DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2008–BT–STD–0015]

RIN 1904–AB86

Energy Conservation Program: Energy Conservation Standards for Walk-In Coolers and Freezers

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

ACTION: Final rule.

SUMMARY: The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including walk-in coolers and walk-in freezers. EPCA also requires the U.S. Department of Energy (DOE) to determine whether more-stringent standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this final rule, DOE is adopting more-stringent energy conservation standards for some classes of walk-in cooler and walk-in freezer components and has determined that these standards are technologically feasible and economically justified and would result in the significant conservation of energy.

DATES: The effective date of this rule is August 4, 2014. Compliance with the amended standards established for walk-in coolers and walk-in freezers in this final rule is required on June 5, 2017.

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

A link to the docket Web page can be found at: *http://www.regulations.gov/#!docketDetail;D=EERE-2010-BT-STD-0003*. The regulations.gov Web page will contain simple instructions on how to access all documents, including public comments, in the docket.

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

FOR FURTHER INFORMATION CONTACT: John Cymbalsky, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–5B, 1000 Independence Avenue SW., Washington, DC, 20585–0121. Telephone: (202) 287–1692. Email: *walk-in_coolers_and_walk-in_freezers@EE.Doe.Gov*

Mr. Michael Kido, U.S. Department of Energy, Office of the General Counsel, GC–71, 1000 Independence Avenue SW., Washington, DC, 20585–0121. Telephone: (202) 586–8145. Email: *Michael.Kido@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

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I. Summary of the Final Rule and Its Benefits

Title III, Part C of EPCA, Public Law 94–163 (42 U.S.C. 6311–6317, as codified), added by Public Law 95–619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment, a program covering certain industrial equipment, which includes the walk-in coolers and walk-in freezers that are the focus of this notice.[1] [2] (42 U.S.C. 6311(1), (20), 6313(f) and 6314(a)(9)) Pursuant to EPCA, any new or amended energy conservation standard that DOE prescribes for certain equipment, such as walk-in coolers and walk-in freezers (collectively, ''walk-ins'' or ''WICFs''), shall be designed to achieve the maximum improvement in energy efficiency that DOE determines is both technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) In accordance with these and other statutory provisions discussed in this notice, DOE is adopting amended energy conservation standards for the main components of walk-in coolers and walk-in freezers (walk-ins), refrigeration systems, panels, and doors. These standards are expressed in terms of annual walk-in energy factor (AWEF) for the walk-in refrigeration systems, R-value for walk-in panels, and maximum energy consumption (MEC) for walk-in doors. These standards are shown in Table I.1. These standards apply to all equipment listed in Table I.1 and manufactured in, or imported into, the United States once the compliance date listed above is reached.

TABLE I.1—ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS

Class descriptor	Class	Standard level
Refrigeration Systems		Minimum 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	$2.30 \times 10^{-4} \times Q + 2.73$
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		Minimum 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		Maximum 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	$0.12 \times A_{nd} + 5.6$

[1] All references to EPCA in this document refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act (AEMTCA), Public Law 112–210 (Dec. 18, 2012).

[2] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A–1.

TABLE I.1—ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS—Continued

Class descriptor	Class	Standard level
Display Doors		Maximum Energy Consumption (kWh/day) †
Display Door, Medium Temperature	DD.M	$0.04 \times A_{dd} + 0.41$
Display Door, Low Temperature	DD.L	$0.15 \times A_{dd} + 0.29$

* Q represents the system gross capacity as calculated in AHRI 1250.
** A_{nd} represents the surface area of the non-display door.
† A_{dd} represents the surface area of the display door.

A. Benefits and Costs to Customers

Table I.2 presents DOE's evaluation of the economic impacts of these standards on customers of walk-in coolers and walk-in freezers, as measured by the average life-cycle cost (LCC) savings and the median payback period (PBP). The average LCC savings are positive for all equipment classes for which customers are impacted by the standards.

TABLE I.2—IMPACTS OF THE FINAL RULE'S STANDARDS ON CUSTOMERS OF WALK-IN COOLERS AND WALK-IN FREEZERS

Equipment class	Average LCC savings *2013$*	Median payback period *Years*
Refrigeration System Class*		
DC.M.I*	5942	3.5
DC.M.O*	6533	2.2
DC.L.I*	2078	1.6
DC.L.O*	5942	3.5
MC.M	547	3.1
MC.L	362	3.1
Panel Class		
SP.M		
SP.L		
FP.L		
Non-Display Door Class		
PD.M		
PD.L		
FD.M		
FD.L		
Display Door Class		
DD.M	143	7.3
DD.L	902	5.4

Note: "—" indicates no impact because standards are set at the baseline level.
*For dedicated condensing (DC) refrigeration systems, results include all capacity ranges.

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 (2013) through the end of the analysis period (2046). Using real discount rates of 10.5 percent for panels, 9.4 percent for doors, and 10.4 percent for refrigeration,[3] DOE estimates that the INPV for manufacturers of walk-in coolers and walk-in freezers is $1,291 million in 2012$. Under these standards, DOE expects the industry net present value to change by −4.10 percent to 6.21 percent. Total industry conversion costs are expected to total $33.61 million. DOE does not expect any plant closings or significant loss of employment to result from these standards.

C. National Benefits[4]

DOE's analyses indicate that these standards would save a significant amount of energy. The lifetime savings for walk-in coolers and walk-in freezers purchased in the 30-year period that begins in the year of compliance with amended standards (2017–2046) amount to 3.149 quadrillion British thermal units (quads). The annual savings in 2030 (0.10 quads) is equivalent to 0.5 percent of total U.S. commercial energy use in 2014.

The cumulative net present value (NPV) of total consumer costs and savings of these standards for walk-in coolers and walk-in freezers ranges from $3.98 billion (at a 7-percent discount rate) to $9.90 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating cost savings minus the estimated

[3] These rates were used to discount future cash flows in the Manufacturer Impact Analysis. The discount rates were calculated from SEC filings and then adjusted based on cost of capital feedback collected from walk-in door, panel, and refrigeration manufacturers in MIA interviews. For a detailed explanation of how DOE arrived at these discount rates, refer to chapter 12 of the final rule TSD.

[4] All monetary values in this section are expressed in 2013 dollars and are discounted to 2014.

increased equipment costs for equipment purchased in 2016–2047.

In addition, these standards are expected to have significant environmental benefits. The energy savings would result in cumulative emission reductions of approximately 159.2 million metric tons (Mt) [5] of carbon dioxide (CO_2), 833 thousand tons of methane, 229 thousand tons of sulfur dioxide (SO_2), 254.4 thousand tons of nitrogen oxides (NO_X), 3.5 thousand tons of nitrous oxide (N_2O), and 0.27 tons of mercury (Hg).[6] Through 2030, the cumulative emissions reductions of CO_2 amount to 61.6 Mt.

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 recent Federal interagency process.[7] The derivation of the SCC values is discussed in section IV.M. Using discount rates appropriate for each set of SCC values, DOE estimates that the net present monetary value of the CO_2 emissions reductions is between $1.2 billion and $16.3 billion. DOE also estimates that the net present monetary value of the NO_X emissions reductions is $183.5 million at a 7-percent discount rate, and $366.1 million at a 3-percent discount rate.[8]

Table I.3 summarizes the national economic costs and benefits expected to result from these standards for walk-in coolers and walk-in freezers.

TABLE I.3—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF WALK-IN COOLERS AND WALK-IN FREEZERS ENERGY CONSERVATION STANDARDS

Category *	Present Value *Billion 2013$*	Discount Rate (percent)
Benefits		
Operating Cost Savings	9.5	7
	19.7	3
CO_2 Reduction Monetized Value ($12.0/t case) **	1.2	5
CO_2 Reduction Monetized Value ($40.5/t case) **	5.3	3
CO_2 Reduction Monetized Value ($62.4/t case) **	8.4	2.5
CO_2 Reduction Monetized Value ($119/t case) **	16.3	3
NO_X Reduction Monetized Value (at $2,684/ton) **	0.2	7
	0.4	3
Total Benefits †	15.0	7
	25.4	3
Costs		
Incremental Installed Costs	5.5	7
	9.8	3
Net Benefits		
Including CO_2 and NO_X Reduction Monetized Value †	9.5	7
	15.6	3

* This table presents the costs and benefits associated with walk-in coolers and walk-in freezers shipped in 2017–2046. These results include benefits to customers which accrue after 2046 from the equipment purchased in 2017–2046. The results account for the incremental variable and fixed costs incurred by manufacturers due to the amended standard, some of which may be incurred in preparation for this final rule.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporates an escalation factor. The value for NO_X is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate.

The benefits and costs of these standards, for equipment sold in 2017–2046, can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from operating the equipment (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing consumer NPV, plus (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[9]

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value

[5] A metric ton is equivalent to 1.1 short tons. Results for NO_X and Hg are presented in short tons.

[6] DOE calculated emissions reductions relative to the *Annual Energy Outlook 2013* (*AEO 2013*) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of December 31, 2012.

[7] *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 November 2013. *http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf*.

[8] DOE is investigating the valuation of the other emissions reductions.

[9] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2014, the year used for discounting the NPV of total consumer costs and savings, for the time-series of costs and benefits, using discount rates of three and seven percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table I.4. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2017 through 2046) that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined is a steady stream of payments.

of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of walk-in coolers and walk-in freezers shipped in 2017–2046. The SCC values, on the other hand, reflect the present value of all future climate-related impacts resulting from the emission of one metric ton of carbon dioxide in each year. These impacts continue well beyond 2100.

Estimates of annualized benefits and costs of these standards are shown in Table I.4. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the average SCC series that uses a 3-percent discount rate, the cost of the standards in this rule is $511 million per year in increased equipment costs, while the benefits are $879 million per year in reduced equipment operating costs, $287 million in CO_2 reductions, and $16.93 million in reduced NO_X emissions. In this case, the net benefit amounts to $671 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the cost of the standards in this rule is $528 million per year in increased equipment costs, while the benefits are $1,064 million per year in reduced operating costs, $287 million in CO_2 reductions, and $19.82 million in reduced NO_X emissions. In this case, the net benefit amounts to $842 million per year.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS

	Discount rate	Million 2013$/year		
		Primary estimate *	Low net benefits estimate *	High net benefits estimate *
Benefits				
Operating Cost Savings	7%	879	854	917.
	3%	1064	1027	1115.
CO_2 Reduction at ($12.08/t case) **	5%	86	86	86.
CO_2 Reduction at ($40.5/t case) **	3%	287	287	287.
CO_2 Reduction at ($62.4/t case) **	2.5%	420	420	420.
CO_2 Reduction at ($119/t case) **	3%	884	884	884.
NO_X Reduction at ($2,684/ton) **	7%	16.93	16.93	16.93.
	3%	19.82	19.82	19.82.
Total Benefits †	7% plus CO_2 range.	981 to 1,780	957 to 1,755	1,020 to 1,818.
	7%	1,183	1,158	1,221.
	3% plus CO_2 range.	1,169 to 1,968	1,133 to 1,931	1,221 to 2,019.
	3%	1,371	1,334	1,422.
Costs				
Incremental Equipment Costs	7%	511	501	522.
	−3%	528	515	541.
Net Benefits				
Total †	7% plus CO_2 range.	470 to 1,269	456 to 1,255	498 to 1,296.
	7%	671	657	699.
	3% plus CO_2 range.	641 to 1,440	617 to 1,416	680 to 1,478.
	3%	842	818	881.

* This table presents the annualized costs and benefits associated with walk-in coolers and walk-in freezers shipped in 2017–2046. These results include benefits to customers which accrue after 2046 from the equipment purchased in 2017–2046. The results account for the incremental variable and fixed costs incurred by manufacturers due to the amended standard, some of which may be incurred in preparation for the final rule. The primary, low, and high estimates utilize projections of energy prices from the *AEO 2013* Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental equipment costs reflect a medium decline rate for projected equipment price trends in the Primary Estimate, a low decline rate for projected equipment price trends in the Low Benefits Estimate, and a high decline rate for projected equipment price trends in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.I.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporate an escalation factor. The value for NO_X is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to average SCC with 3-percent discount rate, which is the $39.7/t CO_2 reduction 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.

D. Conclusion

Based on the analyses culminating in this final rule, DOE found the benefits to the nation from the standards (energy savings, consumer LCC savings, positive NPV of consumer benefit, and emission reductions) outweigh the burdens (loss of INPV and LCC increases for some users of this equipment). DOE has concluded that the standards in this final rule represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in significant conservation of energy. (42 U.S.C. 6295(o), 6316(e))

II. Introduction

The following section briefly discusses the statutory authority underlying this final rule, as well as some of the relevant historical background related to the establishment of standards for walk-in coolers and walk-in freezers.

A. Authority

Title III, Part C of EPCA, Public Law 94–163 (42 U.S.C. 6311–6317, as codified), added by Public Law 95–619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment, a program covering certain industrial equipment, which includes the walk-in coolers and walk-in freezers that are the focus of this notice.[10] [11] (42 U.S.C. 6311(1), (20), 6313(f) and 6314(a)(9)) Walk-ins consist of two major pieces—the structural ''envelope'' within which items are stored and a refrigeration system that cools the air in the envelope's interior.

DOE's energy conservation program for covered equipment generally consists of four parts: (1) Testing; (2) labeling; (3) the establishment of Federal energy conservation standards; and (4) certification and enforcement procedures. For walk-ins, DOE is responsible for the entirety of this program. The DOE test procedures for walk-ins, including those prescribed by Congress in the Energy Independence and Security Act of 2007, Public Law 110–140 (December 19, 2007) (''EISA''), and those established by DOE in a test procedure final rule, currently appear at title 10 of the Code of Federal Regulations (CFR) part 431, section 304.

Any new or amended performance standards that DOE prescribes for walk-ins must achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6313(f)(4)(A)) For purposes of this rulemaking, DOE also plans to adopt those standards that are likely to result in a significant conservation of energy that satisfies both of these requirements. See 42 U.S.C. 6295(o)(3)(B).

Technological feasibility is determined by examining technologies or designs that could be used to improve the efficiency of the covered equipment. DOE considers a design to be technologically feasible if it is in use by the relevant industry or if research has progressed to the development of a working prototype.

In ascertaining whether a particular standard is economically justified, DOE considers, to the greatest extent practicable, the following 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 imposition of the standard;
3. The total projected amount of energy or, as applicable, water savings likely to result directly from the imposition of the standard;
4. Any lessening of the utility or the performance of the covered equipment likely to result from the imposition of 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 imposition of 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))

DOE does not generally 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 of any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. Further, under EPCA's provisions for consumer products, there is a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For purposes of its walk-in analysis, DOE plans to account for these factors.

Additionally, when a type or class of covered equipment such as walk-ins has two or more subcategories, in promulgating standards for such equipment, DOE often specifies more than one standard level. DOE generally will adopt a different standard level than that which applies generally to such type or class of products for any group of covered products that have the same function or intended use if DOE determines that products within such group (A) consume a different kind of energy than that consumed by other covered products within such type (or class) or (B) have a capacity or other performance-related feature that other products within such type (or class) do not have, and which justifies a higher or lower standard. Generally, in determining whether a performance-related feature justifies a different standard for a group of products, DOE considers such factors as the utility to the consumer of the feature and other factors DOE deems appropriate. In a rule prescribing such a standard, DOE typically includes an explanation of the basis on which such higher or lower level was established. DOE plans to follow a similar process in the context of this rulemaking.

DOE notes that since the inception of the statutory requirements setting standards for walk-ins, Congress has since made one additional amendment to those provisions. That amendment provides that the wall, ceiling, and door insulation requirements detailed in 42 U.S.C. 6313(f)(1)(C) do not apply to the given component if the component's manufacturer has demonstrated to the Secretary's satisfaction that ''the component reduces energy consumption at least as much'' if those specified requirements were to apply to that manufacturer's component. American Energy Manufacturing Technology Corrections Act, Public Law 112–210, Sec. 2 (Dec. 18, 2012) (codified at 42 U.S.C. 6313(f)(6)) (AEMTCA). Manufacturers seeking to avail themselves of this provision must ''provide to the Secretary all data and technical information necessary to fully evaluate its application.'' *Id.* DOE codified this amendment into its regulations on October 23, 2013, at 78 FR 62988.

Since the promulgation of the amendment, one company, HH Technologies, submitted data on May 24, 2013, demonstrating that its RollSeal doors satisfied this new AEMTCA provision. DOE reviewed these data and all other submitted information and concluded that the RollSeal doors at issue satisfied 42 U.S.C. 6313(f)(6). Accordingly, DOE issued a determination letter on June 14, 2013, indicating that these doors met Section

[10] All references to EPCA in this document refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act (AEMTCA), Public Law 112–210 (Dec. 18, 2012).

[11] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A–1.

6313(f)(6) and that the applicable insulation requirements did not apply to the RollSeal doors HH Technologies identified. Nothing in this rule affects the previous determination regarding HH Technologies.

Federal energy conservation requirements generally pre-empt state laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a); 42 U.S.C. 6316(b)) However, EPCA provides that for walk-ins in particular, any state standard issued before publication of the final rule shall not be pre-empted until the standards established in the final rule take effect. (42 U.S.C. 6316(h)(2)(B))

Where applicable, DOE generally considers standby and off mode energy use for certain covered products or equipment when developing energy conservation standards. See 42 U.S.C. 6295(gg)(3). Because the vast majority of walk-in coolers and walk-in freezers operate continuously to keep their contents cold at all times, DOE is not proposing standards for standby and off mode energy use.

B. Background

1. Current Standards

EPCA defines a walk-in cooler and a walk-in freezer as an enclosed storage space refrigerated to temperatures above, and at or below, respectively, 32 °F that can be walked into. The statute also defines walk-in coolers and freezers as having a total chilled storage area of less than 3,000 square feet, excluding equipment designed and marketed exclusively for medical, scientific, or research purposes. (42 U.S.C. 6311(20)) 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 new 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 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)) DOE determined by January 1, 2009 that these motors were available from more than one manufacturer; thus, according to EPCA, walk-in evaporator fan motors with a rating of under 1 horsepower and less than 460 volts must be either three-phase motors or electronically commutated motors. DOE documented this determination in the rulemaking docket as docket ID EERE–2008–BT–STD–0015–0072. This document can be found at *http://www.regulations.gov/#!documentDetail;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 sets forth additional requirements for walk-ins with transparent reach-in doors. Freezer doors must have triple-pane glass with either heat-reflective treated glass or gas fill for doors and windows for freezers. 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).

2. History of Standards Rulemaking for Walk-In Coolers and Walk-In Freezers

EPCA directs the Secretary to issue performance-based standards for walk-ins that would apply to equipment manufactured 3 years after the final rule is published, or 5 years if the Secretary determines by rule that a 3-year period is inadequate. (42 U.S.C. 6313(f)(4))

DOE initiated the current rulemaking by publishing a notice announcing the availability of its ''Walk-In Coolers and Walk-In Freezers Energy Conservation Standard Framework Document'' and a meeting to discuss the document. The notice also solicited comment on the matters raised in the document. 74 FR 411 (Jan 6, 2009). More information on the framework document is available at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/30*. The framework document described the procedural and analytical approaches that DOE anticipated using to evaluate energy conservation standards for walk-ins and identified various issues to be resolved in conducting this rulemaking.

DOE held the framework public meeting on February 4, 2009, in which it: (1) Presented the contents of the framework document; (2) described the analyses it planned to conduct during the rulemaking; (3) sought comments from interested parties on these subjects; and (4) in general, sought to inform interested parties about, and facilitate their involvement in, the rulemaking. Major issues discussed at the public meeting included: (1) The scope of coverage for the rulemaking; (2) development of a test procedure and appropriate test metrics; (3) manufacturer and market information, including distribution channels; (4) equipment classes, baseline units, and design options to improve efficiency; and (5) life-cycle costs to consumers, including installation, maintenance, and repair costs, and any consumer subgroups DOE should consider. At the meeting and during the comment period on the framework document, DOE received many comments that helped it identify and resolve issues pertaining to walk-ins relevant to this rulemaking.

DOE then gathered additional information and performed preliminary analyses to help develop potential energy conservation standards for this equipment. This process culminated in DOE's announcement of another public meeting to discuss and receive comments on the following matters: (1) The equipment classes DOE planned to analyze; (2) the analytical framework, models, and tools that DOE used to evaluate standards; (3) the results of the preliminary analyses performed by DOE; and (4) potential standard levels that DOE could consider. 75 FR 17080 (April 5, 2010) (the April 2010 Notice). DOE also invited written comments on these subjects and announced the availability on its Web site of a preliminary technical support document (preliminary TSD) it had prepared to inform interested parties and enable them to provide comments. *Id.* (More information about the preliminary TSD is available at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/30.*) Finally, DOE sought views on other relevant issues that participants believed either would impact walk-in standards or that the proposal should address. *Id.* at 17083.

The preliminary TSD provided an overview of the activities DOE undertook to develop standards for walk-ins and discussed the comments DOE received in response to the framework document. The preliminary TSD also addressed separate standards for the walk-in envelope and the refrigeration system, as well as compliance and enforcement responsibilities and food safety regulatory concerns. The document also described the analytical framework that DOE used (and continues to use) in considering standards for walk-ins, including a description of the methodology, the analytical tools, and the relationships between the various analyses that are part of this rulemaking. Additionally, the preliminary TSD presented in detail each analysis that DOE had performed for these products up to that point, including descriptions of inputs, sources, methodologies, and results. These analyses were as follows:

- A *market and technology assessment* addressed the scope of this rulemaking, identified existing and potential new equipment classes for walk-in coolers and walk-in freezers, characterized the markets for this equipment, and reviewed techniques and approaches for improving its efficiency;
- A *screening analysis* reviewed technology options to improve the efficiency of walk-in coolers and walk-in freezers, and weighed these options against DOE's four prescribed screening criteria;
- An *engineering analysis* estimated the manufacturer selling prices (MSPs) associated with more energy efficient walk-in coolers and walk-in freezers;
- An *energy use analysis* estimated the annual energy use of walk-in coolers and walk-in freezers;
- A *markups analysis* converted estimated MSPs derived from the engineering analysis to customer purchase prices;
- A *life-cycle cost analysis* calculated, for individual customers, the discounted savings in operating costs throughout the estimated average life of walk-in coolers and walk-in freezers, compared to any increase in installed costs likely to result directly from the imposition of a given standard;
- A *payback period analysis* estimated the amount of time it would take customers to recover the higher purchase price of more energy efficient equipment through lower operating costs;
- A *shipments analysis* estimated shipments of walk-in coolers and walk-in freezers over the time period examined in the analysis;
- A *national impact analysis* (NIA) assessed the national energy savings (NES), and the national NPV of total customer costs and savings, expected to result from specific, potential energy conservation standards for walk-in coolers and walk-in freezers; and
- A *manufacturer impact analysis* (MIA) assessed the potential effects on manufacturers of amended efficiency standards.

The public meeting announced in the April 2010 Notice took place on May 19, 2010. At this meeting, DOE presented the methodologies and results of the analyses set forth in the preliminary TSD. Interested parties that participated in the public meeting discussed a variety of topics, but the comments centered on the following issues: (1) Separate standards for the refrigeration system and the walk-in envelope; (2) responsibility for compliance; (3) equipment classes; (4) technology options; (5) energy modeling; (6) installation, maintenance, and repair costs; (7) markups and distributions chains; (8) walk-in cooler and freezer shipments; and (9) test procedures. The comments received since publication of the April 2010 Notice, including those received at the May 2010 public meeting, have contributed to DOE's resolution of the issues in this rulemaking as they pertain to walk-ins. This final rule responds to the issues raised by the commenters. (A parenthetical reference at the end of a quotation or paraphrase provides the location of the item in the public record.)

On September 11, 2013, DOE published a notice of proposed rulemaking (NOPR) in this proceeding (September 2013 NOPR). 78 FR 55781. In the September 2013 NOPR, DOE addressed, in detail, the comments received in earlier stages of rulemaking, and proposed new energy conservation standards for walk-ins. In conjunction with the September 2013 NOPR, DOE also published on its Web site the complete technical support document (TSD) for the proposed rule, which incorporated the analyses DOE conducted and technical documentation for each analysis. Also published on DOE's Web site were the engineering analysis spreadsheets, the LCC spreadsheet, and the national impact analysis standard spreadsheet; these can be found at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/30.*

The standards DOE proposed for walk-in coolers and walk-in freezers are shown in Table II.1.

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Table II.1 Proposed Energy Conservation Standards for Walk-in Coolers and Walk-in Freezers from the September 2013 NOPR

Class Descriptor	Class	Proposed Standard Level
Refrigeration Systems		**Minimum AWEF (Btu/W-h)***
Dedicated Condensing, Medium Temperature, Indoor System, < 9,000 Btu/h Capacity	DC.M.I, < 9,000	$2.63\times10^{-4}\times Q+4.53$
Dedicated Condensing, Medium Temperature, Indoor System, ≥ 9,000 Btu/h Capacity	DC.M.I, ≥ 9,000	6.90
Dedicated Condensing, Medium Temperature, Outdoor System, < 9,000 Btu/h Capacity	DC.M.O, < 9,000	$1.34\times10^{-3}\times Q+0.12$
Dedicated Condensing, Medium Temperature, Outdoor System, ≥ 9,000 Btu/h Capacity	DC.M.O, ≥ 9,000	12.21
Dedicated Condensing, Low Temperature, Indoor System, < 9,000 Btu/h Capacity	DC.L.I, < 9,000	$1.93\times10^{-4}\times Q+1.89$
Dedicated Condensing, Low Temperature, Indoor System, ≥ 9,000 Btu/h Capacity	DC.L.I, ≥ 9,000	3.63
Dedicated Condensing, Low Temperature, Outdoor System, < 9,000 Btu/h Capacity	DC.L.O, < 9,000	$5.70\times10^{-4}\times Q+1.02$
Dedicated Condensing, Low Temperature, Outdoor System, ≥ 9,000 Btu/h Capacity	DC.L.O, ≥ 9,000	6.15
Multiplex Condensing, Medium Temperature	MC.M	10.74
Multiplex Condensing, Low Temperature	MC.L	5.53
Panels		**Minimum U-Factor(Btu/ h-ft²-°F)****
Structural Panel, Medium Temperature	SP.M	$-0.012\times\left(\frac{A_{nf\ edge}}{A_{nf\ core}}\right)^2+0.024\times\left(\frac{A_{nf\ edge}}{A_{nf\ core}}\right)+0.041$
Structural Panel, Low Temperature	SP.L	$-0.0083\times\left(\frac{A_{nf\ edge}}{A_{nf\ core}}\right)^2+0.017\times\left(\frac{A_{nf\ edge}}{A_{nf\ core}}\right)+0.029$
Floor Panel, Low Temperature	FP.L	$-0.0091\times\left(\frac{A_{fp\ edge}}{A_{fp\ core}}\right)^2+0.018\times\left(\frac{A_{fp\ edge}}{A_{fp\ core}}\right)+0.033$
Non-Display Doors		**Maximum 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		**Maximum Energy Consumption (kWh/day)††**
Display Door, Medium Temperature	DD.M	$0.04\times A_{dd}+0.41$
Display Door, Low Temperature	DD.L	$0.15\times A_{dd}+0.29$

In the September 2013 NOPR, in addition to seeking comments generally on its proposal, DOE identified a number of specific issues on which it was particularly interested in receiving comments and views of interested parties, which were detailed in section VII.E of that notice. 78 FR at 55882–55887 (September 11, 2013) After the publication of the September 2013 NOPR, DOE received written comments on these and other issues. DOE also held a public meeting in Washington, DC, on October 9, 2013, to hear oral comments on, and solicit information relevant to, the proposed rule. The comments on the NOPR are addressed in this document.

III. General Discussion

A. Component Level Standards

In the NOPR, DOE proposed component-level standards for walk-in coolers and freezers, in order to ensure accurate testing and compliance. Specifically, DOE proposed to regulate separately three main components of a walk-in: Panels, doors, and refrigeration systems. See 78 FR at 55822 (September 11, 2013). DOE received comments from a number of different entities. A list of these entities is included in Table III.1 below.

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

Commenter	Acronym	Affiliation	Comment number (docket reference)
Air Conditioning Contractors of America	ACCA	Trade Association	119
Air-Conditioning, Heating, and Refrigeration Institute	AHRI	Trade Association	083, 114
Alex Milgroom	Milgroom	Individual	090
American Panel Corporation	APC, American Panel	Manufacturer	099
Architectural Testing, Inc.	AT	Manufacturer	111
Arctic Industries, Inc.	Arctic	Manufacturer	117
Appliance Standards Awareness Project, American Council for an Energy Efficient Economy, and Natural Resources Defense Council.	ASAP, ACEEE, NRDC (ASAP et al.).	Efficiency Organization	113
Bally Refrigerated Boxes, Inc.	Bally	Manufacturer	102
California Investor Owned Utilities	CA IOUs	Utility Association	089, 110
Center for the Study of Science Cato Institute	Cato, CSS	Efficiency Organization	106
Crown Tonka, ThermalRite and International Cold Storage	ICS et al.	Manufacturer	100
ebm-papst Inc.	ebm-papst	Component/Material Supplier	092
Hillphoenix	Hillphoenix	Manufacturer	107
Hussmann Corporation	Hussmann	Manufacturer	093
Imperial-Brown	IB	Manufacturer	098
KeepRite Refrigeration	KeepRite	Manufacturer	105
Lennox International Inc./Heatcraft Refrigeration Products, LLC.	Lennox	Manufacturer	109
Louisville Cooler	Louisville Cooler	Manufacturer	081
Manitowoc Company	Manitowoc	Manufacturer	108
National Coil Company	NCC	Component/Material Supplier	096
National Restaurant Association	NRA	Consumer Advocate	112
New York State Office of the Attorney General	AGNY	State Official/Agency	116
Nor-Lake, Inc.	Nor-Lake	Manufacturer	115
North American Association of Food Equipment Manufacturers.	NAFEM	Consumer Advocate	118
Northwest Energy Efficiency Alliance and Northwest Power and Conservation Council.	NEEA, NPCC (NEEA et al.)	Efficiency Organization	101
Natural Resources Defense Council, Environmental Defense Fund, Union of Concenrned Scientists, Institute for Policy Integrity.	NRDC, EDC, UCS, IPI (NRDC et al.).	Efficiency Organization	094
Robert Kopp	Kopp	Individual	080
Society of American Florists	SAF	Consumer Advocate	103
Suzanne Jaworowski	Jaworowski	Individual	074
The Mercatus Center at George Mason University	Mercatus, Mercatus Center	Efficiency Organization	091
THERMO–KOOL/Mid-South Industries, Inc.	Thermo-Kool	Manufacturer	097
U.S. Chamber of Commerce	US Chamber of Commerce	Regional Agency/Association	095
U.S. Cooler—Division of Craig Industries Inc	US Cooler	Manufacturer	075, 104
Heatcraft Refrigeration Products, LLC	Heatcraft	Manufacturer	*
Honeywell	Honeywell	Manufacturer	*
SmithBucklin Corporation	SmithBucklin	Manufacturer	*
Heating, Air-Conditioning & Refrigeration Distributors International.	HARDI	Manufacturer	*
Heat Transfer Products Group	HT, Heat Transfer	Manufacturer	*
The Danfoss Group	Danfoss	Component/Material Supplier	*

* These commenters were present at the public meeting but did not submit written comments.

DOE received several comments supporting its component-based approach to setting standards for walk-ins. Nor-Lake, Kysor, and Louisville Cooler agreed with this approach. (Nor-Lake, No. 115 at p. 1, Kysor, Public Meeting Transcript, No. 88 at p. 40, and Louisville Cooler, No. 81 at p. 1) Bally, IB, and ICS commented that component-level standards were practical. (Bally, No. 102 at p. 1, IB, No. 98 at p. 1, and Hillphoenix, No. 107 at p. 2) ACCA notes that component-level standards simplify the compliance burden for assemblers. (ACCA, No. 119 at p. 2) US Cooler also agreed with the component approach, noting that the refrigeration industry is well established, and adding that a component-level approach will give US Cooler more flexibility to meet the proposed requirements. (US Cooler, No. 88 at p. 51) ASAP and the CA IOUs agreed with the component performance approach for panels and doors. (ASAP, Public Meeting Transcript, No. 88 at p. 16 and CA IOUs, Public Meeting Transcript, No. 88 at p. 30)

DOE received additional comments concerning how WICF component standards could be set. Thermo-Kool commented that while component level standards were feasible, components added to doors such as windows and heater wires, among others, should be regulated separately—it added that doors should be regulated along with wall and ceiling panels. (ThermoKool, No. 97 at p. 1) Hillphoenix commented that standards for panels, walls, ceilings, and floors should also include the door panel. (Hillphoenix, No. 107 at p. 2) Bally noted that setting separate standards for windows would eliminate the need for door manufacturers to test the same door twice—i.e. with and without windows. (Bally, No. 102 at p. 5) APC commented that electrical components, such as vision windows, heater wires, relief vents, and temperature alarms, should have separate standards and not be included in the analysis of non-display doors. (APC, No. 99 at p. 2) The CA IOUs commented that separate standards for the envelope and refrigeration systems would be highly effective because they would reduce the possibility of underperforming envelopes or under-performing refrigeration systems. The CA IOUs remarked that it would have been difficult to enforce a standard that allowed performance trade-offs between the envelope and refrigeration system. (CA IOUs, No. 110 at p. 1) The CA IOUs further commented that separate lighting performance standards for walk-ins would create more clarity for performance requirements of display doors. (CA IOUs, No. 110 at p. 4)

In light of the comments received, DOE is finalizing an approach that sets out separate component-level standards for panels, doors, and refrigeration systems of WICFs. DOE recognizes that refrigeration systems may be sold as two other separate components—a unit cooler and a condensing unit—and is addressing this through a separate approach and certification process for this equipment. For more details on this approach, see section III.B.2.

B. Test Procedures and Metrics

While Congress had initially prescribed certain performance standards and test procedures concerning walk-ins as part of the EISA 2007 amendments, Congress also instructed DOE to develop specific test procedures for walk-in equipment. DOE subsequently established a test procedure for walk-ins. See 76 FR 21580 (April 15, 2011). See also 76 FR 33631 (June 9, 2011) (final technical corrections). Recently, DOE published additional amendments that would, among other things, permit the use of alternative efficiency determination methods when evaluating the energy usage of refrigeration system unit coolers and condenser units. See 79 FR 27387 (May 13, 2014). These amendments have been taken into account when formulating the standards promulgated in this notice.

The proposed amendments provide an approach that would base compliance on the ability of component manufacturers to produce components that meet the required standards. This approach is also consistent with the framework established by Congress, which set specific energy efficiency performance requirements on a component-level basis. (42 U.S.C. 6313(f)) The approach is discussed more fully below.

1. Panels

In the test procedure final rule for walk-ins, DOE defines ''panel'' as a construction component, excluding doors, used to construct the envelope of the walk-in (*i.e.,* elements that separate the interior refrigerated environment of the walk-in from the exterior). 76 FR 21580, 21604 (April 15, 2011). DOE explained that panel manufacturers would test their panels to obtain a thermal transmittance metric—known as U-factor, measured in British thermal units (Btus) per hour-per square foot degrees (Fahrenheit) ($Btu/h\text{-}ft^2 - {}^\circ F$)—and identified three types of panels: display panels, floor panels, and non-floor panels. A display panel is defined as a panel that is entirely or partially comprised of glass, a transparent material, or both, and is used for display purposes. Id. It is considered equivalent to a window and the U-factor is determined by NFRC 100–2010–E0A1, ''Procedure for Determining Fenestration Product U-factors.'' 76 FR at 33639. Floor panels are used for walk-in floors, whereas non-floor panels are used for walls and ceilings.

The U-factor for floor and non-floor panels accounts for any structural members internal to the panel and the long-term thermal aging of foam. This value is determined by a three-step process. First, both floor and non-floor panels must be tested using ASTM C1363–10, ''Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.'' The panel's core and edge regions must be used during testing. Second, the panel's core U-factor must be adjusted with a degradation factor to account for foam aging. The degradation factor is determined by EN 13165:2009–02, ''Thermal Insulation Products for Buildings—Factory Made Rigid Polyurethane Foam (PUR) Products—Specification,'' or EN 13164:2009–02, ''Thermal Insulation Products for Buildings—Factory Made Products of Extruded Polystyrene Foam (XPS)—Specification,'' as applicable. Third, the edge and modified core U-factors are then combined to produce the panel's overall U-factor. All industry protocols were incorporated by reference most recently in the test procedure final rule correction. 76 FR 33631.

In response to the energy conservation standards NOPR, DOE received comments stating that the ASTM C1363, DIN EN 13164, and DIN EN 13165 were significantly burdensome for manufacturers to conduct. DOE addressed these comments in a separate notice published on May 13, 2014, which proposed certain simplifications to the current procedure. See 79 FR 27387. Specifically, under this approach, manufacturers would no longer need to use the performance-based test procedures for WICF floor and non-floor panels, which include ASTM C1363, DIN EN 13164, and DINE EN 13165 (10 CFR Part 431, Subpart R, Appendix A, sections 4.2, 4.3, 5.1, and 5.2). DOE recognizes that these performance-based procedures for WICF floor and non-floor panels are in addition to the prescriptive requirements established in EPCA for panel insulation R-values and, therefore, may increase the test burden to manufacturers. As DOE is no longer requiring the performance-based procedures which were ultimately used to calculate a U-value of a walk-in panel, the Department reverted to thermal resistance, or R-value, as measured by ASTM C518, as the metric for establishing performance standards for walk-in cooler and freezer panels. Based on the comments submitted by interested parties, DOE finds that using ASTM C518 will provide a sufficient robust method to measure panel energy efficiency while minimizing manufacturer testing burdens.

2. Doors

The walk-in test procedure final rule addressed two door types: display and non-display doors. Within the general context of walk-ins, a door consists of the door panel, glass, framing materials, door plug, mullion, and any other elements that form the door or part of its connection to the wall. DOE defines display doors as doors designed for product movement, display, or both, rather than the passage of persons; a non-display door is interpreted to mean any type of door that is not captured by the definition of a display door. See generally 76 FR 33631.

