Federal Register

Friday,
January 9, 2009

# Part III

# Department of Energy

## 10 CFR Part 431

## Energy Conservation Program for Commercial and Industrial Equipment; Final Rule

**DEPARTMENT OF ENERGY**

**10 CFR Part 431**

**[Docket Number EERE–2006–BT–STD–0126]**

**RIN 1904–AB59**

# Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Commercial Ice-Cream Freezers; Self-Contained Commercial Refrigerators, Commercial Freezers, and Commercial Refrigerator-Freezers Without Doors; and Remote Condensing Commercial Refrigerators, Commercial Freezers, and Commercial Refrigerator-Freezers

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

**ACTION:** Final rule.

**SUMMARY:** The Department of Energy (DOE) is adopting new energy conservation standards for commercial ice-cream freezers; self-contained commercial refrigerators, commercial freezers, and commercial refrigerator-freezers without doors; and remote condensing commercial refrigerators, commercial freezers, and commercial refrigerator-freezers. DOE has determined that energy conservation standards for these types of equipment would result in significant conservation of energy, and are technologically feasible and economically justified.

**DATES:** The effective date of this rule is March 10, 2009. The standards established in today's final rule will be applicable starting January 1, 2012. Incorporation by reference of the material listed is approved by the Director of the Federal Register on March 10, 2009.

**ADDRESSES:** For access to the docket to read background documents, the technical support document, transcripts of the public meetings in this proceeding, or comments received, visit the U.S. Department of Energy, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, SW., 6th Floor, Washington, DC 20024, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Please call Brenda Edwards at the above telephone number for additional information regarding visiting the Resource Room. (**Note:** DOE's Freedom of Information Reading Room no longer houses rulemaking materials.) You may also obtain copies of certain previous rulemaking documents in this proceeding (*i.e.*, framework document, advance notice of proposed rulemaking, notice of proposed rulemaking), draft analyses, public meeting materials, and related test procedure documents from the Office of Energy Efficiency and Renewable Energy's Web site at *http://www.eere.energy.gov/buildings/appliance_standards/commercial/refrigeration_equipment.html*.

**FOR FURTHER INFORMATION CONTACT:**

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**SUPPLEMENTARY INFORMATION:**

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## I. Summary of the Final Rule and Its Benefits

### *A. The Standard Levels*

The Energy Policy and Conservation Act, as amended (42 U.S.C. 6291 *et seq.*; EPCA), directs the Department of Energy (DOE) to establish mandatory energy conservation standards for commercial ice-cream freezers; self-contained commercial refrigerators, commercial freezers, and commercial refrigerator-freezers without doors; and remote condensing commercial refrigerators, commercial freezers, and commercial refrigerator-freezers. (42 U.S.C. 6313(c)(4)(A)) These types of equipment are referred to collectively hereafter as ''commercial refrigeration equipment.'' Any such standard must be designed to ''achieve the maximum improvement in energy efficiency * * * which the Secretary determines is technologically feasible and economically justified.'' (42 U.S.C. 6295(o)(2)(A) and 6316(e)(1)) Furthermore, the new standard must ''result in significant conservation of energy.'' (42 U.S.C. 6295(o)(3)(B) and 6316(e)(1)) The standards in today's final rule, which apply to all commercial refrigeration equipment, satisfy these requirements.[1]

Table I–1 shows the standard levels DOE is adopting today. These standards will apply to all commercial refrigeration equipment manufactured for sale in the United States, or imported to the United States, on or after January 1, 2012.

TABLE I–1—STANDARD LEVELS FOR COMMERCIAL REFRIGERATION EQUIPMENT

| Equipment class [2] | Standard level * ** (kWh/day) *** | Equipment class | Standard level * ** (kWh/day) |
|---|---|---|---|
| VOP.RC.M | 0.82 × TDA + 4.07 | VCT.RC.I | 0.66 × TDA + 3.05 |
| SVO.RC.M | 0.83 × TDA + 3.18 | HCT.RC.M | 0.16 × TDA + 0.13 |
| HZO.RC.M | 0.35 × TDA + 2.88 | HCT.RC.L | 0.34 × TDA + 0.26 |
| VOP.RC.L | 2.27 × TDA + 6.85 | HCT.RC.I | 0.4 × TDA + 0.31 |
| HZO.RC.L | 0.57 × TDA + 6.88 | VCS.RC.M | 0.11 × V + 0.26 |
| VCT.RC.M | 0.22 × TDA + 1.95 | VCS.RC.L | 0.23 × V + 0.54 |
| VCT.RC.L | 0.56 × TDA + 2.61 | VCS.RC.I | 0.27 × V + 0.63 |
| SOC.RC.M | 0.51 × TDA + 0.11 | HCS.RC.M | 0.11 × V + 0.26 |
| VOP.SC.M | 1.74 × TDA + 4.71 | HCS.RC.L | 0.23 × V + 0.54 |
| SVO.SC.M | 1.73 × TDA + 4.59 | HCS.RC.I | 0.27 × V + 0.63 |
| HZO.SC.M | 0.77 × TDA + 5.55 | SOC.RC.L | 1.08 × TDA + 0.22 |
| HZO.SC.L | 1.92 × TDA + 7.08 | SOC.RC.I | 1.26 × TDA + 0.26 |
| VCT.SC.I | 0.67 × TDA + 3.29 | VOP.SC.L | 4.37 × TDA + 11.82 |
| VCS.SC.I | 0.38 × V + 0.88 | VOP.SC.I | 5.55 × TDA + 15.02 |
| HCT.SC.I | 0.56 × TDA + 0.43 | SVO.SC.L | 4.34 × TDA + 11.51 |
| SVO.RC.L | 2.27 × TDA + 6.85 | SVO.SC.I | 5.52 × TDA + 14.63 |
| VOP.RC.I | 2.89 × TDA + 8.7 | HZO.SC.I | 2.44 × TDA + 9. |
| SVO.RC.I | 2.89 × TDA + 8.7 | SOC.SC.I | 1.76 × TDA + 0.36 |
| HZO.RC.I | 0.72 × TDA + 8.74 | HCS.SC.I | 0.38 × V + 0.88 |

* TDA is the total display area of the case, as measured in the Air-Conditioning and Refrigeration Institute (ARI) Standard 1200–2006, Appendix D.

** V is the volume of the case, as measured in ARI Standard 1200–2006, Appendix C.

*** Kilowatt hours per day.

[2] For this rulemaking, equipment class designations consist of a combination (in sequential order separated by periods) of: (1) An equipment family code (VOP=vertical open, SVO=semivertical open, HZO=horizontal open, VCT=vertical transparent doors, VCS=vertical solid doors, HCT=horizontal transparent doors, HCS=horizontal solid doors, or SOC=service over counter); (2) an operating mode code (RC=remote condensing or SC=self contained); and (3) a rating temperature code (M=medium temperature (38 °F), L=low temperature (0 °F), or I=ice-cream temperature (−15 °F)). For example, ''VOP.RC.M'' refers to the ''vertical open, remote condensing, medium temperature'' equipment class. See discussion in section V.A.2 and chapter 3 of the TSD, market and technology assessment, for a more detailed explanation of the equipment class terminology. See Table IV–2 for a list of the equipment classes by category.

### *B. Benefits to Customers of Commercial Refrigeration Equipment*

Table I–2 indicates the impacts on commercial customers of today's standards.

TABLE I–2—IMPLICATIONS OF NEW STANDARDS FOR COMMERCIAL CONSUMERS

| Equipment class | Energy conservation standard | Total installed cost ($) | Total installed cost increase ($) | Life-cycle cost savings ($) | Payback period (years) |
|---|---|---|---|---|---|
| VOP.RC.M | 0.82 × TDA + 4.07 | 8,065 | 536 | 1,788 | 2.0 |
| VOP.RC.L | 2.27 × TDA + 6.85 | 11,222 | 1,947 | 3,938 | 2.8 |
| VOP.SC.M | 1.74 × TDA + 4.71 | 4,381 | 633 | 1,549 | 2.4 |

[1] Currently, no mandatory Federal energy conservation standards exist for the commercial refrigeration equipment covered by this rulemaking.

TABLE I–2—IMPLICATIONS OF NEW STANDARDS FOR COMMERCIAL CONSUMERS—Continued

| Equipment class | Energy conservation standard | Total installed cost ($) | Total installed cost increase ($) | Life-cycle cost savings ($) | Payback period (years) |
|---|---|---|---|---|---|
| VCT.RC.M | 0.22 × TDA + 1.95 | 11,654 | 2,134 | 2,339 | 3.9 |
| VCT.RC.L | 0.56 × TDA + 2.61 | 12,584 | 2,513 | 5,419 | 2.6 |
| VCT.SC.I | 0.67 × TDA + 3.29 | 6,602 | 1,385 | 5,217 | 1.7 |
| VCS.SC.I | 0.38 × V + 0.88 | 4,227 | 326 | 1,757 | 1.3 |
| SVO.RC.M | 0.83 × TDA + 3.18 | 7,470 | 435 | 1,274 | 1.9 |
| SVO.SC.M | 1.73 × TDA + 4.59 | 3,719 | 439 | 1,136 | 2.3 |
| SOC.RC.M | 0.51 × TDA + 0.11 | 12,740 | 240 | 945 | 1.7 |
| HZO.RC.M | 0.35 × TDA + 2.88 | 8,133 | 248 | 1,040 | 1.6 |
| HZO.RC.L | 0.57 × TDA + 6.88 | 8,194 | 270 | 1,102 | 1.6 |
| HZO.SC.M | 0.77 × TDA + 5.55 | 3,398 | 313 | 826 | 2.3 |
| HZO.SC.L | 1.92 × TDA + 7.08 | 3,836 | 460 | 1,761 | 1.7 |
| HCT.SC.I | 0.56 × TDA + 0.43 | 2,478 | 238 | 785 | 1.9 |

The economic impacts on commercial consumers (*i.e.*, the average life-cycle cost (LCC) savings) are positive for all equipment classes. For example, currently available remote condensing vertical open equipment operating at medium temperatures, semivertical equipment with those same characteristics, and vertical closed equipment with transparent doors and operating at low temperatures—three of the most common types of commercial refrigeration equipment—typically have installed prices of $8,065, $7,470 and $12,584, and annual energy costs of $1,879, $1,413, and $2,249, respectively. To meet the new standards, DOE estimates that the installed prices of such equipment will be $8,601, $7,905, and $15,097, respectively, an increase of $536, $435, and $2,513. This price increase will be offset by annual energy savings of about $331, $234, and $977.

*C. Impact on Manufacturers*

Using a real corporate discount rate of 11.5 percent, DOE estimates the industry net present value (INPV) of the commercial refrigeration equipment industry to be $540 million in 2007$. DOE expects the impact of today's standards on the industry net present value (INPV) of manufacturers of commercial refrigeration equipment to be a loss of 7.29 to 27.35 percent (−$39 million to −$148 million). Based on DOE's interviews with manufacturers of commercial refrigeration equipment, DOE expects minimal plant closings or loss of employment as a result of the standards.

*D. National Benefits*

DOE estimates the standards will save approximately 1.035 quads (quadrillion ($10^{15}$) British thermal units (Btu)) of energy over 30 years (2012–2042). This is equivalent to all the energy consumed by more than 5 million American households in a single year.

By 2042, DOE expects the energy savings from the standards to eliminate the need for approximately 0.7 new 1,000-megawatt (MW) power plants. These energy savings will result in cumulative greenhouse gas emission reductions of approximately 52.6 million tons (Mt) of carbon dioxide ($CO_2$), or an amount equal to that produced by approximately 332,500 cars every year. Additionally, the standards will help alleviate air pollution by resulting in between approximately 3.64 and 89.97 kilotons (kt) of cumulative nitrogen oxide ($NO_X$) emission reductions and between approximately 0 and 1.38 tons of cumulative mercury emission reductions from 2012 through 2042. The estimated net present values of these emissions reductions are between $0 and $469 million for $CO_2$, between $394,000 and $9.7 million for $NO_X$, and between $0 and $284,000 for mercury at a 7-percent discount rate in 2007$, discounted to 2008. At a 3-percent discount rate, the estimated net present values of these emissions reductions are between $0 and $955 million for $CO_2$, between $0.8 million and $20.5 million for $NO_X$, and between $0 and $560,000 for mercury.

The national NPV of the standards is $1.414 billion using a 7-percent discount rate and $3.930 billion using a 3-percent discount rate, cumulative from 2012 to 2062 in 2007$. This is the estimated total value of future savings minus the estimated increased equipment costs, discounted to 2008.

The benefits and costs of today's final rule can also be expressed in terms of annualized [2007$] values between 2012 and 2042. Using a 7-percent discount rate for the annualized cost analysis, the cost of the standards established in today's final rule is $95 million per year in increased equipment and installation costs, while the annualized benefits are $229 million per year in reduced equipment operating costs. Using a 3-percent discount rate, the cost of the standards established in today's final rule is $81 million per year, while the benefits of today's standards are $253 million per year.

## II. Introduction

*A. Authority*

Title III of EPCA sets forth a variety of provisions designed to improve energy efficiency. Part A of Title III (42 U.S.C. 6291–6309) provides for the Energy Conservation Program for Consumer Products Other than Automobiles. Part A–1 of Title III (42 U.S.C. 6311–6317) establishes a similar program for ''Certain Industrial Equipment,'' including commercial refrigeration equipment, the subject of this rulemaking.[3] DOE publishes today's final rule pursuant to Part A–1 of Title III, which provides for test procedures, labeling, and energy conservation standards for commercial refrigeration equipment and certain other equipment; and authorizes DOE to require information and reports from manufacturers. The test procedure for commercial refrigeration equipment appears in Title 10 Code of Federal Regulations (CFR) part 431.64.

EPCA provides criteria for prescribing new or amended standards for commercial refrigeration equipment. As indicated above, any new or amended standard for this equipment must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and

[3] This part was originally titled Part C. However, it was redesignated Part A–1 after Part B of Title III of EPCA was repealed by Public Law 109–58.

economically justified. (42 U.S.C. 6295(o)(2)(A) and 6316(e)(1)) Additionally, EPCA provides specific prohibitions on prescribing such standards. DOE may not prescribe an amended or new standard for any equipment for which DOE has not established a test procedure. (42 U.S.C. 6295(o)(3)(A) and 6316(e)(1)) Further, DOE may not prescribe an amended or new standard if DOE determines by rule that such standard would not result in ''significant conservation of energy'' or ''is not technologically feasible or economically justified.'' (42 U.S.C. 6295(o)(3)(B) and 6316(e)(1))

EPCA also provides that in deciding whether such a standard is economically justified for equipment such as commercial refrigeration equipment, DOE must, after receiving comments on the proposed standard, determine whether the benefits of the standard exceed its burdens by considering, to the greatest extent practicable, the following seven factors:

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

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

3. The total projected amount of energy savings likely to result directly from the imposition of the standard;

4. Any lessening of the utility or the performance of the products 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 conservation; and

7. Other factors the Secretary of Energy (Secretary) considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)–(ii) and 6316(e)(1))

In addition, EPCA, as amended (42 U.S.C. 6295(o)(2)(B)(iii) and 6316(e)(1)), establishes a rebuttable presumption that a standard for commercial refrigeration equipment 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 (and as applicable, water) savings during the first year that the consumer will receive as a result of the standard,'' as calculated under the test procedure in place for that standard.

EPCA further provides that the Secretary may not prescribe an amended or new standard if interested persons have established by a preponderance of the evidence that the standard is ''likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding.'' (42 U.S.C. 6295(o)(4) and 6316(e)(1))

Section 325(q)(1) of EPCA is applicable to promulgating standards for most types or classes of equipment, including commercial refrigeration equipment, that have two or more subcategories. (42 U.S.C. 6295(q)(1) and 42 U.S.C. 6316(e)(1)) Under this provision, DOE must specify a different standard level than that which applies generally to such type or class of equipment for any group of products ''which have the same function or intended use, if * * * products within such group—(A) consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard'' than applies or will apply to the other products. (42 U.S.C. 6295(q)(1)(A) and (B)) In determining whether a performance-related feature justifies such a different standard for a group of products, DOE must consider ''such factors as the utility to the consumer of such a feature'' and other factors DOE deems appropriate. (42 U.S.C. 6295(q)(1)) Any rule prescribing such a standard must include an explanation of the basis on which DOE established such a higher or lower level. (See 42 U.S.C. 6295(q)(2))

Federal energy conservation standards for commercial equipment generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c); 42 U.S.C. 6316(e)(2)–(3)) DOE can, however, grant waivers of preemption for particular State laws or regulations, in accordance with the procedures and other provisions of section 327(d) of the Act. (42 U.S.C. 6297(d); 42 U.S.C. 6316(e)(2)–(3))

*B. Background*

1. History of Standards Rulemaking for Commercial Refrigeration Equipment

As discussed in the notice of proposed rulemaking, 73 FR 50072, 50076 (August 25, 2008) (the August 2008 NOPR), the EPACT 2005 amendments to EPCA require that DOE issue energy conservation standards for the equipment covered by this rulemaking. (42 U.S.C. 6313(c)(4)(A)) The amendments also include definitions for terms relevant to this equipment (42 U.S.C. 6311(9)). These definitions provide that commercial refrigeration equipment is connected to either a self-contained condensing unit or to a remote condensing unit (42 U.S.C. 6311(9)(A)(vii)), the two condenser configurations of equipment covered by this rulemaking, and include definitions of a remote condensing unit and self-contained condensing unit (42 U.S.C. 6311(9)(E)–(F)).

DOE commenced this rulemaking on April 25, 2006, by publishing a notice of a public meeting and of the availability of its framework document for the rulemaking. 71 FR 23876. The framework document described the approaches DOE anticipated using and issues to be resolved in the rulemaking. DOE held a public meeting on May 16, 2006, to present the contents of the framework document, describe the analyses DOE planned to conduct during the rulemaking, obtain public comment on these subjects, and facilitate the public's involvement in the rulemaking. DOE also allowed the submission of written statements, after the public meeting, in response to the framework document.

On July 26, 2007, DOE published an advance notice of proposed rulemaking (ANOPR) in this proceeding. 72 FR 41161 (the July 2007 ANOPR). In the July 2007 ANOPR, DOE sought comment on its proposed equipment classes for the rulemaking, and on the analytical framework, models, and tools that DOE used to analyze the impacts of energy conservation standards for commercial refrigeration equipment. In conjunction with the July 2007 ANOPR, DOE published on its Web site the complete ANOPR TSD, which included the results of DOE's various preliminary analyses in this rulemaking. In the July 2007 ANOPR, DOE requested oral and written comments on these results and on a range of other issues. DOE held a public meeting in Washington, DC, on August 23, 2007, to present the methodology and results of the ANOPR analyses and to receive oral comments from those who attended. The oral and written comments DOE received focused on DOE's assumptions, approach, and equipment class breakdown, and were addressed in detail in the August 2008 NOPR.

In the August 2008 NOPR, DOE proposed new energy conservation standards for commercial refrigeration equipment. 73 FR 50072. In conjunction with the August 2008 NOPR, DOE also published on its Web site the complete technical support document (TSD) for the proposed rule, which incorporated the final analyses DOE conducted and technical documentation for each analysis. The TSD included the engineering analysis spreadsheets, the LCC spreadsheet, and the national impact analysis spreadsheet. The standards DOE proposed for commercial refrigeration equipment are shown in Table II–1.

TABLE II–1—AUGUST 2008 PROPOSED STANDARD LEVELS FOR COMMERCIAL REFRIGERATION EQUIPMENT

| Equipment class | Standard level* ** (kWh/day) | Equipment class | Standard level* ** (kWh/day) |
|---|---|---|---|
| VOP.RC.M | 0.82 × TDA + 4.07 | VCT.RC.I | 0.71 × TDA + 3.05 |
| SVO.RC.M | 0.83 × TDA + 3.18 | HCT.RC.M | 0.16 × TDA + 0.13 |
| HZO.RC.M | 0.35 × TDA + 2.88 | HCT.RC.L | 0.34 × TDA + 0.26 |
| VOP.RC.L | 2.28 × TDA + 6.85 | HCT.RC.I | 0.4 × TDA + 0.31 |
| HZO.RC.L | 0.57 × TDA + 6.88 | VCS.RC.M | 0.11 × V + 0.26 |
| VCT.RC.M | 0.25 × TDA + 1.95 | VCS.RC.L | 0.23 × V + 0.54 |
| VCT.RC.L | 0.6 × TDA + 2.61 | VCS.RC.I | 0.27 × V + 0.63 |
| SOC.RC.M | 0.51 × TDA + 0.11 | HCS.RC.M | 0.11 × V + 0.26 |
| VOP.SC.M | 1.74 × TDA + 4.71 | HCS.RC.L | 0.23 × V + 0.54 |
| SVO.SC.M | 1.73 × TDA + 4.59 | HCS.RC.I | 0.27 × V + 0.63 |
| HZO.SC.M | 0.77 × TDA + 5.55 | SOC.RC.L | 1.08 × TDA + 0.22 |
| HZO.SC.L | 1.92 × TDA + 7.08 | SOC.RC.I | 1.26 × TDA + 0.26 |
| VCT.SC.I | 0.73 × TDA + 3.29 | VOP.SC.L | 4.37 × TDA + 11.82 |
| VCS.SC.I | 0.38 × V + 0.88 | VOP.SC.I | 5.55 × TDA + 15.02 |
| HCT.SC.I | 0.56 × TDA + 0.43 | SVO.SC.L | 4.34 × TDA + 11.51 |
| SVO.RC.L | 2.28 × TDA + 6.85 | SVO.SC.I | 5.52 × TDA + 14.63 |
| VOP.RC.I | 2.9 × TDA + 8.7 | HZO.SC.I | 2.44 × TDA + 9 |
| SVO.RC.I | 2.9 × TDA + 8.7 | SOC.SC.I | 1.76 × TDA + 0.36 |
| HZO.RC.I | 0.72 × TDA + 8.74 | HCS.SC.I | 0.38 × V + 0.88 |

* TDA is the total display area of the case, as measured in the ARI Standard 1200–2006, Appendix D.
** V is the volume of the case, as measured in ARI Standard 1200–2006, Appendix C.

In the August 2008 NOPR, DOE identified seven issues on which is was particularly interested in receiving comments and views of interested parties: Light-emitting diode (LED) price projections, base case efficiency trends, operating temperature ranges, offset factors for smaller equipment, extension of standards developed for the 15 primary classes to the remaining 23 secondary classes, standards for hybrid cases and wedges, and standard levels. 73 FR 50134. After the publication of the August 2008 NOPR, DOE received written comments on these and other issues. DOE also held a public meeting in Washington, DC, on September 23, 2008, to hear oral comments on and solicit information relevant to the proposed rule. The August 2008 NOPR included additional background information on the history of this rulemaking. 73 FR 50076–77.

## III. General Discussion

### *A. Test Procedures*

On December 8, 2006, DOE published a final rule (the December 2006 final rule) in which it adopted American National Standards Institute (ANSI)/Air-Conditioning and Refrigeration Institute (ARI) Standard 1200–2006, ''Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets,'' as the DOE test procedure for this equipment.[4] 71 FR 71340, 71369–70; 10 CFR 431.63–431.64. ARI Standard 1200–2006 contains rating temperature specifications of 38 °F (±2 °F) for commercial refrigerators and refrigerator compartments, 0 °F (±2 °F) for commercial freezers and freezer compartments, and −5 °F (±2 °F) for commercial ice-cream freezers. The standard also requires performance tests to be conducted according to the ANSI/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 72–2005, ''Method of Testing Commercial Refrigerators and Freezers.'' In the test procedure final rule, DOE also adopted a −15 °F (±2 °F) rating temperature for commercial ice-cream freezers. 71 FR 71370. In addition, DOE adopted ANSI/Association of Home Appliance Manufacturers (AHAM) Standard HRF–1–2004, ''Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers,'' for determining compartment volumes for this equipment. 71 FR 71369–70.

