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: Notice of proposed rulemaking (NOPR) and announcement of public meeting.

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 freezers. EPCA also requires the U.S. Department of Energy (''DOE'') to periodically determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would save a significant amount of energy. DOE proposes prescribing energy conservation standards for certain categories of walk-in cooler and freezer refrigeration systems and plans to hold a public meeting to receive comment on these proposed standards along with their accompanying analyses.

DATES:

Meeting: DOE will hold a public meeting on September 29, 2016, from 10 a.m. to 2 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section VII, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: DOE will accept comments, data, and information regarding this notice of proposed rulemaking (''NOPR'') before and after the public meeting, but no later than November 14, 2016. See section VII, ''Public Participation,'' for details.

Comments regarding the likely competitive impact of the proposed standard should be sent to the Department of Justice contact listed in the **ADDRESSES** section before October 13, 2016.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 1A–104, 1000 Independence Avenue SW., Washington, DC 20585.

Instructions: Any comments submitted must identify the NOPR on Energy Conservation Standards for WICF refrigeration systems, and provide docket number EE–2015–BT–STD–0016 and/or regulatory information number (RIN) 1904–AD59. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov.* Follow the instructions for submitting comments.

2. *Email: WICF2015STD0016@ee.doe.gov.* Include the docket number and/or RIN in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

3. *Postal Mail:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.

4. *Hand Delivery/Courier:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza SW., 6th Floor, Washington, DC 20024. Telephone: (202) 586–6636. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section VII of this document (''Public Participation'').

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this proposed rule may be submitted to Office of Energy Efficiency and Renewable Energy through the methods listed above and by email to *Chad_S_Whiteman@omb.eop.gov.*

EPCA requires the Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of Justice Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@usdoj.gov* before October 13, 2016. Please indicate in the ''Subject'' line of your email the title and Docket Number of this rulemaking notice.

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

A link to the docket Web page can be found at: *https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=56.* This Web page contains a link to the docket for this proposed rule on the *www.regulations.gov* site. The *www.regulations.gov* Web page contains simple instructions on how to access all documents, including public comments, in the docket. See section VII, ''Public Participation,'' for further information on how to submit comments through *www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT:

Ashley Armstrong, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 586–6590. Email: *walk-in_coolers_and_walk-in_freezers@ee.doe.gov.*

Michael Kido, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 586–8145. Email: *michael.kido@hq.doe.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact the Appliance and Equipment Standards Program staff at (202) 586–6636 or by email: *walk-in_coolers_and_walk-in_freezers@EE.Doe.Gov.*

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed 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 (December 22, 1975), coupled with Section 441(a) Title IV of the National Energy Conservation Policy Act, Public Law 95–619 (November 9, 1978) (collectively codified at 42 U.S.C. 6311–6317), established the Energy Conservation Program for Certain Industrial Equipment.[2] The covered equipment includes certain walk-in cooler and freezer (''WICF'' or ''walk-in'') refrigeration systems, including 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 that DOE prescribes for WICF refrigeration systems must be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42

[1] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated 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 (Apr. 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 NOPR, DOE has proposed to change 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.''

U.S.C. 6313(f)(4)(A)) For purposes of this rulemaking, DOE also plans to adopt standards that are likely to result in a significant conservation of energy that satisfies both of the above requirements. See 42 U.S.C. 6295(o)(3)(B).

In accordance with these and other statutory provisions discussed in this document, DOE proposes to establish performance-based energy conservation standards for the aforementioned classes of WICF refrigeration systems that will be in addition to those standards that DOE has already promulgated for dedicated condensing, medium temperature, indoor and outdoor refrigeration systems. See 10 CFR 431.306(e) (as amended by 80 FR 69838 (November 12, 2015)). The proposed standards, which are expressed in terms of an annual walk-in energy factor (''AWEF'') for classes of walk-in refrigeration systems being considered in this rule, are shown in Table I–1. These proposed standards, if adopted, would apply to all applicable WICF refrigeration systems listed in Table I–1 and manufactured in, or imported into, the United States starting on the date three years after the publication of the final rule for this rulemaking. (For purposes of this analysis, that date is projected to fall on the day after December 31, 2019. This date is subject to change pending publication of the final rule in the **Federal Register**.)

TABLE I–1—PROPOSED ENERGY CONSERVATION STANDARDS FOR THE CONSIDERED EQUIPMENT CLASSES OF WICF REFRIGERATION SYSTEMS

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

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

In various places in this document, DOE will use the following acronyms to denote the seven 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 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 proposed 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 PROPOSED 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 *	$1,717	1.3
	Dedicated, Indoor	Field Paired **	1,820	1.5
	Dedicated, Indoor	Unit Cooler Only †	156	4.6
DC.L.O	Dedicated, Outdoor	Condensing Unit Only	3,148	2.1
	Dedicated, Outdoor	Field Paired	3,294	1.0
	Dedicated, Outdoor	Unit Cooler Only	324	4.3
UC.L	Multiplex	Unit Cooler Only	97	7.3
UC.M	Dedicated, Indoor	Unit Cooler Only	99	1.3
UC.M	Dedicated, Outdoor	Unit Cooler Only	96	1.8
UC.M	Multiplex	Unit Cooler Only	84	2.9

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. Namely, 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 considering establishing standards for the latter, as they are covered by the 2014 final rule and 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 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.F.1.b for more details.

[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.C.1.a).

** Field Paired (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.F.1.a for more details.

† Unit Cooler Only (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.F.1.c for more details.

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

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 to 2049). Using a real discount rate of 10.2 percent, DOE estimates that the INPV from the seven WICF refrigeration system equipment classes being analyzed is $99.7 million in 2015$. Under the proposed standards, DOE expects INPV may change approximately −14.8 percent to −4.4 percent, which corresponds to approximately −14.8 million and −4.4 million in 2015$. To bring equipment into compliance with the proposed standard in this NOPR, DOE expects the industry to incur $16.2 million in total conversion costs.

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

C. National Benefits and Costs [5]

DOE's analyses indicate that the proposed 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 0.90 quadrillion British thermal units (Btu), or quads.[6] This represents a savings of 24 percent relative to the energy use of these products in the case without the proposed standards in place (referred to as the ''no-new-standards case'').

The cumulative net present value (''NPV'') of total consumer costs and savings of the proposed standards for the considered WICF refrigeration systems ranges from $1.8 billion (at a 7-percent discount rate) to $4.3 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 to these anticipated benefits, the proposed standards for the considered WICF refrigeration systems are projected to yield significant environmental benefits. DOE estimates that the proposed standards would result in cumulative emission reductions (over the same period as for energy savings) of 54.4 million metric tons (Mt) [7] of carbon dioxide (CO_2), 31.7 thousand tons of sulfur dioxide (SO_2), 97.7 thousand tons of nitrogen oxides (NO_X), 232.1 thousand tons of methane (CH_4), 0.7 thousand tons of nitrous oxide (N_2O), and 0.1 tons of mercury (Hg).[8] The cumulative reduction in CO_2 emissions through 2030 amounts to 9.3 Mt, which is equivalent to the emissions resulting from the annual electricity use of 849 thousand homes.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the ''Social Cost of Carbon'', or SCC) developed by a Federal interagency Working Group.[9] The derivation of the SCC values is discussed in section IV.L. Using discount rates appropriate for each set of SCC values (see Table I–3), DOE estimates the present monetary value of the CO_2 emissions reduction (not including CO_2 equivalent emissions of other gases with global warming potential) is between $0.4 billion and $5.4 billion, with a value of $1.8 billion using the central SCC case represented by $40.0/t in 2015. DOE also estimates the present monetary value of the NO_X emissions reduction to be $0.08 billion at a 7-percent discount rate and $0.18 billion at a 3-percent discount rate.[10] DOE is still investigating the most appropriate economic estimates to use in valuing the reduction in methane and other emissions, and therefore did not include any values for those emissions in this rulemaking.

DOE notes that the Secretary has determined that the proposed standards are technologically feasible and economically justified. This conclusion is further supported by, but does not depend on, the benefits expected to accrue as a result of the anticipated decreased production of CO_2 emissions. As detailed in section V.D.1 of this document, the projected benefits from these proposed standards exceed the related costs, even ignoring the benefits from reduced CO_2 emissions. Consideration of the benefits of reduced emissions further underscores the Secretary's conclusion.

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

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

[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.

[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 2015* (*AEO 2015*) Reference case. *AEO 2015* generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2014.

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

[10] DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 for further discussion. The U.S. Supreme Court has stayed the rule implementing the Clean Power Plan until the current litigation against it concludes. *Chamber of Commerce, et al.* v. *EPA, et al.,* Order in Pending Case, 136 S.Ct. 999, 577 U.S. ___(2016). However, the benefit-per-ton estimates established in the Regulatory Impact Analysis for the Clean Power Plan are based on scientific studies that remain valid irrespective of the legal status of the Clean Power Plan. DOE is primarily using a national benefit-per-ton estimate for 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—SUMMARY OF ECONOMIC BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR WICF REFRIGERATION SYSTEMS (TSL 3) *

Category	Present value billion 2015$	Discount rate (percent)
Benefits		
Consumer Operating Cost Savings	2.2	7
	5.1	3
CO_2 Reduction Value ($12.4/t case) **	0.4	5
CO_2 Reduction Value ($40.6/t case) **	1.8	3
CO_2 Reduction Value ($63.2/t case) **	2.8	2.5
CO_2 Reduction Value ($118/t case) **	5.4	3
NO_X Reduction Value †	0.1	7
	0.2	3
Total Benefits ‡	4.0	7
	7.0	3
Costs		
Consumer Incremental Installed Costs	0.4	7
	0.8	3
Net Benefits		
Including CO_2 and NO_X Reduction Value ‡	3.6	7
	6.2	3

* This table presents the costs and benefits associated with WICF refrigeration systems shipped in 2020–2049. These results include benefits to consumers which accrue after 2049 from the equipment purchased in 2020–2049. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.

** The CO_2 values represent global monetized values of the SCC, in 2015$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

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

‡ Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.6/t case).

The benefits and costs of the proposed 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 the sum of: (1) The national economic value of the benefits in reduced consumer operating costs, minus (2) the increase in equipment purchase prices and installation costs, plus (3) the value of the benefits of CO_2 and NO_X emission reductions, all annualized.[11]

Although the values of operating cost savings and CO_2 emission reductions are both important, two issues are relevant. The national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of purchasing the covered equipment. The national operating cost savings is measured for the lifetime of WICF refrigeration systems shipped in 2020–2049. The CO_2 reduction is a benefit that accrues globally due to decreased domestic energy consumption that is expected to result from this rule.[12] Like national operating cost savings, the amount of emissions reductions achieved as a result of the proposed standards is calculated based on the lifetime of WICF refrigeration systems shipped during that analysis period. Because CO_2 emissions have a very long residence time in the atmosphere, however, the SCC values reflect CO_2-emissions impacts that continue beyond 2100 through 2300.

Estimates of annualized benefits and costs of the proposed standards are shown in Table I–4.

Using a 7-percent discount rate for benefits and costs other than CO_2 reduction (for which DOE used a 3-percent discount rate along with the average SCC series that has a value of $40.6/t in 2015),[13] the estimated cost of the standards proposed in this rule is $43.9 million per year in increased equipment costs, while the estimated annual benefits are $217.9 million in reduced equipment operating costs, $98.4 million in CO_2 reductions, and $7.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $280 million per year.

Using a 3-percent discount rate for all benefits and costs and the average SCC series that has a value of $40.6/t in 2015, the estimated cost of the proposed standards is $45.9 million per year in increased equipment costs, while the estimated annual benefits are $283.3

[11] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2015, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.,* 2020 or 2030), and then discounted the present value from each year to 2015. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions, for which DOE used case-specific discount rates, as shown in Table I–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.

[12] DOE's analysis estimates both global and domestic benefits of CO_2 emissions reductions. Following the recommendation of the interagency Working Group, DOE places more focus on a global measure of SCC. See section IV.L.1 for further discussion on why the global measure is appropriate.

[13] DOE used a 3-percent discount rate because the SCC values for the series used in the calculation were derived using a 3-percent discount rate (see section IV.L).

million in reduced operating costs, \$98.4 million in CO_2 reductions, and \$10.3 million in reduced NO_X emissions. In this case, the net benefit amounts to \$346 million per year.

TABLE I–4—ANNUALIZED BENEFITS AND COSTS OF PROPOSED STANDARDS (TSL 3) FOR WICF REFRIGERATION SYSTEMS

	Discount rate	Million 2015\$/year		
		Primary estimate *	Low net benefits estimate *	High net benefits estimate *
Benefits				
Consumer Operating Cost Savings	7%	217.9	200.4	237.4.
	3%	283.3	257.9	314.7.
CO_2 Reduction Value (\$12.4/t case) **	5%	29.2	27.8	30.7.
CO_2 Reduction Value (\$40.6/t case) **	3%	98.4	93.5	103.7.
CO_2 Reduction Value (\$63.2/t case) **	2.5%	144.0	136.8	151.9.
CO_2 Reduction Value (\$118/t case) **	3%	299.9	285.0	316.3.
NO_X Reduction Value	7%	7.4	7.1	17.4.
	3%	10.3	9.8	24.6.
Total Benefits †	7% plus CO_2 range	255 to 525	235 to 493	285 to 571.
	7%	324	301	359.
	3% plus CO_2 range	323 to 593	295 to 553	370 to 656.
	3%	392	361	443.
Costs				
Consumer Incremental Product Costs	7%	43.9	43.4	44.4.
	3%	45.9	45.3	46.5.
Net Benefits				
Total †	7% plus CO_2 range	211 to 481	192 to 449	241 to 527.
	7%	280	258	314.
	3% plus CO_2 range	277 to 548	250 to 507	323 to 609.
	3%	346	316	397.

* 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 equipment purchased in 2020–2049. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the *AEO 2015* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

** The CO_2 values represent global monetized values of the SCC, in 2015\$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

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

‡ Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3-percent discount rate (\$40.6/t case). In the rows labeled "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

DOE's analysis of the national impacts of the proposed standards is described in sections IV.F, IV.I and IV.J of this NOPR.

D. Conclusion

DOE has tentatively concluded that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and the proposed standards would result in the significant conservation of energy. DOE further notes that equipment achieving these standard levels is already commercially available for all equipment classes covered by this proposal. Based on the analyses described, DOE has tentatively concluded that the benefits of the proposed standards to the Nation (energy savings, positive NPV of consumer benefits, consumer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers and LCC increases for some consumers).

DOE also considered more-stringent energy efficiency levels for the considered WICF refrigeration systems, and is still considering them in this rulemaking. However, DOE has tentatively concluded that the potential burdens of the more-stringent energy efficiency levels would outweigh the projected benefits. Based on consideration of the public comments DOE receives in response to this NOPR and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this NOPR that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed 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 B of the Energy Policy and Conservation Act of 1975 (''EPCA'' or, in context, ''the Act''), Public Law 94–163 (codified as 42 U.S.C. 6291–6309, as codified) established the Energy Conservation Program for Certain Industrial Equipment, a program covering certain industrial equipment, which includes the refrigeration systems used in walk-ins that are the subject of this rulemaking, which include low-temperature dedicated condensing systems and low and medium temperature unit coolers. (42 U.S.C. 6311(1)(G)) EPCA, as amended, prescribed energy conservation standards for this equipment (42 U.S.C. 6313(f)). 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 covered equipment. Under this requirement, the next review that DOE would need to conduct must occur no later than six years from the issuance of a final rule establishing or amending a standard for covered equipment.

Pursuant to EPCA, DOE's energy conservation program for covered equipment 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 equipment. (42 U.S.C. 6295(o)(3)(A), (r) and 6316(a)) Manufacturers of covered equipment must use the prescribed DOE test procedure as the basis for certifying to DOE that the covered equipment they manufacture complies with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of their covered equipment. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether a manufacturer's covered equipment comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for WICF refrigeration systems appear at title 10 of the Code of Federal Regulations (''CFR'') § 431.304.

DOE has, however, published a NOPR proposing amendments to the test procedures applicable to the equipment classes addressed in this proposal, 81 FR 54926 (August 17, 2016). The standards considered and proposed in this rulemaking were evaluated using those separately proposed 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 proposing, 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 would simplify the current test procedure in a manner that is consistent with the approach agreed upon by the various parties who participated in the negotiated rulemaking. This circumstance leads DOE to tentatively conclude that providing a finalized test procedure that incorporates this limited change prior to the publication of this standards proposal is not necessary. Accordingly, in accordance with section 14 of the Process Rule, DOE tentatively concludes that deviation from the Process Rule is appropriate here. With respect to more substantive future changes that DOE may consider making to the test procedure consistent with the Term Sheet, DOE anticipates conducting a more complete review and analysis of that modified procedure in advance of any subsequent amendments to the WICF refrigeration system standards that DOE may consider later.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered equipment, including WICF refrigeration systems. Any new or amended standard for a type of covered equipment 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 equipment, 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 proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i) and 6316(a)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

(1) The economic impact of the standard on manufacturers and consumers of the 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 products (or 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. (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 a type 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 divided into 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 equipment 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 the 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, DOE is generally required to address standby mode and off mode energy use. Specifically, when DOE adopts a standard satisfying the criteria under 42 U.S.C. 6295(o), DOE must generally 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. In the case of WICFs, DOE is continuing to apply this approach to provide analytical consistency when evaluating potential energy conservation standards for this equipment. See generally, 42 U.S.C. 6316(a).

B. Background

A walk-in cooler and a walk-in freezer 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 on or after January 1, 2009, which are described below.

First, EPCA sets forth general prescriptive standards for walk-ins. 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; walk-ins must also have strip doors, spring hinged doors, or other methods of minimizing infiltration when doors are open. Walk-ins 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 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, EPCA sets forth requirements related to electronically commutated motors for use in walk-ins. 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 horsepower (''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 *https://www.regulations.gov/document?D=EERE-2008-BT-STD-0015-0072*. Additionally, EISA authorized DOE to 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 horsepower 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 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 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 (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 the main components of walk-in coolers and walk-in freezers (walk-ins): 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 I.1.

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

Class descriptor	Class	Standard level
Refrigeration Systems		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	$5.93 \times 10^{-5} \times Q + 2.33$
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	$2.30 \times 10^{-5} \times Q + 2.73$
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
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	$0.05 \times A_{nd} + 1.7$
Passage Door, Low-Temperature	PD.L	$0.14 \times A_{nd} + 4.8$
Freight Door, Medium Temperature	FD.M	$0.04 \times A_{nd} + 1.9$
Freight Door, Low-Temperature	FD.L	$0.12 \times A_{nd} + 5.6$
Display Doors		Max. energy consumption (kWh/day) ††
Display Door, Medium Temperature	DD.M	$0.04 \times A_{dd} + 0.41$
Display Door, Low-Temperature	DD.L	$0.15 \times A_{dd} + 0.29$

* 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 proposals of the separate test procedure rulemaking under consideration by DOE.
† A_{nd} represents the surface area of the non-display door.
†† A_{dd} represents the surface area of the display door.

After publication of the 2014 Final Rule, the Air-Conditioning, Heating and Refrigeration Institute (''AHRI'') and Lennox International, Inc. (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, Inc.* 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 (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.[14]

[14] 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).

A controlling court order from the Fifth Circuit, which was issued on August 10, 2015, vacates those six standards. These vacated standards relate 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. The thirteen other standards established in the June 2014 final rule and shown in Table I–1 (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) have not been vacated and remain subject to the June 5, 2017 compliance date prescribed by the June 2014 final rule.[15] To help clarify the applicability of these standards, DOE is also proposing to modify the organization of its regulations to specify the compliance date of these existing standards and the new standards in this proposal. To aid in readability, DOE is proposing to incorporate the new standards in this proposal with the refrigeration system standards that already exist into a single table that will be inserted into a new 10 CFR 431.306(f).

DOE subsequently established a Working Group to negotiate proposed energy conservation standards to replace the six vacated standards. Specifically, on August 5, 2015, DOE published a notice of intent to establish a walk-in coolers and freezers Working Group (''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, Public Law 104–320.) The purpose of the Working Group was to discuss and, if possible, reach consensus on proposed 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 proposed 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–2). (See Appendix A, List of Members and Affiliates, Negotiated Rulemaking Working Group Ground Rules, Docket No. EERE–2015–BT–STD–0016, No. 0005 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–2—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.

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–3.

TABLE II–3—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 and supplied the group with a variety of analyses and presentations, all of which are available in the docket *https://www.regulations.gov/docket?D=EERE–2015–BT–STD–0016*). These analyses and presentations, developed with direct input from the Working Group members, include preliminary versions of many of the analyses discussed in this NOPR, 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. 0052) that was presented to, and approved by the ASRAC on December 18, 2015. DOE considered the approved term sheet,

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

along with other comments received during the negotiated rulemaking process, in developing energy conservation standards that this document proposes to adopt.