The test metric for doors is in terms of energy use, measured in kilowatt-hours per day (kWh/day). The energy use accounts for thermal transmittance through the door and the electricity use of any electrical components associated with the door. The thermal transmittance is measured by NFRC 100–2010–E0A1, and is converted to energy consumption via conduction losses using an assumed efficiency of the refrigeration system in accordance with the test procedure. See 76 FR at 33636–33637. The electrical energy consumption of the door is calculated by summing each electrical device's individual consumption and accounts for all device controls by applying a ''percent time off'' value to the appropriate device's energy consumption. For any device that is located on the internal face of the door or inside the door, 75 percent of its power is assumed to contribute to an additional heat load on the compressor. Finally, the total energy consumption of the door is found by combining the conduction load, electrical load, and additional compressor load.

DOE received several comments about the proposed metric. NEEA, et al. agreed with the door metric being a combination of the refrigeration load created by the heat loss through the door plus heater draw components associated with the door. (NEEA, et al., No. 101 at p. 5) Nor-Lake commented that doors also have a U-value metric like panels and that other energy consuming devices should be considered as an additional load on the refrigeration system. (Nor-Lake, No. 115 at p. 2) Bally commented that the metric for doors should be a function of the temperature of the WICF box, the linear periphery dimensions of the door, the thickness of the door and the temperature or humidity conditions that exist on the outside of the door. (Bally, No. 102 at p. 3) Hillphoenix commented that the energy consumption posed by the perimeter heat on a door is not associated with surface area, but instead the length of the heater wire. (Hillphoenix, No. 107 at p. 2) At the public meeting, Kysor commented that the door metric should include the R-value as tested by ASTM C518 and the electrical draw for heater wire, if used. (Kysor, Public Meeting Transcript, No. 88 at p. 96) AHRI suggested that the energy metric for door efficiency be expressed as a function of door perimeter length, as opposed to surface area, since the largest heat gain was at the periphery and edges. AHRI pointed out that while the perimeter of a ''medium'' door was 11% greater than a ''small'' door, the surface area was 29% greater causing smaller doors to be over penalized. (AHRI, No. 114 at p. 5)

In response to Nor-Lake's comment, DOE agrees that non-display doors are very similar to panels in that they are both primarily made up of insulation. However, the DOE test procedure adds the additional heat load caused by components like lighting and heater wire to the daily power consumption of these doors. DOE opted for this method because the electrical components, like heater wire, are integrated into the doors. DOE thought this method was more appropriate because the door manufacturers determine which electricity consuming components are integrated into the door. In response to Bally's comment, DOE agrees that the space conditions of a walk-in have an impact on a door's energy consumption. However, the thermal conductance of a cooler or freezer door, a portion of the maximum energy consumption metric, is measured at specific rating conditions to allow for equipment comparisons. These conditions are listed in 10 CFR 431.304 and 10 CFR Subpart R, appendix A. Additionally, DOE expects the thermal transmittance as measured by NFRC 100–2010–E0A1 to capture the energy loss though the periphery of the door because this test method measures the heat transfer through an entire door. DOE appreciates Kysor's comment, but finds that NFRC 100–2010–E0A1, and industry accepted test procedure, more accurately represents the thermal transmittance of the door. DOE agrees with AHRI that the energy consumption of the heater wire is directly related to the amount or length of heater wire used. However, EISA set a precedent by limiting the amount of heater wire per door opening area. Therefore, DOE is setting the standards in terms of door surface area instead of perimeter.

DOE also received comments on the door test procedure. Bally remarked at the public meeting that the percent time off for device controls should be a floating value because it would be more practical than a set percent time off. (Bally, Public Meeting Transcript, No. 88 at p. 148) DOE appreciates Bally's comment and acknowledges that some controls may reduce more energy than other. However, the current test procedure does not measure the effectiveness of the controls. Additionally, DOE is concerned that incorporating additional testing to measure a controls percent time off value would great undue burden on manufacturers. For these reasons the Department is not considering floating percent time off values.

3. Refrigeration

The DOE test procedure incorporates an industry test procedure that applies to walk-in refrigeration systems: AHRI 1250 (I–P)-2009, ''2009 Standard for Performance Rating of Walk-In Coolers and Freezers'' (''AHRI 1250–2009''). (10 CFR 431.304) This procedure applies to three different scenarios—(1) unit coolers and condensing units sold together as a matched system, (2) unit coolers and condensing units sold separately, and (3) unit coolers connected to compressor racks or multiplex condensing systems. It also describes methods for measuring the refrigeration capacity, on-cycle electrical energy consumption, off-cycle fan energy, and defrost energy. Standard test conditions, which are different for indoor and outdoor locations and for coolers and freezers, are also specified.

The test procedure includes a calculation methodology to compute an annual walk-in energy factor (AWEF), which is the ratio of heat removed from the envelope to the total energy input of the refrigeration system over a year. AWEF is measured in Btu/W-h and measures the efficiency of a refrigeration system. DOE established a metric based on efficiency, rather than energy use, for describing refrigeration system performance, because a refrigeration system's energy use would be expected to increase based on the size of the walk-in and on the heat load that the walk-in produces. An efficiency-based metric would account for this relationship and would simplify the comparison of refrigeration systems to each other. Therefore, DOE is using an energy conservation standard for refrigeration systems that would be presented in terms of AWEF.

Several stakeholders commented on the applicability of the test procedure to refrigeration components (i.e., the unit cooler and the condensing unit) sold separately. NEEA, et al. expressed support for the proposed standard's approach of using AHRI 1250 for testing and rating all condensing units. (NEEA, et al., No. 101 at p. 3) CA IOUs, on the other hand, asserted that the AHRI 1250 test was inadequate because it requires a unit cooler for testing a dedicated condensing unit, which is a less reliable rating method due to the lack of a viable enforcement mechanism. (CA IOUs, Public Meeting Transcript, No. 88 at p. 384) CA IOUs recommended modifying the AHRI 1250 test method so that all unit coolers connected to remote condensing units are treated the same, whether they are connected to a dedicated, shared, or multiplex remote condensing unit. (CA IOUs, No. 110 at p. 2) CA IOUs further recommended developing a separate AHRI Standard for the performance rating of WICF refrigeration condensing units, along with TSLs (i.e. Trial Standard Levels) and energy conservation standards specific to refrigeration condensing units. (CA IOUs, No. 110 at p. 3) Manitowoc asserted that manufacturers that build only condensing units—but not evaporator coils—could not test the efficiency of the entire refrigeration system. (Manitowoc, No. 108 at p. 2)

Other stakeholders commented specifically on the metrics established by the test procedure. KeepRite and Bally suggested that the energy efficiency ratio (EER) of the condensing unit and evaporator be used as the refrigeration system metric and basis of performance specifications in place of AWEF. (KeepRite, No. 105 at p. 1; Bally, No. 102 at p. 3) AHRI commented that the use of duty-cycle adjusted EER for condensing units and unit coolers, separately, was a more accurate metric than AWEF and should be the basis for performance specifications, because evaporator assemblies, condensing units, and refrigerants were often specified by contractors, procured from multiple manufacturers, and assembled as custom systems. (AHRI, No. 114 at p. 2) Louisville Cooler commented that using a watts-per-hour was a more practical and replicable method of measuring energy use, and AWEF is impacted by variables such as ambient temperature and seasonal changes. (Louisville Cooler, No. 81 at p. 1) NEEA, et al., on the other hand, stated that AWEF was a logical metric to rate cooling system component efficiency in a way that enabled marketplace differentiation and simplified compliance and enforcement. (NEEA, et al., No. 101 at p. 2)

DOE understands that the test procedure, as originally conceived, required both a unit cooler and a condensing unit to be tested in order to derive an AWEF rating for the system. In light of the issues about enforcement and manufacturer burden raised by the CA IOUs and Manitowoc, DOE has developed a separate approach addressing certification issues for manufacturers who produce and sell condensing units and/or unit coolers as separate products. Under that approach, a manufacturer who sells a unit without a matched condensing unit must rate and certify a refrigeration system containing that unit cooler by testing according to the methodology in AHRI 1250 for unit coolers intended to be used with a parallel rack system (see AHRI 1250, section 7.9). The manufacturer would use the calculation method in this section to determine the system AWEF and certify this AWEF to DOE. Additionally, all unit coolers tested and rated as part of a system under this method must comply with the standards in the multiplex equipment classes. DOE notes that this approach is consistent with the approach recommended by the CA IOUs because the same approach is used for separately-sold unit coolers regardless of what kind of condensing unit they are paired with. A manufacturer who sells a condensing unit separately must rate and certify a refrigeration system containing that condensing unit by conducting the condensing unit portion of the test method (using the standard ratings in section 5.1 of AHRI 1250–2009) but applying nominal values for saturated suction temperature, evaporator fan power, and defrost energy, in order to calculate an AWEF for the refrigeration system basic model containing that condensing unit. These nominal values would be standardized, which means that other similarly situated manufacturers would use these values when calculating the efficiency of a refrigeration system using their particular condensing unit. For complete details on how refrigeration system components must be rated and certified under this approach, see 79 FR 27387 at 27397 (detailing revised approach to be incorporated under 10 CFR 431.304(c)(10)). In response to the comments about the appropriate metrics to use, DOE notes that it is continuing to use AWEF as the metric for WICF refrigeration systems and components, and continues to base its standards on AWEF. DOE believes AWEF is sufficient to capture WICF system and component performance and has not established a different metric, such as EER or watts/hour, for rating refrigeration equipment. In response to Louisville Cooler's comment on the effect of seasonal changes and temperatures, DOE notes that the test procedure established a set of uniform rating conditions that cover multiple ambient temperatures as a proxy for seasonal changes a system exposed to the outdoors may encounter. DOE's standards are based on rating systems under the uniform rating conditions contained in the test procedure, thus maximizing the repeatability of the test.

Lennox noted that the test procedure did not contain provisions for multiple unit cooler matches on a single condensing unit. (Lennox, No. 109 at p. 3) DOE acknowledges this fact but notes that manufacturer installation instructions typically include setup of multiple unit coolers because this setup is commonly used; for instance, by installers who wish to distribute airflow more evenly around a large walk-in. During the test, the system should be set up per the manufacturer's installation instructions. DOE successfully conducted testing of a system with two unit coolers as part of its rulemaking analysis. However, if DOE finds that such instructions are sufficiently unclear to others testing their equipment, DOE may introduce a test procedure addendum or amendment with more specific instructions for setup and testing.

Further, some commenters identified types of systems or technologies that would not be covered by the test procedure. Hussmann commented that the AHRI 1250 procedure did not contain test methods for secondary refrigeration systems, such as those utilizing glycol, brine, or CO_2. (Hussmann, No. 93 at p. 2) Danfoss commented that by regulating units in steady-state conditions, the proposed rule automatically excluded adaptive controls, which had tremendous energy savings potential. (Danfoss, Public Meeting Transcript, No. 88 at p. 115) ACEEE agreed with Danfoss that the AHRI 1250 procedure lacked the ability to account for controls, and other design options not affecting steady-state energy consumption. (ACEEE, Public Meeting Transcript, No. 88 at p. 149) AHRI added that the AHRI 1250 test procedure was likely to be updated in the next three to six months. (AHRI, No. 114 at p. 3)

DOE agrees with Hussmann that the AHRI 1250 procedure does not cover secondary refrigeration systems, and agrees with Danfoss and ACEEE that controls or other options not affecting steady-state energy would also not be covered by AHRI 1250. If a manufacturer believes that the test procedure in its current form does not measure the efficiency of the equipment in a manner representative of its true energy use, the manufacturer may apply for a test procedure waiver. DOE also notes that should the industry develop a test method for WICF units with secondary refrigeration systems or adaptive controls, or update the existing test method so as to include such provisions, DOE will consider adopting it for WICFs. To address AHRI's comment, DOE will also consider adopting test procedure revisions once they are developed.

C. Certification, Compliance, and Enforcement

In keeping with the requirements of EPCA, DOE proposed a compliance date of three years from the date of publication of the final rule. 78 FR 55830 (September 11, 2013) DOE received a variety of comments regarding this issue. Several stakeholders commented in favor of a three-year period between the final rule and the compliance date. Specifically, ASAP, et al. urged DOE to adopt a compliance date three years after publication of the final rule, since DOE's analysis of manufacturer impacts suggests that conversion costs to meet the proposed standards would be modest. (ASAP, et al., No. 113 at p. 5) Manitowoc stated that once the standard is finalized, three years is a sufficient timeframe for compliance. (Manitowoc, No. 108 at p. 3) ASAP, et al. noted that a compliance date of three years after the publication of the final rule is reasonable and that a later compliance date would result in avoidable loss of energy savings. (ASAP et al., No. 113 at p. 5)

Several stakeholders favored a longer period between the final rule and the compliance date. Hussmann stated that DOE should consider the certification process when setting the compliance date and that the compliance date of the proposed standard should be delayed so as to allow for an AEDM to be enforced before the compliance date. (Hussmann, Public Meeting Transcript, No. 88 at p. 75, and No. 93 at p. 6) Lennox expressed concern that a three-year compliance timeframe is not adequate. (Lennox, No. 109 at p. 7) Nor-Lake requested that DOE extend the compliance date beyond 2017 and noted that a compliance date of April 2017 may not give manufacturers enough time to complete required testing since there are currently no known labs in the U.S. that can perform the DIN EN 13164/13165 tests. Nor-Lake observed that manufacturers that produce panels and refrigeration would be overloaded with having to perform both sets of tests. (Nor-Lake, No. 115 at pp. 3–5) Hillphoenix requested additional time for the compliance date and testing to allow for more labs to qualify for testing, because currently none can. (Hillphoenix, No. at p. 69) AHRI recommended that the timeline consider the fact that there is no AHRI or other third-party certification program for these products. (AHRI, Public Meeting Transcript, No. 88 at p. 76)

Regarding enforcement, Hussmann commented that it was unclear how DOE intended to enforce the standard for cooling systems, and ACCA suggested that an outline of DOE's intended enforcement policy be included in the final rule. (Hussmann, No. 93 at p. 1; ACCA, No. 119 at p. 2) ACCA further urged that DOE simplify compliance obligations for the assembler, including giving the industry one year after adoption of an enforcement policy to comply with enforcement provisions. (ACCA, No. 119 at p. 3)

DOE notes that it has since simplified the testing requirements for WICF components—in part by eliminating the requirement to test panels using the ASTM C1363 and DIN EN 13164/13165 tests. For refrigeration systems, DOE established a testing approach for unit coolers and condensing units sold separately and allowed refrigeration systems, unit coolers, and condensing units to be rated using an Alternative Efficiency Determination Method, or AEDM. See 79 FR 27387 (May 14, 2014). DOE believes these changes substantially simplify the process for certification, compliance, and enforcement. Therefore, DOE does not believe additional time is needed for compliance beyond three years from the publication of this notice.

Since component-level standards were proposed in the NOPR, DOE requested comments on who should be responsible for complying with the regulation. DOE received comments from multiple interested parties in this regard. The CA IOUs stated that DOE found that the contractor is the ''manufacturer'' and that DOE should therefore provide a path to certification for contractors. (CA IOUs, No. 89 at p. 20) The CA IOUs further commented that manufacturers sell lighting systems specifically designed for cold storage facilities and these could therefore be regulated at the point of manufacture. (CA IOUs, No. 110 at p. 4) ACCA noted that the assembly of WICF component parts is often performed by independent heating, ventilation, air-conditioning, and refrigeration (HVAC/R) technicians not employed by component part manufacturers. (ACCA, No. 119 at p. 1) US Cooler noted that the proposed standard could significantly impact manufacturers who made individual refrigeration components that were then assembled into complete systems by contractors. (US Cooler, Public Meeting Transcript, No. 88 at p. 344) More specifically, US Cooler expressed concern that wholesalers and contractors would not be held to the same level of compliance as component manufacturers, which would put US Cooler at a competitive disadvantage. (US Cooler, Public Meeting Transcript, No. 88 at p. 51) American Panel agreed that the standards must also apply to wholesalers, as well as component manufacturers to prevent wholesalers from circumventing the regulation (for instance, by selling cooler panels for freezer applications). (American Panel, No. 99 at p. 2) HARDI stated that holding the wholesaler responsible would limit product availability for replacement and repair. (HARDI, Public Meeting Transcript, No. 88 at p. 53) ACEEE stated that the approach chosen should support the goal of legitimate repair parts without abusing the system, where ''repair'' components are being sold by manufacturers to subvert the law. (ACEEE, Public Meeting Transcript, No. 88 at p. 54) Danfoss noted that about 25 percent of WICF refrigeration systems are assembled by contractors and not sold as combined sets, and American Panel noted that 15 percent of systems are unit coolers connected to rack systems, where below 10 percent are dedicated systems matched by a contractor. (Danfoss, Public Meeting Transcript, No. 88 at p. 60, and APC, Public Meeting Transcript, No. 88 at p. 60) Danfoss further expressed concern that the proposed standard would preclude manufacturers like itself who sold only condensing units, but not complete systems, from being able to sell products into the WICF market. (Danfoss, Public Meeting Transcript, No. 88 at p. 343)

In general, DOE notes that the term ''manufacturer'' of a walk-in refers to 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. (See 10 CFR 431.302.) For purposes of certification, DOE will require the manufacturer of the walk-in component to certify compliance with DOE's standards, which are component-based. Namely, the manufacturer of a panel or door that is used in a walk-in must certify compliance. Manufacturers of refrigeration system components—namely, unit coolers and condensing units—that sell those components separately must rate and certify those components, while manufacturers of complete refrigeration systems whose components are not already separately certified must rate and certify those systems, in a manner consistent with DOE's recent final rule, published at 79

FR 27387. This approach will allow manufacturers of one refrigeration component but not the other to sell their products into the WICF market, addressing Danfoss's concern. The manufacturer of the complete walk-in, or the assembler of any component thereof (for example, a person who assembles a walk-in refrigeration system from a separately-sold unit cooler and condensing unit) must use components that are certified to and compliant with DOE's WICF standards. This approach avoids the compliance and certification issues inherent in requiring assemblers or contractors to certify WICF equipment, while maintaining the responsibility of assemblers or contractors to abide by the same standards as WICF components manufacturers, which DOE believes addresses US Cooler's concern about competitive disadvantage. This approach also requires that newly manufactured components comply with the DOE standards, regardless of whether they are being assembled into a new walk-in or being used as a replacement component on an existing walk-in, which addresses ACEEE's concern about the abuse of the ''repair'' designation. DOE appreciates the statements made by Danfoss and American Panel, and notes that because several paths to ''manufacture'' are available for walk-in coolers, it has developed its certification requirements accordingly.

D. Technological Feasibility

1. General

In each standards rulemaking, DOE conducts a screening analysis, which it bases on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such analysis, DOE develops a list of design options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of these means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercial products or in working prototypes to be technologically feasible. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i) Although DOE considers technologies that are proprietary, it will not consider efficiency levels that can only be reached through the use of proprietary technologies (*i.e.,* a unique pathway), as it could allow a single manufacturer to monopolize the market.

Once DOE has determined that particular design options are technologically feasible, it generally evaluates each of these design options in light of the following additional screening criteria: (1) Practicability to manufacture, install, or service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii)–(iv) Section IV.C of this notice discusses the results of the screening analyses for walk-in coolers and freezers. Specifically, it presents the designs DOE considered, those it screened out, and those that are the basis for the TSLs in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the TSD.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for walk-ins using the design parameters for the most efficient products available on the market or in working prototypes. (See chapter 5 of the final rule TSD.) The max-tech levels that DOE determined for this rulemaking are described in section V.A.2 of this final rule.

E. Energy Savings

1. Determination of Savings

For each TSL, DOE projected energy savings from the equipment at issue that are purchased during a 30-year period that begins in the year of compliance with amended standards (2017–2046). The savings are measured over the entire lifetime of products purchased in the 30-year period.[12] The model forecasts total energy use over the analysis period for each representative equipment class at efficiency levels set by each of the considered TSLs. DOE then compares the energy use at each TSL to the base-case energy use to obtain the NES. The NIA model is described in section IV.I of this notice and in chapter 10 of the final rule TSD.

The NIA spreadsheet model calculates energy savings in site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports national energy savings in terms of the savings in the primary energy that is used to generate and transmit the site electricity. To calculate this quantity, DOE derives annual conversion factors from the model used to prepare the Energy Information Administration's (EIA) *Annual Energy Outlook* (*AEO*).

DOE has begun to also estimate full-fuel-cycle energy savings. 76 FR 51282 (August 18, 2011), as amended at 77 FR 49701 (August 17, 2012). The full-fuel-cycle (FFC) metric includes the energy consumed in extracting, processing, and transporting primary fuels, and thus presents a more complete picture of the impacts of energy efficiency standards. DOE's evaluation of FFC savings is driven in part by the National Academy of Science's (NAS) report on FFC measurement approaches for DOE's Appliance Standards Program.[13] The NAS report discusses that FFC was primarily intended for energy efficiency standards rulemakings where multiple fuels may be used by a particular product. In the case of this rulemaking pertaining to walk-ins, only a single fuel—electricity—is consumed by the equipment. DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered equipment. Although the addition of FFC energy savings in the rulemakings is consistent with the recommendations, the methodology for estimating FFC does not project how fuel markets would respond to this particular standard rulemaking. The FFC methodology simply estimates how much additional energy, and in turn how many tons of emissions, may be displaced if the estimated fuel were not consumed by the equipment covered in this rulemaking. It is also important to note that the inclusion of FFC savings does not affect DOE's choice of proposed standards. For more information on FFC energy savings, see section IV.I.

2. Significance of Savings

To adopt more-stringent standards for a covered product, DOE must determine

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

[13] ''Review of Site (Point-of-Use) and Full-Fuel-Cycle Measurement Approaches to DOE/EERE Building Appliance Energy- Efficiency Standards,'' (Academy report) was completed in May 2009 and included five recommendations. A copy of the study can be downloaded at: *http://www.nap.edu/catalog.php?record_id=12670*.

that such action would result in significant additional energy savings. (42 U.S.C. 6295(o)(3)(B),(v) and 6316(a)) Although the term ''significant'' is not defined in EPCA, the U.S. Court of Appeals for the District of Columbia, in *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1373 (D.C. Cir. 1985), indicated that Congress intended significant energy savings in the context of EPCA to be savings that were not ''genuinely trivial.'' The energy savings for these standards are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

F. Economic Justification

1. Specific Criteria

As discussed in section II.A, 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) and 6316(a)) The following sections generally discuss how DOE is addressing each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Commercial Customers

In determining the impacts of a potential new or amended energy conservation standard on manufacturers, DOE conducts a manufacturer impact analysis (MIA), as discussed in section IV.K. First, DOE determines its quantitative impacts using an annual cash flow approach. This includes both a short-term assessment (based on the cost and capital requirements associated with new or amended standards during the period between the announcement of a regulation and the compliance date of the regulation) and a long-term assessment (based on the costs and marginal impacts over the 30-year analysis period [14]). The impacts analyzed include INPV (which values the industry based on expected future cash flows), cash flows by year, changes in revenue and income, and other measures of impact, as appropriate. Second, DOE analyzes and reports the potential impacts on different types of manufacturers, paying particular attention to impacts on small manufacturers. Third, DOE considers the impact of new or amended standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for new or amended standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of other DOE regulations and non-DOE regulatory requirements on manufacturers.

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

b. Savings in Operating Costs Compared to Increase in Price

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of the covered product that are likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of equipment (including the cost of its installation) and the operating costs (including energy and maintenance and repair costs) discounted over the lifetime of the equipment. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with amended standards.

The LCC savings and the PBP for the considered efficiency levels are calculated relative to a base-case scenario, which reflects likely trends in the absence of new or amended standards. DOE identifies the percentage of consumers estimated to receive LCC savings or experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. DOE's LCC and PBP analysis is discussed in further detail in section IV.G.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA also 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)) DOE uses NIA spreadsheet results to project national energy savings.

For the results of DOE's analyses related to the potential energy savings, see section I.A.3 of this notice.

d. Lessening of Utility or Performance of Equipment

In establishing classes of equipment, and in evaluating design options and the impact of potential standard levels, DOE seeks to develop standards that would not lessen the utility or performance of the equipment under consideration. DOE has determined that none of the TSLs presented in this final rule would reduce the utility or performance of the equipment considered in the rulemaking. (42 U.S.C. 6295(o)(2)(B)(i)(IV) and 6316(a)) During the screening analysis, DOE eliminated from consideration any technology that would adversely impact customer utility. For the results of DOE's analyses related to the potential impact of amended standards on equipment utility and performance, see section IV.C of this notice and chapter 4 of the final rule TSD.

e. Impact of Any Lessening of Competition

EPCA requires DOE to consider any lessening of competition that is likely to result from setting new or amended standards for a covered product. Consistent with its obligations under EPCA, DOE sought the views of the United States Department of Justice (DOJ). DOE asked DOJ to provide a written determination of the impact, if any, of any lessening of competition likely to result from the amended standards, together with an analysis of the nature and extent of such impact. 42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii). To assist DOJ in making such a determination, DOE provided DOJ with copies of both the NOPR and NOPR TSD for review. DOJ subsequently determined that the amended standards are unlikely to have a significant adverse impact on competition. Accordingly, DOE concludes that this final rule would not be likely to lead to a lessening of competition.

f. Need of the Nation To Conserve Energy

DOE also considers the need for national energy and water 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 new or amended standards are likely to improve the security and reliability of

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

the Nation's energy system. Reductions in the demand for electricity may also result in reduced costs for maintaining the reliability of the Nation's electricity system. DOE conducts a utility impact analysis to estimate how new or amended standards may affect the Nation's needed power generation capacity.

Energy savings from amended standards for walk-ins are also likely to result in environmental benefits in the form of reduced emissions of air pollutants and GHGs associated with energy production (*e.g.,* from power plants). For a discussion of the results of the analyses relating to the potential environmental benefits of the amended standards, see sections IV.L, IV.M and V.B.6 of this notice. DOE reports the expected environmental effects from the amended standards, as well as from each TSL it considered for walk-ins in the emissions analysis contained in chapter 13 of the final rule TSD. DOE also reports estimates of the economic value of emissions reductions resulting from the considered TSLs in chapter 14 of the final rule TSD.

g. Other Factors

EPCA allows the Secretary, in determining whether a new or amended 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)) There were no other factors considered for this final rule.

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii) and 6316(a), EPCA provides for a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the customer of equipment that meets the new or amended standard level is less than three times the value of the first-year energy (and, as applicable, water) savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values that calculate the PBP for customers of potential new and amended energy conservation standards. These analyses include, but are not limited to, the 3-year PBP contemplated under the rebuttable presumption test. However, DOE routinely conducts a full economic analysis that considers the full range of impacts to the customer, manufacturer, Nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i) and 6316(a). The results of these analyses serve as the basis for DOE to evaluate the economic justification for a potential standard level definitively (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.G.12 of this notice.

IV. Methodology and Discussion of Comments

A. General Rulemaking Issues

During the October 9, 2013 NOPR public meeting, and in subsequent written comments, stakeholders provided input regarding general issues pertinent to the rulemaking, including the trial standard levels, the rulemaking timeline, and other subjects. These issues are discussed in this section.

1. Trial Standard Levels

In the NOPR, DOE proposed the adoption of TSL 4 as the energy conservation standard for walk-ins, based on analysis showing that this level was both technically and economically feasible. 78 FR 55845 (September 11, 2013) NEEA et al. agreed with DOE's proposal, noting that TSL 4 represented the highest economically justified efficiency level, even though higher efficiencies were technologically feasible. (NEEA et al., No. 101 at p. 4)

Reaction to DOE's proposal was somewhat mixed with several parties viewing the proposed standard as sufficiently aggressive for some components but insufficient for other components. Specifically, ASAP opined that DOE's proposed efficiency level was strong, but urged DOE to consider a TSL 4.5, which would combine the envelope components of TSL 4, and the refrigeration components of TSL 5. (ASAP, No. at p. 15) Similarly, the CA IOUs, while agreeing with the proposed TSL for panels, urged DOE to adopt TSL 5 for refrigeration systems, since enhanced condenser coil, improved evaporator fan blades, and improved defrost controls—all of which are refrigeration systems components—offered cost effective options DOE should consider. (CA IOUs, Public Meeting Transcript, No. 88 at p. 26)

On the other hand, some commenters viewed the proposal as infeasible for manufacturers to meet. ThermoKool and US Cooler opined that TSL 2 was adequate. (US Cooler, Public Meeting Transcript, No. 88 at p. 376, ThermoKool, No. 97 at p. 5) Lennox International also noted that DOE's AWEF values for TSL 4 were overly aggressive, based on modeling errors. (Lennox, No. 109 at p. 1)

With regard to the selection of design options at each TSL, Nor-Lake recommended that TSL 4 should consider standard levels requiring panels no thicker than 4 inches for class SP.L, as this was the current panel thickness most common in the industry. Nor-Lake noted that increasing panel thickness greatly increases production time and cost. (Nor-Lake, No. 115 at p. 2)

In response to the comments from stakeholders, DOE reformulated its TSLs. See section V.A for further discussion on the TSLs.

2. Rulemaking Timeline

A number of stakeholders commented on DOE's proposed rulemaking timeline. ICS requested that the target date for the final rule be moved beyond April 2014 to allow more opportunity for discussion and the development of a standard, and specifically recommended the final rule date be extended to at least 2016 to resolve all uncertainties in the analysis, using more accurate industry data. (ICS, et al., No. 100 at p. 2 and 6). Lennox recommended a twelve-month delay in finalizing the proposed rule, in order for DOE to address modeling discrepancies and assumption errors in addition to providing separate performance targets for unit coolers and condensing units. (Lennox, No. 109 at p. 7) Hillphoenix urged DOE to consider extending the completion date of the final rule, to allow, at minimum, four more opportunities for exchange of information between DOE and manufacturers. (Hillphoenix, No. 107 at p. 3) The CA IOUs suggested that DOE delay the adoption of energy conservation standards for walk-in coolers in order to rewrite the standards to make them more enforceable, and to develop separate standards for condensing units. (CA IOUs, No. 110 at p. 3)

Additionally, Bally commented that the timeline is probably unrealistic due to the need for an additional public meeting. (Bally, No. 102 at p. 3) IB stated that DOE's proposal to have a final rule in place by April 2014 is very ambitious and does not allow enough time to make necessary modifications to the proposed rule. IB requested additional public meetings where the analysis assumptions can be reviewed in depth with manufacturers. (IB, No. 98 at p. 4) NCC stated that the time provided by DOE for manufacturers to evaluate the proposed standard was insufficient. (NCC, No. 96 at p. 2) Thermo-Kool commented that the target date for the final rule should be extended in order to allow manufacturers to fully understand DOE's analysis, and to facilitate more public meetings. (ThermoKool, No. 97 at

p. 5) Danfoss urged DOE to consider moving forward with the overall rulemaking but to take more time with the condensing unit and unit cooler split, potentially with an SNOPR, and to take separated condensing and cooling units into account. (Danfoss, Public Meeting Transcript, No. 88 at pp. 88 and 72)

Public comment was also received opposing to extending the schedule. On the industry side, ebm-papst recommended proceeding quickly with the regulation because it raises the bar and spurs development toward a more sustainable refrigeration industry. (ebm-papst, No. 92 at p. 2) Similarly, AGNY commented that the delay in amending efficiency standards for walk-ins has led to inefficient products staying on the market, depriving purchasers of more effective options, and further asserted that delays have cost the nation $2.2 billion in lost savings. (AGNY, No. 116 at p. 2)

While DOE appreciates the concerns expressed by commenters regarding the current rulemaking timeline, DOE believes that the recent modifications it has made will permit manufacturers to much more easily address the various requirements that will be established by this rule. For details regarding the separate analysis and certification of refrigeration system components, see 79 FR 27387 (May 14, 2014).

B. Market and Technology Assessment

When beginning an energy conservation standards rulemaking, DOE develops information that provides an overall picture of the market for the equipment concerned, including the purpose of the equipment, the industry structure, and market characteristics. This activity includes both quantitative and qualitative assessments based primarily on publicly available information (*e.g.,* manufacturer specification sheets, industry publications) and data submitted by manufacturers, trade associations, and other stakeholders. The subjects addressed in the market and technology assessment for this rulemaking include: (1) Quantities and types of equipment sold and offered for sale; (2) retail market trends; (3) equipment covered by the rulemaking; (4) equipment classes; (5) manufacturers; (6) regulatory requirements and non-regulatory programs (such as rebate programs and tax credits); and (7) technologies that could improve the energy efficiency of the equipment under examination. DOE researched manufacturers of walk-in coolers and walk-in freezers and made a particular effort to identify and characterize small business manufacturers. See chapter 3 of the final rule TSD for further discussion of the market and technology assessment.

1. Equipment Included in This Rulemaking

a. Panels and Doors

In the NOPR, DOE identified three types of panels used in the walk-in industry: display panels, floor panels, and non-floor panels. Based on its research, DOE determined that display panels, typically found in beer caves (i.e. walk-ins used for the display and storage of beer or other alcoholic beverages often found in a supermarket) make up a small percentage of all panels currently present in the market. Therefore, because of the extremely limited energy savings potential currently projected to result from amending the requirements that these panels must meet, DOE did not propose to set new standards for walk-in display panels. Display panels, however, must still follow all applicable design standards already prescribed by EPCA. See 10 CFR 431.306(b). Additionally, DOE declined to propose standards for walk-in cooler floor panels because DOE determined through manufacturer interviews and market research that the majority of walk-in coolers are made with concrete floors and do not use insulated floor panels. DOE did, however, propose standards for other panels (i.e. door, ceiling and wall).

Several stakeholders supported DOE's proposal to not set new standards for display and cooler floor panels. Thermo-Kool and Hillphoenix agreed that display panels and cooler floor panels should be excluded. (Thermo-Kool, No. 97 at p. 2; Hillphoenix, No. 107 at p. 3) NEEA stated that it was impractical to regulate or require floors for walk-in coolers. (NEEA, No. 101 at p. 3) American Panel, however, believed that additional energy savings were possible while imposing only a minimal burden on industry if walk-in coolers were required to use insulated floor panels or insulated concrete slabs with thermal breaks instead of requiring panel manufacturers to increase panel thickness. (American Panel, No. 99 at p. 10) DOE agrees with American Panel that in theory a walk-in coolers would consume less energy with a insulated floor. However, EPCA directs DOE to adopt performance standards of walk-in and thus the Department cannot require all walk-in coolers to be installed with insulated floors. Additionally, the Department expected that setting an R-value requirement for walk-in cooler floor panels would cause manufactures to stop selling cooler floor panels to avoid the certification burden.

American Panel asked if DOE considered freezers built inside a walk-in that are built inside another walk-in. American Panel noted that for cooler-freezer combination units, complicated dividing wall panels were required, which were complicated to manufacture, and would be very expensive, should the walk-in freezer require 5 inch insulation. (American Panel, No. 99 at p. 5) DOE agrees that its analysis does not account for the specific installation scenarios of walk-in panels beyond cooler versus freezer applications. However, the Department reiterates that it is not establishing prescriptive standards so freezer panels would not be required to be a specific thickness—only that they meet a particular thermal resistance value.

DOE also identified two types of doors used in the walk-in market, display doors and non-display doors, which are discussed in section VI.2.A. of this NOPR. All types of doors will be subject to the performance standards proposed in this rulemaking.

b. Refrigeration Systems

Blast Chillers and Blast Freezers

In the NOPR, DOE did not include blast freezers in its rulemaking analysis, but proposed to apply the same standards to blast freezer refrigeration systems as to storage freezer refrigeration systems, unless DOE were to find that blast freezer refrigeration systems would have difficulty complying with DOE's standards. DOE requested comments from the public on the inclusion of blast freezers within the scope of the proposed rule. 78 FR at 55799. In response, NEEA, et al., Hussmann, ACEEE, American Panel, the California IOU's, Heatcraft, Bally, Hillphoenix, Lennox, AHRI and Nor-Lake urged DOE to carefully define blast chillers and freezers, and to exclude them from the products covered by the proposed rule, since these were food processing equipment, as opposed to food storage equipment like most other walk-in coolers and freezers. (NEEA, et al., No. 101 at p. 5; Hussmann, No. 93 at p. 7; ACEEE, Public Meeting Transcript, No. 88 at p. 112; APC, Public Meeting Transcript, No. 88 at p. 111; CA IOUs, Public Meeting Transcript, No. 88 at p. 109; Heatcraft, Public Meeting Transcript, No. 88 at p. 108; Bally, Public Meeting Transcript, No. 88 at p. 108; Hillphoenix, No. 107 at p. 3; Lennox, No. 109 at p. 4; AHRI, No. 114 at p. 3; Nor-Lake, No. 115 at p. 1) APC recommended that in addition to blast freezers, blast chillers should also be excluded from the ambit of the proposed rule for similar reasons. (APC, No. 99 at p. 3) AHRI, on the other hand, suggested that blast coolers and freezers, along with ripening rooms, should be held to different efficiency standards than WICFs. (AHRI, No. 114 at p. 3)

After considering the comments received and conducting additional research, DOE agrees with commenters that blast chillers and blast freezers are food processing equipment and place them outside of the definition of a walk-in, which is defined as an ''enclosed storage space.'' (42 U.S.C. 6311(20)(A)) Additionally, DOE has found that blast chillers and blast freezers have very different energy consumption characteristics from storage coolers and freezers, which would justify their classification as a distinct product.

Based on the comments, along with other information reviewed by DOE (e.g. manufacturer brochures and literature) regarding the operation and use of blast chillers and blast freezers. DOE is declining to treat these equipment categories as walk-ins. As a result, these two categories of equipment would not be required to meet the standards that DOE has detailed in this notice. In delineating these equipment, in DOE's view, a blast chiller (or shock chiller) refers to a type of cooling device that is designed specifically to, when fully loaded, cool its contents from 150 °F to 55 °F in less than 90 minutes. Similarly, a blast freezer (or shock freezer) refers to a type of freezer that is designed specifically to, when fully loaded, cool its contents from 150 °F to 32 °F in less than 90 minutes.