[4] The Air-Conditioning and Refrigeration Institute (ARI) and the Gas Appliance Manufacturers Association (GAMA) announced on December 17, 2007, that their members voted to approve the merger of two trade associations to represent the interests of cooling, heating, and commercial refrigeration equipment manufacturers. The merged association became AHRI on January 1, 2008.

### *B. Technological Feasibility*

1. General

As stated above, any standards that DOE establishes for commercial refrigeration equipment must be technologically feasible. (42 U.S.C. 6295(o)(2)(A) and (o)(3)(B); 42 U.S.C. 6316(e)(1)) DOE considers a design option to be technologically feasible if it is in use by the respective industry or if research has progressed to the development of a working prototype. ''Technologies incorporated in commercial products or in working prototypes will be considered technologically feasible.'' 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

This final rule considers the same design options as those evaluated in the August 2008 NOPR. (See chapter 4 of the final rule TSD accompanying this notice.) All the evaluated technologies have been used (or are being used) in commercially available products or working prototypes. Therefore, DOE has determined that all of the efficiency levels evaluated in this notice are technologically feasible.

2. Maximum Technologically Feasible Levels

As required by EPCA (42 U.S.C. 6295(p)(2) and 42 U.S.C. 6316(e)(1)) in developing the August 2008 NOPR, DOE identified the energy use levels that would achieve the maximum reductions in energy use that are technologically feasible (max-tech levels) for commercial refrigeration equipment. 73 FR at 50077–78. (*See* NOPR TSD chapter 5.) DOE received comments indicating that LED efficacy had improved since the August 2008 NOPR. DOE also received comments regarding the LED lighting configurations assumed in the engineering analysis for various equipment types. This caused the max-tech levels proposed in the August 2008 NOPR to change for equipment classes with lighting. In general, the max-tech levels for open equipment classes decreased and the max-tech levels for closed cases increased from the max-tech levels proposed in the August 2008 NOPR. For today's final rule, the max-tech levels for all classes are the levels provided in Table III–1.

TABLE III–1—"MAX-TECH" ENERGY USE LEVELS

| Equipment class | "Max-tech" level (kWh/day) | Equipment class | "Max-tech" level (kWh/day) |
|---|---|---|---|
| VOP.RC.M | 0.74 × TDA + 4.07 | VCT.RC.I | 0.66 × TDA + 3.05 |
| SVO.RC.M | 0.76 × TDA + 3.18 | HCT.RC.M | 0.16 × TDA + 0.13 |
| HZO.RC.M | 0.35 × TDA + 2.88 | HCT.RC.L | 0.34 × TDA + 0.26 |
| VOP.RC.L | 2.27 × TDA + 6.85 | HCT.RC.I | 0.4 × TDA + 0.31 |
| HZO.RC.L | 0.57 × TDA + 6.88 | VCS.RC.M | 0.11 × V + 0.26 |
| VCT.RC.M | 0.22 × TDA + 1.95 | VCS.RC.L | 0.23 × V + 0.54 |
| VCT.RC.L | 0.56 × TDA + 2.61 | VCS.RC.I | 0.27 × V + 0.63 |
| SOC.RC.M | 0.4 × TDA + 0.11 | HCS.RC.M | 0.11 × V + 0.26 |
| VOP.SC.M | 1.65 × TDA + 4.71 | HCS.RC.L | 0.23 × V + 0.54 |
| SVO.SC.M | 1.65 × TDA + 4.59 | HCS.RC.I | 0.27 × V + 0.63 |
| HZO.SC.M | 0.77 × TDA + 5.55 | SOC.RC.L | 0.84 × TDA + 0.22 |
| HZO.SC.L | 1.92 × TDA + 7.08 | SOC.RC.I | 0.99 × TDA + 0.26 |
| VCT.SC.I | 0.67 × TDA + 3.29 | VOP.SC.L | 4.14 × TDA + 11.82 |
| VCS.SC.I | 0.38 × V + 0.88 | VOP.SC.I | 5.26 × TDA + 15.02 |
| HCT.SC.I | 0.56 × TDA + 0.43 | SVO.SC.L | 4.15 × TDA + 11.51 |
| SVO.RC.L | 2.27 × TDA + 6.85 | SVO.SC.I | 5.27 × TDA + 14.63 |
| VOP.RC.I | 2.89 × TDA + 8.7 | HZO.SC.I | 2.44 × TDA + 9. |
| SVO.RC.I | 2.89 × TDA + 8.7 | SOC.SC.I | 1.38 × TDA + 0.36 |
| HZO.RC.I | 0.72 × TDA + 8.74 | HCS.SC.I | 0.38 × V + 0.88 |

*C. Energy Savings*

DOE forecasted energy savings in its national energy savings (NES) analysis, through the use of an NES spreadsheet tool, as discussed in the August 2008 NOPR. 73 FR at 50078, 50101–04, 50121.

One of the criteria that governs DOE's adoption of standards for commercial refrigeration equipment is that the standard must result in "significant conservation of energy." (42 U.S.C. 6295(o)(3)(B) and 42 U.S.C. 6316(e)(1)) While EPCA does not define the term "significant," a U.S. Court of Appeals, in *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1373 (DC Cir. 1985), indicated that Congress intended "significant" energy savings in this context to be savings that were not "genuinely trivial." DOE's estimates of the energy savings for energy conservation standards at each of the trial standard levels (TSLs) in today's rule indicate that the energy savings each would achieve are nontrivial. Therefore, DOE considers these savings "significant" within the meaning of section 325 of EPCA.

*D. Economic Justification*

1. Specific Criteria

As noted earlier, EPCA provides seven factors to evaluate in determining whether an energy conservation standard for commercial refrigeration equipment is economically justified. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(e)(1)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Commercial Customers and Manufacturers

DOE considered the economic impact of the new commercial refrigeration equipment standards on commercial customers and manufacturers. For customers, DOE measured the economic impact as the change in installed cost and life-cycle operating costs, *i.e.*, the LCC. (*See* sections IV.E and VI.C.1.a, and chapter 8 of the TSD accompanying this notice.) DOE investigated the impacts on manufacturers through the manufacturer impact analysis (MIA). (*See* sections IV.I and VI.C.2, and chapter 13 of the TSD accompanying this notice.) The economic impact on commercial customers and manufacturers is discussed in detail in the August 2008 NOPR. 73 FR at 50078–79, 50095–50100, 50104–07, 50013–16, 50117–21, 50130–31.

b. Life-Cycle Costs

DOE considered life-cycle costs of commercial refrigeration equipment, as discussed in the August 2008 NOPR. 73 FR at 50078–79, 50095–50100, 50104, 50013–16, 50117–18. DOE calculated the sum of the purchase price and the operating expense—discounted over the lifetime of the equipment—to estimate the range in LCC benefits that commercial consumers would expect to achieve due to the standards.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for imposing an energy conservation standard, EPCA also requires DOE, in determining the economic justification of a proposed 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 42 U.S.C. 6316(e)(1)) As in the August 2008 NOPR, 73 FR at 50078, 50101–04, 50121, for today's final rule DOE used the NES spreadsheet results in its consideration of total projected savings that are directly attributable to the standard levels DOE considered.

d. Lessening of Utility or Performance of Equipment

In selecting today's standard levels, DOE sought to avoid new standards for commercial refrigeration equipment that would lessen the utility or performance of that equipment. (42 U.S.C. 6295(o)(2)(B)(i)(IV) and 42 U.S.C. 6316(e)(1)) 73 FR at 50079, 50088–89, 50123.

e. Impact of Any Lessening of Competition

DOE considers any lessening of competition that is likely to result from standards. Accordingly, as discussed in the August 2008 NOPR, 73 FR at 50079, 50123, DOE requested that the Attorney General transmit to the Secretary a written determination of the impact, if any, of any lessening of competition likely to result from the proposed 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) and 42 U.S.C. 6316(e)(1))

To assist the Attorney General in making such a determination, DOE provided the Department of Justice (DOJ) with copies of the August 2008 proposed rule and the TSD for review. (DOJ, No. 37 at pp. 1–2) The Attorney General's response is discussed in section VI.C.5 below, and is reprinted at the end of this rule.[5]

f. Need of the Nation To Conserve Energy

In considering standards for commercial refrigeration equipment, the Secretary must consider the need of the Nation to conserve energy. (42 U.S.C. 6295(o)(2)(B)(i)(VI) and 42 U.S.C. 6316(e)(1)) The Secretary recognizes that energy conservation benefits the Nation in several important ways. The non-monetary benefits of the standards are likely to be reflected in improvements to the security and reliability of the Nation's energy system. Today's standards also will likely result in environmental benefits. As discussed in the proposed rule, DOE has considered these factors in adopting today's standards. 73 FR 50074, 50079, 50108, 50123–26, 50132.

g. Other Factors

EPCA directs the Secretary of Energy, 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 42 U.S.C. 6316(e)(1)) In adopting today's standard, DOE considered the LCC impacts on the commercial refrigeration equipment of independent, small grocery/convenience store businesses. Compared to the impact of standards on the overall market for commercial refrigeration equipment, the impact of standards on these businesses might be disproportionate because these businesses experience both higher discount rates and lack of access to national account equipment purchases. 73 FR 50079, 50104, 50117–18.

2. Rebuttable Presumption

Section 325(o)(2)(B)(iii) of EPCA states that there is a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard 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. (42 U.S.C. 6295(o)(2)(B)(iii) and 42 U.S.C. 6316(e)(1)) DOE's LCC and payback period (PBP) analyses generate values that calculate the payback period for consumers of potential energy conservation standards, which includes, but is not limited to, the three-year payback period contemplated under the rebuttable presumption test discussed above. However, DOE routinely conducts a full economic analysis that considers the full range of impacts, including those to the consumer, manufacturer, Nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(e)(1). The results of this analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification).

## IV. Methodology and Discussion of Comments on Methodology

DOE used several analytical tools that it developed previously and adapted for use in this rulemaking. One is a spreadsheet that calculates LCC and PBP. Another tool calculates national energy savings and national NPV. DOE also used the Government Regulatory Impact Model (GRIM), along with other methods, in its MIA. Finally, DOE developed an approach using the National Energy Modeling System (NEMS) to estimate impacts of energy efficiency standards for commercial refrigeration equipment on electric utilities and the environment. The TSD appendices discuss each of these analytical tools in detail. 73 FR 50079–108.

As a basis for this final rule, DOE has continued to use the spreadsheets and approaches explained in the August 2008 NOPR. DOE used the same general methodology as applied in the August 2008 NOPR, but revised some of the assumptions and inputs for the final rule in response to stakeholder comments. The following paragraphs discuss these revisions.

*A. 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. DOE presented various subjects in the market and technology assessment for this rulemaking. (*See* the August 2008 NOPR and chapter 3 of the NOPR TSD.) These include equipment definitions, equipment classes, manufacturers, quantities and types of equipment sold and offered for sale, retail market trends, and regulatory and nonregulatory programs.

1. Definitions Related to Commercial Refrigeration Equipment

a. Air-Curtain Angle Definition

For equipment without doors, an air curtain divides the refrigerated compartment from the ambient space. DOE proposed the following definition of air-curtain angle in the August 2008 NOPR that is consistent with the industry-approved standards: ''Air-curtain angle means: (1) For equipment without doors and without a discharge air grille or discharge air honeycomb, the angle between a vertical line extended down from the highest point on the manufacturer's recommended load limit line and the load limit line itself, when the equipment is viewed in cross-section; and (2) For all other equipment without doors, the angle formed between a vertical line and the straight line drawn by connecting the point at the inside edge of the discharge air opening with the point at the inside edge of the return air opening, when the equipment is viewed in cross-section.'' 73 FR 50080; 50135. DOE did not receive any additional comments on the definition of air-curtain angle in response to the August 2008 NOPR; thus, DOE is adopting these definitions as proposed.

b. Door Angle Definition

The door orientation affects the energy consumption of equipment with doors. This equipment can be broadly categorized by the angle of the door. In the August 2008 NOPR, DOE proposed the following definition of door angle: ''(1) For equipment with flat doors, the angle between a vertical line and the

[5] A notation in the form ''DOJ, No. 37 at pp. 1–2'' identifies a written comment that DOE has received and has included in the docket of this rulemaking. This particular notation refers to (1) a comment submitted by the Department of Justice (DOJ), (2) in document number 37 in the docket of this rulemaking, and (3) appearing on pages 1 and 2 of document number 37.

line formed by the plane of the door, when the equipment is viewed in cross-section; and (2) For equipment with curved doors, the angle formed between a vertical line and the straight line drawn by connecting the top and bottom points where the display area glass joins the cabinet, when the equipment is viewed in cross-section.'' 73 FR 50080; 50135. DOE did not receive any additional comments on the definition of door angle in response to the August 2008 NOPR; thus, DOE is adopting the definition as proposed.

c. Ice-Cream Freezer Definition

During the NOPR public meeting, interested parties expressed concern about the definition of an ''ice-cream freezer'' as used in this rulemaking. Hussman stated that using the term ''ice cream'' to refer to a temperature range might be confusing because ice cream is also a product. (Hussman, Public Meeting Transcript, No. 27 at p. 15)[6] Southern Store Fixtures expressed a similar concern, adding that other types of frozen items, such as frozen juice, may be displayed in ice-cream type cases. (Southern Store Fixtures, Public Meeting Transcript, No. 27 at p. 18)

As described in the July 2007 ANOPR, the EPCA provision that required this rulemaking identifies specifically the categories ''ice-cream freezers,'' ''self-contained commercial refrigerators, freezers, and refrigerator-freezers without doors,'' and ''remote condensing commercial refrigerators, freezers, and refrigerator-freezers.'' (42 U.S.C. 6313(c)(4)(A), added by EPACT 2005, section 136(c)) Because the term ''ice-cream freezers'' was specified in EPCA, the term ''ice cream'' is appropriate to describe that specific equipment category in this rulemaking, and DOE is therefore maintaining the use of that term in the rulemaking. Also, see section IV.A.2 of this final rule.

d. Equipment Configuration Definitions

The configuration of commercial refrigeration equipment affects its energy consumption and the equipment classes into which this equipment is divided. In the August 2008 NOPR, DOE proposed five definitions of equipment configurations, shown in Table IV–1. 73 FR 50081; 50135.

TABLE IV–1—EQUIPMENT CONFIGURATION DEFINITIONS

| Equipment family | Description |
|---|---|
| Vertical Open (VOP) | Equipment without doors and an air-curtain angle ≥0 degrees and <10 degrees from the vertical. |
| Semivertical Open (SVO) | Equipment without doors and an air-curtain angle ≥10 degrees and <80 degrees from the vertical. |
| Horizontal Open (HZO) | Equipment without doors and an air-curtain angle ≥80 degrees from the vertical. |
| Vertical Closed (VC) | Equipment with hinged or sliding doors and a door angle <45 degrees. |
| Horizontal Closed (HC) | Equipment with hinged or sliding doors and a door angle ≥45 degrees. |

DOE did not receive any additional comments on the definitions of the five configurations; thus, DOE is adopting these definitions as proposed.

e. Hybrid and Wedge Case Definitions

As stated in the August 2008 NOPR, certain types of equipment meet the definition of ''commercial refrigeration equipment'' (Section 136(a)(3) of EPACT 2005), but do not fall directly into any of the 38 equipment classes defined in the market and technology assessment. Among these types are hybrid cases and wedge cases; DOE proposed definitions for these in the August 2008 NOPR. Because DOE did not receive any additional comments on the definitions of ''commercial hybrid refrigerators, freezers, and refrigerator-freezers'' or on the definition of ''wedge case,'' DOE is adopting these definitions as proposed in section 431.62.

2. Equipment Classes

Commercial refrigerators, commercial freezers, and commercial refrigerator-freezers can be divided into various equipment classes categorized largely by physical characteristics that affect energy efficiency. Some of these characteristics delineate the categories of equipment covered by this rulemaking.[7] Most affect the merchandise that the equipment can be used to display and how the customer can access that merchandise. Key physical characteristics that affect energy efficiency are the operating temperature, the presence or absence of doors (*i.e.*, closed cases or open cases), the type of doors used (*i.e.*, transparent or solid), the angle of the door or air-curtain (*i.e.*, horizontal, semivertical, or vertical), and the type of condensing unit (*i.e.*, remote or self-contained). As discussed in the August 2008 NOPR, 73 FR 50080–83, DOE is adopting equipment classes in this rulemaking by: (1) Dividing commercial refrigerators, commercial freezers, and commercial refrigerator-freezers into equipment families; (2) subdividing these families based on condensing unit configurations and rating temperature designations; and (3) identifying the resulting classes that are within each of the three equipment categories covered by this rulemaking. Because DOE did not receive any comments in response to the presentation of equipment classes in the August 2008 NOPR, DOE is adopting the equipment classes as proposed without further modification. Table IV–2 presents the equipment classes covered under this rulemaking, organized by the three equipment categories.

[6] A notation in the form ''Hussman, Public Meeting Transcript, No. 27 at p. 15'' identifies an oral comment that DOE received during the September 23, 2008, NOPR public meeting. This comment was recorded in the public meeting transcript in the docket for this rulemaking (Docket No. EE–2006–STD–0126), maintained in the Resource Room of the Building Technologies Program. This particular notation refers to a comment (1) made during the public meeting by Hussman; (2) recorded in document number 27, which is the public meeting transcript filed in the docket of this rulemaking; and (3) appearing on page 15 of document number 27.

[7] ''Commercial refrigerators, commercial freezers, and commercial refrigerator-freezers'' is a type of covered commercial equipment. For purposes of discussion only in this proceeding, DOE uses the term ''categories'' to designate groupings of ''commercial refrigeration equipment.'' The categories of equipment are: Self-contained commercial refrigerators, commercial freezers, and commercial refrigerator-freezers without doors; remote condensing commercial refrigerators, commercial freezers, and commercial refrigerator-freezers; and commercial ice-cream freezers. DOE will analyze specific equipment classes that fall within these general categories and set appropriate standards.

TABLE IV–2—COMMERCIAL REFRIGERATION EQUIPMENT CLASSES BY CATEGORY

| Equipment category | Condensing unit configuration | Equipment family | Operating temperature (°F) | Equipment class designation |
|---|---|---|---|---|
| Remote Condensing Commercial Refrigerators, Commercial Freezers, and Commercial Refrigerator-Freezers. | Remote | Vertical Open | ≥32 | VOP.RC.M |
| | | | <32 | VOP.RC.L |
| | | Semivertical Open | ≥32 | SVO.RC.M |
| | | | <32 | SVO.RC.L |
| | | Horizontal Open | ≥32 | HZO.RC.M |
| | | | <32 | HZO.RC.L |
| | | Vertical Closed Transparent | ≥32 | VCT.RC.M |
| | | | <32 | VCT.RC.L |
| | | Horizontal Closed Transparent | ≥32 | HCT.RC.M |
| | | | <32 | HCT.RC.L |
| | | Vertical Closed Solid | ≥32 | VCS.RC.M |
| | | | <32 | VCS.RC.L |
| | | Horizontal Closed Solid | ≥32 | HCS.RC.M |
| | | | <32 | HCS.RC.L |
| | | Service Over Counter | ≥32 | SOC.RC.M |
| | | | <32 | SOC.RC.L |
| Self-Contained Commercial Refrigerators, Commercial Freezers, and Commercial Refrigerator-Freezers without Doors. | Self-Contained | Vertical Open | ≥32 | VOP.SC.M |
| | | | <32 | VOP.SC.L |
| | | Semivertical Open | ≥32 | SVO.SC.M |
| | | | <32 | SVO.SC.L |
| | | Horizontal Open | ≥32 | HZO.SC.M |
| | | | <32 | HZO.SC.L |
| Commercial Ice-Cream Freezers | Remote | Vertical Open | * ≤ −5 | VOP.RC.I |
| | | Semivertical Open | | SVO.RC.I |
| | | Horizontal Open | | HZO.RC.I |
| | | Vertical Closed Transparent | | VCT.RC.I |
| | | Horizontal Closed Transparent | | HCT.RC.I |
| | | Vertical Closed Solid | | VCS.RC.I |
| | | Horizontal Closed Solid | | HCS.RC.I |
| | | Service Over Counter | | SOC.RC.I |
| | Self-Contained | Vertical Open | | VOP.SC.I |
| | | Semivertical Open | | SVO.SC.I |
| | | Horizontal Open | | HZO.SC.I |
| | | Vertical Closed Transparent | | VCT.SC.I |
| | | Horizontal Closed Transparent | | HCT.SC.I |
| | | Vertical Closed Solid | | VCS.SC.I |
| | | Horizontal Closed Solid | | HCS.SC.I |
| | | Service Over Counter | | SOC.SC.I |

* Ice-cream freezer is defined in 10 CFR 431.62 as a commercial freezer designed to operate at or below −5 °F (−21 °C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.

*B. Engineering Analysis*

The engineering analysis develops cost-efficiency relationships to show the manufacturing costs of achieving increased efficiency. As discussed in the August 2008 NOPR, DOE used the design-option approach, involving consultation with outside experts, review of publicly available cost and performance information, and modeling of equipment cost and energy consumption. 73 FR 50083–50093. Chapter 5 of the NOPR TSD contained detailed discussion of the engineering analysis methodology. In response to the August 2008 NOPR, DOE received a number of comments on the engineering analysis methodology. These comments, and DOE's response, are detailed in the following paragraphs.

1. Approach

For the NOPR, DOE adopted a design-options approach for the engineering analysis. The methodology DOE used to perform the design-option analysis is described in detail in chapter 5 of the TSD. DOE used industry-supplied data, which were developed using an efficiency-level approach, to validate DOE data. DOE received no further comments on the design-options approach and, as a result, made no changes to this methodology for the final rule.

2. Analytical Models

a. Cost Model

In the engineering analysis, DOE establishes the relationship between manufacturer production cost and energy consumption for the commercial refrigeration equipment covered in this rulemaking. In determining this relationship, DOE estimated the incremental manufacturer production costs associated with technological changes that reduce the energy consumption of the baseline models (*i.e.*, design options).

