equipment complies with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of that equipment. (42 U.S.C. 6314(d), 6295(s) and 6316(a)) Similarly, DOE must use these test procedures to determine whether the equipment complies with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s) and 6316(a)) The DOE test procedures for WICF refrigeration systems appear at title 10 of the Code of Federal Regulations (''CFR'') § 431.304.

DOE has recently published a final rule (''December 2016 TP final rule'') amending the test procedures applicable to the equipment classes addressed in this final rule, 81 FR 95758 (December 28, 2016). The standards established in this rulemaking were evaluated using those concurrently amended test procedures. While DOE typically finalizes its test procedures for a given regulated product or equipment prior to proposing new or amended energy conservation standards for that product or equipment, see 10 CFR part 430, subpart C, Appendix A, sec. 7(c) (''Procedures, Interpretations and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products'' or ''Process Rule''), DOE did not do so in this instance. As part of the negotiated rulemaking that led to the Term Sheet setting out the standards that DOE is adopting, Working Group members recommended (with ASRAC's approval) that DOE modify its test procedure for walk-in refrigeration systems. The test procedure changes at issue clarify the scope of equipment classes covered by the regulations, modify the test procedure to ensure that it avoids measuring efficiency benefits for technology options deemed by the Working Group to be inappropriate for consideration under the standards rulemaking, and simplify the structure of the current test procedure as presented in the CFR. Separate from the changes affecting the test procedure itself, DOE's test procedure rule also finalized an approach establishing labeling requirements to mitigate the regulatory burden on installers of walk-ins. Specifically, the test procedure explained that walk-in installers are not required to submit certification reports for the complete walk-in. Additionally, an installer that uses certified components with labels that meets DOE's requirements bears no responsibility for the testing and certification of those walk-in components. The installer is permitted to rely upon the representations of the manufacturer of a WICF component to ensure compliance of the component; if those representations turn out to be false, the component manufacturer is responsible. See Docket No. EERE–2016–BT–TP–0030.

In DOE's view, all of these amendments to the test procedure rule have been consistent with the approach agreed upon by the various parties who participated in the negotiated rulemaking. On July 29, 2016, well before the publication of the energy conservation standard NOPR on September 13, 2016 (81 FR 62979), DOE publicly issued a pre-publication version of the test procedure NOPR, which immediately made it available for all members of the public, including participating stakeholders, to review. As a result, all members of the Working Group and other interested parties had an ample opportunity to review the proposed procedure and evaluate the proposed WICF energy conservation standards against the backdrop of the proposed test procedures, which are consistent with the final test procedures. Thus, DOE concludes that publishing a final version of the test procedure rule—which adopts the limited changes to method for measuring a refrigeration system's AWEF that were proposed in the NOPR—prior to the publication of the standards proposal was not necessary. Accordingly, consistent with section 14 of the Process Rule, DOE has concluded that its deviation from the Process Rule is appropriate here.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including WICF refrigeration systems. Any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)–(3)(B) and 6316(a)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3) and 6316(a)) Moreover, DOE may not prescribe a standard (1) for certain equipment, including WICF refrigeration systems, 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) and 6316(a)) In deciding whether a 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) and 6316(a)) DOE must make this determination after proposing the standard and receiving comments on it, 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 equipment subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered equipment in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered equipment 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 equipment 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) and 6316(a))

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 equipment 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.[14] (42 U.S.C. 6295(o)(2)(B)(iii) and 6316(a))

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 covered equipment. (42 U.S.C. 6295(o)(1) and 6316(a)) 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 equipment 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) and 6316(a))

Additionally, EPCA specifies requirements when promulgating an energy conservation standard for covered equipment that has two or more subcategories. DOE must specify a different standard level for a type or class of equipment 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 equipment within such type (or class); or (B) have a capacity or other performance-related feature which other equipment within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6295(q)(1) and 6316(a)) In determining whether a performance-related feature justifies a different standard for a group of equipment, 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) and 6316(a))

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a) through (c) and 6316(a)) 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) and 6316(a).

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 equipment. (42 U.S.C. 6295(gg)(3)(A)–(B)) In the case of WICFs, DOE is continuing to apply this approach to provide analytical consistency when evaluating energy conservation standards for this equipment. See generally, 42 U.S.C. 6316(a).

B. Background

A walk-in is an enclosed storage space refrigerated to temperatures above, and at or below, respectively, 32 °F that can be walked into and has a total chilled storage area of less than 3,000 square feet. (42 U.S.C. 6311(20)) By definition, equipment designed and marketed exclusively for medical, scientific, or research purposes are excluded. See id.

EPCA also provides prescriptive standards for walk-ins manufactured starting on January 1, 2009. First, walk-ins must have automatic door closers that firmly close all walk-in doors that have been closed to within 1 inch of full closure, for all doors narrower than 3 feet 9 inches and shorter than 7 feet and must also have strip doors, spring hinged doors, or other methods of minimizing infiltration when doors are open. Additionally, they must also contain wall, ceiling, and door insulation of at least R–25 for coolers and R–32 for freezers, excluding glazed portions of doors and structural members, and floor insulation of at least R–28 for freezers. Walk-in evaporator fan motors of under 1 horsepower (''hp'') and less than 460 volts must be electronically commutated motors (brushless direct current motors) or three-phase motors, and walk-in condenser fan motors of under 1 horsepower must use permanent split capacitor motors, electronically commutated motors, or three-phase motors. Interior light sources must have an efficacy of 40 lumens per watt or more, including any ballast losses; less-efficacious lights may only be used in conjunction with a timer or device that turns off the lights within 15 minutes of when the walk-in is unoccupied. See 42 U.S.C. 6313(f)(1).

Second, walk-ins have requirements related to electronically commutated motors used in them. See 42 U.S.C. 6313(f)(2)). Specifically, in those walk-ins that use an evaporator fan motor with a rating of under 1 hp and less than 460 volts, that motor must be either a three-phase motor or an electronically commutated motor unless DOE determined prior to January 1, 2009 that electronically commutated motors are available from only one manufacturer. (42 U.S.C. 6313(f)(2)(A)) Consistent with this requirement, DOE eventually determined that more than one manufacturer offered these motors for sale, which effectively made electronically commutated motors a required design standard for use with evaporative fan motors rated at under 1 hp and under 460 volts. DOE documented this determination in the rulemaking docket as docket ID EERE–2008–BT–STD–0015–0072. This document can be found at *www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0015-0072.* Additionally, DOE may permit the use of other types of motors as evaporative fan motors—if DOE determines that, on average, those other motor types use no more energy in evaporative fan applications than electronically commutated motors. (42 U.S.C. 6313(f)(2)(B)) DOE is unaware of any other motors that would offer performance levels comparable to the electronically commutated motors required by Congress. Accordingly, all evaporator motors rated at under 1 hp and under 460 volts must be electronically commutated motors or three-phase motors.

Third, EPCA requires that walk-in freezers with transparent reach-in doors must have triple-pane glass with either heat-reflective treated glass or gas fill for doors and windows. Cooler doors must have either double-pane glass with

[14] This is equivalent to stating that the rebuttable presumption of a standard is justified if the simple payback to the consumer, as calculated under the applicable test procedures, of the purchased equipment is equal to, or less than 3 years.

treated glass and gas fill or triple-pane glass with treated glass or gas fill. (42 U.S.C. 6313(f)(3)(A)–(B)) For walk-ins with transparent reach-in doors, EISA 2007 also prescribed specific anti-sweat heater-related requirements: Walk-ins without anti-sweat heater controls must have a heater power draw of no more than 7.1 or 3.0 watts per square foot of door opening for freezers and coolers, respectively. Walk-ins with anti-sweat heater controls must either have a heater power draw of no more than 7.1 or 3.0 watts per square foot of door opening for freezers and coolers, respectively, or the anti-sweat heater controls must reduce the energy use of the heater in a quantity corresponding to the relative humidity of the air outside the door or to the condensation on the inner glass pane. See 42 U.S.C. 6313(f)(3)(C)–(D).

EPCA also directed the Secretary to issue performance-based standards for walk-ins that would apply to equipment manufactured three (3) years after the final rule is published, or five (5) years if the Secretary determines by rule that a 3-year period is inadequate. (42 U.S.C. 6313(f)(4)) In a final rule published on June 3, 2014 (June 2014 final rule), DOE prescribed performance-based standards for walk-ins manufactured on or after June 5, 2017. 79 FR 32050. These standards applied to a walk-in's main components: Refrigeration systems, panels, and doors. The standards were expressed in terms of AWEF for the walk-in refrigeration systems, R-value for walk-in panels, and maximum energy consumption for walk-in doors. The standards are shown in Table II–1 and Table II–2.

TABLE II–1—ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLER AND WALK-IN FREEZER REFRIGERATION SYSTEMS SET FORTH IN 2014 RULE

Class descriptor	Class	Standard level min. AWEF (Btu/W-h) *
Dedicated Condensing, Medium—Temperature, Indoor System, <9,000 Btu/h Capacity.	DC.M.I, <9,000	5.61
Dedicated Condensing, Medium—Temperature, Indoor System, ≥9,000 Btu/h Capacity.	DC.M.I, ≥9,000	5.61
Dedicated Condensing, Medium—Temperature, Outdoor System, <9,000 Btu/h Capacity.	DC.M.O, <9,000	7.60
Dedicated Condensing, Medium—Temperature, Outdoor System, ≥9,000 Btu/h Capacity.	DC.M.O, ≥9,000	7.60
Dedicated Condensing, Low-Temperature, Indoor System, <9,000 Btu/h Capacity	DC.L.I, <9,000	5.93 × 10–5 × *Q* + 2.33
Dedicated Condensing, Low-Temperature, Indoor System, ≥9,000 Btu/h Capacity	DC.L.I, ≥9,000	3.10
Dedicated Condensing, Low-Temperature, Outdoor System, <9,000 Btu/h Capacity.	DC.L.O, <9,000	2.30 × 10–4 × *Q* + 2.73
Dedicated Condensing, Low-Temperature, Outdoor System, ≥9,000 Btu/h Capacity.	DC.L.O, ≥9,000	4.79
Multiplex Condensing, Medium—Temperature **	MC.M	10.89
Multiplex Condensing, Low-Temperature **	MC.L	6.57

* These standards were expressed in terms of *Q*, which represents the system gross capacity as calculated in AHRI 1250.
** DOE used this terminology to refer to these equipment classes in the June 2014 final rule. In this rule, DOE has changed "multiplex condensing" to "unit cooler" and the abbreviation "MC" to "UC," consistent with the separate test procedure rulemaking conducted by DOE.

TABLE II–2—ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLER AND WALK-IN FREEZER PANELS AND DOORS SET FORTH IN 2014 RULE

Class descriptor	Class	Standard level
Panels		Min. R-value (h-ft2-°F/Btu)
Structural Panel, Medium-Temperature	SP.M	25
Structural Panel, Low-Temperature	SP.L	32
Floor Panel, Low-Temperature	FP.L	28
Non-display doors		Max. energy consumption (kWh/day) †
Passage Door, Medium-Temperature	PD.M	0.05 × And + 1.7
Passage Door, Low-Temperature	PD.L	0.14 × And + 4.8
Freight Door, Medium-Temperature	FD.M	0.04 × And + 1.9
Freight Door, Low-Temperature	FD.L	0.12 × And + 5.6
Display doors		Max. energy consumption (kWh/day) ††
Display Door, Medium-Temperature	DD.M	0.04 × Add + 0.41
Display Door, Low-Temperature	DD.L	0.15 × Add + 0.29

† And represents the surface area of the non-display door.
†† Add represents the surface area of the display door.

After publication of the June 2014 final Rule, the Air-Conditioning, Heating and Refrigeration Institute (''AHRI'') and Lennox International, Inc. (''Lennox'') (a manufacturer of WICF refrigeration systems) filed petitions for review of DOE's final rule and DOE's subsequent denial of a petition for reconsideration of the rule with the United States Court of Appeals for the Fifth Circuit. *Lennox Int'l* v. *Dep't of Energy,* Case No. 14–60535 (5th Cir.). Other WICF refrigeration system manufacturers—Rheem Manufacturing Co., Heat Transfer Products Group (a subsidiary of Rheem Manufacturing Co.), and Hussmann Corp.—along with the Air Conditioning Contractors of America (''ACCA'') (a trade association representing contractors who install WICF refrigeration systems) intervened on the petitioners' behalf. The Natural Resources Defense Council (''NRDC''), the American Council for an Energy-Efficient Economy, and the Texas Ratepayers' Organization to Save Energy intervened on behalf of DOE. As a result of this litigation, a settlement agreement was reached to address, among other things, six of the refrigeration system standards—each of which is addressed in this document.[15]

A controlling court order from the Fifth Circuit, which was issued on August 10, 2015, vacated those six standards. These vacated standards related to (1) the two energy conservation standards applicable to multiplex condensing refrigeration systems (re-named as ''unit coolers'' for purposes of this rule) operating at medium and low temperatures and (2) the four energy conservation standards applicable to dedicated condensing refrigeration systems operating at low temperatures. See 79 FR at 32124 (June 3, 2014). The thirteen other standards established in the June 2014 final rule and shown in Table II–1 and Table II–2 (that is, the four standards applicable to dedicated condensing refrigeration systems operating at medium temperatures; the three standards applicable to panels; and the six standards applicable to doors) were not vacated and remain subject to the June 5, 2017 compliance date prescribed by the June 2014 final rule.[16] To help clarify the applicability of these standards, DOE is also modifying the organization of its regulations to specify the compliance date of these existing standards and the standards finalized in this rule. To aid in readability, DOE is replacing the existing table at 10 CFR 431.306(e) with a new table that incorporates both the refrigeration system standards established in this rule and the existing refrigeration system standards and clarifies the compliance dates for both sets of standards.

In addition, DOE notes that the existing standard for all capacities of dedicated condensing, medium-temperature, indoor refrigeration systems requires that these equipment classes meet a minimum AWEF of 5.61 Btu/W-h. Likewise, all capacities of dedicated condensing, medium-temperature, outdoor refrigeration systems must meet a minimum AWEF of 7.60 Btu/W-h. Rather than listing multiple ranges of capacity for both indoor and outdoor classes, DOE has modified the organization of these standards by grouping these classes into two line items, each showing the standard for the relevant full capacity range.

After the Fifth Circuit issued its order, DOE established a working group to negotiate energy conservation standards to replace the six vacated standards. Specifically, on August 5, 2015, DOE published a notice of intent to establish a WICF Working Group. 80 FR 46521. The Working Group was established under the Appliance Standards and Rulemaking Federal Advisory Committee (''ASRAC'') in accordance with the Federal Advisory Committee Act (''FACA'') and the Negotiated Rulemaking Act (''NRA''). (5 U.S.C. App. 2; 5 U.S.C. 561–570, Pub. L. 104–320.) The purpose of the Working Group was to discuss and, if possible, reach consensus on standard levels for the energy efficiency of the affected classes of WICF refrigeration systems. The Working Group was to consist of representatives of parties having a defined stake in the outcome of the standards, and the group would consult as appropriate with a range of experts on technical issues.

Ultimately, the Working Group consisted of 12 members and one DOE representative (see Table II–3). (See Appendix A, List of Members and Affiliates, Negotiated Rulemaking Working Group Ground Rules, Docket No. EERE–2015–BT–STD–0016, No. 5 at p. 5.) The Working Group met in-person during 13 days of meetings held August 27, September 11, September 30, October 1, October 15, October 16, November 3, November 4, November 20, December 3, December 4, December 14, and December 15, 2015.

TABLE II–3—ASRAC WALK-IN COOLERS AND FREEZERS WORKING GROUP MEMBERS AND AFFILIATIONS

Member	Affiliation	Abbreviation
Ashley Armstrong	U.S. Department of Energy	DOE.
Lane Burt	Natural Resources Defense Council	NRDC.
Mary Dane	Traulsen	Traulsen.
Cyril Fowble	Lennox International, Inc. (Heatcraft)	Lennox.
Sean Gouw	California Investor-Owned Utilities	CA IOUs.
Andrew Haala	Hussmann Corp	Hussmann.
Armin Hauer	ebm-papst, Inc	ebm-papst.
John Koon	Manitowoc Company	Manitowoc.
Joanna Mauer	Appliance Standards Awareness Project	ASAP.
Charlie McCrudden	Air Conditioning Contractors of America	ACCA.
Louis Starr	Northwest Energy Efficiency Alliance	NEEA.
Michael Straub	Rheem Manufacturing (Heat Transfer Products Group)	Rheem.
Wayne Warner	Emerson Climate Technologies	Emerson.

[15] The ''six'' standards established in the 2014 final rule and vacated by the Fifth Circuit court order have become ''seven'' standards due to the split of one of the equipment classes based on capacity. Specifically, the ''multiplex condensing, low-temperature'' class (see 79 FR 32050, 32124 (June 3, 2014)) has become two classes of ''unit cooler, low-temperature,'', one with capacity (q_{net}) less than 15,500 Btu/h, and the other with capacity greater or equal to 15,500 Btu/h (see Table I–1).

[16] DOE has issued an enforcement policy with respect to dedicated condensing refrigeration systems operating at medium temperatures. See *www.energy.gov/gc/downloads/walk-coolerwalk-freezer-refrigeration-systems-enforcement-policy.*

All of the meetings were open to the public and were also broadcast via webinar. Several people who were not members of the Working Group attended the meetings and were given the opportunity to comment on the proceedings. Non-Working Group meeting attendees are listed in Table II–4.

TABLE II–4—OTHER ASRAC WALK-IN COOLERS AND FREEZERS MEETING ATTENDEES AND AFFILIATIONS

Attendee	Affiliation	Abbreviation
Akash Bhatia	Tecumseh Products Company	Tecumseh.
Bryan Eisenhower	VaCom Technologies	VaCom.
Dean Groff	Danfoss	Danfoss.
Brian Lamberty	Unknown	Brian Lamberty.
Michael Layne	Turbo Air	Turbo Air.
Jon McHugh	McHugh Energy	McHugh Energy.
Yonghui (Frank) Xu	National Coil Company	National Coil.
Vince Zolli	Keeprite Refrigeration	Keeprite.

To facilitate the negotiations, DOE provided analytical support, including detailed analyses and presentations. These materials are available in the relevant rulemaking docket (*www.regulations.gov/#!docketBrowser;rpp=25;po=0;D=EERE-2015-BT-STD-0016*). The analyses and presentations, developed with direct input from the Working Group members, included preliminary versions of many of the analyses discussed in this final rule, including a market and technology assessment; screening analysis; engineering analysis; energy use analysis; markups analysis; life cycle cost and payback period analysis; shipments analysis; and national impact analysis.

On December 15, 2015, the Working Group reached consensus on, among other things, a series of energy conservation standards to replace those that were vacated as a result of the litigation. The Working Group assembled its recommendations into a single term sheet (See Docket EERE–2015–BT–STD–0016, No. 52) that was presented to, and approved by the ASRAC on December 18, 2015. DOE considered the approved term sheet, along with other comments received during the negotiated rulemaking process, in developing energy conservation standards in this document. DOE published a notice of proposed rulemaking on September 13, 2016. (September 2016 NOPR) 81 FR 62979. A public meeting to discuss DOE's proposal was held on September 29, 2016.

III. General Discussion

DOE developed this rule after considering oral and written comments, data, and information from interested parties that represent a variety of interests. DOE received comments from a number of different entities. A list of these entities is included in Table III–1. The following discussion addresses issues raised by these commenters.

TABLE III–1—INTERESTED PARTIES WHO COMMENTED ON THE WICF NOPR

Name	Acronym	Type	Comment No. (docket reference)
Air-Conditioning, Heating, and Refrigeration Institute	AHRI	Trade Association	90
Appliance Standards Awareness Project	ASAP	Energy Efficiency Advocates	*79
Appliance Standards Awareness Project, Natural Resources Defense Council, and Northwest Energy Efficiency Alliance.	ASAP, NRDC and NEEA (ASAP et al.).	Energy Efficiency Advocates	84
California Investor Owned Utilities	CA IOUs	Utility Association	80
Cato Institute	Cato	Think Tank	87
CoilPod LLC	CoilPod	Component/Material Supplier.	77
Eric Andrews	Andrews	Individual	76
Hussmann Corporation	Hussmann	Manufacturer	83
Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, and Union of Concerned Scientists.	Joint Advocates	Energy Efficiency Advocates	81
Lennox International Inc. and Heatcraft Refrigeration Products, LLC.	Lennox	Manufacturer	89
Manitowoc Foodservice, Inc	Manitowoc	Manufacturer	82
Rheem Manufacturing Company and Heat Transfer Products Group, LLC.	Rheem	Manufacturer	91
U.S. Chamber of Commerce, American Chemistry Council, American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Petroleum Institute, Brick Industry Association, Council of Industrial Boiler Owners, National Association of Manufacturers, National Lime Association, National Mining Association, National Oilseed Processors Association, and the Portland Cement Association.	USCC et al	Business Federation	86
Weiss Instruments, Inc	Weiss	Component/Material Supplier.	85

TABLE III–1—INTERESTED PARTIES WHO COMMENTED ON THE WICF NOPR—Continued

Name	Acronym	Type	Comment No. (docket reference)
Zero Zone	Zero Zone	Manufacturer	88

* Comment number 79 indicates the party commented during the public meeting.

A. Equipment Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes by the type of energy used, capacity, or other performance-related features that would justify different standards. In determining whether a performance-related feature would justify applying 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) and 6316(a))

As previously noted in section II.B, a court order vacated the portions of the June 2014 final rule relating to multiplex condensing refrigeration systems (*i.e.,* unit coolers) operating at medium and low temperatures and dedicated condensing refrigeration systems operating at low temperatures. Therefore, this rulemaking focuses on standards related to these refrigeration system classes. More information relating to the scope of coverage is described in section IV.B.1 of this final rule.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE''s adoption and amendment of test procedures. (42 U.S.C. 6293 and 6314) Manufacturers must use the test procedures prescribed under these provisions to certify compliance with the applicable energy conservation standards and to quantify the efficiency of their covered product or equipment.

EPCA, as modified by EISA 2007, required DOE to develop a performance-based test procedure to measure the energy use of walk-in coolers and walk-in freezers. (42 U.S.C. 6213(a)(9)(B)(i)) On April 15, 2011, DOE published test procedures for the principal components that make up a walk-in: The panels, doors, and refrigeration systems. DOE took this component-based testing approach based on a significant body of feedback from interested parties that requiring a single test procedure for an entire walk-in would be impractical because most walk-ins are assembled on-site with components from different manufacturers. 76 FR 21580, 21582 (April 15, 2011).

DOE's current energy conservation standards for WICF refrigeration systems are expressed in terms of AWEF (*see* 10 CFR 431.304(c)(10)). AWEF is an annualized refrigeration efficiency metric that expresses the ratio of the heat load that a system can reject (in Btus) to the energy required to reject that load (in watt-hours). The existing DOE test procedure for determining the AWEF of walk-in refrigeration systems is located at 10 CFR part 431, subpart R. The current DOE test procedure for walk-in refrigeration systems was originally established by an April 15, 2011 final rule, which incorporates by reference the Air-Conditioning, Heating, and Refrigeration Institute (''AHRI'') Standard 1250–2009, *2009 Standard for Performance Rating of Walk-In Coolers and Freezers.* 76 FR 21580, 21605–21612.

On May 13, 2014, DOE updated its test procedures for WICFs in a final rule published in the **Federal Register** (May 2014 test procedure final rule). 79 FR 27388. That rule allowed WICF refrigeration system manufacturers to use an alternative efficiency determination method (''AEDM'') to rate and certify their basic models by using the projected energy efficiency level derived from these simulation models in lieu of testing. It also adopted testing methods to enable an original equipment manufacturer (OEM) to readily test and rate its unit cooler or condensing unit individually rather than as part of matched pairs. Under this approach, a manufacturer who distributes a unit cooler as a separate component must rate that unit cooler as though it were to be connected to a multiplex system. The unit cooler must comply with any applicable unit cooler standard that DOE may establish. Similarly, a manufacturer distributing a condensing unit as a separate component must use fixed values for the suction (inlet) conditions and certain nominal values for unit cooler fan and defrost energy, in lieu of actual unit cooler test data, when calculating AWEF. (10 CFR 431.304(c)(12)(ii))

DOE notes that, although that final rule established the approach for rating individual components of dedicated condensing systems, it still allowed for matched-pair ratings of these systems. This approach addressed the testing of dedicated condensing systems with multiple capacity stages and/or variable-capacity, since the current test procedure of AHRI 1250–2009 does not have a provision for testing individual condensing units with such features. An OEM would have to use matched-pair testing to rate multiple- or variable-capacity systems, but can choose matched-pair or individual-component rating for single-capacity dedicated condensing systems.

The May 2014 test procedure final rule also introduced several clarifications and additions to the AHRI test procedure for WICF refrigeration systems. These changes can be found in 10 CFR 431.304.

The Working Group, in addition to making recommendations regarding standards, also recommended that DOE consider making certain amendments to the test procedure to support the recommended replacement refrigeration system standards. See Term Sheet at EERE–2015–BT–STD–0016, No. 56, recommendation #6 and #7. Consistent with these test procedure-related recommendations, DOE published a test procedure notice of proposed rulemaking on August 17, 2016 (''August 2016 TP NOPR''). 81 FR 54926. A public meeting was held on September 12, 2016. DOE published a test procedure final rule on December 28, 2016. 81 FR 95758. All documents and information pertaining to the test procedure rulemaking can be found in docket EERE–2016–BT–TP–0030. The standard levels discussed in this document were evaluated using that revised test procedure.

C. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties.

DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i)

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

2. Maximum Technologically Feasible Levels

When DOE adopts a 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) and 6316(a)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for WICF refrigeration systems using the design parameters for the most efficient products available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.D.10 of this final rule and in chapter 5 of the final rule TSD.

D. Energy Savings

1. Determination of Savings

For each trial standard level (''TSL''), DOE projected energy savings from application of the TSL to covered WICF refrigeration systems purchased in the 30-year period that begins in the year of compliance with the standards (2020–2049).[17] The savings are measured over the entire lifetime of considered WICF refrigeration systems purchased in the 30-year analysis period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for the equipment at issue would likely evolve in the absence of energy conservation standards.

DOE used its national impact analysis (''NIA'') spreadsheet models to estimate national energy savings (''NES'') from potential standards for considered WICF refrigeration systems at issue. The NIA spreadsheet model (described in section IV.H of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by equipment at the locations where they are used. For electricity, DOE reports national energy savings in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. For natural gas, the primary energy savings are considered to be equal to the site energy savings. DOE also calculates NES in terms of full-fuel-cycle (''FFC'') energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[18] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.I.2 of this document.

2. Significance of Savings

To adopt any new or amended standards for a covered equipment, DOE must determine that such action would result in significant energy savings. (42 U.S.C. 6295(o)(3)(B) and 6316(a)) 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 (*i.e.,* 42 U.S.C. 6295).

E. Economic Justification

1. Specific Criteria

As noted above, EPCA provides seven factors to be evaluated in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(I)(VII) and 6316(a)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Consumers

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

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

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

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

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) and 6316(a)) DOE conducts this comparison in its LCC and PBP analysis.

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

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

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

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III) and 6316(a)) As discussed in section IV.H, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Products

In establishing equipment 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 equipment. (42 U.S.C. 6295(o)(2)(B)(i)(IV) and 6316(a)) Based on data available to DOE, the standards adopted in this document would not reduce the utility or performance of the equipment under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V) and 6316(a)) 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) and 6316(a)) To assist the Department of Justice (''DOJ'') in making such a determination, DOE transmitted copies of its proposed rule and the NOPR TSD to the Attorney General for review, with a request that the DOJ provide its determination on this issue. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for WICF refrigeration systems are unlikely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

f. Need for National Energy Conservation

DOE also considers the need for national energy and water conservation (as applicable) in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI) and 6316(a)) The energy savings from the adopted standards are likely to provide improvements to the security and reliability of the Nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the Nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the Nation's needed power generation capacity, as discussed in section IV.M.

DOE maintains that environmental and public health benefits associated with the more efficient use of energy are important to take into account when considering the need for national energy conservation. The adopted standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and GHGs associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K; the estimated emissions impacts are reported in section V.B.6 of this document. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.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) and 6316(a)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described above, DOE could consider such information under ''other factors.''

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii)) (and as applied to WICFs through 42 U.S.C. 6316(a)), 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 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), which is applied to WICFs through 42 U.S.C. 6316(a). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F of this final rule.

F. Compliance Date of Standards

Under EPCA, performance-based standards for WICFs, including the initial establishment of those standards, have a statutorily prescribed lead time starting on the applicable final rule's publication date and ending three (3) years later. Starting on that later date, WICF manufacturers must comply with the relevant energy conservation standards. See 42 U.S.C. 6313(f)(4)–(5). DOE may extend the lead time to as long as five (5) years if the Secretary determines, by rule, that the default 3-year period is inadequate. (See id.)

As discussed in section III.B, DOE developed test procedures for the principal components that make up walk-ins: The panels, doors, and refrigeration systems. DOE developed test procedures for walk-in refrigeration systems that express their efficiency in terms of AWEF. 76 FR 21580 (April 15, 2011). The June 2014 final rule established DOE's energy conservation standards for walk-in refrigeration systems based on AWEF—these standards, established for low-temperature and medium-temperature dedicated condensing refrigeration systems and for low-temperature and medium-temperature unit coolers (then called multiplex condensing systems), had a compliance date of June 5, 2017. 79 FR at 32124 (June 3, 2014). As discussed in section II.B, the standards for several of these categories of refrigeration systems were vacated. However, the standards for medium-temperature dedicated condensing systems remain in place, and their compliance date remains as June 5, 2017.

In the September 2016 NOPR, DOE projected that that this final rule would publish in the second half of 2016, and that it would hence establish a compliance date in the second half of 2019 for the new refrigeration system standards that DOE is adopting—DOE did not anticipate extending the standards lead time beyond three years. 81 FR at 62992 (Sept. 13, 2016).

DOE updated its enforcement policy for walk-in refrigeration systems on February 1, 2016, indicating that it would not exercise its enforcement authority in regard to energy conservation standards associated with medium-temperature dedicated condensing refrigeration systems for any such equipment manufactured prior to January 1, 2020.[19]

Manitowoc, Hussmann, Lennox, Rheem, and AHRI requested that manufacturers not be required to submit certification reports for WICF equipment covered in this rule and medium-temperature dedicated condensing classes until the projected January 2020 enforcement date. They argued that requiring manufacturers to certify refrigeration systems covered by the June 2014 final Rule on June 5, 2017, despite the fact that enforcement would not occur until 2020, would confuse customers and place unneeded burden on manufacturers. Zero Zone also argued that requiring certification before enforcement begins will cause confusion for manufacturers and customers and will not allow the Department to verify the certification data. (Manitowoc, No. 82 at p. 1; Hussmann, No. 83 at p. 1; Lennox, No. 89 at p. 6; Rheem, No. 91 at pp. 1–2; AHRI, No. 90 at pp. 1–2; Zero Zone, No. 88 at p. 1)

As discussed in the test procedure final rule, DOE has not changed the date for certifying the compliance of equipment covered by the June 2014 standards that have not been vacated, *i.e.,* those applicable to doors and medium-temperature dedicated condensing refrigeration systems. 81 FR at 95759–95760 (December 28, 2016). The compliance date for the WICF equipment covered in this rule, *i.e.,* classes of low-temperature dedicated condensing refrigeration systems and all classes of unit coolers, is three years from today's date.

Weiss asked for clarification regarding how DOE's proposal would address the installation of walk-ins by local contractors who buy components from wholesalers and assemble the walk-in on-site. (Weiss, No. 85 at p. 1).

Lennox commented there is ambiguity whether refrigeration system components assembled into a complete walk-in must be compliant on the date of manufacture of the refrigeration component or when the final WICF is actually assembled. Lennox noted that component manufacturers would need to leave time to sell components in inventory in advance of a compliance deadline, but WICF installers would also need to leave time both to purchase WICF components and install such components in advance of the compliance deadline. Lennox stated that additional burden is placed on WICF component manufacturers to compress timelines by several months or more if assemblers of complete walk-ins are required to use WICF components that are compliant at the time of assembly. (Lennox No. 89 at pp. 7–8) AHRI and Rheem also commented that additional burden is placed on component manufacturers as a result of a shortened compliance period if the requirement remains for installers to use components that are compliant at the time of the complete walk-in assembly. (AHRI No. 90 at p. 3; Rheem No. 91 at p. 3)

Lennox, AHRI and Rheem requested that DOE allow an unlimited sell through period for components manufactured prior to the compliance date of the amended standard. AHRI stated that most products subject to energy conservation standards have unlimited sell through periods for products manufactured before the effective date of an amended standard. *Id.*

As discussed in the test procedure final rule, a manufacturer of a walk-in cooler or walk-in freezer is any person who: (1) Manufactures a component of a walk-in cooler or walk-in freezer that affects energy consumption, including, but not limited to, refrigeration, doors, lights, windows, or walls; or (2) manufactures or assembles the complete walk-in cooler or walk-in freezer. 10 CFR 431.302.

A manufacturer of a walk-in component (*i.e.,* part 1 of the definition of a manufacturer of a walk-in cooler or walk-in freezer) is the entity that manufactures, produces, assembles or imports a walk-in panel, door or refrigeration system. The component manufacturer is responsible for ensuring the compliance of the component(s) it manufactures. DOE also requires that the component manufacturer certify the compliance of the components it manufactures, prior to distribution in commerce. 81 FR at 95778 (December 28, 2016). A walk-in component manufacturer must comply with the applicable energy conservation standards based on the date the component is produced. For example, beginning on June 5, 2017 walk-in door manufacturers must produce doors that comply with the applicable energy consumption standard. Imported components must comply with the applicable energy conservation standards based on the date of importation.

A manufacturer of a complete walk-in (*i.e.,* part 2 of the definition of a manufacturer of a walk-in cooler or walk-in freezer) is the entity that manufactures, produces, assembles or imports a walk-in cooler or freezer (*i.e.,* an enclosed storage space meeting the

[19] *http://energy.gov/sites/prod/files/2016/02/f29/Enforcement%20Policy%20Statement%20-%20WICF%2002-01-16.pdf.*

definition of a walk-in cooler or freezer). This includes ''installers'' of complete walk-ins. DOE explained that while it does not require manufacturers of complete walk-ins to submit certification reports for the complete walk-in itself, a manufacturer of a complete walk-in must ensure that each walk-in it manufactures meets the various statutory and regulatory standards. That is, a manufacturer of a complete walk-in is required to use components that comply with the applicable standards and to ensure the final product fulfills the statutory design requirements. See the test procedure final rule for additional discussion on how a manufacturer of a complete walk-in demonstrates compliance. 81 FR at 95781 (December 28, 2016).

DOE explained several ways a manufacturer of a complete walk-in could assemble a compliant walk-in. The manufacturer of a complete walk-in could make one or more of the components (*e.g.*, a walk-in door), test it, and certify it as the component manufacturer. In this instance the manufacturer of the complete walk-in is also the component manufacturer, and the component must meet the relevant energy conservation standard based on the date the component is produced.

Alternatively, the manufacturer of the complete walk-in could use an uncertified component and accept responsibility for its compliance. In this scenario, the date of installation is the date of manufacture. For example, if walk-in is assembled with a door designed for non-walk-in applications, then the door becomes a walk-in component on the walk-in assembly date, and must meet the relevant energy conservation standard based on the date of assembly.