While DOE believes that the above descriptions should be sufficiently clear to enable manufacturers to readily determine whether a particular device they produce falls under these descriptions, DOE may revise these descriptions in the future through guidance should additional clarification be necessary.

Special Application Walk-In Coolers

Several commenters suggested that certain walk-in coolers designed for special applications should be excluded from the rulemaking. ebm-papst commented that the proposed standard did not separate low-velocity and low-profile unit coolers. (ebm-papst, No. 92 at p. 4) NCC and KeepRite commented that two-way or low-velocity coolers were designed as food-processing workspaces, and should be excluded from the scope of the proposed rule. (NCC, No. 96 at p. 2; K–RP, No. 105 at p. 2) SAF noted that the floriculture industry had unique requirements with regard to air movement and humidity for walk-in coolers since potted plants and cut flowers had a rapid rate of respiration, and further expressed concern that the proposed standard did not account for the large degree of customization used in the engineering of floral storage units due to the higher humidity and gentle airflow required. (SAF, No. 103 at pp. 3 and 7) Manitowoc commented that grouping packaged refrigeration systems with split systems would make it difficult for packaged systems to meet the proposed standard levels at a reasonable cost, since packaged systems were typically 1 horsepower (hp) or less, and increased efficiency would have a greater cost impact. (Manitowoc, No. 108 at p. 2) Lennox stated that there were no known test laboratories in the U.S. that were certified or fully capable of testing the range of products and application temperatures covered by the proposed rule. (Lennox, No. 109 at p. 2)

With respect to low-velocity and floral application coolers, DOE agrees that there is a certain category of medium- and low-temperature unit coolers that are characterized by low airflow. In medium-temperature applications, these unit coolers may also be operated at a higher-than-usual temperature difference between the evaporator coil and the air, which contributes to a high humidity environment necessary for some applications. (For more details on temperature difference, see section IV.D.5.b.) Because these products are used for both storage and process applications, DOE cannot categorically exclude them from coverage, although DOE notes that equipment used for process cooling applications is excluded from the WICF standards. Also, DOE has not found evidence that such products would be at a disadvantage by having to satisfy the standards being adopted today, when tested under the rating conditions in the test procedure. In response to Manitowoc's comment, Manitowoc did not provide, nor has DOE found, evidence that packaged systems would have difficulty meeting the proposed standard; DOE notes that for dedicated condensing systems, which would include packaged systems, its standards for smaller systems are lower than those for larger systems and the required efficiency for smaller systems decreases with system size. To address Lennox's concern, if a manufacturer believes that the test procedure in its current form does not measure the efficiency of a model of covered equipment in a manner representative of its true energy use, the manufacturer may apply for a test procedure waiver for that model.

High-Temperature Products

Hillphoenix commented that the definition of a walk-in cooler as having a maximum temperature of 55 °F was incongruent with the NSF limit of 41 °F as the maximum safe temperature for food. (Hillphoenix, No. 107 at p. 1) ICS, et al., American Panel, IB, Kysor, and ThermoKool suggested that DOE revise its definition of a walk-in cooler to align with the NSF's requirement of food storage at or below 41 °F. (ICS, et al., No. 100 at p. 3; APC, No. 99 at p. 2; IB, No. 98 at p. 1; Kysor, Public Meeting Transcript, No. 88 at p. 40; ThermoKool, No. 97 at p. 1) Hussmann expressed concern that if the standards cover products up to 55 degrees, it may cover some products that have very different energy profiles than traditional [food] storage systems. (Hussmann, Public Meeting Transcript, No. 88 at p. 62) Lennox, however, agreed with DOE's proposal to base the definition of freezers vs. coolers on an operating temperature [at or] below and above 32 °F, respectively. (Lennox, No. 109 at p. 5)

DOE recognizes that the NSF requires food storage at 41 °F or below. However, DOE is retaining its definition of walk-in coolers and freezers because while the foodservice industry accounts for a large portion of the walk-in cooler market, these units also have applications in other industries, which do not fall within the ambit of the NSF standard. DOE notes that it based its analysis on coolers operating at 35 °F (the AHRI 1250 test procedure rating temperature for coolers), which should not disadvantage products that must comply with the NSF requirement.

2. Equipment Classes

In evaluating and establishing energy conservation standards, DOE generally divides covered equipment into classes by the type of energy used, or by capacity or other performance-related feature that justifies a different standard for equipment having such a feature. (42 U.S.C. 6295(q) and 6316(a)) In deciding whether a feature justifies a different standard, DOE must consider factors such as the utility of the feature to users. DOE normally establishes different energy conservation standards for different equipment classes based on these criteria. In the NOPR, DOE proposed separate classes for panels, display doors, non-display doors, and refrigeration systems because each component type has a different utility to the consumer and possesses different energy use characteristics.

a. Panels and Doors

In the NOPR, DOE proposed three equipment classes for walk-in panels: cooler structural panels, freezer structural panels, and freezer floor panels. DOE's proposal was based on the understanding that freezer floor panels and structural panels serve two different utilities.

Freezer floor panels, which are panels used to construct the floor of a walk-in freezer, must often support the load of small machines like hand carts and pallet jacks. Structural panels are panels used to construct the ceiling or wall of a walk-in, provide structure for the walk-in.

Structural panels are further divided into two more classes based on temperature—*i.e.,* cooler versus freezer panels. Cooler structural panels are rated at an average foam temperature of 55 °F, as required in the test procedure. Freezer structural panels are used in walk-in freezers and rated at an average foam temperature of 20 °F, also a test procedure requirement. See 79 FR at 27412. Walk-in freezer panels must also meet a higher R-value than walk-in cooler panels. See 10 CFR 431.306.

For doors, DOE distinguished between two different door types used in walk-ins: display doors and non-display doors. DOE proposed separate classes for display doors and non-display doors to retain consistency with the dual approach laid out by EPCA for these walk-in components. (42 U.S.C. 6313(f)(1)(C) and (3)) Non-display doors and display doors also serve separate purposes in a walk-in. Display doors contain mainly glass in order to display products or objects located inside the walk-in. Non-display doors function as passage and freight doors and are mainly used to allow people and products to be moved into and out of the walk-in. Because of their different utilities, display and non-display doors are made up of different material. Display doors are made of glass or other transparent material, while non-display doors are made of highly insulative materials like polyurethane. The different materials found in display and non-display doors significantly affect their energy consumption.

DOE divided display doors into two equipment classes based on temperature differences: cooler and freezer display doors. Cooler display doors and freezer display doors are exposed to different internal temperature conditions, which affect the total energy consumption of the doors. DOE's test procedure contains an internal rating temperature of 35 °F for walk-in cooler display doors and −10 °F for walk-in freezer display doors. See 76 FR at 21606 and 10 CFR 431.303

DOE also separated non-display doors into two equipment classes, passage and freight doors. Passage doors are typically smaller doors and mostly used as a means of access for people and small machines, like hand carts. Freight doors typically are larger doors used to allow access for larger machines, like forklifts, into walk-ins. The different shape and size of passage and freight doors affects the energy consumption of the doors. Both passage and freight doors are also separated into cooler and freezer classes because, as explained for display doors, cooler and freezer doors are rated at different temperature conditions. A different rating temperature impacts the door's energy consumption.

One stakeholder agreed with DOE's classification of equipment. Nor-Lake commented that the proposed definitions for all three door equipment classes appeared to be reasonable. (Nor-Lake, No. 115 at p. 1)

Other stakeholders recommended changes to the envelope equipment classes. Hillphoenix noted that classifying doors based on whether they were display or non-display doors, and whether they were hinged or non-hinged would allow for standards that would better represent their performance. (Hillphoenix, No. 107 at p. 3) ICS, et al., recommended that DOE categorize door panels with wall, floor, and ceiling panels and account for electrical consuming devices separately. (ICS, et al., No. 100 at pp. 2 and 3) American Panel also suggested that non-display doors should be classified with panels for the purpose of this rulemaking because they share the same R-value. (APC, No. 99 at p. 2) IB agreed with the proposed classes of panels and requested that door panels be included in these categories as they are manufactured from the same materials as those used in wall, floor and ceiling panels. (IB, No. 98 at p. 3)

DOE agrees that non-display doors are very similar to panels because both components are primarily composed of insulation. However, non-display doors have a different utility than panels and for that reason may require features, like windows or heater wire, which walk-in panels do not require. For this reason, in this final rule the Department is creating separate equipment classes for non-display doors and panels.

The Department did not receive any adverse comments regarding the equipment classes proposed for display doors.

The equipment classes being adopted are listed in Table IV.1 below.

TABLE IV.1—EQUIPMENT CLASSES FOR PANELS AND DOORS

Product	Temperature	Class
Structural Panel	Medium	SP.M
	Low	SP.L
Floor Panel	Low	FP.L
Display Door	Medium	DD.M
	Low	DD.L
Passage Door	Medium	PD.M
	Low	PD.L
Freight Door	Medium	FD.M
	Low	FD.L

b. Refrigeration Systems

In the NOPR, DOE divided refrigeration systems into classes based on condensing unit type (i.e. whether the refrigeration system uses a dedicated condensing unit or is connected to a multiplex system), operating temperature (whether the system is designed to operate at medium or low temperature, corresponding to a walk-in cooler or walk-in freezer, respectively), location (for dedicated condensing systems, whether the condensing unit is located indoors or outdoors), and size (for dedicated condensing systems, whether the gross refrigerating capacity exceeds or is less than 9,000 Btu/h). DOE received comments on its proposed equipment classes.

General Comments

NAFEM and Lennox opined that the equipment classes defined in the proposed rule did not fully encompass the variety of products and customizations currently available on the market. (NAFEM, No. 118 at p. 3; Lennox, No. 109 at p. 2) The CA IOUs suggested that the standard would be more enforceable if, instead of classifying products as dedicated condensing or multiplex condensing, WICF refrigeration is treated like commercial refrigeration equipment, with separate classes for self-contained systems, unit coolers, and condensing units. In its view, this approach would address the splitting of the unit cooler from the condensing unit in cases where they are separate. (CA IOUs, No. 89 at p. 19 and Public Meeting Transcript, No. 88 at pp. 30 and 103) ASAP commented that DOE should set a standard level for packaged dedicated refrigeration systems. (ASAP et al., No. 113 at p. 2) American Panel pointed out that the current classification did not account for pre-charged units (i.e. refrigeration units that come ''pre-charged'' with refrigerant coolant added to the unit). (APC, No. 99 at p. 3)

DOE takes note of manufacturer comments that the representative sizes in DOE's analysis do not fully encompass the large variety of products and possible customizations. While recognizing that it would be impossible to model each and every one of these niche products, DOE has not changed the equipment classes or representative units from those analyzed in the NOPR, since these classes and units represent a large majority of the total market for walk-in coolers and freezers. DOE has not found, nor have stakeholders provided evidence, that ''niche'' products would be unable to meet the standards based on current equipment classification. DOE believes that its approach to testing and certification of unit coolers and condensing units sold separately addresses the comment from CA IOUs, and separate equipment classes are not needed; see section III.C for further discussion of certification. If a manufacturer believes that its design is subjected to undue hardship by regulations, the manufacturer may petition DOE's Office of Hearings and Appeals (OHA) for exception relief or exemption from the standard pursuant to OHA's authority under section 504 of the DOE Organization Act (42 U.S.C. 7194), as implemented at subpart B of 10 CFR part 1003. OHA has the authority to grant such relief on a case-by-case basis if it determines that a manufacturer has demonstrated that meeting the standard would cause hardship, inequity, or unfair distribution of burdens.

Condensing Unit Location

Lennox commented that for dedicated condensing units, systems manufactured and certified as outdoor units should be allowed to be used indoors without having to certify their units as indoor units as well; this approach would greatly reduce the testing and certification burden on manufacturers. (Lennox. No. 109 at p. 6) On the other hand, AHRI noted that it was possible for manufacturers to market a unit for use indoors, whereas contractors could choose to assemble it outdoors, where it may not meet the requisite standard. (AHRI, Public Meeting Transcript, No. 88 at p. 106)

DOE understands that indoor and outdoor refrigeration systems are rated differently under the DOE test procedure, and this warrants the creation of separate equipment classes for indoor and outdoor refrigeration systems. Furthermore, indoor and outdoor refrigeration systems are often easily distinguishable visually: outdoor systems are characterized by a metal cover that protects the system from the elements. DOE realizes that a product may be used in a different application from which it was originally designed. In response to Lennox's comment, the standard for an outdoor refrigeration system is generally more stringent than for an indoor refrigeration system of the same size and operating temperature. Therefore, DOE is not opposed to systems rated as outdoor systems being used in practice as indoor systems, without having to be separately certified as ''indoor'' systems. Conversely, as AHRI pointed out, an indoor system used outdoors would not likely meet the requisite standard. DOE believes that in practice, this is not likely to occur at a significant rate because indoor units lack the protective features of outdoor units and therefore would be very unlikely to be installed outdoors. However, if DOE finds that indoor systems are being installed outdoors so as to circumvent the more stringent requirements for outdoor systems, DOE may promulgate future labeling standards specifying that a unit used outdoors must be labeled as an outdoor unit.

Capacity

Lennox commented that the proposed classification for unit coolers did not fully account for various applications and that for dedicated condensing systems, the proposed equipment classification did not fully reflect the range currently available in the market. Further, Lennox noted that linear equations for units with capacity up to 36,000BTU/h, and fixed values for units with higher capacity, would be reasonable. (Lennox, No. 109 at p. 5) Similarly, on the classification of condensing systems, KeepRite commented that the definition between large and small classes at 9,000 Btu/hr was fairly low, and left a disproportionately wide range of products in the ''Large'' category. (K–RP, No. 105 at p. 2) American Panel, too, made a similar suggestion, recommending that equipment be divided into three categories—small (<10,000 Btu), medium, and large (>25,000 Btu)—to better represented the market. (APC, No. 99 at p. 3) Heatcraft stated that DOE did not look at a broad enough range of equipment, and that refrigeration systems can get up to 190,000 Btus in the 3,000 square foot range. (Heatcraft, Public Meeting Transcript, No. 88 at p. 102)

In response to the comments from Lennox, KeepRite, and American Panel suggesting that separating the ''large'' equipment class could better represent the market, DOE notes that above the threshold for ''large'' equipment, the standard level is equally attainable by varying sizes of equipment. DOE did not receive data or evidence from Heatcraft suggesting that systems larger than the ones analyzed would have difficulty meeting DOE's standards. Therefore, DOE is maintaining the size thresholds for refrigeration system classes proposed in the NOPR.

In this document, the Department is adopting the equipment classes listed in Table IV.2.

TABLE IV.2—EQUIPMENT CLASSES FOR REFRIGERATION SYSTEMS

Condensing type	Operating temperature	Condenser location	Refrigeration capacity (Btu/h)	class
Dedicated	Medium	Indoor	<9,000	DC.M.I, <9,000.
			≥9,000	DC.M.I, ≥9,000.
		Outdoor	<9,000	DC.M.O, <9,000.
			≥9,000	DC.M.O, ≥9,000.
	Low	Indoor	<9,000	DC.L.I, <9,000.
			≥9,000	DC.L.I, ≥9,000.
		Outdoor	<9,000	DC.L.O, <9,000.
			≥9,000	DC.L.O, ≥9,000.
Multiplex	Medium			MC.M.
	Low			MC.L.

3. *Technology Assessment*

As part of the market and technology assessment performed for the final rule analysis, DOE developed a comprehensive list of technologies that would be expected to improve the energy efficiency of walk-in panels, non-display doors, display doors, and refrigeration systems. Chapter 3 of the TSD contains a detailed description of each technology that DOE identified. Although DOE identified a number of technologies that improve efficiency, DOE considered in its analysis only those technologies that would impact the efficiency rating of equipment as tested under the DOE test procedure. Therefore, DOE excluded several technologies from the analysis during the technology assessment because they would not improve the rated efficiency of equipment as measured under the specified test procedure. Technologies that DOE determined would impact the rated efficiency were carried through to the screening analysis and are discussed in section IV.C.

ACEEE commented that there were significant technology options used abroad which could, if included in the DOE analysis, provide greater potential for energy savings. (ACEEE, Public Meeting Transcript, No. 88 at p. 142) However, ACEEE did not identify any specific technology options and in the absence of an actionable recommendation, DOE is continuing to apply its methodology. DOE notes that its methodology does not exclude technology options primarily used outside the U.S. if they meet the requirements of the screening analysis.

C. Screening Analysis

DOE uses four screening criteria to determine which design options are suitable for further consideration in a standards rulemaking. Namely, design options will be removed from consideration if they are not technologically feasible; are not practicable to manufacture, install, or service; have adverse impacts on product utility or product availability; or have adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, sections (4)(a)(4) and (5)(b)

1. Panels and Doors

DOE proposed three efficiency improvements for walk-in panels: insulation thickness, insulation material, and framing material. Subsequent to the NOPR's publication, DOE modified its regulations to permit manufacturers to use ASTM C518—which measures panel performance by examining the panel's insulation performance—rather than ASTM C1363—which accounts for, among other things, the impact of structural members in a panel.. Because of this change, framing materials no longer impact the rated efficiency of walk-in panels—and hence, are no longer considered as design options.

Some manufacturers and consumers urged DOE to screen out any design options which would even marginally affect the geometry of a unit, either by increasing its total footprint or reducing the cooled internal space. Specifically, these comments referred to DOE's consideration of added insulation thickness as a design option. ICS, et al., Louisville Cooler, and NRA noted that the increased footprint or decreased internal volume associated with thicker foam panels reduced storage utility and increased cost, perhaps even requiring full kitchen redesigns.(ICS, et al., No. 100 at p. 4; Louisville Cooler, No. 81 at p. 1; NRA, No. 112 at p. 4) SAF expressed concern that some of the design options considered in the WICF analysis, like thicker insulation, would reduce the size of the walk-in and cause a substantial negative impact on floral industry businesses. (SAF, No. 103 at p. 7)

DOE understands stakeholder concerns that increased panel thickness may reduce the interior space of a walk-in and affect the equipment's utility. DOE discussed the relationship between panel thickness and interior walk-in space during the manufacturer interviews. During the interviews, manufacturers agreed that the addition of ½″ of insulation above the baseline thicknesses modeled would be accepted by commercial customers. Manufacturers noted that increased panel thickness would require them to redesign their equipment and, in some cases, replace current foaming fixtures. DOE incorporated these potential outcomes into its engineering and manufacturer impact analyses. Regarding insulation greater than ½ an inch above the baseline thickness having an impact on the usefulness of the product to consumers, DOE notes that manufacturers are already employing these wall thicknesses in currently-available models. DOE believes that fact demonstrates that using thicker insulation is a viable technology option. Accordingly, DOE did not screen out increased panel thickness from its analysis.

In the NOPR, DOE proposed to screen in the following technologies for non-display doors: insulation thickness, insulation material, framing material, improved window glass systems, and anti-sweat heat controls.

DOE also proposed to ''screen in'' electronic lighting ballasts and high-efficiency lighting, occupancy sensors, improved glass system insulation performance, and anti-sweat heater controls as technologies that could improve the performance of display doors are rated by the test procedure.

Several manufacturers were concerned with DOE's proposal to require tinted glass for transparent doors. Hussmann, ACCA and the California IOU's noted that the use of low-e coatings on high-performance display doors would add a considerable tint to the glass, making product visibility difficult and impacting consumer utility. (Hussmann, No. 93 at p. 2) (ACCA, No. 119 at p. 2) (CA IOUs, No. 88 at p. 152) SAF commented that low-e coating would obscure floral products, and have a negative impact on the U.S. floral industry. (SAF, No 103 at pp. 6–7)

DOE clarifies that the performance standards proposed in the NOPR did not require manufacturers to use low-e coating on their doors. Low-e coating was considered as a design option. In the NOPR, DOE proposed TSL 4 which mapped to display cooler doors at efficiency level 1 (a baseline cooler door with LED lighting instead of fluorescent lighting) and mapped to baseline freezer doors. Baseline cooler doors do have one layer of hard coat low-e coating, but DOE expects that manufacturers could achieve this same level of performance by incorporating other design options like an additional pane of glass or a lighting sensor. Baseline display freezer doors do not have low-e coating. DOE notes that its market research shows that some display doors may have a low-e coating. While not all doors may have this feature, it is a viable one that manufacturers could opt to use in certain circumstances when appropriate. DOE also would like to remind stakeholders that it is not setting prescriptive standards, and should manufacturers value some features over others, they are free to use different design paths in order to attain the performance levels required by this rule.

American Panel suggested that DOE should consider air curtains, a device that blows air parallel to an opening to create an infiltration barrier, because the technology would reduce air infiltration, a major contributor to the heat load in a walk-in. American Panel commented that air curtains may save almost as much energy as freezer panels with 5-inches of insulation. (American Panel, No. 99 at p. 10) Manitowoc also commented that the largest factor to energy consumption was door open time and that cooler doors may be open more than 200 times per day. Manitowoc suggested that door closers would significantly reduce energy consumption. (Manitowoc, No. 108 at p. 1) DOE agrees with American Panel and Manitowoc that infiltration adds heat load to walk-ins and that air curtains can be used to reduce infiltration. However, DOE's test procedure establishes metrics to measure the energy consumption or energy use of walk-in components and does not include the heat load caused by infiltration. See 76 FR at 21594–21595. As a result, infiltration-related technologies do not improve the rated performance of walk-ins.

2. Refrigeration Systems

NRA commented that reducing the energy usage of walk-ins has the potential to reduce cooling recovery time for equipment subjected to constant door openings and closings in busy kitchen environments, which could result in food spoilage and create public health and safety risks. (NRA, No. 112 at p. 3) DOE's analysis has not shown that the improvements in equipment efficiency required by its standards would negatively impact the capacity of that equipment or its cooling ability; therefore, DOE does not believe its standards alone would be likely to increase the risks to public health and safety. As noted earlier, DOE has screened from consideration particular design options that it believes may pose undue risks to health and safety.

D. Engineering Analysis

The engineering analysis determines the manufacturing costs of achieving increased efficiency or decreased energy consumption. DOE historically has used the following three methodologies to generate the manufacturing costs needed for its engineering analyses: (1) The design-option approach, which provides the incremental costs of adding to a baseline model design options that will improve its efficiency; (2) the efficiency-level approach, which provides the relative costs of achieving increases in energy efficiency levels, without regard to the particular design options used to achieve such increases; and (3) the cost-assessment (or reverse engineering) approach, which provides ''bottom-up'' manufacturing cost assessments for achieving various levels of increased efficiency, based on detailed data as to costs for parts and material, labor, shipping/packaging, and investment for models that operate at particular efficiency levels.

As discussed in the Framework document, preliminary analysis, and NOPR analysis, DOE conducted the engineering analyses for this rulemaking using a design-option approach for walk-ins. The decision to use this approach was made due to several factors, including the wide variety of equipment analyzed, the lack of equipment efficiency data regarding currently available equipment, and the prevalence of relatively easily implementable energy-saving technologies applicable to this equipment. More specifically, DOE identified design options for analysis, used a combination of industry research and teardown-based cost modeling to determine manufacturing costs, and employed numerical modeling to determine the energy consumption for each combination of design options used to increase equipment efficiency. Additional details of the engineering analysis are available in chapter 5 of the final rule TSD.

1. Representative Equipment for Analysis

In performing its engineering analysis, DOE selected representative units for each primary equipment class to serve as analysis points in the development of cost-efficiency curves.

a. Panels and Doors

DOE proposed three different panel sizes to represent the variations within each class. Table IV.3 shows each equipment class and the representative sizes associated with that class.

TABLE IV.3—SIZES ANALYZED: PANELS

Equipment family name	Equipment family code	Temperature code	Size code	Representative height (feet)	Representative width (feet)
Structural Members	S	C	S	8	1.5
			M	8	4
			L	9	5.5
		F	S	8	1.5
			M	8	4
			L	9	5.5
Floor Panels	F	F	S	8	2
			M	8	4
			L	9	6

Similar to the panel analysis, the engineering analyses for walk-in display and non-display doors both use three different sizes to represent the differences in doors within each size class DOE examined. Details are provided in Table IV.4 for non-display doors and Table IV.5 for display doors.

TABLE IV.4—SIZES ANALYZED: NON-DISPLAY DOORS

Equipment family name	Equipment family code	Temperature code	Size code	Representative height (feet)	Representative width (feet)
Passage Doors	D	C	S	6.5	2.5
			M	7	3
			L	7.5	4
		F	S	6.5	2.5
			M	7	3
			L	7.5	4
Freight Doors	F	C	S	8	5
			M	9	7
			L	12	7

TABLE IV.4—SIZES ANALYZED: NON-DISPLAY DOORS—Continued

Equipment family name	Equipment family code	Temperature code	Size code	Representative height (feet)	Representative width (feet)
		F	S	8	5
			M	9	7
			L	12	7

TABLE IV.5—SIZES ANALYZED: DISPLAY DOORS

Equipment family name	Equipment family code	Temperature code	Size code	Representative height (feet)	Representative width (feet)
Display Doors	D	C	S	5.25	2.25
			M	6.25	2.5
			L	7	3
		F	S	5.25	2.25
			M	6.25	2.5
			L	7	3

American Panel commented that freight doors are typically more than 5 ft wide in order to allow for forklifts to pass through. (American Panel, No. 99 at p. 3) DOE notes that all the freight doors evaluated were 5ft or more in width, as shown in Table IV.4.

b. Refrigeration

In the engineering analysis for walk-in refrigeration systems, DOE used a range of capacities as analysis points for each equipment class. The name of each equipment class along with the naming convention was discussed in section IV.B.2.b. In addition to the multiple analysis points, scroll, hermetic, and semi-hermetic compressors were also investigated because different compressor types have different efficiencies and costs.[15]

Table IV.6 identifies, for each class of refrigeration system, the sizes of the equipment DOE analyzed in the engineering analysis. Chapter 5 of the TSD includes additional details on the representative equipment sizes and classes used in the analysis.

TABLE IV.6—SIZES ANALYZED FOR REFRIGERATION SYSTEM ANALYSIS

Equipment class	Sizes analyzed (Btu/h)	Compressor types analyzed
DC.M.I, <9,000	6,000	Hermetic, Semi-hermetic.
DC.M.I, ≥9,000	18,000	Hermetic, Semi-hermetic, Scroll.
	54,000	Semi-Hermetic, Scroll.
	96,000	Semi-Hermetic, Scroll.
DC.M.O, <9,000	6,000	Hermetic, Semi-hermetic.
DC.M.O, ≥9,000	18,000	Hermetic, Semi-hermetic, Scroll.
	54,000	Semi-Hermetic, Scroll.
	96,000	Semi-Hermetic, Scroll.
DC.L.I, <9,000	6,000	Hermetic, Semi-hermetic, Scroll.
DC.L.I, ≥9,000	9,000	Hermetic, Semi-hermetic, Scroll.
	54,000	Semi-Hermetic, Scroll.
DC.L.O, <9,000	6,000	Hermetic, Semi-hermetic, Scroll.
DC.L.O, ≥9,000	9,000	Hermetic, Semi-hermetic, Scroll.
	54,000	Semi-Hermetic, Scroll.
	72,000	Semi-Hermetic.
MC.M	4,000	
	9,000	
	24,000	
MC.L	4,000	
	9,000	
	18,000	
	40,000	

2. Refrigerants

DOE used R404A, a hydrofluorocarbon (HFC) refrigerant blend, in its analysis for this NOPR because it is widely used currently in the walk-in industry, but requested comment on the ability of systems using other refrigerants to meet a standard based on systems with 404A. 78 FR at 55799. Several stakeholders suggested that future refrigerant policy would play a role in dictating which refrigerant would be used with future refrigeration systems and noted this possibility in response to the engineering analysis.

[15] Scroll compressors are compressors that operate using two interlocking, rotating scrolls that compress the refrigerant. Hermetic and semi-hermetic compressors are piston-based compressors and the key difference between the two is that hermetic compressors are sealed and hence more difficult to repair, resulting in higher replacement costs, while semi-hermetic compressors can be repaired relatively easily.

AHRI commented that future changes in refrigerant policy were likely to drive the market towards low global warming potential (GWP) refrigerants, which could detrimentally affect the performance and efficiency of units. (AHRI, No. 114 at p. 5) KeepRite stated that policies in the near future may require the phase-out of 404A in favor of low-GWP refrigerants which may be less efficient than 404A, making it more difficult to meet the proposed standard. (KeepRite, No. 105 at p. 2) Hussmann agreed that upcoming policies would likely require the phasing-out of 404A in favor of low-GWP refrigerants, which could negatively affect system performance (Hussmann, No. 93 at p. 2) ICS, et al. opined that the DOE analysis did not sufficiently factor in the impending phase-out of HFCs. (ICS, et al., No. 100 at p. 10) Lennox agreed that alternative refrigerants were likely to see growing adoption in walk-ins over the timeline of the rule, but added that this factor may affect the achievable efficiency of a unit either positively or negatively. It suggested that DOE should be prepared to establish separate classes for equipment that uses non-HFC refrigerants if they have an adverse impact on equipment performance. (Lennox, No. 109 at p. 4) Danfoss noted that a change in policy requiring low-GWP refrigerants would greatly impact the cost of production of refrigeration systems, as WICF units use a relatively large volume of charge. (Danfoss, Public Meeting Transcript, No. 88 at p. 164) Manitowoc stated that moving from HFCs to alternative refrigerants would increase cost. (Manitowoc, No. 108 at p. 2)

At this time, DOE does not believe that there is sufficient specific, actionable data presented at this juncture to warrant a change in its analysis and assumptions regarding the refrigerants used in walk-in cooler and freezer applications. As of now, there is inadequate publicly-available data on the design, construction, and operation of equipment featuring alternative refrigerants to facilitate the level of analysis of equipment performance which would be needed for standard-setting purposes. DOE is aware that many low-GWP refrigerants are being introduced to the market, and wishes to ensure that this rule is consistent with the phase-down of HFCs proposed by the United States under the Montreal Protocol. DOE continues to welcome comments on experience within the industry with the use of low-GWP alternative refrigerants. However, there are currently no mandatory initiatives such as refrigerant phase-outs driving a change to alternative refrigerants. Absent such action, DOE will continue to analyze the most commonly-used, industry-standard refrigerants in its analysis.

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

3. Baseline Specifications

a. Panels and Doors

In the NOPR, DOE set the baseline level of performance to correspond to the most common, least efficient component that is compliant with the standards set forth in EPCA. (42 U.S.C. 6313(f)(1)(3)) DOE determined specifications for each equipment class by surveying currently available units and models. More detail about the specifications for each baseline model can be found in chapter 5 of the TSD.

DOE proposed that the baseline cooler structural panels would be comprised of 3.5 inches of polyurethane insulation, with wood framing members around the perimeter of the panel. Baseline freezer structural panels had 4-inches of polyurethane insulation, with wood framing members around the perimeter of the panel. Baseline freezer floor panels had 3.5 inches of polyurethane insulation with wood framing materials around the perimeter of the panel and additional wood structural material in the panel.

Nor-Lake and Thermo Kool commented that DOE's baseline panels seemed reasonable. (Nor-Lake, No. 115 at p. 2; Thermo Kool, No 97 at p. 2) American Panel made a number of suggestions regarding baseline panels. American Panel stated that 85% of the floor panels they built did not need additional structural members because they were going into restaurants. Thus, the floor panel is very similar to the structural panel. (American Panel, Public Meeting Transcript, No. 88 at p. 90) Additionally, American Panel commented that a 3.5-inch thick wood framed panel is not representative of the baseline for walk-in cooler structural panels. Baseline structural cooler panels should be 4 inches thick because that has the food service industry standard for the last 10 to 20 years. Regarding freezer panels materials, American Panel estimated that less than 5% of the total market share has wood framing materials. (American Panel, No. 99 at p. 4) At the NOPR public meeting, American Panel generally stated that wood and hard nose framing material is not commonly used with foam-in-place polyurethane insulation. (American Panel, Public Meeting Transcript, No. 88 at p. 128) Kinser also stated that 4-inch thick urethane panels without framing materials would be a representative baseline. (Kinser, No. 81 at p. 1) US Cooler also disagreed with the baseline assumptions and noted that by misrepresenting the baseline, DOE could overestimate the monetary and emissions savings resulting from this rulemaking. (US Cooler, Public Meeting Transcript, No. 88 at p. 129) NEEA stated that most panel manufacturers were using high density PU foam as panel framing instead of wood. (NEEA, No. 101 at p. 3)

DOE agrees with stakeholders that wood is not the predominate type of framing material in the WICF market, but it is present in the market. In a separate rulemaking, DOE proposed to eliminate the ASTM C1363 test, which measures the full panel thermal conductivity and accounts for features such as framing materials. (DOE subsequently finalized that proposal. See 79 FR at 27391 and 27405–27406.) Therefore, the impacts of framing material would not be captured by the WICF test procedure and framing material was no longer considered a design option for walk-in panels. In the final rule analysis, DOE incorporated high density polyurethane as the framing material for walk-in panels in order to more accurately capture the typical construction and cost of a baseline panel. However, for non-display doors, DOE continued to use wood as the baseline framing material, but DOE accounted for the market share of the baseline type unit and other design options in its efficiency distribution as part of the shipments analysis. See TSD chapter 9.

At the NOPR public meeting, Arctic noted that solid core foam insulation, which DOE interprets as extruded polystyrene, is also found in the walk-in market. (Arctic, Public Meeting Transcript, No. 88 at p. 126) US Cooler also commented that a sizable number of units on the market use extruded polystyrene. US Cooler opined that polyurethane insulation did not have better long term thermal performance than extruded polystyrene. (US Cooler, No. 75 at p. 1) DOE agrees that some walk-ins use extruded polystyrene insulation, but found that the majority of panels are made with poured-in-place polyurethane. For its analysis of a representative panel, DOE continued to use one type of insulation material (i.e. poured-in-place polyurethane) in order to more accurately evaluate the energy consumption of a representative baseline walk-in panel. DOE notes that manufacturers can use any insulation or other features so long as they meet the energy conservation standard levels.

In this final rule, DOE based its analysis on a representative model of a cooler structure panel by assuming that it is comprised of 3.5 inches of polyurethane insulation. Baseline freezer structural panels had 4-inches of polyurethane insulation. Baseline freezer floor panels had 3.5 inches of polyurethane insulation. As previously stated, DOE accounted for high density polyurethane framing materials in all types of panels, but the framing materials did not have an impact on the panel's measured energy efficiency. DOE modeled a baseline cooler structural panel, freezer structural panel, and freezer floor panel to portray an industry representative baseline panel for these equipment classes. These baseline panels correspond to the most common, least efficient component found in the market that complies with the standards set forth in EPCA. (42 U.S.C. 6313(f)(1)(3)) In the case of walk-in cooler structural panels, the Department found that the most common, least efficient panel has an R-value that is higher than the current levels prescribed by EISA. However, the Department recognizes that there are other panel thicknesses and insulation materials employed in the WICF market. DOE used the baseline representative panels in its cost benefit evaluation to determine if energy efficiency improvements based on panel thickness were technologically feasible and economically justifiable.

DOE's NOPR analysis assumed that the baseline non-display doors are constructed in a similar manner to baseline panels. Therefore, DOE uses baseline non-display doors that consist of wood framing materials, foamed-in-place polyurethane insulation. Passage doors were assumed to have a 2.25-square foot window with anti-sweat heater wire. The small freight doors have a 2.25-square foot window with anti-sweat heater wire and both the medium and large freight doors have a 4-square foot window with anti-sweat heater wire. DOE did not include heater wire in the perimeter of the cooler doors in its models, but included heater wire in the perimeter of freezer doors.

Bally stated DOE should add heater wire to cooler doors because condensate from cooler doors could cause a workplace safety issue. (Bally, No. 102 at p. 3) DOE agrees with Bally and for this reason added heater wire to the perimeter of non-display cooler doors.

Nor-Lake, ICS, et al., and American Panel remarked that non-display doors typically do not have windows. (Nor-Lake, No. 115 at pp. 1 and 2; ICS, et al., No. 100 at p. 4; American Panel, Public Meeting Transcript, No. 88 at p. 121) American Panel stated that less than 20% of their non-display doors have windows. (American Panel, Public Meeting Transcript, No. 88 at p. 121) Manitowoc commented that 25% of non-display doors sold by its company were fitted with 1.36-square foot windows and 5% of non-display doors sold had 2.23-square foot windows. (Manitowoc, No. 108 at p. 2) DOE found from its manufacturer interviews that windows in non-display doors serve a specific utility for consumers by allowing the user to look through the window instead of opening the door causing heat gain through infiltration. Therefore, DOE modeled its walk-in cooler doors with windows.

At the public meeting Bally noted that consumers may choose to have windows on WICF doors, and these windows would need additional power to eliminate condensation. Therefore, Bally urged DOE to regulate doors (which DOE interprets to mean the door insulation) separately from windows and other electrical components. (Bally, Public Meeting Transcript, No. 88 at p. 379). DOE agrees with Bally that windows require heater wire to eliminate condensation and accounted for this power consumption in the engineering analysis. DOE is choosing not to regulate windows and electrical components separately from the door because they are inherent to a given door's total energy consumption. Each of these components contributes to the door's efficiency performance, much like the insulation in the door does.

Hillphoenix commented that passage doors do not have complete frames, but instead use backings made of wood, fiber re-enforced plastic, or other materials. (Hillphoenix, Public Meeting Transcript, No. 88 at p. 131) DOE's own research through manufacturer interviews or market research did not indicate that a majority of walk-in non-display doors were constructed with wood backings instead of wood framing material. Accordingly, DOE continued to model the baseline non-display door with a complete wood frame.

Nor-Lake expressed concern that DOE misinterpreted EPCA's requirements for windows in non-display doors, but offered no specific details as to how DOE misinterpreted EPCA. (Nor-Lake, No. 115 at p. 2) DOE notes that all the windows and display doors must meet the design requirements specified in 10 CRF 431.306(b).