During the NOPR public meeting, the American Council for an Energy-Efficient Economy (ACEEE) stated that DOE's method of estimating manufacturer production costs based on a snapshot analysis of available engineering options is flawed, because historical data for other building technologies show that incremental costs of complying with standards have been much lower than DOE estimated. ACEEE attributed this to manufacturers redesigning their processes to meet new energy conservation standards. (ACEEE, Public Meeting Transcript, No. 27 at p. 28) AHRI disagreed with ACEEE and cited the residential central air-conditioner rulemaking as an example of where the actual cost of equipment was much higher than DOE estimated. (AHRI, Public Meeting Transcript, No. 27 at p. 29) However, ACEEE responded that this was because commodity prices increased dramatically for that equipment and that once this was accounted for, the observed price increase in baseline residential air-conditioner units was 2 percent lower than DOE's estimate. (ACEEE, Public Meeting Transcript, No. 27 at p. 30) Appliance Standards Awareness Project (ASAP) added that a retrospective analysis would be useful for helping DOE evaluate its model for predicting costs. (ASAP, Public Meeting Transcript, No. 27 at p. 31) ACEEE also commented that DOE's model for assessing the cost and value of energy conservation standards is flawed, because the model fails to account for manufacturer learning curves. Over time, the price of most equipment drops as more units are produced, regardless of the efficiency standards placed on them. Therefore, DOE's assumption that greater efficiency standards will cause equipment prices to increase is not valid. (ACEEE, No. 31 at p. 1) A comment submitted by representatives of ACEEE, Appliance Standards Awareness Project, Alliance to Save Energy, California Energy Commission, Natural Resources Defense Council, Northeast Energy Efficiency Partnerships, Northwest Power and Conservation Council, Pacific Gas and Electric Company, Sempra Energy Utilities, and Southern California Edison (hereafter referred to as the Joint Comment) agreed with ACEEE that DOE's engineering analysis methodology should take manufacturer learning curves into account. (Joint Comment, No. 34 at p. 6)

The cost-efficiency curves that DOE presented in the NOPR TSD showed incremental costs of implementing design option changes above the baseline. The cost-efficiency curves are not intended to capture future economies of scale, or other related cost reductions that may or may not result from increased cumulative production over time. DOE acknowledges that manufacturing efficiency evolves over time, but notes that earlier trends do not necessarily reflect future trends. DOE has insufficient data to project final minimized unit costs of newer technologies. DOE believes that thorough and rigorous manufacturing cost analysis based on actual equipment at all efficiency levels represents the most effective and appropriate way to estimate current and near-term incremental manufacturing costs. Therefore, DOE has used available information on existing design options in the cost-efficiency analysis.

i. LED Price Projections

DOE estimates the economic impacts of the proposed standards based on current costs of technologically feasible energy saving design options used in commercial refrigeration equipment. One such technology, which has been a focal point in this rulemaking, is solid-state lighting (*i.e.*, LEDs). For the ANOPR, DOE based LED lighting costs on a retrofit case study, but revised its assumptions for the NOPR after gathering information from LED chip and fixture manufacturers. These changes caused the original equipment manufacturer (OEM) cost (*i.e.*, the cost to commercial refrigeration equipment manufacturers) of LED fixtures to increase for both open refrigeration cases and refrigeration cases with transparent doors. Based on these revised costs, DOE tentatively rejected TSL 5 (*i.e.*, the efficiency level where LEDs were first implemented for most equipment classes) because it was not economically feasible.

However, DOE conducted a sensitivity analysis for the NOPR to gauge the effect of expected LED price reductions. That analysis estimated NPV and LCC values for equipment classes if projected LED prices were used in DOE's analysis. DOE's Multi-Year Program Plan was used to estimate the reduction in LED chip price by 2012.[8] The sensitivity analysis used an estimated reduction in LED chip price of 80 percent by 2012, which represented a 50-percent reduction in overall LED system cost, assuming the costs of the power supply and LED fixtures did not change significantly from the values used in the engineering analysis. DOE recognized that if these projected reductions were to be realized or exceeded, the economic impacts of this standard could change significantly, possibly making higher TSLs economically justified. Therefore, in the NOPR, DOE requested comment on all aspects of the LED issue, specifically soliciting any information or data that could increase confidence in the price projections.

DOE received several comments. ASAP, Natural Resources Defense Council (NRDC), Earthjustice, and the Joint Comment all expressed support for the use of DOE LED price projections. They stated that the projections are sufficiently justified and would be a more adequate basis for the standard than the assumption that LED prices will remain constant at 2007 levels. (ASAP, No. 27 at p. 100; NRDC, Public Meeting Transcript, No. 27 at p. 105; Earthjustice, Public Meeting Transcript, No. 27 at p. 106; Joint Comment, No. 34 at p. 2) Pacific Gas and Electric Company, Southern California Edison, and Sempra Energy Utilities (Southern California Gas and San Diego Gas and Electric Company) (hereafter the California Utilities Joint Comment) suggested that the DOE projections might be too conservative. (California Utilities Joint Comment, No. 41 at p. 3) ACEEE agreed, attributing this underestimation to the exclusion of scale-dependent factors. ACEEE stated that as LED production scales up, there will be greater price reductions and increased quality in terms of reproducibility. (ACEEE, No. 31 at p. 7 and Public Meeting Transcript, No. 27 at p. 111) As evidence of the validity of DOE LED cost projections, the California Utilities Joint Comment stated that LED prices have already dropped rapidly, rendering DOE analyses based on 2007 prices obsolete. It suggested that the price of LED lighting for use in refrigeration has already fallen by roughly 10 percent since 2007. (California Utilities Joint Comment, No. 41 at p. 13) The California Utilities Joint Comment also stated that LED prices will continue to drop after 2012, a fact that should be considered in the NPV analyses. (California Utilities Joint Comment, No. 41 at p. 8)

For today's final rule, DOE updated the LED costs to represent the current cost of LEDs. DOE did not receive any data providing a greater level of confidence that LED price reductions would occur. However, LED costs have decreased and the costs used in the NOPR engineering analysis no longer represent the current cost of LEDs. While considerable information is available that suggests LED prices are likely to decline by at least as much as DOE's sensitivity analysis assumed, DOE is not using this information as the basis of its analysis due to a lack of certainty about the timing and success of LED research and product development. See section V.A.2. a for more detail on the updated LED lighting assumptions.

[8] U.S. Department of Energy, Solid-State Lighting Research and Development, Multi-Year Program Plan FY'09–FY'14. This document was prepared under the direction of a Technical Committee from the Next Generation Lighting Initiative Alliance (NGLIA). Information about NGLIA and its members is available at *http://www.nglia.org.*

ii. Material Price Projections

As discussed in the August 2008 NOPR, DOE performed a sensitivity analysis to explore the effects of future LED fixture prices on commercial refrigeration equipment prices in the engineering analysis. During the NOPR public meeting, AHRI commented that if DOE were to include LED price projections in the technical analyses, equivalent actions should be taken for other materials that also have shown recent price variability (*i.e.*, refrigerants). (AHRI, Public Meeting Transcript, No. 27 at p. 102) AHRI believes commodity prices are likely to change significantly, which would affect equipment costs and change efficiency trends. AHRI cited the potential change in costs of hydrofluorocarbon refrigerants (HFCs) if pending legislation capping those refrigerants is passed. (AHRI, No. 33 at p. 3) True Manufacturing Company (True) added that the industry is already using cheaper, less efficient substitute materials to produce heat transfer devices in response to rising copper prices. (True, Public Meeting Transcript, No. 27 at p. 104)

As stated above, DOE did not use LED price projections in the final rule due to a lack of certainty about the timing and extent to which the projections would be realized. Similarly, DOE also did not include material price projections in the final rule analysis.

b. Energy Consumption Model

The energy consumption model estimates the daily energy consumption of commercial refrigeration equipment at various performance levels using a design-options approach. The model is specific to the categories of equipment covered under this rulemaking, but is sufficiently generalized to model the energy consumption of all covered equipment classes. For a given equipment class, the model estimates the daily energy consumption for the baseline and the energy consumption of several levels of performance above the baseline. The model is used to calculate each performance level separately. For the NOPR, DOE updated its radiation load calculations by revising its assumptions for the view factor and changed its calculation method for infiltration load by replacing defrost melt-water with infiltrated air. 73 FR 50086. No comments were received in response to these changes. Therefore, DOE maintained these revised calculation methodologies for the final rule.

3. Equipment Classes Analyzed

For the final rule, DOE did not make any changes to the equipment classes directly analyzed in the NOPR engineering analysis. Table IV–3 shows the 15 equipment classes DOE directly analyzed.

TABLE IV—3 EQUIPMENT CLASSES DIRECTLY ANALYZED IN THE ENGINEERING ANALYSIS

| Equipment class | Description |
|---|---|
| VOP.RC.M | Vertical Refrigerator without Doors with a Remote Condensing Unit, Medium Temperature. |
| VOP.RC.L | Vertical Freezer without Doors with a Remote Condensing Unit, Low Temperature. |
| SVO.RC.M | Semivertical Refrigerator without Doors with a Remote Condensing Unit, Medium Temperature. |
| HZO.RC.M | Horizontal Refrigerator without Doors with a Remote Condensing Unit, Medium Temperature. |
| HZO.RC.L | Horizontal Freezer without Doors with a Remote Condensing Unit, Low Temperature. |
| VCT.RC.M | Vertical Refrigerator with Transparent Doors with a Remote Condensing Unit, Medium Temperature. |
| VCT.RC.L | Vertical Freezer with Transparent Doors with a Remote Condensing Unit, Low Temperature. |
| SOC.RC.M | Service Over Counter Refrigerator with a Remote Condensing Unit, Medium Temperature. |
| VOP.SC.M | Vertical Refrigerator without Doors with a Self-Contained Condensing Unit, Medium Temperature. |
| SVO.SC.M | Semivertical Refrigerator without Doors with a Self-Contained Condensing Unit, Medium Temperature. |
| HZO.SC.M | Horizontal Refrigerator without Doors with a Self-Contained Condensing Unit, Medium Temperature. |
| HZO.SC.L | Horizontal Freezer without Doors with a Self-Contained Condensing Unit, Low Temperature. |
| VCT.SC.I | Vertical Ice-Cream Freezer with Transparent Doors with a Self-Contained Condensing Unit, Ice-Cream Temperature. |
| VCS.SC.I | Vertical Ice-Cream Freezer with Solid Doors with a Self-Contained Condensing Unit, Ice-Cream Temperature. |
| HCT.SC.I | Horizontal Ice-Cream Freezer with Transparent Doors with a Self-Contained Condensing Unit, Ice-Cream Temperature. |

4. Wedge Cases

In the August 2008 NOPR, DOE considered remote condensing and self-contained wedge cases as covered equipment.[9] DOE proposed that the calculated daily energy consumption (CDEC) or total daily energy consumption (TDEC) be measured according to the ANSI/ASHRAE Standard 72–2005 test procedure.[10] DOE also proposed that the maximum daily energy consumption (MDEC) for each model shall be the amount derived by incorporating into the standards equation for the appropriate equipment class a value for the TDA that is the product of: (1) The vertical height of the air curtain or glass (in a transparent door), and (2) the largest overall width of the case when viewed from the front. 73 FR 50113. In the NOPR, DOE sought comment regarding appropriate standard levels for wedge cases, but did not receive any comments on this specific proposal.

Hussman, Hill Phoenix, and AHRI commented that wedge cases should be excluded from this rulemaking because they are niche products that do not represent a significant part of the commercial refrigeration industry. (Hussman, No. 42 at p. 2; Hill Phoenix, No. 32 at p. 6; AHRI, No. 33 at p. 5) Hill Phoenix further states that most supermarkets and grocery stores do not use wedge cases at all, and those that do will only use a few within a store because they are much more expensive per linear foot than a standard case. (Hill Phoenix, Public Meeting Transcript, No. 27 at p. 18) Hussman further states that wedge cases use less than 0.5 percent of the total energy consumed by the supermarket industry and represent only 1.5 percent of the cases shipped. (Hussman, No. 42 at p. 2) DOE acknowledges that wedge cases are niche equipment and do not represent a significant market share in the commercial refrigeration equipment

[9] If a wedge case does not include a refrigeration component and simply serves as a miter transition piece between two other cases, then it does not meet the definition of commercial refrigeration equipment, and is not covered under this rulemaking.

[10] In the August 2008 NOPR, the test procedure cited was ANSI/ASHRAE Standard 72–2005. However, the test procedure DOE adopted into section 431.64 of 10 CFR Part 431 is ARI Standard 1200–2006, which specifically references ANSI/ASHRAE Standard 72–2005 as the method of testing commercial refrigeration equipment. 71 FR 71356 DOE notes that ARI Standard 1200–2006 would give identical test results for the measurement of energy consumption as ANSI/ASHRAE Standard 72–2005. Therefore, for today's final rule, DOE is referencing ARI Standard 1200–2006 for the measurement of CDEC and TDEC of wedge cases.

industry. However, market share is not a basis for rejecting an equipment category from consideration in the rulemaking. Therefore, DOE concludes that wedge cases are covered in this rulemaking.

Hill Phoenix and AHRI also commented that wedge cases should be excluded from this rulemaking because there are no test procedures in place to test wedges since ARI Standard 1200–2006 excludes wedges from its scope of coverage. (Hill Phoenix, No. 32 at p. 2; AHRI, No. 33 at p. 5) As stated in the July 2007 ANOPR, EPCA directs DOE to set standards for commercial refrigeration equipment (*i.e.*, the three categories of equipment identified above). Any equipment that meets the EPCA definition of a ''commercial refrigerator, freezer, or refrigerator-freezer'' and falls under one of these three categories will be covered by this rulemaking. In the December 2006 final rule, DOE incorporated by reference certain sections of ARI Standard 1200–2006 as the test procedure for commercial refrigeration equipment, but did not reference section 2.2, which provides exclusions for certain equipment such as wedge cases.[11] The equipment excluded in this section of ARI Standard 1200–2006 will only be excluded from this rulemaking if they do not meet the EPACT 2005 definition of a ''commercial refrigerator, freezer, or refrigerator-freezer.''[12] 72 FR 41169 DOE believes that the EPACT 2005 definition of a ''commercial refrigerator, freezer, or refrigerator-freezer'' is sufficiently broad that it includes wedge cases. Therefore, DOE has concluded that wedge cases are properly covered in this rulemaking.

Hussman, Hill Phoenix, and AHRI also commented that wedge cases should be excluded from this rulemaking because they do not function effectively and cannot be tested as a stand-alone merchandiser since they require straight cases of the same model on either side. This configuration makes accurate performance testing of wedges nearly impossible and no specific testing guidelines for wedges exist within ANSI/ASHRAE Standard 72–2005 or ANSI/ARI Standard 1200–6006. (Hussman, No. 42 at p. 2; Hill Phoenix, No. 32 at p. 6; AHRI, No. 33 at p. 5) DOE acknowledges that there is no specific guidance in the ANSI/ASHRAE Standard 72–2005 or ARI Standard 1200–2006 test procedures that addresses the proper operation of wedge cases. However, DOE believes that wedge cases are not significantly different from normal display cases used in between other display cases (*i.e.*, cases within a display case line-up) in terms of operation and the ability to be tested. A wedge case and a normal case within a display case line-up both have display cases adjacent to them in normal operation and do not have end panels installed on their sides. DOE expects that wedge cases and cases within a display case line-up should be tested in the same manner under the test procedure.

Hussman and Hill Phoenix also commented that wedge cases should be excluded from this rulemaking because the TDA for inside wedges approaches zero. Therefore, standards for such cases are not meaningful because the TDA in the standards equation is zero. (Hussman, Public Meeting Transcript, No. 27 at p. 16; Hill Phoenix, Public Meeting Transcript, No. 27 at p. 19) As stated above, DOE proposed language in the August 2008 NOPR to specifically address the TDA issue of wedge cases. DOE proposed that for remote condensing and self-contained wedge cases, the CDEC or TDEC shall be measured according to the ANSI/ASHRAE Standard 72–2005 Test Procedure. DOE also proposed that the MDEC for each model shall be the amount derived by incorporating into the standards equation for the appropriate equipment class a value for the TDA that is the product of: (1) The vertical height of the air curtain or glass (in a transparent door), and (2) the largest overall width of the case, when viewed from the front.[10] 73 FR 50113. (See section VI.A.1.) This procedure is conservative because it allows for the widest horizontal dimension of the display case to be used in determining TDA. That is, using this procedure, the standards for a wedge case would be less stringent than a normal display case, in the same equipment class, of equal refrigerated volume.

If a manufacturer finds that meeting the standard for wedge cases would cause hardship, inequity, or unfair distribution of burdens, the manufacturer may petition 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.

5. Ice-Cream Freezers—Temperature Range

In the test procedure final rule for commercial refrigeration equipment, DOE established the definition of ice-cream freezer as ''a commercial freezer that is designed to operate at or below −5 °F (−21 °C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.'' 71 FR 71369–70. DOE incorporated the test procedure into its regulations in 10 CFR 431.62. Under this definition, unless equipment is designed, marketed, or intended specifically for the storage, display or dispensing of ice cream, it would not be considered an ice-cream freezer. For example, multi-purpose commercial freezers manufactured for storing and displaying frozen foods in addition to ice cream and designed to operate at or below −5 °F (−21 °C) would not meet this definition. Thus, DOE would not treat them as commercial ice-cream freezers in this rulemaking. However, any commercial freezer that is specifically manufactured for storing, displaying, or dispensing ice cream and is designed for normal operation at or below −5 °F would meet the definition. Other equipment that meet the definition include freezers designed to operate considerably below −5 °F and are specifically designed for ice cream storage (*e.g.*, ''hardening'' cabinets), as well as ice-cream dipping cabinets designed to operate below −5 °F. For the NOPR, DOE expanded the definition used to categorize a unit's rating temperature by including a specific operating temperature range for medium-temperature, low-temperature, and ice-cream temperature applications.

Hill Phoenix and AHRI commented on the proposed temperature ranges for low-temperature and ice-cream temperature freezers. Hill Phoenix, in agreement with AHRI, stated that the operating range for low-temperature

[11] ARI Standard 1200–2006 refers to wedge cases as ''miter transition display merchandisers used as a corner section between two refrigerated display merchandisers.''

[12] ''(9)(A) The term 'commercial refrigerator, freezer, and refrigerator-freezer' means refrigeration equipment that—

(i) Is not a consumer product (as defined in section 321of EPCA [42 U.S.C. 6291(1)]);

(ii) Is not designed and marketed exclusively for medical, scientific, or research purposes;

(iii) Operates at a chilled, frozen, combination chilled and frozen, or variable temperature;

(iv) Displays or stores merchandise and other perishable materials horizontally, semivertically, or vertically;

(v) Has transparent or solid doors, sliding or hinged doors, a combination of hinged, sliding, transparent, or solid doors, or no doors;

(vi) Is designed for pull-down temperature applications or holding temperature applications; and

(vii) Is connected to a self-contained condensing unit or to a remote condensing unit.'' (42 U.S.C. 6311(9)(A)) cases should be changed to less than 32 °F and greater than −15 °F, and the operating range for ice-cream temperature cases be changed to less than or equal to −15 °F. Hill Phoenix and AHRI stated that freezers that operate below −15 °F are constructed differently than cases that operate in the −5 °F to −10 °F range. Hill Phoenix stated that DOE's current temperature range designations would require freezers that operate in the −5 °F to −10 °F range to be rated at −15 °F. (Hill Phoenix, No. 32 at p. 4; AHRI, No. 33 at p. 4)

As previously stated, ice-cream freezers are defined by the test procedure, which states that an ice-cream freezer is ''a commercial freezer that is designed to operate at or below −5 °F (−21 °C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.'' 71 FR 71369; 10 CFR 431.62. Based on the comments from AHRI and Hill Phoenix discussed above, DOE is modifying the operating temperature ranges used to define each type of equipment from the temperature ranges that were used in the NOPR. For today's final rule, DOE is organizing equipment classes based on the three operating temperature ranges shown in Table IV–4. For today's final rule, DOE will continue to classify equipment as medium temperature (refrigerators), low temperature (freezers), or ice-cream temperature (ice-cream freezers). Furthermore, DOE maintains the required rating temperatures as specified in the test procedure final rule: 38 °F (±2 °F) for commercial refrigerators and refrigerator compartments, 0 °F (±2 °F) for commercial freezers and freezer compartments, and −15 °F (±2 °F) for commercial ice-cream freezers. 71 FR 71370.

TABLE IV–4—RATING TEMPERATURE DESIGNATIONS

| Operating temperature (°F) | Rating temperature (°F) | Description |
|---|---|---|
| ≥32 (M) | 38 | Medium temperature (refrigerators). |
| <32 (L) | 0 | Low temperature (freezers). |
| ≤−5 (I)* | −15 | Ice-cream temperature (ice-cream freezers). |

* Ice-cream freezer is defined in 10 CFR 431.62 as a commercial freezer that is designed to operate at or below −5 °F (−21 °C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.

6. Special Application Temperature Cases

After the NOPR public meeting, DOE received comments on including ''application temperatures'' for commercial refrigeration equipment. These are rating temperatures other than the standard rating temperatures. Hill Phoenix stated that some refrigerated cases are designed for and operate at medium temperature and hold foods with temperature requirements that tend to range from 10 °F to 20 °F. These cases are not designed to operate at the rating temperature of 0 °F. Hill Phoenix also stated that the cases would have to be redesigned to operate at the rating temperature, which would cause them to consume more energy. Therefore, Hill Phoenix recommended that this type of product be tested using the application temperature at which the product is designed to perform, but be required to meet the low-temperature standard. (Hill Phoenix, No. 32 at p. 4) AHRI concurred with Hill Phoenix, recommending that any case designed specifically to hold products at temperatures higher than the rating temperature specified for that class be tested at its application temperature and must meet the energy standards of that class. (AHRI, No. 33 at p. 5) However, the Joint Comment cautioned that rating specialty cases at application temperatures could create loopholes allowing equipment to be tested at an application temperature different from the temperature at which the equipment is designed to operate in the field. (Joint Comment, No. 34 at p. 4)

In the test procedure final rule for commercial refrigeration equipment, DOE adopted ARI Standard 1200–2006 as the DOE test procedure for commercial refrigeration equipment. 71 FR 71340, 71369–70; 10 CFR 431.63–431.64. ANSI/ARI Standard 1200–2006 contains rating temperature specifications of 38 °F (±2 °F) for commercial refrigerators and refrigerator compartments, and 0 °F (±2 °F) for commercial freezers and freezer compartments. In the test procedure final rule, DOE also adopted a −15 °F (±2 °F) rating temperature for commercial ice-cream freezers. 71 FR 71370.

Requiring manufacturers to test special application cases at one of the three specified standard rating temperatures (38 °F, 0 °F, and −15 °F) instead of at their corresponding application temperature could result in higher energy consumption for these cases if they have to be redesigned for testing at the standard rating temperature. However, DOE agrees with the Joint Comment that allowing such special application cases to be tested at an application temperature that is different from the temperature at which the equipment is designed to operate in the field could create loopholes. Therefore, DOE is maintaining the requirement that all equipment must be tested at one of the three specified standard rating temperatures adopted by DOE in the test procedure final rule. In the example from Hill Phoenix, the equipment is classified as a medium-temperature unit, but the equipment is designed to operate below 32 °F and above −5 °F, thus categorizing it as a low-temperature unit under today's final rule. Because it is a low-temperature unit, it is required to be tested at 0 °F (±2 °F).

Any manufacturer that is unable to test such equipment at its designated rating temperature must request a test procedure waiver from DOE under the provisions described in 10 CFR 431.401. If the manufacturer believes that meeting the standard would cause hardship, inequity, or unfair distribution of burdens, it may petition OHA for exception relief from the energy conservation 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. However, the majority of equipment covered by this rulemaking can be tested using the three specified rating temperatures provided in the test procedure.

7. Coverage of Remote Condensing Units

In the framework document, ANOPR, and NOPR, DOE considered energy conservation standards that covered only the refrigerated cases of remote condensing commercial refrigeration equipment, and not the remote condensing unit. DOE cited language in EPACT 2005's definitions for ''self contained condensing unit'' and ''remote condensing unit'' as a justification for this approach. DOE believes that, by definition, the remote condensing units that support remote condensing refrigeration equipment are not considered an ''integral part'' of the refrigeration equipment. (EPACT 2005, Section 136(a)(3)) As a result, DOE stated in the August 2008 NOPR that remote condensing units would not be considered in this rulemaking.