Lastly, the manufacturer of the complete walk-in could use a certified component with a label that meets DOE's requirements, as it is not the manufacturer of the component, and bear no responsibility for the testing and certification of the component. In this case, the component must meet the relevant energy conservation standard based on the date the certified component was manufactured. As long as a manufacturer of a complete walk-in (*e.g.,* installers) uses compliant, certified components that are labeled in accordance with DOE's requirements, then it can assemble a complete walk-in using those components after the effective date of new or amended standards. For example, an installer may use walk-in doors manufactured prior to June 5, 2017 to assemble a walk-in after the compliance date as long as the door was certified as compliant with the standards in effect on the date the door was produced.

IV. Methodology and Discussion of Related Comments

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

DOE used several analytical tools to estimate the impact of the standards considered in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The national impacts analysis uses a second spreadsheet set that provides shipments projections and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (''GRIM''), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this rulemaking at *www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/30*. Additionally, DOE used output from the latest version of the *Annual Energy Outlook* 2016 (''*AEO2106*'') from the Energy Information Administration (''EIA'') for the emissions and utility impact analyses.

A. General Rulemaking Issues

During the September 29, 2016 NOPR public meeting, and in subsequent written comments, stakeholders provided input regarding general issues pertinent to the rulemaking, including the trial standard levels, the rulemaking timeline, and other subjects. These issues are discussed in this section.

1. Proposed Standard Levels

DOE proposed to adopt TSL 3 as the energy conservation standard for the equipment under consideration in this rulemaking. DOE's NOPR analysis showed that this level is both technologically feasible and economically justified. 81 FR at 63021 (September 13, 2016). TSL 3 represents the maximum technologically feasible level and corresponds to the energy conservation standard level that the Working Group unanimously recommended that DOE adopt. (Docket No. EERE–2015–BT–STD–0016, Term Sheet: Recommendation #5 (December 15, 2015), No. 56 at pp. 2–3).

The CA IOUs and ASAP et al. supported the proposed standard levels DOE presented in the NOPR. (CA IOUs, No. 80, at pp. 1–2; ASAP et al., No. 84, at p. 1)

Lennox supported the provisions laid out in the ASRAC Term Sheet, including the recommended standards levels contained therein, which were the result of a negotiated rulemaking. It also commented on the NOPR's consumer impact results, noting that while most equipment classes have positive or minimal negative consumer impacts, for certain equipment classes, the consumer impact is negative for a ''large percentage of consumers.'' (Lennox, No. 89 at p. 7) For example, Lennox noted that 42 percent of consumers had a net cost impact for low temperature unit coolers (UC.L) attached to low temperature multiplex condensing systems (MC.L). Lennox clarified that it does not generally support energy conservation standards that result in such a large portion of consumers experiencing a net cost impact. (Lennox, No. 89 at pp. 6–7)

In general, DOE seeks to avoid adopting standards resulting in large numbers of consumers experiencing net costs. DOE notes that Lennox supports the proposed standard levels, with which WICF Working Group negotiators (including Lennox) had agreed, as documented in the ASRAC Working Group Term Sheet. For the reasons discussed later in this document, DOE is adopting the same standard levels that it proposed as the energy conservation standard for the equipment under consideration in this final rule. See section VI for further discussion on the TSLs, economic justification and energy savings.

Eric Andrews agreed that the economic analysis supported the regulation on the basis of the purchase of new equipment, but expressed concern regarding the up-front cost that the consumer would incur to update existing equipment to the standard level. He commented that ''a credit'' should be made available to defray such costs. He observed further that the market for used equipment was not addressed in the analysis. (Andrews, No. 76 at p. 1) The comment seems to be made based on the assumption that all installed equipment must be upgraded to the standard level. In response, DOE notes that the adopted standard levels will apply only to new equipment manufactured after the compliance date of the standard. See section III.F for additional discussion regarding the compliance date.

2. Test Procedure

a. Process Cooling

Background

EPCA defines a walk-in as ''an enclosed storage space,'' that can be walked into, which has a total area of less than 3,000 square feet, but does not include products designed and marketed exclusively for medical, scientific, or research purposes. (42 U.S.C. 6311(20)) The use of the term ''storage space'' in the definition raises questions about which refrigerated spaces would qualify as a ''storage space'' and thereby comprise equipment subject to the walk-in standards. DOE has discussed the scope of this definition throughout its rulemakings to develop test procedures and energy conservation standards for walk-ins—most recently, the August 2016 TP NOPR addressed whether the scope extends to process cooling equipment such as blast chillers and blast freezers that can be walked into. 81 FR at 54934–54936 (August 17, 2016).

In the August 2016 TP NOPR, DOE described the background leading to the proposal of a definition for walk-in process cooling refrigeration equipment. 81 FR at 54934 (August 17, 2016). As described in that document, interested parties requested that DOE clarify the applicability of standards to this equipment as part of the initial standards rulemaking that DOE conducted for developing walk-in performance-based standards. The discussions in that prior rulemaking led DOE to conclude in the June 2014 final rule that equipment used solely for process cooling would not be required to meet the walk-in standards, but that products used for ''both process and storage'' applications could not categorically be excluded from coverage. 79 FR at 32068 (June 3, 2014). The August 2016 TP NOPR noted also the October 2014 meeting to clarify aspects of the test procedure, during which DOE again stated that blast chillers and blast freezers did not fall within the scope of the energy conservation standards established for walk-ins in the June 2014 final rule. However, DOE acknowledged at the time that it did not have a definition for ''process cooling'' in the context of walk-ins. (Docket No. EERE–2011–BT–TP–0024, Heatcraft and DOE, Public Meeting Transcript (October 22, 2014), No. 117 at pp. 23, 61–63) The question of process cooling arose again during the Walk-in Working Group meetings, during which meeting participants asked DOE to add definitions to clarify the meaning of process cooling (See Docket No. EERE–2015–BT–STD–0016: Manufacturer-submitted material, No. 6 at p. 2; Lennox, Public Meeting Transcript (August 27, 2015), No. 15 at pp. 96–97; AHRI, Public Meeting Transcript (December 15, 2015), No. 60 at pp. 141–142; and Term Sheet, No. 56, Recommendation #7)

The August 2016 TP NOPR explained that DOE considered process cooling more carefully in light of the Working Group's request to develop clarifying definitions and concluded that its initial statements in the June 2014 final rule that blast chillers and blast freezers are not walk-ins were in error. DOE observed that, although the EPCA definition refers to a walk-in as an ''enclosed storage space'', there is no clarity regarding the meaning of ''storage'' or the minimum duration for an item to remain in an enclosure to be considered in ''storage''. Hence, DOE now believes that these categories of equipment, referred to as ''process cooling equipment'' do fall under the EPCA definition for walk-ins and are subject to standards. 81 FR at 54934 (August 17, 2016).

The August 2016 TP NOPR went on to discuss DOE's proposal for defining a walk-in process cooling refrigeration system. DOE specifically developed this proposal, acknowledging the different energy use characteristics of process cooling refrigeration systems as well as their different equipment attributes (as compared to other walk-in refrigeration systems), to exclude such equipment from being subject to walk-in refrigeration system performance standards. (Because DOE now regards process cooling systems as ''walk-in coolers or freezers,'' they will be subject to the statutory design requirements.) DOE proposed defining a ''walk-in process cooling refrigeration system'' as ''a refrigeration system that is used exclusively for cooling food or other substances from one temperature to another.'' 81 FR at 54936 (August 17, 2016). The proposed definition specified that a process cooling refrigeration system must either be (1) distributed in commerce with an enclosure consisting of panels and door(s) such that the assembled product has a refrigerating capacity of at least 100 Btu/h per cubic foot of enclosed internal volume or (2) a unit cooler having an evaporator coil that is at least four-and-one-half (4.5) feet in height and whose height is at least one-and-one-half (1.5) times the width. This proposed definition would cover process cooling systems that are distributed in commerce as part of a complete assembly, process cooling unit coolers that are distributed separately from the enclosure, and refrigeration systems that include unit coolers meeting the process cooling definition. 81 FR at 54954 (August 17, 2016).

DOE noted in the August 2016 TP NOPR that it proposed to consider process cooling refrigerated insulated enclosures to be walk-ins that are subject to the prescriptive statutory requirements for walk-ins. DOE also notes that its discussion and proposals focused on process cooling refrigeration systems rather than the panels and doors that make up the insulated enclosure. Hence, DOE intended the exclusions associated with the proposals to apply only to refrigeration systems that meet the process cooling definition, and that the exclusions would be associated with walk-in refrigeration system performance standards. Id. at 54934–54936. DOE also provided a table in the test procedure NOPR public meeting presentation to clarify its interpretation of the applicability of walk-in standards to different components of process cooling equipment. (Docket No. EERE–2016–BT–TP–0030, Public Meeting Presentation, No. 3 at p. 30) This table indicated that the proposed exclusion for process cooling refrigeration systems would apply to, among other things, dedicated condensing units that are exclusively distributed in commerce with unit coolers meeting the unit cooler portion of the process cooling definition. DOE noted in the test procedure final rule that this exclusion was not explicit in the proposed definition and was clarifying it to explicitly include such dedicated condensing units in the definition. 81 FR at 95768 (December 28, 2016).

Importance of Coverage for Process Cooling Equipment

DOE explained in the August 2016 TP NOPR the reasons it believed that walk-in process cooling equipment should be considered to be covered under the walk-in definition. See 81 FR at 54934–54936 (August 17, 2016). In the test procedure final rule, DOE ultimately concluded that this equipment should be covered as walk-in equipment. 81 FR at 95771 (December, 28, 2016). In DOE's view, covering this equipment as a class of walk-ins is important in furthering DOE's goals for reducing and limiting energy use because this equipment represents a growing sector of the refrigeration industry. Process cooling equipment emerged on the market relatively recently in 1990 to serve a range of food sales and service applications. (Master-Bilt Blast Chillers, No. 25 at pp. 2, 3, 10) The global blast chiller market is expected to grow by an estimated 4.62% per year from 2016–2020 and North America is expected to remain a dominant portion of this market.[20] This growth is the expected result of increased demand in the food service industry (*e.g.,* restaurants, bakeries, catering) and meat processing industry and growth in the frozen food market.[21] Hence, DOE believes that there will be a robust market for process cooling equipment to serve this growing market need, and that there is a large potential growth in energy use associated with this market.

Process Cooling Equipment Status as Walk-In Equipment

Many commenters argued in response to the August 2016 TP NOPR that process cooling equipment does not fall under the walk-in definition. Several of these comments argued that food is not ''stored'' in this equipment and/or the temperature within it is not ''held'' at a given temperature for storage purposes. AHRI, Manitowoc, KeepRite, Rheem, and Hussmann stated that process refrigeration systems are not used for storage and therefore do not satisfy the statutory definition for a walk-in as an ''enclosed storage space.'' (Docket No. EERE–2016–BT–TP–0030; AHRI, No. 11 at p. 5; Manitowoc, No. 10 at p. 3; KeepRite, No. 17 at p. 2; Rheem, No. 18 at p. 3; Hussmann, No. 20 at p. 4) Similarly, Zero Zone argued that the purpose of process refrigeration systems conflicts with the dictionary definition of ''storage.'' (Docket No. EERE–2016–BT–TP–0030, Zero Zone, No. 15 at p. 1) American Panel also explained that product could be dehydrated and damaged if left in the process cooling equipment for an extended period of time. In its view, this fact should disqualify process cooling equipment from being considered as storage space—one of the key elements of the walk-in definition. (Docket No. EERE–2016–BT–TP–0030, American Panel, No. 7 at p. 1) AHRI added that the Term Sheet included the recommendation that DOE define process cooling for the purpose of clarifying that process cooling equipment are not included in the scope of WICFs. (Docket No. EERE–2016–BT–TP–0030, AHRI, No. 11 at p. 5)

Commenters reiterated many of these statements in response to the September 2016 NOPR. Hussmann, Zero Zone, Manitowoc, Rheem, and AHRI argued that process cooling refrigeration systems do not fit the EPCA definition of a WICF ''enclosed storage space.'' (42 U.S.C. 6311 (20)). Manitowoc, Rheem, and AHRI also stated that the inclusion of these equipment was not discussed in the ASRAC negotiations and requested that process cooling refrigeration systems be removed from the scope of the WICF test procedure and be specifically excluded from the WICF energy conservation standard and the EPCA prescriptive requirements. (Hussmann, No. 83 at p. 2; Zero Zone, No. 88 at p. 1; Manitowoc, No. 82 at pp. 1–2; Rheem, No. 91 at p. 2; AHRI, No. 90 at p. 2)

Conversely, the CA IOUs supported classifying process cooling equipment as WICF equipment, which would require the refrigeration systems, panels, and doors of process cooling equipment to meet the prescriptive standards set by EISA 2007. Further, they supported applying the June 2014 final rule WICF standards and the proposed standards to process cooling panels, doors, and dedicated condensing units not sold as part of a ''matched pair'' with a unit cooler. (CA IOUs, No. 80 at p. 2) (The R-value requirements for panels and doors are carry-overs from EISA 2007.)

EPCA defines ''walk-in cooler'' and ''walk-in freezer'' as an enclosed storage space refrigerated to temperatures, respectively, above, and at or below 32 degrees Fahrenheit that can be walked into, and has a total chilled storage area of less than 3,000 square feet. (42 U.S.C. 6311(20)(A)) While EPCA does not define the component terms ''storage'' or ''can be walked into'' used in the walk-in definition, it does expressly exclude certain equipment from the definition (*i.e.* equipment designed and marketed exclusively for medical, scientific, or research purposes). (42 U.S.C. 6311(20)(B))

Commenters appear to be arguing that a unit must hold contents for some minimum time-period to meet the ''storage'' element of the definition but offered no suggested time period for DOE to consider in applying this definition. The statutory definition of ''walk-in cooler and walk-in freezer'' does not indicate a specific timing requirement or provide further information about when the use of a space constitutes storage. Further, although dictionary definitions of ''storage'' indicate that the contents be kept for some period of time, no specific period is provided.[22] As noted in the August 2016 TP NOPR, the Working Group recommended that DOE define ''storage space''—which suggests that the term is ambiguous. 81 FR at 54934 (August 17, 2016). DOE acknowledges that the role of a process cooler or freezer is to chill food rapidly (to approach the temperature of the cooler or freezer, respectively), and one could interpret ''storage space'' to mean a space the primary purpose of which is storage. However, that understanding of ''storage space'' would be incongruous in the context of walk-in coolers and freezers. The purpose of such equipment is not simply storage *per se,* like a warehouse; it is storage at cold temperatures. Storage at cold temperatures necessarily encompasses chilling the items to be stored until they reach the temperature of the storage space, because items are rarely at exactly the storage temperature when they arrive to a walk-in cooler or freezer. A process cooler or freezer chills items more quickly than many walk-ins, but DOE regards that difference as being a difference in degree, not a fundamental difference in kind that makes a process cooler ''chilling'' equipment and not ''storage'' equipment.

DOE notes that Recommendation #7 from WICF Term Sheet (which contains the only mention of process cooling in the Term Sheet) recommended that DOE add ''WICF specific definitions for process cooling, preparation room refrigeration, and storage space.'' (Term Sheet, No. 56 at p. 3) This recommendation does not state that these categories of equipment are excluded from the scope of WICFs. In fact, a comment received in response to the initial 2013 notice of proposed rulemaking for energy conservation standards stated that process cooling equipment would appear to fall within the walk-in definition. (Docket No. EERE–2008–BT–STD–0015, Hussmann, No. 93 at pp. 2, 8–9) In re-examining that comment, along with other information and materials since the publication of the June 2014 final rule, DOE has reconsidered its prior views on process cooling equipment.

As noted in the August 2016 TP NOPR, contents are placed in process

[20] Infinity Research Limited (Technavio), Global Commercial Blast Chillers Market 2016–2020; Published November 2016; Accessed November 2016 at *www.technavio.com/report/global-miscellaneous-global-commercial-blast-chillers-market-2016-2020.*

[21] Hexa Research, Frozen Food Market Analysis By Product (Ready Meals, Meat, Seafood, Fruits & Vegetables, Potatoes, Soup) And Segment Forecasts To 2020; Published November 2014; Accessed November 2016 at *www.hexaresearch.com/research-report/frozen-food-industry/.*

[22] ''Storage: 1. The act of storing; state or fact of being stored. 2. capacity or space for storing. 3. a place, as a room or building, for storing. 4. Computers. memory (def 11). 5. the price charged for storing goods.'' *en.oxforddictionaries.com/definition/storage.* ''Storage: 1a: Space or a place for storing b: An amount stored c: Memory; 2a: The act of storing: The state of being stored; especially: The safekeeping of goods in a depository (as a warehouse) b: The price charged for keeping goods in a storehouse.'' *www.merriam-webster.com/dictionary/storage.*

cooling equipment for at least a brief period of time to reduce their temperature. 81 FR at 54934 (August 17, 2016). When asked during the public meeting how long the products remain in a process cooling system when they are being cooled, American Panel noted that, although the Food and Drug Administration and NSF International have recommended maximum processing times, there is no industry-specified minimum or maximum processing duration for blast chillers or blast freezers. (Docket No. EERE–2016–BT–TP–0030, American Panel, Public Meeting Transcript, No. 23 at p. 48) DOE notes that the 2013 FDA Food Code requires that food starting at 135 °F be cooled to 70 °F within 2 hours and to 41 °F within 6 hours (FDA 2013 Food Code, Chapter 3, Section 501.14(A)), while NSF requires that rapid pulldown refrigerators and freezers be able to reduce food temperature from 135 °F to 40 °F in 4-hours. (NSF/ANSI 7–2009, section 10.5.1) These time periods differ significantly and are substantially longer than the 90-minute pulldown times discussed in the June 2014 final rule. (79 FR at 32068 (June 3, 2014)). This observation underscores American Panel's statement that there is no standard maximum processing time. Also, while DOE recognizes that product may remain in process cooling equipment for a short period of time, this fact alone does not necessarily clarify that the equipment cannot be considered to have a storage function. The period of time a product can be held in a cooler or freezer without sustaining some damage can be expected to vary product by product, depending on a variety of factors including, whether the product is chilled or frozen, its packaging when inserted into the equipment (e.g., what type and size container it is in, whether or not it is covered, etc.), moisture content, size of the individual food pieces, and other factors. Commenters did not provide any indication of how long food products can remain in process cooling equipment after completion of cooldown before they must be removed to avoid damage—hence, making it difficult to draw clear distinctions between residence time in this equipment and lengths of time that would be associated with ''storage.''

Absent a definitive time-period to delineate the use of space as storage space, DOE considered the design and operation of process cooling equipment with other equipment falling within the WICF definition. DOE considers that design and operation are reflective of the function of equipment (*i.e.*, whether it constitutes storage space) because these two elements are necessary components in determining the function or purpose of a given type of equipment.

Manitowoc and AHRI argued in response to the August 2016 TP NOPR that the panels and doors used by process cooling systems are not the same as those used in other WICF systems and therefore the WICF prescriptive requirements should not apply. (Docket No. EERE–2016–BT–TP–0030, Manitowoc, No. 10 at p. 3; AHRI, No. 11 at p. 5) Manitowoc and AHRI did not clarify how the panels and doors are different, and provided no indication that process coolers needed specific utility features that would justify the use of different efficiency levels or be the basis for relief from the performance requirements that are already in place. DOE notes that this discussion of panels and doors did not provide any clarity as to whether process cooling equipment provides any storage function.

In the context of blast chillers, American Panel noted that while the panels and doors for this equipment were similar to those used in other walk-ins, the refrigeration systems used in blast chillers are designed and used very differently from walk-ins—a fact that, in its view, necessitated that these (and similar process cooling equipment) be treated separately from walk-ins. (Docket No. EERE–2016–BT–TP–0030, American Panel, No. 7 at p. 1) American Panel did not clarify how the refrigeration systems are designed differently, in spite of DOE's request for data or information on the qualities, characteristics, or features specific to the refrigeration system that would cause a process refrigeration system to be unable to meet a walk-in refrigeration system standard. See 81 FR at 54950 (August 17, 2016).

American Panel, however, asserted that blast chillers and shock freezers differ from walk-ins in that they have an on/off switch, they do not reach a stable condition until the pulldown cycle ends, either automatically or manually, and they rely on the user to stop and restart the cycle. (Docket No. EERE–2016–BT–TP–0030, American Panel, No. 7 at p. 1) In its view, all of these features differed from the operation of walk-ins, which typically operate continuously and independent of user action, being connected to power at all times. DOE notes that this description of refrigeration equipment operation also applies to other walk-in systems. The walk-in refrigeration system is sized so that its capacity is greater than the walk-in box load. Equation 1, for example, in AHRI 1250–2009, indicates that the box load for a walk-in is 70 percent of the net refrigeration system capacity at the design temperature for conditions outside the box. Hence, a walk-in refrigeration system does not achieve steady state operation—it relies on a thermostat to shut the system off at the desired internal temperature (*e.g.,* 35 °F for a walk-in cooler) as the refrigeration system is pulling down temperature to what would be a lower steady-state temperature. As American Panel indicated, a process cooling system does not reach stable operation until the pulldown cycle has ended and an automatic control may end the cycle to transition the system from the pulldown cycle into stable operation. This ending of the pulldown with an automatic control is the same as a walk-in system's pulldown cycle ending by a thermostat. Hence, in DOE's view, American Panel's observations do not provide a clear distinction between process cooling and other walk-in equipment since the fundamental operational characteristics remain the same.

American Panel also contended that, because a blast chiller's operation changes continuously and the equipment exhibits no stable operating condition, it cannot be tested to a rated AWEF and a test procedure cannot be applied. (Docket No. EERE–2016–BT–TP–0030, American Panel, Public Meeting Transcript, No. 23 at pp. 46–47, 56, 78) American Panel added that, if the test procedure were to be updated to include blast chiller performance testing, the food industry would support using NSF's testing methods for rapid pulldown refrigeration as a starting point. (Docket No. EERE–2016–BT–TP–0030, American Panel, No. 07 at p. 2) DOE notes first that a performance-based test procedure requiring steady state operation is not necessary for process cooling refrigeration systems, because equipment meeting the definition is excluded from the walk-in refrigeration system performance standards,[23] and, hence, a method for measuring AWEF for such equipment is not needed. However, DOE notes also that a blast chiller refrigeration system appears to have no steady operating condition because its capacity is so much larger per insulated box internal volume than for other walk-ins. Once the products have been pulled down to the specified temperature, the walls of the box do not transmit sufficient load to prevent the internal box temperature from dropping further—i.e. the box does

[23] DOE notes that this exclusion does not apply to condensing units distributed in commerce individually, because, as discussed elsewhere in this section, they are indistinguishable from other walk-in refrigeration systems.

not absorb enough heat to prevent its interior from becoming colder. If the same refrigeration system were serving a much larger box, the internal temperature may very well stabilize to a steady-state operating temperature. Conducting a test to determine the system's AWEF would require testing the equipment with a test chamber whose indoor-room conditioning system has enough heating capacity to balance the refrigeration system's cooling capacity. Hence, the difference between a process cooling refrigeration system and other walk-in refrigeration systems is a function of the magnitude of capacity, rather than any fundamental difference in the operation of the equipment. While the magnitude of capacity is relevant to how quickly a unit lowers the temperature of its contents, and may be instructive as to the duration of storage, it does not inform the fundamental consideration of whether a unit provides any storage.

Process cooling equipment such as blast chillers and blast freezers, despite any asserted differences, have several characteristics in common with more conventional walk-ins that make them capable of serving the function of refrigerated product storage. These characteristics include having an insulated enclosure made of insulated panels and a door (or doors) sufficiently large that the enclosure can be walked into, and being cooled with a refrigeration system consisting of a dedicated condensing unit and a refrigerant evaporator that operates using forced convection heat transfer (*i.e.,* enhanced by air movement created by a fan). The panels and doors are fabricated with a sheet metal exterior shell around insulation that serves as a thermal barrier. The panels and/or door may also have a multi-pane window to allow viewing of the interior of the enclosure from the outside. The doors have hinges or another mechanism to allow opening for access to the enclosure interior, with a latching mechanism to ensure positive closure when shut. The refrigeration system can operate to cool the enclosure to refrigerated temperatures. Product can be placed in the refrigerated enclosure. If the product is not already at the temperature of the internal refrigerated space, the product's temperature will drop, approaching the temperature of the interior, due to transfer of heat to the air within the enclosure; otherwise the product temperature remains at the average internal temperature until removed from the enclosure. As discussed above, while some of the details of the design of such systems differ from other walk-ins, these equipment generally resemble all walk-ins and are capable of serving the function of refrigerated product storage.

AHRI, Manitowoc, and Rheem also asserted that process cooling equipment is inconsistent with the term ''walk-in'' because a person cannot walk into a process cooling enclosure during operation. (Docket No. EERE–2016–BT–TP–0030, AHRI, No. 11 at p. 5; Manitowoc, No. 10 at p. 3; Rheem, No. 18 at p. 3) However, DOE notes that the walk-in definition does not specify when the equipment can be walked into—it simply states that the equipment must be one ''that can be walked into.'' (42 U.S.C. 6311(20)(A))

In interpreting the ''walk-in cooler and freezer'' definition, DOE also considered the terms in the context of EPCA's WICF provisions as a whole. EPCA establishes a number of prescriptive requirements for WICFs. (42 U.S.C. 6313(f)(1)) While not dispositive, none of the prescriptive requirements conflicts with including process cooling equipment as a class of walk-in. Additionally, Congress has already spoken to the groups of equipment that are excluded from the walk-in definition by listing specific equipment (*i.e.,* ones designed and marketed exclusively for medical, scientific, or research purposes) that would be walk-ins. (42 U.S.C. 6311(20)(B)) Process cooling equipment is not part of this listing, which suggests that Congress did not contemplate that this equipment would be excluded from being treated as a class of walk-in equipment.

In consideration of these factors, DOE has determined that process cooling equipment falls within the EPCA definition of ''walk-in cooler'' and ''walk-in freezer.'' While products may not be able to be stored in process cooling equipment on a long-term basis, products are still stored in process cooling equipment at least for the duration they are cooled. If Congress had intended to limit the application of the walk-in definition to include only long-term storage, it could have done so when crafting the final language of the statute. Congress, in fact, did not limit what comprises storage space. Moreover, when comparing the design and function of process cooling equipment with other WICFs, DOE was unable to determine a distinction with regard to storage.

AHRI, Manitowoc, KeepRite, Rheem, and Hussmann argued that including process cooling equipment in the definitions of walk-in cooler and walk-in freezer would be inconsistent with DOE's proposed definition for refrigerated storage space, ''as space held at refrigerated temperatures'' since process cooling equipment does not hold a specific temperature but changes the temperature of the contents. (Docket No. EERE–2016–BT–TP–0030, AHRI, No. 11 at p. 5; Manitowoc, No. 10 at p. 3; KeepRite, No. 17 at p. 2; Rheem, No. 18 at p. 3; Hussmann, No. 20 at p. 4) DOE notes that comments submitted by Bally describe process cooling equipment as operating at ''cold temperatures (min. of 5 °F)'' and having ''doors [that] must stay condensate free while the air temperature is at 5 °F.'' (Docket No. EERE–2016–BT–TP–0030, Bally, No. 22 at p. 1) These descriptions suggest control of temperature within the blast chiller is held at the minimum 5 °F—in other words, the interior is held at a temperature near 5 °F. This fact suggests that process cooling equipment can (and do) hold temperatures, contrary to the comments. Nevertheless, DOE notes that the proposed definition for refrigerated storage space as ''space held at refrigerated temperatures'' does not require that the temperature be held at a discrete constant value—instead, it only requires that the space is held at a temperature consistent with ''refrigerated,'' *i.e.,* ''held at a temperature at or below 55 °F''. The spaces within blast chillers and freezers are held below 55 °F and, thus are consistent with the definition of ''refrigerated storage space.''

NAFEM also weighed in on this issue generally, arguing that blast chillers should not be considered within the scope of the walk-in definition because there is no appropriate test procedure for blast chillers. (Docket No. EERE–2016–BT–TP–0030, NAFEM, No. 14 at p. 1) However, EPCA's walk-in definition does not stipulate that its scope extends only to equipment for which there is a test procedure. In fact, EPCA mandated prescriptive standards for walk-ins that took effect (on January 1, 2009, see 42 U.S.C. 6313(f)(1)) before DOE finalized a test procedure on April 15, 2011 for measuring a given unit's energy efficiency. 76 FR 21580. Similarly, in response to American Panel's comment that a process cooling refrigeration system is not a walk-in because it cannot be rated with an AWEF, satisfaction of the separate statutory prescriptive requirements specified in the statute (e.g. use of certain componentry, satisfaction of certain thermal insulation thresholds for doors and panels, and installation of devices to minimize infiltration) have no direct bearing on the AWEF value of a given refrigeration system. Hence, the question of whether a given walk-in refrigeration system can be rated with this metric has no bearing on whether the equipment is a walk-in.

Manitowoc, Rheem, and AHRI also noted that an ASHRAE Special Project Committee (''SPC'') has been formed to draft a relevant testing standard titled, ''Method of Testing for (Rating) Small Commercial Blast Chillers, Chiller/Freezers, and Freezers.'' They argued that in light of this work, it is premature to define process cooling systems while this new industry standard is still under development. (Docket No. EERE–2016–BT–TP–0030, Manitowoc, No. 10 at p. 3; Rheem, No. 18 at p. 3; AHRI, No. 11 at p. 5) DOE notes that the WICF Working Group, which included Manitowoc and Rheem, requested that DOE develop a definition for process cooling. Before the finalization of the WICF Term Sheet on December 15, 2015, DOE was not aware of any announcement from ASHRAE SPC regarding the start of its work. Nevertheless, the SPC has not finished its work, and the commenters did not provide any indication of what equipment definitions the SPC is considering. Accordingly, DOE has finalized its definition in the manner proposed, based on the industry input provided. DOE may consider revising its ''process cooling'' definition if necessary once the ASHRAE rating method for blast chillers, chiller/freezers, and freezers is complete.

Finally, DOE notes that the CA IOUs supported treating process cooling as a subset category of WICF equipment. Further, they supported requiring process cooling panels, doors, and dedicated condensing units not sold as part of a ''matched-pair with a unit cooler'' to meet the June 2014 final rule WICF standards and the proposed standards under consideration. (Docket No. EERE–2016–BT–TP–0030, CA IOUs, No. 21 at p. 2)

As described in the August 2016 TP NOPR, DOE concluded that while process cooling enclosures that resemble walk-ins are within the scope of walk-ins, it proposed to exclude some of the refrigeration systems of these process cooler walk-ins from the performance-based standards established and in development for WICF refrigeration systems. 81 FR at 54934–54937 (August 17, 2016). For the reasons described earlier, DOE has not revised its proposed approach after review of the comments, and believes that its definition, as adopted in the December 2016 TP final rule, satisfies the recommendations of the Working Group Term Sheet.

Distinguishing Characteristics of Process Cooling Refrigeration Systems

DOE received few comments regarding the distinguishing characteristics proposed for process cooling refrigeration systems. In fact, only one of the commenters mentioned any characteristic of the refrigeration system condensing unit of a process cooling system that might distinguish it from the equipment serving other walk-ins—Bally commented that the condensing units are not unique to blast chillers, except with respect to extra receiver capacity. (Docket No. EERE–2016–BT–TP–0030, Bally, No. 22 at p. 1) However, DOE would not consider a larger receiver to be a sufficient difference to distinguish these condensing units since using a larger receiver would not affect steady state energy use as measured by the test procedure, since the receiver itself does not consume energy and does not contribute significantly to the heat transfer function of the condenser. Furthermore, there is a range of refrigerant receiver capacities used in walk-in refrigeration systems and it is not clear that there is an appropriate receiver capacity threshold that would indicate that a condensing unit is used for process cooling rather than for other walk-in functions—neither Bally nor other commenters suggested such a threshold value. Consequently, DOE would not consider a larger receiver to distinguish process cooling condensing units. Absent any other clear distinguishing feature, DOE must conclude that the condensing units used for process cooling are no different than those used for other walk-ins.

Lennox recommended that the evaporator coil height, width, and depth be defined on a diagram accompanying the proposed definition to prevent a misinterpretation of the dimensions. (Docket No. EERE–2016–BT–TP–0030, Lennox, Public Meeting Transcript, No. 23 at p. 40) Lennox provided a diagram to illustrate this in its written comments (Docket No. EERE–2016–BT–TP–0030, Lennox, No. 13 at p. 8) In reviewing this diagram, DOE agreed that the dimensions shown in the provided diagram are consistent with the proposed definition's intent and agrees that a diagram would be useful to clarify the applicable dimensions. Accordingly, the test procedure final rule incorporates a diagram based on the one submitted by Lennox to clarify the process cooling definition. 81 FR at 95772 (December 28, 2016).

With respect to blast freezers, Bally noted that some of these equipment use horizontally-oriented evaporator units and some non-process cooling refrigeration systems chill their contents using a circular pattern. In its view, because of the absence of any standard orientation or chilling pattern for process cooling and non-process cooling refrigeration systems, these design characteristics are not useful for differentiating process refrigeration systems. (Docket No. EERE–2016–BT–TP–0030, Bally, Public Meeting Transcript, No. 23 at pp. 41–42) DOE notes that a horizontally-oriented evaporator that is not part of a unit cooler as defined would not be subject to the unit cooler standards, nor would it, as a matched pair with a dedicated condensing unit, be subject to the dedicated condensing unit standards. In order to clarify the extension of this exclusion to matched pairs including such evaporators, DOE has modified the process cooling refrigeration system definition to explicitly list dedicated condensing units that are distributed in commerce exclusively with evaporators that are not unit coolers. 81 FR at 95772 (December 28, 2016).

Alternatively, Bally suggested that airflow rate may be a good characteristic for differentiating process refrigeration systems from other walk-in refrigeration systems. (Docket No. EERE–2016–BT–TP–0030, Bally, Public Meeting Transcript, No. 23 at p. 44) American Panel expressed concern with the use of a cooling capacity per enclosed volume rating to differentiate process cooling equipment because the equipment may be used to process different quantities or densities of product at different times—a condition which may prevent a given blast chiller from satisfying a definition based on cooling capacity per enclosed volume. (Docket No. EERE–2016–BT–TP–0030, American Panel, Public Meeting Transcript, No. 23 at pp. 38–39) DOE had considered airflow rate or air velocity to distinguish process cooling evaporators, noting that evaporator fan power, velocity, or air flow of a unit cooler could be atypically high for a number of reasons, including the use of inefficient fans or motors, long air ''throw'' distance, and other factors. (See 81 FR at 54936 (August 17, 2016)) For example, DOE's investigation of evaporator fan horsepower showed that the horsepower for process cooling evaporator fans, although generally higher than for other walk-in evaporators, is not always higher than all such other walk-in evaporators—a potential overlapping fact that lessens the value of using horsepower as a clear distinguishing characteristic. Hence, DOE concluded that there would be too much overlap with other WICF unit coolers on the basis of these parameters. DOE notes that Bally's submission did not provide sufficient information or data that would support the use of a specific air flow rate on which DOE could rely that would serve as the basis for distinguishing process coolers from other walk-in refrigeration systems. With respect to American Panel's concerns, DOE notes that its comments provided no alternative value of cooling load per volume for DOE to consider that would enable one to readily distinguish process cooling refrigeration systems from non-process cooling refrigeration systems. While American Panel seems to suggest that the capacity of the refrigeration system would depend on the load inserted into a process cooler, DOE disagrees, because the capacity cited in the proposed definition is the refrigeration system's net capacity when determined in a manner consistent with the prescribed walk-in test conditions—this capacity depends on the refrigeration system characteristics, not on how much product is being cooled. Specifically, when testing a condensing unit alone, the test calls for maintaining certain operating conditions (see, *e.g.,* tables 11 through 14 of AHRI 1250–2009, which specify air and refrigerant entering conditions and refrigerant exiting subcooling condition, but nothing about the quantity of product being cooled). No commenters provided specific suggestions regarding the appropriateness of the proposed 100 Btu/h per cubic foot, *i.e.,* what lower value would be more appropriate. Additionally, commenters provided no other suggestions regarding more appropriate distinguishing characteristics to use for process cooling refrigeration systems, and none provided specific quantified values for recommended parameters to use in the definition. Hence, DOE is largely adopting the approach contained in its proposed definition.