III. General Discussion

A. Test Procedure

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 British thermal units (''Btu'')) 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.* 73 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 rule). 79 FR 27388. That rule allows 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 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 and must comply with any applicable standard DOE may establish for a unit cooler. 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 the final rule established the approach for rating individual components of dedicated condensing systems, it still allows matched-pair ratings of these systems. This approach is required for 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 also recommended that DOE consider making certain amendments to the test procedure to support the refrigeration system standards being proposed in this NOPR to replace the six vacated standards. DOE is conducting a separate test procedure rulemaking to address these recommendations. 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 the proposed test procedure.

B. Technological Feasibility

1. General

As part of its energy conservation standards rulemakings, DOE generally conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the equipment at issue. 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 equipment 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 equipment utility or availability; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii) through (iv). Additionally, it is DOE policy not to include in its analysis any proprietary technology that is a unique pathway to achieving a certain efficiency level. Section IV.B of this NOPR discusses the results of the screening analysis for WICF refrigeration systems, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR technical support document (''TSD'').

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt a standard for a type or class of covered equipment, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such equipment. (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 equipment available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.C.9 of this proposed rule and in chapter 5 of the NOPR TSD.

C. Equipment Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE often divides covered equipment into separate classes by the type of energy used, equipment capacity, or some other performance-related features that justify differing standards. In making a determination whether a performance-related feature justifies a different standard, DOE generally considers 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 (re-named unit coolers for purposes of this rule) 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.A.1 of this proposed rule.

D. Energy Savings

1. Determination of Savings

For each trial standard level (''TSL''), DOE projected energy savings from application of the TSL to the considered WICF refrigeration systems purchased in the 30-year period that begins in the first full year of compliance with the proposed standards (2020–2049).[16] The savings are measured over the entire lifetime of the considered WICF refrigeration systems purchased in the above 30-year 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 model to estimate national energy savings (''NES'') from potential standards adopted for the considered WICF refrigeration systems at issue. The NIA spreadsheet model (described in section IV.H of this notice) calculates energy savings in terms of site energy, which is the energy directly consumed by equipment at the locations where they are used. Based on the site energy, DOE calculates NES in terms of primary energy savings at the site or at power plants, and also 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.[17] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by the covered equipment addressed in this notice. For more information on FFC energy savings, see section IV.H.1 of this proposed rule.

2. Significance of Savings

To adopt any new or amended standards for a type of 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), opined that Congress intended ''significant'' energy savings in the context of section 325 of EPCA (*i.e.* 42 U.S.C. 6295(o)(3)(B) and 6316(a)) to be savings that are not ''genuinely trivial.'' The energy savings for all of the TSLs considered in this rulemaking, including the proposed standards (presented in section V.B.3), are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

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

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential proposed standard 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 (*i.e.* INPV), which values the industry on the basis of expected future cash-flows; (2) cash-flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

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

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 equipment 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 equipment 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 equipment (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the equipment. The LCC analysis requires a variety of inputs, such as equipment prices, equipment energy consumption, energy prices, maintenance and repair costs, equipment lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as equipment 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 equipment 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 equipment in the first full year of compliance with the proposed standards. The LCC savings for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of adopting the proposed 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

[16] Each TSL is comprised of specific efficiency levels for each equipment class. The TSLs considered for this NOPR are described in section V.A. DOE conducted a sensitivity analysis that considers impacts for equipment shipped in a 9-year period.

[17] 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).

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 III.D, 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 proposed in this proposed rule 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 proposed 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 proposed 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)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the Department of Justice (''DOJ'') provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information on how to send comments to DOJ.

f. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI) and 6316(a)) The energy savings from the proposed 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.

The proposed standards also are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases (''GHGs'') associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K; the emissions impacts are reported in section IV.L of this proposed rule. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L.1.

g. Other Factors

In determining whether an energy conservation standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII) and 6316(a)) To the extent interested parties submit any relevant information regarding economic justification that does not fit into the other categories described in this preamble, 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 equipment 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 effects that proposed 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 applies 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 proposed 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 latter 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.) At this time, DOE anticipates that publication of a final rule would occur in the second half of 2016, which would provide a compliance date that would fall in the second half of 2019 for any new standards that DOE would adopt as part of this rulemaking.

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 proposed 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 forecasts 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, which are mainstays in DOE's standards rulemaking proceedings and continue to be refined in response to public input, are available on the DOE Web site for this rulemaking: *https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=56*.

DOE also developed a spreadsheet-based engineering model that calculates performance of different WICF equipment designs and summarizes cost versus efficiency relationships for the classes covered in this rulemaking. DOE made this spreadsheet available on the rulemaking Web site. Additionally, DOE used output from the latest version of EIA's *Annual Energy Outlook* (''*AEO''),* a widely known energy forecast for the United States, for the emissions and utility impact analyses.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the equipment concerned, including the purpose of the equipment, the industry structure, manufacturers, market characteristics, and technologies used in the equipment. 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 equipment 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 the WICF refrigeration systems under consideration. The key findings of DOE's market assessment are summarized below. See chapter 3 of the NOPR TSD for further discussion of the market and technology assessment.

1. Scope of Coverage and Equipment Classes

The NOPR of the separate WICF test procedure rulemaking noted earlier in section III.A addressed the coverage of process cooling walk-ins and their components under DOE's regulations and proposed a definition for process cooling to distinguish this equipment from other walk-ins. 81 FR at 54926 (August 17, 2016). As discussed in the test procedure NOPR, process cooling walk-ins would be considered to be 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 would be subject to both the statutorily-prescribed standards for these components, and the standards established by the June 2014 final rule. See 42 U.S.C. 6313(f) and 10 CFR 431.306. However, a process cooler may not need to satisfy the refrigeration system standards—including those being proposed today—depending on the circumstances.

DOE proposed to define a process cooling refrigeration system as a refrigeration system that either (1) is distributed in commerce with an enclosure such that the refrigeration system capacity meets a certain minimum threshold, indicating that it is designed for refrigeration loads much greater than required simply to hold the temperature of the shipped enclosure at refrigerated temperature, or (2) is a unit cooler with a height dimension of at least 4.5 feet—a specification that its discharge air flow will impinge directly on stored products. 81 FR at 54926 (Augsut 17, 2016). Because of the specific aspects of this definition, the exclusions to the refrigeration system standards would apply to (a) refrigeration systems sold as part of a complete package, including the insulated enclosure, and the refrigeration system for which the capacity per volume meets the proposed process cooling definition, (b) dedicated condensing systems sold as a matched pair in which the unit cooler meets the requirements of the proposed process cooling definition, and (c) unit coolers that meet the requirements of the proposed definition. As discussed in the test procedure document, the exclusion would not apply to condensing units distributed in commerce without unit coolers.

DOE proposes to specify that the refrigeration system standards exclusions be added to the regulatory text at 10 CFR 431.306.

As discussed in section II.B, this NOPR covers proposed energy conservation standards for walk-in refrigeration systems to replace the six standards vacated by the Fifth Circuit court order issued in August 2015. These vacated standards relate to (1) the two energy conservation standards applicable to unit coolers 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 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. In the May 2014 test procedure rule, DOE established a rating method for walk-in refrigeration system components distributed individually; that is, unit coolers sold by themselves are tested and rated with the multiplex condensing system test, while condensing units sold by themselves are tested and rated with the dedicated condensing system test. In other words, all unit coolers sold alone would belong to the (as termed at the time) multiplex condensing class, while all condensing units sold alone would belong to the dedicated condensing class. WICF refrigeration systems consisting of a unit cooler and condensing unit that are manufactured as a matched system and sold together by the manufacturer would also be rated with the dedicated condensing system test and belong to the dedicated condensing class.

During the Working Group meetings, a caucus of manufacturers submitted shipment data showing that the vast majority (>90 percent) of their unit coolers and condensing units were sold as stand-alone equipment, rather than paired with the opposite component. (Docket No. EERE–2015–BT–STD–0016, No. 0029) The data suggested that manufacturers would certify the majority of the equipment they sell using the rating method specified for walk-in refrigeration components that are distributed individually; thus, DOE expects that the majority of systems being certified within the dedicated condensing class would consist of condensing units sold alone, while a much smaller number of systems certified within this class would have been tested as manufacturer-matched pairs under DOE's test procedure.

All unit coolers sold alone would be treated for certification purposes as belonging to the unit cooler class, and likewise, as discussed in the previous paragraph, unit coolers sold alone must be tested and rated with the multiplex condensing system test. However, manufacturer data also showed that the majority of WICF unit coolers are ultimately installed in applications where they are paired with a dedicated condensing unit. See id. (noting in column ''K'' that approximately 82 percent of unit coolers are used in dedicated condensing applications, while approximately 12 percent are used in multiplex condensing applications. For this reason, DOE is proposing to re-name the ''multiplex condensing'' class as the ''unit cooler'' class, in acknowledgment of the fact that most unit coolers are not installed in multiplex condensing applications. For this rulemaking, DOE also conducted additional analysis to evaluate the energy use of unit coolers if they are installed in a dedicated condensing system application—*i.e.,* an application for separately-sold unit coolers that is not covered in the test procedure or reflected in the equipment rating. This is discussed in sections IV.C.2 and IV.E.

In the June 2014 final rule, DOE established a single AWEF standard for low-temperature multiplex condensing systems (unit coolers) regardless of capacity. This particular standard was one of those 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 is proposing to consider different standard levels for different capacities of unit coolers, which would necessitate establishing separate classes for these systems based on capacity ranges. The updated analysis showed that the appropriate standard level for low-temperature unit coolers could vary with capacity. As a result, in DOE's view, applying different standard levels (in the form of different AWEF equations or values) based on capacity would provide a better-fitting approach than its previous one when setting the energy efficiency performance levels for walk-in refrigeration systems. In addition to being consistent with EPCA, which authorizes DOE to create capacity-based classes, see 42 U.S.C. 6295(q), this approach would provide a parallel structure to the one DOE had established in the June 2014 final rule for low-temperature dedicated systems. See 79 FR at 32124 (detailing different capacity-based classes for low-temperature dedicated condensing refrigeration systems). (Although the June 2014 standards for low-temperature dedicated systems were also vacated, analysis conducted during the negotiated rulemaking continued to affirm that it is reasonable to consider different capacity-based classes for low-temperature dedicated condensing refrigeration systems.) The Working Group discussed this issue and ultimately agreed to consider two classes for low-temperature unit coolers based on whether their net capacity is above or below 15,500 Btu/h. See Term Sheet at EERE–2015–BT–STD–0016, No. 0056, recommendation #5. That agreement is reflected in this proposed rule, bringing the total number of standards proposed in this notice to seven. These seven standards would, if adopted, replace the six standards that were vacated.

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:

- 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

DOE continued to consider these 15 options in formulating the WICF refrigeration system standards detailed in this proposal. Discussions during the Working Group negotiation meetings on September 11, 2015 and September 30, 2015 suggested that DOE should consider variable-speed evaporator fan control separately for periods when the compressor is off, and when the compressor is on. At various points in the meetings, Working Group members (Rheem, Hussmann, and Manitowoc) stated that while fan control in the off-cycle mode would be beneficial for both single-capacity and variable-capacity systems, fan control in the on-cycle mode would be beneficial only for variable-capacity systems. (Docket No. EERE–2015–BT–STD–0016, Rheem and Hussmann, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 56–72 and Rheem, Hussmann, and Manitowoc, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 112–117) This is because the unit cooler class is dominated by unit coolers that are also used in dedicated condensing installations, and these coolers—when equipped with evaporator fans that vary speed in the on-cycle mode—would need to be paired with either variable-speed or multiple-capacity compressors to produce an energy efficiency benefit from this feature. However, most dedicated condensing systems under consideration in this rule have single-speed/single-capacity compressors. In the scenario where a unit cooler with on-cycle and off-cycle variable-speed capability is paired with a single-speed or single-capacity compressor, the on-cycle variable-speed feature would not deliver in-field savings while the off-cycle variable speed feature would be expected to deliver savings. DOE determined that delineating these two features into separate design options would more readily facilitate analysis of savings attributed to each feature. Furthermore, during the September 30, 2015 public meeting, Rheem pointed out that using a variable-speed evaporator fan control during the on-cycle mode requires additional features such as a controller that can account for temperature and/or pressure sensor inputs to allow an algorithm to modify fan speed so that delivered cooling matches refrigeration load. (Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 119–123) These extra features would be expected to contribute to a cost difference between on-cycle and off-cycle variable-speed fan control, further suggesting that they should be considered as separate design options. Thus, as presented in the subsequent October 15, 2015 public meeting, DOE considered off-cycle and on-cycle fan controls to be different technology options for the purposes of this rulemaking analysis. (See October 15, 2015 Public Meeting Presentation, slide 42, available in Docket No. EERE–2015–BT–STD–0016, No. 0026, at p. 42)

See chapter 3 of the TSD for further details on the technologies DOE considered.

B. Screening Analysis

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

1. *Technological feasibility.* Technologies that are not incorporated in commercial equipment 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 equipment 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 equipment utility or equipment availability.* If it is determined that a technology would have significant adverse impact on the utility of the equipment to significant subgroups of consumers or would result in the unavailability of any covered equipment type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as equipment 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. Furthermore, DOE also excludes from consideration in the engineering analysis any technology that does not affect rated energy consumption as it would not be considered beneficial in the context of this rulemaking. The reasons for excluding 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 rated energy consumption:

- Liquid suction heat exchanger
- Refrigeration system override
- Economizer cooling

DOE has not received any further evidence that these technologies should be considered and has not included them in the analysis supporting the proposals of this document.

As discussed in section III.A, DOE is proposing to remove the method for testing systems with hot gas defrost from the test procedure in a separate rulemaking. Thus, this option will not affect rated energy consumption and DOE is not considering it further.

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

Consistent with the recommendations made during the Working Group negotiations, DOE's supporting analysis for this proposal does not further consider adaptive defrost and on-cycle variable-speed fans as options that manufacturers can use to improve the rated performance of their equipment. Adaptive defrost is covered by the DOE test procedure as a credit applied to any piece of equipment that has the feature—the test procedure does not include a test method for validating the performance of this feature. The Working Group was unable to develop a definition that adequately defined this feature in a way that all systems meeting the definition would receive performance improvements consistent with the test procedure credit. Hence, the Working Group recommended that certified ratings and standards should be based on equipment not having the feature, although the test procedure could still include it to allow manufacturers to make representations regarding improved performance for equipment having the feature. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (December 3, 2015), No. 0057 at pp. 130–153) DOE has proposed this approach in the separate test procedure rulemaking it is conducting. Thus, the analysis does not consider adaptive defrost as a design option.

Regarding on-cycle variable-speed evaporator fans, as mentioned in section IV.A.1, unit coolers sold individually are tested as though they are used in multiplex applications, but the majority are in fact installed in dedicated condensing applications. Furthermore, most dedicated condensing systems are single-capacity while the design option would only save energy when part of a variable-capacity system. (As a multiplex system is a variable-capacity system, the design option would save energy when the unit cooler is actually installed with a multiplex system.) Because of this discrepancy, most of the savings that would be predicted based on ratings would not be achieved in the field, and manufacturers in the Working Group objected to DOE considering design options for equipment features that would not be useful to most end-users. (Docket No. EERE–2015–BT–STD–0016, No. 0006 at p. 1, item #5c and Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 56–72.) Despite the possibility of some field savings from this feature as mentioned in this preamble (that is, in scenarios where the unit cooler with the on-cycle variable speed feature is installed in a multiplex application or with a variable-speed or multi-capacity dedicated condenser), DOE is currently proposing not to consider this option in the analysis, which is consistent with a proposed modification to the test procedure that would preclude manufacturers from certifying compliance to DOE using ratings derived from testing of on-cycle variable-speed fans, as discussed in the following paragraph.

The Working Group ultimately included in the term sheet a recommendation that would require manufacturers to make representations, including certifications of compliance to DOE, of the energy efficiency or energy consumption of WICF refrigeration systems without adaptive defrost or on-cycle variable-speed fans. See Term Sheet at EERE–2015–BT–STD–0016, No. 0056, recommendation #4. Likewise, they recommended that compliance with the applicable WICF refrigeration system standard should be assessed without using these technologies. As part of this approach, manufacturers would be permitted to make an additional representation of the energy efficiency or consumption for a basic model using either of these technologies as measured in accordance with the DOE test procedure, provided that the additional represented value has been certified to DOE per 10 CFR 429.12. Id. However, the benefit from using these technologies would not be factored in when determining compliance with the proposed standard. Id. The separate test procedure rulemaking currently underway is proposing to adopt these changes, and the NOPR for that rulemaking discusses the reasoning behind adopting these changes in more detail. Because these technologies would not have an effect on the rated efficiency of refrigeration systems for purposes of compliance under the proposed revisions to the test procedure, DOE did not consider these technologies in its analysis supporting the proposed standards.

3. Screened-Out Technologies

In the June 2014 final rule, DOE screened out the following technologies from consideration:

- 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)

DOE has not received any evidence beyond those technologies it has already considered that would weigh in favor of including these screened-out technologies and is continuing to exclude them for purposes of this proposal. Chapter 4 of the TSD contains further details on why DOE is screening out these technologies.

4. Remaining Technologies

Through a review of each technology, DOE tentatively concludes that all of the other identified technologies listed in section IV.A.2 meet 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 NOPR 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

DOE determined that the benefits of these technology options can be measured using the DOE test procedure. Furthermore, the technology options are technologically feasible because they are being used or have previously been used in commercially-available equipment 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 do not result in adverse impacts on consumer utility, equipment availability, health, or safety).

For additional details on DOE's screening analysis, see chapter 4 of the NOPR TSD.

C. 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 equipment to model different levels of efficiency. The efficiency-level approach uses estimates of costs and efficiencies of equipment available on the market at distinct efficiency levels to develop the cost-efficiency relationship. The reverse-engineering approach involves testing equipment for efficiency and determining cost from a detailed bill of materials (''BOM'') derived from reverse engineering representative equipment. The efficiency ranges from that of the typical 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 between increasing efficiency and increasing cost 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. DOE received no comments suggesting that it use of one of the alternative engineering analysis approaches. Consequently, DOE used a design-option approach in the analysis supporting this proposal.

DOE did, however, make several changes to its engineering analysis based on discussions and information provided during the Working Group negotiation meetings. These changes are described in the following sections.

1. 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. On July 20, 2015, the U.S. Environmental Protection Agency (''EPA'') published a final rule under the Significant New Alternatives Policy (''SNAP'') 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). The last of these groups could include WICF refrigeration systems consisting of a unit cooler and condensing unit packaged together into a single piece of equipment. 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.

Given that manufacturers would not be allowed to use R–404A in WICF refrigeration systems when the proposed WICF standards would take effect, DOE conducted its analysis using an alternative refrigerant that can be readily used in most types of WICF refrigeration systems under the July 2015 EPA SNAP rule: R–407A. DOE made this selection after soliciting and obtaining input from the Working Group regarding which refrigerants would most likely be used to replace R–404A in WICF refrigeration systems and be most appropriate to use in its analysis to model WICF system performance. Lennox recommended the use of R–407A because it is currently a viable refrigerant for WICF refrigeration equipment and the manufacturer predicted that it would be the most common refrigerant in supermarket applications in the near future. (Docket No. EERE–2015–BT–STD–0016, Lennox, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 12–13) With respect to the issue of whether R–407A would be appropriate for all types of WICF refrigeration equipment, Rheem acknowledged that R–407A would not be allowed for packaged refrigeration equipment (where the condensing unit and unit cooler components are factory-assembled into a single piece of equipment) beginning January 1, 2020, but noted that this type of equipment comprises a very small segment of the WICF refrigeration market. It added that for this type of equipment, R–448A and R–449A would likely be the preferred alternatives and that they are similar to R–407A in terms of their refrigerant properties, making the choice of using R–407A for the analysis an appropriate one to simulate WICF refrigeration system performance with any of the likely replacement refrigerants. (Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 14–15)

In a subsequent meeting on September 30, 2015, the Working Group voted that DOE should use R–407A in its analysis going forward. The vote passed with 12 members voting ''yes'' and one member voting ''no.'' The member who voted ''no'' (unidentified in the transcript) said that his constituency only uses R–448A. However, the CA IOUs observed that the performance of systems using R–448A is approximately equivalent to systems using R–407A. As a result of the Working Group's vote and discussion, DOE agreed to redo the analysis using R–407A going forward. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 34–39) For purposes of this proposal, DOE's analysis assumes the use of R–407A but a manufacturer would be permitted to use any acceptable refrigerant in its equipment to meet the proposed standard.