For the NOPR, the Joint Comment stated that the scope of this rulemaking should not be limited to the refrigerated cabinets or display cases of remote condensing systems. According to the Joint Comment, regulating the remote condensing units supporting these cabinets has a significant potential to save energy because these units account for 90 percent of the total capacity of commercial refrigeration equipment subject to this rulemaking. (Joint Comment, No. 34 at p. 7)

As stated in the framework document and the July 2007 ANOPR, DOE does not believe that the remote condensing units of remote condensing refrigeration equipment systems are considered part of the equipment to which they are connected. EPCA defines a ''self-contained condensing unit,'' in part, as an ''assembly of refrigerating components that is an integral part of the refrigerated equipment * * *'' (42 U.S.C. 6311(9)(F), added by EPACT 2005, section 136(a)(3)). EPCA also defines a ''remote condensing unit,'' in part, as an ''assembly of refrigerating components that is remotely located from the refrigerated equipment * * *'' (42 U.S.C. 6311(9)(E), added by EPACT 2005, section 136(a)(3)) The EPCA definition of remote condensing unit implies that the remote condensing unit is not part of the refrigeration equipment because it refers to the unit and the refrigeration equipment as separate entities. A remote condensing unit functions as a supplement to remote condensing refrigeration equipment, but is not an ''integral part.'' Therefore, energy conservation standards for remote condensing commercial refrigerators, commercial freezers, and commercial refrigerator-freezers apply only to the refrigerated equipment (*i.e.*, storage cabinets and display cases), but not to the remote condensing units. For the final rule, DOE maintains that the energy conservation standards set for remote condensing commercial refrigeration equipment only apply to display cases, not to the remote condensing units.

However, DOE has the authority to classify industrial or commercial equipment as covered under EPCA section 341(a) and (b), if classification is ''necessary'' to improve the efficiency of industrial equipment (which includes commercial refrigeration equipment) in order to conserve energy. (42 U.S.C. 6312(a) and (b)) If DOE were to add remote condensing units as covered equipment, DOE would undertake a separate rulemaking process to consider standards for these products in accordance with EPCA section 341(a) and (b).

8. Regulating Secondary Cooling Applications

In the framework document, DOE decided to exclude equipment designed for secondary coolant applications. DOE's interpretation of the EPACT 2005 definitions of ''commercial refrigerator, freezer, and refrigerator-freezer'' was consistent with the ARI Standard 1200–2006, which explicitly excludes secondary coolant applications. Following the framework document, many interested parties, including ARI, Southern Company, and EEI, agreed with the exclusion of secondary coolant applications in this rule because of their insignificant presence in the market and the complexity of modifying the test procedure to accommodate them. ACEEE, on the other hand, commented that DOE should have a broad scope of coverage and should, in general, cover as much as possible in the rulemaking. 72 FR 41171.

After considering the framework comments, DOE decided to continue to exclude secondary coolant applications from this rulemaking in the July 2007 ANOPR. Following the ANOPR, commercial refrigeration manufacturers expressed concerns that the exclusion of secondary coolant systems could provide a loophole if customers purchased these lower efficiency systems instead of regulated direct expansion equipment. 73 FR 50106. For the NOPR, the Joint Comment restated that DOE should consider secondary coolant applications in its analysis. (Joint Comment, No. 34 at p. 8)

Section 340(9)(A)(vii) of EPCA (42 U.S.C. 6311(9)(A)(vii), added by EPACT 2005, section 136(a)(3)) states that the terms commercial refrigerator, freezer, and refrigerator-freezer refer to equipment that is connected to a self-contained condensing unit or to a remote condensing unit. DOE maintains that this language excludes secondary coolant applications from coverage in this rulemaking because such applications are not directly connected to self-contained or remote condensing units. 72 FR 41171. For this reason, DOE is excluding secondary coolant applications from this rule.

*C. Markups To Determine Equipment Price*

In the August 2008 NOPR, DOE explained how it developed the distribution channel markups it used. 73 FR 50093–95. DOE did not receive comments on these markups. However, DOE updated the distribution channel markups by including 2008 sales tax data, and updated the markups for commercial refrigeration equipment wholesalers using 2008 financial data. DOE used these markups, along with sales taxes, installation costs, and manufacturer selling prices (MSPs) developed in the engineering analysis, to arrive at the final installed equipment prices for baseline and higher efficiency commercial refrigeration equipment. As explained in the August 2008 NOPR, 73 FR 50093–95, DOE defined three distribution channels for commercial refrigeration equipment to describe how the equipment passes from the manufacturer to the customer. DOE developed market shares by distribution channel for remote condensing and self-contained equipment. DOE retained the same distribution channel market shares described in the August 2008 NOPR.

The new overall baseline and incremental markups for sales to supermarkets within each distribution channel are shown in Table IV–5, Table IV–6, Table IV–7, and Table IV–8. Chapter 6 of the TSD provides additional details on markups.

TABLE IV–5—BASELINE MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX FOR SELF-CONTAINED EQUIPMENT IN SUPERMARKETS

| | Wholesaler | Mechanical contractor (includes wholesaler) | National account (manufacturer-direct) | Overall |
|---|---|---|---|---|
| Distributor(s) Markup | 1.370 | 2.082 | 1.185 | 1.564 |
| Sales Tax | 1.069 | 1.069 | 1.069 | 1.069 |

TABLE IV–5—BASELINE MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX FOR SELF-CONTAINED EQUIPMENT IN SUPERMARKETS—Continued

| | Wholesaler | Mechanical contractor (includes wholesaler) | National account (manufacturer-direct) | Overall |
|---|---|---|---|---|
| Overall Markup | 1.465 | 2.226 | 1.267 | 1.672 |

TABLE IV–6—BASELINE MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX FOR REMOTE CONDENSING EQUIPMENT IN SUPERMARKETS

| | Wholesaler | Mechanical contractor (includes wholesaler) | National account (manufacturer-direct) | Overall |
|---|---|---|---|---|
| Distributor(s) Markup | 1.370 | 2.082 | 1.185 | 1.347 |
| Sales Tax | 1.069 | 1.069 | 1.069 | 1.069 |
| Overall Markup | 1.465 | 2.226 | 1.267 | 1.440 |

TABLE IV–7—INCREMENTAL MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX FOR SELF-CONTAINED EQUIPMENT IN SUPERMARKETS

| | Wholesaler | Mechanical contractor (includes wholesaler) | National account (manufacturer-direct) | Overall |
|---|---|---|---|---|
| Distributor(s) Markup | 1.114 | 1.370 | 1.057 | 1.186 |
| Sales Tax | 1.069 | 1.069 | 1.069 | 1.069 |
| Overall Markup | 1.191 | 1.465 | 1.130 | 1.268 |

TABLE IV–8—INCREMENTAL MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX FOR REMOTE CONDENSING EQUIPMENT IN SUPERMARKETS

| | Wholesaler | Mechanical contractor (includes wholesaler) | National account (manufacturer-direct) | Overall |
|---|---|---|---|---|
| Distributor(s) Markup | 1.114 | 1.370 | 1.057 | 1.112 |
| Sales Tax | 1.069 | 1.069 | 1.069 | 1.069 |
| Overall Markup | 1.191 | 1.465 | 1.130 | 1.189 |

### *D. Energy Use Characterization*

The energy use characterization estimates the annual energy consumption of commercial refrigeration equipment systems (including remote condensing units). This estimate is used in the subsequent LCC and PBP analyses (chapter 8 of the TSD) and NIA (chapter 11 of the TSD). For the August 2008 NOPR, DOE estimated the energy consumption of the 15 equipment classes analyzed in the engineering analysis (chapter 5 of the NOPR TSD) using the relevant test procedure. DOE then validated these energy consumption estimates with annual whole-building simulation modeling of selected equipment classes and efficiency levels. 73 FR 50095. For the final rule analyses, DOE used the same methodology to estimate the annual energy consumption of commercial refrigeration systems presented in the August 2008 NOPR. *See* chapter 7 of the TSD for additional detail on the energy use characterization.

DOE assumed for the energy analysis 24-hour operation of case lighting based on input received during the ANOPR. The California Utilities Joint Comment stated that while many grocers in California may shut down case lighting for 8 hours per day, national trends may be closer to 24-hour operation. (California Utilities Joint Comment, No. 41 at p. 12) The California Utilities Joint Comment also indicated that LED lighting may be more likely to be controlled on and off during the operational day or dimmed based on motion sensors, and that this can be done without the risk of moisture or startup problems common to fluorescent fixtures. They further speculated that retailers would take advantage of these LED characteristics through different operational scenarios. (California Utilities Joint Comment, No. 41 at p. 12) However, they provided no data to indicate the likelihood of a different LED usage profile, and did not provide costs to implement automatic or manual control to support this comment. While the potential for additional lighting controls exists and LEDs may offer additional controllability, the actual likelihood and costs of implementation are unknown. As a result, DOE did not change its default assumption of 24-hour operation based on these comments. Additional detail on the energy use characterization can be found in chapter 7 of the TSD.

### *E. Life-Cycle Cost and Payback Period Analyses*

In response to the requirements of section 325(o)(2)(B)(i) of EPCA, DOE conducted LCC and PBP analyses to evaluate the economic impacts of possible new commercial refrigeration equipment standards on individual customers. DOE used the same spreadsheet models to evaluate the LCC and PBP as it used for the NOPR; however, DOE updated certain specific inputs to the models. Details of the spreadsheet model and of all the inputs to the LCC and PBP analyses are in TSD chapter 8. DOE conducted the LCC and PBP analyses using a spreadsheet model developed in Microsoft Excel for Windows 2003.

The LCC is the total cost for a unit of commercial refrigeration equipment over the life of the equipment, including purchase and installation expense and operating costs (energy expenditures and maintenance). To compute the LCC, DOE summed the installed price of the equipment and its lifetime operating costs discounted to the time of purchase. The PBP is the change in purchase expense due to a given energy conservation standard divided by the change in first-year operating cost that results from the standard. DOE expresses PBP in years. DOE measures the changes in LCC and in PBP associated with a given energy use standard level relative to a base case equipment energy use. The base case forecast reflects the market in the absence of mandatory energy conservation standards.

The data inputs to the PBP calculation are the purchase expense (otherwise known as the total installed customer cost or first cost) and the annual operating costs for each selected design. The inputs to the equipment purchase expense were the equipment price and the installation cost, with appropriate markups. The inputs to the operating costs were the annual energy consumption, the electricity price, and the repair and maintenance costs. The PBP calculation uses the same inputs as the LCC analysis but, because it is a simple payback, the operating cost is for the year the standard takes effect, assumed to be 2012. For each efficiency level analyzed, the LCC analysis required input data for the total installed cost of the equipment, the operating cost, and the discount rate.

Table IV–9 summarizes the inputs and key assumptions DOE used to calculate the economic impacts of various energy consumption levels on customers. Equipment price, installation cost, and baseline and standard design selection affect the installed cost of the equipment. Annual energy use, electricity costs, electricity price trends, and repair and maintenance costs affect the operating cost. The effective date of the standard, the discount rate, and the lifetime of equipment affect the calculation of the present value of annual operating cost savings from a proposed standard. Table IV–9 also shows how DOE modified these inputs and key assumptions for the final rule, relative to the August 2008 NOPR. The changes in the input data and the discussion of the overall approach to the LCC analysis are provided in chapter 8 of the TSD.

TABLE IV–9—SUMMARY OF INPUTS AND KEY ASSUMPTIONS USED IN THE LCC AND PBP ANALYSES

| Input | NOPR description | Changes for final rule |
|---|---|---|
| Baseline Manufacturer Selling Price. | Price charged by manufacturer to either a wholesaler or large customer for baseline equipment. Developed by using industry-supplied efficiency level data and a design option analysis. | Data reflect updated engineering analysis. |
| Standard-Level Manufacturer Selling Price Increases. | Incremental change in manufacturer selling price for equipment at each of the higher efficiency standard levels. Developed by using a combination of energy consumption level and design option analyses. | Data reflect updated engineering analysis. |
| Markups and Sales Tax | Associated with converting the manufacturer selling price to a customer price (chapter 6 of TSD). Developed based on product distribution channels and sales taxes. | Markups updated based on revised data on sales tax and wholesaler financial data. |
| Installation Price | Cost to the customer of installing the equipment. This includes labor, overhead, and any miscellaneous materials and parts. The total installed cost equals the customer equipment price plus the installation price. Installation cost data provided by industry comment. | No change. |
| Equipment Energy Consumption. | Site energy use associated with the use of commercial refrigeration equipment, which includes only the use of electricity by the equipment itself. Taken from engineering analysis and validated in energy use characterization. (chapter 7 of the TSD). | Data reflect updated engineering analysis for each efficiency level. |
| Electricity Prices | Established average commercial electricity price ($/kWh) from EIA data for 2007, in 2007$. DOE then established scaling factors for commercial refrigeration equipment consumers based on the 2003 *Commercial Building Energy Consumption Survey*. | No change. |
| Electricity Price Trends | Used the *AEO2007* reference case to forecast future electricity prices and extrapolated prices to 2042. | Updated to *AEO2008*. |
| Maintenance Costs | Labor and material costs associated with maintaining the commercial refrigeration equipment (*e.g.*, cleaning heat exchanger coils, checking refrigerant charge levels, lamp replacement). Estimated from data in RS Means Facilities Maintenance and Repair Cost Data.[13] Also considered lighting types and configurations for the refrigeration equipment. | No change in methodology; however, LED fixture replacement costs reflect updated engineering analysis costs by equipment class. |

[13] RS Means Company, Inc., 2006. Means Costworks 2006: Facility Maintenance & Repair Cost Data. Kingston, Massachusetts.

TABLE IV–9—SUMMARY OF INPUTS AND KEY ASSUMPTIONS USED IN THE LCC AND PBP ANALYSES—Continued

| Input | NOPR description | Changes for final rule |
| --- | --- | --- |
| Repair Costs | Labor and material costs associated with repairing or replacing components that have failed. Estimated based on replacement frequencies and costs for key components. | No change in methodology from NOPR. Repair costs reflect estimates of individual component life and cost to replace. Repair costs increase with increasing component costs. |
| Equipment Lifetime | Age at which the commercial refrigeration equipment is retired from service. Used an average lifetime of 10 years for large grocery and multi-line retailers and an average lifetime of 15 years for small grocers and convenience stores. | No change. |
| Discount Rate | Computed by estimating the cost of capital for companies that purchase refrigeration equipment using business financial data from the Damodaran Online database. | Updated based on data available in the 2008 version of the Damodaran Web site. |
| Rebound Effect | A rebound effect was not taken into account in the LCC analysis. | No change. |

The changes in the input data and the discussion of the overall approach to the LCC analysis are provided in chapter 8 of the TSD.

In response to the NOPR, DOE received comments on two key issues affecting the LCC analysis: electricity price forecasts and lighting maintenance costs. Regarding electricity price forecasts, ACEEE asked DOE to confirm whether the Energy Information Administration (EIA) electricity price forecasts take into account well-documented regulatory-based changes in electricity prices and are not just based on responses to fuel cost forecasts. (ACEEE, Public Meeting Transcript, No. 27 at p. 82) In response, DOE notes that the EIA electricity price forecasts are developed through NEMS modeling and rely on a comprehensive series of supply- and demand-based modules integrated to capture the market dynamics for various energy sources, including oil, coal, and natural gas. These models also capture a wide range of consumption purposes, including such events as changes in the price and supplies of fossil fuels, developments in electricity markets, likely improvements in technology, and the impact of economic growth and various other regulatory impacts that affect market electricity prices. NEMS is regularly used to provide analyses to Congress and DOE. DOE believes that NEMS does attempt to capture many known regulatory changes.

The Joint Comment stated that DOE should use forecasts for electricity prices other than the Annual Energy Outlook (*AEO*), and that electricity price mitigation effects of the proposed standard must be documented. (Joint Comment, No. 34 at p. 6) This comment addresses both the LCC and NIA analyses. While DOE considers *AEO2008* reference case forecasts in its central case fuel price scenario, DOE reviewed LCC and PBP results based on both the *AEO2008* high price and low price electricity forecasts and discusses the resulting differences in the TSD. While the Joint Comment suggests that DOE consider other forecasts, it does not point to specific forecast sources or provide justification for the selection or weighting of one forecast over the other. The *AEO2008* high price forecast used in the commercial refrigeration equipment analysis provides sufficient insight into probable commercial electricity price variation based on existing data and current regulatory schemes.

DOE considered reporting electricity price impacts but found that the uncertainty of price projections, together with the fairly small impact of the standards relative to total electricity demand, makes these price changes highly uncertain. As a result, they should not be weighed heavily in the decision about the standard level. Given the current complexity of utility regulation in the United States (with significant variances among states), it does not seem appropriate to attempt to measure impacts on infrastructure costs and prices where there is likely to be significant overlap.

DOE develops estimates for repair and maintenance costs for commercial refrigeration equipment in the LCC analysis. In the August 2008 NOPR, DOE assumed that maintenance costs are constant and do not vary with time. AHRI commented that the costs of maintenance do not remain constant, as the cost of HFC refrigerants is expected to increase by 300 percent to 400 percent over the next decade. (AHRI, No. 33 at p. 6) DOE recognizes that refrigerant costs may increase. For remote condensing equipment, leakage during maintenance occurs throughout the entire refrigeration system, including store refrigeration piping and remote condensing units, and is expected to be approximately the same for all standard levels since little refrigerant is stored in the evaporator coils of remote-condensing commercial refrigeration equipment. The law also requires that any HFC refrigerant removed during maintenance must be captured (recovered), and in supermarkets it is often reused within the supermarket chain. 69 FR 11946. Any loss of refrigerant during maintenance is essentially the same at all standard levels analyzed, and therefore does not affect the results of DOE's LCC or NPV analysis. In self-contained equipment, the refrigeration system is sealed and little leakage is expected to occur over the life of the equipment. Consequently, DOE did not revise the maintenance costs from the NOPR to account for future changes in refrigerant costs.

DOE also included in the maintenance costs the cost of necessary lighting component replacements over the life of the commercial refrigeration equipment. DOE received comments on the lighting maintenance costs assumption for LED lamp fixtures. The California Utilities Joint Comment cited evidence from recent assessments, as well as the physical properties of LEDs, suggesting that 50,000 hours is likely a conservative estimate. Fixtures may actually be replaced less frequently than the 5.7 years assumed in the NOPR analysis. (California Utilities Joint Comment, No. 41 at pp. 10–11) The comment noted that the LED light output degrades over time and the amount of degradation is a function of the junction temperature of the LED. Reducing the junction temperature can result in increased time to failure.

While DOE agrees with this assessment, the brightness of a particular LED chip and the corresponding heat rejection and junction temperature are largely a function of power supplied by the LED driver circuitry. As such, manufacturers of LED fixtures can trade off brightness, total fixture cost, and design life for LED fixtures designed for commercial refrigeration equipment applications. The LED manufacturer equipment specification sheets that DOE examined for the final rule provide for a 50,000-hour life for the known commercial refrigeration equipment applications. Due to the recent availability of LED fixtures for use with commercial refrigeration equipment, there are few instances of installed LED light fixtures in this equipment exceeding the 50,000-hour specification. Therefore, DOE did not modify its LED fixture replacement cycle assumptions beyond the manufacturers' estimated life.

DOE also received comments on using a rebuttable presumption payback period to establish the economic justification of an energy conservation standard level. Earthjustice commented that DOE does not provide any rationale for why it did not use or does not plan to use the rebuttable presumption payback period analysis to set the trial standard level for these products. Earthjustice stated that Congress specifically provided that once the rebuttable presumption payback period is satisfied for a trial standard level, no further economic justification would be necessary for DOE's selection of that TSL as the final standard. (Earthjustice, Public Meeting Transcript, No. 27 at p. 88) The Joint Comment also stated that DOE should give greater consideration to the rebuttable presumption payback period when selecting an appropriate standard level, reflecting the intent of Congress in 42 U.S.C. section 6295(o)(2)(B)(iii) that the highest standard level with a 3-year payback constitutes the presumptive lowest standard level that DOE must adopt. (Joint Comment, No. 34 at pp. 3–4)

DOE does consider both the rebuttable presumption payback criteria, as well as a full analysis including all seven relevant statutory criteria under 42 U.S.C. 6295(o)(2)(B)(i), when examining potential standard levels. DOE believes that the commenters may be misinterpreting the statutory provision in question. Earthjustice presents one possible reading of an ambiguous provision (*i.e.*, that DOE need not look beyond the results of the rebuttable presumption inquiry), but DOE believes that such an approach is neither required nor appropriate, because it could ask the agency to ignore other relevant information that would affect the selection of the most stringent standard level that meets all applicable statutory criteria. The commenter's interpretation would essentially restrict DOE from being able to rebut the findings of the preliminary presumptive analysis. However, the statute contains no such restriction, and such an approach would hinder DOE's efforts to base its regulations on the best available information.

Similarly, DOE believes that the Joint Comment misreads the statute in calling for a level that meets the rebuttable presumption test to serve as a minimum level when setting the final energy conservation standard. To do so would not only eliminate the ''rebuttable'' aspect of the presumption but would also lock in place a level that may not be economically justified based on the full complement of statutory criteria. DOE is already obligated under EPCA to select the most stringent standard level that meets the applicable statutory criteria, so there is no need to tie the same requirement to the rebuttable presumption.

DOE also received a comment supporting its selection of commercial refrigeration equipment lifetimes. For the NOPR, DOE determined the lifetime of commercial refrigeration equipment by consulting industry experts, other interested parties, and literature on equipment lifetimes. The Joint Comment stated that DOE's assumptions in the NOPR regarding product life are reasonable. (Joint Comment, No. 34 at p. 2) Therefore, DOE has maintained the NOPR assumptions regarding product life for the final rule.

*F. Shipments Analysis*

The shipments analysis develops future shipments for each class of commercial refrigeration equipment based on current shipments and equipment life assumptions, and takes into account the existing stock and expected growth of buildings using commercial refrigeration equipment. DOE received no comments on the shipments analysis or the resulting shipments during the NOPR. Therefore, DOE used the same shipments model for the final rule analysis as the NOPR.

*G. National Impact Analysis*

The national impact analysis (NIA) assesses future NES and the national economic impacts of different efficiency levels. The analysis measures economic impacts using the NPV metric (*i.e.*, future amounts discounted to the present) of total commercial customer costs, and savings expected to result from new standards at specific efficiency levels. For the final rule analysis, DOE used the same spreadsheet model used in the NOPR to calculate the energy savings and the national economic costs and savings from new standards, but with updates to specific input data. Unlike the LCC analysis, the NES spreadsheet does not use distributions for inputs or outputs. DOE examined sensitivities by applying different scenarios. DOE used the NES spreadsheet to perform calculations of national energy savings and NPV using the annual energy consumption and total installed cost data from the LCC analysis and estimates of national shipments for each of the 15 primary commercial refrigeration equipment classes. DOE forecasted the energy savings from each TSL from 2012 through 2042. DOE forecasted the energy cost savings, equipment costs, and NPV of benefits for all primary commercial refrigeration equipment classes from 2012 through 2062. The forecasts provided annual and cumulative values for all four output parameters.

DOE calculated the NES by subtracting energy use under a standards scenario from energy use in a base case (no new standards) scenario. Energy use is reduced when a unit of commercial refrigeration equipment in the base case efficiency distribution is replaced by a more efficient piece of equipment. Energy savings for each equipment class are the same national average values as calculated in the LCC and payback period spreadsheet. However, these results are normalized on a per-unit-length basis by equipment class and applied to the total annual estimated shipments in terms of line-up length of all equipment with the class. Table IV–10 summarizes key inputs to the NIA analysis and the changes DOE made in the analysis for the final rule. Chapter 11 of the TSD provides additional information about the NIA spreadsheet.