However, to address the comments regarding the inconsistency of the ''storage'' aspect of walk-ins with the pulldown of product temperature in process cooling equipment, DOE will modify the definition to identify refrigeration systems that are ''capable of rapidly cooling food or other substances'' rather than systems that are ''used exclusively'' for this purpose. Also, in order to clarify that the enclosure that uses these refrigeration systems is insulated, DOE will insert ''insulated'' before the word ''enclosure'' in the definition.

KPS raised concern regarding the precision of the process cooling definition, indicating that ''blast chillers'' and ''blast freezers'' are used by customers and manufacturers to describe a range of product types. (Docket No. EERE–2016–BT–TP–0030, KPS, No. 8 at p. 1) KPS did not, however, elaborate on what other types of equipment should be addressed (or excluded) by DOE's proposed definition. DOE is aware, for example, of blast chillers and freezers that are smaller than walk-ins and that might be considered ''reach-in process cooling equipment,'' *i.e.,* process cooling equipment which the user reaches into rather than walks into to insert or remove product. This terminology is consistent with the term ''reach-in'' used with commercial refrigeration equipment (see, *e.g.,* Double Door Refrigerator, No. 93) However, DOE is not concerned that such equipment would be confused with walk-in process cooling equipment, because such reach-in equipment cannot be walked into.

Impact on Refrigeration System Energy Conservation Standards

As discussed above, process cooling refrigeration systems generally are not subject to the energy conservation system standards that are the subject of this final rule notice. DOE explicitly established the process cooling refrigeration system definition in acknowledgement that the energy use of these systems may not be adequately represented by the AWEF metric used to represent the efficiency of other walk-in refrigeration systems. Consequently, this equipment has little bearing on the analysis conducted for this rulemaking or the efficiency levels considered as potential standard levels. Nevertheless, walk-in process cooling equipment is subject to other standards, notably the EPCA prescriptive design standards and the standards for panels and doors as prescribed by the June 2014 final rule.

b. Preparation Room Refrigeration Systems

Hussmann, Zero Zone, Manitowoc, Rheem, and AHRI argued that preparation room refrigeration systems do not fit the EPCA definition of a WICF ''enclosed storage space.'' (42 U.S.C. 6311 (20)). Manitowoc, Rheem, and AHRI also stated that the inclusion of these equipment was not discussed in the ASRAC negotiations and requested that preparation room refrigeration systems be removed from the scope of the WICF test procedure and be specifically excluded from the WICF energy conservation standard and the EPCA prescriptive requirements. (Hussmann, No. 83 at p. 2; Zero Zone, No. 88 at p. 1 Manitowoc, No. 82 at pp. 1–2; Rheem, No. 91 at p. 2; AHRI, No. 90 at p. 2) Stakeholders expressed similar comments in response to the August 2016 TP NOPR. DOE responded to these comments in the December 2016 TP final rule, providing extensive discussion supporting its position, and concluding that preparation room refrigeration systems are indistinguishable from other walk-in refrigeration systems, and hence are subject to the walk-in refrigeration system energy conservation standards. 81 FR at 95773–95774 (December 28, 2016).

c. Single-Package Dedicated System

The CA IOUs agreed that AHRI 1250–2009 is an appropriate test procedure for ''packaged dedicated systems'' and suggested the term ''packaged dedicated system'' be changed to ''single-package dedicated system'' or ''self-contained units,'' in order to improve clarity and align regulatory and industry language. (CA IOUs, No. 80 at pp. 2–3)

Conversely, Manitowoc, Rheem, and AHRI argued that packaged dedicated units be excluded from the scope of the WICF test procedure and specifically excluded from EPCA's prescriptive design requirements and energy conservation standards because their proposed inclusion was neither discussed in the ASRAC negotiations nor a part of the Term Sheet approved by the Working Group. (Manitowoc, No. 82 at pp. 1–2; Rheem, No. 91 at p. 2; AHRI, No. 90 at p. 2)

DOE notes that section 2.1 of AHRI 1250–2009 states that the scope of this testing standard ''applies to mechanical refrigeration equipment consisting of an *integrated single package refrigeration unit* [emphasis added], or separate unit cooler and condensing unit sections, where the condensing section can be located either outdoor or indoor.'' AHRI 1250–2009, section 2.1.

DOE agreed that the suggested use of the term ''single-package dedicated refrigeration system'' would provide further clarity, indicating much more precisely what this equipment is, and is consistent with the approach used for air-conditioning units. DOE adopted the suggested term from the CA–IOUs in its December 2016 TP final rule. 81 FR at 95764 (December 28, 2016).

DOE notes that the definition for ''refrigeration system'' was established in the context of walk-ins to include ''(1) A packaged dedicated system where the unit cooler and condensing unit are integrated into a single piece of equipment'' in its April 15, 2011 final rule establishing test procedures for WICFs. 73 FR at 21605. In DOE's view, packaged systems are walk-in refrigeration systems and are subject to the applicable prescriptive standards established by Congress through EISA 2007 along with the performance standards that DOE prescribes for these systems.[24] DOE notes that this view is not restricted to DOE, as two manufacturers confirmed that a single-package refrigeration system is a type of dedicated condensing system on two occasions during the Working Group meetings. (Docket No. EERE–2015–BT–STD–0016; Lennox, Public Meeting Transcript (October 16, 2015), No. 63 at pp. 249–251; Rheem, Public Meeting Transcript (December 3, 2015), No. 57 at p. 157). Also, DOE notes that the Term Sheet included no indication that these systems are excluded. (Term Sheet, No. 56) Thus, DOE disagrees that these systems are not considered to be WICF refrigeration systems subject to WICF standards, including the prescriptive standards mandated by EPCA.

d. Hot Gas Defrost

Lennox agreed with the removal of the hot gas defrost credit from the test procedure, and recommended that, as a replacement for this removal, that DOE adopt an approach where hot gas defrost models would be assigned the AWEF value of an equivalent electric defrost model. Lennox defined an equivalent electric defrost model as one within +/− 10% of the net capacity of the rated hot gas model. If an equivalent electric defrost model is not available, Lennox recommended that an AEDM could be used to determine a hot gas model's AWEF rating. (Lennox, No. 89 at pp. 5–6) DOE also received numerous comments regarding the treatment of hot gas defrost units in response to the test procedure NOPR, several of which recommended similar or identical approaches. DOE discussed these comments and responded to them in the test procedure final rule, establishing an approach that includes testing such units as if they are electric defrost units, using standardized energy and defrost thermal load contributions in the AWEF calculations. 81 FR at 95774–95777 (December 28, 2016).

[24] With respect to these prescriptive requirements, DOE notes that the relevant statutory provision does not indicate that the promulgation of performance standards supplants those standards that Congress already mandated through its enactment of EISA 2007. Accordingly, because there is no explicit authority in this instance for DOE to override a statutorily-prescribed standard, the initial design requirements established by Congress continue to apply. See 42 U.S.C. 6313(f)(1)–(5) (detailing prescriptive design requirements for certain walk-in components and the process by which DOE must prescribe separate walk-in performance-based standards).

e. High-Temperature Freezers

Lennox requested that DOE allow manufacturers to publish application ratings of medium temperature condensing units to cover the high temperature freezer application range (room temperature of 10 °F to 32 °F) and allow sale for that use. Due to the limitations of low-GWP refrigerants approved by the U.S. Environmental Protection Agency's (''EPA's'') Significant New Alternatives Policy (''SNAP''), Lennox noted that only medium temperature condensing units are able to operate in this range and thus preventing manufacturers from selling these units for this application would violate EPCA's mandate that a new standard shall not result in the unavailability of any product type, features, sizes, capacities and volumes (42 U.S.C. 6295(o)(4)). Further, it suggested that such a limitation would lessen ''the utility or performance'' of this equipment (as contemplated under 42 U.S.C. 6295(o)(2)(B)(i)(IV)) because in today's marketplace, manufacturers publish application data for medium temperature condensing units covering this application range. Lennox also argued that creating a new equipment class or allowing test procedure waivers for these cases will add to manufacturer burden (*i.e.,* additional testing, certification, and marketing costs) without passing any benefit along to customers or improving energy efficiency performance. Finally, Lennox provided test data for 12 medium temperature and 11 low temperature condensing units showing that the medium temperature units actually achieve a higher AWEF value than the low temperature units when operating at the 10 °F test condition. In its view, allowing manufacturers to market and sell their medium temperature units for this application range may actually result in better energy efficiency performance. (Lennox, No. 89 at pp. 2–5)

As explained in the test procedure final rule, DOE requires that equipment that is distributed in commerce consistent with the definitions for multiple equipment classes must be certified for all such classes. 81 FR 95791 (December 28, 2016). Lennox's assertions regarding the potential lessening of utility or performance or the unavailability of any product type, features, sizes, capacities and volumes are undercut by the available data, which show that all of the equipment performance projections—including those provided in Lennox's comments—exceed the minimum AWEF standard proposed by DOE by a large margin (*i.e.,* have a higher energy efficiency performance than the proposed standard). (Lennox, No. 89 at p. 4) Hence, the proposed (and final) standard's stringency will not make these equipment unavailable or reduce their utility.

3. Rulemaking Timeline

DOE issued the test procedure final rule on December 2, 2016. DOE issued the energy conservation standard NOPR on August 30, 2016 and published it on September 13, 2016. 81 FR 62980. The comment period for the energy conservation standard NOPR closed on November 14, 2016.

AHRI, Hussmann and Zero Zone commented on DOE's timeline in conducting concurrent test procedure and energy conservation standard rulemakings. (Docket No. EERE–2015–BT–STD–0016, AHRI, No. 90, at pp. 2–3; Hussmann, No. 83, at p. 2; Zero Zone, No. 88, at p. 1) Hussmann stated that overlapping NOPRs and comment review periods are not adequate. Zero Zone suggested that DOE should not finalize energy conservation standard levels until the test procedure is finalized. AHRI expressed concern that the concurrent rulemakings present a challenge to stakeholders commenting on both proposals. AHRI indicated its view that DOE's proposal is different from the Working Group Term Sheet. Further, AHRI reiterated its requests that DOE's test procedure should exclude ''packaged units,'' ''process refrigeration systems'' and ''preparation room refrigeration systems'' and amend the proposed standards to specifically exclude these equipment from coverage under those standards.

As described in Section II.A, the negotiated rulemaking that led to the Term Sheet setting out the standards that DOE is adopting in this final rule also produced recommendations (with ASRAC's approval) that DOE modify its test procedure for walk-in refrigeration systems. The test procedure changes at issue specifically address the Term Sheet recommendations, *i.e.,* that DOE amend the test procedure to clarify the scope of equipment classes covered by the regulations, (Term Sheet Recommendations #1 and #7, No. 56 at pp. 1–3), and remove from the test procedure any test methods associated with technology options deemed by the Working Group to be inappropriate for consideration under the standards rulemaking (Term Sheet Recommendations #2, #3, and #4, No. 56 at p. 2). DOE issued a pre-publication version of the test procedure NOPR on July 29, 2016 and immediately made it available for stakeholder review, thus giving an extended period for consideration of the test procedure clarifications and simplifications. DOE amended the test procedure consistent with its understanding of the approach agreed upon by the various parties who participated in the negotiated rulemaking.

DOE notes that the test procedure NOPR proposed no changes to the test methods used to determine equipment efficiency levels, other than the amendments made, consistent with the Term Sheet, of removing the test provisions for hot gas defrost, and requiring the demonstration of compliance without the use of adaptive defrost or on-cycle evaporator fans. In light of these facts, in DOE's view, stakeholders had sufficient notice and information regarding these specific aspects related to the test procedure. No additional time was needed to consider these aspects of the proposed amendments beyond that which DOE already provided during its negotiated rulemaking meetings and the proposal itself.

DOE notes also that comments were received in response to the energy conservation standard NOPR, and that some of these addressed interaction between the energy conservation standard and the test procedure, thus indicating that commenters had time to voice concerns regarding such interactions. Further, DOE notes that none of the comments recommended that the proposed standard levels should be changed if the final test procedure were as proposed in the test procedure NOPR. As mentioned above, there were no proposed changes to the test methods other than those recommended by the Working Group—hence, since there is no measurement change, there is no basis for consideration of any standards adjustment associated with measurement change. Finally the test method of the final rule is identical to that of the NOPR, so stakeholder comments made on the basis of the proposed test procedure would have been equally relevant on the basis of the finalized test procedure.[25]

Additionally, commenters indicated that it was the inclusion of what they claim to be additional equipment categories in the scope of the standards that, in their view, goes beyond the agreements reached during the ASRAC negotiations and presented a timing challenge with the rulemakings because the test procedure proposals affecting scope would have a direct bearing on stakeholders' consideration of the standard levels (see, *e.g.,* AHRI, No. 90 at pp. 2, 3). Commenters specifically mentioned single-package dedicated refrigeration systems, preparation room refrigeration systems, and process cooling refrigeration systems as categories that were added to the scope of coverage by the test procedure rulemaking, thus creating the need for more time for consideration of the standard levels. (*Id.*)

In response, DOE does not agree that more time was needed for consideration of the standard levels because DOE does not believe that the test procedure NOPR or final rule extended the regulatory scope of the proposed refrigeration system standards to new equipment, as suggested by AHRI and other manufacturers. First, there is no record indicating that single-package dedicated refrigeration systems were not included as part of the Working Group discussions. The inclusion of this equipment category was confirmed on two occasions during the Working Group meetings by manufacturer representatives (Docket No. EERE–2015–BT–STD–0016; Lennox, Public Meeting Transcript (October 16, 2015), No. 63 at pp. 249–251; Rheem, Public Meeting Transcript (December 3, 2015), No. 57 at p. 157) There was no subsequent discussion to exclude single-package dedicated systems and the Term Sheet does not indicate any such exclusion. DOE clarified at least as far back as the June 2014 energy conservation standard final rule that these systems are subject to the refrigeration system standards. 79 FR at 32068 (June 3, 2014). Hence, stakeholders have had ample time to consider the Term Sheet's recommended standard levels with respect to all of the equipment classes at issue, including single-package dedicated refrigeration systems.

Second, regarding preparation room refrigeration systems, DOE addressed this issue in the December 2016 TP final rule, providing extensive discussion supporting its position, and concluding that preparation room refrigeration systems are indistinguishable from other walk-in refrigeration systems, and hence are subject to the walk-in refrigeration system energy conservation standards. 81 FR at 95773–95774 (December 28, 2016). There has been no evidence brought forth to indicate that such systems are anything other than walk-in refrigeration systems. DOE's test procedure notice specifically requested information that would distinguish these systems from other walk-in refrigeration systems. 81 FR at 54937 (August 17, 2016). Stakeholder responses provided many comments indicating that preparation rooms do not fit the definition of a walk-in (see, *e.g.,* Docket No. EERE–2016–BT–TP–0030, AHRI, No. 11 at p. 4), and commented that DOE's proposed definition did not adequately provide a basis for distinction (see, *e.g.,* Docket No. EERE–2016–BT–TP–0030, Lennox, No. 13 at pp. 8–9), but provided no information that could be used to distinguish these systems. Hence, DOE concludes that these refrigeration systems are indeed walk-in refrigeration systems. As such, in DOE's view, there should not have been any expectation that they would not be subject to the standard levels being discussed by the Working Group. DOE notes that there was no discussion at any time during the Working Group meetings suggesting that preparation room refrigeration systems would be excluded from the walk-in definition, and the Term Sheet does not indicate this possibility. DOE notes also that the possible exclusion of preparation room refrigeration systems from the walk-in refrigeration system standards has been discussed at least since the publication of the 2014 energy conservation standard final rule (see, *e.g.,* 79 FR at 32068 (June 3, 2014)), but DOE has at no time provided indication that they would be excluded. Hence, in DOE's view, stakeholders had sufficient notice that these refrigeration systems would be considered within the context of the Term Sheet's recommended standards well in advance of DOE's issuance of the energy conservation standard NOPR on August 30, 2016.

Third, regarding process cooling refrigeration systems, DOE's test procedure rulemaking defined process cooling refrigeration systems for the purpose of excluding them from having to satisfy the refrigeration system standards established by this final rule. The only exception to this exclusion is a dedicated condensing unit that would be used in a process cooling application that is not distributed in commerce with a process cooling unit cooler or evaporator or a process cooling walk-in enclosure. There has been no evidence presented that these condensing units are any different from other walk-in refrigeration system condensing units with respect to energy use characteristics, so distribution in commerce of such a condensing unit individually is not clearly for process cooling applications and could be for

[25] The test procedure final rule did modify the approach for testing hot gas defrost systems to make the test for such units consistent with tests for electric defrost units. However, this change is consistent with the Term Sheet removal of hot gas defrost as a design option and simply puts hot gas and electric defrost units on the same footing. See additional discussion in section IV.A.2.d.

any walk-in application. DOE's test procedure notice specifically requested information that would distinguish these condensing units from other walk-in condensing units. 81 FR at 54936 (August 17, 2016). Stakeholder responses provided many comments indicating that process cooling equipment does not fit the definition of a walk-in (see, *e.g.,* Docket No. EERE–2016–BT–TP–0030, AHRI, No. 11 at p. 5), but provided no information that could be used to distinguish these systems. In fact, one comment suggested that process cooling condensing units do not differ from other walk-in condensing units except in that they may have a larger refrigerant receiver. (Docket No. EERE–2016–BT–TP–0030, Bally, No. 22 at p. 1) Such a difference would not affect energy use as measured using the dedicated condensing unit test procedure because neither the receiver nor the refrigerant in it consume energy. Hence, while most process cooling refrigeration system equipment would be excluded from the standards, process cooling condensing units that are distributed in commerce individually (without a unit cooler or process cooling enclosure) would have no more challenge meeting the recommended Working Group standard levels than any other walk-in condensing unit. Hence, in DOE's view, further consideration regarding the proposed standard levels for such equipment, particularly when they are generally being excluded from the walk-in standards, is unnecessary.

As indicated, DOE concludes that commenters had adequate information at an early stage in the process regarding both the test method changes adopted in the test procedure rulemaking and the intended scope of coverage, and thus had sufficient time to consider the energy conservation standard proposals. Hence, DOE has not extended the time period for comments, nor delayed finalization of the rulemaking.

4. ASRAC Working Group Representation

Eric Andrews, an owner of an ice cream franchise, commented that this rulemaking has little input from the consumers, observing that the ASRAC Working Group members and attendees primarily represent organizations involved in repair and manufacturing. (Andrews, No. 76 at p. 1)

Prior to the Working Group meetings, on August 5, 2015, DOE published a notice of intent to establish a Working Group for Certain Equipment Classes of Refrigeration Systems of Walk-in Coolers and Freezers to Negotiate a Notice of Proposed Rulemaking for Energy Conservation Standards. 80 FR 46521. DOE notes that the agenda for the WICF Working Group meetings included as key issues (a) proposed energy conservation standards for six classes of refrigeration systems and (b) potential impacts on installers. See id. at 46523. These issues focused on refrigeration systems and installers. The Working Group consisted of 12 representatives of parties having a defined stake in the outcome of the proposed standards and one DOE representative, including six representatives of WICF refrigeration system manufacturers (Traulsen, Lennox, Hussmann, Manitowoc, Rheem, and Emerson). In addition, a representative of the Air Conditioning Contractors of America represented walk-in installers. Other members other than DOE represented efficiency advocacy groups and utilities. (Docket EERE–2015–BT–STD–0016, Term Sheet, No. 56 at p. 4) Hence, DOE believes that the representation was appropriate for the scope of the Working Group meetings. DOE published a notice of proposed rulemaking on September 13, 2016 and immediately made it available for public review. 81 FR 62979. A public meeting to discuss DOE's proposal was held on September 29, 2016. DOE notes all of the Working Group meetings and the NOPR public meeting were open to the public and were also broadcast via webinar. DOE believes that stakeholders, including consumers had ample opportunities to provide inputs to this rulemaking.

B. Market and Technology Assessment

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

1. Scope of Coverage and Product Classes

As discussed in section II.B, this final rule covers energy conservation standards for covered walk-in refrigeration systems to replace the six standards vacated by the Fifth Circuit. These vacated standards relate to (1) the two energy conservation standards applicable to unit coolers (formerly called multiplex condensing systems) operating at medium and low temperatures and (2) the four energy conservation standards applicable to dedicated condensing refrigeration systems operating at low temperatures. As noted earlier, the remaining standards for walk-ins already promulgated by DOE remain in place.

In the June 2014 final rule, DOE divided refrigeration systems into classes based on their treatment under the test procedure with respect to condensing unit configuration. 79 FR at 32069–32070 (June 3, 2014). In the May 2014 test procedure final rule, DOE adopted test methods to address walk-in refrigeration system components distributed individually—*i.e.,* unit coolers or condensing units sold alone can be tested and certified to the applicable standards as individual components. DOE also provided manufacturers the option of testing and certifying any matched pair that includes a condensing unit and a unit cooler. 79 FR at 27391 (May 13, 2013). Dedicated condensing units certified alone and as matched pairs are subject to standards as part of the dedicated condensing unit equipment class, while unit coolers certified alone fall in the unit cooler class (previously identified as the ''multiplex condensing'' class).

As discussed in the September 2016 NOPR, DOE expects that the majority of refrigeration equipment certified within the dedicated condensing class will consist of condensing units sold alone, while a much smaller number of systems certified within this class will be tested as matched pairs under DOE's test procedure. 81 FR at 62993 (September 13, 2016).

In the December 2016 TP final rule, DOE adopted the term ''unit cooler'' to refer to the class of equipment previously identified as ''multiplex condensing'' refrigeration systems. 81 FR at 95766–95767 (December 28, 2016). All unit coolers sold alone will be treated for certification purposes as belonging to the unit cooler class. For this rulemaking, DOE's analysis evaluated the energy use of unit coolers installed in both dedicated condensing and multiplex condensing applications.

This analysis is discussed in sections IV.D.1 and IV.F.

In the June 2014 final rule, DOE established an AWEF standard for low-temperature multiplex condensing systems (unit coolers) that did not vary with capacity. This standard was subsequently vacated through the controlling court order from the Fifth Circuit. Based on further comment and analysis conducted during the negotiated rulemaking to examine potential energy conservation standards for this class of equipment, DOE proposed different standard levels for different capacities of low-temperature unit coolers in the September 2016 NOPR. The proposal brought the total number of standards up to seven which would replace the six standards that were vacated. DOE received comments in support of the proposed standard levels for low-temperature unit coolers. (CA IOUs, No. 80, at p. 1–2). Hence, in light of the analysis conducted and the supporting comments received, this final rule separates low-temperature unit coolers into two classes based on capacity range.

The December 2016 TP final rule addressed the coverage of process cooling walk-ins and their components under DOE's regulations and established a definition for process cooling to distinguish this equipment from other walk-ins. 81 FR at 95767–95773 (December 28, 2016). As discussed in the test procedure final rule, process cooling walk-ins are within the scope of the definition of walk-ins, making them subject to the prescriptive statutory requirements already established by Congress. See 42 U.S.C. 6313(f). In addition, their panels and doors are subject to the component-based performance standards established by the June 2014 final rule. See 42 U.S.C. 6313(f) and 10 CFR 431.306. However, a process cooling refrigeration system may or may not be subject to the refrigeration system standards—including those established today—depending on the circumstances.

DOE has defined a process cooling refrigeration system as a refrigeration system that either (1) is distributed in commerce with an enclosure such that the ratio of refrigeration system capacity per internal enclosure volume is at least 100 Btu/h per cubic foot, indicating that the refrigeration system has ample capacity to reduce the temperature of products inserted into the enclosure in addition to keeping the temperature of the enclosure at refrigerated temperature, *i.e.,* below 55 °F, or (2) is a unit cooler with certain dimensional characteristics observed only for process cooling unit coolers. 81 FR at 95801 (December 28, 2016). In this final rule, DOE is also clarifying at 10 CFR 431.306(e) that the refrigeration system standards do not apply to equipment that meets the process cooling definition. This exclusion applies to both the refrigeration system standards adopted in this rule and the refrigeration system standards adopted in the June 2014 final rule that were not subsequently vacated. Because of the specific aspects of the process cooling definition and the exclusion that DOE is providing for refrigeration systems used in process cooling applications, the refrigeration system standards do not apply to (a) refrigeration systems sold as part of a complete package, including the insulated enclosure, and refrigeration systems for which the capacity per volume meets the process cooling definition, (b) dedicated condensing systems sold as a matched-pair in which the unit cooler meets the requirements of the process cooling definition, and (c) unit coolers that meet the requirements of the process cooling definition. As discussed in the test procedure notice, condensing units distributed in commerce without unit coolers or insulated enclosures are subject to the standards, even if sold for process cooling applications.

2. Technology Options

In the technology assessment for the June 2014 final rule, DOE identified 15 technology options to improve the efficiency of WICF refrigeration systems, as measured by the DOE test procedure (see Docket EERE–2008–BT–STD–0015, Final Rule Technical Support Document, No. 0131, Section 3.3 pp. 3–24 to 3–33):

- Energy storage systems
- Refrigeration system override
- Automatic evaporator fan shut-off
- Improved evaporator and condenser fan blades
- Improved evaporator and condenser coils
- Evaporator fan control
- Ambient sub-cooling
- Higher-efficiency fan motors
- Higher-efficiency compressors
- Liquid suction heat exchanger
- Defrost controls
- Hot gas defrost
- Floating head pressure
- Condenser fan control
- Economizer cooling

Weiss indicated that energy saving cycles/set points offset and anti-sweat heater controls technologies are not included in this analysis. (Weiss, No. 85, at p. 2) DOE notes the test procedure to determine AWEF involves measurement of performance (capacity and power input) when operating with walk-in box temperature at 35 °F for coolers and −10 °F for freezers. Hence the savings of set point offsets would not be measured by the test procedure and cannot be considered in the analysis. Anti-sweat heater control also is not accounted for in the test procedure and hence cannot be considered in the analysis.

DOE continued to consider these 15 options in formulating the WICF refrigeration system standards detailed in this final rule. DOE did not receive any comments regarding the selected technologies listed in this section. See chapter 3 of the TSD for further details on the technologies DOE considered.

C. Screening Analysis

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

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

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

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

(4) *Adverse impacts on health or safety.* If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further. 10 CFR part 430, subpart C, appendix A, 4(a)(4) and 5(b)

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

1. Technologies Having No Effect on Rated Energy Consumption

In the June 2014 final rule, DOE determined that the following technologies do not affect measured energy efficiency (see Docket EERE–2008–BT–STD–0015, Final Rule Technical Support Document, No. 0131, Section 4.2 pp. 4–3 to 4–4):

- Liquid suction heat exchanger
- Refrigeration system override
- Economizer cooling
- Automatic evaporator fan shut-off

Weiss commented on these technologies. Its comments about the use of a liquid suction heat exchanger (''not a lot of applications'') and automatic evaporator fan shut-off (''not much savings'') appear to be in line with DOE's decision exclude them from the analysis. Weiss noted that refrigeration system override should be considered if shifting set points is included as part of this technology. Weiss also suggested that economizer cooling can save energy but requires use of humidity measurement. (Weiss, No. 85 at p. 2). In response, DOE clarifies that these technologies were screened out because they do not affect the rated efficiency as measured by the test procedure. DOE has not received any further evidence that these technologies should be considered and has not included them in the analysis.

As discussed in section III.B, DOE modified the method for testing systems with hot gas defrost in a separate rulemaking that eliminated the credit assigned to hot gas defrost systems when calculating a unit's energy efficiency under the prior test procedure. In the final version of the test procedure that DOE recently adopted, the AWEF of a refrigeration system with hot gas defrost is determined as if it were equipped with electric defrost. 81 FR at 95774–95777 (December 28, 2016). Thus, DOE has dropped hot gas defrost from further consideration in its analysis.

2. Adaptive Defrost and On-Cycle Variable-Speed Evaporator Fans

Consistent with the recommendations made during the Working Group negotiations, DOE established a regulatory approach in the December 2016 TP final rule to address adaptive defrost and on-cycle variable-speed fans in which these features would not be active during testing to demonstrate compliance with the applicable standards, but that the features could be active during testing to support representations of their benefit, such as when advertising equipment performance in product literature. (See Term Sheet at EERE–2015–BT–STD–0016, No. 56, recommendation #4 and 81 FR at 95777 (December 28, 2016)). Weiss commented that many field tests show an energy savings of 15 to 20 percent with adaptive defrost controls but that evaporator fan controls do not yield much savings. (Weiss, No. 85, at p. 2) DOE agrees that there may be the potential for savings with adaptive defrost control but reiterates that a test procedure to properly account for its savings and a suitable regulatory definition for the technology has not been developed and could not be agreed upon by the WICF Working Group. Hence, DOE continues to decline to consider these technology options in its standards analysis for this rule.

3. Screened-Out Technologies

In the June 2014 final rule, DOE screened out the following technologies from consideration (see Docket EERE–2008–BT–STD–0015, Final Rule Technical Support Document, No. 0131, Section 4.3, pp 4–4 to 4–6):

- Energy storage systems (technological feasibility)
- High efficiency evaporator fan motors (technological feasibility)
- 3-phase motors (impacts on equipment utility)
- Improved evaporator coils (impacts on equipment utility)

Weiss indicated that energy storage systems are an old technology, which DOE interprets as support for its decision to screen out this technology. (Weiss, No. 85, at p. 2) DOE has not received any new evidence that would weigh in favor of including these screened-out technologies. Consequently, these technologies have not been considered in the analysis supporting this final rule. Chapter 4 of the final rule TSD contains further discussion of the screening of these technologies.

The implications of screening out these technologies on the analysis and the selected standard levels depend on each particular technology. The test procedure does not take into consideration the benefits of energy storage systems, so screening this technology did not affect the analysis. A manufacturer could adopt the technology, which potentially could save energy in field use, but equipment using it would not have an improved AWEF. Evaporator fans using higher-efficiency motors than the electronically commutated motors required by the prescriptive standards could possibly be sourced by manufacturers in the future, but DOE was not able to identify any such motor technology—if such technology were readily available and considered in the analysis, the final unit cooler efficiency levels set by this rule may have been incrementally higher, assuming designs using such motors would have been cost-effective. If utility concerns regarding improved or larger evaporator coils were not addressed by screening out this technology, the final unit cooler efficiency levels set by this rule may have been incrementally higher, assuming designs using such evaporators would have been cost-effective. A manufacturer could potentially sell unit coolers with such improved evaporators and achieve higher AWEF levels, but at the risk of the utility concerns discussed in the TSD, *e.g.* reduced humidity control and/or potential defrost issues.

4. Remaining Technologies

Through a review of each technology, DOE concludes that all of the remaining technologies listed in section IV.B.2 satisfy all four screening criteria and that their benefits can be measured using the DOE test procedure. In summary, DOE chose the following technology options to be examined further as design options in DOE's analysis:

- Higher efficiency compressors
- Improved condenser coil
- Higher efficiency condenser fan motors
- Improved condenser and evaporator fan blades
- Ambient sub-cooling
- Off-cycle evaporator fan control
- Variable speed condenser fan control
- Floating head pressure

Weiss submitted a list of notes regarding each of the remaining technologies. (Weiss, No. 85, at p. 2) Specifically, Weiss requested that DOE provide details on the analyses of higher efficiency compressors and improved condenser coil technologies. DOE notes that the detailed description and analysis details of these two technologies can be found in section 3.3.5, 3.3.10, 5.5.8.1 and 5.5.8.2 of the final rule TSD. Weiss also suggested that using higher efficiency condenser fan motors would result in improvement with an electronically commutated (''EC'') motor. DOE noted that use of an EC motor was considered as a potential design option in its supporting analysis—see TSD at section 5.5.8.3. Weiss also commented regarding the benefits and costs of improved condenser and evaporator fan blades, variable speed condenser fan control and floating head pressure. DOE notes that the cost and efficiency relationship is reflected in DOE's engineering analysis and the results are provided in Appendix 5A of the TSD. Weiss also indicated that ambient sub-cooling technology is not used in WICF equipment. DOE notes such technology is available in the market for various air conditioning and refrigeration applications. DOE did not receive any supported reasons for screening out such technology during the rulemaking for June 2014 final rule or the Working Group meetings. DOE's analysis has shown that using ambient sub-cooling technology incrementally improves the efficiency of WICF refrigeration systems. Weiss commented that the off-cycle evaporator fan control technology does not make sense for EC motors and claimed that they have high inrush current, thus suggesting that they should be screened out. In response, DOE points to the Working Group consensus regarding consideration of this design option and the fact that the Working Group members provided no information suggesting issues associated with inrush current or related concerns. DOE also notes that this technology is currently available on the market for walk-in unit coolers which use these motors. (Docket No. EERE–2015–BT–STD–0016, Trenton TLP Product Data and Installation, No. 92 at p. 22) Hence, DOE has not removed any of these technologies from consideration in the analysis.

DOE determined that these technology options are technologically feasible because they are being used or have previously been used in commercially-available products or working prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service, and they do not result in adverse impacts on consumer utility, product availability, health, or safety). For additional details, see chapter 4 of the final rule TSD.

D. Engineering Analysis

In the engineering analysis, DOE establishes the relationship between the manufacturer production cost (''MPC'') and improved WICF refrigeration system efficiency. This relationship serves as the basis for cost-benefit calculations for individual consumers, manufacturers, and the Nation. DOE typically structures the engineering analysis using one of three approaches: (1) Design option, (2) efficiency level, or (3) reverse engineering (or cost assessment). The design-option approach involves adding the estimated cost and associated efficiency of various efficiency-improving design changes to the baseline product to model different levels of efficiency. The efficiency-level approach uses estimates of costs and efficiencies of products available on the market at distinct efficiency levels to develop the cost-efficiency relationship. The reverse-engineering approach involves testing products for efficiency and determining cost from a manufacturing cost model based on detailed bills of material (''BOM'') derived from reverse engineering representative equipment. The efficiency ranges from that of the least-efficient WICF refrigeration system sold today (*i.e.,* the baseline) to the maximum technologically feasible efficiency level. At each efficiency level examined, DOE determines the MPC; this relationship is referred to as a cost-efficiency curve. DOE conducted the engineering analysis for the June 2014 final rule using a design-option approach. 79 FR at 32072 (June 3, 2014). DOE received no comments suggesting that it use one of the alternative engineering analysis approaches. Consequently, DOE used a design-option approach in the analysis supporting the September 2016 NOPR and this final rule.