Changing the refrigerant used in the assumptions, however, required some changes to DOE's analysis due to the properties of R–407A. Both R–404A and R–407A are blends of refrigerants that have different boiling points. This means that unlike pure substances such as water, the temperature of the refrigerant changes as it boils or condenses, because one of the refrigerants in the blend, having a lower boiling point, boils off sooner than the other(s). This phenomenon is called ''glide.'' The refrigerants that make up R–404A have nearly identical boiling points. For simplicity, the analysis assumed that R–404 remains at the same temperature as it undergoes a phase change (that is, it would not experience glide). In contrast, R–407A undergoes a much more significant temperature change when it boils—the temperature can rise as much as 8 degrees between the saturated liquid condition (the temperature at which a liquid begins to boil, also called the ''bubble point'') and the saturated vapor condition (the temperature at which a vapor begins to condense, also called the ''dew point''). The average of these two temperatures, bubble point and dew point, is called the mid-point temperature. DOE revised its analysis to account for the glide of R–407A, as discussed in the following sections.

2. As-Tested Versus Field-Representative Performance Analysis

DOE's engineering analysis is based on energy consumption characteristics as measured using the applicable DOE test procedure. The purpose is to replicate the manufacturer's rating so that the costs incurred for manufacturers to produce systems that meet the standard are accurately reflected. The engineering analysis outputs are generally also used as inputs to the downstream analyses such as the energy use, LCC, and NIA (which assess the economic benefits of energy savings of installed equipment), since energy use in the test is intended to reflect field energy use. However, for a number of reasons discussed during the negotiations, but primarily because of the switch in refrigerant from R–404A to R–407A described in the previous section, there are differences between as-tested performance and field performance (*i.e.* the performance that would be expected from a field-installed system). The field-installed system performance could not be captured sufficiently in the energy use analysis, so 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 engineering and other analyses. Specific differences in how DOE modeled as-tested and in-field performance in the analysis are discussed as part of section IV.C.5 and further in chapter 5 of the TSD.

Normally, when a test procedure becomes inadequate to capture representative equipment performance, DOE initiates a rulemaking to revise the test procedure. A revision of this magnitude fell outside the scope of the negotiated rulemaking. DOE has tentatively concluded that implementation of all the necessary test procedure changes is sufficiently complex that it would be prudent to work with the industry standard development groups that developed the original AHRI standard that DOE incorporated by reference into the WICF test procedure. The contemplation of such future changes does not implicate this standards rulemaking, however, because the standards set forth in this proposal are based on a limited group of refrigeration systems and rely on the modifications to the test procedure that DOE has already proposed to make. The fireld-representative analysis further ensures that the proposed test procedures adequately capture the impacts of the standard for the relevant equipment classes. Accordingly, the proposed standards would not have been affected by the incorporation of these additional test procedure changes. Furthermore, the contemplated future changes to the test procedure would affect the standards for medium temperature, dedicated condensing systems, which were not vacated by the litigation and are not at issue in this standards rulemaking. Therefore, DOE is not proposing to revise the test procedure within the context of this rulemaking (except as proposed in section III.A), but reserves the right to update the test procedure in a future rulemaking.

Although DOE is allowing manufacturers to rate and certify unit coolers and condensing units separately, as described in section IV.A.1, and has structured its revised analysis based on this separate-component rating approach, these components will ultimately be installed as part of complete refrigeration systems, and the field-representative analysis reflects this fact. Some installations involve new systems consisting of two new components (a new condensing unit and a new unit cooler). The efficiency of these systems will reflect the design options included in both components. Other installations will involve replacing just the condensing unit or just the unit cooler. The efficiency of these systems will reflect the design options included in the new component only; DOE assumed for purposes of this analysis that the existing component would be at the baseline efficiency level.

Ultimately, DOE provided outputs from the field-representative analysis outputs to the downstream analysis for four scenarios: (1) New unit cooler and new condensing unit that are installed together in the field; (2) new unit cooler that is installed with a multiplex system; (3) new unit cooler that is installed with an existing condensing unit in the field; and (4) new condensing unit that is installed with an existing unit cooler in the field. Scenarios 1 through 3 apply to the evaluation of unit cooler efficiency levels, while scenarios 1 and 4 apply to evaluation of condensing unit efficiency levels. The scenarios analyzed in the downstream analysis are described in section IV.F. DOE evaluated equipment classes of tested unit coolers and condensing units in each of the relevant scenarios. (In the case of the medium temperature unit cooler class, DOE modeled the first scenario as a new unit cooler paired with a dedicated condensing unit meeting the standard for dedicated condensing, medium temperature systems established in the June 2014 final rule, which remains in effect.) During the November 20, 2015 public meeting, DOE presented a diagram mapping the tested classes to the field-representative scenarios. (Docket No. EERE–2015–BT–STD–0016, No. 0041 at p. 17) Details of these four scenarios are also provided in chapter 5 of the TSD.

3. Representative Equipment for Analysis

In the analysis for the June 2014 final rule, DOE analyzed a range of representative WICF refrigeration systems within each equipment class. The representative systems covered different capacities, compressor types, and evaporator fin spacing. In all, DOE analyzed 47 different representative refrigeration systems across all 10 equipment classes. See the June 2014 final rule TSD, chapter 5, pages 5–4 through 5–6 (Docket No. EERE–2008–BT–STD–0015, No. 0031) and 79 FR 32050 at 32073. DOE made several changes to the set of representative systems it analyzed for this proposal.

First, as discussed in section IV.C.1, DOE conducted its analysis for this proposed rule based on the assumption that refrigerant R–407A would be used by walk-in refrigeration system manufacturers. In its prior analysis, not all of the compressor types analyzed in the June 2014 final rule were designed to be compatible with this refrigerant. In the Working Group meeting held on September 11, 2015, National Coil Company, a meeting attendee, pointed out that low-temperature hermetic compressors are not likely to be developed for use with R–407A, and Lennox suggested analyzing scroll compressors for the low-capacity classes that could have used hermetic compressors using R–404A. Emerson, a Working Group member and major compressor manufacturer, agreed with the approach. (Docket No. EERE–2015–BT–STD–0016, National Coil Company, Lennox, and Emerson, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 29–30) A caucus of manufacturers later submitted a document to the docket recommending specific WICF equipment capacity ranges for different types of low-temperature R–407A compressors that DOE should consider in its analysis: 5,000 to 60,000 Btu/h for scroll compressors and 15,000 to 120,000 Btu/h for semi-hermetic compressors. (Docket No. EERE–2015–BT–STD–0016, No. 0008 at p. 25)

Second, the Working Group recognized that DOE's analysis would require additional capacity levels beyond those that had already been considered in the June 2014 final rule. As part of that rule's analysis, DOE analyzed low-temperature, dedicated condensing refrigeration systems with nominal capacities of 6,000, 9,000, 54,000, and 72,000 Btu/h. 79 FR at 32073. During the Working Group meetings, a caucus of manufacturers suggested that DOE consider analyzing low-temperature dedicated condensing systems with nominal capacities of 15,000 Btu/h and 25,000 Btu/h. (Docket No. EERE–2015–BT–STD–0016, No. 0008 at p. 25; see also Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 30, 2015), No. 0067 at p.175) Following this recommendation, DOE analyzed low-temperature dedicated condensing systems at 25,000 Btu/h and considered adding a representative size of 15,000 Btu/h if the initial results indicated that an additional capacity size was required to better model the performance of low-temperature dedicated condensing systems. Ultimately, efficiency trends across capacities suggested that the 25,000 Btu/h point was adequate to represent the intermediate capacity range given the similarity to the AWEF range covered by the 9,000 Btu/h, 25,000 Btu/h, and 54,000 Btu/h. This trend is shown in a graph. See EERE–2015–BT–STD–0016–0051 (presenting a spreadsheet containing a ''pivot awefs'' tab showing efficiency trends across capacities for dedicated condensing systems). Thus, because of the sufficiency of the 25,000 Btu/h at representing the intermediate capacity range for these systems, a full analysis of a 15,000 Btu/h dedicated condensing system was unnecessary for the purposes of this proposal.

Third, in the June 2014 final rule, DOE analyzed representative unit coolers at two different configurations of evaporator fin spacing, 4 fins per inch and 6 fins per inch. (Unit cooler heat exchangers use a fin-tube design, meaning that refrigerant is circulated through copper tubes with aluminum strips, or ''fins'' attached to the tubes to facilitate heat transfer to the air passing through the heat exchanger.) See June 2014 final rule TSD, chapter 5, pages 5–6 (Docket No. EERE–2008–BT–STD–0015, No. 0131). In the September 11, 2015, Working Group meeting, DOE sought feedback on the need to analyze both fin configurations for both medium- and low-temperature unit coolers. Rheem commented that an analysis based on configurations with 4 fins per inch for low-temperature and 6 fins per inch for medium-temperature applications would be appropriate. In their view, these fin configurations would adequately represent these systems. (Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 11, 2015), No. 0061 at p. 109) On the basis of this input, DOE reiterated its plans to conduct the analysis using six fins per inch for medium temperature unit coolers and 4 fins per inch for low-temperature unit coolers. The Working Group raised no objections to this approach. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 183–184)

Table IV–1 identifies, for each class of refrigeration system, the nominal capacities of the equipment DOE analyzed in the engineering analysis for this proposed rule. Chapter 5 of the TSD includes additional details on the representative equipment sizes and classes used in the analysis.

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, Semihermetic	N/A
	54,000	Semihermetic	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, Semihermetic	N/A
	54,000	Semihermetic	N/A
	72,000	Semihermetic	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.

4. Cost Assessment Methodology

a. Teardown Analysis

In support of the June 2014 final rule, DOE conducted a teardown analysis to calculate manufacturing costs of WICF components. The teardown analysis consisted of disassembling WICF equipment; characterizing each subcomponent based on weight, dimensions, material, quantity, and manufacturing process; and compiling a bill of materials incorporating all materials, components, and fasteners to determine the overall manufacturing cost. DOE supplemented this process with ''virtual teardowns,'' in which it used data from manufacturer catalogs to extrapolate cost assumptions to other equipment that DOE did not physically disassemble. 79 FR at 32077. For the analysis supporting this proposed rule, DOE conducted additional physical and virtual teardowns of WICF equipment to ensure that its cost model was representative of the current market.

b. Cost Model

The cost model is one of the analytical tools DOE used in constructing cost-efficiency curves. In developing this model, DOE derives cost model curves from the teardown BOMs and the raw material and purchased parts databases. Cost model results are based on material prices, conversion processes used by manufacturers, labor rates, and overhead factors such as depreciation and utilities. For purchased parts, the cost model considers the purchasing volumes and adjusts prices accordingly. The manufacturers of WICF components (*i.e.* OEMs), convert raw materials into parts for assembly, and also purchase parts that arrive as finished ''ready-to-assemble'' goods. DOE bases most raw material prices on past manufacturer quotes that have been adjusted to present day prices using Bureau of Labor Statistics (''BLS'') and American Metal Market (''AMM'') inflators. DOE inflates the costs of purchased parts similarly and also considers the purchasing volume—the higher the purchasing volume, the lower the price. Prices of all purchased parts and non-metal raw materials are based on the most current prices available, while raw metals are priced on the basis of a 5-year average to smooth out volatility in raw material prices. In calculating the costs for this proposal, DOE updated its cost data to reflect the most recent 5-year price average.

DOE uses the cost model to analyze the MPC impacts of certain design options that affect the size of equipment components and casings. For instance, a design option that increases the volume of a condenser coil will incur material costs for the increase in condenser coil materials, and will incur further material costs for the increase in unit case size and condenser fan size that are required to accommodate the larger coil. To calculate costs for this proposed rule, DOE revised its assumptions about how some design options would impact the growth of a unit's case and components. DOE updated the cost data to account for the cost impacts from changes to the unit components and casing for certain design options. Chapter 5 of the TSD describes DOE's cost model and definitions, assumptions, data sources, and estimates.

c. Manufacturing Production Cost

Once it finalizes the cost estimates for all the components in each teardown unit, DOE totals the cost of the materials, labor, and direct overhead used to manufacture the unit to calculate the manufacturer production cost of such equipment. DOE then breaks the total cost of the equipment into two main costs: (1) The full manufacturer production cost, referred to as MPC; and (2) the non-production cost, which includes selling, general, and administration (''SG&A'') costs; the cost of research and development; and interest from borrowing for operations or capital expenditures. DOE estimated the MPC at each design level considered for each equipment class, from the baseline through max-tech. After incorporating all of the data into the cost model, DOE calculated the percentages attributable to each element of total production cost (*i.e.,* materials, labor, depreciation, and overhead). These percentages were used to validate the data by comparing them to manufacturers' actual financial data published in annual reports, along with feedback obtained from manufacturers during interviews. DOE uses these production cost percentages in the MIA. See section IV.J.3.a for more details on the production costs.

d. Manufacturing Markup

The manufacturer markup converts MPC to manufacturer selling price (''MSP''). DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission 10–K reports filed by publicly-traded manufacturers primarily engaged in commercial refrigeration manufacturing and whose combined equipment range includes WICF refrigeration systems. In the June 2014 final rule, DOE calculated an average markup of 35 percent for WICF refrigeration systems. 79 FR at 32079. In the absence of any adverse comments made during the Working Group meetings, DOE applied the same manufacturer markup in its supporting analysis for this proposal.

e. Shipping Cost

For the June 2014 final rule, DOE developed estimates of shipping rates by conducting market research on shipping rates and by interviewing manufacturers of the covered equipment. DOE found that most manufacturers, when ordering component equipment for installation in their particular manufactured equipment, do not pay separately for shipping costs; rather, it is included in the selling price of the equipment. However, when manufacturers include the shipping costs in the equipment selling price, they typically do not mark up the shipping costs for profit, but instead include the full cost of shipping as part of the price quote. 79 FR at 32079. DOE did not significantly change its methodology for calculating shipping costs in this proposed rule. See chapter 5 of the TSD for more details on the shipping costs.

DOE seeks comment regarding the method it used for estimating the manufacturing costs related to the equipment discussed in this proposal. This is identified as Issue 1 in section VII.E, ''Issues on Which DOE Seeks Comment.''

5. Component and System Efficiency Model

At each representative capacity within each equipment class covered in this rulemaking (see section IV.C.3), DOE selected a particular model of unit cooler or condensing unit, as applicable, to represent the capacity. DOE then used a spreadsheet-based efficiency model to predict the efficiency of each representative unit as tested by the test procedure, similar to the method used in the June 2014 final rule. Generally, the efficiency is calculated as the annual box load—a function of the capacity of the unit—divided by the power consumed by the unit. The power consumption accounts for the power used by, as applicable, the compressor, condenser and evaporator fans, defrost, and/or other energy-using components. For dedicated systems with the condensing unit located outdoors, the box load is dependent on a distribution of outdoor ambient temperatures specified by the test procedure.

In the June 2014 final rule, DOE analyzed two types of systems: Dedicated condensing systems consisting of a manufacturer-paired unit cooler and condensing unit; and systems consisting of a unit cooler paired with a multiplex condenser. However, the focus of the analysis for this proposed rule was on performance of either the condensing unit or unit cooler as tested, rather than a matched pair, since the revised engineering analysis is based on the rating of these components. As discussed in section IV.C.2, DOE also conducted a field representative analysis to evaluate the behavior of systems as installed to develop inputs to the downstream analyses. The following sections describe changes to DOE's analysis as compared with the June 2014 final rule analysis, describing changes associated both with the as-tested engineering analysis and the field-representative analysis. More information on the efficiency analysis can be found in chapter 5 of the TSD.

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

DOE continued to evaluate unit coolers in a manner similar to the June 2014 final rule analysis. That analysis, consistent with the DOE test procedure, examined the performance of unit coolers connected to a multiplex condensing system using AWEF—*i.e.* the ratio of the box load of the walk-in divided by the energy use attributed to the system. (Box load is a factor of the net capacity.) Also per the test procedure, the energy use is the sum of the energy consumed directly by the unit cooler, primarily by the fans (and defrost energy for low-temperature units), and the energy attributed to the multiplex condensing system (compressors, condensers, etc.), calculated by dividing the gross capacity of the unit cooler by an assumed multiplex system EER. However, DOE's updated analysis made changes to some aspects of the calculation.

First, DOE recognizes that the as-tested performance of unit coolers may differ from field-representative performance, a difference due primarily (though not solely) to the change in refrigerant from R–404A to R–407A. As discussed in section IV.C.1, R–407A experiences a significant change in temperature (''glide'') as it evaporates or condenses, while R–404 does not. In typical evaporators, R–407A experiences a glide of approximately 6 degrees from the evaporator entrance to the saturated vapor (dew point) condition. (Although the total glide of R–407A is approximately 8 degrees between bubble point and dew point, refrigerant entering the evaporator is already partially evaporated and is thus at a slightly higher temperature than the true bubble point). The test procedure specifies the evaporator dew point temperature that must be used during a test, and DOE continued to use this dew point temperature for unit coolers using R–407A in the as-tested analysis. In the field-representative analysis, however, DOE shifted the dew point to maintain equivalence of heat transfer of R–404A and R–407A: That is, the heat exchanger should operate with the same average refrigerant temperature in the two-phase region for both refrigerants. Because of the glide of R–407A, an average temperature consistent with R–404A would result in a dew point temperature that is 3 degrees higher than the dew point of a unit cooler using R–404A—that is, half of the 6-degree glide. Likewise, DOE also reduced the superheat (*i.e.* the excess of temperature of a vapor above its dew point) in the field-representative case by 3 degrees so that the exit temperature of the refrigerant from the evaporator is consistent with the as-tested case, where the superheat is specified. (See October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at pp. 20–22.)

Second, DOE adjusted its calculation to measure the net capacity for unit coolers. The June 2014 final rule analysis calculated the net capacity as the refrigerant mass flow multiplied by the rise in refrigerant enthalpy between the inlet and outlet of the unit cooler, minus the fan heat. DOE determined the mass flow rate by choosing for its analysis a compressor with a capacity close to that of the manufacturer-reported capacity of the unit cooler when measured at the test procedure's conditions. However, National Coil Company noted that once the inlet and outlet refrigerant conditions are defined, the compressor does not affect the capacity. It suggested that DOE avoid using a calculation methodology that relies on compressor characteristics. (Docket No. EERE–2015–BT–STD–0016, National Coil Company, Public Meeting Transcript (September 11, 2015), No. 0061 at p. 115) DOE also conducted additional testing, which indicated that the unit coolers' measured capacities are lower than the nominal capacities reported in manufacturer literature. These results suggested that using a unit cooler's nominal capacity would overestimate both capacity and efficiency measured in the test. (September 11, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0003 at p. 40) Rheem suggested that this discrepancy may be due in part to the different test conditions used during testing versus those used when determining the nominal capacity of a unit cooler. (Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 116–117) For the current analysis, DOE used performance modeling of WICF evaporator coils, calibrated based on testing data, to develop an equation relating manufacturer-reported nominal capacity to the net capacity that would be measured during unit cooler testing (as DOE is assuming all unit coolers will be rated using the multiplex system test as discussed in section IV.C.2). (September 30, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0007 at pp. 55 and 57) The tests were conducted using R–404A, but DOE used the performance modeling to predict the capacity trend for unit coolers using R–407A refrigerant, since this was the refrigerant used in the engineering analysis, as discussed in section IV.C.1. (See the October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at pp. 24, 26, and 28) DOE also developed different equations for the as-tested analysis and for the field-representative results, where the field-representative calculations account for the 3-degree shift in dew point and reduction in superheat discussed in the previous paragraph. DOE used this approach for determining unit cooler measured capacity in the subsequent analysis, with agreement from Working Group members. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 205–209)

Third, DOE revised the input assumption for refrigerant suction dew point temperature (*i.e.,* dew point temperature of the refrigerant at the entrance to the condensing unit—which is typically lower than the refrigerant dew point at the unit cooler exit due to pressure drop in the refrigerant line connecting the unit cooler and condensing unit). The suction dew point temperature is used in the engineering analysis calculations to determine the appropriate multiplex system EER values as specified in the test procedure. In the June 2014 final rule analysis, DOE used EER values corresponding to a suction dew point temperature of 19 °F for medium temperature systems and −26 °F for low-temperature systems. For the revised analysis, DOE used 23 °F for medium-temperature systems and −22 °F for low-temperature systems, both of which have higher corresponding EER levels. DOE's initial use of the lower temperatures was based on a conservative interpretation of the open-ended nature of the AHRI 1250–2009 test procedure, which is incorporated by reference in DOE's test procedure. The suction dew point temperatures used in the current analysis are now two degrees lower than the evaporator exit dew point temperature used in the test. (See September 11, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0003 at p. 39) The Working Group generally agreed with this approach and applying that 2-degree dew point reduction to account for pressure drop in the suction line. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 11, 2015), No. 0061 at p. 113)