TABLE IV–10—SUMMARY OF NATIONAL ENERGY SAVINGS AND NET PRESENT VALUE INPUTS

| Input data | Description of NOPR analysis | Changes for final rule |
|---|---|---|
| Shipments | Annual shipments from shipments model for 15 equipment classes. Shipments model based on projected growth in building stock using commercial refrigeration equipment (new stock) and annual replacements to stock based on an equipment life. Equipment lifetime distribution based on a 10-year average life in large grocery and multi-line retail, and a 15-year average life in small grocery and convenience stores (chapter 10, Shipments Analysis). | No change. |
| Effective Date of Standard. | 2012 | No change. |
| Base Case Efficiencies. | Distribution of base case shipments by efficiency level | No change in methodology to derive base case shipments by efficiency level. |
| Standards Case Efficiencies. | Distribution of shipments by efficiency level for each base case and each standards case. Annual market shares by efficiency level remain constant over time for the base case and each standards case. | No change in methodology to derive shipments by efficiency level in each standards case. |
| Annual Energy Consumption per Linear Foot. | Annual weighted-average values are a function of energy consumption level, which are established in the engineering analysis (chapter 5 of the TSD). Converted to a per linear foot basis. | No change in methodology. Energy consumption estimates reflect the updated final rule engineering analysis. |
| Total Installed Cost per Linear Foot. | Annual weighted-average values are a function of energy consumption level (chapter 8 of the TSD). Converted to a per linear foot basis. | No change in methodology. Installed costs reflect the updated final rule LCC. |
| Repair Cost per Linear Foot. | Annual weighted-average values are constant in real dollar terms for each energy consumption level (chapter 8 of the TSD). Converted to a per linear foot basis. | No change in methodology. Repair costs reflect the updated final rule LCC values. |
| Maintenance Cost per Linear Foot. | Annual weighted-average value equals $160 in 2007$ (chapter 8 of the TSD), plus lighting maintenance cost. Converted to a per linear foot basis. | No change. |
| Escalation of Electricity Prices. | EIA *AEO2007* forecasts (to 2030) and extrapolation for beyond 2030 (chapter 8 of the TSD). | EIA *AEO2008* forecasts (to 2030) and extrapolation for beyond 2030 (chapter 8 of the TSD). |
| Electricity Site-to-Source Conversion. | Conversion varies yearly and is generated by DOE/EIA's NEMS program (a time series conversion factor; includes electric generation, transmission, and distribution losses) based on *AEO2007*. | Conversion factor varies yearly and is generated by EIA's NEMS model. Includes the impact of electric generation, transmission, and distribution losses based on *AEO2008.* |
| Discount Rate | 3 and 7 percent real | No change. |
| Present Year | Future costs are discounted to 2008 | No change |
| Rebound Effect | A rebound effect (due to changes in shipments resulting from standards) was not considered in the NIA. | No change. |

The modifications DOE made to the NES and NIA analyses for the final rule primarily reflect updates to the same data sources used in the NOPR, but not changes in methodology. In addition, the underlying input data on equipment costs and energy savings by TSL are based on the LCC analysis results as revised in the final rule.

For the final rule, DOE developed marginal site-source conversion factors that relate the national electrical energy savings at the point of use to the fuel savings at the power plant. These factors use the NEMS model and the examination of the corresponding energy savings from standards scenarios considered in DOE's utility analysis (chapter 14 of the TSD). The conversion factors vary over time, due to projected changes in electricity generation sources (*i.e.*, the power plant types projected to provide electricity to the country) and power plant dispatch scenarios. DOE revised the stream of conversion factors based on the final rule utility impacts analysis and using a version of NEMS consistent with *AEO2008*. DOE also updated the electricity price forecasts used in the NIA to reflect forecasts found in *AEO2008* compared to *AEO2007*.

DOE did not receive information to support revising the shipments analysis or the methodology used in the NIA to estimate future shipments by efficiency level. DOE requested input on this methodology or on additional data to estimate future shipments. True commented that because so many different features and options can degrade a product's efficiency, True cannot afford to test every permutation's efficiency. Traditionally, therefore, True tests the most severe case, which includes all the options, and makes sure it can exceed the standard. As a result, the units shipped out are often more efficient than the testing would indicate. (True, Public Meeting Transcript, No. 27 at p. 119) DOE acknowledges this comment, but did not receive sufficient detail to address this concern in the final rule analysis for individual commercial refrigeration equipment classes. Because the distribution of efficiencies of all TSLs as well as the baseline would be similarly affected by some customers removing specific energy consuming options (*e.g.*, shelf lighting) from their purchased products, the impact of this particular issue on the potential national energy savings of one TSL over another may be insignificant.

To discount future impacts, DOE used discount rates of both 7 percent and 3 percent, in accordance with the Office of Management and Budget (OMB)'s guidelines (OMB Circular A–4, section E, Regulatory Analysis (September 17, 2003)). ASAP commented that DOE leans too heavily on the 7-percent discount rate, and that OMB has DOE looking at both the 3-percent and 7-percent discount rates. ASAP stated that DOE should be giving primacy to the lower discount rate, which is the societal discount rate—the time value of the society as a whole. (ASAP, Public Meeting Transcript, No. 27 at pp. 20–21 and p. 128) PG&E stated that a 3-percent discount rate is used for the California Energy Commission workshops on efficiency, and that it supports the 3-

percent rate for the Federal rulemaking. (PG&E, Public Meeting Transcript, No. 27 at p. 131) The Joint Comment stated that DOE improperly weighs the 7-percent discount rate more than the 3-percent discount rate. The Joint Comment noted that DOE should use the 3-percent discount rate because it is the required social discount rate and because the actual weighted average cost of capital is lower than 7 percent. (Joint Comment, No. 34 at p. 6)

DOE reports and uses both 3-percent and 7-percent discount rates in its analysis of net present value. OMB's guidance to Federal agencies for developing regulatory analysis (OMB Circular A–4, September 17, 2003) [14] references OMB Circular A–94 [15] for the development of discount rates for regulatory analysis. OMB Circular A–94 states that, as a default position, constant-dollar benefit-cost analyses of proposed investments and regulations should report net present value and other outcomes determined using a real discount rate of 3 percent. The 7-percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. OMB A–94 states that regulatory analyses should show the sensitivity of the discounted net present value and other outcomes to variations in the discount rate. The importance of these alternative calculations will depend on the specific economic characteristics of the program under analysis. OMB A–4 notes that the effects of regulation do not always fall exclusively or primarily on the allocation of capital. When regulation primarily and directly affects private consumption (*e.g.*, through higher consumer prices for goods and services), a lower discount rate is appropriate. The alternative most often used is sometimes called the social rate of time preference, or the rate at which society discounts future consumption flows to their present value. To represent these cases, OMB recommends using the rate the average saver uses to discount future consumption as the measure of the social rate of time preference, approximating this with the real rate of return on long-term Government debt (*e.g.*, the yield on Treasury notes minus the annual rate of change in the Consumer Price Index), which has averaged about 3 percent on a pre-tax basis for the last 30 years. For the commercial refrigeration equipment rulemaking in particular, DOE notes that the purchasers of commercial refrigeration equipment are indeed commercial businesses and not ''savers.'' Regarding the comment that the average cost of capital calculated for businesses purchasing commercial refrigeration equipment was less than 7 percent, DOE notes that the average cost of capital calculated for the LCC analysis is the after-tax cost of capital. OMB A–4 specifically notes that pre-tax rates of return better measure society's gains from investment. This is because corporate capital, in particular, pays an additional layer of taxation: The corporate income tax. This tax requires corporate capital to earn a higher pre-tax rate of return in order to provide investors with similar after-tax rates of return compared with non-corporate investments. Based on the guidance provided in OMB A–4, DOE considers both 3-percent and 7-percent discount rates in the NIA analysis.

ASAP stated that discount rates should not be applied to quads because a discount rate is a financial instrument and a quad is a physical quantity. (ASAP, Public Meeting Transcript, No. 27 at p. 22) DOE understands ASAP's concern about discounting of physical quantities. Unlike economic factors that are discounted into the future, physical quantities are not discounted because they do not change over time. DOE reports the undiscounted energy savings in Table VI–31 of today's final rule.

*H. Life-Cycle Cost Sub-Group Analysis*

In analyzing the potential impact of new or amended standards on commercial customers, DOE evaluates the impact on identifiable groups (*i.e.*, sub-groups) of customers, such as different types of businesses that may be disproportionately affected by a National standard level. For this rulemaking, DOE identified independent small grocery and convenience stores as a commercial refrigeration equipment customer sub-group that could be disproportionately affected, and examined the impact of proposed standards on this group. DOE determined the impact on this commercial refrigeration equipment customer sub-group using the LCC spreadsheet model. DOE conducted the LCC and PBP analyses for commercial refrigeration equipment customers represented by the subgroup. DOE did not receive comments on its identification of this class of users as the key sub-group or on the assumptions applied to those sub-groups. DOE relied on the same methodology outlined in the NOPR for the final rule analysis. The results of DOE's LCC sub-group analysis are summarized in section VI.C.2.e and described in detail in chapter 12 of the TSD.

*I. Manufacturer Impact Analysis*

DOE performed a manufacturer impact analysis (MIA) to estimate the financial impact of energy conservation standards on manufacturers of commercial refrigeration equipment, and to assess the impact of such standards on employment and manufacturing capacity. DOE conducted the MIA for commercial refrigeration equipment in three phases. Phase 1, Industry Profile, consisted of preparing an industry characterization, including data on market share, sales volumes and trends, pricing, employment, and financial structure. Phase 2, Industry Cash Flow Analysis, focused on the industry as a whole. In this phase, DOE used the GRIM to prepare an industry cash-flow analysis. Using publicly available information developed in Phase 1, DOE adapted the GRIM's generic structure to perform an analysis of commercial refrigeration equipment energy conservation standards. In Phase 3, Sub-Group Impact Analysis, DOE conducted interviews with manufacturers representing the majority of domestic commercial refrigeration equipment sales. This group included large and small manufacturers, providing a representative cross-section of the industry. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics specific to each company and obtained each manufacturer's view of the industry. The interviews provided valuable information DOE used to evaluate the impacts of an energy conservation standard on manufacturer cash flows, manufacturing capacities, and employment levels.

The GRIM inputs consist of the commercial refrigeration industry's cost structure, shipments, and revenues. This includes information from many of the analyses described above, such as manufacturing costs and selling prices from the engineering analysis and shipments forecasts from the NES.

The GRIM uses the manufacturer production costs in the engineering analysis to calculate the MSPs for each equipment class at each TSL. By multiplying the production costs by different sets of markups, DOE derives the MSPs used to calculate industry

[14] *http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.*

[15] *http://www.whitehouse.gov/omb/circulars/a094/a094.html.*

revenues. Following the NOPR, DOE revised its engineering cost curves to derive new manufacturer production costs. DOE used these updated production costs in the GRIM for the final rule.

The GRIM estimates manufacturer revenues based on total-unit-shipment forecasts and the distribution of these shipments by efficiency. Changes in the efficiency mix at each standard level are a key driver of manufacturer finances. For the final rule analysis, DOE used the total shipments and efficiency distribution found in the final rule NES. For additional detail on the manufacturer impact analysis, refer to chapter 13 of the TSD.

*J. Utility Impact Analysis*

The utility impact analysis estimates the effects of reduced energy consumption due to improved equipment efficiency on the utility industry. This analysis compares forecast results for a case comparable to the *AEO2008* reference case and forecast results for policy cases incorporating each of the commercial refrigeration equipment TSLs.

DOE analyzed the effects of proposed standards on electric utility industry generation capacity and fuel consumption using a variant of EIA's NEMS. EIA uses NEMS to produce its *AEO*, a widely recognized baseline energy forecast for the United States. DOE used a variant known as NEMS–BT. The NEMS–BT is run similarly to the *AEO2008* NEMS, except that commercial refrigeration equipment energy usage is reduced by the amount of energy (by fuel type) saved due to the TSLs. DOE obtained the inputs of national energy savings from the NES spreadsheet model. In response to the August 2008 NOPR, DOE did not receive comments directly on the methodology used for the utility impact analysis. DOE revised the final rule inputs to use the NEMS–BT consistent with the *AEO2008* and to use the NES impacts developed in the commercial refrigeration equipment final rule analysis.

In the utility impact analysis, DOE reported the changes in installed capacity and generation by fuel type that result for each TSL, as well as changes in end-use electricity sales. Chapter 14 of the TSD provides details of the utility analysis methods and results.

*K. Employment Impact Analysis*

DOE considers direct and indirect employment impacts when developing a standard. In this case, direct employment impacts are any changes in the number of employees for, commercial refrigeration equipment manufacturers, their suppliers, and related service firms. Indirect impacts are those changes in employment in the larger economy that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more efficient commercial refrigeration equipment. In this rulemaking, the MIA addresses direct impacts (chapter 13 of the TSD), and the employment impact analysis addresses indirect impacts (chapter 15 of the TSD).

Indirect employment impacts from commercial refrigeration equipment 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 (offset to some degree by the increased spending on maintenance and repair), (2) reduced spending on new energy supply by the utility industry, (3) increased spending on the purchase price of new commercial refrigeration equipment, and (4) the effects of those three factors throughout the economy. DOE expects the net monetary savings from standards to be redirected to other forms of economic activity. DOE also expects these shifts in spending and economic activity to affect the demand for labor.

DOE used the same methodology described in the August 2008 NOPR to estimate indirect national employment impacts using an input/output model of the U.S. economy, called ImSET (Impact of Sector Energy Technologies), which was developed by DOE's Building Technologies Program. 73 FR 50072, 50107–108. The ImSET model estimates changes in employment, industry output, and wage income in the overall U.S. economy resulting from changes in expenditures in various economic sectors. DOE estimated changes in expenditures using the NES spreadsheet. ImSET then estimated the net national indirect employment impacts of potential commercial refrigeration equipment efficiency standards on employment by sector.

In response to the August 2008 NOPR, DOE received several comments on the employment impact analysis. ASAP commented that the discussion of the employment benefits resulting from the net increase in jobs follows a pattern of DOE trivializing these benefits in the rulemakings by stating that they are so small that they would be imperceptible in national labor statistics and might be offset by other unanticipated effects on employment. ASAP stated that it is important that DOE keep performing the employment analysis given the cumulative impact of possible DOE rulemakings over the next 4 years. (ASAP, Public Meeting Transcript, No. 27 at p. 161)

The Joint Comment also stated that TSL 5 would create more jobs than TSL 4, and that DOE cannot reject the difference as statistically insignificant because it must consider the combined effect of all rulemakings. (Joint Comment, No. 34 at p. 5) The Joint Comment further stated that DOE should consider indirect job creation as a serious factor weighing in favor of stronger standards. (Joint Comment, No. 34 at p. 5)

Earthjustice noted that both indirect and direct employment benefits are shown to provide positive employment in the respective employment and MIA analyses and that DOE should consider this in the final rule. (Earthjustice, Public Meeting Transcript, No. 27 at p. 166)

DOE considers the employment impacts without quantifying the net economic value of such impacts. DOE agrees that the indirect employment analysis indicates that new energy conservation standards for commercial refrigeration equipment could increase the demand for labor in the economy and result in additional employment, a net benefit to society that DOE considers in establishing standards for commercial refrigeration equipment. Chapter 15 of the TSD describes and provides results for the employment impact analysis.

*L. Environmental Assessment*

DOE has prepared an environmental assessment (EA) pursuant to the National Environmental Policy Act and the requirements under 42 U.S.C. 6295(o)(2)(B)(i)(VI) and 6316(a) to determine the environmental impacts of the standards being established in today's final rule. Specifically, DOE estimated the reduction in total emissions of $CO_2$ using the NEMS–BT computer model. DOE calculated a range of estimates for reduction in $NO_X$ emissions and mercury (Hg) emissions using current power sector emission rates. However, the EA does not include the estimated reduction in power sector impacts of sulfur dioxide ($SO_2$), because DOE has determined that any such reduction resulting from an energy conservation standard would not affect the overall level of $SO_2$ emissions in the United States due to the presence of national caps on $SO_2$ emissions as addressed below (see chapter 16 of the TSD).

The NEMS–BT is run similarly to the *AEO2008 NEMS,* except the energy use is reduced by the amount of energy saved due to the TSLs. DOE obtained the inputs of national energy savings from the NIA spreadsheet model. For the EA, the output is the forecasted physical emissions. The net benefit of the standard is the difference between emissions estimated by NEMS–BT and the *AEO2008* reference case. The NEMS–BT tracks $CO_2$ emissions using a detailed module that provides results with a broad coverage of all sectors and inclusion of interactive effects.

The Clean Air Act Amendments of 1990 set an emissions cap on $SO_2$ for all power generation. Attaining this target, however, is flexible among generators and is enforced through emissions allowances and tradable permits. Because $SO_2$ emissions allowances have value, generators will almost certainly use them, although not necessarily immediately or in the same year with and without a standard in place. In other words, with or without a standard, total cumulative $SO_2$ emissions will always be at or near the ceiling, while there may be some timing differences between yearly forecasts. Thus, it is unlikely that there will be an $SO_2$ environmental benefit from electricity savings as long as there is enforcement of the emissions ceilings.

Although there may not be an actual reduction in $SO_2$ emissions from electricity savings, there still may be an economic benefit from reduced demand for $SO_2$ emission allowances. Electricity savings decrease the generation of $SO_2$ emissions from power production, which can decrease the need to purchase or generate $SO_2$ emissions allowance credits, and decrease the costs of complying with regulatory caps on emissions.

Like $SO_2$, future emissions of $NO_X$ and Hg would have been subject to emissions caps under the Clean Air Interstate Act (CAIR) and Clean Air Mercury Rule (CAMR). However, as discussed in section VI.C.6, a Federal court has vacated these rules. The NEMS–BT model used for today's final rule assumed that both $NO_X$ and Hg emissions would be subject to CAIR and CAMR emissions caps. In the case of $NO_X$ emissions, CAIR would have permanently capped emissions in 28 eastern states and the District of Columbia. Because the NEMS–BT modeling assumed $NO_X$ emissions would be subject to CAIR, DOE established a range of $NO_X$ reductions based on the use of a $NO_X$ low and high emissions rates (in kt of $NO_X$ emitted per terawatt-hours (TWh) of electricity generated) derived from the *AEO2008*. To estimate the reduction in $NO_X$ emissions, DOE multiplied these emission rates by the reduction in electricity generation due to the standards considered. However, because the emissions caps specified by CAMR would have applied to the entire country, DOE was unable to use NEMS–BT model to estimate the physical quantity changes in mercury emissions due to energy conservation standards. To estimate mercury emission reductions due to standards, DOE used an Hg emission rate (in metric tons of Hg per energy produced) based on *AEO2008*. Because virtually all mercury emitted from electricity generation is from coal-fired power plants, DOE based the emission rate on the metric tons of mercury emitted per TWh of coal-generated electricity. To estimate the reduction in mercury emissions, DOE multiplied the emission rate by the reduction in coal-generated electricity associated with standards considered.

In comments on the August 2008 NOPR, ASAP stated that it was important for DOE to consider the economic impact calculations for carbon, noting that the economic savings are significant. In addition, until the CRE and packaged terminal air conditioner and heat pump (PTAC and PTHP) NOPRs, ASAP did not see that economic values for carbon emissions savings were factored into the analysis in a way that could affect decision making. (ASAP, Public Meeting Transcript, No. 27 at p. 172) On the other hand, AHRI believes DOE has no statutory obligation to monetize $CO_2$ benefits. (AHRI, Public Meeting Transcript, No. 27 at p. 173)

AHRI further commented that if DOE decides to monetize $CO_2$ benefits, then it should account for $CO_2$ emissions that will result from manufacturing more efficient products. For example, DOE should consider the $CO_2$ emissions resulting from additional copper to be mined and incorporated into the finished product. (AHRI, Public Meeting Transcript, No. 27 at p. 173) True also commented on types of manufacturing processes that should be considered in the emissions analysis. True stated that the most significant impact of commercial refrigeration equipment on the environment is from welding agents and refrigerants. True further explained with the global warming potentials (GWPs) of some of these substances at 1,300, 1,500, and 3,800, the impacts are astronomically greater than other impacts the industry faces. (True, Public Meeting Transcript, No. 27 at p. 174)

On the contrary, ASAP emphasized that the congressional deadline of December 31, 2008, means that ''paralysis by analysis'' is not an option at this point in this rulemaking and that it is incumbent upon AHRI to demonstrate that any proposed analysis changes would be significant. (ASAP, Public Meeting Transcript, No. 27 at p. 173) ACEEE commented that for buildings and the equipment used in them (not specific for this class of equipment), the energy use during the operating life is roughly 85 percent of the total lifecycle energy. Also, the incremental energy change from increased use of a largely recycled metals stock is likely have a small impact on this analysis. (ACEEE, Public Meeting Transcript, No. 27 at p. 173)

Several interested parties provided comments on the economic value of $CO_2$ used in DOE's monetization of carbon emissions for the August 2008 NOPR and the final rule for PTACs and PTHPs (73 FR 58772, October 7, 2008). ASAP stated that the low range for monetization of carbon emission reductions should not be zero. (ASAP, Public Meeting Transcript, No. 27 at p. 23) AHRI stated that DOE should not speculate on the value of $CO_2$ emissions because it has no statutory obligation to do so and that any value DOE used would be an estimate. There is no consensus on any single estimate of the value of $CO_2$ emissions. Therefore, DOE should not indulge in speculation to determine a value when it has no statutory obligation to do so. (AHRI, No. 33 at p. 6)

Earthjustice commented that the upper and lower bounds of the values DOE uses for its carbon emissions are arbitrarily low. (Earthjustice, No. 38 at pp. 7–14) Specifically, Earthjustice stated that by using the value of the social cost of carbon (SCC) estimated in Dr. Richard Tol's 2005 meta-analysis, DOE excluded critical damages and made optimistic assumptions that bias the damage cost downwards. (Earthjustice, No. 38 at p. 8) Earthjustice noted that Tol released an update of his 2005 meta-analysis in September 2007, which reports an increase in his peer-reviewed mean estimate of SCC from \$14 to \$20/ton $CO_2$ and from \$43 to \$71/ton carbon.[16] Earthjustice also asserted that the use of Tol's mean as an upper bound is inconsistent with sound risk analysis and distributions of climate damage functions, leading to systematic undervaluation of damages. (Earthjustice, No. 38 at p. 9) Lastly, Earthjustice noted that Tol's estimate relies primarily on estimates that did not use the currently accepted climate change discounting procedure of

[16] Tol, R.S.J. (2007) The social cost of carbon: trends, outliers, and catastrophes. *Research Unit Sustainability and Global Change, Working Paper FNU–144,* Hamburg University and Centre for Marine and Atmospheric Science, Hamburg, Germany.

declining discount rate over time, and it fails to recognize the distinction between the ways in which scarcity affects the value of normal goods and environmental goods. (Earthjustice, No. 38 at p. 11)

AHRI noted that Congress is now engaged in debating a possible cap and trade program for the United States. The size of the allowance cap first set by such legislation or by implementing regulations and the pace of reduction of the emission allowances will largely determine the unit price or value of $CO_2$ emissions reductions. AHRI stated that it would be an arbitrary decision on DOE's part to rely on valuations identified in the Intergovernmental Panel on Climate Change (IPCC) or valuations used in the European Union (EU) cap and trade program when the United States has not yet set an emissions cap itself. Further, AHRI stated that DOE should not allow evaluation of environmental impacts to negate or render moot what has always been, and should remain, the core analysis in appliance standards rulemakings, *i.e.*, consumer payback and life-cycle cost analyses. (AHRI, No. 33 at p. 6) NRDC also stated that the cost of carbon emissions will become an issue with California adopting a Climate Program and the Regional Greenhouse Gas Initiative in the Northeast. (NRDC, Public Meeting Transcript, No. 27 at p. 105)

Earthjustice's written comment states that DOE's monetization of $CO_2$ emissions should reflect the potential U.S. legislation that would put a national cap on $CO_2$ emissions. This includes examining the effect of the standard in reducing allowance prices and the benefit of reduced emissions in the NPV. This is Earthjustice's primary suggested consideration for DOE; otherwise, DOE should take into account existing regional $CO_2$ caps when monetizing $CO_2$. Finally, the most basic consideration DOE must make, according to Earthjustice, is to economically account for the avoided environmental harm from $CO_2$ emissions. (Earthjustice, No. 38 at pp. 2–6)

The Joint Comment stated that DOE should incorporate the monetization of carbon emission reductions in the life-cycle cost analysis and the national impact analysis. The Joint Comment further stated that DOE's exclusion of carbon monetization in the LCC and NIA results in a systematic underestimation of benefits of new energy conservation standards. (Joint Comment, No. 34 at p. 6) Earthjustice stated that DOE does not account for the economic value of $CO_2$ emissions reductions resulting from efficiency standards in any meaningful way. Although DOE has begun estimating a range of values for carbon emissions, it then ignores these values when choosing the new standard level. Earthjustice stated that DOE must address these issues by (1) accounting for the value of emissions reductions resulting from a standard in the economic analyses, the LCC, and NIA; and (2) using reasonable assumptions and sources when determining the value of carbon emission reductions because the current sources evaluated are inadequate. (Earthjustice, No. 38 at p. 1) Specifically, Earthjustice stated that DOE should quantify the effect of a $CO_2$ emission cap on energy prices in the LCC analysis. (Earthjustice, No. 38 at p. 2)

DOE has made several additions to its monetization of environmental emissions reductions in today's rule, which are discussed in section VI.C.6. DOE has chosen to continue to report these benefits separately from the net benefits of energy savings. Nothing in EPCA or in the National Environmental Policy Act (NEPA) requires that the economic value of emissions reduction be incorporated in the net present value analysis of energy savings. Unlike energy savings, the economic value of emissions reduction is not priced in the marketplace. However, DOE will consider both values when weighing the benefits and burdens of standards.