However, as discussed in the September 2016 NOPR, DOE made several changes to its engineering analysis based on discussions and information provided during the Working Group negotiation meetings. These changes are described in detail in chapter 5 of the final rule TSD and summarized in the following sections. DOE did not receive any comments regarding the engineering analysis details as presented in the September 2016 NOPR and chapter 5 of the NOPR TSD. Consequently, DOE did not modify its engineering analysis for this final rule. DOE did, however, adjust its condenser capacity calculation for dedicated condensing units, as discussed in section IV.D.6.d. Details of the engineering analysis are available in chapter 5 of the final rule TSD.

1. Component-Based Analysis

In the June 2014 final rule, DOE's analysis for dedicated condensing systems was based on matched-pair systems, and its analysis for unit coolers (the ''multiplex'' class) was based on field installation in multiplex applications. See Docket EERE–2008–BT–STD–0015, Final Rule Technical Support Document, No. 0131, Section 5.5.3, pp 5–20 to 5–28; see also October 15, 2015 Public Meeting Presentation, slide 8, available in Docket No. EERE–2015–BT–STD–0016, No. 26, at p. 8. However, as discussed in section IV.B.1, most refrigeration system components are sold individually (not as matched pairs) and most unit coolers are installed in dedicated condensing applications. Hence, the analysis conducted for this final rule, as developed initially during the WICF Working Group meetings, was based on individual components (dedicated condensing units tested, certified, and sold alone, and unit coolers also tested, certified, and sold alone). The analysis also considered (within the context of unit coolers) both dedicated condensing and multiplex condensing applications.

2. Refrigerants

The analysis for the June 2014 final rule assumed that the refrigerant R–404A would be used in all new refrigeration equipment meeting the standard. 79 FR at 32074 (June 3, 2014). On July 20, 2015, EPA published a final rule under the SNAP program prohibiting the use of R–404A in certain retail food refrigeration applications. See 80 FR 42870 (''July 2015 EPA SNAP Rule''). Under the rule, R–404A can no longer be used in new supermarket refrigeration systems (starting on January 1, 2017), new remote condensing units (starting on January 1, 2018), and certain stand-alone retail refrigeration units (starting on either January 1, 2019 or January 1, 2020 depending on the type of system). See 40 CFR part 82, Appendix U to Subpart G (listing unacceptable refrigerant substitutes). EPA explained that most commercial walk-in coolers and freezers would fall within the end-use category of either supermarket systems or remote condensing units and would be subject to the rule. 80 FR at 42902 (July 20, 2015).

Given that manufacturers would not be allowed to use R–404A in WICF refrigeration systems when the WICF standards would take effect, the WICF Working Group recommended that DOE conduct its analysis using R–407A, an alternative refrigerant that will be acceptable for use in all of the considered WICF refrigeration systems under the July 2015 EPA SNAP rule. ((Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 30, 2015), No. 67 at pp. 34–39)) Zero Zone supported DOE's proposal of using R–407A in the analysis. Zero Zone also expressed concern that R–407A might not be allowed in future EPA rulemakings and suggested that DOE develop a plan for revising the regulation if R–407A is delisted in the future. (Zero Zone, No. 88, at p. 1) In response to the comments suggesting analysis based on R–407A, DOE revised its analysis using performance information for R–407A compressors, R–407A refrigerant properties, and to account for the temperature glide of R–407A,[26] as discussed in the following sections.

In response to Zero Zone's concern regarding potential future delisting of R–407A, DOE does not believe that there is sufficient specific, actionable data presented at this juncture to warrant a change in its analysis and assumptions regarding the refrigerants used in walk-in cooler and freezer applications. As of now, there is inadequate publicly-available data on the design, construction, and operation of equipment featuring alternative refrigerants to facilitate the level of analysis of equipment performance which would be needed for standard setting purposes. DOE is aware that many low-GWP refrigerants other than R–407A are being introduced to the market, and wishes to ensure that this rule is consistent with the phase-down of HFCs proposed by the United States under the Montreal Protocol. DOE continues to welcome comments on experience within the industry with the use of low-GWP alternative refrigerants. However, there are currently no mandatory initiatives such as refrigerant phase-outs driving a change beyond R407A.

Absent such action, DOE will continue to conduct its analysis based on R–407A, which the Working Group strongly supported. DOE clarifies that it will continue to consider WICF models meeting the definition of walk-in coolers and freezers to be part of their applicable covered equipment class, regardless of the refrigerant that the equipment uses. If a manufacturer believes that its design is subjected to undue hardship by regulations, the manufacturer may petition DOE's Office of Hearing and Appeals (''OHA'') for exception relief or exemption from the standard pursuant to OHA's authority under section 504 of the DOE Organization Act (42 U.S.C. 7194), as implemented at subpart B of 10 CFR part 1003. OHA has the authority to grant such relief on a case-by-case basis if it determines that a manufacturer has demonstrated that meeting the standard would cause hardship, inequity, or unfair distribution of burdens.

[26] ''Temperature glide'' for a refrigerant refers to the increase in temperature at a fixed pressure as liquid refrigerant vaporizes during its conversion from saturated liquid to saturated vapor.

3. As-Tested Versus Field-Representative Performance Analysis

DOE conducted an intermediate analysis to bridge the gap between the engineering analysis and the downstream analyses to predict aspects of field performance that would not be measured by the test procedure. DOE refers to this intermediate analysis as the ''field-representative analysis'' to distinguish it from the normal ''as-tested'' engineering analysis, which represents performance according to the test procedure. DOE conducted the field representative analysis for this rulemaking using a modified version of the engineering calculations in order to facilitate the energy use analysis that is conducted to determine annual energy use of the equipment when installed. Specific differences between DOE's as-tested and in-field performance modeling used in the analysis are discussed in section IV.D.6 and in further detail in chapter 5 of the TSD.

DOE provided outputs from the field-representative analysis for use in the energy use analysis for four equipment installation scenarios: (1) A new unit cooler and a new condensing unit that are installed together in the field; (2) a new unit cooler that is installed with a multiplex system; (3) a new unit cooler that is installed with an existing condensing unit in the field; and (4) a new condensing unit that is installed with an existing unit cooler in the field. Scenarios 1 through 3 apply to the evaluation of unit coolers, while scenarios 1 and 4 apply to the evaluation of condensing units. The scenarios analyzed in the downstream analysis are described in section IV.F. In analyzing medium-temperature unit coolers installed with new medium-temperature condensing units, DOE modeled the condensing units as operating with R–407A and meeting the standard for dedicated condensing, medium -temperature systems established in the June 2014 final rule, which remains in effect.

CoilPod, a company that manufactures certain HVAC-related cleaning tools, commented that energy use in the field can be increased significantly if condenser coils are not cleaned on a regular basis, and provided data for four coil-cleaning scenarios. The data provided are for a double-door merchandiser, a ''larger'' double-door refrigerator, a single-door freezer, and a double-glass-door refrigerator, and constitute daily energy savings from 46 to 50 percent after cleaning. (''COILPOD Energy Savings Data'', No. 77 at p. 1) While data contained only limited details, DOE assumes that these examples are for self-contained commercial refrigeration equipment (''CRE''), because the submitted information addresses equipment such as ''double-door merchandiser'', ''double door fridge'', and ''single door freezer'', common terminology for self-contained CRE, as illustrated in self-contained CRE marketing information (see, *e.g.,* ''Double Door Merchandiser'', No. 92; ''Double Door Refrigerator'', No. 93; ''Single Door Freezer'', No. 94). DOE also notes that none of CoilPod's information mentions that any of the identified equipment were walk-ins. There is no information to indicate whether the condensers for these units are mounted on top or beneath the equipment cabinets, nor any other information regarding accessibility of the condensers for cleaning. DOE does not consider this information to be an adequate average representation of the additional energy use that could be associated with self-contained commercial refrigeration equipment, since it represents only four examples and there is no information to indicate that the data is part of a larger survey that properly represents average impacts of this issue for all such equipment. Further, DOE expects that the impact of neglecting to clean condenser coils will affect different types of equipment differently, and the attention to coil cleaning may be greater for walk-in systems than for self-contained equipment (see *e.g.,* ''Commercial Refrigeration Maintenance'', No. 95, which suggests a greater need for maintenance of walk-ins than other commercial refrigeration), so that the impact on walk-in refrigeration systems may for several reasons be very different than for self-contained refrigerators and freezers. (With the lack of data on walk-in maintenance practices, however, only speculation is possible.) At this point DOE does not have sufficient information quantifying the potential field impact of dirty condenser coils for walk-in refrigeration systems, nor for any other factors that might degrade performance, and has not included any degradation factor in its calculations of field energy use.

DOE did not receive any other comments on the NOPR analysis scenarios or other aspects of its field-representative analysis, and hence has not changed these aspects of its analysis. Details of these four scenarios are also provided in chapter 5 of the TSD.

4. Representative Equipment for Analysis

In the analysis for the June 2014 final rule, DOE analyzed within each equipment class a range of representative WICF refrigeration systems representing different capacities, compressor types, and evaporator fin spacing. Based on WICF Working Group meeting discussions, DOE simplified the range of these parameters in its analysis for this rulemaking, analyzing fewer compressor options and fewer fin spacing options, but modifying the selection of representative capacities. DOE presented its list of representative equipment in Table IV–1 of the September 2016 NOPR. 81 at 62998. DOE did not receive comments regarding the chosen representative equipment and hence used the same selections in its final rule analysis. The selections are shown in Table IV–1 below, which is identical to the table in the September 2016 NOPR.

TABLE IV–1—DETAILS OF REPRESENTATIVE EQUIPMENT ANALYZED

Equipment class	Sizes analyzed (Nominal Btu/h)	Compressor types analyzed	Unit cooler fins per inch
DC.L.I, < 6,500 Btu/h	6,000	Scroll	N/A
DC.L.I, ≥ 6,500 Btu/h	9,000	Scroll	N/A
	25,000*	Scroll, Semi-hermetic	N/A
	54,000	Semi-hermetic	N/A
DC.L.O, < 6,500 Btu/h	6,000	Scroll	N/A
DC.L.O, ≥ 6,500 Btu/h	9,000	Scroll	N/A
	25,000*	Scroll, Semi-hermetic	N/A
	54,000	Semi-hermetic	N/A
	72,000	Semi-hermetic	N/A
UC.M	4,000	N/A	6
	9,000	N/A	6
	24,000	N/A	6
UC.L, < 15,500 Btu/h	4,000	N/A	4
	9,000	N/A	4
UC.L, ≥ 15,500 Btu/h	18,000	N/A	4
	40,000	N/A	4

*Indicates a representative capacity that was not analyzed in the June 2014 final rule analysis. All other listed representative nominal capacities had also been analyzed in the June 2014 final rule.

5. Manufacturer Production Cost and Manufacturer Sales Price

DOE developed a manufacturing cost model to estimate the MPCs of the considered WICF refrigeration systems at each efficiency level from the baseline through max-tech for the representative capacities considered for each equipment class. The manufacturing cost model is a spreadsheet that estimates the dollar cost of manufacturing the considered WICF refrigeration systems based on the price of materials, the average labor rates associated with fabrication and assembly, and the cost of overhead and depreciation associated with the conversion processes used by manufacturers. To estimate these various cost components, DOE conducted manufacturer interviews and collected information on labor rates, tooling costs, raw material prices, and other factors. DOE estimated the costs of raw materials based on the most recent 5-year price averages available.

To support its analyses, which were presented and discussed during the WICF Working Group meeting, DOE conducted new physical and virtual teardowns [27] of WICF equipment to ensure that its cost model was representative of the current market. These new teardowns were in addition those conducted in support of the June 2014 final rule. See chapter 5 of the TSD for a more detailed explanation of how DOE gathered data for cost modeling.

In order to calculate manufacturer sales price (''MSP''), DOE used the same average manufacturer markup of 35 percent for WICF refrigeration systems in its analysis as used in the June 2014 final rule, and also the same methodology for calculating shipping costs.

In the September 2016 NOPR, DOE sought comment regarding the method it used for estimating equipment manufacturing costs in its analysis. 81 FR at 62999 (September 13, 2016). DOE did not receive any comments regarding this issue and has used the same cost estimation methodology for this final rule. Chapter 5 of the final rule TSD provides details and assumptions of the cost model.

6. Component and System Efficiency Model

For each representative capacity within each equipment class covered in this rulemaking (see section IV.D.4), DOE selected a particular model of unit cooler or condensing unit, as applicable, to represent the class at that capacity. DOE used a spreadsheet-based analysis tool to predict the performance of each representative unit for the range of efficiency levels considered in the analysis, similar to the method used in the June 2014 final rule. However, DOE made many revisions to its engineering analysis. For example, as discussed in section IV.D.1, the analysis prepared during the WICF Working Group meetings and used to support the September 2016 NOPR was based on individual components and did not analyze matched-pair dedicated condensing units. Also, as discussed in section IV.D.3, DOE developed field representative calculations in addition to as-tested calculations to evaluate the performance of systems as installed. The following sections summarize additional changes to DOE's engineering spreadsheet analysis as compared with the June 2014 final rule analysis.

a. Unit Coolers (Formerly Termed the ''Multiplex Condensing'' Class)

DOE's analysis of unit cooler test performance is based on the ''parallel rack system'' method of AHRI 1250–2009 (see section 7.9 of AHRI 1250–2009) for calculating unit cooler AWEF, which uses a prescribed multiplex system Energy Efficiency Ratio (''EER'') to calculate compressor energy use

[27] A virtual teardown uses the results from a physical teardown of a specific model and details obtained from product literature for a second model in order to develop manufacturing cost estimates for the second model.

based on unit cooler gross capacity, and also accounts for the energy use of the evaporator fan motor and, for low-temperature units, energy use associated with defrost.[28] These aspects of the analysis have not changed since the June 2014 final rule analysis. See Docket EERE–2008–BT–STD–0015, Final Rule Technical Support Document, No. 0131, Section 5.5.3, pp 5–20 to 5–27. DOE did, however, make a number of changes in response to input received during the WICF Working Group meetings.

First, DOE developed an analytical framework to represent field performance of unit coolers used in multiplex condensing applications using a system EER for R–407A developed during the WICF Working Group meeting discussions. (This change was made to account for the refrigerant shift brought about by the EPA SNAP rule.) Second, DOE adjusted its calculation of unit cooler net capacity using a correlation relating net capacity and nominal capacity developed based on test data. (This change was made to reflect test data obtained and reviewed primarily after publication of the June 2014 final rule.) Third, DOE revised the input assumption for refrigerant suction dew point. (This change was made to establish consistent input assumptions across the analyses conducted for the different classes associated with pressure drop in the suction line.) DOE received no comments on these aspects of the analysis in response to the September 2016 NOPR and has not changed them for this final rule.

b. Condensing Units/Dedicated Condensing Class

DOE made several changes to its prior analysis of dedicated condensing refrigeration systems. As mentioned in section IV.D.1, the analysis developed during the WICF Working Group meetings was based on condensing units tested and sold individually, *i.e.,* not as part of matched pairs including unit coolers. The as-tested analysis uses the nominal values for unit cooler fan and defrost energy use as prescribed in the DOE test procedure (as finalized in 10 CFR part 431, subpart R, appendix C, section 3.4.2.2 in the recent test procedure rulemaking, 81 FR at 95806 (December 28, 2016)). To analyze equipment using R–407A refrigerant, DOE used compressor coefficients for compressors operating with this refrigerant, and made changes in the analysis to account for the refrigerant's temperature glide. The revised analysis also assumed, in calculating refrigeration capacity for a condensing unit, that: (1) Pressure drop in the suction line is equivalent to a 2 °F reduction in dew point temperature;[29] (2) unit cooler exit superheat[30] is 6 °F for low-temperature unit coolers and 10 °F for medium-temperature unit coolers; and (3) the refrigerant temperature entering the condensing unit is 5 °F for low-temperature unit coolers and 41 °F for medium-temperature unit coolers. For the as-tested analysis, DOE assumed that there is no temperature drop in the liquid line after it exits from the condensing unit. The liquid line sub-cooling is assumed to be 8 °F in the field-representative analysis.

As described in section IV.D.4, for the 25,000 Btu/h representative capacity DOE considered both scroll and semi-hermetic compressors. DOE aggregated the analyses for the two compressors to create a single cost-efficiency curve for this representative capacity. See chapter 5 of the TSD for a more detailed explanation of how DOE aggregated the cost-efficiency curves for the compressor types.

DOE received no comments on these aspects of the analysis in response to the NOPR and has not changed them for this final rule.

c. Field-Representative Paired Dedicated Condensing Systems

As discussed in section IV.D.1, DOE based its as-tested engineering analysis for dedicated condensing systems on an evaluation of condensing units tested individually. DOE conducted a separate field-representative analysis that accounts for system operation when installed, which necessarily includes the performance of both the condensing unit and the unit cooler with which it is paired. The assumptions for this field-representative analysis differ in several ways from those of the as-tested analysis, including the refrigerant cooling in the liquid line, refrigerant pressure in the unit cooler (represented by unit cooler exit dew point), and unit cooler fan and defrost power. See chapter 5 of the TSD for more details of how DOE adjusted these assumption for field-representative analysis. DOE received no comments on these aspects of the analysis in response to the NOPR and has not changed them for this final rule.

d. Analysis Adjustment

As part of its final rule analysis, DOE adjusted its equipment performance calculations for condensing units to more fully account for the performance of the high-glide refrigerant R–407A. This methodology was discussed by the Working Group, but the analysis calculations were rerun for the final rule. Specifically, this adjustment affected the calculation of refrigerant enthalpy at the condenser exit, and resulted in an increase in the calculated refrigeration system net capacity for analyses involving dedicated condensing units. The adjustment led to a 0.1 to 0.11 Btu/W-h increase in the AWEF calculated for analyzed DC.L.O and DC.L.I dedicated condensing unit classes and increases in the capacity calculated for dedicated condensing systems in the field-representative analysis. The AWEF values reported in Table IV–2 in section IV.D.10 reflect this adjustment. DOE believes this approach is in-line with the methodology discussed in the Working Group, which recommended that the analysis be based on the use of R–407C refrigerant.

7. Baseline Specifications

Because there have not been any previous performance-based standards for the considered WICF refrigeration systems, there is no established baseline efficiency level for this equipment. DOE developed baseline specifications for the representative units in its analysis, described in section IV.D.4, by examining current manufacturer literature to determine which characteristics represented baseline equipment. DOE assumed that all baseline refrigeration systems comply with the current prescriptive standards in EPCA—namely, that each system satisfies the requirements that (1) evaporator fan motors of under 1 hp and less than 460 volts are electronically commutated motors (brushless direct current motors) and (2) walk-in condenser fan motors of under 1 hp are permanent split capacitor motors. (See section II.B for further details on current WICF standards.) Readers interested in more detailed baseline specifications for the analyzed representative systems should refer to chapter 5 of the TSD. DOE did not receive any comments regarding its baselines in response to the September 2016 NOPR.

8. Design Options

Section IV.C.4 lists technologies that passed the screening analysis and that DOE examined further as potential

[28] Gross capacity differs from net capacity in that it includes the evaporator fan heat.

[29] Compressor performance is generally provided by compressor vendors as a function of pressure levels represented as dew point temperatures—dew point is the temperature of saturated vapor refrigerant, at which any reduction refrigerant enthalpy would result in condensation of refrigerant as dew.

[30] Superheat of refrigerant vapor is equal to the actual temperature of the refrigerant minus the dew point associated with its pressure.

design options. DOE updated the analysis for several of these design options based on information received during the WICF Working Group meetings. DOE maintained its efficiency calculation assumptions in the June 2014 final rule analysis for improved condenser blades, evaporator fan blades and off-cycle evaporator fan control. The following sections summarize the revised treatment of specific design options as compared with the June 2014 final rule analysis. All design options are discussed in more detail in chapter 5 of the TSD. DOE did not receive comments about these analysis changes in response to the September 2016 NOPR and did not make any additional changes for the final rule analysis.

a. Higher Efficiency Compressors

In the June 2014 final rule analysis, DOE considered efficiency improvements associated with variable-speed compressors. DOE removed this option from consideration in the September 2016 NOPR analysis. 81 FR at 63003 (September 13, 2016). As discussed in section IV.D.1, DOE's analysis for the dedicated condensing unit classes was updated to reflect the testing and rating of condensing units alone rather than as part of matched pairs. The current test procedure does not include a method for assessing variable-capacity systems using the condenser-alone rating method. Hence, DOE did not consider variable-speed compressors as a design option in its analysis. This approach does not preclude manufacturers from designing and selling systems with multiple-capacity or variable-capacity compressors, but they would have to be tested and certified as matched-pair systems. DOE may consider this design option in a future rulemaking when the test procedure is modified to allow the testing of multiple-capacity or variable-capacity condensing units individually rather than as part of matched pairs. This test procedure change was part of the set of recommendations made by the WICF Working Group. (Docket No. EERE–2015–BT–STD–0016, Term Sheet: Recommendation #6 (December 15, 2015), No. 56 at p. 3)

b. Improved Condenser Coil

In its supporting analysis for the June 2014 final rule, DOE considered a design option for an improved condenser coil with more face area and heat transfer capacity than a baseline coil. DOE assumed that the coil would be sized to lower the condensing temperature by 10 °F based on DOE testing, input received from manufacturers during interviews, and analysis. Consequently, the analysis used a reduced power input and an increased cooling capacity for the compressor. See the June 2014 final rule TSD, chapter 5, pages 5–44 and 5–45 (Docket No. EERE–2008–BT–STD–0015, No. 0131). DOE revised its analysis for this design option during the WICF Working Group meetings based on input from the negotiating parties. This input included specific condensing unit performance and design details for DOE to consider as part of its analysis. DOE considered a new design approach that would result in a 5-degree condensing temperature reduction. Based in part on the data submitted by manufacturers on condenser coil sizing, (Docket No. EERE–2015–BT–STD–0016, Lennox, No. 30), DOE estimated that following this approach would require a 33 percent increase in airflow and 50 percent increase in total heat transfer area over the baseline. DOE incorporated the revised cost and energy characteristics of this option into the analysis. The assumptions associated with the improved condenser coil for both DC.L.I and DC.L.O analyses are discussed in more detail in section 5.5.8.2 of the TSD.

c. Floating Head Pressure

Floating head pressure is a type of refrigeration system control for outdoor condensing units that uses a lower condensing pressure set-point than conventional head pressure control, thus lowering the condensing pressure and improving compressor efficiency at low ambient temperatures. In its June 2014 final rule analysis, DOE analyzed two modes of operation for this option: floating head pressure with a standard thermostatic expansion valve (''TXV''), and floating head pressure with an electronic expansion valve (''EEV'')—the latter option allows for an even lower condensing pressure set-point compared to systems that do not use an EEV and was considered in the June 2014 final rule's analysis only for scroll compressors. See Docket EERE–2008–BT–STD–0015, Final Rule Technical Support Document, No. 0131, Section 5.5.6.10 pp. 5–52 to 5–53. In revising its current analysis in response to input received during the WICF Working Group meetings, DOE extended consideration of the second step in condensing pressure reduction to semi-hermetic compressors. DOE's modeling also more closely optimized the interaction among design options at the highest efficiency levels (*i.e.,* increasing the minimum head pressure from 125 psi to 135 psi at the lowest ambient temperature). The details of floating head pressure design option are discussed in more detail in section 5.5.8.8 of the final rule TSD.

9. Cost-Efficiency Curves

After determining the cost and energy savings attributed to each design option, DOE evaluates the design options in terms of their manufacturing cost-effectiveness: That is, the gain in as-tested AWEF that a manufacturer would obtain for implementing the design option on their equipment, versus the cost for using that option. For each representative unit listed in section IV.D.4, DOE calculates performance as measured using the test procedure efficiency metric, AWEF, and the manufacturing production cost (*i.e.,* MPC). When using a design-option analysis, DOE calculates these values first for the baseline efficiency and then for more-efficient designs that add design options in the order from the most cost-effective to the least cost-effective. The outcome of this design option ordering is called a ''cost-efficiency curve'' consisting of a set of manufacturing costs and AWEFs for each consecutive design option added in order of most to least cost-effective.

Table IV–2 and Table IV–3 show the AWEFs calculated in this manner. Additional detail is provided in Appendix 5A of the TSD, including graphs of the cost-efficiency curves and correlation of the design option groups considered with their corresponding AWEF levels.

TABLE IV–2—ENGINEERING ANALYSIS OUTPUT: CALCULATED AWEFS FOR DC CLASSES

Representative unit			As-Tested AWEF with each Design Option (DO) added*								
Equipment class	Nominal Btu/h	Compressor type		Base-line	DO 1	DO 2	DO 3	DO 4	DO 5	DO 6	DO 7
DC.L.I, < 6,500 Btu/h.	6,000	Scroll	DO		EC	CD2	CB2				
			AWEF	1.91	1.97	2.3	2.31				

TABLE IV–2—ENGINEERING ANALYSIS OUTPUT: CALCULATED AWEFS FOR DC CLASSES—Continued

Representative unit			As-Tested AWEF with each Design Option (DO) added*								
Equipment class	Nominal Btu/h	Compressor type		Base-line	DO 1	DO 2	DO 3	DO 4	DO 5	DO 6	DO 7
DC.L.I, ≥ 6,500 Btu/h.	9,000	Scroll	DO		EC	CD2	CB2				
			AWEF	2.09	2.14	2.48	2.49				
	25,000 **	Scroll, Semi-hermetic.	DO		EC	CD2	CB2				
			AWEF	2.02	2.06	2.4	2.41				
	54,000	Semi-hermetic.	DO		EC	CD2	CB2				
			AWEF	2.35	2.42	2.68	2.69				
DC.L.O, < 6,500 Btu/h.	6,000	Scroll	DO		FHP	EC	CB2	FHPEV	VSCF	CD2	ASC
			AWEF	2.22	2.57	2.66	2.67	2.87	3	3.09	3.12
DC.L.O, ≥ 6,500 Btu/h.	9,000	Scroll	DO		FHP	EC	FHPEV	CB2	VSCF	CD2	ASC
			AWEF	2.41	2.81	2.89	3.12	3.13	3.18	3.28	3.3
	25,000 **	Scroll, Semi-hermetic.	DO		FHP	EC	FHPEV	VSCF	CB2	ASC	CD2
			AWEF	2.31	2.7	2.77	2.98	3.05	3.05	3.08	3.16
	54,000	Semi-hermetic.	DO		FHP	FHPEV	EC	VSCF	ASC	CB2	CD2
			AWEF	2.6	2.92	3.07	3.16	3.24	3.27	3.27	3.29
	72,000	Semi-hermetic.	DO		FHP	FHPEV	EC	VSCF	ASC	CB2	CD2
			AWEF	2.59	2.9	3.08	3.16	3.25	3.28	3.28	3.29

* Design option abbreviations are as follows: ASC = Ambient sub-cooling; CB2 = Improved condenser fan blades; CD2 = Improved condenser coil; EC = Electronically commutated condenser fan motors; FHP = Floating head pressure; FHPEV = Floating head pressure with electronic expansion valve; VSCF = Variable speed condenser fans.

** As discussed in section IV.D.6.b, DOE aggregated the separate results for scroll and semi-hermetic compressors and created a single aggregated cost-efficiency curve in the engineering analysis for the 25,000 Btu/h nominal capacity.

TABLE IV–3—ENGINEERING ANALYSIS OUTPUT: CALCULATED AWEFS FOR UC CLASSES

Representative unit			As-tested AWEF with each design option (DO) added*			
Equipment class	Nominal Btu/h		Baseline	DO 1	DO 2	DO 3
UC.M	4,000	DO		MEF	EB2	VEF
		AWEF	6.45	7.75	7.91	9.02
	9,000	DO		MEF	EB2	VEF
		AWEF	7.46	8.74	8.89	9.92
	24,000	DO		MEF	VEF	EB2
		AWEF	8.57	9.74	10.64	10.75
UC.L, < 15,500 Btu/h	4,000	DO		EB2	MEF	VEF
		AWEF	3.43	3.47	3.58	3.66
	9,000	DO		MEF	EB2	VEF
		AWEF	3.75	3.86	3.88	3.95
UC.L, ≥ 15,500 Btu/h	18,000	DO		MEF	EB2	VEF
		AWEF	3.94	4.05	4.08	4.15
	40,000	DO		MEF	EB2	VEF
		AWEF	4.06	4.20	4.23	4.32

* Design option abbreviations are as follows: EB2 = Improved evaporator fan blades; MEF = Modulating evaporator fans during compressor off-cycle; VEF = Variable speed evaporator fans during compressor off cycle.

10. Engineering Efficiency Levels

DOE selects efficiency levels for each equipment class. These levels form the basis of the potential standard levels that DOE considers in its analysis. As discussed above, DOE conducted a design-option-based engineering analysis for this rulemaking, in which AWEFs were calculated for specific designs incorporating groups of design options. However, these design-option-based AWEFs vary as a function of representative capacity due to multiple factors and are not generally suitable as the basis for standard levels. Hence, DOE selected engineering efficiency levels (''ELs'') for each class that provide suitable candidate levels for consideration. The efficiency levels do not exactly match the calculated AWEFs at each representative capacity, but the candidate efficiency levels are meant to provide overall representation of the range of efficiencies calculated for the individual representative capacities.

The selected efficiency levels for the equipment classes analyzed for this document are shown in Table IV–4 below. DOE divided the dedicated condensing classes into the same two classes initially considered in the June 2014 final Rule, except that the classes proposed and presented here are split based on the calculated net capacity rather than the 9,000 Btu/h nominal capacity used in the June 2014 final Rule. For the medium-temperature and low-temperature unit cooler classes, where the initial analysis had a single class covering the entire capacity range, DOE proposed in the NOPR two classes for low-temperature unit coolers and one for medium-temperature (81 FR at 63006)—this approach has not changed for the final rule.

The maximum technologically feasible level is represented by EL 3 for all classes. DOE represented the efficiency levels by either a single AWEF or an equation for the AWEF as a function of the net capacity. The efficiency levels for each class are formulated such that they divide the gap in efficiency between the baseline and the maximum technologically feasible efficiency level into approximately equal intervals. The baseline level is generally represented by the lowest AWEF achieved by any representative system in the class, while the maximum technologically feasible level is represented by the highest AWEF achieved by any representative system in the class, rounded down to the nearest 0.05 Btu per watt-hour (''Btu/W-h'') to account for uncertainty in the analysis.

TABLE IV–4—ENGINEERING EFFICIENCY LEVELS FOR EACH EQUIPMENT CLASS*

Equipment class	AWEF			
	Baseline	EL 1	EL 2	EL 3
Dedicated Condensing System—Low, Indoor with a Net Capacity (q_net) of:				
< 6,500 Btu/h	$5.030 \times 10^{-5} \times$ q_net + 1.59.	$6.384 \times 10^{-5} \times$ q_net + 1.67.	$7.737 \times 10^{-5} \times$ q_net + 1.74.	$9.091 \times 10^{-5} \times$ q_net + 1.81.
≥ 6,500 Btu/h	1.92	2.08	2.24	2.40.
Dedicated Condensing System—Low, Outdoor with a Net Capacity (q_net) of:				
< 6,500 Btu/h	$3.905 \times 10^{-5} \times$ q_net + 1.97.	$4.778 \times 10^{-5} \times$ q_net + 2.22.	$5.650 \times 10^{-5} \times$ q_net + 2.47.	$6.522 \times 10^{-5} \times$ q_net + 2.73.
≥ 6,500 Btu/h	2.22	2.53	2.84	3.15.
Unit Cooler—Medium				
All	6.45	7.3	8.15	9.
Unit Cooler—Low with a Net Capacity (q_net) of:				
< 15,500 Btu/h	$2.499 \times 10^{-5} \times$ q_net + 3.36.	$2.191 \times 10^{-5} \times$ q_net + 3.54.	$1.883 \times 10^{-5} \times$ q_net + 3.73.	$1.575 \times 10^{-5} \times$ q_net + 3.91.
≥ 15,500 Btu/h	3.75	3.88	4.02	4.15.

* Where q_net is net capacity as determined and certified pursuant to 10 CFR 431.304

DOE did not receive comments regarding the considered efficiency levels in response to the September 2016 NOPR and notes that the efficiency levels selected in this final rule remain the same as the efficiency levels presented in the NOPR. In the NOPR, DOE discussed two cases where the AWEFs for the maximum-technology EL 3 exceeds the maximum AWEF values as calculated in the design-option engineering analysis. 81 FR at 63006 (September 13, 2016).

The first of these cases involved lower-capacity, low-temperature unit coolers. As discussed in the NOPR (81 FR at 63006–63007), DOE believes that the selected EL 3 is technologically feasible given the uncertainty in the analysis, and the fact that the industry negotiating parties explicitly agreed to a standard at this level during Working Group meetings. (See Docket No. EERE–2015–BT–STD–0016, AHRI, Public Meeting Transcript (December 15, 2015), No. 60 at pp. 229–230) DOE received no comments in response to the September 2016 NOPR objecting to this proposed efficiency level.

The second case involved indoor and outdoor dedicated condensing units at representative nominal capacity of 25,000 Btu/h. As discussed in the NOPR, the AWEF associated with EL 3 for these classes can be achieved for this capacity using semi-hermetic compressors. 81 FR at 63006–63007 (September 13, 2016). DOE also notes that with its now-adjusted dedicated condensing unit analysis described in section IV.D.6.d, the analysis demonstrates that the EL 3 AWEF is achievable with scroll compressors for the 25,000 Btu/h nominal capacity. As noted earlier, the AWEFs calculated in the design-option-based analysis vary as a function of representative capacity due to multiple factors and are not generally suitable as the basis for standard levels, and the selected engineering ELs for each class provide suitable candidate levels for consideration. The efficiency levels do not exactly match the calculated AWEFs at each representative capacity, but are instead meant to provide an overall representation of the range of efficiencies calculated for the individual representative capacities. While AWEF values calculated in the NOPR analysis for the 25,000 Btu/h dedicated condensing classes did not attain the TSL 3 AWEF, the values are consistent with TSL 3 in the current analysis, which DOE believes to be more appropriate for this max-tech TSL. Consequently, in DOE's view, the analysis for this second case shows that the adjusted analysis results in a more appropriate alignment of the engineering analysis with the selected ELs.

E. Markups Analysis

The markups analysis develops appropriate markups (*e.g.,* retailer markups, distributor markups, contractor markups) in the distribution chain and sales taxes to convert the MSP estimates derived in the engineering analysis to consumer prices, which are then used in the LCC and PBP analysis and in the manufacturer impact analysis. At each step in the distribution channel, companies mark up the price of equipment to cover business costs and profit margin.

For this final rule, DOE retained the distribution channels that were used in the NOPR—(1) direct to customer sales, through national accounts or contractors; (2) refrigeration wholesalers to consumers; and (3) OEMs to consumers. The OEM channel primarily represents manufacturers of WICF refrigeration systems who may also install and sell entire WICF refrigeration units.

For each of the channels, DOE developed separate markups for baseline equipment (baseline markups) and the incremental cost of more-efficient equipment (incremental markups). Incremental markups are coefficients that relate the change in the MSP of higher-efficiency models to the change in the retailer sales price. DOE relied on data from the U.S. Census Bureau, the Heating, Air-conditioning & Refrigeration Distributors International (''HARDI'') industry trade group, and RSMeans [31] to estimate average baseline and incremental markups

Chapter 6 of the final rule TSD provides details on DOE's development of markups for the considered WICF refrigeration systems.

[31] R.S. Means Company, Inc. *RSMeans Mechanical Cost Data.* 33rd edition. 2015. Kingston, MA.

F. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of the considered WICF refrigeration systems at different efficiencies in representative U.S. installations, and to assess the energy savings potential of increased WICF refrigeration system efficiency. The energy use analysis estimates the range of energy use of the considered WICF refrigeration systems in the field (*i.e.,* as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adopting amended or new standards.

The estimates for the annual energy consumption of each analyzed representative refrigeration system (see section IV.D.4) were derived assuming that (1) the refrigeration system is sized such that it follows a specific daily duty cycle for a given number of hours per day at full-rated capacity and (2) the refrigeration system produces no additional refrigeration effect for the remaining period of the 24-hour cycle. These assumptions are consistent with the present industry practice for sizing refrigeration systems. This methodology assumes that the refrigeration system is correctly paired with an envelope that generates a load profile such that the rated hourly capacity of the paired refrigeration system, operated for the given number of run hours per day, produces sufficient refrigeration to meet the daily refrigeration load of the envelope with a safety margin to meet contingency situations. Thus, the annual energy consumption estimates for the refrigeration system depend on the methodology adopted for sizing, the implied assumptions and the extent of oversizing.

The WICF equipment run-time hours that DOE used broadly follow the load profile assumptions of the industry test procedure for refrigeration systems—AHRI 1250–2009. As noted earlier, that protocol was incorporated into DOE's test procedure. 76 FR 33631 (June 9, 2011). For the NOPR analysis, DOE used a nominal run-time of 16 hours per day for coolers and 18 hours per day for freezers over a 24-hour period to calculate the capacity of a ''perfectly''-sized refrigeration system at specified reference ambient temperatures of 95 °F and 90 °F for refrigeration systems with outdoor and indoor condensing units, respectively. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 68 at p. 9) Nominal run-time hours for coolers and freezers were adjusted to account for equipment over-sizing safety margin and capacity mismatch factors. They were further adjusted to account for the change in net capacity from increased efficiency projected to occur in the standards case. Additionally, in the case of outdoor condensing equipment, run-time hours were further adjusted based on the typical variations in ambient temperatures for each of the 9 Census Divisions, not the single point 95 °F reference temperature specified in AHRI–1250–2009. For indoor condensing equipment, DOE estimated run-time hours in the no-new-standards, and standards cases based on the steady-state design point ambient temperature of 90 °F specified in AHRI–1250–2009. DOE notes that indoor condensing equipment may be subject to ambient temperatures that are higher, or lower than the design point temperature of 90 °F. To the extent that this occurs, it would be expected to result in some increasing or lowering of consumer opening costs savings in relation to changes in indoor ambient temperature from the results presented in section V.B.1.a. The WICF equipment run-time hours that DOE used broadly follow the load profile assumptions of the industry test procedure for refrigeration systems—AHRI 1250–2009—which is incorporated into DOE's test procedure. See 10 CFR 431.303 and 431.304. As in the NOPR analysis, DOE maintained its use of nominal run-times of 16 hours per day for coolers and 18 hours per day for freezers over a 24-hour period to calculate the capacity of a ''perfectly''-sized refrigeration system at specified reference ambient temperatures of 95 °F and 90 °F for refrigeration systems with outdoor and indoor condensing units, respectively. See generally, Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Transcript (October 1, 2015), No. 68 at pp. 9–13) Nominal run-time hours for coolers and freezers were adjusted to account for equipment over-sizing safety margin and capacity mismatch factors. They were further adjusted to account for the change in net capacity from increased efficiency projected to occur in the standards case, and, in the case of outdoor equipment, variations in ambient temperature. The energy use calculation is discussed in greater detail in chapter 7 of the TSD.

1. Oversize Factors

During the Working Group negotiations, Rheem indicated that the typical and widespread industry practice for sizing the refrigeration system is to calculate the daily heat load on the basis of a 24-hour cycle and divide by 16 hours of run-time for coolers and 18 hours of run-time for freezers. In the field, WICF refrigeration systems are sized to account for a ''worst case scenario'' need for refrigeration to prevent food spoilage, and as such are oversized by a safety margin. (Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (October 1, 2015), No. 68 at pp. 12, 14) Based on discussions with purchasers of WICF refrigeration systems, DOE found that it is customary in the industry to add a 10 percent safety margin to the aggregate 24-hour load, resulting in 10 percent oversizing of the refrigeration system. The use of this 10 percent oversizing of the refrigeration system was presented to the Working Group and accepted without objection and incorporated into the analyses for the NOPR and the final rule. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 68 at pp. 8–16)

Further, DOE recognized that an exact match for the calculated refrigeration system capacity may not be available for the refrigeration systems available in the market because most refrigeration systems are produced in discrete capacities. To account for this situation, DOE used the same approach as in the June 2014 final rule. Namely, DOE applied a capacity mismatch factor of 10 percent to capture the inability to perfectly match the calculated WICF capacity with the capacity available in the market. This approach was presented to the Working Group and accepted without objection and incorporated into both the NOPR final rule analyses. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 68 at pp. 8, 18)

The combined safety margin factor and capacity mismatch factor result in a total oversizing factor of 1.2. With the oversize factor applied, the run-time of the refrigeration system is reduced to 13.3 hours per day for coolers and 15 hours per day for freezers at full design point capacity. These calculations are described in detail in chapter 7 of the final rule TSD.

2. Net Capacity Adjustment Factors

In this final rule, as in the NOPR and June 2014 final rule, DOE assumed that the heat loads to which WICF refrigeration systems are connected remain constant in the no-new-standards and standards cases. To account for changes in the net capacity of more efficient designs in the standard cases, DOE adjusted the run-time hours as part of its supporting analyses. See 81 FR at 63008; 79 FR at 32083.

3. Temperature Adjustment Factors

In this final rule, as in the NOPR and June 2014 final rule, DOE assumed that indoor WICF refrigeration systems are operated at a steady-state with an ambient temperature of 90 °F. See 81 FR at 63008; 79 FR at 32083. For these equipment classes, the run-time hours are only adjusted by the change in steady-state capacity as efficiency increases. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 68 at p. 23)

In this final rule, as in the NOPR, DOE assumed outdoor WICF refrigeration system run-times to be a function of external ambient temperature. 81 FR at 63008 (September 13, 2016). DOE adjusted the run-time hours for outdoor WICF refrigeration systems to account for the dependence of the steady-state capacity on external ambient temperature. External ambient temperatures were determined as regional histograms of annual weighted hourly temperatures. For these equipment, the run-time hours are adjusted by the fraction of heat load that would be removed at each temperature bin of the regional histogram. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 68 at pp. 33–35)

These adjusted run-times were presented to the Working Group in detail for indoor and outdoor dedicated condensing equipment classes. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 20, 2015), No. 66 at pp. 111–119) After reviewing DOE's run-time estimates, the CA IOUs, confirmed the reasonableness of DOE's estimates. (Docket No. EERE–2015–BT–STD–0016, CA IOUs, Public Meeting Transcript (November 4, 2015), No. 65 at p. 190)

Chapter 7 of the final rule TSD provides details on DOE's energy use analysis for the considered WICF refrigeration systems.

G. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for the considered WICF refrigeration systems. The effect of 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 equipment over the life of that equipment, 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 equipment.
- The payback period is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of more-efficient equipment through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of the considered equipment 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 equipment.

For each considered efficiency level in each equipment class, DOE calculated the LCC and PBP for a nationally representative set of WICF refrigeration systems. DOE used shipments data submitted by AHRI to develop its sample. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Transcript (November 3, 2015), No. 64 at pp. 150) The sample weights how the various WICF refrigeration system types and capacities are distributed over different commercial sub-sectors, geographic regions, and configurations of how the equipment is sold (either as a separate unit cooler, a separate condensing unit, or as a combined unit cooler and condensing unit pair matched at the time of installation). For each of these WICF refrigeration systems, DOE determined the energy consumption and the appropriate electricity price, enabling DOE to capture variations in WICF refrigeration system energy consumption and energy pricing.

Inputs to the calculation of total installed cost include the cost of the equipment—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, equipment lifetimes, and discount rates. DOE created distributions of values for equipment lifetime, discount rates, and sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

The computer model DOE uses to calculate the LCC and PBP relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and WICF consumer sample. The model calculated the LCC and PBP for equipment at each efficiency level for 5,000 consumers per simulation run.

DOE calculated the LCC and PBP for all consumers of the considered WICF refrigeration systems as if each consumer were to purchase new equipment in the expected first full year of required compliance with the standards. As discussed in section III.F, DOE currently anticipates a compliance date in early 2020 for the WICF refrigeration systems under consideration.

Table IV–5 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the final rule TSD and its appendices.

TABLE IV–5—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS*

Inputs	Source/method
Equipment Cost	Derived by multiplying MSPs by retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to forecast equipment costs.
Installation Costs	Baseline installation cost determined with data from RS Means. Assumed no change with efficiency level.

TABLE IV–5—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS*—Continued

Inputs	Source/method
Annual Energy Use	The total annual energy use multiplied by the hours per year. Average number of hours based on field data. Variability: Based on the stakeholder submitted data.
Energy Prices	Electricity: Average and marginal prices derived from EIA and Edison Electric Institute (''EEI'') data.
Energy Price Trends	Based on *AEO2016 No-CPP case* price projections.
Repair and Maintenance Costs	Assumed no change with efficiency level.
Product Lifetime	Assumed average lifetime of 12 years.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase WICFs. Primary data source was the Damodaran Online.
Compliance Date	2020.

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

1. System Boundaries

As discussed in section IV.D.6, participants during the Working Group meetings stated that the vast majority of WICF refrigeration equipment are sold as stand-alone components and installed either as a complete system in the field (field-paired) or as replacement components—*i.e.,* to replace either the unit cooler (''UC-only'') or condensing unit (''CU-only''). AHRI provided data to the Working Group indicating that over 90 percent of these WICF refrigeration equipment components are sold as stand-alone equipment with the remaining sold as manufacturer matched pairs (Docket No. EERE–2015–BT–STD–0016, AHRI, No. 29). These data stand in contrast to the June 2014 final rule, where DOE assumed in its analysis that all equipment was sold as manufacturer-matched pairs. Further, section III.B of this document DOE's May 2014 test procedure update that specified that in instances where a complete walk-in refrigeration system consists of a unit cooler and condensing unit sourced from separate manufacturers, each manufacturer is responsible for ensuring the compliance of its respective units. See 79 FR at 27391. Based on the current market situation, the LCC analysis separately estimates the costs and benefits for equipment under the following system configuration scenarios: field-paired systems,[32] condensing unit-only,[33] and unit cooler only.[34]

a. Field-Paired

Under the field-paired system configuration, DOE assumes that the unit cooler and condensing unit are purchased as stand-alone pieces of equipment and paired together in the field. Field-paired results were estimated for dedicated condensing, low-temperature equipment classes only, which include dedicated condensing, low-temperature outdoor (DC.L.O) and dedicated condensing, low-temperature indoor (DC.L.I) equipment classes. Medium-temperature dedicated condensing equipment classes were not analyzed as field-paired equipment because these condensing units fall outside the scope of this final rule's analysis. (These units are already addressed by the June 2014 final rule.) Also, unit coolers used in multiplex condensing applications were not analyzed as field-paired equipment because the scope of these equipment classes only covers the unit cooler portion of the walk-in system.

b. Condensing Unit-Only

Under the condensing unit-only system configuration, DOE assumes that the condensing unit is purchased as a stand-alone piece of equipment and installed with a pre-existing baseline unit cooler. Condensing unit-only results were estimated for low-temperature, dedicated condensing equipment classes only, which includes DC.L.O and DC.L.I equipment classes.

c. Unit Cooler Only

Under the unit cooler-only system configuration, DOE assumes that the unit cooler is purchased as a stand-alone piece of equipment and installed with a pre-existing baseline condensing unit. Unit cooler-only results were estimated for all low-temperature condensing equipment classes (DC.L.O, DC.L.I, and UC.L). For the medium-temperature unit coolers belonging to the UC.M equipment class, DOE estimated the impact of unit cooler design options on multiplex applications (referred to as UC.M in the tables) and on applications where the unit cooler is installed with a pre-existing medium -temperature dedicated condensing unit. For the medium-temperature dedicated applications, DOE assumed that the condensing unit meets the standards adopted in the June 2014 final rule. In the tables contained in this document, the installations with a pre-existing medium-temperature dedicated condensing unit are referred to as UC.M–DC.M.I application and UC.M–DC.M.O applications.

As discussed in section III.B, DOE established a rating method for individually sold walk-in refrigeration system components. Unit coolers sold alone are tested and rated using the AWEF calculation procedure for a walk-in unit cooler matched to a parallel rack system (see section 7.9 of AHRI 1250–2009). Similarly, condensing units sold alone are tested and rated with the dedicated condensing system test. DOE reflected this approach by aggregating unit cooler-only results within the low- and medium-temperature unit cooler equipment classes. The low-temperature unit cooler equipment class (UC.L) is an aggregation of results of all unit coolers attached to DC.L.O, DC.L.I, and low-temperature multiplex condensing systems. The medium-temperature unit cooler equipment class (UC.M) is an aggregation of results of all unit coolers in all application types.

d. System Boundary and Equipment Class Weights

Within each equipment class, DOE examined several different nominal capacities (see section IV.D.4). The life-cycle costs and benefits for each of these capacities was weighted in the results for each equipment class shown in section V based on the respective market share of each equipment class and capacity in the customer sample mentioned above. The system boundaries and customer sample

[32] Paired dedicated systems are described in section IV.D.6.c.

[33] Condensing units are described in section IV.D.6.b.

[34] Unit coolers are described in section IV.D.6.a.

weights (based on share of total sales of the considered WICF refrigeration equipment) are shown in Table IV–6.

TABLE IV–6—SYSTEM BOUNDARIES AND CUSTOMER SAMPLE WEIGHTS

Equipment class application	Reported as equipment class	Capacity (kBtu/h)	System boundary	Weight (%)
DC.L.I	DC.L.I	6	CU-Only	1.2
DC.L.I	DC.L.I	9	CU-Only	0.4
DC.L.I	DC.L.I	25	CU-Only	0.1
DC.L.I	DC.L.I	54	CU-Only	0.0
DC.L.O	DC.L.O	6	CU-Only	0.6
DC.L.O	DC.L.O	9	CU-Only	1.1
DC.L.O	DC.L.O	25	CU-Only	0.4
DC.L.O	DC.L.O	54	CU-Only	0.1
DC.L.O	DC.L.O	72	CU-Only	0.1
DC.L.I	DC.L.I	6	Field-Paired	5.4
DC.L.I	DC.L.I	9	Field-Paired	2.0
DC.L.I	DC.L.I	25	Field-Paired	0.6
DC.L.I	DC.L.I	54	Field-Paired	0.2
DC.L.O	DC.L.O	6	Field-Paired	2.9
DC.L.O	DC.L.O	9	Field-Paired	5.1
DC.L.O	DC.L.O	25	Field-Paired	1.7
DC.L.O	DC.L.O	54	Field-Paired	0.3
DC.L.O	DC.L.O	72	Field-Paired	0.4
DC.L.I	UC.L	6	UC-Only	1.2
DC.L.I	UC.L	9	UC-Only	0.4
DC.L.I	UC.L	25	UC-Only	0.1
DC.L.I	UC.L	54	UC-Only	0.0
DC.L.O	UC.L	6	UC-Only	0.6
DC.L.O	UC.L	9	UC-Only	1.1
DC.L.O	UC.L	25	UC-Only	0.4
DC.L.O	UC.L	54	UC-Only	0.1
DC.L.O	UC.L	72	UC-Only	0.1
UC.M—DC.M.I	UC.M	9	UC-Only	15.5
UC.M—DC.M.I	UC.M	24	UC-Only	4.6
UC.M—DC.M.O	UC.M	9	UC-Only	24.0
UC.M—DC.M.O	UC.M	24	UC-Only	11.7
MC.L	UC.L	4	UC-Only	0.8
MC.L	UC.L	9	UC-Only	3.0
MC.L	UC.L	18	UC-Only	2.0
MC.L	UC.L	40	UC-Only	0.7
MC.M	UC.M	4	UC-Only	1.4
MC.M	UC.M	9	UC-Only	7.9
MC.M	UC.M	24	UC-Only	2.0

2. Equipment Cost

To calculate consumer equipment costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described earlier (along with sales taxes). DOE used different markups for baseline equipment and higher-efficiency equipment because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency equipment.

To develop an equipment price trend for WICFs, DOE derived an inflation-adjusted index of the producer price index (''PPI'') for commercial refrigerators and related equipment from 1978 to 2014.[35] These data, which represent the closest approximation to the refrigeration equipment at issue in this rule, indicate no clear trend, showing increases and decreases over time. Because the observed data do not provide a firm basis for projecting future price trends for WICF refrigeration equipment, DOE used a constant price assumption as the default trend to project future WICF refrigeration system prices. Thus, prices projected for the LCC and PBP analysis are equal to the 2015 values for each efficiency level in each equipment class.

3. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the equipment. DOE used data from *RS Means Mechanical Cost Data 2015* [36] to estimate the baseline installation cost for WICF refrigeration systems. Installation costs associated with hot gas defrost design options for low-temperature dedicated condensing and multiplex condensing equipment were discussed at length during the Working Group meetings. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 68 at p. 54; Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 15, 2015), No. 62 at pp. 36–37, 49–50, 187)

However, the Working Group recommended that DOE remove from the test procedure the method for calculating the energy use and thermal load associated with hot gas defrost (Docket No. EERE–2015–BT–STD–0016, Term Sheet: Recommendation #3 (December 15, 2015), No. 56 at p. 2) This method did not require any testing of defrost, using instead a calculation that includes standardized values associated with both electricity use and thermal load associated with hot gas defrost—the method gave a significantly

[35] Bureau of Labor Statistics, *Producer Price Index Industry Data,* Series: PCU3334153334153.

[36] Reed Construction Data, RSMeans Mechanical Cost Data 2015 Book, 2015.

better AWEF rating for a refrigeration system with hot gas defrost than for systems with electric defrost, in effect representing a ''credit'' for this feature. The credit recognized the reduced electrical usage but, in the absence of a means to account for the energy consumption stemming from the use of the hot gas defrost system itself, industry representatives argued that, in their view, the credit did not provide a completely accurate picture with respect to energy consumption. Consequently, in light of these concerns, in addition to making the corresponding changes to the test procedure, DOE also removed hot gas defrost as a design option from its standards analysis, as discussed in section VI.B.2. For this final rule, as in the NOPR, DOE maintained that while installation costs may increase with equipment capacity, they are not affected by an increase in efficiency and were therefore not considered. See 81 FR at 63009, 63011. Installation costs are discussed in detail in chapter 8 of the final rule TSD.

4. Annual Energy Use

DOE typically considers the impact of a rebound effect in its energy use calculation. A rebound effect occurs when users operate higher efficiency equipment more frequently and/or for longer durations, thus offsetting estimated energy savings. DOE did not incorporate a rebound factor for WICF refrigeration equipment because it is operated 24 hours a day, and therefore there is limited potential for a rebound effect. Additionally, DOE requested comment from the Working Group if there was any evidence contradicting DOE's assumption to not incorporate a rebound factor, (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Transcript (November 20, 2015), No. 66 at pp. 92) to which Hussmann responded that DOE's assumption was reasonable. (Docket No. EERE–2015–BT–STD–0016, Hussmann, Public Meeting Transcript (November 20, 2015), No. 66 at pp. 92) Further, ASAP and Lennox responded in agreement with DOE's assumption to not incorporate a rebound factor in its NOPR. (Docket No. EERE–2015–BT–STD–0016, ASAP, Public Meeting Transcript (September 29, 2016), No. 79 at p. 23; Docket No. EERE–2015–BT–STD–0016, Lennox No. 89 at p. 7) In light of these comments, DOE maintained the same assumptions on rebound effect in this final rule.

For each sampled WICF refrigeration system, DOE determined the energy consumption at different efficiency levels using the approach described in section IV.D.10.

5. Energy Pricing and Projections

DOE derived regional marginal non-residential (*i.e.,* commercial and industrial) electricity prices using data from EIA's Form EIA–861 database (based on the agency's ''Annual Electric Power Industry Report''),[37] EEI Typical Bills and Average Rates Reports,[38] and information from utility tariffs for each of nine (9) geographic U.S. Census Divisions.[39] Electricity tariffs for non-residential consumers generally incorporate demand charges. The presence of demand charges means that two consumers with the same monthly electricity consumption may have very different bills, depending on their peak demand. DOE maintained its approach from the NOPR analysis for the final rule, and derived marginal electricity prices to estimate the impact of demand charges for consumers of WICF refrigeration systems. The methodology used to calculate the marginal electricity rates can be found in appendix 8A of the final rule TSD.

To estimate energy prices in future years, DOE multiplied the average and marginal regional electricity prices by the forecast of annual change in national-average commercial electricity pricing in the Reference case described on p.E–8 in *AEO 2016,*[40] 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.

6. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing equipment components that have failed in an appliance. Industry participants from the Working Group indicated that maintenance and repair costs do not change with increased WICF refrigeration system efficiency. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 15, 2015), No. 62 at pp. 38, 53) As in the NOPR, DOE did not include these costs in the final rule.

7. Equipment Lifetime

For this analysis, DOE continued to use an estimated average lifetime of 10.5 years for the WICF refrigeration systems examined in this rulemaking, with a minimum and maximum of 2 and 25 years, respectively, used in the June 2014 final rule. 79 FR at 32086 (June 3, 2014). DOE reflects the uncertainty of equipment lifetimes in the LCC analysis for equipment components by using probability distributions. DOE presented this assumption at the NOPR public meeting and invited comment. DOE received no comments on its estimated WICF refrigeration system lifetimes. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Presentation (September 29, 2016), No. 78 at p. 29)

8. Discount Rates

In calculating the LCC, DOE applies discount rates to estimate the present value of future operating costs to the consumers of WICF refrigeration systems. DOE derived the discount rates for both the NOPR and final rule analyses by estimating the average cost of capital for a large number of companies similar to those that would likely to purchase WICF refrigeration systems. This approach resulted in a distribution of potential consumer discount rates from which DOE sampled in the LCC analysis. Most companies use both debt and equity capital to fund investments, so their cost of capital is the weighted average of the cost to the company of equity and debt financing.

DOE estimated the cost of equity financing by using the Capital Asset Pricing Model (''CAPM'').[41] The CAPM assumes that the cost of equity is proportional to the amount of systematic risk associated with a company. Data for deriving the cost of equity and debt financing primarily came from Damodaran Online, which is a widely used source of information about company debt and equity financing for most types of firms.[42]

[37] Available at: *www.eia.doe.gov/cneaf/electricity/page/eia861.html.*

[38] Edison Electric Institute. *Typical Bills and Average Rates Report.* Winter 2014 published April 2014, Summer 2014 published October 2014: Washington, D.C. (Last accessed June 2, 2015.) *www.eei.org/resourcesandmedia/products/Pages/Products.aspx.*

[39] U.S. Census Bureau, Census Divisions and Census Regions *www.census.gov/geo/reference/gtc/gtc_census_divreg.html* (Last accessed February 2, 2016)

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

[41] Harris, R.S. *Applying the Capital Asset Pricing Model.* UVA–F–1456. Available at SSRN: *http://ssrn.com/abstract=909893.*

[42] Damodaran Online, *The Data Page: Cost of Capital by Industry Sector,* (2004–2013) (Available at: *http://pages.stern.nyu.edu/~adamodar/*).

More details regarding DOE's estimates of consumer discount rates are provided in chapter 8 of the final rule TSD.

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

To accurately estimate the share of consumers that would be affected by a potential energy conservation standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution (market shares) of equipment efficiencies under the no-new-standards case (*i.e.,* the case without amended or new energy conservation standards). In the case of WICF refrigeration systems, DOE was unable to find usable data on the distribution of efficiencies in the market, nor was information offered by participants during the Working Group meetings. For this analysis, DOE continued to assume, as it did for the NOPR analysis, that 100 percent of WICF refrigeration equipment is at the baseline efficiency level in the no-new-standards case. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting (October 1, 2015), No. 068 at pp. 53–54) DOE presented this assumption at the NOPR public meeting and invited comment. DOE received no comments on its efficiency distribution assumption in the no-new-standards case. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Presentation (September 29, 2016), No. 78 at p. 29)

10. Payback Period (PBP) Analysis

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

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

As noted above, EPCA, as amended, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii) and 6316(a)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price projection for the year in which compliance with the standards would be required.

H. Shipments Analysis

DOE uses forecasts of annual equipment shipments to calculate the national impacts of the energy conservation standards on energy use, NPV, and future manufacturer cash-flows.[43] The shipments model takes an accounting approach, tracking the vintage of units in the stock and market shares of each equipment class. The model uses equipment shipments as inputs to estimate the age distribution of in-service equipment stocks for all years. The age distribution of in-service equipment stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

In DOE's shipments model, shipments of the considered WICF refrigeration systems are driven by new purchases and stock replacements due to failures. Equipment failure rates are related to equipment lifetimes described in section IV.G.7. New equipment purchases are driven by growth in commercial floor space.

DOE initialized its stock and shipments model based on shipments data provided by stakeholders during the Working Group meetings. These data showed that for low-temperature, dedicated condensing equipment classes, 5 percent of shipments are manufacturer-matched condensing units and unit coolers, and the remaining 95 percent is sold as individual condensing units or unit coolers that installers then match in the field. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 3, 2015), No. 64 at p. 120; Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 20, 2015), No. 66 at pp. 83–84) For medium and low-temperature unit coolers, 82 percent are paired with dedicated condensing systems, and the remaining 18 percent are paired with multiplex systems; 70 percent of unit coolers are medium-temperature, and 30 percent are low-temperature. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 4, 2015), No. 65 at p. 117)

As with the NOPR and the June 2014 final rule, DOE assumed in this analysis that shipments of new equipment would increase over time at the same rate of growth as commercial floor space projected in *AEO 2016.* As presented to the Working Group, DOE took this approach because data on historic trends in market shares of WICF equipment classes and capacities were lacking. Because of this limitation, DOE assumed that the share of shipments for each equipment class and capacity would remain constant over time. (Docket No. EERE–2015–BT–STD–0016, Public Meeting Presentation (November 20, 2015), No. 42, at p. 24)

DOE recognizes that an increase in equipment price resulting from energy conservation standards may affect end-user decisions regarding whether to purchase new WICF equipment. However, DOE has not found any information in existing literature, or provided by stakeholders, that indicates that there is a price elasticity for WICFs. As in the June 2014 final rule, NOPR, and as presented at the NOPR public meeting, similar to other commercial refrigeration equipment, DOE assumed that WICF equipment is a necessity for food safety, storage and business operations. Because of this assumption, DOE concluded that the demand for WICF equipment is inelastic and assumed an elasticity of zero for this analysis.[44] (79 FR 32050; 81 FR 62979; Docket No. EERE–2015–BT–STD–0016, Public Meeting Presentation (November 20, 2015), No. 42, at pp. 27–38) DOE did not receive any comments suggesting that there should be a price elasticity for the considered WICF equipment applied to its previous analysis—either in response to the proposal or during the Working Group negotiations.

I. National Impact Analysis

The NIA assesses the national energy savings (''NES'') and the national net present value (''NPV'') from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[45] (''Consumer'' in this context refers to consumers of the product being regulated.) DOE calculates the NES and

[43] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are not readily available for DOE to examine. In general, one would expect a close correspondence between shipments and sales in light of their direct relationship with each other.

[44] See: Zero Zone, Inc., *et al.*, v. *United States Department of Energy*, et al., 832 F.3d 654 (7th Cir. 2016).

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

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.[46] For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of WICF refrigeration systems sold from 2020 through 2049.

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

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

Table IV–7 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.

TABLE IV–7—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2020
Efficiency Trends	No-new-standards case: none. Standards cases: none.
Annual Energy Consumption per Unit	Annual weighted-average values are a function of energy use at each TSL.
Total Installed Cost per Unit	Does not change with efficiency level. Incorporates projection of future equipment prices based on historical data.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit	Annual values do not change with efficiency level.
Energy Prices	*AEO2016 no-CPP case price forecasts (to 2040) and extrapolation through 2050.*
Energy Site-to-Primary and FFC Conversion	Site-to-Primary: A time-series conversion factor based on *AEO 2016.* FFC: Utilizes data and projections published in *AEO 2016.*
Discount Rate	Three and seven percent.
Present Year	2016.

1. Equipment Efficiency Trends

For the standards cases, DOE used a ''roll-up'' scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective (2020). In this scenario, the market of products in the no-new-standards case that do not meet the standard under consideration would ''roll up'' to meet the new standard level, and the market share of products above the standard would remain unchanged.

Because data on trends in efficiency for the considered WICF refrigeration systems are lacking, DOE took a conservative approach and assumed that no change in efficiency would occur over the shipments projection period in the no-new-standards case. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 20, 2015), No. 66 at pp. 83–84)

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (TSL) and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO 2016.* Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

In 2011, in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use full-fuel-cycle (''FFC'') measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). After evaluating the approaches discussed in that document, 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[47] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of

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

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

energy use and emissions is described in appendix 10A of the final rule TSD.

3. Net Present Value Analysis

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

As discussed in section IV.F.1 of this final rule, DOE used a constant price trend for WICF refrigeration systems. DOE applied the same trend to forecast prices for each equipment class at each considered efficiency level. DOE's projection of equipment prices is discussed in appendix 10B of the final rule TSD.

To evaluate the effect of uncertainty regarding the price trend estimates, DOE investigated the impact of different equipment price forecasts on the consumer NPV for the considered TSLs for the considered WICF refrigeration systems. In addition to the default price trend, DOE considered one equipment price sensitivity case in which prices increase and one in which prices decrease. The derivation of these price trends and the results of the sensitivity cases are described in appendix 10B of the final rule TSD.

The operating cost savings are energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the average regional energy prices by a projection of annual national-average commercial energy price changes consistent with the cases described on page E–8 in AEO 2016,[48] 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 through 2040. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO 2016* case that have lower and higher economic growth. Those cases have lower and higher energy price trends and the NIA results based on these cases are presented in appendix 10B of the final rule TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final rule, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (''OMB'') to Federal agencies on the development of regulatory analysis.[49] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

J. Consumer Subgroup Analysis

In analyzing the potential impact of the new or amended standards on commercial consumers, DOE evaluates the impact on identifiable groups (*i.e.,* subgroups) of consumers that may be disproportionately affected. Small businesses typically face a higher cost of capital, which could make it more likely that they would be disadvantaged by a requirement to purchase higher efficiency equipment.

DOE estimated the impacts on the small business customer subgroup using the LCC model. To account for a higher cost of capital, the discount rate was increased by applying a small firm premium to the cost of capital.[50] In addition, electricity prices associated with different types of small businesses were used in the subgroup analysis.[51] Apart from these changes, all other inputs for the subgroup analysis are the same as those in the LCC analysis. Details of the data used for the subgroup analysis and results are presented in chapter 11 of the final rule TSD.

K. Manufacturer Impact Analysis

1. Definition of Manufacturer

A manufacturer of a walk-in is any person who: (1) Manufactures a component of a walk-in cooler or walk-in freezer that affects energy consumption, including, but not limited to, refrigeration, doors, lights, windows, or walls; or (2) manufactures or assembles the complete walk-in cooler or walk-in freezer. 10 CFR 431.302. DOE requires a manufacturer of a walk-in component to certify the compliance of the components it manufactures. This document establishes energy conservation standards for seven classes of refrigeration equipment that are components of complete walk-in coolers and walk-in freezers. DOE provides a qualitative and quantitative analysis on the potential impacts of the adopted rule on the affected WICF refrigeration manufacturers. The results are presented in section V.B.2. This document does not set new or amended energy conservation standards in terms of the performance of the complete walk-in cooler or walk-in freezer and does not create new burdens on manufacturers who assemble the complete walk-in cooler or freezer. DOE provides a qualitative review of the potential impacts on those manufacturers that assemble complete walk-ins in section V.B.2.e.

2. Overview

DOE performed an MIA to estimate the financial impacts of energy conservation standards on manufacturers of the seven WICF refrigeration system equipment classes being analyzed. The MIA also has qualitative aspects and seeks to determine how energy conservation standards might affect competition, production capacity, and overall cumulative regulatory burden for manufacturers. Finally, the MIA serves to identify any disproportionate impacts on manufacturer subgroups, including small business manufacturers.

The quantitative part of the MIA primarily relies on the Government Regulatory Impact Model (*i.e.,* GRIM), an industry cash-flow model with inputs specific to this rulemaking. The key GRIM inputs include data on the industry cost structure, unit production costs, equipment shipments, manufacturer markups, and investments

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

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

[50] See chapter 8 of the final TSD for a more detailed discussion of discount rates.

[51] Small businesses tend to face higher electricity prices than the average WICF users.

in R&D and manufacturing capital required to produce compliant equipment. The key GRIM outputs are the INPV, which is the sum of industry annual cash-flows over the analysis period, discounted using the industry-weighted average cost of capital, and the impact to domestic manufacturing employment. The model uses standard accounting principles to estimate the impacts of more-stringent energy conservation standards on a given industry by comparing changes in INPV between a no-new-standards case and the various trial standards cases (TSLs). To capture the uncertainty relating to manufacturer pricing strategy following the adoption of standards, the GRIM estimates a range of possible impacts under two markup scenarios. DOE notes that the INPV estimated by the GRIM is reflective of industry value derived from the seven equipment classes being analyzed. The model does not capture the revenue from equipment falling outside the scope of this rulemaking.

The qualitative part of the MIA addresses manufacturer characteristics and market trends. Specifically, the MIA considers such factors as a potential standard's impact on manufacturing capacity, competition within the industry, and the cumulative impact of other Federal regulations. The complete MIA is outlined in chapter 12 of the final rule TSD.

DOE conducted the MIA for this rulemaking in three phases. In phase 1, DOE prepared an industry characterization based on the market and technology assessment and publicly available information. In Phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the impacts of an energy conservation standard on manufacturers of WICF refrigeration systems. In general, more-stringent energy conservation standards can affect manufacturer cash-flow in three distinct ways: (1) By creating a need for increased investment; (2) by raising production costs per unit; and (3) by altering revenue due to higher per-unit prices and possible changes in sales volumes. In Phase 3 of the MIA, DOE used information from the Working Group negotiations to update key inputs to GRIM to better reflect the industry. Updates include changes to the engineering inputs and shipments model.

As part of Phase 3, DOE also evaluated subgroups of manufacturers that may be disproportionately impacted by the adopted standards or that may not be accurately represented by the average cost assumptions used to develop the industry cash-flow analysis. Such manufacturer subgroups may include small business manufacturers, low-volume manufacturers, niche players, and/or manufacturers exhibiting a cost structure that largely differs from the industry average. DOE identified one manufacturer subgroup for which average cost assumptions may not hold: Small businesses.

To identify small businesses for this analysis, DOE applied the size standards published by the Small Business Administration (''SBA'') to determine whether a company is considered a small business. (65 FR 30840, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (September 5, 2000); and codified at 13 CFR part 121.) To be categorized as a small business manufacturer of WICF refrigeration systems under North American Industry Classification System (''NAICS'') code 333415 (''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing''), a WICF refrigeration systems manufacturer and its affiliates may employ a maximum of 1,250 employees. The 1,250-employee threshold includes all employees in a business' parent company and any other subsidiaries. Using this classification in conjunction with a search of industry databases and the SBA member directory, DOE identified three manufacturers of WICF refrigeration systems that qualify as small businesses.