Fourth, DOE used a different set of EER values in its field-representative analysis of unit coolers connected to multiplex condensing systems. The Working Group observed that the EER values used in the test procedure are likely based on R–404A, while, as discussed in this preamble, DOE's updated analysis to represent field performance was based on the use of R–407A. Members of the Working Group representing a caucus of manufacturers submitted EER values that they asserted would be more representative of a multiplex condensing system operating in the field, since the new values were based on the use of R–407A. (Docket No. EERE–2015–BT–STD–0016, No. 0009) DOE observed that the Working Group-recommended values were significantly lower than the test procedure values, which cannot be explained by the difference in refrigerants. The Working Group did not object to the use of the submitted EER values. Accordingly, DOE used these new EER values in the field-representative analysis for unit coolers (while continuing to use EER values from the test procedure in the as-tested analysis). (Docket No. EERE–2015–BT–STD–0016, Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 194–198; See also the October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 19)

b. Condensing Units/Dedicated Condensing Class

DOE made several changes to the way it analyzed dedicated condensing refrigeration systems. In the June 2014 final rule, DOE analyzed systems consisting of a paired unit cooler and condensing unit to represent the dedicated condensing class. In contrast, as described in sections III.A, IV.A.1, and IV.C.2, DOE based its analysis for this proposed rule on testing and rating condensing units as individual components rather than as part of matched-pair systems in order to evaluate efficiency levels for the dedicated condensing equipment classes. The as-tested analysis uses the nominal values for unit cooler fan and defrost energy use as prescribed in the DOE test procedure. (10 CFR 431.304(c)(12))

As in the June 2014 final rule analysis, DOE calculated compressor performance using the standard 10-coefficient compressor model described in section 6.4 of AHRI Standard 540–2004 (AHRI 540), ''Performance Rating of Positive Displacement Refrigerant Compressors and Compressor Units.'' See the June 2014 final rule TSD, chapter 5, pp. 5–22 (Docket No. EERE–2008–BT–STD–0015, No. 0131) However, in the updated analysis, DOE used compressor coefficients for compressors operating with R–407A to be consistent with the approach discussed in section IV.C.1. (See the October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 18.) Also, DOE used a return gas temperature of 5 degrees F in generating the coefficients using the software, suggested as the appropriate temperature for a low-temperature system by a caucus of manufacturers. (Docket No. EERE–2015–BT–STD–0016, No. 0008 at p. 26)

The change to refrigerant R–407A also affected the condensing temperature in the analysis. As discussed in section IV.C.1, R–407A experiences approximately 8 degrees of glide, or temperature change, as it condenses. A caucus of manufacturers submitted information on R–407A glide and requested that DOE increase the assumed condenser dew-point temperatures by 4 °F to maintain a midpoint temperature consistent with that of the analysis done with R–404A. (Docket No. EERE–2015–BT–STD–0016, No. 0008 at pp. 4–9) The midpoint temperature is representative of the average refrigerant temperature in the condenser heat exchanger. After considering the merits of the argument, DOE implemented this change in the analysis going forward. This change is similar to the shift in dew point on the evaporator side described in section IV.C.5.a, but is applied in the as-tested analysis as well as the field-representative analysis for condensing units. This is because the test procedure specifies the outdoor air temperature rather than the condensing temperature for tests of condensing units, unlike for unit coolers, for which the test procedure specifies the evaporating temperature. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 23–24 and Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 184–187) (See also October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at pp. 19–20)

In the June 2014 final rule, DOE used the saturated vapor temperature at the evaporator exit to derive the compressor power and mass flow from the 10-coefficient equation described in this preamble. For the analysis supporting this proposed rule, DOE instead used the suction dew point in the compressor coefficient equations. (See October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 29) As described in section IV.C.5.a, the suction dew point is 2 degrees lower than the dew point at the evaporator exit; this approach is consistent with DOE's selection of suction dew point for choosing the appropriate EER for multiplex systems.

Also in the June 2014 final rule, DOE assumed that the refrigerant entering the unit cooler would be a subcooled liquid (that is, its temperature would be lower than the saturated liquid temperature in the condenser, primarily due to exposure of the refrigerant line to lower ambient temperatures). Rheem suggested that this would be inappropriate for a condenser-only test because there would be two phases of refrigerant in the receiver, and without a separate subcooler within the condensing unit, the refrigerant would not experience subcooling significantly greater than zero at the condenser exit. DOE assumed liquid line subcooling would occur after the condenser exit and thus would not be captured in the condenser-only test. (Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 131–133) DOE revised its analysis to assume 0 degrees of additional sub-cooling in the condensing unit for baseline systems. (See October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 30)

As described in section IV.C.3, one of the analyzed capacities of condensing unit—25,000 Btu/h nominal capacity—could be sold with two compressor types, scroll or semi-hermetic. The June 2014 final rule efficiency model also analyzed multiple compressor types at certain representative sizes. In that analysis, DOE developed a separate cost-efficiency curve for each different compressor type. The life-cycle cost analysis then aggregated both curves into one set of efficiency levels, and selected points among the aggregated efficiency levels defining a new ''cost-effective'' curve where, when faced with a choice between two compressors, the manufacturer would choose the less expensive design among the options at the same efficiency level. DOE indicated in the Working Group meeting on September 30, 2015 that for the revised analysis, a single cost-efficiency curve would be developed for each representative condensing unit capacity, but that DOE was considering whether compressor type should be considered as a design option or whether DOE should aggregate the efficiency curves for the two compressors into a single curve. In the same meeting, ASAP suggested that it would be appropriate to consider higher-efficiency compressors as a design option, but Rheem raised concerns that this could restrict them to using only one compressor or one compressor manufacturer's offering. (Docket No. EERE–2015–BT–STD–0016, ASAP, Public Meeting Transcript (September 30, 2015), No. 0067 at p. 181–182; Docket No. EERE–2015–BT–STD–0016, Rheem, Public Meeting Transcript (September 30, 2015), No. 0067 at p. 182–183) As presented in the November 3, 2015 public meeting, DOE ultimately revised its approach to create a single aggregated cost-efficiency curve in the engineering analysis for the 25,000 Btu/h nominal capacity, thus aggregating results developed separately for the scroll and semi-hermetic compressors. Consequently, DOE did not consider compressor type as a design option. (Docket No. EERE–2015–BT–STD–0015, various parties, Public Meeting Transcript (November 3, 2015), No. 0064 at pp. 75–80 and the November 3, 2015 Public Meeting Presentation, available in Docket No. EERE–2015–BT–STD–0016, No. 0033 at pp. 29–32) See chapter 5 of the TSD for more details of how DOE aggregated the cost-efficiency curves for the compressor types.

c. Field-Representative Paired Dedicated Condensing Systems

DOE based its ''as-tested'' engineering analysis for dedicated condensing systems on an evaluation of condensing units tested individually. DOE recognizes that this approach is an approximation of actual in-field performance, in large part because each condensing unit will ultimately be paired with a given unit cooler in the field. Furthermore, certain conditions specified in the test procedure are contingent upon the use of a refrigerant that does not experience significant glide, and systems using R–407A, a refrigerant that does experience glide, would behave differently under such conditions than systems using a non-glide refrigerant. To account for the potential calculated differences between as-tested versus in-field performance, DOE conducted a separate field-representative analysis that accounts for actual system operation, which necessarily includes the performance of both the condensing unit and the unit cooler with which it is paired. This field-representative analysis includes a number of key elements.

First, although refrigerant subcooling at the exit of a condensing unit tested alone would be zero degrees as discussed in section IV.C.5.b, during field operation of a system, subcooling between the condenser exit and unit cooler entrance may occur due to exposure of the refrigerant line to ambient air with a temperature lower than the refrigerant. DOE's June 2014 final rule analysis of paired systems assumed that subcooling at the unit cooler inlet would be 12 °F, based on test data for paired systems—DOE presented these data during the negotiated rulemaking. (Docket No. EERE–2015–BT–STD–0016, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 133–135 and September 30, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0007 at p. 23) However, the test data were based on systems using R–404A and DOE reasoned that the glide from R–407A could result in a lower refrigerant temperature at the condenser exit (4 degrees) than for R–404A, assuming the same mid-point temperature is used. (See the discussion regarding glide and maintaining the same average refrigerant temperature for different refrigerants, described in the previous two sections, for further details.) Thus, DOE assumed a subcooling temperature of 8 degrees in the field-representative analysis—4 degrees lower than the 12 degrees attributed to operation with R–404A. In effect, the analysis assumes that the final liquid temperature would be the same for both refrigerants. DOE also checked to make sure that this final liquid refrigerant temperature was not lower than the ambient temperature. The Working Group did not object to this approach and DOE continued to use it in preparing this proposal. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 213–214; October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 30.

Second, DOE assumed a unit cooler exit dew point for the field-representative analysis that is 3 degrees higher than the exit dew point temperature specified in the test procedure. This is similar to the adjustment made for condensing units, described in the previous paragraphs. To account for the 6 degrees of glide within an evaporator using R–407A and maintain the same average refrigerant temperature as the equivalent R–404A analysis, the exit dew point must be 3 degrees higher that the prescribed test procedure temperature. DOE also adjusted the evaporator exit superheat to maintain a refrigerant temperature at the unit cooler exit that would be consistent with the equivalent R–404A analysis. In the as-tested analysis, the evaporator superheat was assumed to be 6 °F for low temperature systems and 10 °F in medium temperature systems; in the field representative analysis, DOE reduced both of these by 3 degrees to account for the 3-degree increase in evaporator dew point temperature. (October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 22) Similar to the as-tested analysis, DOE continued to use a 2-degree reduction in dew point temperature between the evaporator exit and condensing unit entrance to represent suction line pressure drop in the field-representative analysis. (October 15, 2015 Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 29)

Third, the as-tested analysis of a dedicated condensing system (*i.e.* a condensing unit tested alone) uses nominal values for the unit cooler fan and defrost power, as required by the test procedure. See 10 CFR 431.304(c)(12)(ii). During the Working Group meetings, manufacturers provided data on representative unit cooler fan and defrost power. (Docket No. EERE–2015–BT–STD–0016, No. 0011). As presented in the October 15, 2015 public meeting, DOE used these data to estimate unit cooler fan and defrost power for a field-matched system since the manufacturer-supplied data would be, when compared to other available data, the most likely dataset to be reasonably representative of installed system performance. (Docket No. EERE–2015–BT–STD–0016, No. 0026 at p. 40 and Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 227–228) DOE did not receive any adverse comments and proceeded with this approach in the analysis for this proposed rule.

6. Baseline Specifications

Because there have not been any previous performance-based standards for 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.C.3, by examining current manufacturer literature to determine which characteristics represented baseline equipment versus high-efficiency equipment. DOE conducted additional testing and teardowns to supplement the data used in the June 2014 final rule analysis and identify characteristics not listed in manufacturer literature. DOE assumed that all baseline refrigeration systems comply with the current prescriptive standards in EPCA—namely, (1) evaporator fan motors of under 1 horsepower and less than 460 volts are electronically commutated motors (brushless direct current motors) or three-phase motors and (2) walk-in condenser fan motors of under 1 horsepower are permanent split capacitor motors, electronically commutated motors, or three-phase motors. (See section II.B for further details on current WICF standards.)

During the negotiations, Working Group members observed that DOE's baseline energy consumption values did not seem to account for some equipment features, such as controls, that may be included on the equipment and would use energy during a test. DOE's test procedure for WICFs incorporates by reference the industry standard AHRI 1250–2009 in its entirety, with certain exceptions as outlined in 10 CFR 431.304. (See 10 CFR 431.303, which incorporates this industry standard by reference.) One provision in section 5.1 of this industry standard requires that the power input measured during the test should include power used by accessories such as condenser fans, controls, and similar accessories. Members of the Working Group requested that DOE either revise its test procedure to introduce an exception to the industry standard modifying the provision so as not to measure these loads during a test, or to account for power used by these accessories in the analysis. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 51–56; See also Docket No. EERE–2015–BT–STD–0016, No. 0006 at p. 1, recommendation #4.) DOE requested, and Working Group members then provided, additional data regarding auxiliary power-using equipment features, fan and defrost power, and condenser coil sizing for baseline refrigeration systems. (Docket No. EERE–2015–BT–STD–0016, Nos. 0010, 0011, and 0030, respectively.) In lieu of introducing a modification to the test procedure, DOE considered this information in formulating baseline specifications in this NOPR analysis. See chapter 5 of the TSD for more detailed baseline specifications for the representative systems.

7. Design Options

Section IV.B.4 lists technologies that passed the screening analysis and that DOE examined further as potential design options. DOE updated the analysis for several of these design options based on information received during the Working Group meetings. The following sections address design options for which DOE received new information or conducted additional analysis during the negotiation period. All design options are discussed in more detail in chapter 5 of the TSD.

a. Higher Efficiency Compressors

In the analysis for the June 2014 final rule, DOE considered a design option for a high-efficiency compressor designed to run at multiple discrete capacities or variable capacity. During the Working Group meetings, members noted that a provision in section 7.8.1 of AHRI 1250–2009, the industry test procedure incorporated by reference, specifies that the method for testing a condensing unit alone (*i.e.* not as part of a matched pair) applies only to single-capacity WICF refrigeration systems. (See 10 CFR 431.303, which incorporates this industry standard by reference; see also Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (September 11, 2015), No. 0061 at pp. 87–94 and Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 157–167).

As discussed in section IV.C.2, most condensing units are sold separately by OEMs and would be rated separately, rather than rated with specified unit coolers as matched pair systems. DOE's analysis for dedicated condensing unit standards has been updated to reflect the concerns noted by the Working Group by being based on the testing and rating of condensing units alone rather than as part of matched pairs. While the analysis reflects this change, the current test procedure does not allow testing of variable-capacity systems using the condenser-alone rating method. Adopting standards that would require use of a variable-capacity compressor would force manufacturers to rate and sell units as matched pairs, a result that, in DOE's view, may create an excessive burden on manufacturers and the related distribution system, since it would restrict the option of selling individual components and because the numbers of possible matched pair systems would be much greater than the number of individual condensing units and unit coolers (for example, if a manufacturer sells 5 condensing units and 5 unit coolers that could all be paired with each other, there are 25 possible matched-pair combinations as compared with 10 individual units). Therefore, DOE did not analyze variable-capacity compressors. This approach does not preclude manufacturers from designing and selling systems with variable-capacity compressors but would require them to test and certify such systems as matched-pair systems—which would need to comply with the applicable energy conservation standards. DOE may consider this design option in a future rulemaking if the test procedure can be modified so that it properly addresses variable-capacity systems.

b. Improved Condenser Coil

In its supporting analysis for the June 2014 final rule, DOE considered a design option for an improved condenser coil. The improved condenser coil would have 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 degrees F, thus reducing the compressor power input, and increasing the compressor's cooling capacity. 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's revised analysis still includes this design option, but with modified details. During Working Group meetings, manufacturers said that DOE had underestimated the cost increase for a condenser coil with a 10-degree lower condensing temperature. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 56–60) DOE requested, and manufacturers then provided, data on specifications related to representative baseline and oversized coils. (Docket No. EERE–2015–BT–STD–0016, Lennox, No. 0030) DOE considered the data in updating the costs of this design option.

In subsequent meetings, some meeting attendees—namely, McHugh Energy, ASAP, and NEEA—were concerned about the high cost of improving the coil, relative to the savings that would be achieved. They noted that a TD reduction of 10 degrees may be too costly to be a realistic option, and requested that DOE further optimize condensing unit improvements in terms of both coil face area and air side heat transfer. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 3, 2015), No. 0064 at pp. 50–57 and Public Meeting Transcript (November 20, 2015), No. 0066 at pp 34–38; see also email correspondence at Docket No. EERE–2015–BT–STD–0016, No. 0040) Thus, 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, 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. (December 3, 2015 Public Meeting

Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0049 at pp. 8–11)

c. Improved Condenser and Evaporator Fan Blades

The supporting analysis for the June 2014 final rule considered design options for improved evaporator and condenser fan blades that could increase fan efficiency by five percent. See the June 2014 final rule TSD, chapter 5, pages 5–46 and 5–47 (Docket No. EERE–2008–BT–STD–0015, No. 0131). During Working Group negotiation meetings, a caucus of manufacturers submitted a document asking DOE to provide additional data supporting the efficiency improvement estimate. (Docket No. EERE–2015–BT–STD–0016, No. 0006 at p. 2, clarification question #2) A Working Group member representing a fan supplier (ebm-papst) responded that five percent was a reasonable estimate of fan efficiency improvement and that he had observed an example of a 12 percent efficiency improvement when replacing a stamped aluminum blade with an engineered plastic blade. (Docket No. EERE–2015–BT–STD–0016, ebm-papst, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 144–147) McHugh Energy, another negotiation meeting attendee, referenced a report by the Florida Solar Energy Center showing that it was possible to achieve fan efficiency improvements between 17 and 25 percent. (Docket No. EERE–2015–BT–STD–0016, McHugh Energy, Public Meeting Transcript (September 30, 2015), No. 0067 at pp. 147–148) Both stakeholders also submitted supporting material to the rulemaking docket (Docket No. EERE–2015–BT–STD–0016, No. 0013 and Docket No. EERE–2015–BT–STD–0016, No. 0014). Based on the updated information received, DOE's analysis continues to assume that an average five percent fan efficiency improvement can be achieved using higher-efficiency evaporator and condenser fan blades. In DOE's view, this level of improvement in fan efficiency is, based on available information reviewed as part of this rulemaking, achievable and reasonable. While it may be possible for higher efficiencies to be achieved, DOE is retaining a more conservative approach to ensure its projected efficiency improvements are realistically achievable within the lead-time proposed for this rule.

d. Off-Cycle Evaporator Fan Control

As with the June 2014 final rule, DOE continued to analyze two modes of off-cycle evaporator fan control: modulating fan control, which cycles the fans on and off with a 50 percent duty cycle when the compressor is off; and variable-speed fan control, which turns the fan speed down to 50 percent of full speed when the compressor is off. DOE did not receive any comments on its efficiency assumptions for modulating and variable-speed fans and DOE is not proposing to change its approach to calculating the efficiency of this option. DOE assumed that all evaporator fan motors are electronically commutated (''EC'') motors. See section II.B (discussing EPCA's requirements for EC or three-phase motors) and section IV.B (explaining DOE's reasoning for screening out three phase motors) for further background. DOE is aware that variable-speed EC motors typically cost more than single-speed EC motors. For purposes of this analysis, DOE assumed that the costs of constant-torque permanent-magnet motors are representative of single-speed EC evaporator fan motors and the costs of constant-airflow permanent-magnet motors are representative of variable-speed EC evaporator fan motors. (DOE also implemented these assumptions in its analysis of variable-speed EC condenser fan motors.) DOE is aware that motor suppliers may sell different brands of motors with similar capabilities. See chapter 5 of the TSD for more details on motor costs.

e. Floating Head Pressure

Floating head pressure is a type of WICF refrigeration control that allows the condensing pressure to decrease at low ambient temperatures, thus lowering the condensing temperature and improving compressor efficiency. Previously, in support of the June 2014 final rule, 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''). In testing conducted in support of this proposed rule, DOE found that systems with floating head pressure had a minimum head pressure of 180 psi at the lowest ambient rating temperature of 35 °F when using a TXV. DOE predicted that systems equipped with an EEV could maintain an even lower pressure because an EEV would be able to control the refrigerant flow at even larger pressure differences between the lowest and highest ambient temperatures and avoid instability. However, at the time, DOE's understanding was that the minimum condensing pressure and temperature is also limited by the compressor operating envelope. DOE assumed that for hermetic and semi-hermetic compressors, the lowest condensing dew point temperature at which the compressor can operate is approximately 75 °F, corresponding to a pressure of approximately 175 psi (for the June 2014 final rule's analysis, DOE increased this to a minimum of 180 psi to be consistent with the test results). For scroll compressors, DOE assumed the minimum condensing temperature is approximately 50 °F, corresponding to a pressure of approximately 120 psi (DOE increased this to a minimum of 125 psi for the final rule's analysis). DOE assumed this minimum pressure would apply at the lowest ambient rating condition—35 °F. DOE made these compressor operating envelope assumptions based on manufacturer compressor literature that it gathered at the time. See the June 2014 final rule TSD, chapter 5, pages 5–52 and 5–53 (Docket No. EERE–2008–BT–STD–0015, No. 0131).

In discussions with the Working Group, Emerson (a compressor manufacturer) suggested that semi-hermetic compressors that operate at lower pressures that are consistent with the floating head pressure with EEV option are currently available. (Docket No. EERE–2015–BT–STD–0016, Emerson, Public Meeting Transcript (December 3, 2015), No. 0057 at pp. 47–51) DOE conducted additional research and found technical literature from multiple compressor manufacturers showing semi-hermetic compressors using R–407A that could operate at condensing temperatures as low as 50 °F, corresponding to a vapor pressure of about 101 psi. (For R–404A, a condensing temperature of 50 °F corresponds to a vapor pressure of about 118 psi). In light of this updated information, DOE included both semi-hermetic and scroll compressors when evaluating the design option to improve energy efficiency with lower floating head pressure using an EEV. (As discussed in section IV.C.1, DOE did not analyze systems with hermetic compressors.)