Nor-Lake commented that freezer windows in non-display doors tend not to be gas-filled since they have heated glass and the heater wires allow the gas to escape. (Nor-Lake, No. 115 at p. 2) In the display door market, DOE found that freezer display doors have both gas fill and anti-sweat heater wire. From an engineering perspective, it is unclear why windows in non-display doors would be significantly different from the glass packets used in display doors. DOE received no other comments stating that windows in freezer non-displays would lose all gas fill due to anti-sweat heater wire. Accordingly, both design features are included in the analysis.

The baseline display doors modeled in DOE's analysis are based on the minimum specifications set by EPCA. (42 U.S.C. 6313(f)(3)) DOE modeled baseline display cooler doors comprised of two panes of glass with argon gas fill, hard coat low emittance or low-e coating, 2.9 Watts per square foot of anti-sweat heater wire, no heater wire controller, and one fluorescent light. The baseline display freezer doors modeled in DOE's analysis consist of three panes of glass, argon gas, and soft coat low-e coating, 15.23 watts per square foot of anti-sweat heater wire power, an anti-sweat heater wire controller, and one fluorescent light.

Thermo-Kool commented that the Department's baseline for panels and doors was accurate. (Thermo-Kool, No. 97 at p. 2) US Cooler noted that DOE considered heater wire in doors that remained on all the time, whereas most units in the market used wires which only came on as needed. (US Cooler, Public Meeting Transcript, No. 88 at p. 143) DOE included heater wire controllers as a design option as a result of US Cooler's comment. Bally remarked that a typical cooler display door draws about 1.15 amps or 1.6 Wh/day. (Bally, Public Meeting Transcript, No. 88 at p. 135; Bally No. 102 at p.4) However, DOE found in its research that display doors typically drew more than 1.6 Wh/day—which prompted DOE to include a higher power draw in its engineering analysis.

b. Refrigeration

DOE determined baseline characteristics for refrigeration systems based on typical low-cost, low-efficiency products currently on the market that meet the standards set forth in EPCA See 42 U.S.C. 6313(f)(1)–(3). In the NOPR, DOE asked for comment on its assumptions about baseline equipment and received several responses, which are addressed below.

In the NOPR, DOE tentatively proposed not to include piping and insulation between the unit cooler and condensing unit, as it believes these components would not be supplied by the manufacturer or included in the equipment's MSP, but by the contractor upon installation of the equipment. DOE requested comment on this assumption. Hussmann agreed with DOE's proposal that equipment such as piping that is used for final installation should not be included in the rulemaking. (Hussmann, No. 93 at p. 4) Thus, DOE has continued not to include such final installation components in its analysis.

DOE made certain assumptions regarding the baseline temperature difference (TD) between saturated condensing temperature (SCT) and ambient air temperature for the condenser and between walk-in internal air temperature and saturated evaporating temperature (SET) for the evaporator that it used in the analysis for freezers and coolers and indoor and outdoor units. The SCT is the dew-point temperature [16] of the refrigerant that corresponds to the refrigerant pressure in the compressor discharge line at the entrance to the condenser, while the SET is the dew-point temperature of the refrigerant that corresponds to the refrigerant pressure at the exit of the evaporator. DOE's baseline assumptions for the NOPR are listed in Table IV.10 below. DOE notes that the temperatures of air entering the evaporator and condenser coils are prescribed by the test procedure. The temperature difference (TD) is calculated as the difference between the air temperature and the refrigerant temperature (SET or SCT).

TABLE IV.10—SATURATION TEMPERATURES ASSUMED IN THE NOPR

Application	Temperature of air entering the evaporator coil (°F)	Saturated evaporating temperature (SET) (°F)	Temperature difference (TD) between entering air and SET (°F)
Evaporator			
Medium Temperature	35	25	10
Low Temperature	−10	−20	10
Condenser			
Application	Temperature of air entering the condenser coil (°F)	Saturated condensing temperature (SCT) (°F)	Temperature difference (TD) between entering air and SCT (°F)
Medium Temperature Indoor	90	115	25
Medium Temperature Outdoor	95	115	20
Low Temperature Indoor	90	110	20
Low Temperature Outdoor	95	110	15

Several interested parties commented on the values of SET, SCT, and/or TD used in the analysis. Nor-Lake pointed out that the TD for evaporators could range from 7 °F to 25 °F depending on the application. (Nor-Lake, No. 115 at p. 2) Lennox commented that the DOE model used a constant condenser TD for fixed, floating, and variable speed calculations. (Lennox, No. 109 at p. 7) Lennox also stated that baseline SCT values of 120 °F for medium temperature applications and 115 °F for low temperature applications would be more in line with industry practice. (Lennox, No. 109 at p. 7) Heatcraft noted that the TDs DOE assumed were lower than industry standards. (Heatcraft, Public Meeting Transcript, No. 88 at p. 135)

DOE conducted further testing in preparing the final rule and observed the following SET, SCT, and TDs at the highest ambient rating condition (that is, a 95 °F ambient air temperature for the units tested):

[16] Dew-point temperature is the vapor-liquid equilibrium point for a refrigerant mixture where the temperature of the mixture at a defined pressure is the maximum temperature required for a liquid drop to form in the vapor. (ANSI/ASHRAE Standard 23.1–2010, ''Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant.'')

TABLE IV.11—SATURATION TEMPERATURES OBSERVED DURING TESTING

Unit tested	Temperature of air entering the evaporator coil (°F)	Saturated evaporating temperature (SET) (°F)	Temperature difference (TD) between entering air and SET (°F)
Evaporator			
Medium Temperature Outdoor—Unit 1	35	22	13
Medium Temperature Outdoor—Unit 2	35	20	15
Low Temperature Outdoor—Unit 3	−10	−10	10
Low Temperature Outdoor—Unit 4	−10	−21	11
Condensor			
Unit tested	Temperature of air entering the condenser coil (°F)	Saturated condensing temperature (SCT) (°F)	Temperature difference (TD) between entering air and SCT (°F)
Medium Temperature Outdoor—Unit 1	95	109	14
Medium Temperature Outdoor—Unit 2	95	114	20
Low Temperature Outdoor—Unit 3	95	106	11
Low Temperature Outdoor—Unit 4	95	106	11

The test results for evaporator TDs are close to the values DOE assumed in the NOPR, while the test results for condenser TDs are equal to or lower than the values DOE assumed in the NOPR. Based on these test results, DOE continued to use its assumed values in Table IV.10 for SET, SCT, and TD at the highest ambient rating condition, with the exception of unit cooler (evaporator) TD for medium temperature systems, which DOE changed to 14 °F. To address Nor-Lake's comment, DOE acknowledges that some units may operate with different evaporator TDs, and notes that if a manufacturer believes that the test procedure in its current form does not measure the efficiency of the equipment in a manner representative of its true energy use, the manufacturer may apply for a test procedure waiver. In response to Lennox's comment about constant condenser TD, DOE has updated its model such that, for lower ambient rating conditions, the model recalculates the TD based on the head pressure, with different values for fixed and floating head pressure. The model's treatment of the variable speed condenser fan option also takes the differences in TD into account. DOE discusses these calculations in more detail in chapter 5 of the TSD. To address Lennox's and Heatcraft's concern about baseline SCT values, DOE notes that it did not observe a higher condenser TD in testing than its baseline assumptions. Although DOE recognizes that some units on the market may have higher TDs, DOE is unaware of specific units that have higher TDs. Additionally, assigning a higher TD for the baseline might overestimate the energy savings of design options that lower the TD, such as having a larger condenser coil.

4. Cost Assessment Methodology

a. Teardown Analysis

To calculate the manufacturing costs of the different walk-in components, DOE disassembled baseline equipment. This process of disassembling systems to obtain information on their baseline components is referred to as a ''physical teardown.'' During the physical teardown, DOE characterized each component that makes up the disassembled equipment according to its weight, dimensions, material, quantity, and the manufacturing processes used to fabricate and assemble it. The information was used to compile a bill of materials (BOM) that incorporates all materials, components, and fasteners classified as either raw materials or purchased parts and assemblies.

DOE also used a supplementary method, called a ''virtual teardown,'' which examines published manufacturer catalogs and supplementary component data to estimate the major physical differences between equipment that was physically disassembled and similar equipment that was not. For virtual teardowns, DOE gathered product data such as dimensions, weight, and design features from publicly-available information, such as manufacturer catalogs.

The teardown analyses allowed DOE to identify the technologies that manufacturers typically incorporate into their equipment. The end result of each teardown is a structured BOM, which DOE developed for each of the physical and virtual teardowns. DOE then used the BOM from the teardown analyses as input to the cost model to calculate the manufacturer production cost (MPC) for the product that was torn down. The MPCs derived from the physical and virtual teardowns were then used to develop an industry average MPC for each product class analyzed. See chapter 5 of the TSD for more details on the teardown analysis.

For display doors and non-display freight doors, limited information was publicly available, particularly as to the assembly process and shipping. To compensate for this situation, DOE conducted physical teardowns for two representative units, one within each of these equipment classes. DOE supplemented the cost data it derived from these teardowns with information from manufacturer interviews. The cost models for panels and for non-display structural doors were created by using public catalog and brochure information posted on manufacturer Web sites and information gathered during manufacturer interviews.

For the refrigeration system, DOE conducted physical teardowns of unit cooler and condensing unit samples to construct a BOM. The selected systems were considered representative of baseline, medium-capacity systems, and used to determine the base components and accurately estimate the materials, processes, and labor required to manufacture each individual component. From these teardowns, DOE gleaned important information and data not typically found in catalogs and brochures, such as heat exchanger and fan motor details, assembly parts and processes, and shipment packaging.

b. Cost Model

The cost model is one of the analytical tools DOE used in constructing cost-efficiency curves. DOE derived the 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. Original equipment manufacturers (OEMs), i.e., the manufacturers of WICF components, convert raw materials into parts for assembly, and also purchase parts that arrive as finished goods, ready-to-assemble. DOE bases most raw material prices on past manufacturer quotes that have been inflated 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 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 spikes. Chapter 5 of the TSD describes DOE's cost model and definitions, assumptions, data sources, and estimates.

c. Manufacturing Production Cost

Once it finalized the cost estimates for all the components in each teardown unit, DOE totaled the cost of the materials, labor, and direct overhead used to manufacture the unit to calculate the manufacturer production cost of such equipment. The total cost of the equipment was broken down 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 product 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.K).

In discussing earlier comments received from interested parties, the NOPR's preamble erred in characterizing comments from American Panel as stating that panel costs were around $0.25 per square foot. As a result, US Cooler and American Panel stated that $0.25 per square foot was too low a cost for panels. (US Cooler, Public Meeting Transcrip, No. 88, at p. 19; American Panel, Public Meeting Transcript, No. 88 at p. 20) However, in the NOPR's actual analysis, the Department estimated that the manufacturer production cost of walk-in panels was considerably higher than $0.25 per square foot. The panel costs used in the analysis are listed in Table IV.7.

TABLE IV.7—NOPR INSULATION THICKNESS MATERIAL AND LABOR COST

Insulation thickness *in*	Material	Material/labor cost for non-floor panels *$/ft²*	Material/labor cost for floor panels *$/ft²*
3.5	Polyurethane	$5.06	$5.50
4	Polyurethane	5.22	5.64
5	Polyurethane	5.58	5.99
6	Polyurethane	5.92	6.33

Based on manufacturer feedback, the Department further revised its cost model, which resulted in increased insulation prices. The material and labor prices used to characterize the cost of walk-in panels used in the analysis for this final rule are listed in Table IV.8.

TABLE IV.8—FINAL RULE INSULATION THICKNESS MATERIAL AND LABOR COST

Insulation thickness *in*	Material	Material/labor cost for non-floor panels *$/ft²*	Material/labor cost for floor panels *$/ft²*
3.5	Polyurethane	$6.62	$7.14
4	Polyurethane	6.83	7.34
5	Polyurethane	7.248	7.81
6	Polyurethane	7.652	8.21

In the NOPR, in an effort to capture the anticipated cost reduction in LED fixtures in the analyses, DOE incorporated price projections from its Solid State Lighting program into its MPC values for the primary equipment classes. The price projections for LED case lighting were developed from projections developed for the DOE's Solid State Lighting Program's 2012 report, Energy Savings Potential of Solid-State Lighting in General Illumination Applications 2010 to 2030 (''the energy savings report''). ASAP, et al. supported the use of price projections in DOE's analysis because LED prices are likely to drop in the future as market penetration increases. (ASAP et al., No. 113 at p. 4) More details about DOE price projections for LEDs are described in Chapter 5 of the TSD.

d. Manufacturing Markup

DOE uses MSPs to conduct its downstream economic analyses. DOE calculated the MSPs by multiplying the manufacturer production cost by a markup and adding the equipment's shipping cost. The production price of the equipment is marked up to ensure that manufacturers can make a profit on the sale of the equipment. DOE gathered information from manufacturer interviews to determine the markup used by different equipment manufacturers. Using this information, DOE calculated an average markup for each component of a walk-in, listed in Table IV.9.

TABLE IV.9—MANUFACTURER MARKUPS

Walk-in component	Markup (percent)
Panels	32
Display Doors	50
Non-Display Doors	62
Refrigeration Equipment	35

e. Shipping Costs

The shipping rates in the NOPR, were developed by conducting market research on shipping rates and by interviewing manufacturers of the covered equipment. For example, DOE found through its research that most panel, display door, and non-display door manufacturers use less than truck load freight to ship their respective components and revised its estimated shipping rates accordingly. DOE also found that most manufacturers, when ordering component equipment for installation in their particular manufactured product, 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. DOE has revised its methodology accordingly. Please refer to chapter 5 of the TSD for details.

American Panel commented that the estimated shipping costs for 5-inch panels could be significantly higher than shipping costs for 4-inch panels and could range for a 67 percent to 140 percent increase. (American Panel, No. 99 at p. 6) Artic Industries commented that shipping has generally increased over the years and thicker panels will cause additional increases in the shipping price. (Artic Industries, No. 88 at pp. 301–304) US Cooler commented that DOE should not estimate shipping just by weight and volume because less than truck load shipment limit the amount of square footage a manufacturer can use per shipment. (US Cooler, No. 88 at p. 305) DOE appreciates American Panel's and Artic Industries comment on shipping. The Department found that while insulation thickness was a factor in increased shipping costs, so was the size of the walk-in being shipped. DOE modeled six different sized walk-ins each with 3.5-inch, 4-inch, 5-inch and 6-inch thick insulation. DOE used a weighted average based on using each walk-in's estimated market share to develop a shipping price for square foot of panel. DOE appreciates US Coolers comment and accounted for a square footage limit in the shipping costs.

5. Energy Consumption Model

In the NOPR, DOE proposed using an energy consumption model to estimate separately the energy consumption of panels, display doors, non-display doors and entire refrigeration systems at various performance levels using a design-option approach. DOE developed the model as a Microsoft Excel spreadsheet. The models estimate the performance of the baseline equipment and levels of performance above the baseline associated with specific design options that are added cumulatively to the baseline equipment. The model did not account for interactions between refrigeration systems and envelope components, nor did it address how a design option for one component may affect the energy consumption of other components.

At the public meeting, Heatcraft requested that DOE share modeling tool and baseline assumptions used for the engineering analysis. (Heatcraft, Public Meeting Transcript, No. 88 at p. 123) DOE posted the spreadsheets used to model the energy consumption of walk-in panels, doors, and refrigeration systems to the WICF energy conservation standards rulemaking docket Web page, located at: *http://www.regulations.gov/#!docketDetail;D=EERE-2008-BT-STD-0015*

In comments on the NOPR, Lennox stated that the results of the DOE model were not validated with actual laboratory results. (Lennox, No. 109 at p. 2) KeepRite noted that the DOE model was not verified through testing or prototyping, and was therefore overestimating the efficiency gain achievable by manufacturers. (KeepRite, No. 105 at p. 1) Since the publication of the NOPR, DOE has conducted additional testing to support its analysis. See chapter 5 for details.

a. Panels and Doors

In the NOPR performance model for walk-in panels, doors, and display doors, DOE used various assumptions to estimate the performance of each WICF component. In the NOPR, DOE used polyurethane insulation with a thermal resistance of 6.82 ft-h-°F/Btu-in for panels and non-display doors. This thermal resistance accounted for the aging of insulation when measuring walk-in panel performance. See 76 FR at 21612. DOE proposed in a separate rulemaking to eliminate the long term thermal aging test procedure. In this final rule, DOE's analysis used as its industry representative baseline panel a panel comprised of polyurethane insulation, which has as a thermal resistance value, without accounting for long term thermal aging, of 8 ft-h-°F/Btu-in. DOE also received a comment on the thermal resistance used in the non-display door model. IB commented that the insulation's age had no significant impact on door performance. (IB, No. 98 at p. 2) DOE agrees with IB's comment. The aging of insulation in non-display doors is not measured by the DOE test procedure and therefore does not have an impact on the door's performance. In the final rule analysis, DOE modeled its non-display doors assuming they would use polyurethane insulation with a thermal resistance of 8 ft-h-°F/Btu-in.

In the NOPR, DOE requested comment on the performance data of panels, non-display doors, and display doors which was calculated by the Department's energy consumption models and found in appendix 5A of the NOPR TSD. DOE requested that interested parties produce additional data regarding about the thermal resistance performance of panels, display doors, or non-display doors and their design options. Bally commented that DOE's evaluation of non-display doors was inappropriate because it did not account for the impact of the door frame. Bally recommended DOE evaluate the door frame along with the door cap. (Bally, No. 102 at p. 4) Bally added that the majority of heat through non-display doors was at the periphery rather than the center of the door. (Bally, Public Meeting Transcript, No. 88 at p. 122) Bally expanded on this comment by explaining that doors are not sealed tightly and it recommended that DOE account for the heat gain caused by these gaps. (Bally, No. 102 at p. 4) DOE appreciates Bally's comment, but notes that it did not account for gaps around the perimeter of doors. The Department did not adopt a test procedure that measured heat gain via infiltration and therefore did not consider gaps in the doors to have an impact on the performance of the door as measured by the DOE test procedure.

In the NOPR, DOE evaluated the energy consumption associated with individual panels and doors at various sizes. As a result of this methodology, DOE associated design options such as occupancy sensors with one door. DOE recognizes that in the marketplace, one occupancy sensor may serve multiple doors, and received a comment from NEEA, et al. confirming this practice. (NEEA, et al., No. 101 at p. 5) However, DOE is regulating display doors as single component and therefore assumed that all the costs and benefits of an occupancy sensor would be associated with the individual door. Although occupancy sensors may be applied over multiple doors, it is possible that a single display door could be installed in a walk-in with a single occupancy sensor. The Department chose this more conservative path and assumed one occupancy sensor per door.

b. Refrigeration Systems

The CA IOUs made several recommendations for changing the refrigeration system model, particularly for the condensing unit. First, they noted that published condensing unit capacity ratings are overestimated by approximately 35 percent because they rely on compressor capacity information based on a 65 °F return gas temperature, whereas return gas temperature is more likely to be around 41 °F for coolers and 5 °F for freezers. Furthermore, they stated that the productive capacity of a walk-in system is more closely represented by the enthalpy difference between the liquid line enthalpy and the enthalpy of the refrigerant at approximately 10 °F superheat. (CA IOUs, No. 110 at pp. 3–4)

DOE agrees with the assessment by the CA IOUs that current published capacity ratings for WICF components are not necessarily indicative of the capacity of a system made up of those components when that system is tested under AHRI 1250, because AHRI 1250 has different rating conditions than the test procedures currently used to rate the components individually. DOE has adjusted its engineering model to more closely replicate unit performance under the test procedure based on additional test data developed during the NOPR phase. In the energy consumption model, return gas temperature is calculated based on an assumed evaporator superheat (i.e., heating of the refrigerant gas above its saturation temperature, measured at the evaporator exit) and compressor superheat (i.e., heating of the refrigerant gas above its saturation temperature, measured at the suction line entrance to the condensing unit), which are in turn based on test results. The evaporator superheat can be manually set by adjusting the expansion valve; manufacturers typically include recommended evaporator superheat ranges in their installation literature (for instance, one manufacturer recommends an evaporator superheat of 4 to 6 °F for low temperature applications). The compressor superheat is equal to the evaporator superheat plus additional refrigerant temperature rise in the suction line plus the dew point temperature reduction associated with the suction line pressure drop. The energy model calculates the capacity of the system based on the refrigerant enthalpy difference between the unit cooler entrance (liquid line) and exit (suction line), accounting for evaporator superheat, as recommended by CA IOUs. Additional warming of the refrigerant in the suction line is not considered to represent additional capacity, but it reduces refrigerant density and, by extension, condensing unit capacity. The model assumes that the unit does not use a suction line heat exchanger. Similarly, pressure drop in the suction line is also accounted for in the model.

With respect to modeling systems with electric defrost in the NOPR, DOE's analysis applied a temperature-terminated defrost approach for all defrost control schemes (baseline or higher)—that is, once a defrost is initiated, the defrost mechanism continues to heat the evaporator coil until the coil temperature reaches 45 °F, which ensures that the coil is fully defrosted. In the engineering model for electric defrost, DOE calculated the defrost time based on the amount of heat applied by the defrost mechanism and the amount of heat energy it would take to heat the coil and melt the ice, with a ''bypass factor'' accounting for heat lost into the coil's surroundings and not used to heat the coil.

Lennox commented that DOE's calculations for defrost time were too short, and that a typical defrost duration would be in the 20 to 30 minute range, and upwards of 45 to 60 minutes for larger electric defrost units. (Lennox, No. 109 at p. 7)

After further evaluation, DOE agrees with Lennox's assessment. DOE conducted testing of low temperature refrigeration systems and found defrost times of approximately 30 minutes. DOE updated its assumptions in the engineering analysis to assume a 30-minute defrost duration for electric defrost systems smaller than 50,000 Btu/h. In the absence of test data for very large systems, DOE believes Lennox's estimates are reasonable and has increased the assumed defrost time to 45 minutes for electric defrost systems between 50,000 and 75,000 Btu/h and 1 hour for electric defrost systems larger than 75,000 Btu/h for larger electric defrost units it analyzed.

DOE also included drain line heater wattage in the NOPR analysis for low-temperature units. Lennox noted that drain-line heaters are not typically supplied by the manufacturer of the main component (i.e. the unit cooler). (Lennox, No. 109 at p. 7) Accordingly, DOE has removed this from the energy model.

For more details on the energy model, see chapter 5 of the TSD.

6. Design Options

a. Panels and Doors

DOE evaluated the following design options in the NOPR analysis for panels, display doors, and non-display doors:

Panels
- Increased insulation thickness up to 6 inches
- Improved insulation material
- Improved framing material

Display Doors
- Electronic lighting ballasts and high-efficiency lighting
- Occupancy sensors
- Display and window glass system insulation performance
- Anti-sweat heater controls
- No anti-sweat systems

Non-Display Doors
- Increased insulation thickness up to 6 inches
- Improved insulation material
- Improved panel framing material
- Display and window glass system insulation performance
- Anti-sweat heater controls
- No anti-sweat systems

DOE received a number of comments on increased panel thickness. In the NOPR, DOE increased the thickness of walk-in panels from the market representative baseline of 3.5 inches of polyurethane for walk-in cooler structural panels and freezer floor panels to 4 inches, 5 inches, and 6 inches. For walk-in freezer structural panels DOE increased the panel thickness from the baseline of 4 inches to 5 inches and 6 inches. Nor-Lake and American Panel commented that increased insulation thickness resulted in longer cure times. These manufacturers commented that it takes 25 or 30 minutes to cure 4 inch thick panels, 45 minutes to cure 5 inch thick panels, and 60 minutes to cure 6 inch thick panels. (Nor-Lake, No. 115 at p. 1; American Panel, No. 99 at pp. 5 and 6) In response to these comments, DOE accounted for increased cure time in the panel cost model.

Nor-Lake and Manitowoc also stated that increasing the thickness of insulation provided only a minimal amount of R-value improvement. (Nor-lake, No. 115 at p. 1; Manitowoc, No.

108 at p. 3) DOE notes that it found that increasing the thickness of a panel directly improves the panel's efficiency. Accordingly, in preparing the analysis for this final rule, DOE continued to use increased panel thickness as a design option.

To improve the insulation material, DOE evaluated hybrid panels, which are a sandwich of polyurethane and vacuum-insulated panels (VIPs). Nor-Lake commented that vacuum-insulated panels were cost prohibitive and technologically infeasible. (Nor-Lake, No. 115 at p. 2) Bally also commented that VIPs were not economically practical and therefore should be excluded as a design option. (Bally, No. 102 at p. 2) Thermo-Kool remarked that VIPs were too fragile and too expensive to be used in walk-ins. (Thermo-Kool, No. 97 at p. 2)

DOE considered vacuum-insulated panels as a design option in its engineering analysis because they have the potential to improve equipment efficiency, are available on the market today, are currently used in refrigeration products. 10 CFR part 430, subpart C, appendix A, sections (4)(a)(4) and (5)(b). DOE agrees with Thermo-Kool that VIPs may be too fragile for walk-in applications and therefore incorporated VIPs as part of a hybrid panel, which sandwiches the VIPs in 2-inch polyurethane layers. However, DOE understands that there is a high level of cost required in implementing this design option, including redesign costs, and sought to reflect that through appropriate cost values obtained from manufacturer interviews and other sources and included in its analyses. As a result, vacuum-insulated panels appear only in max-tech designs for each equipment class, and are not included in any of the modeled configurations selected in setting the standard levels put forth in this rule.

Bally commented that DOE should consider pocket connectors as a design option for panels (Bally, Public Meeting Transcript, No. 88 at p. 148) DOE appreciates Bally's suggestion, but as previously described in this final rule notice the Department's test procedure for walk-in panels only measures the insulation's thermal resistance. Therefore, this technology would not result in energy savings as measured by the test procedure.

DOE received a few comments on the design options evaluated for display doors. NEEA, et al. and the CA IOUs suggested that DOE consider low-e, gas filled glazing for medium temperature display doors. (NEEA et al., No. 101 at p.5; CA IOUs, No. 110 at p. 4) DOE clarifies that it evaluated 3 improved glass packs above the baseline, which included more efficient gas fills low-emissivity glazed panes, and additional glass panes. Chapter 5 of the TSD explains the design options for display doors in more detail.

NEEA, et al. also recommended that DOE exclude lighting from the door frame assembly because it is not physically part of the door and because LEDs are already common in the WICF market. NEEA, et al. stated that the inclusion of lighting into the standards for doors would cause difficulty in enforcing compliance because no doors are shipped with lighting. (NEEA, et al., No. 101 at p. 5). In its market assessment, DOE found that lighting is typically installed and sold as part of the door assembly. Therefore, DOE continued to account for lighting used with display doors. DOE does not expect that including lighting will complicate enforcement of DOE standards because it is sold with the display door as integrated componentry. DOE agrees that LEDs are common in the WICF market and has accounted for the market share of LEDs as part of the efficiency distribution in the shipments analysis, detailed in chapter 9 of the TSD.

Bally remarked that it was unclear as to what technology DOE was referring to by ''automatic door opener/closer.'' Bally asked for clarification as to how the power draw of opening and closing devices was to be evaluated. (Bally, No. 102 at p.5) DOE notes that because the test procedure does not measure heat gain from infiltration, it did not account for door openings and closings as part of its list of potential design options. See section III.B, infra.

IB commented that edging material had no significant impact on door performance. (IB, No. 98 at p. 2) IB may be correct in that the edging material does not have a significant impact on door performance in real world applications. However, the DOE test procedure for doors measures the thermal performance for the entire door, including any materials in the edge of the door. Additionally, DOE notes that the edge materials, which could act like a thermal bridge, would have an impact on the performance of the door. For this reason, DOE continued to evaluate the possibility of using improved framing materials for non-display doors.

b. Refrigeration

DOE included the following design options in the NOPR analysis:

- Higher efficiency compressors
- Improved condenser coil
- Higher efficiency condenser fan motors
- Improved condenser and evaporator fan blades
- Ambient sub-cooling
- Evaporator and condenser fan control
- Defrost control
- Hot gas defrost
- Head pressure control

DOE described the design options in detail in chapter 5 of the NOPR TSD. In the notice, DOE requested comment on the design options, particularly improved condenser coil, fan motor efficiency, fan motor controls, and floating head pressure. In response, DOE received comments on these and other options.

Larger Condenser Coil

In the NOPR, DOE considered a larger condenser coil as a design option, which would reduce the condenser TD, increasing system capacity and resulting in a higher AWEF. DOE increased the fan power proportionally to coil size, but requested comment on whether increasing the condenser coil size would require an increase in evaporator coil size. 78 FR at 55816. Hussmann commented that a larger condenser coil would not require a larger evaporator coil. (Hussmann, No. 93 at p. 5) Furthermore, DOE's analysis did not indicate that a larger evaporator coil would be required. Accordingly, DOE is not implementing a larger evaporator coil along with the larger condenser coil design option in the final rule analysis.

Defrost Controls

In the preliminary analysis, DOE assumed that a demand defrost control would be tested using the optional demand defrost test in AHRI 1250, section C11.2 and would have the equivalent effect of reducing the number of defrosts per day by 50 percent. However, stakeholder comments on the preliminary analysis stated that a 50 percent reduction was too difficult to achieve using current technologies. Therefore, in the NOPR, for the defrost controls design option, DOE applied a generic defrost control that would have the effect of reducing the number of defrosts per day by 40 percent. 78 FR at 55818. In comments on the NOPR assumption, Manitowoc noted that demand-defrost systems had been shown to reduce the number of defrost cycles as much as 80 percent compared to ''timed defrost'' systems. (Manitowoc, No. 108 at p. 3) DOE acknowledges that the energy savings due to demand-defrost systems may vary widely depending on the control mechanism; however, given the range of stakeholder comments it has received on the issue, believes an 80 percent reduction is too aggressive. DOE notes that its recently adopted approach with respect to the measurement of refrigeration system performance [79 FR 27387], provides a default value for the reduction in defrosts from 4 to 2.5 defrosts per day due to demand-defrost controls. DOE has applied this default value in the engineering analysis for the final rule. For more details, see chapter 5.

Hot Gas Defrost

In the NOPR, DOE included hot gas defrost as a design option for multiplex condensing systems because it assumed the unit cooler could use hot gas generated by the compressor rack. DOE did not include hot gas defrost as a design option for dedicated condensing systems because DOE did not believe it was effective at saving energy. 78 FR at 55804. In response, Heat Transfer commented that it manufactured many dedicated systems with hot gas defrost, which increased the efficiency of the unit. (Heat Transfer, Public Meeting Transcript, No. 88 at p. 140) After further review, DOE agrees with Heat Transfer that hot gas defrost is a valid design option for dedicated condensing systems as well as unit coolers connected to multiplex systems, and has implemented this option in the analysis. Heat Transfer's literature claims that hot gas defrost causes systems to defrost four times faster, but did not have specific details on the energy savings. See chapter 5 for further details on the hot gas defrost design option.

Fan and Motor Efficiency

In the NOPR, DOE assumed that baseline evaporator fan motors would be electronically commutated motors (ECMs), while baseline condenser fan motors would be permanent split capacitor (PSC) motors. One design option was to replace PSC motors in condenser fans with more-efficient ECMs. This approach was consistent with EPCA, which specified that evaporator fan motors of under 1 horsepower and less than 460 volts must use electronically commutated motors or 3-phase motors and condenser fan motors of under 1 horsepower must use electronically commutated motors, permanent split capacitor-type motors, or 3-phase motors. (42 U.S.C. 6313(f)(1)(E)-(F)) In the NOPR, DOE screened out 3-phase motors from its design options because not all customers have 3-phase power, although it noted that this would in no way prohibit manufacturers from using them to improve rated energy use. 78 FR at 55805.

In comments on the NOPR, Regal-Beloit noted that three-phase motors and multi-horsepower ECMs could greatly improve unit efficiency. ebm-papst also commented that evaporator fans for WICFs did not necessarily have to be axial fans and that other types of air-moving devices, such as backward curved motorized impellers, may be a more efficient choice for certain refrigeration systems due to their aerodynamic characteristics. (ebm-papst, No. 92 at p. 5) Hussmann stated that the only way to accurately obtain fan motor power is to test the fan motors in-unit, or reference the fan, motor, and coil operating curves to determine power consumption at the desired CFM and pressure differential. (Hussmann, No. 93 at p. 5)

DOE agrees with Regal-Beloit and ebm-papst that other, more efficient types of fans and motors may exist and may be used by manufacturers to improve the efficiency of their WICF equipment. DOE is continuing to screen out 3-phase motors based on utility to the consumer, because not all customers would have 3-phase power. In response to Hussmann's comment, DOE notes that Hussmann did not provide any detailed fan information for WICFs that DOE could use in the analysis. Furthermore, DOE does not believe that the consideration of such detailed information would significantly improve the analysis, as DOE believes it has made reasonable, conservative estimates for fan efficiency based on stakeholder comments and market research.

Evaporator Fan Controls

In the NOPR, DOE applied both modulated evaporator fan controls and variable speed evaporator fan controls design options for all classes analyzed. A modulated fan control cycles the fans at a 50 percent duty cycle when the compressor cycles off, while variable speed fan control reduces fan speed during the off-cycle. To account for these types of controls, DOE's analysis reduced the fan speed to 50 percent. Lennox commented that the model takes into account variable speed during refrigeration, which would incorrectly reflect a greater AWEF value. (Lennox, No. 109 at p. 7) Hussmann mentioned that fan modulation always requires an electronic expansion valve (EEV) to function properly, which is not always accounted for in TSL 4. (Hussmann, No. 93 at p. 5) DOE notes that it has applied variable speed evaporator fans to those refrigeration applications where unit coolers are connected to a multiplex condensing unit in order to determine the fan speed during high and low load periods as specified in AHRI 1250, section 7.9. (That section requires that for unit coolers with variable speed evaporator fans that modulate fan speed in response to load, the fan shall be operated under its minimum, maximum and intermediate speed that equals to the average of the maximum and minimum speeds, respectively during the unit cooler test, and quadratic fit equations relating evaporator net capacities, fan operating speed, and fan power consumption be developed.) To address Hussmann's comment, DOE notes that the analysis is conservative regarding the fan speed reduction, with a maximum fan speed reduction of 50 percent. DOE does not expect that the system would need an EEV for this control approach.

Refrigeration Summary

After considering all the comments it received on the design options, DOE applied the following design options in the final rule analysis:

- Higher efficiency compressors
- Improved condenser coil
- Higher efficiency condenser fan motors
- Improved condenser and evaporator fan blades
- Ambient sub-cooling
- Evaporator and condenser fan control
- Defrost control
- Hot gas defrost
- Head pressure control

E. Markups Analysis

DOE applies multipliers called ''markups'' to the MSP to calculate the customer purchase price of the analyzed equipment. These markups are in addition to the manufacturer markup (discussed in section IV.D.3.d) and are intended to reflect the cost and profit margins associated with the distribution and sales of the equipment. DOE identified two major distribution channels for walk-ins, and markup values were calculated for each distribution channel based on industry financial data. The overall markup values were then calculated by weighted-averaging the individual markups with market share values of the distribution channels.

In estimating markups for walk-ins and other equipment, DOE developed separate markups for the cost of baseline equipment and the incremental cost of higher-efficiency equipment. Incremental markups are applied as multipliers only to the MSP increments of higher-efficiency equipment compared to baseline, and not to the entire MSP.

See chapter 6 of the final rule TSD for more details on DOE's markups analysis.

F. Energy Use Analysis

The energy use analysis estimates the annual energy consumption of refrigeration systems serving walk-ins and the energy consumption that can be directly ascribed to the selected components of the WICF envelopes. These estimates are used in the subsequent LCC and PBP analyses and NIA.

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 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 adequate refrigeration effect to meet the daily refrigeration load of the envelope with a safety margin to meet contingency situations. Thus, the annual energy consumption estimates for the refrigeration system depend on the methodology adopted for sizing, the implied assumptions and the extent of oversizing. The sizing methodology is further discussed later in this section.

For the envelopes, the estimates of equipment and infiltration loads are no longer used in estimating energy consumption in the analysis because these factors are not intended to be mitigated by any of the component standards. DOE calculated only the transmission loads across the envelope components under test procedure conditions and combined that with the annual energy efficiency ratio (AEER) to arrive at the annual refrigeration energy consumption associated with the specific component. AEER is a ratio of the net amount of heat removed from the envelope in Btu by the refrigeration system and the annual energy consumed in watt-hours using bin temperature data specified in AHRI 1250–2009 to calculate AWEF. The annual electricity consumption attributable to any envelope component is the sum of the direct electrical energy consumed by electrically-powered sub-components (e.g., lights and anti-sweat heaters) and the refrigeration energy, which is computed by dividing the transmission heat load traceable to the envelope component by the AEER metric, where the AEER metric represents the efficiency of the refrigeration system with which the envelope is paired.

DOE estimated the annual energy consumption per unit of the specific envelope components by calculating the transmission load of the component over 24 hours under the test procedure conditions, and then calculating the annual refrigeration energy consumption attributed to that component by applying an appropriate AEER value. DOE used the same approach for the final rule's analysis.

1. Sizing Methodology for the Refrigeration System

The load profile of WICF equipment 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).

As a result, the DOE test procedure incorporates an assumption that, during a 24-hour period, a WICF refrigeration system experiences a high-load period of 8 hours corresponding to frequent door openings, equipment loading events, and other design load factors, and a low-load period for the remaining 16 hours, corresponding to a minimum load resulting from conduction, internal heat gains from non-refrigeration equipment, and steady-state infiltration across the envelope surfaces. During the high-load period, the ratio of the envelope load to the net refrigeration system capacity is 70 percent for coolers and 80 percent for freezers. During the low-load period, the ratio of the envelope load to the net refrigeration system capacity is 10 percent for coolers and 40 percent for freezers. The relevant load equations correspond to a duty cycle for refrigeration systems, where the system runs at full design point refrigeration capacity for 7.2 hours per day for coolers and 12.8 hours per day for freezers. Specific equations to vary load based on the outdoor ambient temperature are also specified.

For this final rule, DOE concluded that the duty cycle assumptions of AHRI 1250–2009 should not be used for the sizing purposes because they may not represent the average conditions for WICF refrigeration systems for all applications under all conditions. DOE recognizes that test conditions are often designed to effectively compare the performance of equipment with different features under the same conditions.