The WICF refrigeration systems manufacturer subgroup analysis for the seven analyzed equipment classes is discussed in greater detail in chapter 12 of the final rule TSD and in section VI.B of this document.

3. Government Regulatory Impact Model and Key Inputs

DOE uses the GRIM to quantify the changes in cash-flows over time due to new or amended energy conservation standards. These changes in cash-flows result in either a higher or lower INPV for the standards case compared to the no-new standards case. The GRIM analysis uses a standard annual cash-flow analysis that incorporates MPCs, manufacturer markups, shipments, and industry financial information as inputs. It then models changes in MPCs, investments, and manufacturer margins that may result from analyzed energy conservation standards. The GRIM uses these inputs to calculate a series of annual cash-flows beginning with the reference year of the analysis, 2016, and continuing to 2049. Annual cash-flows are discounted to the reference year using a discount rate of 10.2 percent. DOE then computes INPV by summing the stream of discounted annual cash-flows during the analysis period. The GRIM analysis focuses on manufacturer impacts with respect to the seven covered refrigeration equipment classes. The major GRIM inputs are described in detail in the following sections.

a. Manufacturer Production Costs

Manufacturing higher-efficiency equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex and expensive components. The increases in the MPCs of the analyzed equipment can affect the revenues, gross margins, and cash-flow of the industry, making these equipment costs key inputs for the GRIM and the MIA.

In the MIA, DOE used the MPCs and shipping costs calculated in the engineering analysis, as described in section IV.D and further detailed in chapter 5 of this final rule TSD. DOE used information from its teardown analysis, described in section IV.D.5 to disaggregate the MPCs into material, labor, and overhead costs. To calculate the MPCs for equipment above the baseline, DOE added incremental material, labor, overhead costs from the engineering cost-efficiency curves to the baseline MPCs. These cost breakdowns and equipment markups were validated with manufacturers during manufacturer interviews conducted for the June 2014 final rule and further revised based on additional feedback from the Working Group.

b. Shipment Scenarios

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of shipments by equipment class. For the no-new standards case analysis, the GRIM uses the NIA shipment forecasts from 2016, the base year for the MIA analysis, to 2049, the final year of the analysis period. For the standards case shipment forecast, the GRIM uses the NIA standards case shipment forecasts. The NIA assumes zero elasticity in demand. With no elasticity, the total number of shipments per year in the standards case is equal to the total shipments per year in the no-new standards case. DOE assumed that equipment efficiencies in the no-new standards case that did not meet the standard under consideration would ''roll up'' to meet the new standard in the compliance year. Section IV.G and in chapter 9 of the TSD provide further details about the shipment scenarios.

c. Capital and Product Conversion Costs

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

To evaluate the level of conversion costs the industry would likely incur to comply with energy conservation standards, DOE used the data gathered in support of the June 2014 final rule. 79 FR at 32091 (June 3, 2014). The supporting data relied on manufacturer comments and information derived from the equipment teardown analysis and engineering model. DOE also incorporated feedback received during the ASRAC negotiations, which included updated conversion costs to better reflect changes in the test procedure, design options and design option ordering, the dollar year, and the competitive landscape for walk-in refrigeration systems. Finally, DOE incorporated analysis from the WICF test procedure final rule to estimate the costs associated with testing and labeling.

In general, the analysis assumes that all conversion-related investments occur between the year of publication of the final rule and the year by which manufacturers must comply with a new or amended standard. The investment figures used in the GRIM can be found in Table IV–8 of this document. For additional information on the estimated product conversion and capital conversion costs, see chapter 12 of the final rule TSD.

TABLE IV–8—INDUSTRY PRODUCT AND CAPITAL CONVERSION COSTS PER TRIAL STANDARD LEVEL

	Trial standard level		
	1	2	3
Product Conversion Costs (2015$ MM)	3.0	6.0	14.0
Capital Conversion Costs (2015$ MM)	0.3	1.1	4.7

Capital conversion costs are driven by investments related to larger condenser coils. DOE estimated that four manufacturers produce their own condenser coils, which requires an estimated total investment of $1.0 million per manufacturer. The remainder of the capital conversion costs is attributed to the ambient sub-cooling design option.

DOE's engineering analysis suggests that many efficiency levels can be reached through the incorporation of more efficient components. Many of these changes are component swaps that do not require extensive R&D or redesign. DOE estimated product conversion costs of $20,000 per manufacturer per equipment class for component swaps. For improved evaporator fan blades, additional R&D effort may be required to account for proper airflow within the cabinet and across the heat exchanger. DOE estimates product conversion costs to be $50,000 per manufacturer per equipment class. Chapter 12 of the final rule TSD provides further details on the methodology that was used to estimate conversion costs.

d. Testing and Labeling Costs

In the test procedure final rule, DOE added a labeling requirement for WICF refrigeration systems. 81 FR at 95803 (December 28, 2016). As part of that rule's analysis, DOE accounted for the burdens manufacturers would incur to update their marketing materials in the product conversion cost estimates. Marketing materials include literature, data sheets, selection software, sales training, and compliance documentation. In the test procedure final rule, DOE estimated that manufacturers would incur product conversion costs of $50,000 per manufacturer to update marketing materials for WICF refrigeration systems. Based on a total of ten manufacturers, DOE included industry labeling costs of $0.5 million in product conversion costs for all TSLs.

DOE also included testing costs that manufacturers would incur as a result of the test procedure for WICF refrigeration systems. DOE allows manufacturers to use alternative efficiency determination methods (''AEDMs'') to determine representative values of efficiency. AEDMs must be validated with tested performance of at least two distinct basic models for each equipment classes. *See* 10 CFR 429.70. DOE estimates that testing costs are $7,500 per basic model. Using this estimate, the cost to validate AEDMs for seven equipment classes totals $105,000 per manufacturer.

In addition, DOE included the costs to run AEDMs. Based on DOE's Compliance Certification Management System (''CCMS'') Web site, refrigeration manufacturers have up to 100 WICF refrigeration models. DOE estimates it takes an estimated 3 hours per model for a mechanical engineer to run an AEDM model. Using an average hourly wage for a mechanical engineer in 2015 of $42.40,[52] the costs to run AEDMs are $12,720 per manufacturer. In summary, testing costs are estimated to be $1.2 million, and labeling costs are $0.5 million for the WICF refrigeration industry.

e. Manufacturer Markup Scenarios

As discussed above, MSPs include direct manufacturing production costs (*i.e.,* labor, material, and overhead estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied manufacturer markups to the MPCs estimated in the engineering analysis and then added the cost of shipping. Modifying these manufacturer markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case manufacturer markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of new or amended energy conservation standards: (1) A preservation of gross margin percentage markup scenario and (2) a preservation of operating profit markup scenario. These scenarios lead to different manufacturer markup values that, when applied to the inputted MPCs, result in varying revenue and cash-flow impacts. These manufacturer markup scenarios were presented during the NOPR public meeting and DOE received no additional comment on them. (Public Meeting Transcript (September 29, 2016), No. 79 at pp. 40–41) DOE further notes that these markup scenarios are consistent

[52] *www.bls.gov/oes/current/oes172141.htm.*

with the scenarios modeled in the June 2014 final rule for walk-ins.

Under the preservation of gross margin percentage scenario, DOE applied a single uniform ''gross margin percentage'' markup across all efficiency levels. As production costs increase with efficiency, this scenario implies that the absolute dollar markup will increase as well. Based on publicly-available financial information for walk-in manufacturers, submitted comments, and information obtained during manufacturer interviews from the June 2014 final rule, DOE assumed the non-production cost markup—which includes SG&A expenses, R&D expenses, interest, and profit—to be 1.35. The manufacturer markup of 1.35 was presented during the NOPR public meeting and DOE received no additional comments. Public Meeting Transcript (September 29, 2016), No. 79 at pp. 40–41) Manufacturers have indicated that it would be optimistic for DOE to assume that, as manufacturer production costs increase in response to an energy conservation standard, manufacturers would be able to maintain the same gross margin percentage markup. Therefore, DOE assumes that this scenario represents a high bound to industry profitability under an energy conservation standard.

The preservation of operating profit markup scenario assumes that manufacturers are able to maintain only the no-new standards case total operating profit in absolute dollars in the standards cases, despite higher equipment costs and investment. The no-new standards case total operating profit is derived from marking up the cost of goods sold for each equipment by the preservation of gross margin markup. In the standards cases for the preservation of operating profit markup scenario, DOE adjusted the WICF manufacturer markups in the GRIM at each TSL to yield approximately the same earnings before interest and taxes in the standards cases in the year after the compliance date of the adopted WICF refrigeration system standards as in the no-new standards case. Under this scenario, while manufacturers are not able to yield additional operating profit from higher production costs and the investments that are required to comply with the adopted WICF refrigeration system energy conservation standards, they are able to maintain the same operating profit in the standards case that was earned in the no-new standards case.

4. Discussion of Comments

As part of the court settlement reached in *Lennox Int'l* v. *Dep't of Energy,* DOE agreed to consider any comments regarding any potential impacts of the standards on installers and to consider and substantively address any potential impacts of the standards on installers in its MIA. See *Lennox Int'l* v. *Dep't of Energy,* Case No. 14–60535, Joint Settlement Motion (filed July 29, 2015) (5th Cir.). During the Working Group meetings, walk-in installers were represented by ACCA. As part of DOE's attempt to consider and address any potential installer impacts, the NOPR specifically sought comment on any conversion costs and stranded assets that walk-in installers might incur. See 81 FR at 63033 and 63048–63049 (detailing specific issues on which DOE sought input regarding potential installer-related impacts to the proposed rule).

Stakeholders raised one issue related to installers and the possibility of stranded assets. AHRI and Rheem noted that installers of complete walk-ins may have stranded assets if they are required to use components that are compliant at the time of the complete walk-in assembly. AHRI added that compliant components may not be available to installers until the compliance date of the new standards, leading to equipment availability constraints. (AHRI No. 90 at p. 3; Rheem No. 91 at p. 3)

DOE addresses this comment and clarifies the compliance date for manufacturers of complete walk-ins in section III.F.

L. 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 2016,* as described in section IV.N. Details of the methodology are described in the appendices to chapters 13 and 15 of the final rule TSD.

Combustion emissions of CH_4 and N_2O are estimated using emissions intensity factors published by the EPA—GHG Emissions Factors Hub.[53] 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 CO_2-equivalent (CO_2eq). Emissions of CH_4 and N_2O are often 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,[54] 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 2016* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of February 29, 2016. DOE's estimation of impacts accounts for the presence of the emissions control programs discussed in the following paragraphs.

SO_2 emissions from affected electric generating units (''EGUs'') are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) SO_2 emissions from 28 eastern States and DC were also limited under the Clean Air Interstate Rule (CAIR). 70 FR 25162 (May 12, 2005). CAIR created an allowance-based trading program that operates along with the Title IV program. In 2008, CAIR was remanded

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

[54] Intergovernmental Panel on Climate Change. Anthropogenic and Natural Radiative Forcing. In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Chapter 8. 2013. 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, Editors. Cambridge University Press: Cambridge, United Kingdom and New York, NY, USA.

to EPA by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect.[55] 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,[56] 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.[57] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR [58] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.[59] *AEO 2016* incorporates implementation of CSAPR.

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

Beginning in 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (''MATS'') for power plants. 77 FR 9304 (February 16, 2012). In the MATS final rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (''HAP''), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO 2016* 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.[60] Therefore, DOE believes that energy conservation standards that decrease electricity generation will generally reduce SO_2 emissions in 2016 and beyond.

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

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2016,* which incorporates the MATS.

The *AEO2016* Reference case (and some other cases) assumes implementation of the Clean Power Plan (CPP), which is the EPA program to regulate CO_2 emissions at existing fossil-fired electric power plants.[61] DOE used the *AEO2016* No-CPP case as a basis for developing emissions factors for the electric power sector to be consistent with its use of the No-CPP case in the NIA.[62]

M. 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, CH_4, N_2O and NO_X that are expected to result from each of the TSLs considered. In order to make this calculation analogous to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the projection period for each TSL. This section summarizes the basis for the values used for monetizing the emissions benefits and presents the values considered in this final rule.

1. Social Cost of Carbon

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

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

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

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

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

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

[60] DOE notes that on June 29, 2015, the U.S. Supreme Court ruled that the EPA erred when the agency concluded that cost did not need to be considered in the finding that regulation of hazardous air pollutants from coal- and oil-fired electric utility steam generating units (EGUs) is appropriate and necessary under section 112 of the Clean Air Act (''CAA''). *Michigan* v. *EPA,* 135 S. Ct. 2699 (2015). The Supreme Court did not vacate the MATS rule, and DOE has tentatively determined that the Court's decision on the MATS rule does not change the assumptions regarding the impact of energy conservation standards on SO_2 emissions. Further, the Court's decision does not change the impact of the energy conservation standards on mercury emissions. The EPA, in response to the U.S. Supreme Court's direction, has now considered cost in evaluating whether it is appropriate and necessary to regulate coal- and oil-fired EGUs under the CAA. EPA concluded in its final supplemental finding that a consideration of cost does not alter the EPA's previous determination that regulation of hazardous air pollutants, including mercury, from coal- and oil-fired EGUs, is appropriate and necessary. 79 FR 24420 (April 25, 2016). The MATS rule remains in effect, but litigation is pending in the D.C. Circuit Court of Appeals over EPA's final supplemental finding MATS rule.

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

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

to reflect the value of damages in the United States resulting from a unit change in CO_2 emissions, while a global SC–CO_2 value is meant to reflect the value of damages worldwide.

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

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

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of CO_2 emissions, the analyst faces a number of challenges. A report from the National Research Council [63] points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of GHGs, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise questions of science, economics, and ethics and should be viewed as provisional.

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

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

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

b. Current Approach and Key Assumptions

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

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

In 2010, the IWG selected four sets of SC–CO_2 values for use in regulatory analyses. Three sets of values are based on the average SC–CO_2 from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SC–CO_2 estimate across all three models at a 3-percent discount rate, was included to represent higher-than-expected impacts from climate change further out in the tails of the SC–CO_2 distribution. The values grow in real terms over time. Additionally, the IWG determined that a range of values from 7 percent to 23 percent should be used to adjust the global SC–CO_2 to calculate domestic effects,[64] although

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

[64] 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.

preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV–9 presents the values in the 2010 IWG report.[65]

TABLE IV–9—ANNUAL SC–CO_2 VALUES FROM 2010 IWG REPORT

[2007$ Per metric ton CO_2]

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

In 2013 the IWG released an update (which was revised in July 2015) that contained SC–CO_2 values that were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[66] DOE used these values for this final rule. Table IV–10 shows the four sets of SC–CO_2 estimates from the 2013 interagency update (revised July 2015) in 5-year increments from 2010 through 2050. The full set of annual SC–CO_2 estimates from 2010 through 2050 is reported in appendix 14A of the final rule TSD. The central value that emerges is the average SC–CO_2 across models at the 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the IWG emphasizes the importance of including all four sets of SC–CO_2 values.

TABLE IV–10—ANNUAL SC–CO2 VALUES FROM 2013 IWG UPDATE (REVISED JULY 2015)

[2007$ Per metric ton CO_2]

Year	Discount rate and statistic			
	5%	3%	2.5%	3%
	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 SC–CO_2 estimates should be treated as provisional and revisable because they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned previously points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SC–CO_2. 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.[67]

DOE converted the values from the 2013 interagency report (revised July 2015) to 2015$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of

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

[66] 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. *www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf.*

[67] 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. (November 26, 2013). In July 2015 OMB published a detailed summary and formal response to the many comments that were received: This is available at *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.

SC–CO_2 cases, the values for emissions in 2020 are $13.5, $47.4, $69.9, and $139 per metric ton avoided (values expressed in 2015$). DOE derived values after 2050 based on the trend in 2010–2050 in each of the four cases in the interagency update.

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

DOE received several comments on the development of and the use of the SC–CO_2 values in its analyses. A group of trade associations led by the U.S. Chamber of Commerce objected to DOE's continued use of the SC–CO_2 SCC in the cost-benefit analysis and stated that the SC–CO_2 SCC calculation should not be used in any rulemaking until it undergoes a more rigorous notice, review, and comment process. (U.S. Chamber of Commerce, No. 86 at p. 4) The Cato Institute stated that the current SC–CO_2 SCC estimates are discordant with the best scientific literature on the equilibrium climate sensitivity and the fertilization effect of carbon dioxide, and are based upon the output of integrated assessment models that have little utility because of their great uncertainties. The Cato Institute stated that until the SC–CO_2 SCC values are corrected, the SC–CO_2 SCC should be barred from use in this and all other Federal rulemakings. (Cato Institute, No. 87 at pp. 1–2)

In contrast, the Joint Advocates stated that only a partial accounting of the costs of climate change (those most easily monetized) can be provided, which inevitably involves incorporating elements of uncertainty. The Joint Advocates commented that accounting for the economic harms caused by climate change is a critical component of sound benefit-cost analyses of regulations that directly or indirectly limit greenhouse gases. The Joint Advocates stated that several Executive Orders direct Federal agencies to consider non-economic costs and benefits, such as environmental and public health impacts. (Docket No. EERE–2015–BT–STD–0016, Joint Advocates, No. 81 at p. 2–3) Furthermore, the Joint Advocates argued that without an SC–CO_2 SCC estimate, regulators would by default be using a value of zero for the benefits of reducing carbon pollution, thereby implying that carbon pollution has no costs. The Joint Advocates stated that it would be arbitrary for a Federal agency to weigh the societal benefits and costs of a rule with significant carbon pollution effects but to assign no value at all to the considerable benefits of reducing carbon pollution. (Docket No. EERE–2015–BT–STD–0016, Joint Advocates, No. 81 at p. 3)

The Joint Advocates stated that assessment and use of the IAMs in developing the SC–CO_2 SCC values has been transparent. The Joint Advocates further noted that repeated opportunities for public comment demonstrate that the IWG's SC–CO_2 SCC estimates were developed and are being used transparently. (Docket No. EERE–2015–BT–STD–0016, Joint Advocates, No. 81 at p. 4) The Joint Advocates stated that (1) the IAMs used reflect the best available, peer-reviewed science to quantify the benefits of carbon emission reductions; (2) uncertainty is not a valid reason for rejecting the SC–CO_2 SCC analysis, and (3) the IWG was rigorous in addressing uncertainty inherent in estimating the economic cost of pollution. (Joint Advocates, No. 81 at pp. 5, 17–18, 18–19) The Joint Advocates added that the increase in the SC–CO_2 SCC estimate in the 2013 update reflects the growing scientific and economic research on the risks and costs of climate change, but is still very likely an underestimate of the SC–CO_2 SCC. (Docket No. EERE–2015–BT–STD–0016, Joint Advocates, No. 81 at p. 4)

In response to the comments on the SC–CO_2 SCC, in conducting the interagency process that developed the SC–CO_2 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 SC–CO_2 SCC estimates. These uncertainties and model differences are discussed in the IWG's reports, as are the major assumptions. Specifically, uncertainties in the assumptions regarding climate sensitivity, as well as other model inputs such as economic growth and emissions trajectories, are discussed and the reasons for the specific input assumptions chosen are explained. However, the three integrated assessment models used to estimate the SC–CO_2 are frequently cited in the peer-reviewed literature and were used in the last assessment of the IPCC. In addition, new versions of the models that were used in 2013 to estimate revised SC–CO_2 values were published in the peer-reviewed literature. The GAO report mentioned by IECA noted that the working group's processes and methods used consensus-based decision making, relied on existing academic literature and models, and took steps to disclose limitations and incorporate new information.[68] Although uncertainties remain, the revised SC–CO_2 values are based on the best available scientific information on the impacts of climate change. The current estimates of the SC–CO_2 have been developed over many years, using the best science available, and with input from the public.[69] DOE notes that not using SC–CO_2 estimates because of uncertainty would be tantamount to assuming that the benefits of reduced carbon emissions are zero, which is inappropriate. Furthermore, the commenters have not offered alternative estimates of the SC–CO_2 that they believe are more accurate.

The Cato Institute also stated that the SC–CO_2 approach is at odds with existing OMB guidelines for preparing regulatory analyses. (Cato Institute, No. 87 at p. 1)

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

Regarding the use of global SC–CO_2 values, DOE's analysis estimates both

[68] *www.gao.gov/products/GAO-14-663.* (Last accessed September 22, 2016)

[69] In November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SC–CO_2 estimates. In July 2015, OMB published a detailed summary and formal response to the many comments that were received. See *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.

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

2. Social Cost of Methane and Nitrous Oxide

The Joint Advocates stated that EPA and other agencies have begun using a methodology developed to specifically measure the social cost of methane in recent proposed rulemakings, and recommended that DOE should use the social cost of methane metric to more accurately reflect the true benefits of energy conservation standards. They stated that the methodology in the study used to develop the social cost of methane provides reasonable estimates that reflect updated evidence and provide consistency with the Government's accepted methodology for estimating the SC–CO_2. (Docket No. EERE–2015–BT–STD–0016, Joint Advocates, No. 81 at pp. 19–20)

While carbon dioxide is the most prevalent greenhouse gas emitted into the atmosphere, other GHGs are also important contributors. These include methane and nitrous oxide. Global warming potential values (''GWPs'') are often used to convert emissions of non-CO_2 GHGs to CO_2-equivalents to facilitate comparison of policies and inventories involving different GHGs. While GWPs allow for some useful comparisons across gases on a physical basis, using the social cost of carbon to value the damages associated with changes in CO_2-equivalent emissions is not optimal. This is because non-CO_2 GHGs differ not just in their potential to absorb infrared radiation over a given time frame, but also in the temporal pathway of their impact on radiative forcing, which is relevant for estimating their social cost but not reflected in the GWP. Physical impacts other than temperature change also vary across gases in ways that are not captured by GWP.

In light of these limitations and the paucity of peer-reviewed estimates of the social cost of non-CO_2 gases in the literature, the 2010 SC–CO_2 Technical Support Document did not include an estimate of the social cost of non-CO_2 GHGs and did not endorse the use of GWP to approximate the value of non-CO_2 emission changes in regulatory analysis. Instead, the IWG noted that more work was needed to link non-CO_2 GHG emission changes to economic impacts.

Since that time, new estimates of the social cost of non-CO_2 GHG emissions have been developed in the scientific literature, and a recent study by Marten *et al.* (2015) provided the first set of published estimates for the social cost of CH_4 and N_2O emissions that are consistent with the methodology and modeling assumptions underlying the IWG SC–CO_2 estimates.[70] Specifically, Marten *et al.* used the same set of three integrated assessment models, five socioeconomic and emissions scenarios, equilibrium climate sensitivity distribution, three constant discount rates, and the aggregation approach used by the IWG to develop the SC–CO_2 estimates. An addendum to the IWG's Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866 summarizes the Marten *et al.* methodology and presents the SC–CH_4 and SC–N_2O estimates from that study as a way for agencies to incorporate the social benefits of reducing CH_4 and N_2O emissions into benefit-cost analyses of regulatory actions that have small, or ''marginal,'' impacts on cumulative global emissions.[71]

The methodology and estimates described in the addendum have undergone multiple stages of peer review and their use in regulatory analysis has been subject to public comment. The estimates are presented with an acknowledgement of the limitations and 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, just as the IWG has committed to do for the SC–CO_2. The OMB has determined that the use of the Marten *et al.* estimates in regulatory analysis is consistent with the requirements of OMB's Information Quality Guidelines Bulletin for Peer Review and OMB Circular ASC–4.

The SC–CH_4 and SC–N_2O estimates are presented in Table IV–11. Following the same approach as with the SC–CO_2, values for 2010, 2020, 2030, 2040, and 2050 are calculated by combining all outputs from all scenarios and models for a given discount rate. Values for the years in between are calculated using linear interpolation. The full set of annual SC–CH_4 and SC–N_2O estimates between 2010 and 2050 is reported in appendix 14SC–A of the final rule TSD. DOE derived values after 2050 based on the trend in 2010SC–2050 in each of the four cases in the IWG addendum.

[70] Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH_4 and N_2O Mitigation Benefits Consistent with the U.S. Government's SC–CO_2 Estimates. *Climate Policy*. 15(2): 272SC–298 (published online, 2014).

[71] United States Government—Interagency Working Group on Social Cost of Greenhouse Gases. Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide. August 2016. *www.whitehouse.gov/sites/default/files/omb/inforeg/august_2016_sc_ch4_sc_n2o_addendum_final_8_26_16.pdf*.

TABLE IV–11—ANNUAL SC–CH_4 AND SC–N_2O ESTIMATES FROM 2016 IWG ADDENDUM

[2007$ per metric ton]

Year	SC–CH_4				SC–N_2O			
	Discount rate and statistic				Discount rate and statistic			
	5%	3%	2.5%	3%	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile	Average	Average	Average	95th percentile
2010	370	870	1,200	2,400	3,400	12,000	18,000	31,000
2015	450	1,000	1,400	2,800	4,000	13,000	20,000	35,000
2020	540	1,200	1,600	3,200	4,700	15,000	22,000	39,000
2025	650	1,400	1,800	3,700	5,500	17,000	24,000	44,000
2030	760	1,600	2,000	4,200	6,300	19,000	27,000	49,000
2035	900	1,800	2,300	4,900	7,400	21,000	29,000	55,000
2040	1,000	2,000	2,600	5,500	8,400	23,000	32,000	60,000
2045	1,200	2,300	2,800	6,100	9,500	25,000	34,000	66,000
2050	1,300	2,500	3,100	6,700	11,000	27,000	37,000	72,000

DOE multiplied the CH_4 and N_2O emissions reduction estimated for each year by the SC–CH_4 and SC–N_2O estimates for that year in each of the four cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SC–CH_4 and SC–N_2O estimates in each case.

3. Social Cost of Other Air Pollutants

As noted previously, DOE estimated how the considered energy conservation standards would reduce site NO_X emissions nationwide and decrease power sector NO_X emissions in those 22 States not affected by CSAPRIL

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.[72] The report includes high and low values for NO_X (as $PM_{2.5}$) for 2020, 2025, and 2030 using discount rates of 3 percent and 7 percent; these values are presented in appendix 14B of the final rule TSD. DOE primarily relied on the low estimates to be conservative.[73] The national average low values for 2020 (in 2015$) are $3,187/ton at 3-percent discount rate and $2,869/ton at 7-percent discount rate. DOE developed values specific to the sector for WICF refrigeration systems using a method described in appendix 14B of the final rule TSD. For this analysis DOE used linear interpolation to define values for the years between 2020 and 2025 and between 2025 and 2030; for years beyond 2030 the value is held constant.

DOE estimated the monetized value of NO_X emissions reductions from gas WICF refrigeration systems using benefit per ton estimates from the EPA's ''Technical Support Document Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 17 Sectors.''[74] Although none of the sectors refers specifically to residential and commercial buildings, DOE believes that the sector called ''Area sources'' would be a reasonable proxy for residential and commercial buildings. ''Area sources'' represents all emission sources for which states do not have exact (point) locations in their emissions inventories. Since exact locations would tend to be associated with larger sources, ''area sources'' would be fairly representative of small dispersed sources like homes and businesses. The EPA Technical Support Document provides high and low estimates for 2016, 2020, 2025, and 2030 at 3- and 7-percent discount rates. As with the benefit per ton estimates for NO_X emissions reductions from electricity generation, DOE primarily relied on the low estimates to be conservative.

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

DOE is evaluating appropriate monetization of reduction in other emissions in energy conservation standards rulemakings. DOE has not included monetization of those emissions in the current analysis but notes that it would not expect the inclusion of such values to change its analysis or conclusions with respect to the adopted standards.

N. Utility Impact Analysis

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

[72] 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.). 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.

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

[74] *www.epa.gov/sites/production/files/2014-10/documents/sourceapportionmentbpttsd.pdf.*

in the appendices to chapters 13 and 15 of the final rule TSD.

The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of electricity savings calculated in the NIA to provide estimates of selected utility impacts of potential new or amended energy conservation standards.

O. Employment Impact Analysis

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

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (''BLS''). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[75] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, the BLS data suggest that net national employment may increase due to shifts in economic activity resulting from energy conservation standards.

DOE estimated indirect national employment impacts for the standard levels considered in this final rule using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 (''ImSET'').[76] ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that characterize economic flows among 187 sectors most relevant to industrial, commercial, and residential building energy use.

DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2020), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the final rule TSD.

V. Analytical Results and Conclusions

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

A. Trial Standard Levels

DOE analyzed the benefits and burdens of three TSLs for the considered WICF refrigeration systems. These TSLs were developed by combining specific efficiency levels for each of the equipment classes analyzed by DOE. (Efficiency levels for each class are described in section IV.D.10.) 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.

TSL 3 represents the maximum technologically feasible level. It is also the energy conservation standard level that the Working Group unanimously recommended that DOE adopt. (Term Sheet at EERE–2015–BT–STD–0016–0056, recommendation #5). TSLs 1 and 2 are direct representations of efficiency levels 1 and 2. These efficiency levels for each class were formulated to divide the gap in efficiency between the baseline and the maximum technologically feasible efficiency level into approximately equal intervals. Table IV–1 shows the mapping of minimum AWEF values for each equipment class and nominal capacity to each TSL.

TABLE V–1—MAPPING OF AWEF TO TRIAL STANDARD LEVELS

Equipment component	Equipment class	Nominal capacity Btu/hr	Trial standard level		
			1	2	3
Condensing Unit	DC.L.I	6000	1.91	1.97	2.30
		9000	2.09	2.14	2.48
		25000	2.06	2.40	2.40

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

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

TABLE V–1—MAPPING OF AWEF TO TRIAL STANDARD LEVELS—Continued

Equipment component	Equipment class	Nominal capacity Btu/hr	Trial standard level		
			1	2	3
		54000	2.35	2.35	2.42
	DC.L.O	6000	2.57	2.67	3.00
		9000	2.41	2.81	3.13
		25000	2.70	2.77	3.16
		54000	2.60	2.92	3.16
		72000	2.59	2.90	3.16
Unit Cooler	UC.M	4000	7.30	8.15	9.00
		9000	7.30	8.15	9.00
		24000	7.30	8.15	9.00
	UC.L	4000	3.61	3.78	3.95
		9000	3.69	3.85	4.01
		18000	3.88	4.02	4.15
		40000	3.88	4.02	4.15

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on consumers of the considered WICF refrigeration systems by looking at what the effects of the standards at each TSL would be 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 equipment affects consumers in two ways: (1) Purchase prices for the equipment increase and (2) equipment annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* equipment 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.

The LCC results are the shipment-weighted average of results for each equipment class over system capacity using the weights for each shown in Table IV–6. The results for each TSL were approximated by analyzing the equipment class and nominal capacity combinations with the closest AWEF rating shown in Table V–1 that was analyzed in the engineering analysis. See chapter 8 of the TSD for more detailed LCC results.

Table V–2 through Table V–20 show the LCC and PBP results for the TSLs considered for each equipment class. In the first of each pair of tables, the simple payback is measured relative to baseline equipment. In the second table, the impacts are measured relative to the efficiency distribution in the no-new-standards case in the compliance year (see section IV.G.1 of this document). Consumers for whom the LCC increases at a given TSL experience a net cost.

TABLE V–2—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR INDOOR DEDICATED CONDENSING UNITS, LOW-TEMPERATURE

[DC.L.I, condensing unit only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$3,727	$2,149	$18,320	$20,900	0.0	10.6
1	1	3,729	2,146	18,320	20,873	0.0	10.6
2	2	3,788	2,093	18,019	20,513	1.0	10.6
3	3	4,006	1,955	16,689	19,628	1.5	10.6

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR INDOOR DEDICATED CONDENSING UNITS, LOW-TEMPERATURE

[DC.L.I, condensing unit only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$26	0
2	2	387	0

TABLE V–3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR INDOOR DEDICATED CONDENSING UNITS, LOW-TEMPERATURE—Continued

[DC.L.I, condensing unit only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2015$)	Percent of consumers that experience net cost
3	3	1,272	0

* The savings represent the average LCC for affected consumers.

TABLE V–4—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR OUTDOOR DEDICATED CONDENSING UNITS, LOW-TEMPERATURE

[DC.L.O, condensing unit only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$4,508	$2,630	$22,368	$25,587	0.0	10.5
1	1	4,533	2,534	21,655	24,834	0.1	10.5
2	2	4,585	2,359	20,105	23,490	0.4	10.5
3	3	4,914	2,226	19,003	22,748	1.2	10.5

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–5—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR OUTDOOR DEDICATED CONDENSING UNITS, LOW-TEMPERATURE

[DC.L.O, Condensing Unit Only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2015$)	Percent of consumers that experience net cost
1	1	$753	0
2	2	2,097	0
3	3	2,839	0

* The savings represent the average LCC for affected consumers.

TABLE V–6—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR INDOOR PAIRED DEDICATED CONDENSING SYSTEMS, LOW-TEMPERATURE

[DC.L.I, field-paired]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$6,012	$2,147	$15,938	$23,294	0.0	10.6
1	1	6,015	2,142	15,929	23,257	0.1	10.6
2	2	6,078	2,087	15,665	22,877	1.0	10.6
3	3	6,318	1,938	16,316	21,922	1.5	10.6

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–7—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR INDOOR PAIRED DEDICATED CONDENSING SYSTEMS, INDOOR CONDENSING UNITS

[DC.L.I, field-paired]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2015$)	Percent of consumers that experience net cost
1	1	$63	0
2	2	442	0
3	3	1,397	0

* The savings represent the average LCC for affected consumers.

TABLE V–8—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR OUTDOOR PAIRED DEDICATED CONDENSING SYSTEMS, LOW-TEMPERATURE

[DC.L.O, field-paired]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$7,304	$2,631	$19,136	$28,435	0.0	10.5
1	1	7,331	2,530	18,811	27,652	0.2	10.5
2	2	7,412	2,330	15,688	26,128	0.5	10.5
3	3	7,830	2,155	22,020	25,140	1.4	10.5

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–9—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR OUTDOOR PAIRED DEDICATED CONDENSING SYSTEMS, OUTDOOR CONDENSING UNITS

[DC.L.O, field-paired]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2015$)	Percent of consumers that experience net cost
1	1	$783	0
2	2	2,307	0
3	3	3,294	0

* The savings represent the average LCC for affected consumers.

TABLE V–10—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR LOW-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING INDOOR CONDENSING UNITS

[DC.L.I, unit cooler only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$2,283	$2,147	$18,347	$19,468	0.0	10.5
1	1	2,317	2,134	18,269	19,396	1.7	10.5
2	2	2,379	2,122	18,162	19,361	3.6	10.5
3	3	2,433	2,113	18,062	19,347	4.8	10.5

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–11—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR LOW-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING INDOOR CONDENSING UNITS

[DC.L.I, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$86	2
2	2	121	6
3	3	135	15

* The savings represent the average LCC for affected consumers.

TABLE V–12—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR LOW-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING OUTDOOR CONDENSING UNITS

[DC.L.O, unit cooler only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$2,795	$2,630	$22,308	$23,816	0.0	10.4
1	1	2,809	2,624	22,268	23,782	0.6	10.4
2	2	2,856	2,604	22,151	23,673	2.4	10.4
3	3	2,969	2,572	21,876	23,529	4.5	10.4

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–13—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR LOW-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING OUTDOOR CONDENSING UNITS

[DC.L.O, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$35	0
2	2	144	3
3	3	288	15

* The savings represent the average LCC for affected consumers.