DOE also more closely optimized the interaction among design options at the highest efficiency levels. Specifically, after DOE updated its design options and efficiency model, implementing the larger condenser coil caused AWEF to drop for large semi-hermetic units due to the interaction of floating head pressure, variable-speed condenser fans and the condenser coil option. This AWEF reduction was associated with operation of the condenser fans at excessive speed for the 35 °F test condition. To compensate, DOE increased the minimum head pressure from 125 psi to 135 psi at the lowest ambient temperature. (December 14

Public Meeting Presentation, Docket No. EERE–2015–BT–STD–0016, No. 0050 at pp. 4–6; see also Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (December 14, 2015), No. 0059 at pp. 9–20).

8. Cost-Efficiency Curves

After determining the cost and energy savings attributed to each design option, DOE then 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. The goal is to determine which designs a manufacturer is more or less likely to implement to meet a given standard level. For each representative unit listed in section IV.C.3, 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 order of the most 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. DOE conducted this analysis for the equipment classes evaluated in this proposal at the representative nominal capacities discussed in section IV.C.3.

Table IV–2 and Table IV–3 show the AWEFs calculated in this manner. Additional detail is provided in appendix 5A of the NOPR 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	1.81	1.87	2.19	2.20				
DC.L.I, ≥6,500 Btu/h	9,000	Scroll	DO		EC	CD2	CB2				
			AWEF	1.98	2.04	2.37	2.38				
	** 25,000	Scroll, Semi-hermetic	DO		EC	CD2	CB2				
			AWEF	1.92	1.96	2.30	2.30				
	54,000	Semi-hermetic	DO		EC	CD2	CB2				
			AWEF	2.25	2.31	2.57	2.58				
DC.L.O, <6,500 Btu/h	6,000	Scroll	DO		FHP	EC	CB2	FHPEV	CD2	VSCF	ASC
			AWEF	2.13	2.46	2.55	2.56	2.75	2.81	2.98	3.00
DC.L.O, ≥6,500 Btu/h	9,000	Scroll	DO		FHP	EC	FHPEV	CB2	CD2	VSCF	ASC
			AWEF	2.31	2.70	2.78	3.00	3.01	3.08	3.15	3.18
	* 25,000	Scroll, Semi-hermetic	DO		FHP	EC	FHPEV	CB2	VSCF	ASC	CD2
			AWEF	2.22	2.60	2.67	2.87	2.94	2.95	2.98	3.06
	54,000	Semi-hermetic	DO		FHP	FHPEV	EC	VSCF	ASC	CB2	CD2
			AWEF	2.51	2.82	2.97	3.05	3.14	3.17	3.17	3.19
	72,000	Semi-hermetic	DO		FHP	FHPEV	EC	VSCF	ASC	CB2	CD2
			AWEF	2.49	2.80	2.98	3.06	3.15	3.18	3.18	3.19

* 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.C.5.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

9. 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 in this preamble, 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 represent 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. DOE divided the dedicated condensing classes into the same two classes initially considered in the 2014 Final Rule, except that the current classes are split based on actual net capacity rather than the 9,000 Btu/h nominal capacity used previously. (This is based on a re-evaluation of the analysis in light of new data indicating that nominal capacity and net capacity may be very different for a given system.) For the medium-temperature and low-temperature unit cooler classes, where the initial analysis had a single class covering the entire capacity range, for some of the efficiency levels for this NOPR, DOE considered a class split based on actual net capacity. DOE adopted this approach because the current analysis shows significant variation of efficiency at the lower capacity levels (the selected proposal has two classes for low-temperature unit coolers and one for medium-temperature).

The maximum technologically feasible level is represented by EL 3 for all classes. DOE represented these efficiency levels by either a single AWEF or an equation for the AWEF as a function of the net capacity. The ELs 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/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:				
<21,800 Btu/h	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.

In two cases, DOE selected maximum-technology ELs whose AWEFs exceed the maximum AWEFs as calculated in the design-option engineering analysis (see Table IV–2) for one or more representative capacities. First, for low temperature unit coolers, the smaller representative capacities had lower maximum achievable AWEFs than the AWEF values obtained with the maximum technology (EL3) equation for this class. DOE notes that there is some uncertainty regarding the actual obtainable AWEFs for lower-capacity models of this class. The analysis is based on a ratio between actual capacity and nominal capacity that DOE developed based on testing and modeling of unit coolers that collectively suggest an increasing trend in the actual/nominal capacity ratio as nominal capacity increases (this analysis is described in section IV.C.5.a). However, there is some uncertainty in this analysis because of the limited number of tests for which data were available to DOE. If DOE had used a data regression approach assuming that the actual/nominal capacity ratio did not depend on capacity, the analyses for the 4,000 and 9,000 Btu/h nominal representative capacities would have shown that the selected maximum technology EL is achievable. Given the uncertainty in the analysis results and the fact that, during the December 15, 2015 Working Group negotiation meeting, the industry negotiating parties explicitly agreed to a standard level for small-capacity UC.L systems essentially equal to the selected maximum-technology level (EL3) for this class (see Docket No. EERE–2015–BT–STD–0016, AHRI, Public Meeting Transcript (December 15, 2015), No. 0060 at pp. 229–230), DOE believes that the selected EL 3 is technologically feasible.

Second, for dedicated refrigeration systems—low temperature, with a net capacity of ≥6,500 Btu/h, for both indoor and outdoor systems, the analysis for a system with a representative nominal capacity of 25,000 Btu/h indicates that the maximum achievable AWEFs are 2.30 for indoor systems and 3.06 for outdoor (see Table IV–2). These values are lower than the AWEF values obtained with the maximum technology (EL3) equation for this class. However, the AWEFs shown in Table IV–2 for 25,000 Btu/h nominal capacity units represent an aggregation of results developed separately for systems using either scroll or semi-hermetic compressors, which means that the listed AWEFs can be achieved by a system using either compressor type. The DOE analysis at this nominal capacity, when disaggregated by compressor type, shows that the AWEF values for EL 3 levels can be met at the 25,000 Btu/h nominal representative capacity with systems using semi-hermetic compressors (though not with systems using scroll compressors). Hence, DOE concludes that EL 3 is technologically feasible for these classes.

Although DOE observed a trend of AWEFs increasing with capacity across the representative units for the medium temperature unit cooler class, DOE is maintaining a single AWEF level for all sizes within that class due to the outcome of a sensitivity analysis that investigated efficiency trends of high capacity unit coolers. That sensitivity analysis, contained in appendix 5B of the TSD, showed that large unit coolers—*i.e.,* those with a capacity greater than approximately 60,000 Btu/h—tend to have disproportionately higher fan power (as a factor of net capacity) than the largest representative unit coolers DOE analyzed in this rulemaking. Particularly, DOE found that large-capacity medium-temperature unit coolers would most likely be unable to meet a higher standard (such as those exceeding EL 3) because their higher fan power per capacity would reduce their measured AWEF compared to the largest capacity unit analyzed (of 24,000 Btu/h nominal capacity). Larger unit coolers could be used with walk-in coolers of less than 3,000 square feet and thus are within the scope of this rulemaking. Consequently, based on the available information it reviewed and the corresponding analysis, DOE tentatively concludes that efficiency levels higher than EL 3 would not be technologically feasible for this class.

D. Markups Analysis

The markups analysis develops appropriate markups in the equipment 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 the equipment to cover business costs and profit margin.

For this NOPR, DOE retained the distribution channels that were used in the 2014 final rule—(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 [18] to estimate average baseline and incremental markups.

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

Because the identified market channels are complex and their characterization required a number of assumptions, DOE seeks input on its analysis of market channels described in this preamble. This is identified as Issue 2 in section VII.E, ''Issues on Which DOE Seeks Comment.''

E. 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 adoption of amended or new standards.

The estimates for the annual energy consumption of each analyzed representative refrigeration system (see section IV.C.2) 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.

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

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. 0068 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, and, in the case of outdoor equipment, variations in ambient temperature. 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. (Public Meeting October 1, 2015, 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, and, in the case of outdoor equipment, variations in ambient temperature.

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. 0068 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 NOPR analysis. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 0068 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 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 the NOPR analysis. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 1, 2015), No. 0068 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.

2. Net Capacity Adjustment Factors

As in the 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.

3. Temperature Adjustment Factors

As in the 2014 final rule, DOE assumed that indoor WICF refrigeration systems are operated at a steady-state ambient temperature of 90 °F. 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. 0068 at p. 23)

As in the 2014 final rule, DOE assumed that outdoor WICF refrigeration system run-times to be a function of external ambient temperature. 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. 0068 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. 0066 at pp. 111–119) After reviewing DOE's run-time estimates, the CA–IOUs, along with an individual participating in the Working Group meetings, confirmed the reasonableness of DOE's estimates. (Docket No. EERE–2015–BT–STD–0016, CA IOUs, Public Meeting Transcript (November 4, 2015), No. 0065 at p. 190)

Chapter 7 of the NOPR TSD provides details on DOE's energy use analysis for the considered WICF refrigeration systems covered by this analysis.

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for 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 stakeholders to develop its sample. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 3, 2015), No. 0064 at pp. 119–120) 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 MPCs, manufacturer markups, retailer and distributor markups, and sales taxes—and installation costs. Inputs to the calculation of operating expenses include annual energy consumption, energy prices and price projections, repair and maintenance costs, 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 air compressor 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 proposed standards. As discussed in section III.F, DOE currently anticipates a compliance date in the second half of 2019. Therefore, for purposes of its analysis, DOE used 2020 as the first full year of compliance with the standards for the WICF refrigeration systems under consideration in this proposal.

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 NOPR 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 MPCs by manufacturer and 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.
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: Marginal prices derived from EIA and EEI data.
Energy Price Trends	Based on *AEO 2015* price forecasts.
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 air compressors. Primary data source was the Damodaran Online.
Compliance Date	Late 2019 (2020 for purposes of analysis).

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

1. System Boundaries

As discussed in section IV.C.5, 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. 0029). These data stand in contrast to the 2014 Final Rule, where DOE assumed in its analysis that all equipment was sold as manufacturer-matched pairs. Further, in section III.A DOE discusses its May 2014 update of the test procedure specifying that in instances where a complete walk-in refrigeration system consists of a unit cooler and condensing unit that are both sourced from separate manufacturers, each manufacturer is responsible for ensuring the compliance of its respective units. 79 FR 27388 (May 13, 2014). 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,[19] condensing unit-only,[20] and unit cooler only.[21]

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 the condensing units are covered equipment under the 2014 final rule and fall outside the scope of this analysis. 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.

[19] Paired dedicated systems are described in section IV.C.5.c.

[20] Condensing units are described in section IV.C.5.b.

[21] Unit coolers are described in section IV.C.5.a.

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 2014 Final Rule. In the tables, 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.A, DOE established a rating method for walk-in refrigeration system components distributed individually; that is, unit coolers sold by themselves are tested and rated with the multiplex condensing system test, while condensing units sold by themselves 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 multiplex equipment classes. The low-temperature multiplex 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 multiplex 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.A.1). 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 in this preamble. The system boundaries and customer sample 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
UC.L	UC.L	4	UC-Only	0.8
UC.L	UC.L	9	UC-Only	3.0
UC.L	UC.L	18	UC-Only	2.0
UC.L	UC.L	40	UC-Only	0.7
UC.M	UC.M	4	UC-Only	1.4
UC.M	UC.M	9	UC-Only	7.9
UC.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.[22] These data, which represent the closest approximation to the refrigeration equipment at issue in this proposal, 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.

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

DOE requests comments on the most appropriate trend to use for real (inflation-adjusted) walk-in prices. This is identified as Issue 3 in section VII.E, ''Issues on Which DOE Seeks Comment.''

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* [23] 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. 0068 at p. 54; Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (October 15, 2015), No. 0062 at pp. 36–37, 49–50, 187)

However, the Working Group recommended that DOE remove the hot gas defrost from the test procedure (Docket No. EERE–2015–BT–STD–0016, Term Sheet: Recommendation #3 (December 15, 2015), No. 0056 at p. 2)

Consequently, DOE also removed hot gas defrost as a design option, as discussed in section VI.B.1.

DOE requests comment on whether any of the efficiency levels considered in this NOPR might lead to an increase in installation costs and, if so, data regarding the magnitude of the increased cost for each relevant efficiency level. This is identified as Issue 4 in section VII.E, ''Issues on Which DOE Seeks Comment.''

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. 0066 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. 0066 at pp. 92)

DOE requests comment on its assumption to not consider the impact of a rebound effect for the WICF refrigeration system classes covered in this NOPR. Further, DOE requests any data or sources of literature regarding the magnitude of the rebound effect for the covered WICF refrigeration equipment. This is identified as Issue 5 in section VII.E, ''Issues on Which DOE Seeks Comment.''

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

5. Energy Prices and Energy Price 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''),[24] EEI Typical Bills and Average Rates Reports,[25] and information from utility tariffs for each of 9 geographic U.S. Census Divisions.[26] 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. For the NOPR analysis DOE 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 NOPR 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 price in the Reference case from *AEO 2015,* which has an end year of 2040.[27] 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. 0062 at pp. 38, 53) Accordingly, DOE did not include these costs in its supporting analysis.

DOE requests comment on whether any of the efficiency levels considered in this NOPR might lead to an increase in maintenance and repair costs and, if so, data regarding the magnitude of the increased cost for each relevant efficiency level. This is identified as Issue 6 in section VII.E, ''Issues on Which DOE Seeks Comment.''

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, that it used in the June, 2014 final rule (79 FR 32050). DOE reflects the uncertainty of equipment lifetimes in the LCC analysis for equipment components by using probability distributions. DOE presented this assumption to the Working Group during the October 15, 2015 public meeting and invited comment. DOE received no comments on WICF refrigeration system lifetimes. (Docket No. EERE–2015–BT–STD–0016, DOE, Public Meeting Transcript (October 15, 2015), No. 0062 at p. 41)

DOE seeks comment on these minimum, average, and maximum equipment lifetimes, and whether or not they are appropriate for all equipment classes and capacities. This is identified as Issue 7 in section VII.E, ''Issues on Which DOE Seeks Comment.''

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 the NOPR analysis by estimating the average cost of capital for a large number of companies similar to those that could purchase WICF refrigeration

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

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

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

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

[27] U.S. Department of Energy-Energy Information Administration, *Annual Energy Outlook 2015 with Projections to 2040* (Available at: *http://www.eia.gov/forecasts/aeo/*).

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'').[28] 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.[29]

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

9. 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 the NOPR analysis, the efficiency distribution in the no-new-standards case assumes that 100 percent of WICF refrigeration equipment is at the baseline efficiency level.

DOE requests comment on its assumption that all WICF refrigeration systems covered by this rulemaking would be at the baseline efficiency level in the compliance year. This is identified as Issue 8 in section VII.E, ''Issues on Which DOE Seeks Comment.''

10. Payback Period Analysis

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

The inputs to the payback period (*i.e.* PBP) calculation for each efficiency level are the change in total installed cost of the equipment 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 in light of the shorter time-frame involved.

As noted in this preamble, 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 equipment complying with an energy conservation standard level will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price forecast for the year in which compliance with the proposed standards would be required.

G. Shipments Analysis

DOE uses forecasts of annual equipment shipments to calculate the national impacts of the proposed energy conservation standards on energy use, NPV, and future manufacturer cash-flows.[30] 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.F.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 which were then matched by the installer in the field. (Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 3, 2015), No. 0064 at p. 120; Docket No. EERE–2015–BT–STD–0016, various parties, Public Meeting Transcript (November 20, 2015), No. 0066 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. 0065 at p. 117)

DOE assumed that shipments of new equipment would increase over time at the rate of growth of commercial floor space projected in *AEO 2015.* Because data on historic trends in market shares of WICF equipment classes and capacities were lacking, DOE took a conservative approach and assumed that they would remain constant over time. ((See November 20, 2015 Public Meeting Presentation, slide 24, available in Docket No. EERE–2015–BT–STD–0016, No. 0042, at p. 24)

DOE seeks comment on the share of equipment sold as individual components versus the share of equipment sold as manufacturer matched equipment. This is identified as Issue 9 in section VII.E, ''Issues on Which DOE Seeks Comment.''

H. National Impact Analysis

The NIA assesses the national energy savings (*i.e.* NES) and the net present value (*i.e.* NPV) from a national perspective of total consumer costs and savings that would be expected to result from the proposed standards at specific efficiency levels.[31] (''Consumer'' in this context refers to consumers of the equipment being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual equipment shipments, along with the

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

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

[30] 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.

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

annual energy consumption and total installed cost data from the energy use and LCC analyses.[32] For the present analysis, DOE forecasted the energy savings, operating cost savings, equipment costs, and NPV of consumer benefits over the lifetime of WICF refrigeration systems sold from 2020 through 2049.[33]

DOE evaluates the impacts of the proposed 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 the proposed energy conservation standards. DOE compares the no-new-standards case with a characterization of the market for each equipment class if DOE adopts amended or new standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of equipment with efficiencies greater than the standard.

Table IV–7 summarizes the inputs and methods DOE used for the NIA analysis for the NOPR. Discussion of these inputs and methods follows the table. See chapter 10 of the NOPR 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	Late 2019. First full year of analysis is 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	*AEO 2015* forecasts (to 2040) and extrapolation thereafter.
Energy Site-to-Primary and FFC Conversion	Site-to-Primary: A time-series conversion factor based on *AEO 2015.* FFC: Utilizes data and projections published in *AEO 2015.*
Discount Rate	Three and seven percent.
Present Year	2015.

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. 0066 at pp. 83–84)

DOE requests comment on its assumption that the WICF refrigeration system efficiency of the classes covered in this proposal would remain unchanged over time in the absence of adopting the proposed standards. This is identified as Issue 10 in section VII.E, ''Issues on Which DOE Seeks Comment.''

1. National Energy Savings

The NES analysis compares the projected national energy consumption of the considered equipment between each potential standards case (TSL) and the no-new-standards case. DOE calculated the annual national energy consumption by multiplying the number of units (stock) of each equipment (by vintage or age) by the unit energy consumption (also by vintage). DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO 2015.* Cumulative energy savings are the sum of the NES for each year in which equipment purchased in 2020–2049 continues to operate.

In 2011, in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System (''NEMS'') is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector[34] that EIA uses to prepare its *Annual Energy Outlook.* The approach used for deriving FFC measures of energy use and emissions is described in appendix 10A of the NOPR TSD.

2. 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; 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 equipment shipped during the forecast period.

As discussed in section IV.F.1 of this proposed 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 NOPR TSD.

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

[33] Because the anticipated compliance date is in late 2019, for analytical purposes DOE used 2020 as the first full year of compliance.

[34] For more information on NEMS, refer to *The National Energy Modeling System: An Overview,* DOE/EIA–0581 (98) (Feb.1998) (Available at: *http://www.eia.gov/oiaf/aeo/overview/*).

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 NOPR 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 regional energy prices by the forecast of annual national-average commercial electricity price changes in the Reference case from *AEO 2015,* which has an end year of 2040. To estimate price trends after 2040, DOE used the average annual rate of change in prices from 2020 to 2040. As part of the NIA, DOE also analyzed scenarios that used inputs from the *AEO 2015* Low Economic Growth and High Economic Growth cases. Those cases have higher and lower energy price trends compared to the Reference case. NIA results based on these cases are presented in appendix 10B of the NOPR TSD.

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

I. Consumer Subgroup Analysis

In analyzing the potential impact of the proposed 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.[36] In addition, electricity prices associated with different types of small businesses were used in the subgroup analysis.[37] 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 NOPR TSD.

J. Manufacturer Impact Analysis

1. Definition of Manufacturer

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. DOE requires a manufacturer of a walk-in component to certify the compliance of the components it manufactures. This document proposes energy conservation standards for seven classes of refrigeration equipment which are components of complete walk-in coolers and walk-in freezers. DOE provides a qualitative and quantitative analysis on the potential impacts of the proposed rule on the affected WICF refrigeration manufacturers. The results are presented in sections V.B.2.a through V.B.2.e. 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, in DOE's view, this proposal would not create any significant 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.f.

2. Overview of WICF Refrigeration Manufacturer Analysis

DOE performed an MIA to estimate the financial impacts of the proposed energy conservation standards on manufacturers of the seven WICF refrigeration system equipment classes being analyzed, and to estimate the potential impacts of such standards on cash-flow and industry valuation. The MIA also has qualitative aspects and seeks to determine how the proposed 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 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 the proposed 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 NOPR TSD.

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

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

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

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 proposed 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'') codes 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 two 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 NOPR TSD and in section VI.A of this document.

3. GRIM Analysis 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 proposed energy conservation standards. The GRIM uses these inputs to calculate a series of annual cash-flows beginning with the base year of the analysis, 2016, and continuing to 2049. DOE computes INPV by summing the stream of discounted annual cash-flows during the analysis period. The GRIM analysis for this proposal focuses on manufacturer impacts with respect to the seven covered refrigeration equipment classes. DOE used a real discount rate of 10.2 percent for WICF refrigeration manufacturers. The major GRIM inputs are described in detail in the following sections.

a. Manufacturer Production Costs

Manufacturing a higher-efficiency equipment is typically more expensive than manufacturing a 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 calculated in the engineering analysis, as described in section IV.C and further detailed in chapter 5 of this NOPR TSD. DOE used information from its teardown analysis, described in section IV.C.4 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 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 last 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 as explained in section IV.G and in chapter 9 of the TSD.