As it did for the NOPR, 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. A fixed oversize factor of 10 percent was then applied to this size to calculate the actual runtime. With the oversize factor applied, DOE assumes that the runtime of the refrigeration system is 13.3 hours per day for coolers and 15 hours per day for freezers at full design point capacity. The reference outside ambient temperatures for the design point capacity conform to the AHRI 1250–2009 conditions incorporated into the DOE test procedure and are 95 °F and 90 °F for refrigeration systems with outdoor and indoor condensers, respectively.

2. Oversize Factors

As stated previously, DOE observed 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 runtime for coolers and 18 hours of runtime for freezers. Based on discussions with purchasers of walk-ins, 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.

Further, DOE recognized that an exact match for the calculated refrigeration capacity may not be available for the refrigeration systems available in the market because most refrigeration systems are mass-produced in discrete capacities. The capacity of the best matched refrigeration system is likely to be the nearest higher capacity refrigeration system available. This consideration led DOE to develop a scaled mismatch factor that could be as high as 33 percent for the smaller refrigeration system sizes, and was scaled down for the larger sized units. DOE applied this mismatch oversizing factor to the required refrigeration capacity at the high-load condition to determine the required capacity of the refrigeration system to be paired with a given envelope.

In preparing the NOPR analysis, DOE considered comments from interested parties and recalculated the mismatch factor because compressors for the lower capacity units are available at smaller size increments than what DOE had initially assumed in the preliminary analysis. For larger sizes, the size increments of available capacities are higher than size increments available for the lower capacities. DOE further noted as part of the revised analysis that under current industry practice, if the exact calculated size of the refrigeration system with a 10 percent safety margin is not available in the market, the user may choose the closest matching size even if it has a lower capacity, allowing the daily runtimes to be somewhat higher than their intended values. The designer would recalculate the revised runtime with the available lower capacity and compare it with the target runtime of 16 hours for coolers and 18 hours for freezers and, if this value falls within acceptable limits, then the chosen size of the refrigeration system is accepted and there is no mismatch oversizing.

DOE further examined the data of available capacities in published catalogs of several manufacturers and noted that the range of available capacities depends on compressor type and manufacturer. Furthermore, because smaller capacity increments are available for units in the lower capacity range and larger capacity increments are available for units in the higher capacity range, the mismatch factor is generally uniform over the range of equipment sizes. For the NOPR, DOE tentatively concluded from these data that a scaled mismatch factor linked to the target capacity of the unit may not be applicable, but that the basic need to account for discrete capacities available in the market is still valid. To this end, for the final rule DOE applied a uniform average mismatch factor of 10 percent over the entire capacity range of refrigeration systems.

To estimate the runtimes for the NOPR, DOE started with nominal runtimes of 16 hours for coolers, and 18 hours for freezers. However, these runtimes are appropriate for perfectly sized refrigeration systems, and do not account for equipment oversizing. DOE estimated runtimes as a function of this oversizing in accordance with industry practice (see chapter 7 of the final rule TSD).

Several stakeholders commented that the runtime assumptions were too short, and should be increased to 18 hours for larger walk-ins used by convenience and grocery stores (ACCA, No. 119, at p. 3), or 16 hours for walk-in coolers and 20 hours for walk-in freezers (NorLake, No. 115, at p. 2), or 16 hours for walk-in coolers and 18 hours for walk-in freezers (Manitowoc, No. 108; at p. 3).

It is not clear whether the values cited in the comments refer to nominal runtimes. If so, DOE's assumptions are roughly similar to the values cited in the comments. Because the comments regarding runtimes do not provide enough evidence for DOE to revise its assumptions, DOE maintained the same approach for estimating runtimes as it used in the NOPR.

G. Life-Cycle Cost and Payback Period Analysis

DOE conducts LCC and PBP analyses to evaluate the economic impacts of potential energy conservation standards for walk-ins on individual customers—that is, buyers of the equipment. As stated previously, DOE adopted a component-based approach for developing performance standards for walk-in coolers and freezers. Consequently, the LCC and PBP analyses were conducted separately for the refrigeration system and the envelope components: panels, non-display doors, and display doors.

The LCC is defined as the total consumer expense over the life of a piece of equipment, consisting of purchase, installation, and operating costs (expenses for energy use, maintenance, and repair). To calculate the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the equipment. The PBP is defined as the estimated number of years it takes customers to recover the increased purchase cost (including installation) of more efficient equipment. The increased purchase cost is derived from the higher first cost of complying with the higher energy conservation standard. DOE calculates the PBP by dividing the increase in purchase cost (normally higher) by the change in the average annual operating cost (normally lower) that results from the standard.

For any given efficiency level, DOE measures the PBP and the change in LCC relative to the base-case equipment efficiency levels. The base-case estimate reflects the market without new or amended energy conservation standards. For walk-ins, the base-case estimate assumes that newly manufactured walk-in equipment complies with the existing EPCA requirements and either equals or exceeds the efficiency levels achievable by EPCA-compliant equipment. Inputs to the economic analyses include the total installed operating, maintenance, and repair costs.

Inputs to the calculation of total installed cost include the cost of equipment—which consists of manufacturer costs, manufacturer markups, distribution channel 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, discount rates, and the year that compliance with standards is required. DOE created probability distributions for equipment lifetime inputs to account for their uncertainty and variability.

DOE developed refrigeration and envelope component spreadsheet models to calculate the LCC and PBP. Chapter 8 of the final rule TSD and its appendices provide details on the refrigeration and envelope subcomponent spreadsheet models and on all the inputs to the LCC and PBP analyses.

Table IV.12 summarizes DOE's approach and data used to derive inputs to the LCC and PBP calculations for the NOPR and the changes made for this final rule.

TABLE IV.12—SUMMARY OF INPUTS AND METHODS IN THE LCC AND PBP ANALYSIS*

Inputs	NOPR analysis	Changes for final rule
Installed Costs		
Equipment Cost	• Derived by multiplying manufacturer cost by manufacturer and retailer markups and sales tax, as appropriate.	• No change for systems, and display doors, DOE maintain its use of a declining price trend. • For non-display doors and panels the manufacture experience curve was revised to use constant real prices.
	• Includes a factor for estimating equipment price trends due to manufacturer experience.	
Installation Costs	Based on RS Means Mechanical Cost Data 2012. Assumed no change with efficiency level.	No change.

TABLE IV.12—SUMMARY OF INPUTS AND METHODS IN THE LCC AND PBP ANALYSIS*—Continued

Inputs	NOPR analysis	Changes for final rule
Operating Costs		
Annual Energy Use	DOE calculated daily load profile of the refrigeration system revised to 13.3 hours runtime per day for coolers and 15 hours for freezers, at full rated capacity and at outside air temperatures corresponding to the reference rating temperatures.	No change.
Energy Prices	Commercial and industrial prices of electricity based on Form EIA–826 Database Monthly Electric Utility Sales and Revenue Data.	No change.
Energy Price Trends	Forecasted using *AEO2013* price forecasts	No change.
Repair and Maintenance Costs.	• Annualized repair and maintenance costs of the combined system were derived from RS Means 2012 walk-in cooler and freezer maintenance data. Doors and refrigeration systems were replaced during the lifetime. • Refrigerant recharge cost set at $0.	Increased refrigerant recharge cost to $500, to reflect industry practice,
Present Value of Operating Cost Savings		
Equipment Lifetime	Based on manufacturer interviews. Variability: characterized using Weibull probability distributions.	Revised to reflect stakeholder comments, see section IV.G.7 for details.
Discount Rates	Based on Damodaran Online, October 2012	No change.
Compliance Date	2017	No change.

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

1. Equipment Cost

To calculate customer equipment costs, DOE multiplied the MSPs developed in the engineering analysis by the distribution channel markups, described in section IV.E. DOE applied baseline markups to baseline MSPs, and incremental markups to the MSP increments associated with higher efficiency levels.

For the NOPR, DOE developed an equipment price trend for WICFs based on the inflation-adjusted index of the producer price index (PPI) for air conditioning, refrigeration, and forced air heating from 1978 to 2012.[17] A linear regression of the inflation-adjusted PPI shows a downward trend. To project a future trend, DOE extrapolated the historic trend using the regression results. For the LCC and PBP analysis, this default trend was applied between the present and the first year of compliance with amended standards, 2017.

Several commenters stated that, since prices for metal and urethane chemicals have increased about 3 percent annually over the last 20 years, there is no justification for DOE's assumed decrease in prices. (APC, No. 99, at p. 8; ThermoKool, No. 97 at p. 4) Hussmann noted that a large portion of WICF manufacturer cost comes from copper coil and sheet metal; since the prices of these commodities have more than doubled in the last 10 years, Hussmann expects materials costs to increase in the future. (Hussmann, No.93, at p. 6) US Cooler pointed out that WICF prices have not decreased since 1986. (US Cooler, No. PMeeting, at pp. 310–311) US Cooler also argued that the WICF industry is dependent on the price of metals. (US Cooler, No. 99 at p. 8)

DOE believes that the comments on past prices likely refer to nominal prices, since that is what manufacturers see. The PPI index that DOE used shows a slight increasing trend from 1980 to 2012. DOE uses real (inflation-adjusted) prices throughout its analysis, however, and the inflation-adjusted PPI shows a slight declining trend. For the final rule, DOE used a more disaggregated PPI: for commercial refrigerators and related equipment. The exponential fit that was derived exhibits a very slight declining trend, which DOE generally applied for WICFs.

However, DOE determined that this trend was inappropriate for panels and non-display doors, where the majority of the manufacturer cost is polyurethane foam insulation. For these equipment classes DOE used constant real prices when estimating future equipment price. For details on the estimation of future equipment price, see appendix 8D of the final rule TSD.

2. Installation Costs

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the equipment. For the NOPR analysis, DOE included refrigeration system component installation costs based on *RS Means Mechanical Cost Data 2012*.[18] Refrigeration system installation costs included separate installation costs for the condensing unit and unit cooler. DOE continued with this approach for refrigeration systems in preparing this final rule.

For the NOPR, DOE estimated installation costs separately for panels, non-display doors, and display doors. Installation costs for panels were calculated per square foot of area while installation costs for non-display doors were calculated per door. Display door installation costs were omitted and assumed to be included in the panel installation costs for display walk-ins. DOE assumed that display doors are either installed along with the other walk-in components and that and the installation costs for the display doors are included in the ''mark-up'' amounts for the OEM channel.

DOE received several comments regarding panel installation costs as a result of increased foam insulation thickness. ICS stated that panels requiring more than 4 inches of foam insulation will require thermal barriers and automatic fire suppression, which are expensive and will place a burden on manufacturers and add unnecessary costs on end users. (ICS, No. 100, at p. 7) Similarly, Nor-Lake asserted that building codes may require a thermal barrier, sprinkler system, or other tests

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

[18] Reed Construction Data, *RSMeans Mechanical Cost Data 2012 Book*, 2012.

if panel foam thickness increases above 4 inches. (Nor-Lake, No. 115 at p. 4)

For cooler and freezer walls greater than 400 ft^2, the International Building Code [19] (IBC) requires sprinkler systems and other fire safety criteria regardless of panel thickness.[20] Therefore, there would be no additional installation costs for walk-ins of this size that would be dependent on foam thickness.

For walk-in coolers up to 400 ft^2, Section 2603.4.1.3 of the IBC states that these coolers do not require special consideration for foam thickness up to 4 inches if the metal facing is of greater thickness than 0.032-inch or 0.016-inch for aluminum or steel, respectively. For foam thicknesses greater than 4 inches and up to 10 inches, a thermal barrier is required. DOE added the cost of installing a 0.5-inch gypsum thermal barrier when the panel foam thickness exceeds 4 inches.[21] The cost of materials and labor was estimated at \$1.53 ft^2 (this includes the installation cost for taped, and finished (level 4 finish) fire resistant 0.5-inch gypsum) based on *RSMeans Facilities Construction Cost Data, 2013* [22]. This cost was applied to all installations of walk-ins up to 400 ft^2 where foam thickness is greater than 4 inches and up to 10 inches.

3. Maintenance and Repair Costs

Maintenance costs are associated with maintaining the equipment's operation, whereas repair costs are associated with repairing or replacing components that have failed in the refrigeration system and the envelope (i.e. panels and doors). In preparing the final rule's analysis, DOE followed the same approach that it applied for the NOPR analysis with regard to maintenance for display doors with lights. 78 FR 55781, 55828. The remaining data on general maintenance for an entire walk-in were apportioned between the refrigeration system and the envelope doors. Based on the descriptions of maintenance activities in the *RS Means Facilities Maintenance and Repair Cost Data, 2013,*[23] and manufacturer interviews, DOE assumed that the general maintenance associated with the panels is minimal and did not include any maintenance costs for panels in its analysis. RS Means 2013 data provided general maintenance costs for display and storage walk-ins.

For this final rule, the total annual maintenance costs for a walk-in unit range from \$172 to \$265; of this DOE assumed \$152 would be spent on the refrigeration system and the rest would be spent on the display and passage doors of the envelope. Maintenance costs were assumed to be the same across small, medium, and large door sizes in the case of both non-display doors and display doors. As stated previously, annual maintenance costs for the envelope wall and floor panels were assumed to be negligible and were not considered.

Several parties stated that DOE had underestimated the maintenance costs associated with refrigerant leakage and refrigerant charge. (ACCA, No. 119, at p. 3; Nor-Lake, No. 115, at p. 2; ICS, et al., No. 100 at p. 5; NRA No. 112, at p.3). ICS, et al. recommended an annual cost of \$500 to \$700, while Nor-Lake suggested \$600.

Based on the comments received, DOE used an annual cost of \$500 to account for system refrigerant recharging.

4. Annual Energy Consumption

Typical annual energy consumption of walk-ins at each considered efficiency level is obtained from the energy use analysis results (see section IV.F of this notice).

5. Energy Prices

DOE calculated average State commercial electricity prices using the U.S. Energy Information Administration's (EIA's) ''Database of Monthly Electric Utility Sales and Revenue Data.'' [24] DOE calculated an average State commercial price by (1) estimating an average commercial price for each utility company by dividing the commercial revenues by commercial sales; and (2) weighting each utility by the number of commercial customers it served by state.

6. Energy Price Projections

To estimate energy prices in future years, DOE extrapolated the average State electricity prices described above using the forecast of annual average commercial electricity prices developed in the Reference Case from *AEO2013.*[25] AEO2013 forecasted prices through 2040. To estimate the price trends after 2040, DOE assumed the same average annual rate of change in prices as from 2031 to 2040.

7. Equipment Lifetime

For the NOPR, DOE estimated lifetimes for the individual components analyzed instead of the entire unit. It used an average lifetime of 15 years for panels, 14 years for display and non-display doors, and 12 years for refrigeration systems. DOE reflects the uncertainty of equipment lifetimes in the LCC analysis for equipment components by using probability distributions.

A number of stakeholders asserted that DOE had overestimated the equipment lifetimes, and that in general the average lifetime for WICFs is 10 years. (NAFEM, No. 118, at p. 3; Bally, No. 102, at p. 2; APC, No. PMeeting, at p. 246; Louisville Cooler, No. PMeeting, at p. 249; Hillphoenix, No. 107 at p. 5) Louisville Cooler stated that WICFs have a wide range of lifetimes, and that a typical fast food or convenience store walk-in unit will have a 10-year life, but institutional walk-ins would have a life up to 20 years. (Louisville Cooler, No. 81 at p. 1)

For refrigeration systems, ThermoKool agreed with the assumed lifetime of 12 years (ThermoKool, No. 97 at p. 3), while Bally and Manitowoc suggested that average system lifetimes are between 6 and 10 years. (Bally, No. 102 at p. 2; Manitowoc, No. 108, at p. 4)

Nor-Lake commented that typical panel lifetime is 10 to 15 years (Nor-Lake, No. 115, at p. 3), while Manitowoc commented that 10 years is more typical. (Manitowoc, No. 108, at p. 4) Several comments stated that panel lifetimes from 7 to 10 years are representative. (IB, No. 98, at p. 3; ThermoKool, No. 97, at p. 3; Hillphoenix, No. 107, at p. 7) Further, IB stated that panel lifetimes should not be less than the minimum lifetime of the door. (IB, No. 98, at p. 3) APC asserted that customers will likely replace the entire WICF when the panels fail if the remaining components are close to end-of-life. (APC, No. PMeeting at p. 244)

ThermoKool and Bally commented that doors have lifetimes of 3 to 5 years and 4 to 6 years, respectively. (ThermoKool, No. 97, at p. 3; Bally, No.

[19] International Code Council, Inc., *International Building Code,* 2012, ISBN: 978–1–60983–040–3.

[20] Section 2603.4.1.2 states that foam plastics used in cooler and freezer walls up to a maximum thickness of 10 inches shall be protected by an automatic sprinkler system. Where the cooler or freezer is within a building, both the cooler or freezer and the part of building in which it is located shall be sprinklered.

[21] Section 2603.4 defines a thermal barrier material where the average temperature of the exposed surface does not rise more than 250 °F after 15 minutes of fire exposure. One can meet this criterion using 0.5 inch gypsum which is rated at.

[22] Reed Construction Data, *RSMeans Facilities Maintenance & Repair 2013 Cost Data Book,* 2013.

[23] Reed Construction Data, *RSMeans Facilities Maintenance & Repair 2013 Cost Data Book.* 2013.

[24] U.S. Energy Information Administration. *EIA–826 Sales and Revenue Spreadsheets.* (Last accessed May 16, 2012). *www.eia.doe.gov/cneaf/electricity/page/eia826.html.*

[25] The spreadsheet tool that DOE used to conduct the LCC and PBP analyses allows users to select price forecasts from either *AEO's* High Economic Growth or Low Economic Growth Cases. Users can thereby estimate the sensitivity of the LCC and PBP results to different energy price forecasts.

102, at p. 2) Danfoss, Hillphoenix, APC, and IB asserted that doors are replaced every 3 years. (Danfoss, No. PMeeting at p. 239; Hillphoenix, No. 107, at p. 5; APC, No. PMeeting, at p. 246; IB, No. 98, at p. 3) The CA IOUs, after contacting end-users of walk-in doors, stated that their lifetime is approximately 15 years. (CA IOUS, No. 110, at p. 6) CA IOUs further stated that while there is a wide range of lifetimes for freight and panel doors, 8 to 9 years is typical. (CA IOUs, No. 110, at p. 6) Nor-Lake stated that the typical lifetime of a passage door is 8 to 10 years, and the typical lifetime of a freight door is 5 to 7 years. (Nor-Lake, No. 115, at p. 3)

Based on the stakeholder comments, DOE revised its lifetime estimates for this final rule. In all cases, DOE reduced the average equipment lifetime, as shown in Table IV.13. Equipment lifetimes are described in detail in chapter 8 of the final rule TSD.

TABLE IV.13—AVERAGE EQUIPMENT LIFETIMES FOR WALK-IN COOLERS AND FREEZERS (IN YEARS)

Component	NOPR	Final Rule	
		Small	All other sizes
Display Door	14	12	12
Freight Door	14	12	6
Passage Door	14	12	6
Panel Wall/Floor	15	12	12
Refrigeration System	12	10	10

8. Discount Rates

In calculating the LCC, DOE applies discount rates to estimate the present value of future operating costs to the customers of walk-ins.[26] DOE derived the discount rates for the walk-in analysis by estimating the average cost of capital for a large number of companies similar to those that could purchase walk-ins. This approach resulted in a distribution of potential customer 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).[27] The CAPM assumes that the cost of equity is proportional to the amount of systematic risk associated with a company.

9. Compliance Date of Standards

Amended standards for WICFs apply to equipment manufactured beginning on the date 3 years after the final rule is published unless DOE determines, by rule, that a 3-year period is inadequate, in which case DOE may extend the compliance date for that standard by an additional 2 years. (42 U.S.C. 6313(f)(4)(B)) In the absence of any information indicating that 3 years is inadequate, DOE projects a compliance date for the standards of 2017. Therefore, DOE calculated the LCC and PBP for walk-in coolers and freezers under the assumption that compliant equipment would be purchased in the year when compliance with the new standard is required—2017.

10. Base-Case Efficiency Distributions

To accurately estimate the share of consumers who would likely be impacted by a standard at a particular efficiency level, DOE's LCC analysis considers the projected distribution of equipment efficiencies that consumers purchase under the base case (*i.e.,* the case without new energy efficiency standards). DOE refers to this distribution of equipment efficiencies as a base-case efficiency distribution.

For the NOPR, DOE examined the range of standard and optional equipment features offered by manufacturers. For refrigeration systems, DOE estimated that 75 percent of the equipment sold under the base case would be at DOE's assumed baseline level—that is, the equipment would comply with the existing standards in EPCA, but have no additional features that improve efficiency. The remaining 25 percent of equipment would have features that would increase its efficiency. While manufacturers could have many options, DOE assumed that the average efficiency level of this equipment would correspond to the efficiency level achieved by the baseline equipment with the first design option in the sequence of design options in the engineering analysis ordered by their relative cost-effectiveness.

For panels and non-display doors, DOE estimated that 100 percent of the equipment sold under the base case would consist of equipment at the baseline level—that is, minimally compliant with EPCA. For cooler display doors, DOE assumed that 25 percent of the current shipments are minimally compliant with EISA and the remaining 75 percent are higher-efficiency (45 percent are assumed to have LED lighting, corresponding to the first efficiency level above the baseline in the engineering analysis, and 30 percent are assumed to have LED lighting plus anti-sweat heater wire controls, corresponding to the second efficiency level above the baseline). For freezer display doors, DOE assumed that 80 percent of the shipments would be minimally compliant with EPCA and the remaining 20 percent would have LED lighting, corresponding to the first efficiency level above the baseline. (See section IV.C for a discussion of the efficiency levels and design options in the engineering analysis). For further information on DOE's estimate of base-case efficiency distributions, see chapter 8 of the final rule TSD.

11. Inputs to Payback Period Analysis

Payback period is the amount of time it takes the customer to recover the higher purchase cost of more energy efficient equipment as a result of lower operating costs. Numerically, the PBP is the ratio of the increase in purchase cost to the decrease in annual operating expenditures. This type of calculation is known as a ''simple'' PBP because it does not take into account changes in operating cost over time or the time value of money; that is, the calculation is done at an effective discount rate of zero percent. PBPs are expressed in years. PBPs greater than the life of the equipment mean that the increased total

[26] The LCC analysis estimates the economic impact on the individual customer from that customer's own economic perspective in the year of purchase and therefore needs to reflect that individual's own perceived cost of capital. By way of contrast DOE's analysis of national impact requires a societal discount rate. These rates used in that analysis are 7 percent and 3 percent, as required by OMB Circular A–4, September 17, 2003.

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

installed cost of the more-efficient equipment is not recovered in reduced operating costs over the life of the equipment.

The inputs to the PBP calculation are the total installed cost to the customer of the equipment for each efficiency level and the average annual operating expenditures for each efficiency level in the first year. The PBP calculation uses the same inputs as the LCC analysis, except that electricity price trends and discount rates are not used.

12. Rebuttable-Presumption Payback Period

Sections 325(o)(2)(B)(iii) and 345(e)(1)(A) of EPCA (42 U.S.C. 6295(o)(2)(B)(iii) and 42 U.S.C. 6316(a)(A)) establish a rebuttable presumption applicable to walk-ins. The rebuttable presumption states that a new or amended 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. This rebuttable presumption test is an alternative way of establishing economic justification.

To evaluate the rebuttable presumption, DOE estimated the additional cost of purchasing more-efficient, standards-compliant equipment, and compared this cost to the value of the energy saved during the first year of operation of the equipment. DOE views the increased cost of purchasing standards-compliant equipment as including the cost of installing the equipment for use by the purchaser. DOE calculated the rebuttable presumption payback period (RPBP), or the ratio of the value of the increased installed price above the baseline efficiency level to the first year's energy cost savings. When the RPBP is less than 3 years, the rebuttable presumption is satisfied; when the RPBP is equal to or more than 3 years, the rebuttable presumption is not satisfied. Note that this PBP calculation does not include other components of the annual operating cost of the equipment (*i.e.,* maintenance costs and repair costs).

While DOE examined the rebuttable presumption, it also considered whether the standard levels considered are economically justified through a more detailed analysis of the economic impacts of these levels pursuant to 42 U.S.C. 6295(o)(2)(B)(i). Consistent with its usual practice, DOE conducted this more thorough analysis to help ensure the completeness of its analysis of the standards under consideration. The results of this analysis served as the basis for DOE to evaluate the economic justification for a potential standard level definitively (thereby supporting or rebutting the results of any preliminary determination of economic justification).

H. Shipments

Forecasts of equipment shipments are used to calculate the national impacts of standards on energy use, NPV, and future manufacturer cash flows. The envelope component model and refrigeration system shipments model take an accounting approach, tracking market shares of each equipment class and the vintage of units in the existing stock. Stock accounting uses equipment shipments as inputs to estimate the age distribution of in-service equipment stocks for all years. The age distribution of in-service equipment stocks is a key input to calculations of both the NES and NPV because operating costs for any year depend on the age distribution of the stock. Detailed description of the procedure to calculate future shipments is presented in chapter 9 of the final rule TSD.

In DOE's shipments model, shipments of walk-in units and their components are driven by new purchases and stock replacements due to failures. Equipment failure rates are related to equipment lifetimes, which were revised for the final rule, as described in section IV.G.7. DOE modeled its growth rate projections for new equipment using the commercial building floor space growth rates from the *AEO 2013* NEMS–BT model.

Complete historical shipments data for walk-ins could not be obtained from any one single source. Therefore, for the NOPR DOE used data from multiple sources to estimate historical shipments.

NEEA suggested that DOE use industry data such as those collected by NAEFEM to forecast shipments, even if it does not cover all manufacturers. (NEEA, No. 101, at p. 6) DOE contacted NAFEM, which provided DOE with recent copies of their ''Size and Shape of the Industry'' reports.[28] These reports contain data on the annual sales of walk-in units in the food service sector for 2002–2012. DOE analyzed the data received from NAFEM and also obtained other data from manufacturer interviews and other sources. For the final rule, DOE included these new data into its shipments analysis.

a. Share of Shipments and Stock by Equipment Class

For the NOPR, DOE estimated that dedicated condensing units account for approximately 70 percent of the refrigeration market and the remaining 30 percent consists of unit coolers connected to multiplex condensing systems. For dedicated condensing refrigeration systems, DOE estimated that approximately 66 percent and 3 percent of the shipments and stock of the refrigeration market is accounted for by outdoor and indoor dedicated condensing refrigeration systems, respectively. For unit coolers connected to multiplex systems, DOE estimated that medium temperature units account for about 25 percent of the shipments and stock.

Regarding the relative shares of stock or shipments between walk-in coolers and freezers, for the NOPR, DOE estimated 71 percent share for coolers and 29 percent for freezers. DOE estimated that shares by size of walk-in units are 52 percent, 40 percent, and 8 percent for small, medium, and large units, respectively.

DOE received no comments on the above estimates, and for this final rule DOE maintained the same values that were used in the NOPR.

2. Impact of Standards on Shipments

For various equipment, price increases due to standards could lead to more refurbishing of equipment (or purchase of used equipment), which would have the effect of deferring the shipment of new equipment for a period of time. For the NOPR, DOE did not have enough information on customer behavior to explicitly model the extent of refurbishing at each TSL.

ACCA and Hussmann stated that additional panel insulation will encourage businesses to extend the life of old units or purchase a used unit rather than a new unit. (ACCA, No. 93, at p.7; Hussmann, No. 93, at p. 7) However, Manitowoc noted that there is a very limited market for used equipment because the panel design does not lend itself to multiple cycles. (Manitowoc, No. 108, at p. 4) ACCA pointed out that while there is a large market for used small WICFs typically used in restaurants, larger WICFs found in grocery stores are less likely to be resold. (ACCA, No 119, at p. 3)

DOE acknowledges that price increases from amended standards could lead to increases in equipment refurbishing or the purchase of used equipment. DOE did not have enough

[28] North American Association of Food Equipment Manufacturers. *2012 Size and Shape of Industry.* Chicago, IL.

information on WICF customer behavior to explicitly model the extent of refurbishing at each TSL. However, DOE believes that the degree of refurbishing would not be significant enough to change the ranking of the TSLs considered for this rule.

Manitowoc argued that if the price of a WICF is too high, customers will use other appliances to keep their food cold, such as reach-ins and under-counter coolers, which would cause higher energy consumption. (Manitowoc, No. 108, at p. 4) Thermo-Kool agreed that higher prices would encourage customers to buy alternative means to keep products cold or frozen (Thermo-Kool, No. 97 at p. 3).

DOE is releasing a concurrent standard for commercial refrigeration equipment, which includes the alternative equipment mentioned by Manitowoc and Thermo-Kool. The equipment covered under that rule will be subject to similar price increases as WICFs. Therefore, DOE believes that there will be limited incentive for customers to purchase alternatives to WICFs that meet the standards in this final rule.

I. National Impact Analysis—National Energy Savings and Net Present Value

The NIA assesses the NES and the NPV of total customer costs and savings that would be expected as a result of amended energy conservation standards. The NES and NPV are analyzed at specific efficiency levels for each walk-in equipment class. DOE calculates the NES and NPV based on projections of annual equipment shipments, along with the annual energy consumption and total installed cost data from the LCC analysis. For the final rule analysis, DOE forecasted the energy savings, operating cost savings, equipment costs, and NPV of customer benefits over the lifetime of equipment sold from 2017 through 2046.

DOE evaluated the impacts of the amended standards by comparing base-case projections with standards-case projections. The base-case projections characterize energy use and customer costs for each equipment class in the absence of any amended energy conservation standards. DOE compares these projections with projections characterizing the market for each equipment class if DOE were to adopt an amended standard at specific energy efficiency levels for that equipment class.

DOE uses a Microsoft Excel spreadsheet model to calculate the energy savings and the national customer costs and savings from each TSL. The final rule TSD and other documentation that DOE provides during the rulemaking help explain the models and how to use them, and interested parties can review DOE's analyses by interacting with these spreadsheets. The NIA spreadsheet model uses average values as inputs (as opposed to probability distributions of key input parameters from a set of possible values).

For the final rule analysis, the NIA used projections of energy prices and commercial building starts from the *AEO2013* Reference Case. In addition, DOE analyzed scenarios that used inputs from the *AEO2013* Low Economic Growth and High Economic Growth Cases. These cases have lower and higher energy price trends, respectively, compared to the Reference Case. NIA results based on these cases are presented in appendixes 10A and 10B of the final rule TSD.

A detailed description of the procedure to calculate NES and NPV, and inputs for this analysis are provided in chapter 10 of the final rule TSD.

1. Forecasted Efficiency in the Base Case and Standards Cases

A key component of the NIA is the trend in energy efficiency forecasted for the base and standards cases. As discussed in section IV.G, DOE used data collected from manufacturers and an analysis of market information to develop a base-case energy efficiency distribution (which yields a shipment-weighted average efficiency) for each of the considered equipment classes for the first year of the forecast period. For both refrigeration systems and envelope components, DOE assumed no improvement of energy efficiency in the base case and held the base-case energy efficiency distribution constant throughout the forecast period.

To estimate market behavior in the standards cases, DOE uses a ''roll-up'' scenario. Under the roll-up scenario, DOE assumes that equipment efficiencies in the base case that do not meet the standard level under consideration would ''roll up'' to meet the new standard level, and equipment efficiencies above the standard level under consideration would be unaffected.

The estimated efficiency trends in the base case and standards cases are further described in chapter 8 of the final rule TSD.

2. National Energy Savings

For each year in the forecast period, DOE calculates the NES for each potential standard level by multiplying the stock of equipment affected by the energy conservation standards by the estimated per-unit annual energy savings. DOE typically considers the impact of a rebound effect in its calculation of NES for a given piece of equipment. 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 walk-ins because they are operated 24 hours a day, and therefore there is no potential for a rebound effect.

Major inputs to the NES calculation are annual unit energy consumption, shipments, equipment stock, a site-to-primary energy conversion factor, and a full fuel cycle factor.

The annual unit energy consumption is the site energy consumed by a walk-in component in a given year. Because the equipment classes analyzed in this rule represent a range of different equipment that is sold across a range of sizes, DOE adopted different ''unit'' definitions for panels, and all other walk-in equipment. For panels, NES is expressed as a square footage of equipment, while for all other components NES is expressed per unit. DOE determined annual forecasted shipment-weighted average equipment efficiencies that, in turn, enabled determination of shipment-weighted annual energy consumption values.

The NES spreadsheet model keeps track of the total square feet of walk-in cooler and freezer panels, and component units shipped each year. The walk-in stock in a given year is the total number of walk-ins shipped from earlier years that is still in use in that year, based on the equipment lifetime.

DOE did not include any rebound effect for WICFs in its NOPR analysis. Several commenters agreed that there would be no rebound effect for WICFs. (ThermoKool, No. 97, at p. 4; APC, No. 99, at p.8; NEEA et al., No. 101, at p. 6; Hillphoenix, No. 107, at p. 5) DOE maintained the same approach in preparing the final rule.

To estimate the national energy savings expected from energy conservation standards, DOE uses a multiplicative factor to convert site energy consumption (energy use at the location where the appliance is operated) into primary or source energy consumption (the energy required to deliver the site energy). For this final rule, DOE used conversion factors based on *AEO 2013.* For electricity, the conversion factors vary over time because of projected changes in generation sources (*i.e.,* the types of power plants projected to provide electricity to the country). Because the *AEO* does not provide energy forecasts beyond 2040, DOE used conversion factors that remain constant at the 2040 values throughout the rest of the forecast.

DOE has historically presented NES in terms of primary energy savings. 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 Science, DOE announced its intention to use full-fuel-cycle (FFC) measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011) After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in the **Federal Register** in which DOE explained its determination that 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). The approach used for this final rule, and the FFC multipliers that were applied, are described in appendix 10E of the final rule TSD. NES results are presented in both primary energy and FFC savings in section V.B.3.a.

3. Net Present Value of Customer Benefit

The inputs for determining the NPV of the total costs and benefits experienced by walk-in customers are: (1) Total annual installed cost; (2) total annual savings in operating costs; and (3) a discount factor. DOE calculated net national customer savings for each year as the difference between the base-case scenario and standards-case scenarios in terms of installation and operating costs. DOE calculated operating cost savings over the life of each piece of equipment shipped in the forecast period.

DOE multiplied monetary values in future years by the discount factor to determine the present value of costs and savings. DOE estimated national impacts using both a 3-percent and a 7-percent real discount rate as the average real rate of return on private investment in the U.S. economy. These discount rates are used in accordance with the Office of Management and Budget (OMB) guidance to Federal agencies on the development of regulatory analysis (OMB Circular A–4, September 17, 2003), and section E, ''Identifying and Measuring Benefits and Costs,'' therein. The 7-percent rate is an estimate of the average before-tax rate of return on private capital in the U.S. economy, and reflects the returns on real estate and small business capital, including corporate capital. DOE used the 3-percent rate to capture the potential effects of amended standards on private consumption. This rate represents the rate at which society discounts future consumption flows to their present value. DOE defined the present year as 2014 for the analysis.

J. Customer Subgroup Analysis

In analyzing the potential impact of new or amended standards on commercial customers, DOE evaluates the impact on identifiable groups (*i.e.,* subgroups) of customers, such as different types of businesses that may be disproportionately affected. Small businesses typically face a higher cost of capital. In general, the higher the cost of capital, the more likely it is that an entity would be disadvantaged by a requirement to purchase higher efficiency equipment. Based on data from the 2007 U.S. Economic Census and size standards set by the U.S. Small Business Administration (SBA), DOE determined that a majority of small restaurants fall under the definition of small businesses. It believes that this subgroup is broadly representative of small businesses that use walk-in coolers and walk-in freezers.

DOE estimated the impacts on the identified customer subgroup using the LCC spreadsheet model. The inputs for small restaurants were fixed to ensure that the discount rates, electricity prices, and equipment lifetime associated with that subgroup were selected. The discount rate was further increased by applying the small firm premium to the WACC. Apart from these changes, all other inputs for the subgroup analysis are the same as those in the LCC analysis. Details of the data used for the subgroup analysis and results are presented in chapter 11 of the final rule TSD.

K. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impact of new energy conservation standards on manufacturers of walk-in equipment and to determine the impact of such standards on employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA primarily relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model with inputs specific to this rulemaking. The key GRIM inputs are data on the industry cost structure, product costs, shipments, and assumptions about markups and conversion expenditures. The key output is the industry net present value (INPV). Different sets of markup scenarios will produce different results. The qualitative part of the MIA addresses factors such as equipment characteristics, impacts on particular subgroups of manufacturers, and important market and product trends. The complete MIA is outlined in chapter 12 of the final rule TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the walk-in industry that includes a top-down cost analysis of manufacturers used to derive preliminary financial inputs for the GRIM (*e.g.,* sales general and administration (SG&A) expenses; research and development (R&D) expenses; and tax rates). DOE used public sources of information, including company Securities and Exchange Commission (SEC) 10–K filings, Moody's company data reports, corporate annual reports, the U.S. Census Bureau's Economic Census, and Dun and Bradstreet reports.

In Phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the impacts of an energy conservation standard. 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 conducted structured, detailed interviews with a representative cross-section of manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns.

Also in Phase 3, DOE evaluated subgroups of manufacturers that may be disproportionately impacted by amended standards, or that may not be accurately represented by the average cost assumptions used to develop the industry cash-flow analysis. For example, small manufacturers, niche players, or manufacturers exhibiting a cost structure that largely differs from the industry average could be more negatively affected.

DOE identified one subgroup, small manufacturers, for separate impact analyses. DOE applied the small business size standards published by the SBA to determine whether a company is considered a small business. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part

121. The Small Business Administration (SBA) defines a small business for North American Industry Classification System (NAICS) 333415 ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing'' as having 750 or fewer employees. The 750-employee threshold includes all employees in a business's parent company and any other subsidiaries. The small businesses were further sub-divided into small manufacturers of panels, doors, and refrigeration equipment to better understand the impacts of the rulemaking on those entities. The small business subgroup is discussed in sections V.B.2.d and VI.B of this notice and in Chapter 12 of the final rule TSD.