TABLE V–14—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR MEDIUM-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING INDOOR CONDENSING UNITS

[DC.M.I, unit cooler only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$2,187	$1,183	$10,010	$11,583	0.0	10.5
1	1	2,187	1,183	10,010	11,583	0.0	10.5
2	2	2,218	1,170	9,901	11,511	1.8	10.5
3	3	2,227	1,167	9,875	11,497	1.9	10.5

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

Note: DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

TABLE V–15—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR MEDIUM-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING INDOOR CONDENSING UNITS

[DC.M.I, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$0	0
2	2	72	1
3	3	87	1

* The savings represent the average LCC for affected consumers.

Note: DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

TABLE V–16—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR MEDIUM-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING OUTDOOR CONDENSING UNITS

[DC.M.O, unit cooler only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$2,294	$956	$8,070	$9,912	0.0	10.6
1	1	2,294	956	8,070	9,912	0.0	10.6
2	2	2,320	942	7,956	9,833	1.4	10.6
3	3	2,329	940	7,937	9,823	1.5	10.6

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

Note: DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

TABLE V–17—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR MEDIUM-TEMPERATURE UNIT COOLERS, ATTACHED TO DEDICATED CONDENSING OUTDOOR CONDENSING UNITS

[DC.M.O, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$0	0
2	2	79	0
3	3	89	1

* The savings represent the average LCC for affected consumers.

Note: DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

TABLE V–18—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR UNIT COOLERS, LOW-TEMPERATURE, ATTACHED TO LOW-TEMPERATURE MULTIPLEX CONDENSING UNITS

[MC.L, unit cooler only]

TSL	EL	Average costs 2015$				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$2,850	$2,131	$18,831	$20,492	0.0	10.6
1	1	2,856	2,130	18,820	20,488	0.6	10.6
2	2	2,898	2,113	18,670	20,390	2.8	10.6

TABLE V–18—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR UNIT COOLERS, LOW-TEMPERATURE, ATTACHED TO LOW-TEMPERATURE MULTIPLEX CONDENSING UNITS—Continued

[MC.L, unit cooler only]

TSL	EL	Average costs 2015$				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
3	3	3,115	2,090	18,468	20,418	7.6	10.6

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–19—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR UNIT COOLERS, LOW-TEMPERATURE ATTACHED TO LOW-TEMPERATURE MULTIPLEX CONDENSING UNITS

[MC.L, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$4	2
2	2	101	9
3	3	74	49

* The savings represent the average LCC for affected consumers.

TABLE V–20—AVERAGE LCC AND PBP RESULTS BY TRIAL STANDARD LEVEL FOR UNIT COOLERS, MEDIUM-TEMPERATURE, ATTACHED TO MEDIUM-TEMPERATURE MULTIPLEX CONDENSING UNITS

[MC.M, unit cooler only]

TSL	EL	Average costs (2015$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	$2,020	$675	$5,928	$7,592	0.0	10.5
1	1	2,026	674	5,918	7,588	0.6	10.5
2	2	2,056	662	5,813	7,520	2.4	10.5
3	3	2,076	659	5,789	7,517	3.0	10.5

Note: The results for each TSL are calculated assuming that all consumers use equipment at that efficiency level. The PBP is measured relative to the baseline (EL 0) equipment.

TABLE V–21—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR UNIT COOLERS, MEDIUM-TEMPERATURE, ATTACHED TO MEDIUM-TEMPERATURE MULTIPLEX CONDENSING UNITS

[MC.M, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2015$)	Percent of consumers that experience net cost
1	1	$4	1
2	2	72	2
3	3	75	8

* The savings represent the average LCC for affected consumers.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on small businesses. Table V–22 compares the average LCC savings and PBP at each efficiency level for the small business consumer subgroup, along with the average LCC savings for the entire sample. In most cases, the average LCC savings and PBP for the small business subgroup at the considered efficiency levels are not substantially different from the average for all businesses. The small business subgroup is the subgroup of consumers most likely to be affected by this final rule. Small businesses are likely to experience higher electricity prices, and experience higher costs of capital than the average for all businesses. Chapter 11 of the final rule TSD presents the complete LCC and PBP results for the small business subgroup.

TABLE V–22—COMPARISON OF LCC SAVINGS AND PBP FOR SMALL BUSINESSES CONSUMER SUBGROUP AND ALL CONSUMERS

Equipment class—application (design path)	Consumer subgroup	LCC savings (2015$)		
		TSL 1	TSL 2	TSL 3
DC.L.I—C-Only *	National Average	$26	$387	$1,272
	Small Businesses	25	359	1,179
DC.L.O—CU-Only *	National Average	753	2,097	2,839
	Small Businesses	698	1,960	2,628
DC.L.I—F–P **	National Average	63	442	1,397
	Small Businesses	58	410	1,293
DC.L.O—F–P **	National Average	783	2,307	3,294
	Small Businesses	733	2,164	3,060
DC.L.I—UC-Only †	National Average	86	121	135
	Small Businesses	78	107	116
DC.L.O—UC-Only †	National Average	35	144	288
	Small Businesses	32	131	259
UC.M—DC.M.I	National Average	0	72	87
	Small Businesses	0	67	81
UC.M—DC.M.O	National Average	0	79	89
	Small Businesses	0	73	82
UC.L—MC.L	National Average	4	101	74
	Small Businesses	NA	NA	NA
UC.M—MC.M	National Average	4	72	75
	Small Businesses	NA	NA	NA
Consumer Simple PBP (years)				
DC.L.I—CS-Only *	National Average	0.0	1.0	1.5
	Small Businesses	0.0	1.0	1.4
DC.L.O—CS-Only *	National Average	0.1	0.4	1.2
	Small Businesses	0.1	0.4	1.2
DC.L.I—F–P **	National Average	0.1	1.0	1.5
	Small Businesses	0.1	1.0	1.5
DC.L.O—F–P **	National Average	0.2	0.5	1.4
	Small Businesses	0.2	0.5	1.4
DC.L.I—UC-Only †	National Average	1.7	3.6	4.8
	Small Businesses	1.7	3.6	4.8
DC.L.O—UC-Only †	National Average	0.6	2.4	4.5
	Small Businesses	0.6	2.3	4.5
UC.M—DC.M.I	National Average	0.0	1.8	1.9
	Small Businesses	0.0	0.0	1.8
UC.M—DC.M.O	National Average	0.0	1.4	1.5
	Small Businesses	0.0	0.0	1.3
UC.L—MC.L	National Average	0.6	2.8	7.6
	Small Businesses	NA	NA	NA
UC.M—MC.M	National Average	0.6	2.4	3.0
	Small Businesses	NA	NA	NA

"NA" indicates that these equipment classes are not commonly purchased by small businesses.

Note: DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

* Condensing Unit Only (CU-Only): condensing unit-only. This analysis evaluates standard levels applied to a condensing unit for a scenario in which a new condensing unit is installed to replace a failed condensing unit, but the existing unit cooler is not replaced. See section IV.G.1.b for more details.

** Field-Paired (FP): field-paired unit cooler and condensing unit. This analysis evaluates a scenario in which both a new condensing unit and a new unit cooler are installed. See section IV.G.1.a for more details.

† Unit Cooler Only (UC-Only): unit cooler only. This analysis evaluates standard levels applied to a unit cooler for a scenario in which a new unit cooler is installed to replace a failed unit cooler, but the existing condensing unit (or multiplex system) is not replaced. See section IV.G.1.c for more details.

c. Rebuttable Presumption Payback

As discussed in section III.E.2, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for the equipment at issue 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 the considered WICF refrigeration systems. 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 that is likely seen by consumers of the WICF refrigeration systems.

Table V–23 presents the rebuttable-presumption payback periods for the considered TSLs for WICF refrigeration systems. These results show that, in most cases, the projected payback period will be three years or less for each of the different equipment classes with respect to each TSL examined. While DOE examined the rebuttable-presumption criterion, it also 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) and 6316(a), 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—REBUTTABLE PAYBACK PERIOD (YEARS) FOR WICF REFRIGERATION SYSTEMS

Equipment class (Design Path)	Trial standard level		
	1	2	3
DC.L.I (CU-Only) *	0.0	1.0	1.5
DC.L.O (CU-Only) *	0.1	0.4	1.2
DC.L.I (FP) **	0.1	1.0	1.5
DC.L.O (FP) **	0.2	0.5	1.4
DC.L.I (UC-Only) †	1.7	3.6	4.8
DC.L.O (UC-Only) †	0.6	2.4	4.5
UC.M–DC.M.I	0.0	0.0	1.8
UC.M–DC.M.O	0.0	0.0	1.4
UC.L–MC.L	0.6	2.8	7.6
UC.M–MC.M	0.6	2.4	3.0

Note: DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium-temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

* CU-Only: Condensing unit-only. This analysis evaluates standard levels applied to a condensing unit distributed in commerce without a designated companion unit cooler for a scenario in which a new condensing unit is installed to replace a failed condensing unit, but the existing unit cooler is not replaced. See section IV.G.1.b for more details.

** FP: Field-paired unit cooler and condensing unit. This analysis evaluates standard levels applied to a condensing unit distributed in commerce without a designated companion unit cooler for a scenario in which both a new condensing unit and a new unit cooler are installed. See section IV.G.1.a for more details.

† UC-Only: Unit cooler only. This analysis evaluates standard levels applied to a unit cooler distributed in commerce without a designated companion condensing unit, either dedicated or multiplex, for a scenario in which a new unit cooler is installed to replace a failed unit cooler, but the existing condensing unit is not replaced. See section IV.G.1.c for more details.

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of the energy conservation standards on manufacturers of the seven WICF refrigeration system equipment classes being analyzed. The section below describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the final rule TSD explains the analysis in further detail.

Industry Cash Flow Analysis Results

Table V–24 and Table V–25 depict the financial impacts on manufacturers of the seven WICF refrigeration equipment classes being analyzed. The financial impacts on these manufacturers are represented by changes in INPV.

The impact of energy efficiency standards were analyzed under two manufacturer markup scenarios: (1) The preservation of gross margin percentage and (2) the preservation of operating profit. As discussed in section IV.J.3.d, DOE considered the preservation of gross margin percentage scenario by applying a uniform ‘‘gross margin percentage’’ markup across all efficiency levels. As production cost increases with efficiency, this scenario implies that the absolute dollar markup will increase. DOE assumed a manufacturer markup of 1.35 for WICF refrigeration systems. This manufacturer markup is consistent with the one DOE assumed in the engineering analysis and the no-new-standards case of the GRIM. WICF refrigeration manufacturers indicated that it is optimistic to assume that as their production costs increase in response to an efficiency standard, they would be able to maintain the same gross margin percentage markup. Therefore, DOE assumes that this scenario represents a high bound to industry profitability under an energy-conservation standard. It also represents a lower bound to expected consumer payback periods and end-user life cycle cost savings calculated in the NIA, since an upper bound to industry profitability is also the scenario in which the highest possible costs are being passed on to the end user.

The preservation of operating profit scenario reflects WICF refrigeration manufacturer concerns about their inability to maintain their margins as manufacturing production costs increase to reach more-stringent efficiency levels. In this scenario, while WICF refrigeration manufacturers make the necessary investments required to convert their facilities to produce new standards-compliant equipment, operating profit does not change in absolute dollars and decreases as a percentage of revenue.

Each of the modeled scenarios results in a unique set of cash-flows and corresponding industry values at each TSL. In the following discussion, the INPV results refer to the difference in industry value between the no-new-standards case and each standards case resulting from the sum of discounted cash-flows from 2016 (the base year) through 2049 (the end of the analysis period). To provide perspective on the short-run cash-flow impact, DOE includes in the discussion of the results a comparison of free cash-flow between the no-new-standards case and the standards case at each TSL in the year before new standards take effect.

Table V–24 and Table V–25 show the MIA results for each TSL using the markup scenarios described above for the seven WICF refrigeration system equipment classes being analyzed.

TABLE V–24—MANUFACTURER IMPACT ANALYSIS FOR WICF REFRIGERATION MANUFACTURERS UNDER THE PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level		
			1	2	3
INPV	2015*$ MM*	97.9	97.1	96.4	91.7
Change in INPV ($)	2015*$ MM*		(0.7)	(1.5)	(6.1)
Change in INPV (%)	%		(0.8)	(1.5)	(6.3)
Product Conversion Costs	2015*$ MM*	1.7	3.0	6.0	14.0
Capital Conversion Costs	2015*$ MM*		0.3	1.1	4.7
Total Investment Required	2015*$ MM*	1.7	3.3	7.1	18.7

TABLE V–25—MANUFACTURER IMPACT ANALYSIS FOR WICF REFRIGERATION MANUFACTURERS UNDER THE PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level		
			1	2	3
INPV	2015*$ MM*	97.9	96.6	93.4	83.6
Change in INPV ($)	2015*$ MM*		(1.2)	(4.4)	(14.3)
Change in INPV (%)	%		(1.2)	(4.5)	(14.6)
Product Conversion Costs	2015*$ MM*	1.7	3.0	6.0	14.0
Capital Conversion Costs	2015*$ MM*		0.3	1.1	4.7
Total Investment Required	2015*$ MM*	1.7	3.3	7.1	18.7

As explained in section IV.J.3.d, DOE modeled the upfront testing and labeling costs in both the no-new-standards case and the standards cases. These costs total $1.7 million for the industry.

At TSL 1, DOE estimates impacts on INPV range from −$1.2 million to −$0.7 million, resulting in a change in INPV of −1.2 percent to −0.8 percent, respectively. At TSL 1, industry free cash-flow is expected to decrease by approximately 7.4 percent to $7.0 million, compared to the no-new standards case value of $7.5 million in 2019, the year leading up to the expected standards compliance date.

DOE expects WICF refrigeration manufacturers to incur approximately $3.0 million in product conversion costs for redesign, testing and labeling. DOE estimates that WICF refrigeration manufacturers will incur $0.3 million in capital conversion costs associated with TSL 1.

At TSL 1, the shipment-weighted average MPC increases by approximately 0.6 percent across all WICF refrigeration systems relative to the no-new standards case MPC in 2020, the expected year of compliance. In the preservation of gross margin markup scenario, WICF refrigeration manufacturers are able to fully pass on this slight cost increase to consumers. The increase in MSP is outweighed by the $3.3 million in conversion costs that WICF refrigeration manufacturers would incur, which causes a slight negative change in INPV at TSL 1 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, WICF refrigeration manufacturers earn the same operating profit as would be earned in the no-new standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the 0.6 percent shipment-weighted average MPC increase results in a reduction in manufacturer markup after the compliance year. This reduction in manufacturer markup and the $3.3 million in conversion costs incurred by WICF refrigeration manufacturers cause a negative change in INPV at TSL 1 under the preservation of operating profit markup scenario.

At TSL 2, DOE estimates impacts on INPV range from −$4.4 million to −$1.5 million, resulting in a change in INPV of −4.5 percent to −1.5 percent. At TSL 2, industry free cash-flow is expected to decrease by approximately 24.7 percent to $5.7 million, compared to the no-new standards case value of $7.5 million in 2019, the year leading up to the expected standards compliance date.

DOE expects WICF refrigeration systems to incur approximately $6.0 million in product conversion costs for redesign, testing and labeling. DOE estimates WICF refrigeration manufacturers will incur $1.1 million in capital conversion costs associated with TSL 2 to invest in tooling necessary to update condensing system production equipment for models that do not meet the required efficiency levels.

At TSL 2, the shipment-weighted average MPC increases by approximately 3.5 percent for all WICF refrigeration systems relative to the no-new standards case MPC in 2020, the expected year of compliance. In the preservation of gross margin markup scenario, manufacturers are able to fully pass on this cost increase to consumers. The increase in MSP is outweighed by $7.1 million in conversion costs that WICF refrigeration manufacturers would incur, which causes a 1.5 percent drop in INPV at TSL 2.

Under the preservation of operating profit markup scenario, WICF refrigeration manufacturers earn the same per-unit operating profit as would be earned in the no-new standards case. This scenario results in a reduction in manufacturer markup after the compliance year. This reduction in manufacturer markup and the $7.1 million in conversion costs incurred by WICF refrigeration manufacturers cause a negative change in INPV at TSL 2 under the preservation of operating profit markup scenario.

At the max-tech level (TSL 3), DOE estimates impacts on INPV range from −$14.3 million to −$6.1 million, or a change in INPV of −14.6 percent to −6.3 percent. At TSL 3, industry free cash-flow is expected to decrease by approximately 79.5 percent to $1.5 million, compared to the no-new standards case value of $7.5 million in 2019, the year immediately prior to the year of compliance for the new standards.

DOE expects manufacturers of WICF refrigeration systems to incur approximately $14.0 million in product conversion costs for redesign, testing and labeling. DOE estimates manufacturers will incur $4.7 million in capital conversion costs associated with TSL 3 to invest in tooling and machinery necessary to update condensing system production equipment for models that do not meet the required efficiency levels.

At TSL 3, the shipment-weighted average MPC increases by approximately 9.8 percent for all WICF refrigeration systems relative to the no-new standards case MPC in 2020, the expected year of compliance. In the preservation of gross margin markup scenario, manufacturers are able to fully pass on this cost increase to consumers. The increase in MSP is outweighed by $18.7 million in conversion costs that WICF refrigeration manufacturers would incur, which causes a negative change in INPV at TSL 3 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, WICF refrigeration manufacturers earn the same operating profit as would be earned in the no-new standards case, but they do not earn additional profit from their investments. In this scenario, the 9.8 percent shipment-weighted average MPC increase results in a reduction in manufacturer markup after the compliance year. This reduction in manufacturer markup and $18.7 million in conversion costs incurred cause a negative change in INPV at TSL 3 under the preservation of operating profit markup scenario.

a. Impacts on Direct Employment

To quantitatively assess the impacts of energy conservation standards on WICF refrigeration manufacturer employment, DOE used the GRIM to estimate the domestic labor expenditures and number of employees in the no-new-standards case and at each TSL. DOE used statistical data from the U.S. Census Bureau's 2014 Annual Survey of Manufacturers (''ASM'') and the results of the engineering analysis to calculate industry-wide labor expenditures and domestic employment levels. Labor expenditures related to equipment manufacturing depend on the labor intensity of the equipment, the sales volume, and an assumption that wages remain fixed in real terms over time. The total labor expenditures in each year are calculated by multiplying the MPCs by the labor percentage of MPCs.

The total labor expenditures in the GRIM were then converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker (production worker hours multiplied by the labor rate found in the U.S. Census Bureau's 2014 ASM). The estimates of production workers in this section cover workers, including line supervisors, who are directly involved in fabricating and assembling equipment within the OEM facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are also included as production labor. DOE's production worker estimates only account for workers who manufacture the seven equipment classes covered by this rulemaking. For example, a production line worker producing a dedicated condensing medium-temperature WICF refrigeration unit would not be included in the estimate of the production workers since dedicated condensing medium-temperature units are not covered in this rule.

DOE calculated the direct employment associated with the seven analyzed equipment classes by multiplying the number of production workers by the ratio of total employment to production workers reported in the 2014 ASM.

Using the GRIM, DOE estimates in the absence of new energy conservation standards, there would be 154 employees associated with the seven analyzed walk-in refrigeration system equipment classes in 2020. Of these workers, 112 are production workers and 42 are non-production workers. The employment impacts shown in Table V–26 represent the potential direct employment changes that could result following the compliance date for the seven WICF refrigeration equipment classes addressed in this rule. The upper end of the results in the table contains estimates regarding the maximum increase in direct employment after the implementation of new energy conservation standards. The table's results are based on the assumption that WICF refrigeration manufacturers would continue to produce the same scope of covered equipment within the United States. The lower end of the range represents the maximum decrease in the total number of U.S. production workers if production moved to lower labor-cost countries. Additional detail on the analysis of direct employment can be found in chapter 12 of the TSD.

TABLE V–26—DIRECT EMPLOYMENT FOR THE SEVEN REFRIGERATION EQUIPMENT CLASSES IN 2020

	No-standards case	Trial standard level		
		1	2	3
Production Workers in 2020 (without changes in production locations)	112	113	116	123
Direct Employment in 2020	154	155	159	169
Potential Changes in Direct Employment in 2020		(112)—1	(112)—5	(112)—15

The direct employment impacts shown are independent of the employment impacts from the broader U.S. economy, which are documented in the Employment Impact Analysis found in chapter 13 of the TSD.

b. Impacts on Manufacturing Capacity

DOE did not identify any significant capacity constraints for the design options being evaluated for this rulemaking. For most WICF refrigeration manufacturers, the walk-in market makes up a relatively small percentage of their overall revenues. Additionally, most of the design options being evaluated are available as equipment options today. As a result, DOE does not anticipate that the industry will likely experience any capacity constraints directly resulting from any of the energy conservation standards considered by DOE in this rulemaking.

c. Impacts on Subgroups of Manufacturers

As discussed in section IV.J.2, using average cost assumptions to develop an industry cash-flow estimate may not be adequate for assessing differential impacts among manufacturer sub-groups. Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. DOE used the results of the industry characterization performed in the market and technology assessment to group manufacturers exhibiting similar characteristics. Consequently, DOE analyzed small manufacturers as a sub-group for the final rule's analysis. Further details about the industry characterization can be found in section 0 and in chapter 3 of the final rule TSD.

DOE evaluated the impact of new energy conservation standards on small manufacturers, particularly those defined as ''small businesses'' by the SBA. The SBA defines a ''small business'' as having 1,250 employees or less for NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' Using this definition, DOE identified three refrigeration system manufacturers. DOE describes the differential impacts on these small businesses in section VI.B of this document.

d. 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. 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 several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

In addition to these energy conservation standards for WICF refrigeration systems, DOE identified other regulations that affect one or more WICF refrigeration system manufacturers and will take effect three years before or after the estimated 2020 compliance year, which is the time frame 2017 to 2023. While all of these regulations may not apply to each individual WICF refrigeration system manufacturer, a given manufacturer may be subject to one or more of these listed regulations depending on its particular product/equipment portfolio. DOE summarizes these regulations in Table V–27. Also, included in the table are Federal regulations that have compliance dates beyond the three years before or after the compliance date. Chapter 12 of the final rule TSD includes the full details of the cumulative regulatory burden.

TABLE V–27—OTHER DOE REGULATIONS POTENTIALLY AFFECTING WICF REFRIGERATION SYSTEM MANUFACTURERS

Federal energy conservation standard	Number of manufacturers *	Number of manufacturers affected by this WICF refrigeration rule **	Approx. standards year	Industry conversion costs millions $	Industry conversion costs/product revenue *** (%)
Commercial Refrigeration Equipment 79 FR 17725 (March 28, 2014).	54	5	2017	$184.0 Million (2012$)	1.5.
Non-vacated Walk-in Cooler and Walk-in Freezer Components 79 FR 32050 (June 3, 2014).	63	10	2017	33.6 Million (2012$)	2.6.
Automatic Commercial Icemakers 80 FR 4646 (January 28, 2015).	16	1	2018	$25.1 Million (2013$)	2.3.
Small, Large, and Very Large Commercial Package Air Conditioning and Heating Equipment 81 FR 2420 (January 15, 2016).	12	2	2018	$520.8 Million (2014$)	4.9.
Commercial Packaged Boilers 81 FR 15836 (June 9, 2016)	45	1	2019	$27.5 Million (2014$)	2.3.
Commercial Warm Air Furnaces 81 FR 2420 (January 15, 2016).	14	2	2019	$7.5 Million (2014$) to $22.2 Million (2014$).	1.7–5.1.
Commercial Water Heaters 81 FR 34440 (March 31, 2016)	25	1	2019	$29.8 Million (2014)	3.0.
Dehumidifiers 81 FR 38338 (June 13, 2016)	25	1	2019	$52.5 Million (2014)	4.5.
Furnace Fans 79 FR 38129 (July 3, 2014)	38	3	2019	$40.6 Million (2013$)	1.6.
Residential Boiler 81 FR 2320 (January 15, 2016)	36	1	2021	$2.5 Million (2014$)	Less than 1.
Direct Heating Equipment and Residential Water Heaters 75 FR 20112 (April 16, 2010) +.	39	1	2015	17.5 (2009$)	4.9.
Residential Central Air Conditioners and Heat Pumps 76 FR 37408 (June 27, 2011) +.	45	4	2015	$18.0 (2009$)	Less than 1.
External Power Supplies 79 FR 7846 (February 10, 2014) +	243	1	2016	$43.4 (2012$)	2.3.
Microwave Ovens 78 FR 36316 (June 17, 2013) +	12	1	2016	$43.1 (2011$)	Less than 1.
Battery Chargers 81 FR 38266 (June 13, 2016) +	30	1	2018	$19.5 (2013$)	Less than 1.

* This column presents the total number of manufacturers identified in the energy conservation standard rule contributing to cumulative regulatory burden.

** This column presents the number of manufacturers producing WICF refrigeration systems that are also listed as manufacturers in the energy conservation standard contributing to cumulative regulatory burden.

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

+ Consistent with Chapter 12 of the TSD, DOE has assessed whether this rule will have significant impacts on manufacturers that are also subject to significant impacts from other EPCA rules with compliance dates within three years of this rule's compliance date. However, DOE recognizes that a manufacturer incurs costs during some period before a compliance date as it prepares to comply, such as by revising product designs and manufacturing processes, testing products, and preparing certifications. As such, to illustrate a broader set of rules that may also create additional burden on manufacturers, DOE has expanded the timeframe of potential regulatory overlap to include other EPCA rules with compliance dates that fall within six years of compliance date of this rule. Note that this list of rules does not indicate that DOE considers any one particular rule to contribute significantly to cumulative impact. DOE has chosen to broaden its list of rules in order to provide additional information about its rulemaking activities.

This final rule establishes energy conservation standards for seven WICF refrigeration system equipment classes. The thirteen other standards established in the June 2014 final rule (that is, the four standards applicable to dedicated condensing refrigeration systems operating at medium temperatures; three standards applicable to panels;

and six standards applicable to doors) were not vacated and remain subject to the June 5, 2017 compliance date prescribed by the June 2014 final rule.[77]

DOE anticipates that ten manufacturers who would be subject to this final rule would also be subject to certain of the non-vacated standards, namely the refrigeration system standards applicable to dedicated condensing refrigeration systems operating at medium temperatures. Three of these manufacturers also produce panels and non-display doors, and would be subject to those non-vacated standards as well.

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

e. Impact on Manufacturers of Complete Walk-Ins

A manufacturer of a complete walk-in is the entity that assembles the complete walk-in cooler or walk-in freezer. In some cases, this may be an ''installer.'' Walk-in manufacturers have been subject to regulation since 2009, when EPCA's statutorily-prescriptive standards for walk-in coolers and freezers went into effect. 42 U.S.C. 6313(f)(1) EPCA required that all completed walk-ins must: have automatic door closers; have strip doors, spring hinged doors, or other method of minimizing infiltration when doors are open; and for all interior lights, use light sources with an efficacy of 40 lumens per watt or more. Furthermore, for walk-ins that use an evaporator fan motor with a rating of under 1 hp and less than 460 volts, that fan motor must be either a three-phase motor or an electronically commutated motor. Also, walk-in freezers with transparent reach-in doors must have triple-pane glass with either heat-reflective treated glass or gas fill for doors and windows. 42 U.S.C. 6313(f)(1)

Due to existing regulations, manufacturers of complete walk-ins have a responsibility to use components that comply with the applicable standards and to ensure the final assembled equipment satisfies the already statutorily-prescribed design requirements enacted by Congress. To aid manufacturers in meeting these responsibilities, DOE has established labeling requirements as part of a separate final rule amending the walk-in test procedure. 81 FR at 95782–95789 (December 28, 2016). As part of that rule, permanent nameplates must include information about the manufacturer or brand, and indicate that the component is suitable for walk-in use. In DOE's view, such a requirement will help reduce the burden on manufacturers of complete walk-ins, relative to the existing compliance regime, by allowing them to more easily identify and select compliant WICF components for assembly.

DOE notes that this final rule does not establish requirements that specify performance requirements for the complete walk-in. Manufacturers of complete walk-ins, including installers (*i.e.,* the parties that assemble the complete walk-in) have no paperwork or certification requirements as a result of this rule when using certified walk-in components. DOE was unable to identify installer conversion costs that would be likely to occur as a direct result of the standard since these costs are borne by component manufacturers. Installers will not have stranded assets, as they will be able to install certified components purchased before the compliance date. DOE finds the burdens on manufacturers of complete walk-ins to be *de minimis.* Manufacturers of complete walk-in have an existing obligation to ensure components comply with prescriptive requirements in EPCA. 42 U.S.C. 6313(f)(1) Based on today's standard, that process would be simplified, as *installers would be able to identify compliant components based on a required label.*

Companies that are both manufacturers of walk-in components and manufacturers of complete walk-ins must comply with standards for WICF components established in the June 2014 final rule for panels, doors, and medium-temperature dedicated condensing refrigeration systems. They would also need to comply with the standards for low-temperature dedicated condensing refrigeration systems and unit coolers established in this rule. Additionally, DOE notes that these entities are already responsible for complying with the statutorily-prescribed design standards for complete walk-ins.

As part of the court settlement reached in *Lennox Int'l* v. *Dep't of Energy,* DOE agreed to consider any comments regarding any potential impacts of the standards on installers and to consider and substantively address any potential impacts of the standards on installers in its MIA. See *Lennox Int'l* v. *Dep't of Energy,* Case No. 14–60535, Joint Settlement Motion (filed July 29, 2015) (5th Cir.). During the Working Group meetings, walk-in installers were represented by ACCA. As part of DOE's attempt to consider and address any potential installer impacts, the NOPR specifically sought comment on any conversion costs and stranded assets that walk-in installers might incur. See 81 FR at 63033 and 63048–63049 (detailing specific issues on which DOE sought input regarding potential installer-related impacts to the proposed rule).

Stakeholders raised one issue related to installers and the possibility of stranded assets. AHRI and Rheem noted that installers of complete walk-ins may have stranded assets if they are required to use components that are compliant at the time of the complete walk-in assembly. AHRI added that compliant components may not be available to installers until the compliance date of the new standards, leading to equipment availability constraints. (AHRI No. 90 at p. 3; Rheem No. 91 at p. 3)

DOE addresses this comment and clarifies the compliance date for manufacturers of complete walk-ins in section III.F.

3. National Impact Analysis

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

a. Significance of Energy Savings

To estimate the energy savings attributable to potential standards for the considered WICF refrigeration systems, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of equipment purchased in the 30-year period that begins in the year of anticipated compliance with the amended standards (2020–2049). Table V–28 presents DOE's projections of the national energy savings for each TSL considered for the considered WICF

[77] See *www.energy.gov/sites/prod/files/2016/02/f29/Enforcement%20Policy%20Statement%20-%20WICF%2002-01-16.pdf* (outlining DOE's enforcement discretion policy to not seek civil penalties or injunctive relief concerning certain violations of the WICF refrigeration systems standards established in the June 2014 rule that were not vacated).

refrigeration systems. The savings were calculated using the approach described in section IV.H of this document.

TABLE V–28—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WICF REFRIGERATION SYSTEMS; 30 YEARS OF SHIPMENTS
[2020–2049]

	Trial standard level		
	1	2	3
	Quads		
Primary energy	0.1	0.5	0.8
FFC energy	0.1	0.5	0.9

OMB Circular A–4 [78] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of equipment shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[79] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to WICF refrigeration systems. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V–29. The impacts are counted over the lifetime of the considered WICF refrigeration systems purchased in 2020–2028.

TABLE V–29—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WICF REFRIGERATION SYSTEMS; 9 YEARS OF SHIPMENTS
[2020–2028]

	Trial standard level		
	1	2	3
	Quads		
Primary energy	0.03	0.1	0.2
FFC energy	0.03	0.1	0.2

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 examined for the WICF refrigeration systems addressed in this final rule. In accordance with OMB's guidelines on regulatory analysis,[80] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V–30 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2020–2049.

TABLE V–30—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049

Discount rate	Trial standard level		
	1	2	3
	Billion 2015$		
3 percent	0.5	2.0	3.2
7 percent	0.2	0.9	1.4

The NPV results based on the aforementioned 9-year analytical period are presented in Table V–31. The impacts are counted over the lifetime of products purchased in 2020–2028. As mentioned previously, such results are presented for informational purposes only and are not indicative of any

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

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

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

change in DOE's analytical methodology or decision criteria.

TABLE V–31 CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR WICF REFRIGERATION SYSTEMS; NINE YEARS OF SHIPMENTS

[2020–2028]

Discount rate	Trial standard level		
	1	2	3
	Billion 2015$		
3 percent	0.2	0.4	1.5
7 percent	0.1	0.2	0.9

The above results reflect the use of a constant trend to estimate the change in price for the considered WICF refrigeration systems over the analysis period (see section IV.H.1). DOE also conducted a sensitivity analysis that considered one scenario with an increasing price trend and one scenario with a decreasing price trend. The results of these alternative cases are presented in appendix 10B of the final rule TSD.

c. Indirect Impacts on Employment

DOE expects that amended energy conservation standards for WICF refrigeration systems will reduce energy expenditures for consumers of those products, with the resulting net savings being redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.N of this document, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes (2020–2025), where these uncertainties are reduced.

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

4. Impact on Utility or Performance of Products

DOE tentatively concluded in the NOPR that the standards adopted in this final rule will not lessen the utility or performance of the WICF refrigeration systems under consideration in this rulemaking, based on testing conducted in support of the engineering analysis, and requested comment on this issue. 81 FR at 63035. DOE did not receive any comments suggesting that the selected standard levels would impact utility or performance and DOE notes that manufacturers of these equipment categories currently offer equipment that employ the various design options that would be needed to meet the adopted standards.

5. Impact of Any Lessening of Competition

DOE considered any lessening of competition that would be likely to result from new or amended standards. As discussed in section III.E.1.e, the Attorney General of the United States must assess a proposed rule to determine the impact, if any, of any lessening of competition likely to result from the proposed standard and to transmit such determination in writing to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. To assist the Attorney General in making this determination, DOE provided the Department of Justice (''DOJ'') with copies of the final rule and the TSD for review. In its assessment letter responding to DOE, DOJ concluded that, based on the information currently available, it does not believe that the proposed energy conservation standards for WICF refrigeration systems are likely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

6. Need of the Nation To Conserve Energy

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

Energy conservation resulting from potential energy conservation standards for the considered WICF refrigeration systems is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V–32 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The emissions were calculated using the multipliers discussed in section IV.H.2. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD.

TABLE V–32—CUMULATIVE EMISSIONS REDUCTION FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049

	Trial standard level		
	1	2	3
Power Sector Emissions			
CO_2 (million metric tons)	6.0	25.4	43.5
SO_2 (thousand tons)	4.9	21.0	35.9
NO_X (thousand tons)	3.2	13.8	23.6
Hg (tons)	0.0	0.1	0.1
CH_4 (thousand tons)	0.6	2.7	4.6
N_2O (thousand tons)	0.1	0.4	0.7
Upstream Emissions			
CO_2 (million metric tons)	0.3	1.4	2.4
SO_2 (thousand tons)	0.0	0.2	0.3
NO_X (thousand tons)	4.8	20.2	34.7
Hg (tons)	0.0001	0.0003	0.0006
CH_4 (thousand tons)	29.4	125	214
N_2O (thousand tons)	0.00	0.01	0.02
Total FFC Emissions			
CO_2 (million metric tons)	6.3	26.8	45.8
SO_2 (thousand tons)	5.0	21.1	36.2
NO_X (thousand tons)	8.0	34.0	58.2
Hg (tons)	0.0	0.1	0.1
CH_4 (thousand tons)	30.0	127	218
N_2O (thousand tons)	0.1	0.4	0.7

Negative values refer to an increase in emissions.