If demand elasticity were not zero, there would be a small drop in shipments due to some purchasers electing to repair rather than replace failing equipment. However, as this equipment is required for business operations, the total number of units in the stock must remain constant. The net effect of demand elasticity is therefore to delay the purchase of new equipment, which has a very limited impact on the national impacts estimates. 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.

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 32091–32092) 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.

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)	2.2	4.8	11.3
Capital Conversion Costs (2015$ MM)	....	2.3	4.9

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 subcooling design option, which requires an estimated investment of $100,000 per manufacturer.

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 manufacturers 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 NOPR TSD provides further details on the methodology that was used to estimate conversion costs.

DOE seeks additional information on industry capital and product conversion costs of compliance associated with the new standards for WICF refrigeration systems proposed in this document. This is identified as Issue 11 in section VII.E, ''Issues on Which DOE Seeks Comment.''

d. Manufacturer Markup Scenarios

As discussed in this preamble, 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 markup scenarios are consistent with the scenarios modeled in the 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. This markup is consistent with the one DOE assumed in the engineering analysis (see section IV.C.4.d). 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 proposed 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 proposed 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.

DOE requests comment on the appropriateness of assuming a constant manufacturer markup of 1.35 across all equipment classes and efficiency levels. This is identified as Issue 12 in section VII.E, ''Issues on Which DOE Seeks Comment.''

K. Emissions Analysis

The emissions analysis consists of two components. The first component estimates the effect of potential energy conservation standards on power sector and site (where applicable) combustion emissions of CO_2, NO_X, SO_2, and Hg. The second component estimates the impacts of potential standards on emissions of two additional greenhouse gases, CH_4 and N_2O, as well as the reductions to emissions of all species due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion. For the considered WICF refrigeration systems in this NOPR, DOE does not expect emissions to increase from the manufacturing of new equipment. As discussed in section IV.G, the number of units that are manufactured and shipped is not expected to change. Further, neither the design process nor installation processes are expected to generate emissions. The associated emissions are referred to as upstream emissions.

The analysis of power sector emissions uses marginal emissions factors that were derived from data in *AEO 2015,* as described in section IV.M. The methodology is described in chapter 13 and chapter 15 of the NOPR TSD.

Combustion emissions of CH_4 and N_2O are estimated using emissions intensity factors from the EPA's GHG Emissions Factors Hub.[38] The FFC upstream emissions are estimated based on the methodology described in chapter 15 of the NOPR TSD. The upstream emissions include both emissions from fuel combustion during extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2.

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

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying each ton of gas by the gas' global warming potential (GWP) over a 100-year time horizon. Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,[39] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

The *AEO* incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2015* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of October 31, 2014. DOE's estimation of impacts accounts for the presence of the emissions control programs discussed in the following paragraphs.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) SO_2 emissions from 28 eastern States and DC were also limited under the Clean Air Interstate Rule (CAIR). 70 FR 25162 (May 12, 2005). CAIR created an allowance-based trading program that operates along with the Title IV program. In 2008, CAIR was remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect.[40] 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,[41] 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.[42] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR.[43] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.

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

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

Beginning in 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO 2015* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2016. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, emissions will be far below the cap established by CAIR, so it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by any regulated EGU.[44] Therefore, DOE believes that energy conservation

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

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

[40] See *North Carolina* v. *EPA,* 550 F.3d 1176 (D.C. Cir. 2008); *North Carolina* v. *EPA,* 531 F.3d 896 (D.C. Cir. 2008).

[41] See *EME Homer City Generation, LP* v. *EPA,* 696 F.3d 7, 38 (D.C. Cir. 2012), *cert. granted,* 81 U.S.L.W. 3567, 81 U.S.L.W. 3696, 81 U.S.L.W. 3702 (U.S. June 24, 2013) (No. 12–1182).

[42] *See EPA* v. *EME Homer City Generation,* 134 S. Ct. 1584, 1610 (U.S. 2014). The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain States due to their impacts in other downwind States was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR.

[43] See *Georgia* v. *EPA,* Order (D.C. Cir. filed October 23, 2014) (No. 11–1302).

[44] DOE notes that the Supreme Court recently determined that EPA erred by not considering costs in the finding that regulation of hazardous air pollutants from coal- and oil-fired electric utility steam generating units is appropriate. See *Michigan* v. *EPA* (Case No. 14–46, 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 efficiency standards on SO_2 emissions. Further, the Court's decision does not change the impact of the energy efficiency standards on mercury emissions. DOE will continue to monitor developments related to this case and respond to them as appropriate.

standards will generally reduce SO_2 emissions in 2016 and beyond.

CAIR established a cap on NO_X emissions in 28 eastern States and the District of Columbia.[45] Energy conservation standards are expected to have little effect on NO_X emissions in those States covered by CAIR because excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions from other facilities. However, standards would be expected to reduce NO_X emissions in the States not affected by the caps, so DOE estimated NO_X emissions reductions from the standards considered in this NOPR for these States.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2015,* which incorporates the MATS.

L. Monetizing Carbon Dioxide and Other Emissions Impacts

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

1. Social Cost of Carbon

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

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

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

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of CO_2 emissions, the analyst faces a number of challenges. A report from the National Research Council[46] 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.

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 quantify such benefits and consider them in its cost-benefit analysis. Moreover, the interagency group's SCC estimates are well supported by the existing scientific and economic literature. As a result, DOE has relied on the interagency group's SCC estimates in quantifying the social benefits of reducing CO_2 emissions. Specifically, DOE estimated the benefits from reduced emissions in any future year by multiplying the change in emissions in that year by the SCC values appropriate for that year. The present value of the benefits are then 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 SCC values reflect the interagency group's best assessment, based on current data, of the societal effect of CO_2 emissions. The interagency group is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across Federal agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: Global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented the first sustained interagency effort within the U.S. government to develop harmonized SCC estimates for use in regulatory analysis. The results of this preliminary effort were used in the Regulatory Impact Analyses of several

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

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

proposed and final rules from EPA and DOE.

c. Current Approach and Key Assumptions

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

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

In 2010, the interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, was included to represent higher-than-expected impacts from climate change further out in the tails of the SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[47] although preference is given to consideration of the global benefits of reducing CO_2 emissions.[48] Table IV–9 presents the values in the 2010 interagency group report,[49] which is reproduced in appendix 16A of the NOPR TSD.

TABLE IV–9—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[2007$ per metric ton CO_2]

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

The SCC values used for this document were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature, as described in the 2013 update from the interagency Working Group (revised July 2015).[50] Table IV–10 shows the updated sets of SCC estimates from the latest interagency update in 5-year increments from 2010 to 2050. The full set of annual SCC values between 2010 and 2050 is reported in appendix 16B of the NOPR TSD, which contains the July 2015 report. The central value that emerges is the average SCC across models at the 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

[47] 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.

[48] As discussed in appendix 16A of the NOPR TSD, 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 SCC 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.

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

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

TABLE IV–10—ANNUAL SCC VALUES FROM 2013 INTERAGENCY UPDATE (REVISED JULY 2015), 2010–2050
[2007$ per metric ton CO_2]

Year	Discount rate			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable because they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned previously points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.[51]

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report (revised July 2015), adjusted to 2015$ using the implicit price deflator for gross domestic product (''GDP'') from the Bureau of Economic Analysis. For each of the four sets of SCC cases specified, the values for emissions in 2015 were $12.4, $40.6, $63.2, and $118 per metric ton avoided (values expressed in 2015$). DOE derived values after 2050 using the relevant growth rates for the 2040–2050 period in the interagency update.

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

2. Social Cost of Other Air Pollutants

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

DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards.[52] The report includes high and low values for NO_X (as $PM_{2.5}$) for 2020, 2025, and 2030 using discount rates of 3 percent and 7 percent; these values are presented in appendix 16C of the NOPR TSD. DOE primarily relied on the low estimates to be conservative.[53] DOE assigned values for 2021–2024 and 2026–2029 using, respectively, the values for 2020 and 2025. DOE assigned values after 2030 using the value for 2030. DOE developed values specific to the end-use category for WICFs using a method described in appendix 16C of the NOPR TSD.

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 avoided SO_2 and Hg emissions in energy conservation standards rulemakings. DOE has not included monetization of those emissions in the current analysis.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the electric power generation industry that would result from the adoption of the proposed energy conservation standards. The utility impact analysis estimates the changes in installed electrical capacity and generation that would result for each TSL. The analysis is based on published output from the NEMS associated with *AEO 2015.* NEMS produces the AEO Reference case, as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. DOE uses published side cases to estimate the marginal impacts of reduced energy demand on the utility sector. These marginal factors are estimated based on the changes to electricity sector generation, installed

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

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

[53] For the monetized NO_X benefits associated with $PM_{2.5}$, the related benefits are primarily based on an estimate of premature mortality derived from the ACS study (Krewski et al. 2009), which is the lower of the two EPA central tendencies. Using the lower value is more conservative when making the policy decision concerning whether a particular standard level is economically justified. If the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al. 2012), the values would be nearly two-and-a-half times larger. (See chapter 16 of the NOPR TSD for further description of the studies mentioned.)

capacity, fuel consumption and emissions in the *AEO* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the NOPR TSD.

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

N. Employment Impact Analysis

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

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's BLS,[54] which 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.[55] 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 NOPR using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 3.1.1 (''ImSET'').[56] 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 generated results for near-term timeframes (2020), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the NOPR 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 proposing to adopt in this NOPR. Additional details regarding DOE's analyses are contained in the NOPR 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.C.9.) DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the NOPR TSD.

TSL 3 represents the maximum technologically feasible level and the proposed energy conservation standard that was negotiated by, and unanimously agreed on by the Working Group (Term Sheet at EERE–2015–BT–STD–0016–0056, recommendation #5). TSLs 1 and 2 are direct representations of efficiency levels 1 and 2. Table IV–1 shows the mapping of minimum AWEF values for each equipment class and nominal capacity to each TSL.

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

[55] See Bureau of Economic Analysis, Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II), U.S. Department of Commerce (1992).

[56] J.M. Roop, M.J. Scott, and R.W. Schultz, *ImSET 3.1: Impact of Sector Energy Technologies,* PNNL–18412, Pacific Northwest National Laboratory (2009) (Available at: *www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf*).

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	6,000	1.94	2.10	2.24
		9,000	2.05	2.24	2.40
		25,000	2.08	2.24	2.40
		54,000	2.08	2.24	2.40
	DC.L.O	6,000	2.42	2.71	3.02
		9,000	2.50	2.80	3.14
		25,000	2.53	2.84	3.15
		54,000	2.53	2.84	3.15
		72,000	2.53	2.84	3.15
Unit Cooler	UC.M	4,000	7.30	8.15	9.00
		9,000	7.30	8.15	9.00
		24,000	7.30	8.15	9.00
	UC.L	4,000	3.61	3.78	3.95
		9,000	3.69	3.85	4.01
		18,000	3.88	4.01	4.15
		40,000	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 proposed 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.

Life-Cycle Cost and Payback Period

In general, higher-efficiency equipment affect consumers in two ways: (1) Purchase price increases, and (2) annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* 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 equipment lifetime and a discount rate. Chapter 8 of the NOPR 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–3 show the LCC and PBP results for the TSL efficiency levels considered for each equipment class under the different consumer installation scenarios discussed in section IV.F.1. In the first of each pair of tables, the simple payback is measured relative to the baseline equipment (EL 0). In the second table, impacts are measured relative to the efficiency distribution in the no-new-standards case in the compliance year (see section IV.F.9 of this document). Consumers for whom the LCC increases at a given TSL are projected to 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	$2,227	$18,320	$22,047		10.6
1	1	3,761	2,191	18,019	21,779	0.9	10.6
2	2	4,004	2,005	16,484	20,488	1.2	10.6
3	3	4,036	1,981	16,294	20,330	1.3	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	$268	0
2	2	1,559	0
3	3	1,717	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	$2,712	$22,368	$26,877		10.5
1	1	4,562	2,523	20,808	25,370	0.3	10.5
2	2	4,670	2,379	19,617	24,286	0.6	10.5
3	3	5,288	2,236	18,440	23,728	2.1	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	$1,507	0
2	2	2,590	0
3	3	3,148	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	$6,011	$2,226	$18,450	$24,461		10.6
1	1	6,051	2,185	18,108	24,159	1.0	10.6
2	2	6,310	1,992	16,504	22,814	1.3	10.6
3	3	6,412	1,961	16,247	22,659	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	$320	0
2	2	1,665	0
3	3	1,820	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	$2,713	$22,428	$29,731		10.5
1	1	7,366	2,518	20,814	28,180	0.3	10.5
2	2	7,431	2,387	19,737	27,167	0.5	10.5
3	3	7,627	2,275	18,810	26,438	1.0	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–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	$1,552	0
2	2	2,564	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	$2,227	$18,347	$20,629		10.5
1	1	2,317	2,213	18,232	20,549	1.6	10.5
2	2	2,378	2,201	18,128	20,507	3.5	10.5
3	3	2,433	2,190	18,041	20,473	4.6	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	$81	0
2	2	122	1
3	3	156	2

* 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	$2,712	$22,308	$25,103		10.4
1	1	2,809	2,705	22,255	25,064	0.6	10.4
2	2	2,856	2,685	22,087	24,943	2.3	10.4
3	3	2,969	2,651	21,810	24,779	4.3	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	$39	0
2	2	160	0
3	3	324	2

* 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	$1,226	$10,010	$12,198		10.5
1	1	2,187	1,226	10,010	12,198	0.0	10.5
2	2	2,218	1,212	9,901	12,119	1.8	10.5
3	3	2,227	1,209	9,875	12,102	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 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	79	1
3	3	96	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 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	$984	$8,070	$10,364		10.6
1	1	2,294	984	8,070	10,364	0.0	10.6
2	2	2,320	970	7,956	10,277	1.3	10.6
3	3	2,329	968	7,937	10,265	1.4	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 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	87	0
3	3	99	0

* 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 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

[UC.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	$2,209	$18,831	$21,681		10.6
1	1	2,856	2,207	18,820	21,676	0.6	10.6
2	2	2,898	2,190	18,670	21,569	2.7	10.6

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

[UC.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	2,166	18,468	21,583	7.3	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

[UC.L, 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	112	8
3	3	97	42

* 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

[UC.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	$698	$5,928	$7,948		10.5
1	1	2,026	697	5,918	7,944	0.6	10.5
2	2	2,056	685	5,813	7,869	2.3	10.5
3	3	2,076	682	5,789	7,864	2.9	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.

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

[UC.M, unit cooler only]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * 2015$	Percent of consumers that experience net cost
1	1	$5	1
2	2	79	2
3	3	84	7

* The savings represent the average LCC for affected consumers.

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 proposal. 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 NOPR 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—CS Only	National Average	$268	$1,559	$1,717
	Small Businesses	249	1,445	1,591
DC.L.O—CS Only	National Average	1,507	2,590	3,148
	Small Businesses	1,401	2,408	2,890
DC.L.I—Field Paired	National Average	320	1,665	1,820
	Small Businesses	297	1,542	1,681
DC.L.O—Field Paired	National Average	1,552	2,564	3,294
	Small Businesses	1,455	2,402	3,068
DC.L.I—UC Only	National Average	81	122	156
	Small Businesses	73	108	136
DC.L.O—UC Only	National Average	39	160	324
	Small Businesses	35	146	293
UC.M—DC.M.I	National Average	0	79	96
	Small Businesses	0	74	89
UC.M—DC.M.O	National Average	0	87	99
	Small Businesses	0	80	91
UC.L	National Average	4	112	97
	Small Businesses	NA	NA	NA
UC.M	National Average	5	79	84
	Small Businesses	NA	NA	NA
Consumer Simple PBP (years)				
DC.L.I—CS Only	National Average	0.9	1.2	1.3
	Small Businesses	0.9	1.2	1.3
DC.L.I—CS Only	National Average	0.3	0.6	2.1
	Small Businesses	0.3	0.6	2.1
DC.L.O—CS Only	National Average	1.0	1.3	1.5
	Small Businesses	1.0	1.3	1.5
DC.L.I—Field Paired	National Average	0.3	0.5	1.0
	Small Businesses	0.3	0.5	1.0
DC.L.O—Field Paired	National Average	1.6	3.5	4.6
	Small Businesses	1.6	3.5	4.6
DC.L.I—UC Only	National Average	0.6	2.3	4.3
	Small Businesses	0.6	2.2	4.3
DC.L.O—UC Only	National Average	0.0	1.8	1.9
	Small Businesses	0.0	1.8	1.8
UC.M—DC.M.I	National Average	0.0	1.3	1.4
	Small Businesses	0.0	1.3	1.4
UC.M—DC.M.O	National Average	0.6	2.7	7.3
	Small Businesses	NA	NA	NA
UC.L	National Average	0.6	2.3	2.9
	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 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.F.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.F.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.F.1.c for more details.

Rebuttable Presumption Payback

As discussed in section IV.F.10, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for equipment that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption payback period for each of the considered TSLs, DOE used discrete values, and, as required by EPCA, based the energy use calculation on the DOE test procedure 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.

Table V–23 presents the rebuttable-presumption payback periods for the considered TSLs for the WICF equipment classes evaluated in this proposal. These results show that, in almost all cases, the projected payback period will be under three years for each of the different equipment classes with respect to each TSL examined. In those cases, the rebuttable presumption therefore applies. While DOE examined the rebuttable-presumption criterion, it also considered whether the standard levels considered for the NOPR are economically justified through a more detailed analysis of the economic impacts of those levels for each equipment class in this NOPR, pursuant to 42 U.S.C. 6295(o)(2)(B)(i), that considers the full range of impacts to the consumer, manufacturer, Nation, and environment. The results of that analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level, thereby supporting or rebutting the results of any preliminary determination of economic justification.

TABLE V–23—REBUTTABLE PAYBACK PERIOD (YEARS) FOR WICF REFRIGERATION SYSTEMS

Equipment class	Trial standard level		
	1	2	3
DC.L.I (CU-Only)	0.7	1.4	1.2
DC.L.O (CU-Only)	0.3	0.5	1.9
DC.L.I (Field Paired)	0.8	1.6	1.6
DC.L.O (Field Paired)	0.4	0.5	0.9
DC.L.I (UC Only)	0.0	0.1	0.1
DC.L.O (UC Only)	0.0	0.0	0.1
UC.M—DC.M.I	0.0	0.2	0.3
UC.M—DC.M.O	0.0	0.3	0.4
UC.L	0.3	1.3	3.4
UC.M	0.1	0.2	0.3

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 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.F.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.F.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.F.1.c for more details.

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of the proposed 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 NOPR 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*	99.7	99.1	97.7	95.3
Change in INPV ($)	2015*$ MM*		(0.6)	(2.0)	(4.4)
Change in INPV (%)	%		(0.6)	(2.0)	(4.4)
Product Conversion Costs	2015*$ MM*		2.2	4.8	11.3
Capital Conversion Costs	2015*$ MM*			2.3	4.9
Total Investment Required	2015*$ MM*		2.2	7.1	16.2

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*	99.7	98.3	93.4	84.9
Change in INPV ($)	2015*$ MM*		(1.5)	(6.3)	(14.8)
Change in INPV (%)	%		(1.5)	(6.3)	(14.8)
Product Conversion Costs	2015*$ MM*		2.2	4.8	11.3
Capital Conversion Costs	2015*$ MM*			2.3	4.9
Total Investment Required	2015*$ MM*		2.2	7.1	16.2

At TSL 1, DOE estimates impacts on INPV range from −$1.5 million to −$0.6 million, or a change in INPV of −1.5 percent to −0.6 percent. At TSL 1, industry free cash-flow is expected to decrease by approximately 8.1 percent to $7.7 million, compared to the no-new standards case value of $8.3 million in 2019, the year leading up to the proposed standards.

DOE expects WICF refrigeration manufacturers to incur approximately $2.2 million in product conversion costs for redesign and testing. DOE estimates WICF refrigeration manufacturers will incur minimal capital conversion costs associated with TSL 1, because the most cost effective design options are generally use of more efficient purchased parts.

At TSL 1, the shipment-weighted average MPC increases by approximately 1.0 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 the approximately $2.2 million in conversion costs that WICF refrigeration manufacturers would incur, which causes a 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 1.0 percent shipment-weighted average MPC increase results in a reduction in manufacturer markup after the compliance year. This reduction in manufacturer markup and the $2.2 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 −$6.3 million to −$2.0 million, or a change in INPV of −6.3 percent to −2.0 percent. At TSL 2, industry free cash-flow is expected to decrease by approximately 30.2 percent to $5.8 million, compared to the no-new standards case value of $8.3 million in 2019, the year leading up to the proposed standards.