Although this rulemaking does not affect $SO_2$ emissions, there are markets for $SO_2$ emissions allowances. The market clearing price of $SO_2$ emissions is roughly the marginal cost of meeting the regulatory cap, not the marginal value of the cap itself. Further, because national $SO_2$ emissions are regulated by a cap and trade system, the need to meet these caps is already included in the price of energy or energy savings. With a cap on $SO_2$, the value of energy savings already includes the value of $SO_2$ control for those consumers experiencing energy savings. The economic cost savings associated with $SO_2$ emissions caps is approximately equal to the change in the price of traded allowances resulting from energy savings multiplied by the number of allowances that would be issued each year. That calculation is uncertain because the energy savings for commercial refrigeration equipment are so small relative to the entire electricity generation market that the resulting emissions savings would have almost no impact on price formation in the allowances market. These savings would most likely be outweighed by uncertainties in the marginal costs of compliance with $SO_2$ emissions caps.

For those emissions currently not priced ($CO_2$, Hg, and $NO_X$), only a range of estimated economic values based on environmental damage studies of varying quality and applicability is available. DOE is weighing these values separately and is not including them in the NPV analysis.

## V. Discussion of Other Comments

Since DOE opened the docket for this rulemaking, it has received more than 100 comments from a diverse set of parties, including manufacturers and their representatives, trade associations, wholesalers and distributors, energy conservation advocates, and electric utilities. Section IV of this preamble discusses comments DOE received on the analytic methodologies it used. Additional comments DOE received in response to the August 2008 NOPR addressed the information DOE used in its analyses, results of and inferences drawn from the analyses, impacts of standards, the merits of the different TSLs and standards options DOE considered, and other issues affecting adoption of standards for commercial refrigeration equipment. DOE addresses these comments in this section.

### *A. Information and Assumptions Used in Analyses*

#### 1. Market and Technology Assessment

##### a. Data Sources

DOE summarized its analysis for energy consumption in chapter 3 of the NOPR TSD. Traulsen stated that there are problems with the use of energy consumption data reported to government agencies because of inaccurate data reporting. Traulsen cited several problems with U.S. Environmental Protection Agency's (EPA's) ENERGY STAR database for self-contained commercial solid-door food service refrigerators and freezers, including equipment listed in the database that does not conform to the ENERGY STAR specifications. Traulsen suggested that sources such as these not be used in the technical analyses because of the errors they contain. (Traulsen, No. 25 at p. 1)

The ENERGY STAR requirements for commercial solid door refrigerators and freezers cover self-contained commercial refrigerators, freezers, and refrigerator-freezers that have solid doors, which are not covered in this commercial refrigeration equipment rulemaking. In terms of equipment classes, there is no overlap between the ENERGY STAR program and DOE's rulemaking on commercial refrigeration equipment, except for commercial ice-cream freezers. EPA's commercial ice-cream freezer equipment class does not coincide with DOE's commercial ice-cream freezer equipment class because they are defined differently and tested at different rating temperatures. In addition, DOE understands that Traulsen has a large market in the commercial refrigeration industry for self-contained commercial refrigerator and freezers with doors. However, these equipment classes are not covered in this rulemaking. Also, DOE did not use energy consumption databases from other government agencies such as EPA. Rather, DOE conducted its own evaluation of energy consumption data for existing equipment from major manufacturers and compiled a performance database. The primary source of information for the database was equipment data sheets that were publicly available on manufacturers' Web sites. From these data sheets, equipment information such as total refrigeration load, evaporator temperature, lighting power draw, defrost power draw, and motor power draw allowed determination of calculated daily energy consumption (CDEC) according to the DOE test procedure. See chapter 3 of the TSD for additional information on market performance data.

b. Beverage Merchandisers

In response to the NOPR, Coca-Cola submitted a comment questioning the market share and shipment data in DOE's analysis. Coca-Cola stated that its own purchases contradict DOE's figures. According to Coca-Cola, vertical closed transparent, self-contained, medium temperature (VCT.SC.M) equipment makes up the majority of Coca-Cola's purchases. DOE's exclusion of this class accounts for the differences between Coca-Cola's purchases and the number of units shipped that DOE reported in the engineering analysis. (Coca-Cola, No. 21 at p. 1)

As explained in the July 2007 ANOPR, VCT.SC.M equipment is currently covered by energy conservation standards established in EPCA. 72 FR 41176. Therefore, self-contained glass-front beverage merchandisers (beverage coolers), which are included in the VCT.SC.M equipment class, are not covered in this commercial refrigeration equipment rulemaking. As a result, all the shipment and market share data reported in the engineering analysis are valid for the classes of commercial refrigeration equipment covered in this rulemaking.

2. Engineering Analysis

a. Design Options

In the NOPR, DOE reevaluated the list of design options remaining after the ANOPR screening analysis. Based on public comments, DOE made the following design option changes in the NOPR and did not receive any further comment for the final rule: increasing insulation thickness as a design option; revising anti-sweat heater power values for certain equipment classes with glass doors; and revising assumptions made to estimate changes in cost and efficiency for high-efficiency, single-speed compressors used in self-contained equipment. 73 FR 50087. However, there were certain design options for which DOE did receive comments and that warranted changes for the final rule. Specifically, LED cost and efficiency assumptions were updated.

For the NOPR, DOE could only identify LED luminaires on the market for use in vertical refrigerated cases with transparent doors (*i.e.*, the VCT equipment family). DOE used these LED luminaires as the basis for LED lighting for open refrigerated cases, because DOE could not identify LED luminaires for use in open refrigerated cases. However, when DOE reexamined the current state of LED lighting for the final rule, DOE identified LED luminaries on the market for use in open refrigerated cases. DOE updated the LED lighting prices for open refrigerated cases using these newly identified LED luminaires.

For the final rule, DOE also updated the LED prices for lighting used in the VCT equipment families using the actual reduction in the lumen-based price of LED chips reported in DOE's Multi-Year Program Plan between 2007 and 2008. DOE's 2007 Multi-Year Program Plan reported that the latest available OEM device price for LED chips was $35/kilolumen.[17] DOE's 2008 Multi-Year Program Plan reported that the latest available OEM device price for LED chips was $25/kilolumen.[18] This equates to a 29-percent reduction in lumen-based LED chip costs from 2007–2008. For the final rule, DOE applied this 29-percent reduction in lumen-based LED chip costs to the LED lighting for the VCT equipment families, representing about a 9-percent reduction in LED system costs, assuming the costs of the power supply and LED fixtures did not change from the values used in the NOPR engineering analysis. For additional detail regarding LED costs, see section IV.B.2.a.

In addition to expected price reductions, DOE received comments on the unique performance advantages of LED systems following the NOPR. Philips stated that LED systems are virtually maintenance-free. Without maintenance costs, LED payback periods amount to roughly half of their life expectancy. (Philips, No. 29 at pp. 1–6) Philips also claimed that LED efficacy (lm/W) is expected to increase. Increases in efficacy effectively reduce the operational costs of the system by allowing for less energy consumption while maintaining output. (Philips, No. 29 at p. 1)

As mentioned above, for today's final rule, DOE reexamined the LED lighting assumptions that were used in the NOPR. DOE identified more efficacious LED lighting options for use in both vertical refrigerated cases with transparent doors and open refrigerated cases than the LED lighting identified in the NOPR analysis. Based on the new LED lighting options, DOE updated case lighting configurations for each equipment class specific to LED lighting in the engineering analysis. For more detail about the updated LED lighting performance assumptions, see chapter 5 and appendix B of the TSD.

In addition to the life-cycle benefits afforded by LEDs, the California Utilities Joint Comment stated that LED systems have a higher degree of controllability, which gives the systems dimming, cold start, and short cycling capabilities. (California Utilities Joint Comment, No. 41 at p. 3) ASAP added that these features allow LED systems to be turned off in situations in which fluorescents could not. This equates to improved energy efficiency for commercial refrigeration equipment that uses LED lighting. (ASAP, Public Meeting Transcript, No. 27 at p. 106)

The enhanced controllability of LED lighting can offer multiple benefits over fluorescent lighting. Specifically, the ability to reduce the operating time of LED lighting can lead to increased energy efficiency for commercial refrigeration equipment. Therefore, in the July 2007 ANOPR, DOE specifically requested public comment on using 24 hours as the case lighting operational hours. 72 FR 41187. In the August 2008 NOPR, based on public comment, DOE determined that 24 hours was an adequate assumption for case lighting operating hours regardless of lighting type. 73 FR 50095. In addition, the test procedure DOE adopted for commercial refrigeration equipment, ANSI/ARI Standard 1200–2006, is a steady-state

[17] U.S. Department of Energy, Solid-State Lighting Research and Development, Multi-Year Program Plan FY08–FY13.

[18] U.S. Department of Energy, Solid-State Lighting Research and Development, Multi-Year Program Plan FY09–FY14.

test procedure, which is unable to capture significant energy savings due to dimming controls or motion sensors. 71 FR 71370.

Following the NOPR, some manufacturers expressed concerns that implementing LED lighting would reduce the quality of their equipment. Specifically, they disagreed with the use of general white light LEDs to develop a price specifically for LED lighting used in commercial refrigeration equipment. True and Southern Store Fixtures stated that the grocery store market will be most affected by the use of LED lighting because certain food products, such as meat, dairy, deli, and produce, have to have a special display color. (True, Public Meeting Transcript, No. 27 at p. 111; Southern Store Fixtures, Public Meeting Transcript, No. 27 at p. 108) Continental Refrigerator added that in low-temperature applications, there is degradation in LED color quality, requiring the technology to be developed further. (Continental Refrigerator, No. 27 at p. 141) Southern Store Fixtures stated that LEDs used in commercial refrigeration equipment are more expensive because additional labor is required to test and sort the LEDs to meet the industry's color quality requirements. (Southern Store Fixture, Public Meeting Transcript, No. 27 at p. 108) Hill Phoenix agreed with Southern Store Fixtures and added that repeatability and minimizing the LED output variance also factors into this costly sorting process (*i.e.*, binning). (Hill Phoenix, Public Meeting Transcript, No. 27 at p. 109) PG&E estimated that this premium will remain constant independent of any future price reductions. (PG&E, Public Meeting Transcript, No. 27 at p. 110) AHRI and Hill Phoenix suggested that prices for LED systems used in commercial refrigeration equipment will not experience the same price reductions that the rest of the LED industry will. Both interested parties agreed that, because the commercial refrigeration market for LEDs is small, there will not be a great demand for high-quality LEDs, providing little incentive for LED suppliers to offer low-price, high-quality LEDs. (AHRI, No. 33 at p. 2 and Hill Phoenix, No. 32 at p. 2)

DOE acknowledges that a premium markup is applied to LED chips used in commercial refrigeration applications due to the binning process. This highly selective process requires LED chips to be chosen by hand to ensure the consistency in color, temperature and light quality demanded by commercial refrigeration equipment customers. As LED technology advances (*e.g.*, efficacy or price), the binning process for quality remains the same, resulting in a constant markup on the price of LED chips used for commercial refrigeration equipment. DOE accounted for this premium in the pricing used for the NOPR analysis. In the update of LED prices between 2007 and 2008 for the final rule, DOE maintained the markup associated with the higher level of quality needed for LEDs used in commercial refrigeration equipment.

DOE also received comments on the relative benefits of using LEDs in low-temperature cases versus medium-temperature cases and in closed cases versus open cases. The California Utilities Joint Comment stated that LED luminous output is 10 percent higher at 0 °F than at 25 °F. (California Utilities Joint Comment, No. 41 at p. 11) Southern Store Fixtures stated the heat from the LED fixture could be used to control condensate on closed case doors. It suggested using a remote power module for open cases. (Southern Store Fixtures, Public Meeting Transcript, No. 27 at p. 98) Hill Phoenix also stated that it is still a challenge for LED lighting in open cases to provide the quality and quantity of light required by the food marketing industry. (Hill Phoenix, No. 32 at p. 1)

As stated above, DOE was able to identify for the final rule LED luminaires currently available on the market for both open refrigerated cases and vertical refrigerated cases with transparent doors. The benefits of using LEDs vary depending on the type of commercial refrigerated equipment in which they are used. However, the luminaires DOE identified for use in the final rule analysis were specifically developed for individual types of commercial refrigeration equipment, and the luminaire manufacturers reported that the performance and quality of those luminaires were developed to meet the specific light output requirements of the commercial refrigeration equipment manufacturers that use them. Therefore, although the LED luminous output may be about 10 percent higher for low-temperature cases compared to medium-temperature cases, the luminaires chosen for the analysis were actual products that commercial refrigeration equipment manufacturers specified provide appropriate lighting levels. Likewise, the power configuration used in the analysis for LED fixtures was also based on actual products used in closed and open cases. However, DOE did modify the LED lighting configurations assumed in the engineering analysis based on comments received and lighting manufacturer specification sheets. Most notably, for the final rule, DOE doubled the shelf lighting for open cases compared to that assumed for the NOPR. This increase in shelf lighting is needed to meet the lighting requirements of open cases due to the directional nature of LED lighting. See appendix B for more detail regarding the lighting configurations assumed in the engineering analysis.

b. Baseline Models

DOE established baseline specifications for each equipment class modeled in the engineering analysis by reviewing available manufacturer data, selecting several representative units, and then aggregating the physical characteristics of those units. This process created a unit representative of commercial refrigeration equipment currently offered for sale in each equipment class, with average characteristics for physical parameters (*e.g.*, volume, TDA), and minimum performance of energy-consuming components (*e.g.*, fans, lighting). In the NOPR analysis, DOE made several revisions to the baseline specifications. These changes include updates to baseline lighting, TDA calculations, and baseline energy consumption. Appendix B of the NOPR TSD explained in detail the changes made to the baseline design specifications relative to the ANOPR analysis. DOE received no comments specific to these changes, and is therefore maintaining them for the final rule.

c. Consideration of Alternative Refrigerants

The framework document stated that due to the phaseout of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) in refrigeration equipment, the industry would likely use HFC refrigerants in their products. Following the framework document, AHRI stated that most of the data it provided to DOE was based on the use of HFC refrigerants. In the ANOPR TSD and NOPR, DOE assumed that HFC refrigerants were already in wide use in the refrigeration industry, and therefore used HFC refrigerants as the basis for the technical analysis conducted in the rulemaking.

The Joint Comment in response to the NOPR stated that DOE should consider alternative primary refrigerants such as hydrocarbons, ammonia, and $CO_2$ in its analysis because of their potential energy benefits, and because of the current phase-out of CFCs and HCFCs as refrigerants. The Joint Comment pointed out that alternative primary refrigerants are widely used in countries other than the United States, principally in Europe. (Joint Comment, No. 34 at p. 8)

As stated in the ANOPR TSD and NOPR, DOE based its technical analysis on the use of HFC refrigerants. A Federal phaseout of CFC refrigerants has already occurred, and a Federal phaseout of HCFC refrigerants is pending in 2010. Thus, DOE did not consider CFCs and HCFCs in its analysis. Likewise, although alternative refrigerants such as hydrocarbons, ammonia, and $CO_2$ are used in Europe and elsewhere in the world, there is no evidence that they are widely used for commercial refrigeration applications in the United States. In addition, current state and local building codes would not allow the use of many alternative refrigerants (Safety Class A3—most hydrocarbon refrigerants) in remote condensing equipment covered by this rulemaking due to flammability concerns. These codes would also severely limit the use of ammonia due to toxicity concerns. Both could be considered for use with secondary loop refrigeration systems, but these are not the subject of this rulemaking. Hydrocarbon refrigerants could possibly be used for small self-contained commercial refrigeration equipment covered in this rulemaking if they contain less than 3 pounds of refrigerant and if they have been certified by Underwriters Laboratories or another product certification lab. However, DOE believes that no such equipment has been certified for the U.S. market, and it did not consider these refrigerants as a viable design option in the engineering analysis.

The majority of the U.S. commercial refrigeration industry uses HFC refrigerants in commercial refrigeration equipment. Since the analysis should be based on the refrigerant most widely used in commercial refrigeration equipment, it is unnecessary to consider alternative refrigerants. For these reasons, DOE has continued to use HFC refrigerants as the basis for its technical analysis. DOE used the HFC refrigerant R–404A for all remote condensing equipment and HFC refrigerant R–404A or refrigerant R–134A for all self-contained equipment.

d. Consideration of NSF 7 Type II Equipment

On December 8, 2006, DOE published a final rule in which it adopted ANSI/ARI Standard 1200–2006 as the DOE test procedure for commercial refrigeration equipment. 71 FR at 71340, 71369–70. DOE incorporated the test procedure into its regulations in 10 CFR 431.63–431.64. The standard also requires performance tests to be conducted according to ANSI/ASHRAE Standard 72–2005. Following the NOPR, DOE received comments from Southern Store Fixtures and Zero Zone stating that the DOE test procedure is insufficient because a subset of the equipment covered in this rulemaking is designed for and operates under harsher conditions than the 75.2 °F dry-bulb and 64.4 °F wet-bulb ambient temperature condition used in the DOE test procedure.

According to Southern Store Fixtures and Zero Zone, the hotter, more humid ambient condition requires additional energy consumption to power larger compressors and the anti-condensate capabilities necessary in this environment. These conditions make it more difficult to meet the standards proposed by this rulemaking. As a result, both Zero Zone and Southern Store Fixtures suggested that DOE should account for the difference between test procedure ambient conditions and operating ambient conditions for this subset of equipment by making a distinction similar to the one currently used in the National Sanitation Foundation Standard 7 (NSF 7) standard. (Zero Zone Public Meeting Transcript, No. 27 at p. 17 and Southern Store Fixtures No. 27 at p. 18) Under NSF 7, equipment intended for use in more severe environments is designated as ''Type II'' equipment and is tested at 80 °F dry-bulb and 68 °F wet-bulb ambient conditions. NSF ''Type I'' equipment is tested at the same ambient conditions as the DOE test procedure, namely the 75.2 °F dry-bulb and 64.4 °F wet-bulb temperature ambient condition.

To address this issue, AHRI suggested exempting Type II equipment from coverage or instructing manufacturers of Type II equipment to apply for waivers. (AHRI, Public Meeting Transcript, No. 27 at p. 50) If the waiver approach is pursued, Southern Store Fixtures suggested using available NSF Type II testing data to find the relationship among food temperature, the metric used in NSF testing, and energy consumption, the metric used in the DOE test procedure. This relationship would allow at least some Type II equipment to be considered fairly under this rule and mitigate a spike in waiver applications. (Southern Store Fixtures, Public Meeting Transcript, No. 27 at p. 54)

After consideration of these comments, DOE believes that instituting a distinction between Type I and Type II commercial refrigeration equipment, as defined by NSF 7, is unnecessary in this rulemaking. The DOE test procedure, ARI Standard 1200–2006, requires that energy consumption testing for all commercial refrigeration equipment covered in this rulemaking be conducted according to ANSI/ASHRAE Standard 72–2005, which prescribes specific ambient conditions. There is no requirement to address the ambient conditions specified in the NSF 7 standard. The two standards also serve different purposes. The ANSI/ASHRAE 72–2005 standard measures energy consumption for a specific ambient condition, whereas the NSF 7 standard measures food temperature at a specific ambient condition for food safety purposes. Although these test procedures have different purposes, including the NSF 7 Type II test procedure would have a minimal impact on the energy consumption of this equipment because the differences between the ANSI/ASHRAE 72–2005 and NSF 7 Type II ambient test conditions are marginal. NSF 7 Type II equipment is defined as a unit intended for use in an environment in which the ambient dry-bulb temperature does not exceed 80 °F. This is at most 5 °F higher than the 75 °F ambient dry bulb temperature used in the DOE test procedure. Therefore, the test procedure requires all commercial refrigeration equipment covered under this rulemaking to be tested for energy consumption according to the ambient conditions specified in ANSI/ASHRAE Standard 72–2005 and will not include any distinction between Type I and Type II equipment as defined by NSF 7.

e. Product Class Extension Factors

In the NOPR, DOE developed multipliers to extend standards from the 15 equipment classes it directly analyzed to the remaining 23 secondary equipment classes of commercial refrigeration equipment it did not directly analyze. DOE's approach involved a matched-pair analysis, which examined the relationship between several related pairs of equipment classes. Chapter 5 of the TSD discusses the development of the extension multipliers and the set of focused matched-pair analyses.