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

Table V–33 presents the global value of the CO_2 emissions reduction at each TSL. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values; these results are presented in chapter 14 of the final rule TSD.

TABLE V–33—PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049

TSL	SC-CO_2 case			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
	Million 2015$			
1	44.7	204	324	623
2	190	867	1376	2643
3	325	1484	2355	4525

As discussed in section IV.L.2, DOE estimated monetary benefits likely to result from the reduced emissions of methane and N_2O that DOE estimated for each of the considered TSLs for WICF refrigeration systems. DOE used the recent values for the SC–CH_4 and SC–N_2O developed by the interagency working group. Table V–34 presents the value of the CH_4 emissions reduction at each TSL, and Table V–35 presents the value of the N_2O emissions reduction at each TSL.

TABLE V–34—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049

TSL	$SC\text{-}CH_4$ case			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
	Million 2015$			
1	9.5	30.1	42.6	80.2
2	40.3	128	181	340
3	69.0	218	309	582

TABLE V–35—PRESENT VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049

TSL	$SC\text{-}N_2O$ case			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
	Million 2015$			
1	0.2	1.0	1.6	2.8
2	1.0	4.4	6.9	11.7
3	1.8	7.5	11.9	20.0

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 GHG emissions in this rulemaking is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. Consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this rule the most recent values resulting from the interagency review process. DOE notes, however, that the adopted standards would be economically justified even without inclusion of the monetized benefits accruing from reduced GHG emissions.

DOE also estimated the monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from the considered TSLs for WICF refrigeration systems. The dollar-per-ton values that DOE used are discussed in section IV.L of this document.

Table V–36 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates. This table presents results that use the low benefit-per-ton values, which reflect DOE's primary estimate. Results that reflect the range of NO_X benefit-per-ton values are presented in Table V–36.

TABLE V–36—PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049 *

TSL	3% discount rate	7% discount rate
	Million 2015$	
1	14.3	5.8
2	60.4	24.8
3	103	42.4

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

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII) and 6316(a)) No other factors were considered in this analysis.

C. Summary of National Economic Impacts

Table V–37 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced GHG and NO_X emissions to the NPV of consumer savings calculated for each TSL considered in this rulemaking.

TABLE V–37—CONSUMER NPV COMBINED WITH PRESENT VALUE OF BENEFITS FROM EMISSIONS REDUCTIONS

TSL	Consumer NPV and low NO_X values at 3% discount rate added with:			
	GHG 5% discount rate, average case	GHG 3% discount rate, average case	GHG 2.5% discount rate, average case	GHG 3% Discount Rate, 95th percentile case
	Billion 2015$			
1	0.6	0.7	0.9	1.2
2	2.3	3.1	3.6	5.1
3	3.7	5.0	6.0	8.4
TSL	Consumer NPV and Low NO_X Values at 7% Discount Rate Added with:			
	GHG 5% discount rate, average case	GHG 3% discount rate, average case	GHG 3% discount rate, average case	GHG 3% discount rate, 95th percentile case
	Billion 2015$			
1	0.3	0.5	0.6	0.9
2	1.1	1.9	2.5	3.9
3	1.8	3.1	4.1	6.5

Note: The GHG benefits include the estimated benefits for reductions in CO_2, CH_4, and N_2O emissions using the four sets of SC–CO_2, SC–CH_4, and SC–N_2O values developed by the interagency working group.

The national operating cost savings are domestic U.S. monetary savings that occur as a result of purchasing the considered WICF refrigeration equipment, and are measured for the lifetime of products shipped in 2020–2049. The benefits associated with reduced GHG emissions achieved as a result of the adopted standards are also calculated based on the lifetime of WICF refrigeration systems shipped in 2020–2049. However, the GHG reduction is a benefit that accrues globally. Because CO_2 emissions have a very long residence time in the atmosphere, the SC–CO_2 values for future emissions reflect climate-related impacts that continue through 2300.

D. Conclusion

When considering new or amended energy conservation standards, the standards that DOE adopts for walk-ins 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) and 6316(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) and 6316(a)) The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B) and 6316(a)).

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

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

1. Benefits and Burdens of TSLs Considered for WICF Refrigeration System Standards

Table V–38 and Table V–39 summarize the quantitative impacts estimated for each TSL for the considered WICF refrigeration systems. The national impacts are measured over the lifetime of WICF refrigeration systems purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2020–2049). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. The efficiency levels contained in each TSL are described in section V.A of this document.

TABLE V–38—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION SYSTEMS TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC National Energy Savings (*quads*)			
Quads	0.1	0.5	0.9
NPV of Consumer Costs and Benefits (*billion 2015$*)			
3% discount rate	0.5	2.0	3.2
7% discount rate	0.2	0.9	1.4

TABLE V–38—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION SYSTEMS TSLS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC Emissions Reduction			
CO_2 (*million metric tons*)	6.3	26.8	45.8
SO_2 (*thousand tons*)	5.0	21.1	36.2
NO_X (*thousand tons*)	8.0	34.0	58.2
Hg (*tons*)	0.02	0.07	0.12
CH_4 (*thousand tons*)	30.0	127	218
N_2O (*thousand tons*)	0.1	0.4	0.7
Value of Emissions Reduction			
CO_2 (*Billion 2015$*) *	0.0 to 0.6	0.2 to 2.6	0.3 to 4.5
CH_4 (*billion 2015$*)	0.0 to 0.1	0.0 to 0.3	0.1 to 0.6
N_2O (*million 2015$*)	0.000 to 0.003	0.001 to 0.012	0.002 to 0.020
NO_X—3% discount rate (*million 2015$*)	14	60	103
NO_X—7% discount rate (*million 2015$*)	6	25	42

Parentheses indicate negative (−) values.
* Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.

TABLE V–39—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION EQUIPMENT TSLS: MANUFACTURER AND CONSUMER IMPACTS ‡

Category	TSL 1 *	TSL 2 *	TSL 3 *
Manufacturer Impacts			
Industry NPV (2015$ million) (No-new-standards case INPV = 97.9)	96.6–97.1	93.4–96.4	83.6–91.7
Industry NPV (*% change*)	(1.2)–(0.8)	(4.5)–(1.5)	(14.6)–(6.3)
Consumer Average LCC Savings (2015$)			
DC.L.I (CU-Only) *	26	387	1,272
DC.L.O (CU-Only)	753	2,097	2,839
DC.L.I (Field-Paired) **	63	442	1,397
DC.L.O (Field-Paired)	783	2,307	3,294
DC.L.I (UC-Only) †	86	121	135
DC.L.O (UC-Only)	35	144	288
UC.M—DC.M.I	0	72	87
UC.M—DC.M.O	0	79	89
UC.L—MC.L (UC-Only)	4	101	74
UC.M—MC.M (UC-Only)	4	72	75
Shipment-Weighted Average	107	393	615
Consumer Simple PBP (years)			
DC.L.I (CU-Only) *	0.0	1.0	1.5
DC.L.O (CU-Only) *	0.1	0.4	1.2
DC.L.I (Field -Paired) **	0.1	1.0	1.5
DC.L.O (FP) **	0.2	0.5	1.4
DC.L.I (UC-Only) †	1.7	3.6	4.8
DC.L.O (UC-Only) †	0.6	2.4	4.5
UC.M—DC.M.I	0.0	0.0	1.8
UC.M—DC.M.O	0.0	1.4	1.5
UC.L—MC.L (UC-Only)	0.6	2.8	7.6
UC.M—MC.M (UC-Only)	0.6	2.4	3.0
Shipment-Weighted Average	0.2	1.2	2.2
% of Consumers that Experience Net Cost			
DC.L.I (CU-Only) *	0	0	0
DC.L.O (CU-Only) *	0	0	0
DC.L.I (FP) **	0	0	0
DC.L.O (FP) **	0	0	0
DC.L.I (UC-Only) †	2	6	15
DC.L.O (UC-Only) †	0	3	15
UC.M—DC.M.I	0	1	1
UC.M—DC.M.O	0	0	1
UC.L—MC.L (UC-Only)	2	9	49
UC.M—MC.M (UC-Only)	1	2	8

TABLE V–39—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION EQUIPMENT TSLS:—Continued MANUFACTURER AND CONSUMER IMPACTS ‡

Category	TSL 1 *	TSL 2 *	TSL 3 *
Shipment-Weighted Average	0	1	5

Parentheses indicate negative (−) values. Weighted results are by shares of each product class in total projected shipments in 2020.

* CU-Only: Condensing unit-only. This analysis evaluates standard levels applied to a condensing unit distributed in commerce without a designated companion unit cooler for a scenario in which a new condensing unit is installed to replace a failed condensing unit, but the existing unit cooler is not replaced. See section IV.G.1.b for more details.

** FP: Field-paired unit cooler and condensing unit. This analysis evaluates standard levels applied to a condensing unit distributed in commerce without a designated companion unit cooler for a scenario in which both a new condensing unit and a new unit cooler are installed. See section IV.G.1.a for more details.

† UC-Only: Unit cooler only. This analysis evaluates standard levels applied to a unit cooler distributed in commerce without a designated companion condensing unit, either dedicated or multiplex, for a scenario in which a new unit cooler is installed to replace a failed unit cooler, but the existing condensing unit is not replaced. See section IV.G.1.c for more details.

‡ For this NOPR, DOE is examining the impacts of unit coolers (UC.M and UC.L) combined with medium—temperature dedicated condensing equipment (DC.M.I and DC.M.O), but DOE is not considering establishing standards for the latter equipment, as they are covered by the June 2014 final rule standards that were not vacated by the Fifth Circuit order.

DOE first considered TSL 3, which represents the max-tech efficiency levels. TSL 3 would save an estimated 0.85 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $1.4 billion using a discount rate of 7 percent, and $3.2 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 48.5 Mt of CO_2, 36.2 thousand tons of SO_2, 58.2 thousand tons of NO_X, 0.12 ton of Hg, 218 thousand tons of CH_4, and 0.7 thousand tons of N_2O. The estimated monetary value of the GHG emissions reduction at TSL 3 ranges from $325 million to $4,525 million for CO_2, from $69 million to $582 million for CH_4, and from $1.8 million to $20 million for N_2O. The estimated monetary value of the NO_X emissions reduction at TSL 3 is $42 million using a 7-percent discount rate and $103 million using a 3-percent discount rate.

At TSL 3, the average LCC impact for low-temperature dedicated condensing units is a savings of $1,272 for DC.L.I, $2,839 for DC.L.O for the condensing unit-only; $1,397 for DC.L.I , $3,294 for DC.L.O for field-paired equipment. The average LCC impact for low-temperature unit coolers (UC.L) is a savings of $135 and $288 when connected to indoor and outdoor low-temperature dedicated condensing units, respectively, and $74 when connected to low-temperature multiplex condensing equipment. The average LCC impact for medium-temperature unit coolers (UC.M) is a savings of $87 and $89 when connected to indoor and outdoor medium-temperature dedicated condensing units, respectively, and $75 when connected to medium-temperature multiplex condensing equipment. The simple payback period impact for low-temperature dedicated condensing units is 1.5 years for DC.L.I and, 1.2 years for DC.L.O for the condensing unit-only; 1.5 years for DC.L.I and, 1.4 years for DC.L.O for field-paired equipment. The simple payback period for low-temperature unit coolers (UC.L) is 4.8 years and 4.5 years when connected to indoor and outdoor low-temperature dedicated condensing units, respectively, and 7.6 years when connected to low-temperature multiplex condensing equipment. The simple payback period for medium-temperature unit coolers (UC.M) is 1.9 years and 1.5 years when connected to indoor and outdoor medium-temperature dedicated condensing units, respectively, and 3.0 years when connected to medium-temperature multiplex condensing equipment. The fraction of consumers experiencing a net LCC cost is zero percent for DC.L.I and DC.L.O for condensing unit-only; and zero percent for DC.L.I, and DC.L.O for field-paired equipment. The fraction of consumers experiencing a net LCC cost for low-temperature unit coolers (UC.L) is 15 percent when connected to indoor and outdoor low-temperature dedicated condensing units, respectively, and 49 percent when connected to low-temperature multiplex condensing equipment. The fraction of consumers experiencing a net LCC cost for medium-temperature unit coolers (UC.M) is 1 percent when connected to indoor and outdoor medium-temperature dedicated condensing units, and 8 percent when connected to medium-temperature multiplex condensing equipment. At TSL 3, the projected change in INPV ranges from a decrease of $14.3 million to a decrease of $6.1 million, which corresponds to decreases of 14.6 percent and 6.3 percent, respectively.

In addition, the adopted TSL 3 standards are consistent with the unanimous recommendations submitted by the Working Group and approved by the ASRAC. (See: Term Sheet at EERE–2015–BT–STD–0016–0056, recommendation #5) DOE has encouraged the negotiation of standard levels, in accordance with the FACA and the NRA, as a means for interested parties, representing diverse points of view, to analyze and recommend energy conservation standards to DOE. Such negotiations may often expedite the rulemaking process. In addition, standard levels recommended through a negotiation may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

After considering the analysis and weighing the benefits and burdens, the Secretary has concluded that at TSL 3 for the considered WICF refrigeration systems, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, the estimated monetary value of the emissions reductions, and positive average LCC savings would collectively outweigh the negative impacts on some consumers and on manufacturers. As noted earlier, DOE's analysis of this level is independent of any benefits that may accrue from the reduction of GHG and NO_X projected to occur with this level. Accordingly, the Secretary has concluded that TSL 3 would offer the maximum improvement in efficiency that is both technologically feasible and economically justified. The Secretary has also concluded that TSL3 would result in the significant conservation of energy.

Therefore, based on the above considerations, DOE is adopting the energy conservation standards for WICF refrigeration systems at TSL 3. These adopted energy conservation standards for the considered WICF refrigeration systems, which are expressed as AWEF, are shown in Table V–40.

TABLE V–40—ADOPTED ENERGY CONSERVATION STANDARDS FOR WICF REFRIGERATION SYSTEMS

Equipment class	Capacity (C_{net*}) (*Btu/h*)	Minimum AWEF (*Btu/W-h*)
Unit Coolers—Low-Temperature	<15,500	$1.575 * 10^{-5} * q_{net} + 3.91$
	≥15,500	4.15
Unit Coolers—Medium-Temperature	All	9.00
Dedicated Condensing System—Low-Temperature, Outdoor	<6,500	$6.522 * 10^{-5} * q_{net} + 2.73$
	≥6,500	3.15
Dedicated Condensing System—Low-Temperature, Indoor	<6,500	$9.091 * 10^{-5} * q_{net} + 1.81$
	≥6,500	2.40

* Where q_{net} is net capacity as determined and certified pursuant 10 CFR 431.304.

2. Annualized Benefits and Costs of the Adopted Standards

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

Table V–41 shows the annualized values for the considered WICF refrigeration systems under TSL 3, expressed in 2015$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for benefits and costs other than GHG reductions (for which DOE used average social costs with a 3-percent discount rate),[81] the estimated cost of the adopted standards for the considered WICF refrigeration systems is $34 million per year in increased equipment costs, while the estimated annual benefits are $169 million in reduced equipment operating costs, $95 million in GHG reductions, and $4.2 million in reduced NO_X emissions. In this case, the net benefit amounts to $234 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the adopted standards for the considered WICF refrigeration systems is $36 million per year in increased equipment costs, while the estimated annual benefits are $213 million in reduced operating costs, $95 million in CO_2 GHG reductions, and $5.8 million in reduced NO_X emissions. In this case, the net benefit amounts to $279 million per year.

TABLE V–41—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS (TSL 3) FOR WICF REFRIGERATION SYSTEMS

	Discount rate (percent)	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
		Million 2015$/year		
Benefits				
Consumer Operating Cost Savings	7	169.3	158.4	183.0.
	3	213.4	196.9	233.9.
GHG Reduction (using avg. social costs at 5% discount rate) **.	5	29.8	27.2	32.4.
GHG Reduction (using avg. social costs at 3% discount rate) **.	3	95.3	86.7	104.0.
GHG Reduction (using avg. social costs at 2.5% discount rate) **.	2.5	137.7	125.1	150.4.
GHG Reduction (using 95th percentile social costs at 3% discount rate) **.	3	285.8	259.8	311.9.
NO_X Reduction †	7	4.2	3.9	10.1.
	3	5.8	5.3	14.3.
Total Benefits ††	7 plus GHG range	203 to 459	190 to 422	225 to 505.
	7	269	249	297.
	3 plus GHG range	249 to 505	229 to 462	281 to 560.
	3	314	289	352.
Costs				
Consumer Incremental Equipment Costs	7	34	36	33.
	3	36	38	34.
Net Benefits				
Total ††	7 plus GHG range	169 to 425	154 to 386	192 to 472.
	7	234	213	264.

[81] DOE used average social costs with a 3-percent discount rate these values are considered as the ''central'' estimates by the interagency group.

TABLE V–41—SELECTED CATEGORIES OF ANNUALIZED BENEFITS AND COSTS OF ADOPTED STANDARDS (TSL 3) FOR WICF REFRIGERATION SYSTEMS—Continued

	Discount rate (percent)	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
		Million 2015$/year		
	3 plus GHG range	213 to 469	192 to 424	247 to 526.
	3	279	251	318.

* This table presents the annualized costs and benefits associated with the considered WICF refrigeration systems shipped in 2020–2049. These results include benefits to consumers which accrue after 2049 from the WICF refrigeration systems purchased from 2020–2049. The incremental installed costs include incremental equipment cost as well as installation costs. The results account for the incremental variable and fixed costs incurred by manufacturers due to the adopted standards, some of which may be incurred in preparation for the rule. The GHG reduction benefits are global benefits due to actions that occur nationally. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices and real GDP from the *AEO2016* No-CPP case, a Low Economic Growth case, and a High Economic Growth case, respectively. In addition, incremental product costs reflect constant prices in the Primary Estimate, a low decline rate in the Low Benefits Estimate, and a high decline rate in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.G. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding. The equipment price projection is described in section IV.G.2 of this document and chapter 8 of the final rule technical support document (TSD). In addition, DOE used estimates for equipment efficiency distribution in its analysis based on national data supplied by industry. Purchases of higher efficiency equipment are a result of many different factors unique to each consumer including boiler heating loads, installation costs, site environmental consideration, and others. For each consumer, all other factors being the same, it would be anticipated that higher efficiency purchases in the baseline would correlate positively with higher energy prices. To the extent that this occurs, it would be expected to result in some lowering of the consumer operating cost savings from those calculated in this rule.

** The interagency group selected four sets of SC-CO_2 SC-CH_4, and SC-N_2O values for use in regulatory analyses. Three sets of values are based on the average social costs from the integrated assessment models, at discount rates of 5 percent, 3 percent, and 2.5 percent. The fourth set, which represents the 95th percentile of the social cost distributions calculated using a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the social cost distributions. The social cost values are emission year specific. See section IV.L for more details.

† DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.M.3 for further discussion. For the Primary Estimate and Low Net Benefits Estimate, DOE used national benefit-per-ton estimates for NO_X emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.* 2009). For the High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.* 2011); these are nearly two-and-a-half times larger than those from the ACS study.

†† Total Benefits for both the 3-percent and 7-percent cases are presented using the average social costs with 3-percent discount rate. In the rows labeled ''7% plus GHG range'' and ''3% plus GHG 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 social cost 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 (October 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 WICF refrigeration systems are intended to address are as follows:

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

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

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

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

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

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

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

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') and a final regulatory flexibility analysis (''FRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (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 Web site (*http://energy.gov/gc/office-general-counsel*). DOE has prepared the following FRFA for the products that are the subject of this rulemaking.

A manufacturer of a walk-in cooler or walk-in freezer is any person who: (1) Manufactures a component of a walk-in cooler or walk-in freezer (collectively, ''walk-ins'' or ''WICFs'') that affects energy consumption, including, but not limited to, refrigeration, doors, lights, windows, or walls; or (2) manufactures or assembles the complete walk-in cooler or walk-in freezer. 10 CFR 431.302. DOE considers manufacturers of refrigeration components (WICF refrigeration manufacturers) and assemblers of the complete walk-in (installers) separately for this Regulatory Flexibility Review.

This document sets energy conservation standard for seven equipment classes of WICF refrigeration systems. Manufacturers of WICF refrigeration systems are responsible for ensuring the compliance of the components to the new standard. WICF refrigeration manufacturers are required to certify to DOE that the components they manufacture or import comply with the applicable standards. DOE used the SBA's small business size standards to determine whether any small WICF refrigeration system manufacturers would be subject to the requirements of the rule. *See* 13 CFR part 121. WICF refrigeration manufacturing is classified under NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 1,250 employees or less for an entity to be considered as a small business for this category.

This document does not include new or amended energy conservation standards that are measured in terms of the performance of the complete walk-in cooler or freezer. Manufacturers (which may be on-site installers) assemble certified components that have been previously tested and rated, such as panels, doors, and refrigeration systems, to complete the walk-in on-site. However, they are not required to certify compliance of their installations to DOE for energy conservation standards. Installers of complete walk-ins are categorized under NAICS 238220, which covers ''refrigeration contractors.'' SBA has set a revenue threshold of $15 million or less for an entity to be considered small for this category. However, given the lack of publicly available revenue information for walk-in assemblers and installers, DOE chose to use a threshold of 1,250 employees or less to be small in order to be consistent with the threshold for WICF component manufacturers. Based on these thresholds, DOE presents the following FRFA analysis:

1. Need for, and Objectives of, the Rule

Title III, Part C of the Energy Policy and Conservation Act of 1975, as amended (''EPCA'') (codified at 42 U.S.C. 6291–6309) established the Energy Conservation Program for Certain Industrial Equipment, which covers certain industrial equipment, including the walk-in refrigeration systems addressed in this rulemaking—low-temperature dedicated condensing systems and low- and medium-temperature unit coolers. (42 U.S.C. 6311(1)(G)) EPCA established prescriptive standards for these equipment, see 42 U.S.C. 6313(f), and required DOE to establish performance-based standards for walk-ins that achieve the maximum improvement in energy that the Secretary determines is technologically feasible and economically justified. See 42 U.S.C. 6313(f)(4)

As noted elsewhere in this document, DOE published and codified a final rule that requires walk-in manufacturers to meet certain performance-based energy conservation standards starting on June 5, 2017. See 10 CFR 431.306(e). Those standards applied to the main components of a walk-in: Refrigeration systems, panels, and doors.[82] Also as discussed earlier in this document, a legal challenge was filed in this matter, which resulted in a settlement agreement and court order in which the United States Court of Appeals for the Fifth Circuit vacated six refrigeration system standards—(1) the two energy conservation standards applicable to multiplex condensing refrigeration systems (re-named unit coolers for purposes of this rule) operating at medium and low temperatures and (2) the four energy conservation standards applicable to dedicated condensing refrigeration systems operating at low temperatures. This final rule, which was the result of a months-long negotiated

[82] Although DOE had considered alternative performance-based standards for panels in a NOPR published September 11, 2013 (78 FR 55782, 55784), the June 2014 final rule did not deviate from the panel standards prescribed by EPCA. (see 42 U.S.C. 6313(f) and 79 FR at 32051 (June 3, 2016)) Hence, the compliance date for the panel standards was January 1, 2009.

rulemaking arising from the settlement agreement, is consistent with the Term Sheet developed as part of that negotiated rulemaking and adopts the agreed-upon standards contained in that Term Sheet for the seven classes of refrigeration systems. This rule also examines any potential impacts on walk-in installers.

2. Significant Issues Raised in Response to the IRFA

DOE did not receive written comments that specifically addressed impacts on small businesses or were provided in response to the IRFA.

3. Description on Estimated Number of Small Entities Regulated

During its market survey, DOE used available public information to identify small WICF refrigeration manufacturers. DOE's research involved industry trade association membership directories (including those maintained by AHRI 1A[83] and NAFEM 1A[84]), public databases (*e.g.* the SBA Database[85]), individual company websites, market research tools (*e.g.,* Dun and Bradstreet reports 1A[86] and Hoovers reports 1A[87]) to create a list of companies that manufacture or sell equipment covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small WICF refrigeration manufacturers during manufacturer interviews conducted for the June 2014 final rule and at DOE public meetings. DOE reviewed publicly-available data and contacted companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of WICF refrigeration systems. DOE screened out companies that do not offer equipment covered by this rulemaking, do not meet the definition of a ''small business,'' or are foreign-owned.

DOE identified ten WICF refrigeration manufacturers that produce equipment for one or more of the equipment classes analyzed in this final rule. All ten are domestic companies. Three of the ten WICF refrigeration manufacturers are small businesses based on the 1,250 person threshold for NAICS 333415.

DOE was unable to identify any company that operated exclusively as a manufacturer of complete walk-ins. All businesses that were manufacturers of complete walk-ins offered their services as part of a broader range of products and service capabilities. All small business manufacturers of complete walk-ins that DOE identified were on-site installers that also offered HVAC installation or commercial refrigeration equipment installation services. DOE relied on U.S. Census data for NAICS code 238300. The NAICS code aggregates information for ''plumbing, heating, and air-conditioning contractors,'' which includes ''refrigeration contractors''.

According to the 2012 U.S. Census ''Industry Snapshot'' for NAICS 238220, there were approximately 87,000 plumbing, heating, and air-conditioning contractor establishments in the United States.[88] Based on detailed breakdowns provided in the 2007 U.S. Census, DOE was able to disaggregate the 87,000 business by contractor type.[89] In examining these businesses, 35% were exclusively plumbing, sprinkler installation, or steam and piping fitting contractors and were unlikely to provide walk-in installation services. Of the remaining 65% of establishments, DOE estimated that 3,400 to 14,100 provide offer walk-in installation services.

U.S. Census data from 2012 showed that less than 1% of plumbing, heating, and air-conditioning contracting companies have more than 500 or more employees. While the U.S. Census data show that average revenue per establishment is approximately $1.7 million, the data provide no indication of what the revenue distribution or the median revenue in the industry might be. Assuming that the plumbing, heating, and air-conditioning employment data are representative of those found with walk-in installer employment numbers, the vast majority of installers are small businesses based on a 1,250-person threshold.

4. Description and Estimate of Compliance Requirements, Including Differences in Cost, if Any, for Different Groups of Small Entities

DOE identified three small WICF refrigeration businesses that manufacture WICF refrigeration equipment addressed by this rule. One small business focuses on large warehouse refrigeration systems, which are outside the scope of this rulemaking. However, this company offers small capacity units that can be sold to the walk-in market as well. The second small business specializes in building evaporators and unit coolers for a range of refrigeration applications, including the walk-in market. Further, based on manufacturer interviews conducted for the June 2014 final rule, DOE determined that the WICF refrigeration system revenue for this company is small compared to its total revenue. The third small business offers a wide range of equipment, including cooling towers, industrial refrigeration equipment, and water treatment systems. This company has a limited portfolio of unit coolers, which is a small portion of its offerings.

Conversion costs are the primary driver of negative impacts on WICF refrigeration manufacturers. While there will be record keeping expenses associated with certification and compliance requirements, DOE expects the cost to be small relative to the investments necessary to determine which equipment are compliant, redesign non-compliant equipment, purchase and install new manufacturing line equipment, and update marketing materials. These conversion costs are described in section IV.J.C of this document.

Since no market share information for small WICF refrigeration manufacturers is publicly-available, DOE relied on company revenue data for the small and large businesses as proxies for market share. For companies that are diversified conglomerates, DOE used revenue figures from the corporate business unit that produced walk-in refrigeration systems.

At the adopted standard level, DOE estimates total conversion costs for an average small manufacturer to be $0.69 million per year over the three-year conversion period. Using revenue figures from Hoovers.com, DOE estimates that conversion costs are 1.0 percent of total small business revenue over the three-year conversion period.

DOE estimates that there are approximately 3,400 to 14,100 walk-in installers and 99% of them are small businesses. Installers of complete walk-ins have been subject to regulation since 2009, when EPCA's prescriptive standards for walk-ins went into effect. EPCA required that all completed walk-ins must: Have automatic door closers; have strip doors, spring hinged doors, or other method of minimizing infiltration when doors are open; for all interior lights, use light sources with an efficacy of 40 lumens per watt or more; contain wall, ceiling, and door insulation of at least R–25 for coolers and R–32 for

[83] See *www.ahridirectory.org/ahriDirectory/pages/home.aspx.*

[84] See *www.nafem.org/find-members/MemberDirectory.aspx.*

[85] See *http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm.*

[86] See *www.dnb.com/.*

[87] See *www.hoovers.com/.*

[88] U.S. Census Bureau. Industry Snapshot *thedataweb.rm.census.gov/TheDataWeb_HotReport2/econsnapshot/2012/snapshot.hrml?NAICS=238220* (Last accessed July 2016).

[89] U.S. Census Bureau. Industry Statistics Portal *www.census.gov/econ/isp/sampler.php?naicscode=238220&naicslevel=6#* (Last accessed August 2016).

freezers; contain floor insulation of at least R–28 for freezers; and use doors that have certain features; and use certain types of motors in components of the refrigeration system.

This rule does not add energy conservation standards that would measure the performance of the complete walk-in. Manufacturers who strictly assemble or install complete walk-ins do not certify compliance to DOE. DOE was unable to identify installer conversion costs that would be likely to occur as a direct result of the adopted standard since these costs are borne by component manufacturers. DOE was unable to identify any potential stranded assets since installers will be able to continue installing completed walk-ins using certified components meeting prior applicable requirements that are purchased before the compliance date of this rule. Installers may continue using components that complied with prior applicable requirements after the compliance date for this final rule is reached. The burden of this rule on installers is *de minimis.*

5. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from the adopted standards, represented by TSL 3. In reviewing alternatives to the adopted standards, DOE examined energy conservation standards set at lower efficiency levels. While TSL 1 and TSL 2 would reduce the impacts on small business manufacturers, it would come at the expense of a reduction in energy savings and NPV benefits to the consumer. TSL 1 achieves 89 percent lower energy savings and 86 percent lower NPV benefits to the consumer compared to the energy savings at TSL 3. TSL 2 achieves 44 percent lower energy savings and 36 percent lower NPV benefit to the consumer compared to the energy savings at TSL 3.

DOE believes that establishing standards at TSL 3 balances the benefits of the energy savings at TSL 3 with the potential burdens placed on WICF refrigeration systems manufacturers, including small business manufacturers. Accordingly, DOE is not adopting one of the other TSLs considered in the analysis, or the other policy alternatives examined as part of the regulatory impact analysis and included in chapter 12 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 WICF refrigeration systems 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 WICF refrigeration systems, 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 WICF refrigeration systems. 76 FR 12422 (March 7, 2011); 80 FR 5099 (January 30, 2015). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 30 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

D. Review Under the National Environmental Policy Act of 1969

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

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 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 (February 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. Pub. L. 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 WICF refrigeration systems 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 WICF refrigeration systems, starting on 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. 6313(f)(4), this final rule establishes energy conservation standards for WICF refrigeration systems that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified, as required by 6295(o)(2)(A), 6295(o)(3)(B), and 6316(a). A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this final rule.

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

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

I. Review Under Executive Order 12630

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

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 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 certain classes of WICF refrigeration systems, 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. Information Quality

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy, issued its Final Information Quality Bulletin for Peer Review (the Bulletin). 70 FR 2664 (January 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 peer reviews of the energy conservation standards development process and the analyses that are typically used and prepared a report describing that peer review.[90] Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. DOE has determined that the peer-reviewed analytical process continues to reflect current practice, and the Department followed that process for developing energy conservation standards in the case of the present rulemaking.

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule prior to its effective date. The report will state that it has been determined that the rule is 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 431

Administrative practice and procedure, Confidential business information, Energy conservation, Incorporation by reference, Intergovernmental relations, Small businesses.

Issued in Washington, DC, on June 27, 2017.

Steven Chalk,

Acting Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE amends part 431 of chapter II, of title 10 of the Code of Federal Regulations, as set forth below:

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. In § 431.306, revise paragraph (e) to read as follows:

§ 431.306 Energy conservation standards and their effective dates.

* * * * *

(e) *Walk-in cooler refrigeration systems.* All walk-in cooler and walk-in freezer refrigeration systems manufactured starting on the dates listed in the table, except for walk-in process cooling refrigeration systems (as defined in § 431.302), must satisfy the following standards:

Equipment class	Minimum AWEF (Btu/W-h)*	Compliance date: equipment manufactured starting on . . .
Dedicated Condensing System—Medium, Indoor	5.61	June 5, 2017.
Dedicated Condensing System—Medium, Outdoor	7.60.	
Dedicated Condensing System—Low, Indoor with a Net Capacity (q_{net}) of:		
< 6,500 Btu/h	$9.091 \times 10^{-5} \times q_{net} + 1.81$	July 10, 2020.
≥ 6,500 Btu/h	2.40.	
Dedicated Condensing System—Low, Outdoor with a Net Capacity (q_{net}) of:		
< 6,500 Btu/h	$6.522 \times 10^{-5} \times q_{net} + 2.73$.	
≥ 6,500 Btu/h	3.15.	
Unit Cooler—Medium	9.00.	
Unit Cooler—Low with a Net Capacity (q_{net}) of:		
< 15,500 Btu/h	$1.575 \times 10^{-5} \times q_{net} + 3.91$.	
≥ 15,500 Btu/h	4.15.	

*Where q_{net} is net capacity as determined in accordance with § 431.304 and certified in accordance with 10 CFR part 429.

Appendix

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

U.S. Department of Justice
Antitrust Division
Renata B. Hesse
Acting Assistant Attorney General
Main Justice Building
950 Pennsylvania Avenue NW.,
Washington, DC 20530-0001
(202) 514–2401 I (202) 616–2645 (Fax).

November 10, 2016

Daniel Cohen, Esq.
Assistant General Counsel for Legislation Regulation and Energy Efficiency
U.S. Department of Energy
Washington, DC 20585

Re: Docket No. EERE–2015–BT–STD–0016

Dear Assistant General Counsel Cohen:

I am responding to your September 14, 2016 letter seeking the views of the Attorney General about the potential impact on competition of proposed energy conservation standards for walk-in coolers and walk-in freezers.

Your request was submitted under Section 325(o)(2)(B)(i)(V) of the Energy Policy and Conservation Act, as amended (EPCA), 42 U.S.C. § 6295(o)(2)(B)(i)(V), which requires the Attorney General to make a

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

determination of the impact of any lessening of competition that is likely to result from the imposition of proposed energy conservation standards. The Attorney General's responsibility for responding to requests from other departments about the effect of a program on competition has been delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR § 0.40(g).

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

We have reviewed the proposed standards contained in the Notice of Proposed Rulemaking (81 Fed. Reg. 62980, Sept. 13, 2016), and the related technical support document. We also monitored the public meeting held on the proposed standards on September 29, 2016; reviewed supplementary information submitted to the Attorney General by the Department of Energy and public comments submitted in connection with this proceeding; and conducted interviews with industry participants.

Based on the information currently available, we do not believe that the proposed energy conservation standards for walk-in coolers and walk-in freezers are likely to have a significant adverse effect on competition.

Sincerely,

Renata B. Hesse

Acting Assistant Attorney General

[FR Doc. 2017–14079 Filed 7–7–17; 8:45 am]

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