DOE expects WICF refrigeration systems to incur approximately $4.8 million in product conversion costs for redesign and testing. DOE estimates WICF refrigeration manufacturers will incur $2.3 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 5.4 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 approximately $7.1 million in conversion costs that WICF refrigeration manufacturers would incur, which causes a 2.0 percent drop in INPV at TSL 2.

Under the preservation of operating profit markup scenario, WICF refrigeration 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 −$14.8 million to −$4.4 million, or a change in INPV of −14.8 percent to −4.4 percent. At TSL 3, industry free cash-flow is expected to decrease by approximately 68.1 percent to $2.7 million, compared to the no-new standards case value of $8.3 million in 2019, the year immediately prior to the proposed year of compliance for the new standards.

DOE expects manufacturers of WICF refrigeration systems to incur approximately $11.3 million in product conversion costs for redesign and testing. DOE estimates manufacturers will incur $4.9 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 12.8 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 approximately $16.2 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 12.6 percent shipment-weighted average MPC increase results in a reduction in manufacturer markup after the compliance year. This reduction in manufacturer markup and the $16.2 million in conversion costs incurred cause a negative change in INPV at TSL 3 under the preservation of operating profit markup scenario.

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 proposal.

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 191 employees associated with the seven analyzed walk-in refrigeration system equipment classes in 2020. 139 of these are production workers and 52 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 in this proposal. The upper end of the results in the table estimates the maximum increase in the number of direct employment after the implementation of new energy conservation standards and it assumes 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)	139	140	146	155
Direct Employment in 2020	191	192	200	213
Potential Changes in Direct Employment in 2020	....	(139)—1	(139)—9	(139)—22

The 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.

DOE requests comment and data on the potential impacts to direct employment levels. This is identified as Issue 13 in section VII.E, ''Issues on Which DOE Seeks Comment.''

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, the industry should not experience capacity constraints directly resulting from an energy conservation standard.

Impacts on Subgroups of Manufacturers

As discussed in section IV.I, 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 to group manufacturers exhibiting similar characteristics. Consequently, DOE analyzes small manufacturers as a sub-group.

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 two refrigeration system manufacturers. DOE describes the differential impacts on these small businesses in this document in section VI.B.

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.

DOE identified one regulation, in addition to amended energy conservation standards for WICF refrigeration systems, that manufacturers will face for equipment they manufacture approximately three years before or after to the estimated compliance date of these proposed standards. DOE summarizes these regulations in Table V–27, and includes the full details of the cumulative regulatory burden, in chapter 12 of the final rule TSD.

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

Regulation	Number of manufacturers *	Number of manufacturers from today's rule **	Approximate standards year	Industry conversion costs (2012$ million)	Conversion costs as a percentage of revenue ***
Commercial Refrigeration Equipment, 79 FR 17726 (March 28, 2014)	54	4	2017	$184.0	2
Non-vacated Walk-in Cooler and Walk-in Freezer Components, 79 FR 32050 (June 3, 2014)	63	9	2017	33.6	3

* 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 the covered walk-in refrigeration equipment that are also identified as manufacturers in the energy conservation standard contributing to cumulative regulatory burden.
*** This column presents conversion costs as a percentage of conversion period revenue for the industry. The conversion period is the time-frame 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.

This NOPR proposes energy conservation standards for seven WICF refrigeration system equipment classes. The thirteen other standards established in the June 2014 final rule and shown in Table I–1 (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) have not been vacated and remain subject to the June 5, 2017 compliance date prescribed by the June 2014 final rule.[57]

DOE anticipates that nine manufacturers who would be subject to this proposal 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.

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 horsepower (''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

[57] But see *http://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 regarding the WICF refrigeration systems at issue in this rulemaking proceeding).

product fulfills the prescriptive design requirements. To aid manufacturers of complete walk-ins in meeting these responsibilities, DOE has proposed labeling requirements as part of a separate NOPR addressing potential amendments to the test procedure for walk-in coolers and walk-in freezers. 81 FR 54926 (August 17, 2016). As part of that proposal, DOE is considering requiring the use of permanent nameplates on WICF components that include rating information and indications of suitability for WICF applications. In DOE's view, the inclusion of such a requirement would 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 document does not propose to include energy conservation standards that are measured in terms of the performance of the complete walk-in and does not introduce new burdens on manufacturers of the complete walk-in, including installers (*i.e.,* the parties that assemble the complete walk-in). As a practical matter, walk-in manufacturers already comply with the applicable panel and door requirements, which have been in effect since 2009. Additionally, installers, and all other manufacturers of complete walk-ins, have no paperwork or certification requirements as a result of this proposal when using certified walk-in components. DOE was unable to identify whether installer conversion costs would be likely to occur as a direct result of the proposed standards since conversion costs are borne by component manufacturers. It is possible installers would have stranded assets in the form of refrigeration component inventory that is not compliant with the proposed standard. However, the WICF market involves a high degree of customization—walk-ins can vary dramatically in size, shape, capacity, and end-user application. This suggests that installers do not generally carry significant refrigeration system inventory. Furthermore, installers will have a conversion period, between the publication date and the compliance date of the final rule, to wind-down component surpluses and these components may be used to repair existing units deployed in the field.

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 2014 final rule for panels, doors, and medium-temperature dedicated condensing refrigeration systems.[58] They would also have to comply with the standards proposed in this document for low-temperature dedicated condensing refrigeration systems and for unit coolers. Additionally, they have existing responsibility to comply with prescriptive design standards for the complete walk-ins.

DOE requests data on conversion costs (upfront investments necessary ahead of the standard taking effect) and stranded assets, if any, that manufacturers who assemble complete walk-ins (including those installed on-site) could incur as a result of the proposed standards. DOE also requests comment on any direct burdens on installers that would arise as a result of the proposed rule. This is identified as Issue 14 in section VII.E, ''Issues on Which DOE Seeks Comment.''

C. National Impact Analysis

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 first full year of anticipated compliance with the proposed standards (2020–2049). Table V–28 present DOE's projections of the national energy savings for each TSL considered for the considered WICF refrigeration systems. The savings were calculated using the approach described in section IV.H of this proposed rule.

TABLE V–28—CUMULATIVE NATIONAL ENERGY SAVINGS FOR WICF REFRIGERATION SYSTEMS SHIPPED IN 2020–2049

	Quads		
	Trial standard level		
	1	2	3
Primary energy	0.23	0.62	0.86
FFC energy	0.24	0.65	0.90

OMB Circular A–4 [59] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using nine, rather than 30, years of equipment shipments. The choice of a nine-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of, and compliance with, such revised standards.[60] The review timeframe established in EPCA is generally not synchronized with the equipment lifetime, equipment 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

[58] See also *http://www.energy.gov/gc/downloads/walk-coolerwalk-freezer-refrigeration-systems-enforcement-policy* (detailing aspects of DOE's enforcement policy as to walk-in refrigeration systems).

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

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

analysis results based on a nine-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; NINE YEARS OF SHIPMENTS

[2020–2028]

	Quads		
	Trial standard level		
	1	2	3
Primary energy	0.14	0.18	0.23
FFC energy	0.15	0.18	0.24

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the TSLs considered for the considered WICF refrigeration systems. In accordance with OMB's guidelines on regulatory analysis,[61] 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 equipment purchased in 2020–2049.

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

Discount rate	Billion 2015$		
	Trial standard level		
	1	2	3
3 percent	1.3	3.3	4.3
7 percent	0.5	1.4	1.8

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 equipment purchased in 2020–2028. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

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

[2020–2028]

Discount rate	Billion 2015$		
	Trial standard level		
	1	2	3
3 percent	0.7	0.9	0.8
7 percent	0.3	0.5	0.6

The 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.F). 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 NOPR TSD.

c. Indirect Impacts on Employment

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

The results suggest that the proposed standards are likely to have a negligible impact on the net demand for labor in

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

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 NOPR TSD presents detailed results regarding anticipated indirect employment impacts.

1. Impact on Utility or Performance of Products

Based on testing conducted in support of this proposed rule, discussed in section IV.C.1. of thisdocument, DOE has tentatively concluded that the proposed standards would not reduce the utility or performance of the WICF refrigeration systems under consideration in this rulemaking. Manufacturers of these equipment currently offer units with an efficiency level that that meets or exceeds the proposed standards.

DOE seeks comment on whether there are features or attributes of the more energy-efficient WICF refrigeration systems that manufacturers would produce to meet the standards in this proposed rule that might affect how they would be used by consumers. DOE requests comment specifically on how any such effects should be weighed in the choice of standards for the final rule. This is identified as Issue 15 in section VII.E, ''Issues on Which DOE Seeks Comment.''

2. Impact of Any Lessening of Competition

As discussed in section III.E.e, the Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact. To assist the Attorney General in making this determination, DOE has provided DOJ with copies of this NOPR and the accompanying TSD for review. DOE will consider DOJ's comments on the proposed rule in determining whether to proceed to a final rule to adopt standards for the equipment at issue. DOE will publish and respond to DOJ's comments in that document. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information to send comments to DOJ.

3. 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 NOPR 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 the proposed standards for the considered WICF refrigeration systems is expected to yield environmental benefits in the form of reduced emissions of 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 table includes both power sector emissions and upstream emissions. The emissions were calculated using the multipliers discussed in section IV.K. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR 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)	13.5	37.2	51.5
SO_2 (thousand tons)	8.1	22.5	31.2
NO_X (thousand tons)	14.8	40.9	56.5
Hg (*tons*)	0.03	0.08	0.12
CH_4 (thousand tons)	1.2	3.2	4.5
N_2O (thousand tons)	0.2	0.5	0.6
Upstream Emissions			
CO_2 (million metric tons)	0.8	2.1	2.9
SO_2 (thousand tons)	0.1	0.4	0.5
NO_X (thousand tons)	10.8	29.8	41.2
Hg (*tons*)	0.0003	0.001	0.001
CH_4 (thousand tons)	59.5	164.6	227.7
N_2O (thousand tons)	0.01	0.02	0.03
Total FFC Emissions			
CO_2 (million metric tons)	14.2	39.3	54.4
SO_2 (thousand tons)	8.3	22.9	31.7
NO_X (thousand tons)	25.6	70.7	97.7
Hg (*tons*)	0.03	0.08	0.12
CH_4 (thousand tons)	60.7	167.9	232.1
CH_4 (thousand tons CO_2eq) *	1,699.5	4,700.0	6,500.1
N_2O (thousand tons)	0.2	0.5	0.7
N_2O (thousand tons CO_2eq) *	45.6	126.2	174.5

* CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP).

As part of the analysis for this proposed rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the considered TSLs for the considered WICF refrigeration systems. As discussed in section IV.L of this document, for CO_2, DOE used the most recent values for the SCC developed by an interagency process. The four sets of SCC values for CO_2 emissions reductions in 2015 resulting from that process (expressed in 2015$) are represented by $12.4/metric ton (the average value from a distribution that uses a 5-percent discount rate), $40.6/metric ton (the average value from a distribution that uses a 3-percent discount rate), $63.2/metric ton (the average value from a distribution that uses a 2.5-percent discount rate), and $118/metric ton (the 95th-percentile value from a distribution that uses a 3-percent discount rate). The values for later years are higher due to increasing damages (public health, economic and environmental) as the projected magnitude of climate change increases.

Table V–33 presents the global value of CO_2 emissions reductions at each TSL. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values; these results are presented in chapter 16 of the NOPR TSD.

TABLE V–33—ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR PRODUCTS SHIPPED IN 2020–2049

TSL	SCC case*			
	Million 2015$			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
Power Sector Emissions				
1	95.9	437.2	693.5	1,332.8
2	265.3	1,209.1	1,917.8	3,685.9
3	367.0	1,672.2	2,652.3	5,097.6
Upstream Emissions				
1	5.3	24.2	38.4	73.8
2	14.6	66.9	106.2	204.0
3	20.1	92.5	146.9	282.2
Total FFC Emissions				
1	101.2	461.4	731.9	1,406.6
2	279.9	1,276.0	2,024.0	3,889.9
3	387.1	1,764.7	2,799.2	5,379.8

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.4, $40.6, $63.2, and $118 per metric ton (2015$). The values are for CO_2 only (*i.e.,* not CO_{2eq} of other greenhouse gases).

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. DOE is part of the Interagency Working Group (''IWG'') on the Social Cost of Carbon and as such, will work with other Federal agencies to continue to review its estimates for 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. It will also consider on-going input from the National Academies of Sciences, Engineering and Medicine, who recently provided interim recommendations to the IWG for enhancing its presentation of uncertainty regarding these estimates and who will be providing a more comprehensive report in early 2017. Consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this proposed rule the most recent values and analyses using the recommendations from the IWG.

DOE also estimated the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from the considered TSLs for WICF refrigeration systems. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V–34 presents the cumulative present values for NO_X emissions for each TSL calculated using 7-percent and 3-percent discount rates. This table presents values that use the low dollar-per-ton values, which reflect DOE's primary estimate. Results that reflect the range of NO_X dollar-per-ton values are presented in Table V–36.

While the SCC-related values (including social cost of N2O and methane) did not play a direct role in influencing the level of efficiency proposed in this document, DOE notes that environmental benefits that flow from these values are used to support DOE's decisions on efficiency. DOE also notes that their relationship to the projected energy savings that would accrue from the proposed standards is a positive one. In other words, as the level of efficiency—as determined under DOE's analysis independent of the separate examination of the SCC impacts—increases, so too does the level of potential benefits with respect to GHG emissions. Accordingly, the greenhouse gas related data project potential benefits that are separate but additive to those that were independently derived from DOE's examination of the consumer benefits of the potential standard level considered in this document.

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

TSL	Million 2015$	
	3% discount rate	7% discount rate
Power Sector Emissions		
1	27.9	11.5
2	77.2	31.9
3	106.7	44.1
Upstream Emissions		
1	20.2	8.1
2	55.9	22.5
3	77.3	31.1
Total FFC Emissions		
1	48.1	19.7
2	133.1	54.4
3	184.0	75.2

4. Other Factors

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

5. Summary of National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the consumer savings calculated for each TSL considered in this rulemaking. Table V–35 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of consumer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and 3-percent discount rate. The CO_2 values used in the columns of each table correspond to the 2015 values in the four sets of SCC values discussed.

TABLE V–35—NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

TSL	Billion 2015$			
	Consumer NPV at 3% discount rate added with:			
	SCC Case $12.4/ metric ton and 3% low NO_X values	SCC Case $40.6/ metric ton and 3% low NO_X values	SCC Case $63.2/ metric ton and 3% low NO_X values	SCC Case $118/ metric ton and 3% low NO_X values
1	1.4	1.8	2.0	2.7
2	3.7	4.7	5.5	7.4
3	4.8	6.2	7.2	9.8
TSL	Billion 2015$			
	Consumer NPV at 7% discount rate added with:			
	SCC Case $12.4/ metric ton and 7% low NO_X values	SCC Case $40.6/ metric ton and 7% low NO_X values	SCC Case $63.2/ metric ton and 7% low NO_X values	SCC Case $118/ metric ton and 7% low NO_X values
1	0.7	1.0	1.3	2.0
2	1.7	2.7	3.5	5.4
3	2.2	3.6	4.6	7.2

Note: The SCC case values represent the global SCC in 2015, in 2015$, for each case.

In considering the results, two issues are relevant. First, the national operating cost savings are domestic U.S. monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of equipment shipped in 2020 to 2049. Because CO_2 emissions have a very long residence time in the atmosphere,[62] the SCC values in future years reflect future CO_2-emissions impacts that continue beyond 2100.

D. Conclusion

When considering new or amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered equipment must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. See 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 NOPR, DOE considered the impacts of adopting the proposed standards for the specified 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, the 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–36 and Table V–37 summarize the quantitative impacts estimated for each TSL for the considered WICF refrigeration systems. The national impacts are measured over the lifetime of these WICF refrigeration systems purchased in the 30-year period that begins in the anticipated year of compliance with the proposed 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 proposed rule.

TABLE V–36—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION SYSTEMS TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3
Cumulative FFC National Energy Savings *(quads)*			
	0.24	0.65	0.90.
NPV of Consumer Costs and Benefits *(2015$ billion)*			
3% discount rate	1.3	3.3	4.3.
7% discount rate	0.5	1.4	1.8.
Cumulative FFC Emissions Reduction (Total FFC Emissions)			
CO_2 (million metric tons)	14.2	39.3	54.4.
SO_2 (thousand tons)	8.3	22.9	31.7.
NO_X (thousand tons)	25.6	70.7	97.7.
Hg (*tons*)	0.03	0.08	0.12.
CH_4 (thousand tons)	60.7	167.9	232.1.
CH_4 (thousand tons CO_2eq) *	1699.5	4700.0	6500.1.
N_2O (thousand tons)	0.17	0.48	0.66.
N_2O (thousand tons CO_2eq) *	45.6	126.2	174.5.
Value of Emissions Reduction (Total FFC Emissions)			
CO_2 (2015$ billion) **	0.10 to 1.41	0.28 to 3.89	0.39 to 5.38.
NO_X—3% discount rate *(2015$ million)*	48.1 to 109.7	133.1 to 303.4	184.0 to 419.6.
NO_X—7% discount rate *(2015$ million)*	19.7 to 44.3	54.4 to 122.6	75.2 to 169.6.

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

TABLE V–37—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION SYSTEMS TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1 *	TSL 2 *	TSL 3 *
Manufacturer Impacts			
Industry NPV (2015$ million) (No-new-standards case INPV = 99.7)	98.3 to 99.1	93.4 to 97.7	84.9 to 95.3.
Industry NPV (*% change*)	(1.5) to (0.6)	(6.3) to (2.0)	(14.8) to (4.4).

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

TABLE V–37—SUMMARY OF ANALYTICAL RESULTS FOR WICF REFRIGERATION SYSTEMS TSLS: MANUFACTURER AND CONSUMER IMPACTS—Continued

Category	TSL 1 *	TSL 2 *	TSL 3 *
Consumer Average LCC Savings (2015$)			
DC.L.I (CU-Only) *	268	1,559	1,717.
DC.L.O (CU-Only)	1,507	2,590	3,148.
DC.L.I (Field Paired) **	320	1,665	1,820.
DC.L.O (Field Paired)	1,552	2,564	3,294.
DC.L.I (UC-Only) †	81	122	156.
DC.L.O (UC-Only)	39	160	324.
UC.M—DC.M.I	0	79	96.
UC.M—DC.M.O	0	87	99.
UC.L	4	112	97.
UC.M	5	79	84.
Consumer Simple PBP (years)			
DC.L.I (CU-Only) *	0.9	1.2	1.3.
DC.L.O (CU-Only)	0.3	0.6	2.1.
DC.L.I (Field Paired) **	1.0	1.3	1.5.
DC.L.O (Field Paired)	0.3	0.5	1.0.
DC.L.I (UC-Only) †	1.6	3.5	4.6.
DC.L.O (UC-Only)	0.6	2.3	4.3.
UC.M—DC.M.I	0.0	1.8	1.9.
UC.M—DC.M.O	0.0	1.3	1.4.
UC.L	0.6	2.7	7.3.
UC.M	0.6	2.3	2.9.
% 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 (Field Paired) **	0	0	0.
DC.L.O (Field Paired)	0	0	0.
DC.L.I (UC-Only) †	0	1	2.
DC.L.O (UC-Only)	0	0	2.
UC.M—DC.M.I	0	1	1.
UC.M—DC.M.O	0	0	0.
UC.L	1	8	42.
UC.M	1	2	7.

Note: Parentheses indicate negative (−) values. The entry "n.a." means not applicable because there is no change in the standard at certain TSLs.

* 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.F.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.F.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.F.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 2014 final rule standards that were not vacated by the Fifth Circuit order.

In analyzing the different standards, DOE first considered TSL 3, which represents the max-tech efficiency levels. TSL 3 would save an estimated 0.86 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $1.8 billion using a discount rate of 7 percent, and $4.3 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 54.4 Mt of CO_2, 31.7 thousand tons of SO_2, 97.7 thousand tons of NO_X, 0.012 tons of Hg, 232.1 thousand tons of CH_4, and 0.7 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 3 ranges from $0.39 billion to $5.38 billion.