2. Government Regulatory Impact Model

DOE uses the GRIM to quantify the changes in the walk-in industry cash flow due to amended standards that result in a higher or lower industry value. The GRIM analysis uses a standard, annual cash-flow analysis that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs, and models changes in costs, investments, and manufacturer margins that would result from new energy conservation standards. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning with the base year of the analysis, 2013 in this case, and continuing to 2046. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. DOE applied discount rates derived from industry financials and then modified them according to feedback during manufacturer interviews. Discount rates ranging from 9.4 to 10.5 percent were used depending on the component being manufactured.

The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the base case and each TSL (the standards case). Essentially, the difference in INPV between the base case and a standards case represents the financial impact of the energy conservation standard on manufacturers. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the TSD.

DOE presents its estimates of industry impacts by grouping the major equipment classes served by the same manufacturers. For the WICF industry, DOE groups results by panels, doors, and refrigeration systems.

a. Government Regulatory Impact Model Key Inputs

(1) Manufacturer Production Costs

Manufacturing higher efficiency equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex components, which are more costly than baseline components. The changes in the MPCs of the analyzed WICF components can affect the revenues, gross margins, and cash flow of the industry, making these production cost data key GRIM inputs for DOE's analysis.

In the MIA, DOE used the MPCs for each considered efficiency level calculated in the engineering analysis, as described in section IV.D and further detailed in chapter 5 of the NOPR TSD. In addition, DOE used information from its teardown analysis, described in section IV.D.3, 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.

(2) Shipments Forecast

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of shipments by equipment class. For the base-case analysis, the GRIM uses the NIA base-case shipment forecasts from 2013, the base year for the MIA analysis, to 2046, 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 9.3.1 in chapter 9 of the TSD. Therefore, the total number of shipments per year in the standards case is equal to the total shipments per year in the base case. DOE assumes a new efficiency distribution in the standards case, however, based on the energy conservation standard. DOE assumed that product efficiencies in the base case that did not meet the standard under consideration would ''roll up'' to meet the new standard in the standard year.

(3) Product and Capital Conversion Costs

New energy conservation standards will cause manufacturers to incur conversion costs to bring their production facilities and product 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 product 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 product designs can be fabricated and assembled.

To evaluate the level of capital conversion expenditures manufacturers would likely incur to comply with energy conservation standards, DOE used the manufacturer interviews to gather data on the level of capital investment required at each efficiency level. DOE validated manufacturer comments through estimates of capital expenditure requirements derived from the product teardown analysis and engineering model described in section IV.D.3. For the final rule, adjustments were made to the capital conversion costs based on feedback in the NOPR written comments and changes in the test procedure for panels and refrigeration components. DOE assessed the product conversion costs at each level by integrating data from quantitative and qualitative sources. DOE considered feedback from multiple manufacturers at each efficiency level to determine conversion costs such as R&D expenditures and certification costs. Industry certification costs included fire safety testing by Underwriter Laboratories (UL) and food safety certifications by the NSF International (NSF). Manufacturers' data was aggregated to better reflect the industry as a whole and to protect confidential information. For the final rule, adjustments were made to product conversion costs based on feedback in the NOPR written comments and changes in the test procedure for panels and refrigeration components.

In general, DOE 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 an amended standard. The investment figures used in the GRIM can be found in section V.B.2.a of this notice. For additional information on the estimated product conversion and capital conversion costs, see chapter 12 of the final rule TSD.

b. Government Regulatory Impact Model Scenarios

Markup Scenarios

As discussed above, MSPs include direct manufacturing production costs (*i.e.,* labor, material, and overhead estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied markups to the MPCs estimated in the engineering analysis and then added in the cost of shipping. Modifying these markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of 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 markups values that, when applied to the inputted MPCs, result in varying revenue and cash flow impacts.

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, DOE assumed the non-production cost markup—which includes SG&A expenses, R&D expenses, interest, and profit—to be 1.32 for panels, 1.50 for solid doors, 1.62 for display doors, and 1.35 for refrigeration. These markups are consistent with the ones DOE assumed in the engineering analysis. Manufacturers have indicated that it is optimistic 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.

In the preservation of operating profit scenario, manufacturer markups are set so that operating profit 1 year after the compliance date of the amended energy conservation standard is the same as in the base case. Under this scenario, as the cost of production and the cost of sales rise, manufacturers generally must reduce their markups to a level that maintains base-case operating profit. The implicit assumption behind this markup scenario is that the industry can maintain only its operating profit in absolute dollars after the standard. Operating margin in percentage terms is reduced between the base case and standards case.

3. Discussion of Comments

During the October 2013 NOPR public meeting, interested parties commented on the assumptions and results of the analyses as described in the TSD. Oral and written comments addressed several topics, including refrigerants, installation contractors, impacts on small manufacturers, the base case markup, and the number of small panel manufacturers in the industry.

a. Refrigerants

NAFEM and ICS requested that DOE incorporate the phase out of HFCs in its analysis. NAFEM stated that alternative refrigerants could add to overall engineering costs and reduce energy savings. (NAFEM, No. 118 at p. 4) (ICS, et al., No. 100 at p. 7) (IB, No. 98 at p. 2). The use of alternative refrigerants is not a direct result of this rule and is not included in this analysis. Furthermore, there is no regulatory requirement to use alternative refrigerants at this time. DOE does not include the impacts of pending legislation or regulatory proposals in its analysis, as any impact would be speculative. For this final rule, DOE does not include the impact of alternative refrigerants in its analysis.

b. Installation Contractors

ACCA noted that the MIA did not assess the impact on installation contractors. (ACCA, No. 88 at p. 338) Consistent with EPCA, and in keeping with industry's requests submitted at the Preliminary Analysis and summarized in the proposal, DOE has taken a component-based approach in setting standards for WICF. (42 U.S.C. 6311(20)) As such, the MIA focuses on manufacturers of WICF panels, WICF refrigeration, and WICF doors. DOE does not consider the installation contractors to be manufacturers for the purpose for the Manufacturer Impact Analysis as they do not produce the panels, refrigeration components, or doors being tested, labeled, and certified.

c. Small Manufacturers

In written comments, manufacturers stated that new energy efficiency standards would impose severe economic hardship on small business manufacturers. (Manitowoc, No. 108 at p. 4) (Hillphoenix, No. 107 at p. 6) (APC, No.99 at p. 20) NAFEM stated that small businesses do not have the R&D resources to create and implement the design options necessary to meet the standards. (NAFEM, No. 118 at p. 4) A large number of comments focused on the economic hardship of small business manufacturers that DOE considered to be primarily manufacturers of WICF panels. These comments focused on capital conversion costs, product conversion costs, and production capacity impacts.

Hillphoenix and ICS commented that increased panel thickness would result in excessive capital conversion costs, especially for small manufacturers. (Hillphoenix, No. 107 at p. 6) (ICS, et al., No. 100 at p. 7) US Cooler stated that small manufacturers using foamed-in-place polyurethane that do not currently have the capability to manufacture 5'' insulation would be faced with costs of $800,000 for two foamed-in-place fixtures. Arctic stated that in order to manufacture 5'' foamed-in-place polyurethane panels, small manufacturers would be required to invest at least $1M. (Arctic, No. 117 at p. 2) Thermo-Kool estimated that the equipment cost required to manufacture thicker insulation panels would likely be in excess of $1 million for each manufacturer. (ThermoKool, No. 97 at p. 2) Arctic and US Cooler added that moving from a 4-inch to a 5-inch insulation panel would result in prohibitive retooling and labor costs for small manufacturers currently making 4-inch panels. (Arctic, No. 117 at p. 1) (US Cooler, No. 104 at p. 1) ICS further noted that requiring more than 4 inches of foam insulation will require thermal barriers and automatic fire suppression, which are expensive and will add to manufacturer burdens and place unnecessary costs on end users. (ICS, et al., No. 100 at p. 7) US Cooler and Arctic asserted that small manufacturers using extruded polystyrene (EPS) would need to make extensive and costly changes to their manufacturing process and materials to meet a standard above baseline since EPS is only sold in 4'' thick sheets. (US Cooler, No. 104 at p. 2) (Arctic, No. 117 at p. 1).

Manufacturers were also concerned about the product conversion costs related to the standard proposed in the NOPR. Specifically, commenters cited high testing costs and limited availability of test labs accredited to perform ASTM C1363 as prohibitive barriers to small manufacturers complying with the standard. (Hillphoenix, No. 107 at p. 6) (Hussmann, No. 93 at p. 6) (Arctic, No. 117 at p. 1) (US Cooler, No. 100 at p.

6) APC commented that the ASTM C1363 test had an excessive cost-burden of around $4,000 for each test. (APC, No. 99 at p. 1) IB estimated the total cost of testing to be in the range of $2.5 million for a manufacturer and stated that such a cost would be prohibitive for small businesses. (IB, No. 98 at p. 4)

Aside from capital conversion costs and product conversion costs, panel manufacturers noted other concerns related to a standard that would require an increase in panel thickness. Nor-Lake noted that increased panel thickness would raise production costs. These higher production costs stem in part from the additional curing time needed for thicker panels—Nor-Lake pointed out that a 4'' panel took approximately 25 minutes to cure, while 5'' and 6'' panels took 45 minutes and one hour, respectively, to cure. (Nor-Lake, No. 115 at p. 1) APC agreed with Nor-Lake's cure time estimates and further noted that a 5'' panel would force manufacturers to lose 1/3rd of their production capacity. (APC, No. 99 at p. 4) Manitowoc stated that thicker panels would be heavier, necessitating longer curing times and raising safety concerns during the manufacturing process. (Manitowoc, No. 108 at p. 3)

DOE has taken the industry's feedback on capital conversion costs, product conversion costs, production capacity implications into account in its final rule analysis. As a result, DOE selected a standard level that is equivalent to the current baseline for WICF panels. Consequently, DOE expects that no new investment in capital equipment or outside testing would be necessary to meet the standard, thereby minimizing impacts on small manufacturers.

d. Mark Up Scenarios

Manufacturers submitted several comments with regard to manufacturer markups. Hussmann stated that the market does not use a simple markup and that markups vary based on customer payback periods and each manufacturer's ability to maximize profits. (Hussmann, No.93 and p.3) Thermokool submitted a comment that DOE's markups are extremely undervalued. (ThermoKool, No 97 at p.3) APC noted that panel markups are closer to 1.46 (rather than DOE's value of 1.32) and refrigeration markups are closed to 1.45 (rather than DOEs markup of 1.35). (APC, No 99 at p.6)

While applying a simple markup on manufacturer production cost may not be a common practice to arrive at a selling price for walk-in panel manufacturers, DOE believes applying a simple industry-average markup is a useful tool for modeling the industry as a whole. DOE validated its markup values with eight different panel manufacturers during manufacturer interviews. While the industry-average markup values may be low for specific companies, especially for small manufacturers, DOE notes that using low markup assumptions provides a more conservative analysis, which ensures that DOE does not understate the potential negative impacts on industry.

e. Number of Small Businesses

American Panel commented on the number of manufacturers in the WICF panel industry. It estimates that there are only 5 large manufacturers of walk-in panels. Therefore, American Panel suggested that 42 of 47 walk-in panel manufacturers (89%) are small businesses, not 42 of 52 (81%) as estimated by DOE in the NOPR.

DOE identified 5 parent companies with 10 subsidiaries that produce walk-in panels. This is consistent with American Panel's written comment that there are only 5 large manufacturers of walk-in panels. DOE has revised its regulatory flexibility analysis to more accurately reflect the number of large and small manufacturers identified in the industry.

L. Emissions Analysis

In the emissions analysis, DOE estimated the reduction in power sector emissions of CO_2, NO_X, sulfur dioxide (SO_2) and Hg from amended energy conservation standards for walk-in coolers and walk-in freezers. In addition, DOE estimates emissions impacts in production activities (extracting, processing, and transporting fuels) that provide the energy inputs to power plants. These are referred to as ''upstream'' emissions. Together, these emissions account for the full-fuel-cycle (FFC). In accordance with DOE's FFC Statement of Policy (76 FR 51282 (Aug. 18, 2011)) 77 FR 49701 (August 17, 2012), the FFC analysis includes impacts on emissions of methane (CH_4) and nitrous oxide (N_2O), both of which are recognized as greenhouse gases.

DOE conducted the emissions analysis using emissions factors for CO_2 and most of the other gases derived from data in *AEO 2013,* supplemented by data from other sources. DOE developed separate emissions factors for power sector emissions and upstream emissions. The method that DOE used to derive emissions factors is described in chapter 13 of the final rule TSD.

EIA prepares the *Annual Energy Outlook* using NEMS. Each annual version of NEMS incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2013* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of December 31, 2012.

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 (42 U.S.C. 7651 *et seq.*) and the District of Columbia (DC). 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)), which created an allowance-based trading program. CAIR was remanded to the U.S. Environmental Protection Agency (EPA) by the U.S. Court of Appeals for the District of Columbia but it remained in effect.[29] In 2011, EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (Aug. 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR.[30] The court ordered EPA to continue administering CAIR. The *AEO 2013* emissions factors used for this final rule assume that CAIR remains a binding regulation through 2040.

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 a new or amended 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 around 2015, 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 final 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

[29] 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).

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

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. *AEO2013* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2015. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, NEMS shows a reduction in SO_2 emissions when electricity demand decreases (*e.g.,* as a result of energy efficiency standards). Emissions will be far below the cap that would be 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. Therefore, DOE believes that energy efficiency standards will reduce SO_2 emissions in 2015 and beyond.

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

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions factors based on *AEO2013,* which incorporates the MATS.

M. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of the standards in this final 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 customer 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 each of these emissions and presents the values considered in this final rule.

For this final rule, DOE is relying on a set of values for the SCC that was developed by a Federal interagency process. The basis for these values is summarized below, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the final rule TSD.

1. Social Cost of Carbon

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) 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 carbon dioxide. A domestic SCC value is meant to reflect the value of damages in the United States resulting from a unit change in carbon dioxide emissions, while a global SCC value is meant to reflect the value of damages worldwide.

Under section 1(b) of Executive Order 12866, 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 carbon dioxide emissions, the analyst faces a number of challenges. A report from the National Research Council [31] points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of GHGs; (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise questions of science, economics, and ethics and should be viewed as provisional.

Despite the limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing CO_2 emissions. The agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC value appropriate for that year. The net present value of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years.

It is important to emphasize that the interagency process is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across Federal agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the

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

existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: Global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules.

c. Current Approach and Key Assumptions

After the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates. Specially, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models (IAMs) 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. 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.

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 IAMs, 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 temperature 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,[32] although preference is given to consideration of the global benefits of reducing CO_2 emissions.

Table IV.14 presents the values in the 2010 interagency group report,[33] which is reproduced in appendix 14A of the final rule TSD.

TABLE IV.14—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[2007 Dollars 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 rule were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[34] Table IV.15 shows the updated sets of SCC estimates in 5-year increments from 2010 to 2050. The full set of annual SCC estimates between 2010 and 2050 is reported in appendix 14B of the final rule TSD. The central value that emerges is the average SCC across models at the 3 percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

Table IV.15 Annual SCC Values from 2013 Interagency Report, 2010–2050 (2007 dollars per metric ton)

[32] 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.

[33] *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. *www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf.*

[34] *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 November 2013. *http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf.*

TABLE IV.15—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[2007 Dollars per metric ton]

Year	Discount rate			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
2010	11	32	51	89
2015	11	37	57	109
2020	12	43	64	128
2025	14	47	69	143
2030	16	52	75	159
2035	19	56	80	175
2040	21	61	86	191
2045	24	66	92	206
2050	26	71	97	220

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The 2009 National Research Council report mentioned above 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 analytic 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.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report, adjusted to 2013$ using the GDP price deflator. For each of the four sets of SCC values, the values for emissions in 2015 were $12.0, $40.5, $62.4, and $119 per metric ton avoided (values expressed in 2013$). 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.

In responding to the walk-in coolers and walk-in freezers NOPR, many commenters questioned the scientific and economic basis of the SCC values. These commenters made extensive comments about: the alleged lack of economic theory underlying the models; the sufficiency of the models for policy-making; potential flaws in the models' inputs and assumptions (including the discount rates and climate sensitivity chosen); whether there was adequate peer review of the three models; whether there was adequate peer review of the TSD supporting the 2013 SCC values;[35] whether the SCC estimates comply with OMB's ''Final Information Quality Bulletin for Peer Review''[36] and DOE's own guidelines for ensuring and maximizing the quality, objectivity, utility and integrity of information disseminated by DOE; and why DOE is considering global benefits of carbon dioxide emission reductions rather than solely domestic benefits. (*See* AHRI, No. 83; ANGA, *et al.*/Chamber of Commerce, No.95; Cato, No. 106; Mercatus, No. 91). Several other parties expressed support for the derivation and application of the SCC values. (EDF, *et al.,* No. 94; ASAP, No. 113; Kopp, No. 80)

In response to the comments on the SCC values, DOE acknowledges the limitations in the SCC estimates, which are discussed in detail in the 2010 interagency group report. Specifically, uncertainties in the assumptions regarding climate sensitivity, as well as other model inputs such as economic growth and emissions trajectories, are discussed and the reasons for the specific input assumptions chosen are explained. Regarding discount rates, there is not consensus in the scientific or economics literature regarding the appropriate discount rate to use for intergenerational time horizons. The SCC estimates thus use a reasonable range of discount rates, from 2.5% to 5%, in order to show the effects that different discount rate assumptions have on the estimated values. More information about the choice of discount rates can be found in the 2010 interagency group report starting on page 17.

Regarding peer review of the models, the three integrated assessment models used to estimate the SCC are frequently cited in the peer-reviewed literature and were used in the last assessment of the IPCC. In addition, new versions of the models that were used in 2013 to estimate revised SCC values were published in the peer-reviewed literature (see appendix 16B of the DOE final rule TSD for discussion).

DOE believes that the SCC estimates comply with OMB's Final Information Quality Bulletin for Peer Review and DOE's own guidelines for ensuring and maximizing the quality, objectivity, utility and integrity of information disseminated by DOE.

As to why DOE is considering global benefits of carbon dioxide emission reductions rather than solely domestic benefits, a global measure of SCC because of the distinctive nature of the climate change problem, which 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. Second, climate change presents a problem that the United States alone cannot solve. The issue of global versus domestic measures of the SCC is further discussed in appendix 16A of the DOE final rule TSD.

In November 2013, OMB announced minor technical corrections to the 2013 SCC values and a new opportunity for

[35] Available at: *http://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf.*

[36] Available at: *http://www.cio.noaa.gov/services_programs/pdfs/OMB_Peer_Review_Bulletin_m05-03.pdf.*

public comment on the interagency technical support document underlying the SCC estimates. *See* 78 FR 70586. The comment period for the OMB announcement closed on February 26, 2014. OMB is currently reviewing comments and considering whether further revisions to the 2013 SCC estimates are warranted to the underlying science and economic basis of the SCC estimates resulting from the interagency process. DOE stands ready to work with OMB and the other members of the interagency working group on further review and revision of the SCC estimates as appropriate.

AHRI stated that DOE calculates the present value of the costs of standards to consumers and manufacturers over a 30-year period, but the SCC values reflect the present value of future climate related impacts well beyond 2100. AHRI stated that DOE's comparison of 30 years of cost to hundreds of years of presumed future benefits is inconsistent and improper. (AHRI, No. 114 at p. 6)

For the analysis of national impacts of the proposed standards, DOE considered the lifetime impacts of products shipped in a 30-year period. With respect to energy and energy cost savings, impacts continue past 30 years until all of the products shipped in the 30-year period are retired. With respect to the valuation of CO_2 emissions reductions, DOE considers the avoided emissions over the same period as the energy savings. CO_2 emissions have on average a very long residence time in the atmosphere. Thus, emissions in the period considered by DOE would contribute to global climate change over a very long time period, with associated social costs. The SCC for any given year represents the discounted present value, in that year and expressed in constant dollars, of a lengthy stream of future costs estimated to result from the emission of one ton of CO_2. It is worth pointing out that because of discounting, the present value of costs in the distant future is very small. DOE's accounting of energy cost savings and the value of avoided CO_2 emissions reductions is consistent—both consider the complete impacts associated with products shipped in the 30-year period.

2. Valuation of Other Emissions Reductions

DOE investigated the potential monetary benefit of reduced NO_X emissions from the potential standards it considered. As noted above, DOE has taken into account how new or amended energy conservation standards would reduce NO_X emissions in those 22 States not affected by emissions caps. DOE estimated the monetized value of NO_X emissions reductions resulting from each of the TSLs considered for this final rule based on estimates found in the relevant scientific literature. Estimates of monetary value for reducing NO_X from stationary sources range from $476 to $4,893 per ton (2013$).[37] DOE calculated monetary benefits using a medium value for NO_X emissions of $2,684 per short ton (in 2013$), and real discount rates of 3 percent and 7 percent.

DOE is evaluating how to appropriately monetize avoided SO_2 and Hg emissions in energy conservation standards rulemakings. It has not included monetization of these emissions in the current analysis.

N. Utility Impact Analysis

The utility impact analysis estimates several important effects on the utility industry of the adoption of new or amended standards. For this analysis, DOE used the NEMS–BT model to generate forecasts of electricity consumption, electricity generation by plant type, and electric generating capacity by plant type, that would result from each considered TSL. DOE obtained from the NIA the energy savings inputs associated with efficiency improvements made to the equipment under consideration. DOE conducts the utility impact analysis as a scenario that departs from the latest *AEO* Reference Case. In the analysis for this rule, the estimated impacts of standards are the differences between values forecasted by NEMS–BT and the values in the *AEO2013* Reference Case. For more details on the utility impact analysis, see chapter 15 of the final rule TSD.

O. Employment Impact Analysis

Employment impacts are one of the factors that DOE considers in selecting an efficiency standard. Employment impacts include direct and indirect impacts. Direct employment impacts are any changes that affect the ability of walk-in equipment manufacturers, their suppliers, and related service firms to employ workers. Indirect impacts are changes in employment in the larger economy that occur because of the shift in expenditures and capital investment caused by the purchase and operation of more-efficient walk-ins. Direct employment impacts are analyzed as part of the MIA. Indirect impacts are assessed as part of the employment impact analysis.

Indirect employment impacts from amended standards consist of the net jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, as a consequence of (1) reduced spending by end users on electricity; (2) reduced spending on new energy supplies by the utility industry; (3) increased spending on the purchase price of new covered equipment; and (4) the effects of those three factors throughout the Nation's economy. DOE expects the net monetary savings from amended standards to stimulate other forms of economic activity. DOE also expects these shifts in spending and economic activity to affect the demand for labor.

In developing this analysis for these standard, DOE estimated indirect national employment impacts using an input/output model of the U.S. economy called Impact of Sector Energy Technologies, Version 3.1.1 (ImSET). 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 the 187 sectors. ImSET's national economic I–O structure is based on a 2002 U.S. benchmark table, specially aggregated to the 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 the NOPR, DOE used ImSET only to estimate short-term employment impacts.

For more details on the employment impact analysis and its results, see chapter 16 of the final rule TSD.

V. Analytical Results

A. Trial Standard Levels

As discussed in section III.B, DOE is setting separate performance standards for the refrigeration system and for the envelope's doors and panels. The

[37] The values for NO_X emissions originally came from: U.S. Office of Management and Budget, Office of Information and Regulatory Affairs, *2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities,* Washington, DC. In 2001$, the NO_X values range from $370 to $3,800 per short ton. DOE converted the 2001$ values to 2013$ using gross domestic product (GDP) price deflators from the Bureau of Economic Analysis (BEA) (see *http://research.stlouisfed.org/fred2/series/GDPDEF/*).

manufacturers of these components would be required to comply with the applicable performance standards. For a fully assembled WICF unit in service, the aggregate energy consumption would depend on the individual efficiency levels of both the refrigeration system and the components of the envelope.

The refrigeration system removes heat from the interior of the envelope and accounts for most of the walk-in's energy consumption. However, the refrigeration system and envelope interact with each other and affect each other's energy performance. On the one hand, because the envelope components reduce the transmission of heat from the exterior to the interior of the walk-in, the energy savings benefit for any efficiency improvement for these envelope components depends on the efficiency level of the refrigeration system. Thus, any potential standard level for the refrigeration system would affect the energy that could be saved through standards for the envelope components. On the other hand, the economics of higher-efficiency refrigeration systems depend on the refrigeration load profile of the WICF unit as a whole, which is partially impacted by the envelope components.

To accurately characterize the total benefits and burdens for each of its proposed standard levels, DOE developed TSLs that each consist of a combination of standard levels for both the refrigeration system and the set of envelope components that comprise a walk-in. Each TSL consists of a standard for refrigeration systems, a standard for panels, a standard for non-display doors, and a standard for display doors.

1. Trial Standard Level Selection Process

This section describes how DOE selected the TSLs. First, DOE selected several potential efficiency levels for refrigeration systems by performing LCC and NIA analyses for refrigeration systems. Second, DOE selected levels for the envelope components by performing LCC and NIA analyses for the envelope components paired with each of the selected refrigeration system levels alone. Third, DOE chose three composite TSLs from the combinations of the potential levels for the refrigeration systems and the potential levels for the envelope components. This process accounts for the fact that, as described above, the choice of refrigeration efficiency level affects the energy savings and NPV of the envelope component levels.

DOE enumerated up to ten potential efficiency levels for each of the refrigeration system classes and capacity points. Each analyzed capacity point in any refrigeration system had efficiency levels corresponding to an added applicable design option (described in section IV.D). DOE also analyzed three competing compressor technologies for each dedicated condensing refrigeration system class. These compressor technologies are: Hermetic reciprocating, semi-hermetic, and scroll. (For a detailed description regarding each of these compressor technologies, see chapter 5 of the final rule TSD.)

At a given efficiency level, the compressor with the lowest life-cycle cost result was selected to represent the equipment at that efficiency level. From the set of possible efficiency levels for a given class, DOE selected three for further analysis. The first refrigeration system levels were based on the maximum technology from the engineering analysis, the second their relative energy saving potential while maintaining positive national net present values for each equipment class. The last was based on maximizing the national net present value (''Max NPV'').

After the three potential efficiency levels for each refrigeration system class were selected as described above, DOE proceeded with the LCC and NIA analysis of the envelope components (panels and doors). DOE conducted the LCC and NIA analyses on the envelope components by pairing them with each refrigeration system efficiency levels. Each panel and door class has between four and nine potential efficiency levels, each corresponding to an engineering design option applicable to that class (described in section IV.C). These LCC and NPV results represent the entire range of the economic benefits to the consumer at various combinations of efficiency levels of the refrigeration systems and the envelope components. The pairing of refrigeration system efficiency levels with the efficiency levels of envelope component classes is discussed in detail in chapter 10 of the final rule TSD.

DOE selected envelope component levels for further analysis based on the following criteria: maximum NPV, maximum NES with positive NPV, and maximum NES (Max Tech).

Finally, DOE chose three composite TSLs by selecting from the combinations of the three potential levels for the refrigeration systems and the three potential levels for the envelope components. The composite TSLs and criteria for each one are shown in Table V.1. The composite TSLs are numbered from 1 to 3 in order of least to most energy savings.

TABLE V.1—CRITERIA DESCRIPTION FOR THE COMPOSITE TSLS

TSL	Component requirement	System requirement
1	Max NPV @7% discount rate	Max NPV @7% discount rate.
2	Max NES with NPV >$0	Max NES with NPV >$0.
3	Max Tech	Max Tech.

* NPV is evaluated discounted at 7%.

TSL 3 is the max-tech level for each equipment class for all components. TSL 2 represents the maximum efficiency level of the refrigeration system equipment classes with a positive NPV at a 7-percent discount rate, combined with the maximum efficiency level with a positive NPV at a 7-percent discount rate for each envelope component (panel, non-display door, or display door). TSL 1 corresponds to the efficiency level with the maximum NPV at a 7-percent discount rate for refrigeration system classes and components. Table V.2 shows the mapping of TSLs to analysis point ELs and capacity. For more details on the criteria for the TSLs, see chapter 10 of the final rule TSD.

TABLE V.2—MAPPING BETWEEN TSLS AND ANALYTICAL POINT ELS

Equipment class	Nominal size (Btu/h)	Baseline		TSL 1		TSL 2		TSL 3	
		Compressor technology	EL	Compressor technology	EL	Compressor technology	EL	Compressor technology	EL
DC.M.I.	6,000	HER	0	SEM	6	SEM	6	SEM	6
DC.M.I.	18,000	HER	0	HER	6	HER	6	HER	6
DC.M.I.	54,000	SEM	0	SEM	6	SEM	6	SEM	6
DC.M.I.	96,000	SEM	0	SEM	6	SEM	6	SEM	6
DC.M.O.	6,000	HER	0	SEM	4	SEM	7	SEM	7
DC.M.O.	18,000	HER	0	HER	7	SCR	8	SCR	8
DC.M.O.	54,000	SEM	0	SCR	6	SCR	10	SCR	10
DC.M.O.	96,000	SEM	0	SCR	8	SCR	9	SCR	9
DC.L.I.	6,000	HER	0	HER	7	SCR	7	SCR	7
DC.L.I.	9,000	HER	0	HER	7	SCR	7	SCR	7
DC.L.I.	54,000	SEM	0	SEM	7	SEM	8	SEM	8
DC.L.O.	6,000	HER	0	HER	4	SCR	10	SCR	10
DC.L.O.	9,000	HER	0	HER	6	SCR	11	SCR	11
DC.L.O.	54,000	SEM	0	SCR	9	SCR	10	SCR	10
DC.L.O.	72,000	SEM	0	SEM	8	SEM	12	SEM	12
MC.M.N.	4,000	6FIN	0	6FIN	3	6FIN	3	6FIN	3
MC.M.N.	9,000	6FIN	0	6FIN	3	6FIN	3	6FIN	3
MC.M.N.	24,000	6FIN	0	6FIN	3	6FIN	3	6FIN	3
MC.L.N.	4,000	4FIN	0	4FIN	4	4FIN	4	4FIN	4
MC.L.N.	9,000	6FIN	0	6FIN	4	6FIN	4	6FIN	4
MC.L.N.	18,000	4FIN	0	4FIN	3	4FIN	5	4FIN	5
MC.L.N.	40,000	4FIN	0	4FIN	3	4FIN	5	4FIN	5

While DOE maintained the same methodology in the final rule as it did in the NOPR for mapping ELs to TSLs, the number of TSLs has changed for this final rule. In the NOPR DOE established six TSLs to specifically examine the impacts of a standard where (a) all compressor technologies could meet a minimum efficiency as a system requirement, and (b) only display doors had an NPV > $0 as a component requirement. These criteria were created in addition to the three TSL criteria used in this final rule, for to a total of six NOPR TSLs. The criteria for selecting TSL in the NOPR and this final rule are shown in Table V.3, as shown in this table, the NOPR TSLs 4 through 6 are equivalent to the final rule TSLs 1 through 3.

TABLE V.3—COMPARISON OF NOPR TO FINAL RULE TSL CRITERIA

NOPR TSL criteria			Final rule TSL criteria		
TSL	System requirement	Component requirement	TSL	System requirement	Component requirement
1	All Compressors Max NPV	Max NPV (all components).			
2	Max NPV	Display Doors, NPV > $0.			
3	All Compressors NPV > $0	Max NES, NPV > $0.			
4	Max NPV	Max NPV	1	Max NPV	Max NPV.
5	Max NES, NPV > $0	Max NES, NPV > $0	2	Max NES, NPV > $0	Max NES, NPV > $0.
6	Max Tech	Max Tech	3	Max Tech	Max Tech.

The ''All Compressors'' NOPR refrigeration systems TSLs (TSLs 1, and 3) were added to the NOPR in response to stakeholder comments during the initial phase of the rule-making. For this final rule, the three TSLs considered by DOE are inclusive of all compressor types. Subsequently, the ''All Compressors'' TSLs are redundant in this final rule; and were therefore dropped from the analysis.

The ''Display Doors, NPV > $0'' NOPR component TSL (TSL 2) was dropped from the final rule because Max NPV, and Max NES where NPV is greater than $0 only occur in this final rule under conditions where all components are held at the baseline except for the equipment classes covering display doors. Hence, for this final rule TSLs 1 and 2 effectively use the ''Display Doors'' criterion.

2. Trial Standard Level Equations

For panels, DOE expresses the TSLs in terms of R-value. As discussed in section III.B.1, DOE is no longer requiring the performance-based procedures to calculate a U-value of a walk-in panel. The Department reverted to thermal resistance, or R-value, as measured by ASTM C518, as the metric for establishing performance standards for walk-in cooler and freezer panels.

For display and non-display doors, respectively, the normalization metric is the surface area of the door. The TSLs are expressed in terms of linear equations that establish maximum daily energy consumption (MEC) limits in the form of:

$$MEC = D \times (\text{Surface Area}) + E$$

Coefficients D and E were uniquely derived for each equipment class by plotting the energy consumption at a given performance level versus the surface area of the door and determining the slope of the relationship, D, and the offset, E, where the offset represents the theoretical energy consumption of a door with no surface area. (The offset is necessary because not all energy-consuming components of the door scale directly with surface area.) The surface area is defined in the walk-in cooler and freezer test procedure final rule.

For refrigeration systems, the TSLs are expressed as a minimum efficiency level (AWEF) that the system must meet. For low temperature, dedicated condensing systems (DC.L classes), DOE calculated the AWEF differently for small and large classes based on DOE's expectation that small-sized equipment may have difficulty meeting the same efficiency standard as large equipment. Specifically, DOE observed that for low temperature systems, higher-capacity equipment tended to be more efficient than lower-capacity equipment (DOE did not observe strong trends of this form for medium temperature equipment). DOE expressed the AWEF for the small capacity dedicated condensing systems as a linear equation normalized to the system's gross capacity, where the equation was based on the AWEFs for the smallest two capacities analyzed. DOE expressed the AWEF for large capacity dedicated condensing systems as a single number corresponding to a value continuous with the standard level for the small capacity class at the boundary capacity point between the classes (i.e., 9,000 Btu/h). DOE calculated a single minimum efficiency for each multiplex condensing system class because DOE found that equipment capacity did not have a significant effect on equipment efficiency. See chapter 10 of the final rule TSD for details regarding the AWEF calculations.

Table V.4, Table V.5, Table V.6, Table V.7, Table V.8, Table V.9, and Table V.10 show the R-values or equations analyzed for structural cooler panels, structural freezer panels, freezer floor panels, display doors, non-display passage doors, non-display freight doors, and refrigeration systems, respectively. For walk-in cooler structural panels, DOE evaluated a market baseline R-value that is higher than the current energy conservation levels in TSLs 1 and 2. As explained further in section IV.D.3, DOE established an industry representative baseline for walk-in components, but this baseline assumed a specific insulation material and thickness while EISA established R-value standards irrespective of such features.

Additionally, DOE notes that the equations and AWEFs for a particular class of equipment may be the same across more than one TSL. This occurs when the criteria for two different TSLs are satisfied by the same efficiency level for a particular component. For example, for all refrigeration classes the max-tech level has a positive NPV; thus, the efficiency level with the maximum energy savings with positive NPV (TSL 2) is the same as the efficiency level corresponding to max-tech (TSL 3).

TABLE V.4—R-VALUES FOR ALL STRUCTURAL COOLER PANEL TSLS

TSL	Equations for R-value (h-ft^2-°F/Btu)
Baseline	28
TSL 1	28
TSL 2	28
TSL 3	90

TABLE V.5—R-VALUES FOR ALL STRUCTURAL FREEZER PANEL TSLS

TSL	Equations for R-value (h-ft^2-°F/Btu)
Baseline	32
TSL 1	32
TSL 2	32
TSL 3	90

TABLE V.6—R-VALUES FOR ALL FREEZER FLOOR PANEL TSLS

TSL	Equations for maximum R-value (h-ft^2-°F/Btu)
Baseline	28
TSL 1	28
TSL 2	28
TSL 3	90

TABLE V.7—EQUATIONS FOR ALL DISPLAY DOOR TSLS

TSL	Equations for maximum energy consumption (kWh/day)	
	DD.M	DD.L
Baseline	$0.14 \times A_{dd} + 0.82$	$0.04 \times A_{dd} + 0.88$
TSL 1	$0.05 \times A_{dd} + 0.39$	$0.09 \times A_{dd} + 1.9$
TSL 2	$0.04 \times A_{dd} + 0.41$	$0.15 \times A_{dd} + 0.29$
TSL 3	$0.008 \times A_{dd} + 0.29$	$0.11 \times A_{dd} + 0.32$

*A_{dd} represents the surface area of the display door.

TABLE V.8—EQUATIONS FOR ALL PASSAGE DOOR TSLS

TSL	Equations for maximum energy consumption (kWh/day)	
	PD.M	PD.L
Baseline	$0.05 \times A_{nd} + 1.7$	$0.14 \times A_{nd} + 4.8$
TSL 1	$0.05 \times A_{nd} + 1.7$	$0.14 \times A_{nd} + 4.8$
TSL 2	$0.05 \times A_{nd} + 1.7$	$0.14 \times A_{nd} + 4.8$
TSL 3	$0.04 \times A_{nd} + 1.6$	$0.13 \times A_{nd} + 3.9$

*A_{nd} represents the surface area of the non-display door.

TABLE V.9—EQUATIONS FOR ALL FREIGHT DOOR TSLs

TSL	Equations for maximum energy consumption (kWh/day)	
	FD.M	FD.L
Baseline	$0.04 \times A_{nd} + 1.9$	$0.12 \times A_{nd} + 5.6$
TSL 1	$0.04 \times A_{nd} + 1.9$	$0.12 \times A_{nd} + 5.6$
TSL 2	$0.04 \times A_{nd} + 1.9$	$0.12 \times A_{nd} + 5.6$
TSL 3	$0.03 \times A_{nd} + 1.9$	$0.09 \times A_{nd} + 5.2$

*A_{nd} represents the surface area of the non-display door.