Following the NOPR, Southern Store Fixtures questioned the extension multiplier for self-contained equipment that was based on the analytical results for open remote condensing equipment. Southern Store Fixtures believed that the extension multiplier of 2.51 DOE developed to correlate remote medium-temperature equipment without doors to self-contained medium-temperature equipment without doors should be higher to adequately account for the more severe conditions in which self contained equipment are typically used, but did not offer a recommendation for the value. (Southern Store Fixtures, Public Meeting Transcript, No. 27 at p. 37)

The DOE test procedure, ARI Standard 1200–2006, requires that energy consumption testing for all commercial refrigeration equipment covered in this rulemaking be conducted according to ANSI/ASHRAE Standard 72–2005, which prescribes specific ambient conditions. The ambient conditions specified by the DOE test procedure are the same regardless of the condensing unit configuration (*i.e.*, remote condensing or self-contained). In addition, the 2.51 extension multiplier was developed based on the relationship between the medium temperature VOP, SVO, and HZO equipment classes that DOE directly analyzed. Because neither an alternative value nor contradicting analysis was offered, for today's final rule, DOE will continue to use the 2.51 and other extension multipliers developed in the NOPR.

f. TSL Energy Limits

After the NOPR, Hussman submitted a comment expressing its concern about the technologies required for equipment to meet minimum energy consumption levels for TSL 4. In particular, Hussman is reluctant to use the no-heat door design option in humid climates, such as Houston, Texas. In its experience, no-heat doors in humid climates result in more condensation on store floors. According to Hussman, wet floors have led to accidents and costly law suits, indirectly linking increased energy efficiency with increased safety risks. (Hussman, No. 42 at p. 1)

Energy conservation standards for today's final rule set a maximum allowable energy conservation level for commercial refrigeration equipment. DOE does not limit the technologies manufacturers can use to achieve standards. Manufacturers are free to use any combination of technologies and design options to achieve a required level of energy consumption. Manufacturers also have the ability to design equipment for use in specific regions where certain design options may cause safety concerns. Certain anti-condensate design options consume no energy and could be used to achieve the energy consumption levels TSL 4 requires. Anti-condensate films can be applied to the inner surface of glass doors to prevent condensation and fog formation. By installing this film, some portion (and potentially all) of the glass and/or door mullion heaters can be removed and still maintain fog-free operation. In addition, DOE does not have the authority to set regional standards for commercial refrigeration equipment, and therefore cannot customize its analysis to exclude the use of design options in a specific climate region. Therefore, in developing the energy conservation standards for today's final rule, DOE did not make any modifications to accommodate concerns related to any particular climate regions.

g. Compressor Selection Oversize Factor

DOE's energy consumption model selects the most appropriate compressor by comparing each compressor's capacity to the total refrigeration load in the case multiplied by the compressor oversize factor. For the ANOPR analysis, DOE listed capacity at the standard rating conditions used in ANSI/ARI Standard 540–2004.[19] However, the standard rating conditions differed from the operating conditions used in the model, resulting in different capacity values. Because the standard conditions and modeled conditions differed, the model typically overestimated the capacity of the selected compressors. To compensate, DOE adjusted the compressor oversize factor to an unrealistic level (typically level 1) for the ANOPR model to select the correct compressor. In the NOPR analysis, DOE revised the capacity values used to select self-contained compressors in the energy consumption model. For the NOPR, DOE used capacities based on the same conditions used to calculate total refrigeration load and revised the oversize factor (typically 1.4 in the NOPR model) for all self-contained equipment classes to maintain the selection of the correct compressor size. See chapter 5 of the TSD for more detail.

Following the NOPR, Structural Concepts commented that the compressor selection criteria in the engineering analysis results in the selection of unreasonable compressors for the refrigeration load. Specifically, Structural Concepts stated that the refrigeration load is 6,990 Btu/h for the VOP.SC.M equipment class, and the compressor sizing value is 9,787 Btu/h. Using the oversize factor value of 1.4, the compressor selected in the engineering analysis has a capacity of 13,219 Btu/h. The selection of an unrealistically large compressor unfairly skews the energy efficiency ratio because the larger compressor has a higher efficiency rating than the next smallest compressor that has a rated capacity closer to the compressor sizing value. (Structural Concepts, No. 30 at p. 3)

The energy consumption model selects a compressor assuming that the rated capacity of the compressor must be at or above the compressor sizing value. This prevents the selection of a compressor that is unable to meet the refrigeration load. The example Structural Concepts selected highlights one of the more extreme cases of how this model can select a compressor that is larger than necessary. However, Structural Concepts did not provide a recommendation that would result in the selection of a more appropriate compressor, or a more appropriate compressor oversize factor value to use for all the self-contained equipment classes. Because manufacturers previously agreed that the compressor oversize factor of 1.4 was appropriate to use for all the self-contained equipment classes used in the analysis, DOE maintained its assumptions from the NOPR.

h. Offset Factors for Self-Contained Equipment

For the NOPR, DOE developed offset factors to adjust the energy consumption calculations to accommodate smaller equipment for the equipment classes it directly analyzed. These offset factors account for the components of the refrigeration load that remain constant even when equipment sizes vary (*i.e.*, the conduction end effects) and disproportionately affect smaller cases. In the equation that describes the relationship between energy consumption and the corresponding TDA or volume metric, the offset factors are intended to approximate these constant loads and provide a fixed end point that corresponds to a zero TDA or zero volume case. See chapter 5 of the TSD for further details on the development of these offset factors for each equipment class. Following the NOPR, Structural Concepts requested that DOE increase the offset factor for self-contained equipment because DOE's analysis selected compressors that were too large and had unrealistically high efficiencies. (Structural Concepts, No. 30 at p. 4)

The compressors suggested by Structural Concepts for DOE's model would, in some cases, be undersized for

[19] 18ANSI/ARI Standard 540–2004: Performance Rating of Positive Displacement Refrigerant Compressors and Compressor Units lists standard rating conditions for hermetic refrigeration compressors. For medium-temperature equipment, compressors are rated at 20 °F suction dewpoint, 120 °F discharge dewpoint, 40 °F return gas, and 0 °F subcooling. For low-temperature equipment, compressors are rated at −10 °F suction dewpoint, 120 °F discharge dewpoint, 40 °F return gas, and 0 °F subcooling. For ice-cream-temperature equipment, compressors are rated at −25 °F suction dewpoint, 105 °F discharge dewpoint, 40 °F return gas, and 0 °F subcooling.

the refrigeration load. As mentioned in section V.A.2.g, DOE maintained the methodology used to select compressors in the energy consumption model. Because DOE did not receive any comments on necessary improvements or data on which its analysis can be reevaluated, and because the compressor selections used to develop the offset factors have not changed, DOE maintained the offset factors developed in the NOPR.

i. Self-Contained Condensing Coils

Following the NOPR, Structural Concepts revealed a discrepancy about the running temperature for self-contained equipment using coil enhancements. (Structural Concepts, No. 30 at p. 1) Chapter 5, section 5.6.3.7 of the NOPR TSD stated that self-contained equipment condenser coil enhancements would allow the condenser to run at a saturated condenser temperature (SCT) 10 °F cooler than a standard coil. However, the engineering analysis spreadsheet showed a decrease of 14 °F for this design option. There was a typographical error in the NOPR TSD and the 14 °F decrease in the engineering analysis is correct. In chapter 5 of the final rule TSD, DOE updated its figure to reflect the correct SCT 14 °F cooler temperature for the coil enhancements design option for self-contained equipment.

Structural Concepts also questioned the validity of using 98 °F as the baseline SCT in the engineering analysis. According to Structural Concepts, this value is not representative of the current ''off the shelf'' self-contained condensing units available. It believes the baseline SCT value should be closer to 105 °F or 110 °F. (Structural Concepts, No. 30 at p. 2)

There are condensing coils available that operate at both higher and lower SCT than the standard coil used in its model. This discrepancy exists because the standard coil used in DOE's model is not an actual condensing coil. DOE reviewed a range of available manufacturer data, selected several representative units, and aggregated the physical characteristics of the selected units to create a representative unit for each equipment class. The 98 °F operating SCT is an average characteristic. DOE also conducted a sensitivity analysis to evaluate Structural Concept's claim that baseline SCT was too low. In this sensitivity analysis in which the SCT was raised to 105 °F, DOE observed only minor changes in the energy consumption of the self-contained units. For these reasons, DOE will continue to use 98 °F as the baseline SCT for self-contained equipment condensers for today's final rule.

For the NOPR, DOE used data from teardowns by Southern California Edison's Refrigeration and Thermal Test Center (RTTC) to model the enhanced condenser coil used in the engineering analysis. Based on this information, DOE considered both minimum and maximum technology levels for this design option. For each level, DOE specified an overall UA-value and a coil cost. The UA-value is normalized to the standard coil, and the coil cost is normalized to the heat removal capacity of the coil. This approach allowed DOE to apply the details of coil design across all self-contained equipment classes. In consultation with outside experts, DOE determined that applying the same coil improvements to different sized coils would result in similar performance improvements. *See* chapter 5 of the TSD for more detail on the development of the enhanced condenser coil specifications.

Following the NOPR, Structural Concepts stated that DOE overstates the magnitude of the UA-value increase achievable with an enhanced condenser coil. It claimed the enhanced condenser prototype DOE used as a model for this design option is too large for use in self-contained equipment and, because UA-value primarily depends on surface area, the use of a smaller, practical condenser would yield a lower UA-value. As a result, it requested that DOE base the UA-value on coils that are closer in size to the standard coil. (Structural Concepts, No. 30 at p. 2)

The specifications for the enhanced coil used in DOE's analysis are based on a model developed specifically for use in a self-contained refrigeration system. The details of the coil construction are based on data from teardowns by Southern California Edison's Refrigeration and Thermal Test Center (RTTC).[20] Therefore, DOE is confident that it modeled an appropriately sized high efficiency condenser coil. In addition to increased exterior dimensions, DOE's enhanced condenser coil also uses a higher fin pitch, rifled tubing, and different tube spacing to achieve a higher UA-value than the standard coil. Structural Concepts also did not provide costs for their suggested coil model. Because DOE did not receive additional information or data that would suggest that the UA-value is not representative of enhanced condenser coils, and the data that was provided were incomplete, DOE maintained its assumptions from the NOPR for the enhanced condenser coil.

3. Manufacturer Impact Analysis

The Joint Comment stated that DOE gives exclusive consideration to the preservation-of-gross-margin (absolute dollars) scenario. According to the Joint Comment, relying solely on this scenario only considers manufacturers' expectations about the manufacturing impacts at the proposed standard. (Joint Comment, No. 7 at p. 2) The Joint Comment stated the preservation-of-gross-margin-percentage markup scenario provides a more plausible representation of impacts on manufacturers due to new energy conservation standards. (Joint Comment, No. 7 at p. 3)

DOE developed two markup scenarios: The preservation-of-gross-margin-percentage and the preservation-of-gross-margin (absolute dollars). DOE used these scenarios to bound the potential impacts on the industry value as a result of new energy conservation standards and presented its findings in the August 2008 NOPR for public comment. 73 FR 50107. The preservation-of-gross-margin-percentage markup scenario is a lower bound estimate on manufacturer impacts because it assumes that manufacturers will be able to fully recover all the increases in production costs due to energy conservation standards requirements. The preservation-of-gross-margin (absolute dollars) markup scenario is an upper bound estimate on manufacturer impacts because it assumes that manufacturers will be able to only partially recover cost increases (to maintain an absolute dollar gross margin) due to energy conservation standards. The markup scenarios DOE modeled in the GRIM reflect both its interpretation of qualitative information learned during manufacturer interviews and the analysis of limited profit margin data provided under confidentiality agreements.

DOE notes the large uncertainty about the actual impacts on the industry due to standards. The commercial refrigeration equipment industry has never been regulated for energy efficiency and manufacturers do not have previous experience on how energy conservation standards affect their business. The seven manufacturers that DOE interviewed for the NOPR expressed a divergence of views on how prices would change after standards. Most manufacturers stated that they expect profit levels to decrease due to new energy conservation standards based on their recent inability to pass on

[20] Refrigeration and Thermal Test Center. *Personal communication.* Southern California Edison. March 29, 2007.

increases in material and component costs to their customers. The portion of production costs reflected in selling prices varied significantly from manufacturer to manufacturer. In general, companies with lower market shares face greater challenges in passing along costs and would suffer larger margin impacts due to new energy conservation standards. Manufacturers with relatively large market shares have been more successful passing through costs and they are more confident of maintaining profit levels over the long term. Because of the divergence of experience with cost pass-through and the implication for prices and profitability after standards, DOE considers the full range of potential impacts bounded by the markup scenarios and does not consider one scenario to be more likely.

In response to the NOPR, Earthjustice noted that the direct employment benefits are shown to provide positive employment in the MIA analysis. Earthjustice stated DOE should consider these benefits in the final rule. (Earthjustice, Public Meeting Transcript, No. 27 at p. 166)

For the MIA, DOE calculated the direct employment impacts on the commercial refrigeration industry. DOE calculated total labor expenditures for the industry using the production costs from the engineering analysis, labor information from U.S. Census Bureau's 2006 Annual Survey of Manufacturers, and the total industry shipments from the NES. DOE translated the total labor expenditures for the industry into the total number of domestic jobs using the domestic share of commercial refrigeration equipment manufacturing, the labor rate for the industry, and the annual hours per worker. DOE calculated its estimate of the domestic employment for the base case and each TSL. The direct employment results characterized by the MIA represent U.S. production and non-production workers that are affected by this rulemaking in the commercial refrigeration equipment manufacturing industry.

For the final rule, DOE examined the impacts of energy conservation standards on domestic manufacturing employment levels. The direct employment impact analysis conducted as part of the MIA estimates the number of domestic workers who are affected by this rulemaking in the commercial refrigeration equipment manufacturing industry, assuming that shipment levels and product availability remain at current levels. Because labor costs are assumed to be a fixed percentage of total manufacturing production costs, which increase with more efficient equipment, the GRIM predicts a gradual increase in employment after standards. DOE has considered all employment impacts in weighing the benefits and the burdens, including direct (as calculated by the MIA) and indirect (as calculated by the employment impact analysis). For further details on the direct employment impact analysis, see chapter 13 of the accompanying TSD.

## VI. Analytical Results and Conclusions

### *A. Trial Standard Levels*

DOE selected between four and eight energy consumption levels for each commercial refrigeration equipment class in the LCC analysis. Based on the results of the analysis, DOE selected five trial standard levels above the baseline level for each equipment class for the NOPR. The range of TSLs selected includes the most energy efficient combination of design options with a positive NPV at the 7-percent discount rate, and the combination of design options with the minimum LCC. TSLs also were selected that filled large gaps between the baseline and the level with the minimum LCC.

For the NOPR, DOE developed offset factors to adjust the energy efficiency requirements for smaller equipment in each equipment class analyzed. These offset factors account for certain components of the refrigeration load (such as the conduction end effects) that remain constant even when equipment sizes vary. These constant loads affect smaller cases disproportionately. The offset factors are intended to approximate these constant loads and provide a fixed end point, corresponding to a zero TDA or zero volume case, in an equation that describes the relationship between energy consumption and the corresponding TDA or volume metric. See chapter 5 of the TSD for further details on the development of these offset factors for each equipment class.

For the final rule, DOE preserved the general methodology it used for the selection of efficiency levels in the NOPR in establishing specific efficiency levels for equipment classes. These levels are based on the results of the updated LCC analysis and made up the TSLs used in the NOPR. Table VI–1 shows the TSL levels DOE selected for energy use for the equipment classes analyzed. TSL 5 is the max-tech level for each equipment class. TSL 4 is the maximum efficiency level with a positive NPV at the 7-percent discount rate, except for VOP.RC.M. In this class, the minimal difference in energy efficiency between the minimum life-cycle cost level as determined by the LCC analysis and the maximum efficiency level with positive NPV prompted DOE to select the minimum life-cycle cost level instead of the maximum level with positive NPV. TSL 4 is a combination of the efficiency levels selected for TSL 3 and TSL 5. For a given equipment class, the efficiency levels selected for TSL 4 are either equivalent to those of TSL 3 or TSL 5. TSL 3 is the efficiency level that provides the minimum life-cycle cost determined by the LCC analysis. TSL 2 and TSL 1 represent lower efficiency levels that fill in the gap between the current baseline and the levels determined to have the minimum LCC.

Table VI–1 shows the same TSL levels in terms of proposed equations that establish an MDEC limit through a linear equation of the form:

$MDEC = A \times TDA + B$ *(for equipment using TDA as a normalizing metric)*

*or*

$MDEC = A \times V + B$ *(for equipment using volume as a normalizing metric)*

Coefficients *A* and *B* are uniquely derived for each equipment class based on the calculated offset factor *B* (see chapter 5 of the TSD for offset factors) and the equation slope *A*. Equation slope *A* would be used to describe the efficiency requirements for equipment of different sizes within the same equipment class. Chapter 9 of the TSD explains the methodology DOE used for selecting TSLs and developing the coefficients shown in Table VI–2.

TABLE VI–1—TRIAL STANDARD LEVELS FOR ANALYZED EQUIPMENT EXPRESSED IN TERMS OF DAILY ENERGY CONSUMPTION

| Equipment class | Normalization metric | Normalization value * | Test metric (kWh/day) | Trial standard levels for equipment analyzed expressed in terms of energy consumption (kWh/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Baseline | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
| VOP.RC.M | TDA [ft$^2$] ** | 53.30 | CDEC | 57.90 | 51.99 | 50.68 | 47.69 | 47.69 | 43.75 |
| VOP.RC.L | TDA [ft$^2$] | 44.66 | CDEC | 133.60 | 118.44 | 113.28 | 112.00 | 108.40 | 108.40 |
| VOP.SC.M | TDA [ft$^2$] | 14.93 | TDEC †† | 39.60 | 35.95 | 33.38 | 30.70 | 30.70 | 29.33 |
| VCT.RC.M | TDA [ft$^2$] | 65.00 | CDEC | 33.18 | 31.77 | 30.00 | 16.36 | 16.18 | 16.18 |
| VCT.RC.L | TDA [ft$^2$] | 65.00 | CDEC | 69.31 | 65.73 | 46.90 | 39.60 | 39.18 | 39.18 |
| VCT.SC.I | TDA [ft$^2$] | 26.00 | TDEC | 45.63 | 33.35 | 23.39 | 21.17 | 20.81 | 20.81 |
| VCS.SC.I | V [ft$^3$] † | 48.00 | TDEC | 27.13 | 24.31 | 21.64 | 19.07 | 19.07 | 19.07 |
| SVO.RC.M | TDA [ft$^2$] | 40.00 | CDEC | 43.56 | 39.58 | 38.59 | 36.34 | 36.34 | 33.61 |
| SVO.SC.M | TDA [ft$^2$] | 12.80 | TDEC | 33.11 | 30.66 | 28.87 | 26.74 | 26.74 | 25.74 |
| SOC.RC.M | TDA [ft$^2$] | 51.00 | CDEC | 31.70 | 30.01 | 27.93 | 26.24 | 26.24 | 20.62 |
| HZO.RC.M | TDA [ft$^2$] | 33.00 | CDEC | 19.63 | 17.89 | 15.73 | 14.69 | 14.54 | 14.54 |
| HZO.RC.L | TDA [ft$^2$] | 46.00 | CDEC | 38.38 | 35.30 | 33.41 | 32.97 | 32.97 | 32.97 |
| HZO.SC.M | TDA [ft$^2$] | 12.00 | TDEC | 19.23 | 17.85 | 16.51 | 14.93 | 14.81 | 14.81 |
| HZO.SC.L | TDA [ft$^2$] | 12.00 | TDEC | 38.69 | 36.02 | 33.52 | 30.31 | 30.14 | 30.14 |
| HCT.SC.I | TDA [ft$^2$] | 5.12 | TDEC | 7.25 | 6.37 | 3.70 | 3.53 | 3.32 | 3.32 |

* This is the assumed baseline size for each equipment class used in DOE's analyses.
** TDA is total display area of the case.
† V is gross refrigerated volume of the case.
†† TDEC is total daily energy consumption of the case.

TABLE VI–2—TRIAL STANDARD LEVELS EXPRESSED IN TERMS OF EQUATIONS AND COEFFICIENTS FOR EACH PRIMARY EQUIPMENT CLASS

| Equipment class | Test metric (kWh/day) | Trial standard levels for primary equipment classes analyzed | | | | | |
|---|---|---|---|---|---|---|---|
| | | Baseline | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
| VOP.RC.M | CDEC | 1.01 × TDA + 4.07 | 0.9 × TDA + 4.07 | 0.87 × TDA + 4.07 | 0.82 × TDA + 4.07 | 0.82 × TDA + 4.07 | 0.74 × TDA + 4.07 |
| VOP.RC.L | CDEC | 2.84 × TDA + 6.85 | 2.5 × TDA + 6.85 | 2.38 × TDA + 6.85 | 2.35 × TDA + 6.85 | 2.27 × TDA + 6.85 | 2.27 × TDA + 6.85 |
| VOP.SC.M | TDEC | 2.34 × TDA + 4.71 | 2.09 ×TDA + 4.71 | 1.92 ×TDA + 4.71 | 1.74 × TDA + 4.71 | 1.74 × TDA + 4.71 | 1.65 × TDA + 4.71 |
| VCT.RC.M | CDEC | 0.48 × TDA + 1.95 | 0.46 × TDA + 1.95 | 0.43 × TDA + 1.95 | 0.22 × TDA + 1.95 | 0.22 × TDA + 1.95 | 0.22 × TDA + 1.95 |
| VCT.RC.L | CDEC | 1.03 × TDA + 2.61 | 0.97 × TDA + 2.61 | 0.68 × TDA + 2.61 | 0.57 × TDA + 2.61 | 0.56 × TDA +2.61 | 0.56 × TDA + 2.61 |
| VCT.SC.I | TDEC | 1.63 × TDA + 3.29 | 1.16 × TDA + 3.29 | 0.77 × TDA + 3.29 | 0.69 × TDA + 3.29 | 0.67 × TDA + 3.29 | 0.67 × TDA + 3.29 |
| VCS.SC.I | TDEC | 0.55 × V + 0.88 | 0.49 × V + 0.88 | 0.43 × V + 0.88 | 0.38 × V + 0.88 | 0.38 × V + 0.88 | 0.38 × V + 0.88 |
| SVO.RC.M | CDEC | 1.01 × TDA + 3.18 | 0.91 × TDA + 3.18 | 0.89 × TDA + 3.18 | 0.83 × TDA + 3.18 | 0.83 × TDA + 3.18 | 0.76 × TDA + 3.18 |
| SVO.SC.M | TDEC | 2.23 × TDA + 4.59 | 2.04 × TDA + 4.59 | 1.9 × TDA + 4.59 | 1.73 × TDA + 4.59 | 1.73 × TDA + 4.59 | 1.65 × TDA + 4.59 |
| SOC.RC.M | CDEC | 0.62 × TDA + 0.11 | 0.59 × TDA + 0.11 | 0.55 × TDA + 0.11 | 0.51 × TDA + 0.11 | 0.51 × TDA + 0.11 | 0.4 × TDA + 0.11 |
| HZO.RC.M | CDEC | 0.51 × TDA + 2.88 | 0.45 × TDA + 2.88 | 0.39 × TDA + 2.88 | 0.36 × TDA + 2.88 | 0.35 × TDA + 2.88 | 0.35 × TDA + 2.88 |
| HZO.RC.L | CDEC | 0.68 × TDA + 6.88 | 0.62 × TDA + 6.88 | 0.58 × TDA + 6.88 | 0.57 × TDA + 6.88 | 0.57 × TDA + 6.88 | 0.57 × TDA + 6.88 |
| HZO.SC.M | TDEC | 1.14 × TDA + 5.55 | 1.03 × TDA + 5.55 | 0.91 × TDA + 5.55 | 0.78 × TDA + 5.55 | 0.77 × TDA + 5.55 | 0.77 × TDA + 5.55 |
| HZO.SC.L | TDEC | 2.63 × TDA + 7.08 | 2.41 × TDA + 7.08 | 2.2 × TDA + 7.08 | 1.94 × TDA + 7.08 | 1.92 × TDA + 7.08 | 1.92 × TDA + 7.08 |
| HCT.SC.I | TDEC | 1.33 × TDA + 0.43 | 1.16 × TDA + 0.43 | 0.64 × TDA + 0.43 | 0.6 × TDA + 0.43 | 0.56 × TDA + 0.43 | 0.56 × TDA + 0.43 |

In addition to the standards for the 15 primary equipment classes DOE analyzed, DOE is adopting standards for the remaining 23 secondary equipment classes of commercial refrigeration equipment covered in this rulemaking that were not directly analyzed in the engineering analysis due to low annual shipments (less than 100 units per year). DOE's approach involved extension multipliers developed using both the 15 primary equipment classes analyzed and a set of focused matched-pair analyses. In addition, standards for certain primary equipment classes could be directly applied to other similar secondary equipment classes. Chapter 5 of the TSD discusses the development of the extension multipliers and the set of focused matched-pair analyses.