At TSL 3, the average LCC impact for low-temperature dedicated condensing units is a savings of $1,171 for DC.L.I, $3,148 for DC.L.O for the condensing unit-only; $1,820 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 $156 and $324 when connected to indoor and outdoor low-temperature dedicated condensing units, respectively, and $97 when connected to low-temperature multiplex condensing equipment. The average LCC impact for medium-temperature unit coolers (UC.M) is a savings of $96 and $99 when connected to indoor and outdoor medium-temperature dedicated condensing units, respectively, and $84 when connected to medium-temperature multiplex condensing equipment. The simple payback period impact for low-temperature dedicated condensing units is 1.2 years for DC.L.I and, 2.1 years for DC.L.O for the condensing unit-only; 1.5 years for DC.L.I and, 1.0 years for

DC.L.O for field-paired equipment. The simple payback period for low-temperature unit coolers (UC.L) is 4.6 years and 4.3 years when connected to indoor and outdoor low-temperature dedicated condensing units, respectively, and 7.3 years when connected to low-temperature multiplex condensing equipment. The simple payback period for medium-temperature unit coolers (UC.M) is 1.8 years and 1.3 years when connected to indoor and outdoor medium-temperature dedicated condensing units, respectively, and 2.9 years when connected to medium-temperature multiplex condensing equipment. The fraction of consumers experiencing a net LCC cost is zero percent for low-temperature dedicated condensing units DC.L.I and DC.L.O for the 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 2 percent when connected to indoor and outdoor low-temperature dedicated condensing units, respectively, and 42 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 and zero percent when connected to indoor and outdoor medium-temperature dedicated condensing units, respectively, and 7 percent when connected to medium-temperature multiplex condensing equipment.

At TSL 3, the projected change in INPV ranges from −$14.8 million to −$4.4 million, which corresponds to a change of −14.8 percent and −4.4 percent, respectively. DOE estimates that compliance with TSL 3 will require a total industry investment of $16.2 million.

In addition, the proposed 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 proposed 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 tentatively 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 outweigh the negative impacts on some consumers and on manufacturers. Accordingly, the Secretary has tentatively concluded that TSL 3 would offer the maximum improvement in efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. DOE's conclusion is further supported by, but does not depend on, the benefits from the reduction of greenhouse gases projected to occur with this level.

Therefore, based on the considerations, DOE proposes to adopt the energy conservation standards for WICF refrigeration systems at TSL 3. The proposed energy conservation standards for the considered WICF refrigeration systems, which are expressed as AWEF, are shown in Table V–38.

TABLE V–38—PROPOSED 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. Summary of Annualized Benefits and Costs of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized net benefit is the sum of: (1) The annualized national economic value (expressed in 2015$) of the benefits from operating equipment that meet the proposed 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 CO_2 and NO_X emission reductions.[63]

Table V–39 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 CO_2 reduction (for which DOE used a 3-percent discount rate along with the average SCC series that has a value of $40.6/t in 2015),[64] the estimated cost of the standards proposed in this rule is $43.9 million per year in increased equipment costs, while the estimated annual benefits are $217.9 million in reduced equipment operating costs, $98.4 million in CO_2 reductions, and

[63] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2015, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (2020, 2030, *etc.*), and then discounted the present value from each year to 2015. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions, for which DOE used case-specific discount rates. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year that yields the same present value.

[64] DOE used a 3-percent discount rate because the SCC values for the series used in the calculation were derived using a 3-percent discount rate (see section IV.L).

$7.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $280 million per year.

Using a 3-percent discount rate for all benefits and costs and the average SCC series that has a value of $40.6/t in 2015, the estimated cost of the proposed standards is $45.9 million per year in increased equipment costs, while the estimated annual benefits are $283.3 million in reduced operating costs, $98.4 million in CO_2 reductions, and $10.3 million in reduced NO_X emissions. In this case, the net benefit amounts to $346 million per year.

TABLE V–39—ANNUALIZED BENEFITS AND COSTS OF PROPOSED STANDARDS (TSL 3) FOR WICF REFRIGERATION SYSTEMS

	Discount rate	Million 2015$/year		
		Primary estimate *	Low net benefits estimate *	High net benefits estimate *
Benefits				
Consumer Operating Cost Savings	7%	217.9	200.4	237.4.
	3%	283.3	257.9	314.7.
CO_2 Reduction Value ($12.4/t case) **	5%	29.2	27.8	30.7.
CO_2 Reduction Value ($40.6/t case) **	3%	98.4	93.5	103.7.
CO_2 Reduction Value ($63.2/t case) **	2.5%	144.0	136.8	151.9.
CO_2 Reduction Value ($118/t case) **	3%	299.9	285.0	316.3.
NO_X Reduction Value	7%	7.4	7.1	17.4.
	3%	10.3	9.8	24.6.
Total Benefits †	7% plus CO_2 range	255 to 525	235 to 493	285 to 571.
	7%	324	301	359.
	3% plus CO_2 range	323 to 593	295 to 553	370 to 656.
	3%	392	361	443.
Costs				
Consumer Incremental Product Costs	7%	43.9	43.4	44.4.
	3%	45.9	45.3	46.5.
Net Benefits				
Total †	7% plus CO_2 range	211 to 481	192 to 449	241 to 527.
	7%	280	258	314.
	3% plus CO_2 range	277 to 548	250 to 507	323 to 609.
	3%	346	316	397.

* This table presents the annualized costs and benefits associated with WICF refrigeration systems shipped in 2020–2049. These results include benefits to consumers which accrue after 2049 from the equipment purchased in 2020–2049. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the *AEO 2015* Reference case, Low Economic Growth case, and High Economic Growth case, respectively.

** The CO_2 values represent global monetized values of the SCC, in 2015$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

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

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3-percent discount rate ($40.6/t case). In the rows labeled "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

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

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

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

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

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011. 76 FR 3281 (Jan. 21, 2011). Executive Order 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 NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') 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*).

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 systems, 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 system components (referred to as WICF refrigeration manufacturers) and assemblers of the complete walk-in (or installers) separately for this Regulatory Flexibility Review.

This document proposes to set energy conservation standards for seven equipment classes of WICF refrigeration systems. Manufacturers of WICF refrigeration system components are responsible for ensuring the compliance of the components to the proposed standard. WICF refrigeration manufacturers are required to certify to DOE the compliance of the components they manufacture or import. DOE used the SBA's small business size standards to determine whether any small WICF refrigeration 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 propose new or amended energy conservation standards that are measured in terms of the performance of the complete walk-in cooler or freezer. Manufacturers of complete walk-ins (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 ''Commercial Refrigeration System Installation.'' 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 present the following IRFA analysis:

1. Why This Action Is Being Considered

Title III, Part B of the Energy Policy and Conservation Act of 1975 (''EPCA'' or, in context, ''the Act''), Public Law 94–163 (codified as 42 U.S.C. 6291–6309, as codified) established the Energy Conservation Program for Certain Industrial Equipment, a program covering certain industrial equipment, which includes the refrigeration systems used in walk-ins that are the subject of this rulemaking—low-temperature dedicated condensing systems and low and medium temperature unit coolers. (42 U.S.C. 6311(1)(G)) EPCA, as amended, prescribed energy conservation standards for these equipment (42 U.S.C. 6313(f)). In addition, EPCA required DOE to establish performance-based standards for walk-in coolers and freezers that achieve the maximum improvement in energy that the Secretary finds is technologically feasible and economically justified. 42 U.S.C. 6313(f)(4)

2. Objectives of, and Legal Basis for, the Proposed Rule

As noted elsewhere in this document, DOE published a final rule prescribing performance-based energy conservation standards for walk-ins manufactured on or after June 5, 2017. 79 FR 32050 (June 3, 2014). Those standards applied to the main components of a walk-in: Refrigeration systems, panels, and doors. Also as discussed earlier in this document, a legal challenge was filed to that rule, which resulted in a settlement agreement and court order in which the Fifth Circuit Court of Appeals vacated six refrigeration system standards established in that rule—(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 proposal, which was the result of a months-long negotiated rulemaking arising from the settlement agreement, is consistent with the Term Sheet developed as part of that negotiated rulemaking and would, if finalized, adopt the agreed-upon standards contained in that Term Sheet for the six classes of refrigeration systems. The proposal also examines the potential impacts on walk-in installers.

3. Description and Estimated Number of Small Entities Regulated

During its market survey, DOE used available public information to identify small WICF refrigeration component manufacturers. DOE's research involved industry trade association membership directories (including those maintained by AHRI[65] and NAFEM),[66] public databases (*e.g.* the SBA Database),[67] individual company Web sites, market research tools (*e.g.,* Dunn and Bradstreet reports[68] and Hoovers reports)[69] 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 component 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 nine WICF refrigeration manufacturers that produce equipment for one or more of the equipment classes analyzed in this proposal. All nine refigeration manufacturers are domestic companies. Two of the nine 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 code 238220, there are approximately 87,000 plumbing, heating, and air-conditioning contractor establishments in the United States.[70] Based on detailed breakdowns provided in the 2007 U.S. Census, DOE was able to disaggregate the 87,000 business by contractor type.[71] 35% of the establishments were exclusively plumbing, sprinkler installation, or steam and piping fitting contractors and were unlikely to provide walk-in installation services. Of these remaining 65% of establishments, DOE estimated that 3,400 to 14,100 provide offer walk-in installation services.[72]

U.S. Census data from 2012 show 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

DOE identified two small WICF refrigeration businesses that manufacture refrigeration components used in walk-in applications. 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 other 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 the total revenue.

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, to

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

[66] See *http://www.nafem.org/find-members/MemberDirectory.aspx.*

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

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

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

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

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

[72] In the August 2016 test procedure NOPR for walk-in coolers and walk-in freezers, DOE estimated a different number of walk-in contractors. (81 FR 54926) For this Notice, DOE's used more detailed information from the 2007 U.S. Census to improve the estimated number of walk-in contractors. As a result, the range of potential walk-in contractors estimated in this Notice is lower than the range published in the test procedure NOPR.

redesign non-compliant equipment, to purchase and install new manufacturing line equipment, and to 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.

TABLE VI–1—AVERAGE SMALL WICF REFRIGERATION MANUFACTURER'S CAPITAL AND PRODUCT CONVERSION COSTS

Trial standard level	Small manufacturer		
	Capital conversion costs (2015$ millions)	Product conversion costs (2015$ millions)	Conversion costs/ conversion period revenue * (%)
TSL1	0.00	0.05	0.02
TSL2	0.05	0.11	0.07
TSL3	0.10	0.29	0.18

* Conversion costs are the total investments made over the 3-year compliance period, between the publication of the final rule and the first year of compliance with the proposed standard.

At the proposed standard level, DOE estimates total conversion costs for an average small WICF refrigeration manufacturer to be $0.39 million per year over the three-year conversion period. Using revenue figures from Hoovers.com, DOE estimates that conversion costs are less than one percent of total small business revenue over the three-year conversion period.

DOE estimates that there are approximately 10,000 to 30,000 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-in coolers and freezers 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 freezers; contain floor insulation of at least R–28 for freezers; use doors that have certain features; and use certain types of motors in components of the refrigeration system.

This proposal does not propose to add energy conservation standards that would measure the performance of the complete walk-in and does not introduce new responsibilities on installers. 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 proposed standards since these costs are borne by component manufacturers. It is possible installers would have stranded assets in the form of refrigeration components inventory that is not compliant with the proposed standards. However, the WICF market involves a high degree of customization—walk-ins can vary dramatically in size, shape, capacity, and end-user application. This suggests that installers do not generally carry significant refrigeration system inventory. Furthermore, installers will have a conversion period, between the publication date and the compliance date of the final rule, to wind-down component surpluses and these components may be used to repair existing units deployed in the field.

DOE requests comment on the number of small WICF refrigeration manufacturers in the industry, data on the market share of those manufacturers, and the conversion costs those manufacturers are likely to incur. Additionally, DOE requests comment on the conversion costs and stranded assets, if any, that installers of walk-ins may incur. This is identified as Issue 16 in section VII.E, ''Issues on Which DOE Seeks Comment.''

5. Duplication, Overlap, and Conflict With Other Rules and Regulations

DOE found no duplication, overlap, or conflict with other rules and regulations for the rule being proposed here.

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from DOE's proposed rule, represented by TSL 3. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at lower efficiency levels (there are no levels higher than TSL 3). For all considered efficiency levels, there would be no new responsibilities on assemblers and installers. While TSL 1 and TSL 2 would reduce the impacts on small business WICF refrigeration manufacturers, it would come at the expense of a reduction in energy savings and NPV benefits to consumers. TSL 1 achieves 73 percent lower energy savings and 71 percent less NPV benefits to consumers compared to the energy savings and NPV benefits at TSL 3. TSL 2 achieves 28 percent lower energy savings and 24 percent less NPV benefits to consumers compared to the energy savings and NPV benefits at TSL 3.

Setting the standards for the refrigeration systems discussed in this document at the TSL 3 level balances the benefits of the energy savings at TSL 3 with the potential burdens placed on WICF refrigeration manufacturers, including small business manufacturers. Accordingly, because of these results, DOE is not proposing to adopt one of the other TSLs or policy alternatives examined as part of DOE's overall analysis. See discussion in section V (discussing the analyzed TSLs) and chapter 17 of the NOPR TSD (examining policy alternatives to setting standards).

Additional compliance flexibilities may be available through other means. For example, 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 equipment comply with any applicable energy conservation standards. In certifying compliance, manufacturers will be required to test their equipment 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. *See generally* 10 CFR part 429, subpart B. 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 proposed 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 proposed 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 proposed rule. DOE's CX determination for this proposed 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 proposed rule and has tentatively 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 equipment that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) Therefore, no further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect 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.*

Although this proposed rule does not contain a Federal intergovernmental mandate, it 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 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, starting at the compliance date for the applicable standard.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the proposed 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 NOPR and the TSD for this proposed 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 proposed rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(d), (f), and (o), 6313(e), and 6316(a), this proposed rule would establish energy conservation standards for the considered WICF equipment classes that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this proposed 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 proposed 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 proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

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

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

K. Review Under Executive Order 13211

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

DOE has tentatively concluded that this regulatory action, which proposes energy conservation standards for the considered walk-in refrigeration systems, is not a significant energy action because the proposed 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 proposed rule.

L. Review Under the Information Quality Bulletin for Peer Review

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

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The ''Energy Conservation Standards Rulemaking Peer Review Report'' dated February 2007 has been disseminated and is available at the following Web site: *http://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0.*

VII. Public Participation

A. Attendance at the Public Meeting

The time, date, and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this document. If you plan to attend the public meeting, please notify the Appliance and Equipment Standards Program Staff at (202) 586–6636 or *Appliance_Standards_Public_Meetings@ee.doe.gov.*

Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures which require advance notice prior to attendance at the public meeting. If a foreign national wishes to participate in the public meeting, please inform DOE of this fact as soon as possible by contacting Ms. Regina Washington at (202) 586–1214 or by email (*Regina.Washington@ee.doe.gov*) so that the necessary procedures can be completed.

DOE requires visitors to have laptops and other devices, such as tablets, checked upon entry into the Forrestal Building. Any person wishing to bring these devices into the building will be required to obtain a property pass. Visitors should avoid bringing these devices, or allow an extra 45 minutes to check in. Please report to the visitor's desk to have devices checked before proceeding through security.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding identification (ID) requirements for individuals wishing to enter Federal buildings from specific States and U.S. territories. As a result, driver's licenses from several States or territory will not be accepted for building entry, and instead, one of the alternate forms of ID listed below will be required. DHS has determined that regular driver's licenses (and ID cards) from the following jurisdictions are not acceptable for entry into DOE facilities: Alaska, American Samoa, Arizona, Louisiana, Maine, Massachusetts, Minnesota, New York, Oklahoma, and Washington. Acceptable alternate forms of Photo-ID include: U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by the States of Minnesota, New York, or Washington (Enhanced licenses issued by these States are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government-issued Photo-ID card.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's Web site at: *https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=56*. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address shown in the **ADDRESSES** section at the beginning of this document. The request and advance copy of statements must be received at least one week before the public meeting and may be emailed, hand-delivered, or sent by mail. DOE prefers to receive requests and advance copies via email. Please include a telephone number to enable DOE staff to make follow-up contact, if needed.

C. Conduct of the Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA. (42 U.S.C. 6306) A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the public meeting, interested parties may submit further comments on the proceedings, as well as on any aspect of the rulemaking, until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will allow, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the procedures that may be needed for the proper conduct of the public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this notice and will be accessible on the DOE Web site. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via www.regulations.gov. The *www.regulations.gov* Web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the Web site will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section below.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery/courier, or mail. Comments and documents submitted via email, hand delivery/courier, or mail also will be posted to *www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No telefacsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery/courier two well-marked copies: One copy of the document marked ''confidential'' including all the information believed to be confidential, and one copy of the document marked ''non-confidential'' with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person that would result from public disclosure; (6) when such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. DOE seeks comment regarding the method it used for estimating the manufacturing costs related to the equipment discussed in this proposal. See section IV.C.4 for details.

2. DOE seeks input on its analysis of distribution channels in the WICF market. See section IV.D for details.

3. DOE requests comments on the most appropriate trend to use for real (inflation-adjusted) walk-in prices. See section IV.F.2 for details.

4. DOE requests comment on whether any of the efficiency levels considered in this NOPR might lead to an increase in installation costs and, if so, data regarding the magnitude of the increased cost for each relevant efficiency level. See section IV.F.3 for details.

5. DOE requests comment on its assumption to not consider the impact of a rebound effect for the WICF refrigeration system classes covered in this NOPR. Further, DOE requests any data or sources of literature regarding the magnitude of the rebound effect for the covered WICF refrigeration equipment. See section IV.F.4 for details.

6. DOE requests comment on whether any of the efficiency levels considered in this NOPR might lead to an increase in maintenance and repair costs and, if so, data regarding the magnitude of the increased cost for each relevant efficiency level. See section IV.F.6 for details.

7. DOE seeks comment on the minimum, average, and maximum equipment lifetimes it assumed for the covered classes of WICF refrigeration equipment, and whether or not they are appropriate for all equipment classes and capacities. See section IV.F.7 for details.

8. DOE requests comment on its assumption that all WICF refrigeration systems covered by this rulemaking would be at the baseline efficiency level in the compliance year. See section IV.F.9 for details.

9. DOE seeks comment on the share of equipment sold as individual components versus the share of equipment sold as manufacturer matched equipment. See section IV.G for details.

10. DOE requests comment on its assumption that the WICF refrigeration system efficiency of the classes covered in this proposal would remain unchanged over time in the absence of adopting the proposed standards. See section IV.H for details.

11. DOE seeks additional information on industry capital and product conversion costs that would be required to achieve compliance with the proposed WICF refrigeration systems standards. See section IV.J.3.c for details.

12. DOE requests comment on the appropriateness of assuming a constant manufacturer markup of 1.35 across all equipment classes and efficiency levels for the classes of WICF refrigeration systems discussed in this proposed rulemaking. See section IV.J.3.d for details.

13. DOE requests comment and data on the potential impacts to direct employment levels. See section V.B.2.b for details.

14. DOE requests data on conversion costs (upfront investments necessary ahead of the standard taking effect) and stranded assets manufacturers of complete walk-ins could incur as a result of the proposed standard. DOE also requests comment on any direct burdens on manufacturers of complete walk-ins that would arise as a result of the proposed rule. See section V.B.2.f for details.

15. DOE seeks comment on whether there are features or attributes of more energy-efficient WICF refrigeration systems that manufacturers would

produce to meet the standards in this proposed rule that might affect how they would be used by consumers. DOE requests comment specifically on how any such effects should be weighed in the choice of standards for the final rule. See section V.C.1 for details.

16. DOE requests comment on the number of small WICF refrigeration manufacturers in the industry, data on the market share of those manufacturers, and the conversion costs those manufacturers are likely to incur. Additionally, DOE requests comment on the conversion costs and stranded assets small installers of walk-ins may incur. See section VI.B.4 for details.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking.

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 August 30, 2016.

David Friedman,

Acting Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE proposes to amend 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), and add paragraph (f) to read as follows:

§ 431.306 Energy conservation standards and their effective dates.

* * * * *

(e) *Walk-in cooler and freezer refrigeration systems.* All walk-in cooler and walk-in freezer refrigeration systems manufactured starting on June 5, 2017 and before [DATE THREE YEARS AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE **FEDERAL REGISTER**], except for walk-in process cooling refrigeration systems (as defined in 10 CFR 431.302), must satisfy the following standards:

Equipment class	Minimum AWEF (Btu/W-h)
Dedicated Condensing, Medium Temperature, Indoor System	5.61
Dedicated Condensing, Medium Temperature, Outdoor System	7.60

(f) *Walk-in cooler and freezer refrigeration systems.* All walk-in cooler and walk-in freezer refrigeration systems manufactured starting on [DATE 3 YEARS AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE **FEDERAL REGISTER**], except for walk-in process cooling refrigeration systems (as defined in 10 CFR 431.302), must satisfy the following standards:

Equipment class	Minimum AWEF (Btu/W-h) *
Dedicated Condensing System—Medium, Indoor	5.61.
Dedicated Condensing System—Medium, Outdoor	7.60.
Dedicated Condensing System—Low, Indoor with a Net Capacity (q_{net}) of:	
<6,500 Btu/h	$9.091 \times 10^{-5} \times q_{net} + 1.81$.
≥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.

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