TABLE V.10—AWEFS FOR ALL REFRIGERATION SYSTEM TSLs

Equipment class	Equations for minimum AWEF (Btu/W-h)*			
	Baseline	TSL 1	TSL 2	TSL 3
DC.M.I, <9,000	3.51	5.61	5.61	5.61
DC.M.I, ≥9,000	3.51	5.61	5.61	5.61
DC.M.O, <9,000	3.14	6.99	7.60	7.60
DC.M.O, ≥9,000	3.14	6.99	7.60	7.60
DC.L.I, <9,000	$1.39 \times 10^{-4} \times Q + 0.98$	$8.67 \times 10^{-5} \times Q + 2.00$	$5.93 \times 10^{-5} \times Q + 2.33$	$5.93 \times 10^{-5} \times Q + 2.33$
DC.L.I, ≥9,000	2.23	2.78	3.10	3.10
DC.L.O, <9,000	$1.96 \times 10^{-4} \times Q + 0.82$	$3.21 \times 10^{-4} \times Q + 1.29$	$2.30 \times 10^{-4} \times Q + 2.73$	$2.30 \times 10^{-4} \times Q + 2.73$
DC.L.O, ≥9,000	2.57	4.17	4.79	4.79
MC.M	6.11	10.89	10.89	10.89
MC.L	3.29	5.58	6.57	6.57

*Q represents the system gross capacity as calculated in AHRI 1250.

B. Economic Justification and Energy Savings

1. Economic Impacts on Commercial Customers

a. Life-Cycle Cost and Payback Period

Customers affected by new or amended standards usually incur higher purchase prices and experience lower operating costs. DOE evaluates these impacts on individual consumers by calculating changes in LCC and the PBP associated with the TSLs. Using the approach described in section IV.F, DOE calculated the LCC impacts and PBPs for the efficiency levels considered in this final rule. Inputs used for calculating the LCC include total installed costs (*i.e.,* equipment price plus installation costs), annual energy savings, and average electricity costs by consumer, energy price trends, repair costs, maintenance costs, equipment lifetime, and consumer discount rates. DOE based the LCC and PBP analyses on energy consumption under conditions of actual equipment use. DOE created distributions of values for some inputs, with probabilities attached to each value, to account for their uncertainty and variability. DOE used probability distributions to characterize equipment lifetime, discount rates, sales taxes and several other inputs to the LCC model.

Table V.11 through Table V.19 show key results of the LCC and PBP analysis for each equipment class. Each table presents the mean LCC, mean LCC savings, median PBP, and distribution of customer impacts in the form of percentages of customers who experience net cost, no impact, or net benefit. Generally, customers who currently buy equipment in the base case scenario at or above the level of performance specified by the TSL under consideration would be unaffected if the amended standard were to be set at that TSL. Customers who buy equipment below the level of the TSL under consideration would be affected if the amended standard were to be set at that TSL. Among these affected customers, some may benefit (lower LCC) and some may incur net cost (higher LCC).

TABLE V.11—SUMMARY LCC AND PBP RESULTS FOR MEDIUM TEMPERATURE DEDICATED CONDENSING REFRIGERATION SYSTEMS—OUTDOOR CONDENSER

TSL	Energy consumption kWh/yr	Mean values 2013$			Life-cycle cost savings				Median payback period years
		Installed cost	Annual operating cost	LCC	Average savings 2013$	Customers that experience			
						Net cost %	No impact %	Net benefit %	
1	13484	11153	2172	28825	6382	0	0	100	1.1
2	12414	12060	2087	29036	6533	0	0	100	2.2
3	12414	12060	2087	29036	6533	0	0	100	2.2

TABLE V.12—SUMMARY LCC AND PBP RESULTS FOR MEDIUM-TEMPERATURE DEDICATED CONDENSING REFRIGERATION SYSTEMS—INDOOR CONDENSER

TSL	Energy consumption kWh/yr	Mean values 2013$			Life-cycle cost savings				Median payback period years
		Installed cost	Annual operating cost	LCC	Average savings 2013$	Customer that experience: Net cost %	No impact %	Net benefit %	
1	7550	5997	1512	18320	1485	0	0	100	2.8
2	16396	11484	2560	32218	5942	2	0	98	3.5
3	16396	11484	2560	32218	5942	2	0	98	3.5

TABLE V.13—SUMMARY OF LCC AND PBP RESULTS FOR LOW-TEMPERATURE DEDICATED-CONDENSING REFRIGERATION SYSTEMS—OUTDOOR CONDENSER

TSL	Energy consumption kWh/yr	Mean values 2013$			Life-cycle cost savings				Median payback period years
		Installed cost	Annual operating cost	LCC	Average savings 2013$	Customer that experience: Net cost %	No impact %	Net benefit %	
1	18598	9408	2712	31375	6463	0	0	100	1.0
2	16396	11484	2560	32218	5942	2	0	98	3.5
3	16396	11484	2560	32218	5942	2	0	98	3.5

TABLE V.14—SUMMARY OF LCC AND PBP RESULTS FOR LOW-TEMPERATURE DEDICATED-CONDENSING REFRIGERATION SYSTEMS—INDOOR CONDENSER

TSL	Energy consumption kWh/yr	Mean values 2013$			Life-cycle cost savings				Median payback period years
		Installed cost	Annual operating cost	LCC	Average savings 2013$	Customer that experience: Net cost %	No impact %	Net benefit %	
1	11958	5452	1974	21483	2157	0	0	100	1.7
2	11497	5882	1948	21697	2078	0	0	100	1.6
3	11497	5882	1948	21697	2078	0	0	100	1.6

TABLE V.15—SUMMARY LCC AND PBP RESULTS FOR MEDIUM-TEMPERATURE MULTIPLEX REFRIGERATION SYSTEMS

[Unit coolers only]

TSL	Energy consumption kWh/yr	Mean values 2013$			Life-cycle cost savings				Median payback period years
		Installed cost	Annual operating cost	LCC	Average savings 2013$	Customer that experience: Net cost %	No impact %	Net benefit %	
1	5634	2288	1214	12931	362	0	0	100	3.1
2	5634	2288	1214	12931	362	0	0	100	3.1
3	5634	2288	1214	12931	362	0	0	100	3.1

TABLE V.16—SUMMARY LCC AND PBP RESULTS FOR LOW-TEMPERATURE MULTIPLEX REFRIGERATION SYSTEMS

[Unit coolers only]

TSL	Energy consumption kWh/yr	Mean values 2013$			Life-cycle cost savings				Median payback period years
		Installed cost	Annual operating cost	LCC	Average savings 2013$	Customer that experience: Net cost %	No impact %	Net benefit %	
1	9264	2381	1577	16143	598	0	0	100	2.7
2	9240	2453	1575	16195	547	0	0	100	3.1
3	9240	2453	1575	16195	547	0	0	100	3.1

TABLE V.17—SUMMARY LCC AND PBP RESULTS FOR STRUCTURAL AND FLOOR PANELS

[per ft²]

TSL	Energy consumption kWh/yr	Life-cycle cost 2013$			Life-cycle cost savings 2013$				Median payback period years
		Installed cost	Discounted operating cost	LCC	Average savings	Consumers that experience Net cost %	No impact %	Net benefit %	
Medium Temperature Structural Panel									
1	0	15.0	0.2	16.4	—	0	100	0	—
2	0	15.0	0.1	16.3	—	0	100	0	—
3	0.5	36.5	0.0	36.9	−20.7	100	0	0	238.6
Low Temperature Structural Panel									
1	0	15.5	0.6	21.2	—	0	100	0	—
2	0	15.5	0.6	20.7	—	0	100	0	—
3	2	36.6	0.2	38.4	−17.7	100	0	0	58.8
Low Temperature Floor Panel									
1	0	15.9	0.6	20.9	—	0	100	0	—
2	0	15.9	0.5	20.5	—	0	100	0	—
3	2	37.6	0.2	39.0	−18.6	100	0	0	64.7

Note: "—" indicates no impact because all purchases are at or above the given TSL in the base case.

TABLE V.18—SUMMARY LCC AND PBP RESULTS FOR DISPLAY DOORS

[Per unit, weighted across all sizes]

TSL	Energy consumption kWh/yr	Life-cycle cost 2013$			Life-cycle cost savings 2013$				Median payback period years
		Installed cost	Discounted operating cost	LCC	Average savings	Consumers that experience Net cost %	No impact %	Net benefit %	
Medium Temperature Display Door									
1	572	1,228	62.8	1,782	460	0	30	69	2.4
2	466	1,480	51.8	1,936	143	41	0	59	7.3
3	193	4,270	23.3	4,476	−2,396	100	0	0	39.5
Low Temperature Display Door									
1	2142	2,626	235	4,698	976	4	0.00	96	4.2
2	1578	3,071	177	4,629	902	10	0.00	90	5.4
3	1277	4,331	145	5,611	−79	59	0.00	41	9.6

TABLE V.19—SUMMARY LCC AND PBP RESULTS FOR NON-DISPLAY DOORS

[Per unit, weighted across all sizes]

TSL	Energy consumption kWh/yr	Life-cycle cost 2013$			Life-cycle cost savings 2013$				Median payback period years
		Installed cost	Discounted operating cost	LCC	Average savings	Consumers that experience Net cost %	No impact %	Net benefit %	
Medium Temperature Passage Door									
1	0	868	156	1,827	—	0	100	0	—
2	0	868	152	1,803	—	0	100	0	—
3	1193	2,299	531	5,315	−2000	100	0	0	30.8
Low Temperature Passage Door									
1	0	2,053	552	5,449	—	0	100	0	—

TABLE V.19—SUMMARY LCC AND PBP RESULTS FOR NON-DISPLAY DOORS—Continued

[Per unit, weighted across all sizes]

TSL	Energy consumption kWh/yr	Life-cycle cost 2013$			Life-cycle cost savings 2013$				Median payback period years
		Installed cost	Discounted operating cost	LCC	Average savings	Consumers that experience			
						Net cost %	No impact %	Net benefit %	
2	0	2,053	531	5,315	—	0	100	0	—
3	4099	4,590	443	7,313	−1,998	100	0	0	30.7
Medium Temperature Freight Door									
1	0	1,750	230	3,164	—	0	100	0	—
2	0	1,750	224	3,126	—	0	100	0	—
3	175	4,577	198	5,795	−2,668	100	0	0	115.5
Low Temperature Freight Door									
1	0	1,945	861	7,239	—	0	100	0	—
2	0	1,945	826	7,023	—	0	100	0	—
3	6350	4,617	678	8,784	−1,761	100	0	0	19.1

Note: "—" indicates no impact because all purchases are at or above the given TSL in the base case.

b. Customer Subgroup Analysis

As described in section IV.I, DOE estimated the impact of potential amended efficiency standards for walk-ins for the representative customer subgroup: Full-service restaurants.

Table V.20 and Table V.21 presents the comparison of mean LCC savings for the subgroup with the values for all WICF customers. For all TSLs in all equipment classes, the LCC savings for this subgroup are not significantly different, less than 10 percent higher than the national average values. The equipment class that shows the most substantial change is DD.L, it shows decrease in LCC savings, when compared to national average values. (Chapter 11 of the final rule TSD presents the percentage change in LCC savings compared to national average values.)

TABLE V.20—SUBGROUP MEAN LIFE-CYCLE COST SAVINGS FOR WICF REFRIGERATION SYSTEMS (2013$)

Equipment class	Group	TSL 1	TSL 2	TSL 3
DC.L.I	Full-service Restaurants	2157	2157	2078
	All Business Types	2096	2096	2020
DC.L.O	Full-service Restaurants	6463	6463	5942
	All Business Types	2096	2096	2020
DC.M.I	Full-service Restaurants	1485	1485	5942
	All Business Types	1445	1445	5793
DC.M.O	Full-service Restaurants	6382	6382	6533
	All Business Types	6244	6244	6386

*Multiplex refrigeration systems are not typically used in small restaurants.

TABLE V.21—SUBGROUP MEDIAN LIFE-CYCLE COST SAVINGS FOR WICF ENVELOPE COMPONENTS (PANELS AND DOORS) (2223$)

Equipment Class	Group	TSL1	TSL2	TSL3
SP.M	Full-service Restaurants	—	—	−23
	All Business Types	—	—	−21
SP.L	Full-service Restaurants	—	—	−20
	All Business Types	—	—	−18
FP.L	Full-service Restaurants	—	—	−21
	All Business Types	—	—	−19
DD.M	Full-service Restaurants	434	107	−2612
	All Business Types	460	143	−2396
DD.L	Full-service Restaurants	873	761	−306
	All Business Types	976	902	−79
PD.M	Full-service Restaurants	—	—	—
	All Business Types	—	—	—
PD.L	Full-service Restaurants	—	—	−2157
	All Business Types	—	—	−1998
FD.M	Full-service Restaurants	—	—	−2844
	All Business Types	—	—	−2668
FD.L	Full-service Restaurants	—	—	−1930

TABLE V.21—SUBGROUP MEDIAN LIFE-CYCLE COST SAVINGS FOR WICF ENVELOPE COMPONENTS (PANELS AND DOORS) (2223$)—Continued

Equipment Class	Group	TSL1	TSL2	TSL3
	All Business Types	—	—	−1761

Note: Dashes represent components at baseline efficiency and therefore do not have a payback period. Numbers in parentheses indicate negative values.

TABLE V.22—SUBGROUP MEDIAN PAYBACK PERIOD FOR WICF REFRIGERATION SYSTEMS (YEARS)

Equipment class	Group	TSL1	TSL2	TSL3
DC.L.I	Full-service Restaurants	1.7	1.7	1.6
	All Business Types	1.6	1.6	1.6
DC.L.O	Full-service Restaurants	1.0	1.0	3.5
	All Business Types	1.0	1.0	1.0
DC.M.I	Full-service Restaurants	2.8	2.8	3.5
	All Business Types	2.7	2.7	2.7
DC.M.O	Full-service Restaurants	1.1	1.1	2.2
	All Business Types	1.1	1.1	1.1

* Multiplex refrigeration systems are not typically used in small restaurants.

TABLE V.23—SUBGROUP MEDIAN PAYBACK PERIOD FOR WICF ENVELOPE COMPONENTS (PANELS AND DOORS) (YEARS)

Equipment class	Group	TSL1	TSL2	TSL3
SP.M	Full-service Restaurants	—	—	253.1
	All Business Types	—	—	238.6
SP,L	Full-service Restaurants	—	—	62.4
	All Business Types	—	—	58.8
FP.L	Full-service Restaurants	—	—	68.7
	All Business Types	—	—	64.7
DD.M	Full-service Restaurants	2.5	7.3	39.9
	All Business Types	2.4	7.3	39.5
DD.L	Full-service Restaurants	4.3	5.5	9.7
	All Business Types	4.2	5.4	9.6
PD.M	Full-service Restaurants	—	—	—
	All Business Types	—	—	—
PD.L	Full-service Restaurants	—	—	31.3
	All Business Types	—	—	30.7
FD.M	Full-service Restaurants	—	—	117.8
	All Business Types	—	—	115.5
FD.L	Full-service Restaurants	—	—	19.5
	All Business Types	—	—	19.1

Note: Dashes represent components at baseline efficiency and therefore do not have a payback period.

c. Rebuttable Presumption Payback

As discussed in section IV.G.12, EPCA provides a rebuttable presumption that a given standard is economically justified if the increased purchase cost of equipment that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. However, DOE routinely conducts a full economic analysis that considers the full range of impacts, including those to the customer, manufacturer, Nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(a). The results of this analysis serve as the basis for DOE to evaluate definitively the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). Therefore, if the rebuttable presumption is not met, DOE may justify its standard on another basis. Table V.24 shows the rebuttable payback periods analysis for each equipment class at each TSL.

TABLE V.24—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS TSLS: REBUTTABLE PAYBACK PERIOD

[years]

Equipment class	Median payback period TSL 1	TSL 2	TSL 3
DC.L.I	1.7	1.6	1.6
DC.L.O	1.0	3.4	3.4
DC.M.I	2.7	3.4	3.4
DC.M.O	1.1	2.1	2.1
MC.L	2.7	3.1	3.1
MC.M	3.1	3.1	3.1

TABLE V.24—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS TSLS: REBUTTABLE PAYBACK PERIOD—Continued

[years]

Equipment class	Median payback period TSL 1	TSL 2	TSL 3
SP.M	....	....	234.6
SP.L	....	....	58.4
FP.L	....	....	63.5
DD.M	2.4	7.5	39.3
DD.L	4.7	5.4	9.4
PD.M	....	....	....
PD.L	....	....	31.0
FD.M	....	....	113.4
FD.L	....	....	19.3

2. Economic Impacts on Manufacturers

DOE performed a manufacturer impact analysis (MIA) to estimate the impact of new energy conservation standards on manufacturers of walk-in cooler and freezer refrigeration, panels, and doors. The section below describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the TSD explains the analysis in further detail.

a. Industry Cash-Flow Analysis Results

Table V.25 through Table V.27 depict the financial impacts on manufacturers and the conversion costs DOE estimates manufacturers would incur at each TSL. The financial impacts on manufacturers are represented by changes in industry net present value (INPV).

The impact of energy efficiency standards were analyzed under two markup scenarios: (1) The preservation of gross margin percentage and (2) the preservation of operating profit. As discussed in section IV.K.2.b, 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 the nonproduction cost markup—which includes SG&A expenses; research and development expenses; interest; and profit to be 1.32 for panels, 1.50 for solid doors, 1.62 for display doors, and 1.35 for refrigeration. These markups are consistent with the ones DOE assumed in the engineering analysis and the base case of the GRIM. Manufacturers have 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.

The preservation of earnings before interest and taxes (EBIT) scenario reflects manufacturer concerns about their inability to maintain their margins as manufacturing production costs increase to reach more-stringent efficiency levels. In this scenario, while 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 base case and each standards case that result from the sum of discounted cash flows from the base year 2013 through 2046, 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 base case and the standards case at each TSL in the year before new standards take effect.

Table V.25 through Table V.27 show the MIA results for each TSL using the markup scenarios described above for WICF panel, door and refrigeration manufacturers, respectively.

TABLE V.25—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WICF PANELS

	Units	Base case	Trial standard level		
			1	2	3
INPV	*2012 $M*	381.94	381.94	381.94	97.41 to 670.62.
Change in INPV	*2012 $M*		0	0	−284.53 to 288.68.
	%		0	0	−74.49 to 75.58.
Capital Conversion Costs	*2012 $M*		0	0	162.77.
Product Conversion Costs	*2012 $M*		0	0	35.41.
Total Investment Required	*2012 $M*		0	0	198.18.

TABLE V.26—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WICF DOORS

	Units	Base case	Trial standard level		
			1	2	3
INPV	*2012 $M*	484.85	475.67 to 506.50	457.34 to 545.60	245.50 to 1233.63.
Change in INPV	*2012 $M*		−9.19 to 21.64	−27.51 to 60.74	(239.35) to 748.48.
	%		−1.89 to 4.46	−5.67 to 12.53	(49.37) to 154.43.
Capital Conversion Costs	*2012 $M*		0.04	0.15	85.99.
Product Conversion Costs	*2012 $M*		0.13	0.22	14.63.
Total Investment Required	*2012 $M*		0.18	0.37	100.62.

TABLE V.27—MANUFACTURER IMPACT ANALYSIS RESULTS FOR WICF REFRIGERATION SYSTEMS

	Units	Base case	Trial standard level		
			1	2	3
INPV	*2012 $M*	424.37	404.15 to 434.60	398.99 to 443.82	398.99 to 443.82.
Change in INPV	*2012 $M*		−20.22 to 10.24	−25.38 to 19.46	−25.38 to 19.46.
	(%)		−4.76 to 2.41	−5.98 to 4.59	−5.98 to 4.59.
Capital Conversion Costs	*2012 $M*		13.18	14.50	14.50.
Product Conversion Costs	*2012 $M*		15.55	18.74	18.74.
Total Investment Required	*2012 $M*		28.73	33.23	33.23.

Walk-In Cooler and Freezer Panel MIA Results

At all TSLs, the evaluated efficiency levels for walk-in panel equipment classes are at the baseline level. The baseline represents the most common, least efficient products that can legally be purchased on the market today. To meet a baseline standard, walk-in panel manufacturers should not have to integrate any new technologies or design options into existing operations. As a result, capital conversion costs and product conversion costs are expected to be zero. At TSL 1 and TSL 2, INPV remains the same as in the base case. There is no change from the base case value of $381.94 million.

For TSL 3, DOE models the change in INPV for panels to range from −$284.53 million to $288.68 million, or a change in INPV of −74.49 percent to 75.58 percent. At this standard level, door industry free cash flow is estimated to decrease by as much as $74.45 million, or −226.84 percent compared to the base case value of $37.49 million in the year before the compliance date.

Walk-In Cooler and Freezer Door MIA Results

For TSL 1, DOE models the change in INPV for doors to range from −$9.19 million to $21.64 million, or a change in INPV of −1.89 percent to 4.46 percent. At this standard level, door industry free cash flow is estimated to decrease by as much as $0.06 million, or −0.15 percent compared to the base case value of $37.49 million in the year before the compliance date.

At TSL 2, DOE estimates the impacts on door INPV to range from −$27.51 million to $60.74 million, or a change in INPV of −5.67 percent to 12.53 percent. At this level, door industry free cash flow is estimated to decrease by $0.13 million in the year before the compliance year, or −0.33 percent compared to the base case value of $37.49 million in the year before the compliance date.

At TSL 3, DOE estimates the impacts on door INPV to range from −239.95 to 748.48, or a change in INPV of −49.37 percent to 154.43 percent. At this level, door industry free cash flow is estimated to decrease by as much as 38.66 million in the year before the compliance year, or −103.13 percent compared to the base case value of $37.49 million in the year before the compliance date.

Walk-in Cooler and Freezer Refrigeration MIA Results

At TSL 1, DOE estimates impacts on refrigeration INPV to range from −$20.22 million to $10.24 million, or a change in INPV of −4.76 percent to 2.41 percent. At this level, refrigeration industry free cash flow is estimated to decrease by as much as $9.53 million, or −26.47 percent compared to the base-case value of $36.02 million in 2016, the year before the compliance year.

At TSL 2 and TSL 3, DOE estimates impacts on refrigeration INPV to range from −$25.38 million to $19.46 million, or a change in INPV of −5.98 percent to 4.59 percent. At this level, refrigeration industry free cash flow is estimated to decrease by as much as $10.93 million, or −30.35 percent compared to the base-case value of $36.02 million in the year before the compliance date.

b. Impacts on Direct Employment

Methodology

To quantitatively assess the impacts of energy conservation standards on employment, DOE used the GRIM to estimate the domestic labor expenditures and number of employees in the base case and at each TSL from 2013 through 2046. DOE used statistical data from the U.S. Census Bureau's 2011 Annual Survey of Manufacturers (ASM), the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels. Labor expenditures related to manufacturing of the product are a function of the labor intensity of the product, 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 2011 ASM). The estimates of production workers in this section cover workers, including line supervisors who are directly involved in fabricating and assembling a product 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 estimates only account for production workers who manufacture the specific products covered by this rulemaking. To further establish a lower bound to negative impacts on employment, DOE reviewed design options, conversion costs, and market share information to determine the maximum number of manufacturers that would leave the industry at each TSL.

In evaluating the impact of energy efficiency standards on employment, DOE performed separate analyses on all three walk-in component manufacturer industries: panels, doors and refrigeration systems.

Using the GRIM, DOE estimates in the absence of new energy conservation standards, there would be 2,878 domestic production workers for walk-in panels, 1,302 domestic production workers for walk-in doors, and 415 domestic production workers for walk-in refrigeration systems in 2017.

Table V.28, Table V.29, and Table V.30 show the range of the impacts of energy conservation standards on U.S. production workers in the panel, door, and refrigeration system markets, respectively. Additional detail on the analysis of direct employment can be found in chapter 12 of the TSD.

TABLE V.28—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC PRODUCTION WORKERS IN 2017 FOR PANELS

TSL	1	2	3
Potential Changes in Domestic Production Workers 2017 (from a base case employment of 2,878)	0 to 0	0 to 0	−863 to 738

TABLE V.29—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC PRODUCTION WORKERS IN 2017 FOR DOORS

TSL	1	2	3
Potential Changes in Domestic Production Workers 2017 (from a base case employment of 1,318)	0 to 101	0 to 200	−132 to 1,979

TABLE V.30—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC PRODUCTION WORKERS IN 2017 FOR REFRIGERATION SYSTEMS

TSL	1	2	3
Potential Changes in Domestic Production Workers 2017 (from a base case employment of 424)	−64 to 56.	−161 to 88.	−161 to 88

The employment impacts shown in Table V.28 through Table V.30 represent the potential production employment changes that could result following the compliance date of these energy conservation standards. The upper end of the results in the table estimates the maximum increase in the number of production workers after the implementation of new energy conservation standards and it assumes that manufacturers would continue to produce the same scope of covered products within the United States. The lower end of the range represents the maximum decrease to the total number of U.S. production workers in the industry due to manufacturers leaving the industry. However, in the long-run, DOE would expect the manufacturers that do not leave the industry to add employees to cover lost capacity and to meet market demand. Please note that DOE does not propose any increase in energy conservation standards for Walk-in Panels, medium and low temperature solid doors, therefore there would likely be no significant change in employment in these industries.

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

c. Impacts on Manufacturing Capacity

Panels

Manufacturers indicated that design options that necessitate thicker panels could lead to longer production times for panels. In general, every additional inch of foam increases panel cure times by roughly 20 minutes. A standard that necessitates 6-inch thick panels for any of the panel equipment classes would require manufacturers to add equipment to maintain throughput due to longer curing times or to purchase all new tooling to enable production if the manufacturer's current equipment cannot accommodate 6-inch panels. Given that the only efficiency level considered for panels in this rule is baseline, DOE does not anticipate any changes in production techniques or new capacity constraints resulting from this rulemaking.

Doors

Display door manufacturers did not identify any design options which would lead to capacity constraints. However, manufacturers commented on differences between the two types of low-emittance coatings analyzed: hard low emittance coating (''hard-coat''), the baseline option, and soft low emittance coating (''soft-coat''), the corresponding design option. Hard-coat is applied to the glass pane at high temperatures during the formation of the pane and is extremely durable, while soft-coat is applied in a separate step after the glass pane is formed and is less durable than hard low emittance coating but has better performance characteristics. Manufacturers indicated that soft-coat is significantly more difficult to work with and may require new conveyor equipment. As manufacturers adjust to working with soft-coat, longer lead times may occur.

The production of solid doors is very similar to the production of panels. Similar to panels, DOE is only considering the baseline efficiency level for passage and freight doors. The Department does not expect capacity challenges for the production of solid doors as a result of this rule.

Refrigeration

DOE did not identify any significant capacity constraints for the design options being evaluated for this rulemaking. For most 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 product options today. As a result, the industry should not experience capacity constraints directly resulting from an energy conservation standard.

d. Impacts on Small Manufacturer Sub-Group

As discussed in section IV.I.1, 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, specifically ones defined as ''small businesses'' by the SBA. The SBA defines a ''small business'' as having 750 employees or less for NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' Based on this definition, DOE identified two refrigeration system manufacturers, forty-two panel manufacturers, and five door manufacturers in the WICF industry that are small businesses. DOE describes the differential impacts on these small businesses in this rule at section VI.B, Review Under the Regulatory Flexibility Act.

e. Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of several impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. Multiple regulations affecting the same manufacturer can strain profits and can 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 and equipment efficiency.

For the cumulative regulatory burden analysis, DOE looks at other regulations that could affect walk in cooler and freezer manufacturers that will take effect approximately 3 years before or after the compliance date of new energy conservation standards for these products. In addition to the new energy conservation regulations on walk-ins, several other Federal regulations apply to these products and other equipment produced by the same manufacturers. While the cumulative regulatory burden focuses on the impacts on manufacturers of other Federal requirements, DOE also describes a number of other regulations in section VI.B because it recognizes that these regulations also impact the products covered by this rulemaking.

Companies that produce a wide range of regulated products may be faced with more capital and product development expenditures than competitors with a narrower scope of products. Regulatory burdens can prompt companies to exit the market or reduce their product offerings, potentially reducing competition. Smaller companies in particular can be affected by regulatory costs since these companies have lower sales volumes over which they can amortize the costs of meeting new regulations. DOE discusses below the regulatory burdens manufacturers could experience, mainly, DOE regulations for other products or equipment produced by walk-in manufacturers and other Federal requirements including the United States Clean Air Act, the Energy Independence and Security Act of 2007. While this analysis focuses on the impacts on manufacturers of other Federal requirements, in this section DOE also describes a number of other regulations that could also impact the WICF equipment covered by this rulemaking: Potential climate change and greenhouse gas legislation, State conservation standards, and food safety regulations. DOE discusses these and other requirements, and includes the full details of the cumulative regulatory burden, in chapter 12 of the final rule TSD.

DOE Regulations for Other Products Produced by Walk-In Cooler and Freezer Manufacturers

In addition to the new energy conservation standards on walk in cooler and freezer equipment, several other Federal regulations apply to other products produced by the same manufacturers. DOE recognizes that each regulation can significantly affect a manufacturer's financial operations. Multiple regulations affecting the same manufacturer can strain manufacturers' profits and possibly cause an exit from the market. DOE is conducting an energy conservation standard rulemaking for commercial refrigeration equipment and cannot include the costs of this rulemaking in its cumulative analysis because the rulemaking is not yet complete and no cost estimates are available.

Federal Clean Air Act

The Clean Air Act defines the EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The most significant of these additional regulations is the EPA-mandated phase-out of hydrochlorofluorocarbons (HCFCs). The Act requires that, on a quarterly basis, any person who produced, imported, or exported certain substances, including HCFC refrigerants, report the amount produced, imported and exported. Additionally—effective January 1, 2015—selling, manufacturing, and using any such substance is banned unless such substance (1) has been used, recovered, and recycled; (2) is used and entirely consumed in the production of other chemicals; or (3) is used as a refrigerant in appliances manufactured prior to January 1, 2020. Finally, production phase-outs will continue until January 1, 2030 when such production will be illegal. These bans could trigger design changes to natural or low global warming potential refrigerants and could impact the insulation used in equipment covered by this rulemaking.

State Conservation Standards

Since 2004, the State of California has had established energy standards for walk-in coolers and freezers. California's Code of Regulations (Title 20, Section 1605) prescribe requirements for insulation levels, motor types, and use of automatic door-closers used for WICF applications. These requirements have since been amended and mirror those standards that Congress prescribed as part of EISA 2007. Other States, notably, Connecticut, Maryland, and Oregon, have recently established energy efficiency standards for walk-ins that are also identical to the ones contained in EPCA. These standards would not be preempted until any Federal standards that DOE may adopt take effect. See 42 U.S.C. 6316(h)(2). Once DOE's standards are finalized, all other State standards that are in effect would be pre-empted. As a result, these State standards do not pose any regulatory burden above that which has already been established in EPCA.

Food Safety Standards

Manufacturers expressed concern regarding Federal, State, and local food safety regulations. A walk-in must perform to the standards set by NSF, state, country, and city health regulations. There is general concern among manufacturers about conflicting regulation scenarios as new energy conservation standards may potentially prevent or make it more difficult for them to comply with food safety regulations.

3. National Impact Analysis

a. Energy Savings

DOE estimated the NES by calculating the difference in annual energy consumption for the base-case scenario and standards-case scenario at each TSL for each equipment class and summing up the annual energy savings over the lifetime of all equipment purchased in 2017–2046.

Table V.31 presents the primary NES (taking into account losses in the generation and transmission of electricity) for all equipment classes and the sum total of NES for each TSL. Table V.32 presents estimated FFC energy savings for each considered TSL. The total FFC NES progressively increases from 2.506 quads at TSL 1 to 3.883 quads at TSL 3.

TABLE V.31—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS IN QUADS

	TSL 1	TSL 2	TSL 3
DC.L.I	0.030	0.035	0.035
DC.L.O	0.832	1.077	1.077
DC.M.I	0.069	0.069	0.069
DC.M.O	1.028	1.279	1.279
MC.L.N	0.016	0.016	0.016
MC.M	0.046	0.046	0.046
SP.M	0.000	0.000	0.044
SP.L	0.000	0.000	0.064
FP.L	0.000	0.000	0.017
DD.M	0.329	0.423	0.643
DD.L	0.116	0.154	0.174
PD.M	0.000	0.000	0.076
PD.L	0.000	0.000	0.245
FD.M	0.000	0.000	0.009

TABLE V.31—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS IN QUADS—Continued

	TSL 1	TSL 2	TSL 3
FD.L	0.000	0.000	0.027
Total	2.466	3.099	3.821

* For DC refrigeration systems, results include all capacity ranges.

TABLE V.32—CUMULATIVE NATIONAL FULL-FUEL CYCLE ENERGY SAVINGS IN QUADS

	TSL 1	TSL 2	TSL 3
DC.L.I	0.031	0.036	0.036
DC.L.O	0.846	1.094	1.094
DC.M.I	0.070	0.070	0.070
DC.M.O	1.045	1.300	1.300
MC.L.N	0.016	0.017	0.017
MC.M	0.046	0.046	0.046
SP.M	0.000	0.000	0.045
SP.L	0.000	0.000	0.065
FP.L	0.000	0.000	0.018
DD.M	0.334	0.429	0.653
DD.L	0.118	0.157	0.177
PD.M	0.000	0.000	0.077
PD.L	0.000	0.000	0.249
FD.M	0.000	0.000	0.009
FD.L	0.000	0.000	0.027
Total	2.506	3.149	3.883

Circular A–4 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 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[38] The review timeframe established in EPCA is generally not synchronized with the equipment lifetime, equipment manufacturing cycles or other factors specific to walk-in coolers and walk-in freezers. Thus, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology. The primary and full-fuel cycle NES results based on a 9-year analysis period are presented in Table V.33 and Table V.34, respectively. The impacts are counted over the lifetime of equipment purchased in 2017–2025.

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

TABLE V.33—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS FOR 9-YEAR ANALYSIS PERIOD

[Equipment purchased in 2017–2025]

	TSL 1	TSL 2	TSL 3
DC.L.I	0.0	0.0	0.0
DC.L.O	0.2	0.3	0.3
DC.M.I	0.0	0.0	0.0
DC.M.O	0.3	0.3	0.3
MC.L.N	0.0	0.0	0.0
MC.M	0.0	0.0	0.0
SP.M	0.0	0.0	0.0
SP.L	0.0	0.0	0.0
FP.L	0.0	0.0	0.0
DD.M	0.1	0.1	0.2
DD.L	0.0	0.0	0.1
PD.M	0.0	0.0	0.0
PD.L	0.0	0.0	0.1
FD.M	0.0	0.0	0.0
FD.L	0.0	0.0	0.0
Total	0.6	0.8	1.1

TABLE V.34—CUMULATIVE FULL FUEL CYCLE NATIONAL ENERGY SAVINGS FOR 9-YEAR ANALYSIS PERIOD

[Equipment purchased in 2017–2025]

	TSL 1	TSL 2	TSL 3
DC.L.I	0.0	0.0	0.0
DC.L.O	0.2	0.3	0.3
DC.M.I	0.0	0.0	0.0
DC.M.O	0.3	0.3	0.3
MC.L.N	0.0	0.0	0.0
MC.M	0.0	0.0	0.0
SP.M	0.0	0.0	0.0
SP.L	0.0	0.0	0.0
FP.L	0.0	0.0	0.0
DD.M	0.1	0.1	0.2
DD.L	0.0	0.0	0.1
PD.M	0.0	0.0	0.0
PD.L	0.0	0.0	0.1
FD.M	0.0	0.0	0.0
FD.L	0.0	0.0	0.0
Total	0.7	0.8	1.1

b. Net Present Value of Customer Costs and Benefits

DOE estimated the cumulative NPV to the Nation of the net savings for WICF customers that would result from potential standards at each TSL. In accordance with OMB guidelines on regulatory analysis (OMB Circular A–4, section E, September 17, 2003), DOE calculated NPV using both a 7-percent and a 3-percent real discount rate.

Table V.35 and Table V.36 show the customer NPV results for each of the TSLs DOE considered for walk-in coolers and walk-in freezers at 7-percent and 3-percent discount rates, respectively. The impacts cover the expected lifetime of equipment purchased in 2017–2046.

Efficiency levels for TSL 3 were chosen to represent the maximum technology for both refrigeration equipment, and envelope components, as such the NPV results at a 7-percent discount rate are mixed, they are negative for all envelope component equipment classes, while positive for refrigeration systems. TSL 2 was chosen to correspond to the highest efficiency level with a positive NPV at a 7-percent discount rate for each equipment class. The criterion for TSL 1 was to select efficiency levels with the highest NPV at a 7-percent discount rate. Consequently, the total NPV is highest for TSL 1. TSL 2 shows the second highest total NPV at a 7-percent discount rate.

TABLE V.35—NET PRESENT VALUE IN BILLIONS (2013$) AT A 7-PERCENT DISCOUNT RATE FOR UNITS SOLD IN 2017–2046

	TSL 1	TSL 2	TSL 3
DC.L.I	0.1	0.1	0.1
DC.L.O	2.2	1.0	1.0
DC.M.I	0.1	0.1	0.1
DC.M.O	2.8	2.5	2.5
MC.L.N	0.0	0.0	0.0
MC.M	0.1	0.1	0.1
SP.M	0.0	0.0	−18.9
SP.L	0.0	0.0	−6.6
FP.L	0.0	0.0	−2.0
DD.M	0.7	0.0	−10.0
DD.L	0.1	0.1	−0.2
PD.M	0.0	0.0	−5.1
PD.L	0.0	0.0	−4.1
FD.M	0.0	0.0	−0.6
FD.L	0.0	0.0	−0.2
Total	6.24	3.98	−43.92

* For DC refrigeration systems, results include all capacity ranges.

TABLE V.36—NET PRESENT VALUE IN BILLIONS (2013$) AT A 3-PERCENT DISCOUNT RATE FOR UNITS SOLD IN 2017–2046

	TSL 1	TSL 2	TSL 3
DC.L.I	0.2	0.1	0.1
DC.L.O	4.8	2.8	2.8
DC.M.I	0.3	0.3	0.3
DC.M.O	5.9	5.5	5.5
MC.L.N	0.1	0.1	0.1
MC.M	0.2	0.2	0.2
SP.M	0.0	0.0	−33.2
SP.L	0.0	0.0	−11.6

TABLE V.36—NET PRESENT VALUE IN BILLIONS (2013$) AT A 3-PERCENT DISCOUNT RATE FOR UNITS SOLD IN 2017–2046—Continued

	TSL 1	TSL 2	TSL 3
FP.L	0.0	0.0	−3.5
DD.M	1.6	0.5	−17.1
DD.L	0.3	0.3	−0.2
PD.M	0.0	0.0	−8.9
PD.L	0.0	0.0	−7.0
FD.M	0.0	0.0	−1.1
FD.L	0.0	0.0	−0.4
Total	13.38	9.90	−73.93

* For DC refrigeration systems, results include all capacity ranges.

The NPV results based on the aforementioned 9-year analysis period are presented in Table V.37 and Table V.38. The impacts are counted over the lifetime of equipment purchased in 2017–2025. As mentioned previously, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.37 —NET PRESENT VALUE IN MILLIONS (2013$) AT A 7-PERCENT DISCOUNT RATE FOR UNITS SOLD IN 2017–2025

	TSL 1	TSL 2	TSL 3
DC.L.I	0.0	0.0	0.0
DC.L.O	1.0	0.4	0.4
DC.M.I	0.1	0.1	0.1
DC.M.O	1.3	1.1	1.1
MC.L.N	0.0	0.0	0.0
MC.M	0.0	0.0	0.0
SP.M	0.0	0.0	−9.1
SP.L	0.0	0.0	−3.2
FP.L	0.0	0.0	−1.0
DD.M	0.2	−0.1	−5.1
DD.L	0.0	0.0	−0.2
PD.M	0.0	0.0	−2.5
PD.L	0.0	0.0	−2.0
FD.M	0.0	0.0	−0.3
FD.L	0.0	0.0	−0.1
Total	2.7	1.6	−21.7

TABLE V.38—NET PRESENT VALUE IN MILLIONS (2013$) AT A 3-PERCENT DISCOUNT RATE FOR UNITS SOLD IN 2017–2025

	TSL 1	TSL 2	TSL 3
DC.L.I	0.0	0.0	0.0
DC.L.O	1.5	0.8	0.8
DC.M.I	0.1	0.1	0.1
DC.M.O	2.0	1.8	1.8
MC.L.N	0.0	0.0	0.0
MC.M	0.1	0.1	0.1
SP.M	0.0	0.0	−11.7
SP.L	0.0	0.0	−4.0
FP.L	0.0	0.0	−1.2
DD.M	0.5	0.1	−6.2
DD.L	0.1	0.1	−0.1
PD.M	0.0	0.0	−3.1
PD.L	0.0	0.0	−2.5
FD.M	0.0	0.0	−0.4
FD.L	0.0	0.0	−0.2
Total	4.4	3.0	−26.5

c. Indirect Employment Impacts

In addition to the direct impacts on manufacturing employment discussed in section V.B.2, DOE develops general estimates of the indirect employment impacts of amended standards on the economy. As discussed above, DOE expects energy amended conservation standards for walk-in coolers and walk-in freezers to reduce energy bills for commercial customers, and the resulting net savings to be redirected to other forms of economic activity. DOE also realizes that these shifts in spending and economic activity by walk-in owners could affect the demand for labor. Thus, indirect employment impacts may result from expenditures shifting between goods (the substitution effect) and changes in income and overall expenditure levels (the income effect) that occur due to the imposition of amended standards. These impacts may affect a variety of businesses not directly involved in the decision to make, operate, or pay the utility bills for walk-in coolers and walk-in freezers. To estimate these indirect economic effects, DOE used an input/output model of the U.S. economy as described in section IV.K of this notice.

Customers who purchase more-efficient equipment pay lower amounts towards utility bills, which results in job losses in the electric utilities sector. However, in the input/output model, the dollars saved on utility bills are re-invested in economic sectors that create more jobs than are lost in the electric utilities sector. Thus, the amended energy conservation standards for walk-in coolers and walk-in freezers are likely to slightly increase the net demand for labor in the economy. As shown in chapter 16 of the final rule TSD, DOE estimates that net indirect employment impacts from amended walk-in standards are very small relative to the national economy. The net increase in jobs might be offset by other, unanticipated effects on employment. Neither the BLS data nor the input/output model used by DOE includes the quality of jobs.

4. Impact on Utility or Performance of Equipment

In performing the engineering analysis, DOE considers design options that would not lessen the utility or performance of the individual classes of equipment. (42 U.S.C. 6295(o)(2)(B)(i)(IV) and 6316(a)) As presented in the screening analysis (chapter 4 of the final rule TSD), DOE eliminates from consideration any design options that reduce the utility of the equipment. For this final rule, DOE concluded that none of the efficiency levels considered for walk-in coolers and walk-in freezers would reduce the utility or performance of the equipment.

5. Impact of Any Lessening of Competition

EPCA directs DOE to consider any lessening of competition that is likely to result from standards. It also directs the Attorney General of the United States (Attorney General) to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a direct final rule and simultaneously published proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii)) To assist the Attorney General in making a determination for WICF standards, DOE provided the Department of Justice (DOJ) with copies of the NOPR and the TSD for review. On behalf of the Attorney General, the DOJ's Antitrust Division concluded that the standard levels proposed by DOE (which are the same ones being adopted in this final rule) would not be likely to have an adverse impact on competition.

6. Need of the Nation To Conserve Energy

An improvement in the energy efficiency of the equipment subject to this final rule is likely to improve the security of the Nation's energy system by reducing overall demand for energy. Reduced electricity demand may also improve the reliability of the electricity system. Reductions in national electric generating capacity estimated for each considered TSL are reported in chapter 14 of the final rule TSD.

Energy savings from amended standards for walk-in coolers and walk-in freezers could also produce environmental benefits in the form of reduced emissions of air pollutants and GHGs associated with electricity production.

Table V.72 provides DOE's estimate of cumulative emissions reductions projected to result from the TSLs considered in this rule. The table includes both power sector emissions and upstream emissions. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD.

TABLE V.39—CUMULATIVE EMISSIONS REDUCTION ESTIMATED FOR WALK-IN COOLERS AND WALK-IN FREEZERS TSLS FOR EQUIPMENT PURCHASED IN 2017–2046

	TSL		
	1	2	3
Power Sector Emissions			
CO_2 *(million metric tons)*	118.9	149.5	184.0
SO_2 *(thousand tons)*	180.7	227.1	279.8
NO_X *(thousand tons)*	95.9	120.5	149.3
Hg *(tons)*	0.2	0.3	0.3
N_2O *(thousand tons)*	2.7	3.4	4.2
CH_4 *(thousand tons)*	16.1	20.3	25.0
Upstream Emissions			
CO_2 *(million metric tons)*	7.7	9.7	12.0
SO_2 *(thousand tons)*	1.7	2.1	2.6
NO_X *(thousand tons)*	106.6	133.9	165.1
Hg *(tons)*	0.0	0.0	0.0
N_2O *(thousand tons)*	0.1	0.1	0.1
CH_4 *(thousand tons)*	646.7	812.8	1001.8
Total FFC Emissions			
CO_2 *(million metric tons)*	126.7	159.2	196.0
SO_2 *(thousand tons)*	182.4	229.2	282.4
NO_X *(thousand tons)*	202.5	254.4	314.4
Hg *(tons)*	0.2	0.3	0.3
N_2O *(thousand tons)*	2.8	3.5	4.4
CH_4 *(thousand tons)*	662.9	833.0	1026.8

As part of the analysis for this final rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that were estimated for each of the TSLs considered. As discussed in section IV.M, for CO_2, DOE used values for the SCC developed by a Federal interagency process. The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, which represents the 95th-percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. The four SCC values for CO_2 emissions reductions in 2015, expressed in 2013$, are $12.0, $40.5, $62.4, and $119 per metric ton of CO_2. The values for later years are higher due to increasing emissions-related costs as the magnitude of projected climate change increases.

Table V.40 presents the global value of CO_2 emissions reductions at each TSL. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in chapter 14 of the final rule TSD.

TABLE V.40—GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS TSLS

TSL	SCC Scenario			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
million 2013$				
Power Sector Emissions				
1	894	3965	6255	12221
2	1124	4983	7861	15358
3	1379	6119	9655	18856
Upstream Emissions				
1	56	252	399	778
2	70	316	501	977
3	86	389	616	1201

TABLE V.40—GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS TSLs—Continued

TSL	SCC Scenario			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
Total FFC Emissions				
1	950	4217	6654	12999
2	1194	5299	8362	16336
3	1464	6507	10271	20057

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other GHG emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed in this final rule on reducing CO_2 emissions is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions, including HFCs. This ongoing review will consider the comments on this subject that are part of the public record for this final rule and other rulemakings, as well as other methodological assumptions and issues. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this final rule the most recent values and analyses resulting from the ongoing interagency review process.

DOE also estimated a range for the cumulative monetary value of the economic benefits associated with NO_X emission reductions anticipated to result from amended walk-in standards. Table V.42 shows the present value of cumulative NO_X emissions reductions for each TSL calculated using the average dollar-per-ton values and 7-percent and 3-percent discount rates.

TABLE V.41—CUMULATIVE PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR WALK-IN COOLERS AND FREEZERS TSLs

TSL	3% discount rate	7% discount rate
Million 2013$		
Power Sector Emissions		
1	138.1	70.0
2	173.5	88.0
3	213.6	108.3
Upstream Emissions		
1	153.3	76.0
2	192.6	95.5
3	236.3	117.2
Total FFC Emissions		
1	291.3	146.0
2	366.1	183.5
3	450.0	225.5

7. Summary of National Economic Impact

The NPV of the monetized benefits associated with emission reductions can be viewed as a complement to the NPV of the customer savings calculated for each TSL considered in this final rule. Table V.42 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 customer savings calculated for each TSL, at both a 7-percent and a 3-percent discount rate. The CO_2 values used in the table correspond to the four scenarios for the valuation of CO_2 emission reductions discussed above.

TABLE V.42—NET PRESENT VALUE OF CUSTOMER SAVINGS COMBINED WITH NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

TSL	SCC Value of $12.0/metric ton CO_2* and medium value for NO_X	SCC Value of $40.5/metric ton CO_2* and medium value for NO_X	SCC Value of $62.4/metric ton CO_2* and medium value for NO_X	SCC Value of $119/metric ton CO_2* and medium value for NO_X
Customer NPV at 3% Discount Rate added with Value of Emissions Based on: *billion 2013$*				
1	14.7	18.2	20.8	27.6
2	11.5	15.9	19.3	27.8
3	−71.9	−66.5	−62.4	−51.9
Customer NPV at 7% Discount Rate added with Value of Emissions Based on: *billion 2013$*				
1	7.4	10.9	13.5	20.3
2	5.4	9.8	13.2	21.7
3	−42.1	−36.7	−32.6	−22.1

* These label values represent the global SCC in 2015, in 2013$. The present values have been calculated with scenario-consistent discount rates.

Although adding the value of customer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. customer 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 quite different time frames for analysis. The national operating cost savings is measured for the lifetime of equipment shipped in 2017–2046. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one metric ton of CO_2 in each year. These impacts continue well beyond 2100.

8. Other Factors

EPCA allows the Secretary, in determining whether a 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)) DOE has not considered other factors in development of the standards in this final rule.

C. Conclusions

Any new or amended energy conservation standard for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and 6316(a)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens 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 a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B) and 6316(a))

For this rulemaking, DOE considered the impacts of potential standards at each TSL, beginning with the maximum technologically feasible level, to determine whether that level met the evaluation criteria. If 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 in understanding the benefits and/or burdens of each TSL, tables in this section summarize the quantitative analytical results for each TSL, based on the assumptions and methodology discussed herein. The efficiency levels contained in each TSL are described in section V.A. In addition to the quantitative results presented in the tables below, 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. Section V.B.1.b presents the estimated impacts of each TSL for the considered subgroups. DOE discusses the impacts on employment in WICF manufacturing in section V.B.2.b and discusses the indirect employment impacts in section IV.O.

1. Benefits and Burdens of Trial Standard Levels Considered for Walk-in Coolers and Walk-In Freezers

Table V.43 through Table V.46 summarize the quantitative impacts estimated for each TSL for WICFs.

TABLE V.43—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS

Category	TSL 1	TSL 2	TSL 3
Cumulative National Energy Savings *quads*			
Primary	2.466	3.099	3.821
Full-fuel cycle	2.506	3.149	3.883
Cumulative NPV of Customer Benefits *2013$ billion*			
3% discount rate	13.38	9.90	−73.93
7% discount rate	6.24	3.98	−43.92
Industry Impacts			
Change in Industry NPV (2013$ million)	−29.41 to 31.88	−52.89 to 80.20	−549.26 to 1056.92
Change in Industry NPV (%)	−2.28 to 2.47	−4.1 to 6.21	−42.54 to 81.86
Cumulative Emissions Reductions **			
CO_2 (Mt)	126.7	159.2	196.0
SO_2 (kt)	182.4	229.2	282.4
NO_X (kt)	202.5	254.4	314.4
Hg (t)	0.22	0.27	0.34
N_2O (kt)	2.8	3.5	4.4
N_2O (kt CO_2eq)	662.9	833.0	1026.8
CH_4 (*kt*)	126.7	159.2	196.0
CH_4 (*kt* CO_2eq)	182.4	229.2	282.4
Monetary Value of Cumulative Emissions Reductions *2013$ million* †			
CO_2	949.7 to 12,999	1,193.5 to 16336	1,464.4 to 20,0576
NO_X—3% discount rate	291.3	366.1	450.0

TABLE V.43—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS—Continued

Category	TSL 1	TSL 2	TSL 3
NO_X—7% discount rate	146.0	183.5	225.5

** "Mt" stands for million metric tons; "kt" stands for kilotons; "t" stands for tons. 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.44—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS TSLS: MEAN LCC SAVINGS

Mean LCC Savings* *2013$*			
Equipment class	TSL 1	TSL 2	TSL 3
DC.L.I	2157	2078	2078
DC.L.O	6463	5942	5942
DC.M.I	1485	5942	5942
DC.M.O	6382	6533	6533
MC.L	598	547	547
MC.M	362	362	362
SP.M	—	—	−21
SP.L	—	—	−18
FP.L	—	—	−19
DD.M	460	143	−2396
DD.L	976	902	−79
PD.M	—	—	−2000
PD.L	—	—	−1998
FD.M	—	—	−2668
FD.L	—	—	−1761

* "—" indicates no impact because there is no change in the standards.

TABLE V.45—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS TSLS: MEDIAN PAYBACK PERIOD

Median payback period* (in years)			
Equipment class	TSL 1	TSL 2	TSL 3
DC.L.I	1.7	1.6	1.6
DC.L.O	1.0	3.5	3.5
DC.M.I	2.8	3.5	3.5
DC.M.O	1.1	2.2	2.2
MC.L	2.7	3.1	3.1
MC.M	3.1	3.1	3.1
SP.M	—	—	238.6
SP.L	—	—	58.8
FP.L	—	—	64.7
DD.M	2.4	7.3	39.5
DD.L	4.2	5.4	9.6
PD.M	—	—	30.8
PD.L	—	—	30.7
FD.M	—	—	115.5
FD.L	—	—	19.1

* "—" indicates no impact because there is no change in the standards.

TABLE V.46—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS TSLS: DISTRIBUTION OF CUSTOMER LCC IMPACTS

Equipment class	TSL 1*	TSL 2*	TSL 3*
DC.L.I:			
Net Cost (%)	0	0	0
No Impact (%)	0	0	0
Net Benefit (%)	100	100	100
DC.L.O:			
Net Cost (%)	0	2	2
No Impact (%)	0	0	0
Net Benefit (%)	100	98	98
DC.M.I:			
Net Cost (%)	0	2	2
No Impact (%)	0	0	0
Net Benefit (%)	100	98	98
DC.M.O:			
Net Cost (%)	0	0	0
No Impact (%)	0	0	0
Net Benefit (%)	100	100	100
MC.L:			
Net Cost (%)	0	0	0

TABLE V.46—SUMMARY OF RESULTS FOR WALK-IN COOLERS AND FREEZERS TSLS: DISTRIBUTION OF CUSTOMER LCC IMPACTS—Continued

Equipment class	TSL 1 *	TSL 2 *	TSL 3 *
No Impact (%)	0	0	0
Net Benefit (%)	100	100	100
MC.M:			
Net Cost (%)	0	0	0
No Impact (%)	0	0	0
Net Benefit (%)	100	100	100
SP.M:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0
SP.L:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0
FP.L:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0
DD.M:			
Net Cost (%)	0	41	100
No Impact (%)	30	0	0
Net Benefit (%)	69	59	0
DD.L:			
Net Cost (%)	4	10	59
No Impact (%)	0	0	0
Net Benefit (%)	96	90	41
PD.M:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0
PD.L:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0
FD.M:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0
FD.L:			
Net Cost (%)	0	0	100
No Impact (%)	100	100	0
Net Benefit (%)	0	0	0

* In some cases the percentages may not sum to 100 percent due to rounding.

TSL 3 corresponds to the max-tech level for all the equipment classes and offers the potential for the highest cumulative energy savings. The estimated energy savings from TSL 3 is 3.883 quads, an amount DOE deems significant. TSL 3 shows a net negative NPV for customers with estimated increased costs valued at $−43.92 billion at a 7-percent discount rate. Estimated emissions reductions are 196.0 Mt of CO_2, 314.4 thousand tons of NO_X, 282.4 thousand tons of SO_2, 1026.8 thousand tons of methane, and 0.34 tons of Hg. The CO_2 emissions have an estimated value of $1.5 billion to $20.1 billion and the NO_X emissions have an estimated value of $225.5 million at a 7-percent discount rate.

For TSL 3 the mean LCC savings for all equipment classes are positive for refrigeration systems, and negative for all refrigeration components, implying an increase in LCC in all component cases. The median PBP is longer than the lifetime of the equipment for all refrigeration component equipment classes. Similarly, the mean LCC savings for panels, which require the use of vacuum insulated panels at TSL 3, are negative with median PBP as high as nearly 240 years. As a result, DOE's analysis does not project that there would be any benefits from setting a standard at TSL 3 for any of the affected components.

At TSL 3, manufacturers may expect diminished profitability due to large increases in equipment costs, capital investments in equipment and tooling, and expenditures related to engineering and testing. The projected change in INPV ranges from a decrease of $549.3 million to an increase of $1056.9 million based on DOE's manufacturer markup scenarios. The upper bound gain of $1056.9 million in INPV is considered an optimistic scenario for manufacturers because it assumes manufacturers can fully pass on substantial increases in equipment costs and upfront investments. DOE recognizes the risk of large negative impacts on industry if manufacturers' expectations concerning reduced profit margins are realized. TSL 3 could reduce walk-in INPV by up to 42.5 percent if impacts reach the lower bound of the range.

After carefully considering the analytical results and weighing the benefits and burdens of TSL 3, DOE finds that the benefits to the Nation from TSL 3, in the form of energy savings and emissions reductions, including environmental and monetary benefits, are small compared to the burdens, in the form of a decrease in customer NPV. DOE concludes that the burdens of TSL 3 outweigh the benefits and, therefore, does not find TSL 3 to be economically justifiable.

TSL 2 corresponds to the highest efficiency level, in each equipment class, which maximized energy savings, while maintaining a positive NPV at a 7-percent discount rate for each equipment class. The estimated energy savings from TSL 2 is 3.149 quads, an amount DOE deems significant. TSL 2 shows a net positive NPV for all customers with estimated at $9.90 billion at a 7-percent discount rate. Estimated emissions reductions are 159.2 Mt of CO_2, 254.4 thousand tons of NO_X, 229.2 thousand tons of SO_2, 833.0 thousand tons of methane, and 0.27 tons of Hg. The CO_2 emissions have an estimated value of $1.2 billion to $16.3 billion and the NO_X emissions have an estimated value of $183.5 million at a 7-percent discount rate.

At TSL 2, the projected change in INPV ranges from a decrease of $52.9 million to an increase of $80.2 million. At TSL 2, DOE recognizes the risk of negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the lower bound of the range of impacts is reached, as DOE expects, TSL 2 could result in a net loss of 4.10 percent in total INPV for manufacturers of walk-in refrigeration systems, panels, and doors.

For TSL 2 the mean LCC savings for all equipment classes are positive for refrigeration systems, and l refrigeration components, implying an reduction in LCC in all cases. The median PBP is shorter than the lifetime of the equipment for all equipment classes.

After careful consideration of the analytical results, weighing the benefits and burdens of TSL 3, and comparing them to those of TSL 2, the Secretary concludes that TSL 2 will offer the maximum improvement in efficiency that is technologically feasible and economically justified and will result in the significant conservation of energy. Therefore, DOE today is adopting standards at TSL 2 for walk-in coolers and walk-in freezers. The energy conservation standards for walk-in coolers and walk-in freezers are shown in Table V.47. DOE notes that instead of adopting the baseline R-value represented in TSL 2 for panels, the Agency is adopting the current Federal standard levels. DOE is not amending the standards for panels at this time but is continuing to require that these components satisfy the current panel energy conservation standards that Congress enacted. DOE has decided to retain the current panel energy conservation levels because it determined from its analysis that there is no TSL level that shows that higher panel standards are economically justified. While DOE's analysis reveals that a portion of the market has already surpassed the current Federal energy conservation standards for certain types of panels at the representative thickness and material analyzed, DOE's analysis does not provide the economic justification needed to amend the Federal standards for all types of WICF panels. Thus, DOE is retaining the current Federal standards, which establish a single R-value level that is independent of material properties or thickness and is continuing to allow manufacturers to have the flexibility to optimize both material properties and thickness at their discretion to meet the Federal standards.

TABLE V.47—ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS

Class descriptor	Class	Standard level
Refrigeration systems		Minimum 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	$2.30 \times 10^{-4} \times Q + 2.73$
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		Minimum R-value (h-ft²-°/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		Maximum 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	$0.12 \times A_{nd} + 5.6$

TABLE V.47—ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS—Continued

Class descriptor	Class	Standard level
Refrigeration systems		Minimum AWEF (Btu/W-h) *
Display Doors		Maximum Energy Consumption (kWh/day)†
Display Door, Medium Temperature	DD.M	$0.04 \times A_{dd} + 0.41$
Display Door, Low Temperature	DD.L	$0.15 \times A_{dd} + 0.29$

** Q represents the system gross capacity as calculated in AHRI 1250.
** And represents the surface area of the non-display door.
† Add represents the surface area of the display door.

2. Summary of Benefits and Costs (Annualized) of the Standards

The benefits and costs of these standards, for equipment sold in 2017–2046, can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from operating the equipment (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing consumer NPV), plus (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[39]

Estimates of annualized benefits and costs of these standards are shown in Table V.48. 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 uses a 3-percent discount rate, the cost of the standards in this rule is $511 million per year in increased equipment costs, while the benefits are $879 million per year in reduced equipment operating costs, $287 million in CO_2 reductions, and $16.93 million in reduced NO_X emissions. In this case, the net benefit amounts to $671 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the cost of the standards in this rule is $528 million per year in increased equipment costs, while the benefits are $1,064 million per year in reduced operating costs, $287 million in CO_2 reductions, and $19.82 million in reduced NO_X emissions. In this case, the net benefit amounts to $842 million per year.

TABLE V.48—ANNUALIZED BENEFITS AND COSTS OF NEW AND AMENDED STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS

	Discount rate	Primary estimate *	Low net benefits estimate *	High net benefits estimate *
		million 2013$/year		
Benefits:				
Operating Cost Savings	7%	879	854	1901
	3%	1064	1027	1115
CO_2 Reduction at ($12.0/t case)**	5%	86	86	86
CO_2 Reduction at ($40.5/t case)**	3%	287	287	287
CO_2 Reduction at ($62.4/t case)**	2.5%	420	420	420
CO_2 Reduction at ($117/t case)**	3%	884	884	884
NO_X Reduction at ($2,684/ton)**	7%	16.93	16.93	16.93
	3%	19.82	19.82	19.82
Total Benefits †	7% plus CO_2 range	981 to 1,780	957 to 1,755	1,020 to 1,818
	7%	1,183	1,158	1,221
	3% plus CO_2 range	1,169 to 1,968	1,133 to 1,931	1,221 to 2,019
	3%	1,371	1,334	1,422
Costs:				
Incremental Equipment Costs	7%	511	501	522
	3%	528	515	541
Net Benefits:				
Total †	7% plus CO_2 range	470 to 1,269	456 to 1,255	498 to 1,296
	7%	671	657	699
	3% plus CO_2 range	641 to 1,440	617 to 1,416	680 to 1,478

[39] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2014, the year used for discounting the NPV of total consumer costs and savings, for the time-series of costs and benefits using discount rates of three and seven percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table I.3. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2017 through 2046) that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined is a steady stream of payments.

TABLE V.48—ANNUALIZED BENEFITS AND COSTS OF NEW AND AMENDED STANDARDS FOR WALK-IN COOLERS AND WALK-IN FREEZERS—Continued

	Discount rate	Primary estimate *	Low net benefits estimate *	High net benefits estimate *
	3%	842	818	881

* This table presents the annualized costs and benefits associated with walk-in coolers and walk-in freezers shipped in 2017–2046. These results include benefits to customers which accrue after 2046 from the equipment purchased in 2017–2046. The results account for the incremental variable and fixed costs incurred by manufacturers due to the amended standard, some of which may be incurred in preparation for the final rule. The primary, low, and high estimates utilize projections of energy prices from the *AEO 2013* Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental equipment costs reflect a medium decline rate for projected equipment price trends in the Primary Estimate, a low decline rate for projected equipment price trends in the Low Benefits Estimate, and a high decline rate for projected equipment price trends in the High Benefits Estimate.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporate an escalation factor. The value for NO_X is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to average SCC with 3-percent discount rate, which is the $40.5/t CO_2 reduction 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 these standards address are as follows:

(1) There are external benefits resulting from improved energy efficiency of commercial refrigeration equipment that are not captured by the users of such equipment. These benefits include externalities related to environmental protection and energy security that are not reflected in energy prices, such as reduced emissions of greenhouse gases. DOE attempts to quantify some of the external benefits through use of Social Cost of Carbon values.

In addition, DOE has determined that this regulatory action is an ''economically significant regulatory action'' under section 3(f)(1) of Executive Order 12866. Accordingly, section 6(a)(3) of the Executive Order requires that DOE prepare a regulatory impact analysis (RIA) on this rule and that the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) review this rule. DOE presented to OIRA for review the draft rule and other documents prepared for this rulemaking, including the RIA, and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 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). EO 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

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

B. Review Under the Regulatory Flexibility Act

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

For manufacturers of walk-in coolers and walk-in freezers, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at *http://www.sba.gov/content/small-business-size-standards*. Walk-in 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 750 employees or less for an entity to be considered as a small business for this category. Based on this threshold, DOE present the following FRFA analysis:

1. Description and Estimated Number of Small Entities Regulated

During its market survey, DOE used available public information to identify potential small manufacturers. DOE's research involved industry trade association membership directories (including AHRI Directory,[40] and NAFEM[41]), public databases (*e.g.* the SBA Database,[42]) individual company Web sites, and market research tools (*e.g.*,, Dunn and Bradstreet reports[43] and Hoovers reports[44]) 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 manufacturers during manufacturer interviews and at DOE public meetings. DOE reviewed publicly available data and contacted select companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered walk-in coolers and walk-in freezers. 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.

Based on this information, DOE identified forty-seven panel manufacturers and found forty-two of the identified panel manufacturers to be small businesses. As part of the MIA interviews, the Department interviewed nine panel manufacturers, including three small business operations. During MIA interviews, multiple manufacturers claimed that there are ''hundreds of two-man garage-based operations'' that produce WICF panels in small quantities. They asserted that these small manufacturers do not typically comply with EISA 2007 standards and do not obtain UL or NSF certifications for their equipment. DOE was not able to identify these small businesses and did not consider them in its analysis. This rule sets the energy conservation standard for walk-in panels at the baseline efficiency level. Based on manufacturer comments in the NOPR public meeting, DOE expects that all manufacturers will be able to meet the baseline efficiency level without product changes, implementation of new design options, or investments in capital equipment. As a result, DOE certifies that the standard would not have a significant impact on small businesses with respect to the walk-ins panel industry.

DOE identified forty-nine walk-in door manufacturers. Forty-five of those produce solid doors and four produce display doors. Of the forty-five solid door manufacturers, forty-two produce panels as their primary business and are considered in the category of panel manufacturers above. The remaining three solid door manufacturers are all considered to be small businesses. Of the four display door manufacturers, two are considered small businesses. Therefore, of the seven manufacturers that exclusively produce WICF doors (three producing solid doors and four producing display doors), DOE determined that five are small businesses. As part of the MIA interviews, the Department interviewed six door manufacturers, including four small business operations. Based on an analysis of the anticipated conversion costs relative to the size of the small businesses in the door market, DOE certifies that the proposed standards would not have a significant impact on a large number of small businesses with respect to the door industry. The complete analysis of small door manufacturer is presented below in section VI.B.2.

DOE identified nine refrigeration system manufacturers in the WICF industry. Two of those companies are foreign-owned. Based on publicly available information, two of the remaining seven domestic manufacturers are small businesses. One small business focuses on large warehouse refrigeration systems, which are outside the scope of this rulemaking. However, at its smallest capacity, this company's units can be sold to the walk-in market. The other small business specializes in building evaporators and unit coolers for a range of refrigeration applications, including the walk-in market. As part of the MIA interviews, the Department interviewed five refrigeration manufacturers, including the two small business operations. Both small businesses expressed concern that the rulemaking would negatively impact their businesses and one small business indicated it would exit the walk-in industry as a result of any standard that would directly impact walk-in refrigeration system energy efficiency. However, due to the small number of small businesses that manufacture WICF refrigeration systems and the fact that only one of two focuses on WICF refrigeration as a key market segment and constitutes a very small share of the overall walk-in market, DOE certifies that the proposed standards would not have a significant impact on a substantial number of small businesses with respect to the refrigeration equipment industry.

2. Description and Estimate of Compliance Requirements

Given the significant role of small businesses in the walk-ins door industries, DOE provides a detailed analysis of the impacts of the standard on the industry. For the walk-in door industry, DOE identified seven small manufacturers that produce doors as their primary product, as described in section VI.B.1. Three companies produce solid doors and four companies produce display doors.

All three manufacturers of customized passage doors and freight doors are small. This rule sets the energy conservation standard for the passage and freight door equipment classes at the baseline efficiency level. DOE expects that manufacturers will not need to make capital equipment investments or product conversion investments as result of this standard. As a result, DOE certifies that the standards set for passage and freight doors would not have a significant impact on small businesses manufacturers.

In the display door market, two of the four manufacturers are small. If conversion costs for display door manufacturers were large, the small manufacturers could be at a disadvantage due to the necessary capital and product conversion costs, which do not necessarily scale with size or sales volume. However, as illustrated in Table VI.1, conversion costs for display door manufacturers are negligible for most TSLs. This is because the considered design options primarily consist of component swaps and relatively straight-forward

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

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

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

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

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

component additions. Also, manufacturers will have between three and five years from the publication date of the final rule to make the necessary equipment and production line changes.

TABLE VI.1—IMPACTS OF CONVERSION COSTS ON A SMALL DISPLAY DOOR MANUFACTURER

	Capital conversion cost as a percentage of annual capital expenditures	Product conversion cost as a percentage of annual R&D expense	Total conversion cost as a percentage of annual revenue	Total conversion cost as a percentage of annual operating income
TSL 1	4	10	0	2
TSL 2	52	17	1	4
TSL 3	817	30	4	33

TABLE VI.2—IMPACTS OF CONVERSION COSTS ON A LARGE DISPLAY DOOR MANUFACTURER

	Capital conversion cost as a percentage of annual capital expenditures	Product conversion cost as a percentage of annual R&D expense	Total conversion cost as a percentage of annual revenue	Total conversion cost as a percentage of annual operating income
TSL 1	1	2	0	0
TSL 2	9	3	0	1
TSL 3	144	5	1	6

At the standard set in this rule (TSL 2), the engineering analysis suggests that manufacturers would need to purchase more efficient components, such as LED lights; incorporate anti-sweat heater controllers; and include lighting controls. Furthermore, for low-temperature applications, manufacturers may need to incorporate special coatings and krypton gas fills to reduce energy loss through display doors. Manufacturers noted in interviews they would likely purchase glass packs that already have the appropriate glass layers and coatings to meet the standard. Most manufacturers are able to apply gas fillings to their products today, though they may need to invest in additional stations for krypton gas. Based on DOE's analysis, the capital conversion costs and product conversion costs appear to be manageable for both small and large display door manufacturers. As a result, DOE certifies that these standards would not have a significant impact on a substantial number of small display door manufacturers.

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

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the rule being adopted today.

4. Significant Alternatives to the Rule

The discussion above analyzes impacts on small businesses that would result from DOE's amended standards. In addition to the other TSLs being considered, the rulemaking TSD includes a regulatory impact analysis (RIA). For walk-in coolers and walk-in freezers, the RIA discusses the following policy alternatives: (1) No change in standard; (2) consumer rebates; (3) consumer tax credits; and (4) manufacturer tax credits; (5) voluntary energy efficiency targets; and (6) bulk government purchases. While these alternatives may mitigate to some varying extent the economic impacts on small entities compared to the standards, DOE determined that the energy savings of these alternatives are significantly smaller than those that would be expected to result from adoption of the amended standard levels. (See chapter 17 of the final rule TSD for the analysis supporting this determination.) Accordingly, DOE is declining to adopt any of these alternatives and is adopting the standards set forth in this rulemaking.

C. Review Under the Paperwork Reduction Act

Manufacturers of walk-in coolers and walk-in freezers must certify to DOE that their equipment comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their equipment according to the DOE test procedures for walk-in coolers and walk-in freezers, 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 walk-in coolers and walk-in freezers. (76 FR 12422 (March 7, 2011)). 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 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

D. Review Under the National Environmental Policy Act of 1969

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

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism.'' 64 FR 43255 (Aug. 10, 1999) imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the equipment that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) 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; and (3) provide a clear legal standard for affected conduct rather than a general standard and promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final 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 an amended regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *http://energy.gov/gc/office-general-counsel*.

DOE has concluded that this final rule would likely require expenditures of $100 million or more on the private sector. Such expenditures may include: (1) Investment in research and development and in capital expenditures by walk-in coolers and walk-in freezers 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 walk-in coolers and walk-in freezers, starting at the compliance date for the applicable standard.

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

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. 2 U.S.C. 1535(a). DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(d), (f), and (o), 6313(e), and 6316(a), this final rule would establish energy conservation standards for walk-in coolers and walk-in freezers 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 the ''Regulatory Impact Analysis'' section of the TSD for this final rule.

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

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

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859 (March 18, 1988), that this regulation 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 guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed this final rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

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

DOE has concluded that this regulatory action, which sets forth energy conservation standards for walk-in coolers and walk-in freezers, is not a significant energy action because the amended 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 the final rule.

L. Review Under the Information Quality Bulletin for Peer Review

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

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

M. Congressional Notification

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

VII. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 431

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

Issued in Washington, DC, on May 8, 2014.

David T. Danielson,

Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons stated in the preamble, DOE amends part 431 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, to read 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.

■ 2. Section 431.302 is amended by revising the definition for ''Display door'' and adding, in alphabetical order, definitions for ''Freight door'' and ''Passage door'' to read as follows:

§ 431.302 Definitions concerning walk-in coolers and freezers.

* * * * *

Display door means a door that:

(1) Is designed for product display; or

(2) Has 75 percent or more of its surface area composed of glass or another transparent material.

* * * * *

Freight door means a door that is not a display door and is equal to or larger than 4 feet wide and 8 feet tall.

* * * * *

Passage door means a door that is not a freight or display door.

* * * * *

■ 3. In § 431.304, revise paragraph (a) to read as follows:

§ 431.304 Uniform test method for the measurement of energy consumption of walk-in coolers and walk-in freezers.

(a) *Scope.* This section provides test procedures for measuring, pursuant to EPCA, the energy consumption of walk-in coolers and walk-in freezers.

* * * * *

■ 4. In § 431.306, revise paragraph (a)(3), and add paragraphs (c), (d), and (e) to read as follows:

§ 431.306 Energy conservation standards and their effective dates.

(a) * * *

(3) Contain wall, ceiling, and door insulation of at least R–25 for coolers and R–32 for freezers, except that this paragraph shall not apply to:

(i) Glazed portions of doors not to structural members and

(ii) A walk-in cooler or walk-in freezer component if the component manufacturer has demonstrated to the satisfaction of the Secretary in a manner consistent with applicable requirements that the component reduces energy consumption at least as much as if such insulation requirements of subparagraph (a)(3) were to apply.

* * * * *

(c) *Walk-in cooler and freezer display doors.* All walk-in cooler and walk-in freezer display doors manufactured starting June 5, 2017, must satisfy the following standards:

Class descriptor	Class	Equations for maximum energy consumption (kWh/day)*
Display Door, Medium Temperature	DD.M	$0.04 \times A_{dd} + 0.41$.
Display Door, Low Temperature	DD.L	$0.15 \times A_{dd} + 0.29$.

*A_{dd} represents the surface area of the display door.

(d) *Walk-in cooler and freezer non-display doors.* All walk-in cooler and walk-in freezer non-display doors manufactured starting on June 5, 2017, must satisfy the following standards:

Class descriptor	Class	Equations for maximum 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	$0.12 \times A_{nd} + 5.6$.

*A_{nd} represents the surface area of the non-display door.

(e) *Walk-in cooler and freezer refrigeration systems.* All walk-in cooler and walk-in freezer refrigeration systems manufactured starting on June 5, 2017, must satisfy the following standards:

Class descriptor	Class	Equations for minimum 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	$2.30 \times 10^{-4} \times Q + 2.73$
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

*Q represents the system gross capacity as calculated by the procedures set forth in AHRI 1250.

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