Using this approach, DOE developed an additional set of TSLs for these secondary equipment classes that corresponds to each of the equations shown in Table VI–2 at each TSL. Table VI–3 shows this additional set of corresponding TSL levels.

TABLE VI–3—TRIAL STANDARD LEVELS EXPRESSED IN TERMS OF EQUATIONS AND COEFFICIENTS FOR EACH SECONDARY EQUIPMENT CLASS

| Equipment class | Test metric (kWh/day) | Trial standard levels for secondary equipment classes analyzed | | | | | |
|---|---|---|---|---|---|---|---|
| | | Baseline | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
| SVO.RC.L | CDEC | 2.84 × TDA + 6.85 | 2.5 × TDA + 6.85 | 2.38 × TDA + 6.85 | 2.35 × TDA + 6.85 | 2.27 × TDA + 6.85 | 2.27 × TDA + 6.85 |
| VOP.RC.I | CDEC | 3.6 × TDA + 8.7 | 3.17 × TDA + 8.7 | 3.03 × TDA + 8.7 | 2.99 × TDA + 8.7 | 2.89 × TDA + 8.7 | 2.89 × TDA + 8.7 |
| SVO.RC.I | CDEC | 3.6 × TDA + 8.7 | 3.17 × TDA + 8.7 | 3.03 × TDA + 8.7 | 2.99 × TDA + 8.7 | 2.89 × TDA + 8.7 | 2.89 × TDA + 8.7 |
| HZO.RC.I | CDEC | 0.87 × TDA + 8.74 | 0.78 × TDA + 8.74 | 0.73 × TDA + 8.74 | 0.72 × TDA + 8.74 | 0.72 × TDA + 8.74 | 0.72 × TDA + 8.74 |
| VCT.RC.I | CDEC | 1.2 × TDA + 3.05 | 1.14 × TDA + 3.05 | 0.8 × TDA + 3.05 | 0.67 × TDA + 3.05 | 0.66 × TDA + 3.05 | 0.66 × TDA + 3.05 |
| HCT.RC.M | CDEC | 0.39 × TDA + 0.13 | 0.34 × TDA + 0.13 | 0.19 × TDA + 0.13 | 0.18 × TDA + 0.13 | 0.16 × TDA + 0.13 | 0.16 × TDA + 0.13 |

TABLE VI–3—TRIAL STANDARD LEVELS EXPRESSED IN TERMS OF EQUATIONS AND COEFFICIENTS FOR EACH SECONDARY EQUIPMENT CLASS—Continued

| Equipment class | Test metric (kWh/day) | Trial standard levels for secondary equipment classes analyzed | | | | | |
|---|---|---|---|---|---|---|---|
| | | Baseline | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
| HCT.RC.L | CDEC | 0.81 × TDA + 0.26 | 0.71 × TDA + 0.26 | 0.39 × TDA + 0.26 | 0.37 × TDA + 0.26 | 0.34 × TDA + 0.26 | 0.34 × TDA + 0.26 |
| HCT.RC.I | CDEC | 0.95 × TDA + 0.31 | 0.83 × TDA + 0.31 | 0.46 × TDA + 0.31 | 0.43 × TDA + 0.31 | 0.4 × TDA + 0.31 | 0.4 × TDA + 0.31 |
| VCS.RC.M | CDEC | 0.16 × V + 0.26 | 0.14 × V + 0.26 | 0.13 × V + 0.26 | 0.11 × V + 0.26 | 0.11 × V + 0.26 | 0.11 × V + 0.26 |
| VCS.RC.L | CDEC | 0.33 × V + 0.54 | 0.3 × V + 0.54 | 0.26 × V + 0.54 | 0.23 × V + 0.54 | 0.23 × V + 0.54 | 0.23 × V + 0.54 |
| VCS.RC.I | CDEC | 0.39 × V + 0.63 | 0.35 × V + 0.63 | 0.31 × V + 0.63 | 0.27 × V + 0.63 | 0.27 × V + 0.63 | 0.27 × V + 0.63 |
| HCS.RC.M | CDEC | 0.16 × V + 0.26 | 0.14 × V + 0.26 | 0.13 × V + 0.26 | 0.11 × V + 0.26 | 0.11 × V + 0.26 | 0.11 × V + 0.26 |
| HCS.RC.L | CDEC | 0.33 × V + 0.54 | 0.3 × V + 0.54 | 0.26 × V + 0.54 | 0.23 × V + 0.54 | 0.23 × V + 0.54 | 0.23 × V + 0.54 |
| HCS.RC.I | CDEC | 0.39 × V + 0.63 | 0.35 × V + 0.63 | 0.31 × V + 0.63 | 0.27 × V + 0.63 | 0.27 × V + 0.63 | 0.27 × V + 0.63 |
| SOC.RC.L | CDEC | 1.3 × TDA + 0.22 | 1.23 × TDA + 0.22 | 1.15 × TDA + 0.22 | 1.08 × TDA + 0.22 | 1.08 × TDA + 0.22 | 0.84 × TDA + 0.22 |
| SOC.RC.I | CDEC | 1.52 × TDA + 0.26 | 1.44 × TDA + 0.26 | 1.34 × TDA + 0.26 | 1.26 × TDA + 0.26 | 1.26 × TDA + 0.26 | 0.99 × TDA + 0.26 |
| VOP.SC.L | TDEC | 5.87 × TDA + 11.82 | 5.25 × TDA + 11.82 | 4.82 × TDA + 11.82 | 4.37 × TDA + 11.82 | 4.37 × TDA + 11.82 | 4.14 × TDA + 11.82 |
| VOP.SC.I | TDEC | 7.45 × TDA + 15.02 | 6.67 × TDA + 15.02 | 6.13 × TDA + 15.02 | 5.55 × TDA + 15.02 | 5.55 × TDA + 15.02 | 5.26 × TDA + 15.02 |
| SVO.SC.L | TDEC | 5.59 × TDA + 11.51 | 5.11 × TDA + 11.51 | 4.76 × TDA + 11.51 | 4.34 × TDA + 11.51 | 4.34 × TDA + 11.51 | 4.15 × TDA + 11.51 |
| SVO.SC.I | TDEC | 7.11 × TDA + 14.63 | 6.5 × TDA + 14.63 | 6.05 × TDA + 14.63 | 5.52 × TDA + 14.63 | 5.52 × TDA + 14.63 | 5.27 × TDA + 14.63 |
| HZO.SC.I | TDEC | 3.35 × TDA + 9 | 3.06 × TDA + 9 | 2.8 × TDA + 9 | 2.46 × TDA + 9 | 2.44 × TDA + 9 | 2.44 × TDA + 9 |
| SOC.SC.I | TDEC | 2.13 × TDA + 0.36 | 2.02 × TDA + 0.36 | 1.88 × TDA + 0.36 | 1.76 × TDA + 0.36 | 1.76 × TDA + 0.36 | 1.38 × TDA + 0.36 |
| HCS.SC.I | TDEC | 0.55 × V + 0.88 | 0.49 × V + 0.88 | 0.43 × V + 0.88 | 0.38 × V + 0.88 | 0.38 × V + 0.88 | 0.38 × V + 0.88 |

1. Miscellaneous Equipment

As stated in the August 2008 NOPR, certain types of equipment meet the definition of ''commercial refrigeration equipment'' (Section 136(a)(3) of EPACT 2005), but do not fall directly into any of the 38 equipment classes defined in the market and technology assessment. One of these types is hybrid cases, in which two or more compartments are in different equipment families and are contained in one cabinet. Another is refrigerator-freezers, which have two compartments in the same equipment family but have different operating temperatures. Hybrid refrigerator-freezers, where two or more compartments are in different equipment families and have different operating temperatures, may also exist. Another is wedge cases, which form miter transitions (a corner section between two refrigerated display merchandisers) between standard display case lineups. DOE is using language that will allow manufacturers to determine appropriate standard levels for these types of equipment.

An example of a pure hybrid case (one with two or more compartments in different equipment families and operating at the same temperature) is a unit with one open and one closed medium-temperature compartment, such as those seen in coffee shops that sell baked goods and beverages. These hybrid cases may be either self-contained or remote condensing, and may be cooled by one or more condensing units. They may also have one evaporator cooling both compartments or one evaporator feeding each compartment separately.

An example of a refrigerator-freezer is a unit with doors where one compartment operates at medium temperature and one compartment operates at low temperature. Remote condensing commercial refrigerator-freezers (with and without doors) and self-contained commercial refrigerator-freezers without doors may operate in one of two ways. They may operate as separate chilled and frozen compartments with evaporators fed by two sets of refrigerant lines or two compressors. Alternatively, they may operate as separate chilled and frozen compartments fed by one set of low-temperature refrigerant lines (with evaporator pressure regulator (EPR) valves or similar devices used to raise the evaporator pressure) or one compressor.

An example of a hybrid refrigerator-freezer is a unit with one open compartment at medium temperature and one closed compartment at low temperature. As with pure hybrid cases, these cases may be either self-contained or remote condensing, and may be cooled by one or more condensing units. In the case of remote condensing equipment, they may operate as separate chilled and frozen compartments with evaporators fed by two sets of refrigerant lines or two compressors, or they may operate as separate chilled and frozen compartments fed by one set of low-temperature refrigerant lines (with EPR valves or similar devices used to raise the evaporator pressure of one compartment) or one compressor.

In the August 2008 NOPR, DOE proposed using the following language for requiring manufacturers to meet standards for hybrid cases, refrigerator-freezers, and hybrid refrigerator-freezers:

• For commercial refrigeration equipment with two or more compartments (*i.e.*, hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator freezers), the MDEC for each model shall be the sum of the MDEC values for all of its compartments. For each compartment, measure the TDA or volume of that compartment, and determine the appropriate equipment class based on that compartment's equipment family, condensing unit configuration, and designed operating temperature. The MDEC limit for each compartment shall be the calculated value obtained by entering that compartment's TDA or volume into the standard equation for that compartment's equipment class. Measure the calculated daily energy consumption (CDEC) or total daily energy consumption (TDEC) for the entire case as follows:

○ For remote condensing commercial hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers, where two or more independent condensing units each separately cool only one compartment, measure the total refrigeration load of each compartment separately according to the ANSI/ASHRAE Standard 72–2005 test procedure. Calculate compressor energy consumption (CEC) for each compartment using Table 1 in ARI Standard 1200–2006 using the saturated evaporator temperature for that compartment. The calculated daily energy consumption (CDEC) for the entire case shall be the sum of the CEC for each compartment, fan energy consumption (FEC), lighting energy consumption (LEC), anti-condensate energy consumption (AEC), defrost energy consumption (DEC), and condensate evaporator pan energy consumption (PEC) (as measured in ARI Standard 1200–2006).

◦ For remote condensing commercial hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers, where two or more compartments are cooled collectively by one condensing unit, measure the total refrigeration load of the entire case according to the ANSI/ASHRAE Standard 72–2005 test procedure. Calculate a weighted saturated evaporator temperature for the entire case by (i) multiplying the saturated evaporator temperature of each compartment by the volume of that compartment (as measured in ARI Standard 1200–2006), (ii) summing the resulting values for all compartments, and (iii) dividing the resulting total by the total volume of all compartments. Calculate the CEC for the entire case using Table 1 in ARI Standard 1200–2006, using the total refrigeration load and the weighted average saturated evaporator temperature. The CDEC for the entire case shall be the sum of the CEC, FEC, LEC, AEC, DEC, and PEC.

◦ For self-contained commercial hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers, measure the total daily energy consumption (TDEC) for the entire case according to the ANSI/ASHRAE Standard 72–2005 test procedure.

In response to the NOPR, Traulsen suggested that DOE address commercial refrigerator-freezers by summing the maximum daily energy consumption values for all of its individual compartments. (Traulsen, No. 25 at p. 2)

DOE agrees with this suggestion and notes that it is in alignment with the proposal in the August 2008 NOPR for commercial refrigeration equipment with two or more compartments. Therefore, DOE is adopting the language above for hybrid cases, refrigerator-freezers, and hybrid refrigerator-freezers in its final rule.

Additionally, DOE is adopting the following language to address wedge cases: For remote condensing and self-contained wedge cases, measure the CDEC or TDEC according to the ANSI/ARI 1200–2006 test procedure. The MDEC for each model shall be the amount derived by incorporating into the standard equation for the appropriate equipment class a value for the TDA that is the product of: (1) The vertical height of the air curtain (or glass in a transparent door), and (2) the largest overall width of the case when viewed from the front.

## *B. Significance of Energy Savings*

To estimate the energy savings through 2042 due to new standards, DOE compared the energy consumption of commercial refrigeration equipment under the base case (no standards) to energy consumption of this equipment under each TSL that DOE considered. Table VI–4 shows DOE's NES estimates, which it based on the *AEO2008* reference case, for each TSL. Chapter 11 of the TSD describes these estimates in more detail. DOE reports both undiscounted and discounted values of energy savings. Discounted energy savings represent a policy perspective where energy savings farther in the future are less significant than energy savings closer to the present. Each TSL considered in this rulemaking resulted in significant energy savings, and the amount of savings increased with higher energy conservation standards. Energy savings ranged from an estimated 0.168 quads to 1.298 quads for TSLs 1 through 5 (undiscounted).

TABLE VI–4—SUMMARY OF CUMULATIVE NATIONAL ENERGY SAVINGS FOR COMMERCIAL REFRIGERATION EQUIPMENT (ENERGY SAVINGS FOR UNITS SOLD FROM 2012 TO 2042)

| Trial standard level | Primary national energy savings (quads) (sum of all equipment classes) | | |
|---|---|---|---|
| | Undiscounted | 3% Discounted | 7% Discounted |
| 1 | 0.168 | 0.088 | 0.041 |
| 2 | 0.645 | 0.339 | 0.159 |
| 3 | 1.013 | 0.532 | 0.250 |
| 4 | 1.035 | 0.544 | 0.256 |
| 5 | 1.298 | 0.683 | 0.321 |

## *C. Economic Justification*

### 1. Economic Impact on Commercial Customers

#### a. Life-Cycle Costs and Payback Period

Commercial customers will be affected by the standards because they will experience higher purchase prices and lower operating costs. Generally, these impacts are best captured by changes in life-cycle costs and payback period. Therefore, DOE calculated the LCC and PBP for the standard levels considered in this rulemaking. DOE's LCC and PBP analyses provided five key outputs for each TSL, reported in Table VI–5 through Table VI–19. The first three outputs are the proportion of purchases of commercial refrigeration equipment where the purchase of a design that complies with the TSL would create: (1) A net life-cycle cost, (2) no impact, or (3) a net life-cycle savings for the consumer. The fourth output is the average net life-cycle savings from purchasing a complying design. The fifth output is the average PBP for the customer purchasing a design that complies with the TSL compared with purchasing baseline equipment. The PBP is the number of years it would take for the customer to recover the increased costs of higher-efficiency equipment through energy savings based on the operating cost savings from the first year of ownership. The PBP is an economic benefit-cost measure that uses benefits and costs without discounting.

TABLE VI–5—SUMMARY LCC AND PBP RESULTS FOR VOP.RC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 99 |
| Equipment with No Change in LCC (%) | 64 | 46 | 29 | 29 | 1 |
| Equipment with Net LCC Savings (%) | 36 | 54 | 71 | 71 | 0 |
| Mean LCC Savings ($) * | 1,344 | 1,308 | 1,788 | 1,788 | (3,959) |

TABLE VI–5—SUMMARY LCC AND PBP RESULTS FOR VOP.RC.M EQUIPMENT CLASS—Continued

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Mean Payback Period (years) | 0.8 | 1.3 | 2.0 | 2.0 | 138.1 |

* Numbers in parentheses indicate negative savings.

TABLE VI–6—SUMMARY LCC AND PBP RESULTS FOR VOP.RC.L EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 69 | 52 | 23 | 8 | 8 |
| Equipment with Net LCC Savings (%) | 31 | 48 | 77 | 92 | 92 |
| Mean LCC Savings ($) | 3,501 | 4,500 | 4,610 | 3,938 | 3,938 |
| Mean Payback Period (years) | 0.7 | 1.1 | 1.2 | 2.8 | 2.8 |

TABLE VI–7—SUMMARY LCC AND PBP RESULTS FOR VOP.SC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 69 |
| Equipment with No Change in LCC (%) | 67 | 35 | 21 | 21 | 1 |
| Equipment with Net LCC Savings (%) | 33 | 65 | 79 | 79 | 30 |
| Mean LCC Savings ($) | 842 | 1,209 | 1,549 | 1,549 | (451) |
| Mean Payback Period (years) | 0.8 | 1.6 | 2.4 | 2.4 | 11.2 |

TABLE VI–8—SUMMARY LCC AND PBP RESULTS FOR VCT.RC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 80 | 60 | 17 | 8 | 8 |
| Equipment with Net LCC Savings (%) | 20 | 40 | 83 | 92 | 92 |
| Mean LCC Savings ($) | 320 | 657 | 2,375 | 2,339 | 2,339 |
| Mean Payback Period (years) | 0.8 | 1.3 | 3.8 | 3.9 | 3.9 |

TABLE VI–9—SUMMARY LCC AND PBP RESULTS FOR VCT.RC.L EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 62 | 43 | 20 | 10 | 10 |
| Equipment with Net LCC Savings (%) | 38 | 57 | 80 | 90 | 90 |
| Mean LCC Savings ($) | 762 | 4,137 | 5,450 | 5,419 | 5,419 |
| Mean Payback Period (years) | 1.1 | 2.4 | 2.5 | 2.6 | 2.6 |

TABLE VI–10—SUMMARY LCC AND PBP RESULTS FOR VCT.SC.I EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 55 | 41 | 20 | 9 | 9 |
| Equipment with Net LCC Savings (%) | 45 | 59 | 80 | 91 | 91 |
| Mean LCC Savings ($) | 2,941 | 4,893 | 5,234 | 5,217 | 5,217 |
| Mean Payback Period (years) | 1.0 | 1.5 | 1.6 | 1.7 | 1.7 |

TABLE VI–11—SUMMARY LCC AND PBP RESULTS FOR VCS.SC.I EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 76 | 50 | 11 | 11 | 11 |
| Equipment with Net LCC Savings (%) | 24 | 50 | 89 | 89 | 89 |
| Mean LCC Savings ($) | 704 | 1,321 | 1,757 | 1,757 | 1,757 |
| Mean Payback Period (years) | 0.4 | 0.6 | 1.3 | 1.3 | 1.3 |

TABLE VI–12—SUMMARY LCC AND PBP RESULTS FOR SVO.RC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 99 |
| Equipment with No Change in LCC (%) | 65 | 47 | 30 | 30 | 1 |
| Equipment with Net LCC Savings (%) | 35 | 53 | 70 | 70 | 0 |
| Mean LCC Savings ($) | 907 | 896 | 1,274 | 1,274 | (2,974) |
| Mean Payback Period (years) | 0.8 | 1.3 | 1.9 | 1.9 | 196.8 |

TABLE VI–13—SUMMARY LCC AND PBP RESULTS FOR SVO.SC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 69 |
| Equipment with No Change in LCC (%) | 68 | 36 | 22 | 22 | 2 |
| Equipment with Net LCC Savings (%) | 32 | 64 | 78 | 78 | 29 |
| Mean LCC Savings ($) | 583 | 853 | 1,136 | 1,136 | (355) |
| Mean Payback Period (years) | 0.6 | 1.4 | 2.3 | 2.3 | 11.5 |

TABLE VI–14—SUMMARY LCC AND PBP RESULTS FOR SOC.RC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 92 |
| Equipment with No Change in LCC (%) | 82 | 64 | 29 | 29 | 3 |
| Equipment with Net LCC Savings (%) | 18 | 36 | 71 | 71 | 5 |
| Mean LCC Savings ($) | 405 | 851 | 945 | 945 | (1,458) |
| Mean Payback Period (years) | 0.5 | 0.8 | 1.7 | 1.7 | 19.4 |

TABLE VI–15—SUMMARY LCC AND PBP RESULTS FOR HZO.RC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 80 | 60 | 39 | 19 | 19 |
| Equipment with Net LCC Savings (%) | 20 | 40 | 61 | 81 | 81 |
| Mean LCC Savings ($) | 419 | 887 | 1,063 | 1,040 | 1,040 |
| Mean Payback Period (years) | 0.5 | 0.8 | 1.2 | 1.6 | 1.6 |

TABLE VI–16—SUMMARY LCC AND PBP RESULTS FOR HZO.RC.L EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 59 | 39 | 19 | 19 | 19 |
| Equipment with Net LCC Savings (%) | 41 | 61 | 81 | 81 | 81 |
| Mean LCC Savings ($) | 668 | 1,047 | 1,102 | 1,102 | 1,102 |
| Mean Payback Period (years) | 1.0 | 1.4 | 1.6 | 1.6 | 1.6 |

TABLE VI–17—SUMMARY LCC AND PBP RESULTS FOR HZO.SC.M EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 73 | 45 | 21 | 10 | 10 |
| Equipment with Net LCC Savings (%) | 27 | 55 | 79 | 90 | 90 |
| Mean LCC Savings ($) | 344 | 615 | 861 | 826 | 826 |
| Mean Payback Period (years) | 0.4 | 1.0 | 1.8 | 2.3 | 2.3 |

TABLE VI–18—SUMMARY LCC AND PBP RESULTS FOR HZO.SC.L EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 73 | 46 | 21 | 10 | 10 |
| Equipment with Net LCC Savings (%) | 27 | 54 | 79 | 90 | 90 |
| Mean LCC Savings ($) | 670 | 1,215 | 1,784 | 1,761 | 1,761 |
| Mean Payback Period (years) | 0.3 | 0.8 | 1.5 | 1.7 | 1.7 |

TABLE VI–19—SUMMARY LCC AND PBP RESULTS FOR HCT.SC.I EQUIPMENT CLASS

| | Trial standard level | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Equipment with Net LCC Increase (%) | 0 | 0 | 0 | 0 | 0 |
| Equipment with No Change in LCC (%) | 65 | 47 | 30 | 14 | 14 |
| Equipment with Net LCC Savings (%) | 35 | 53 | 70 | 86 | 86 |
| Mean LCC Savings ($) | 211 | 775 | 797 | 785 | 785 |
| Mean Payback Period (years) | 0.6 | 1.4 | 1.5 | 1.9 | 1.9 |

For five equipment classes (VOP.RC.M, VOP.SC.M, SVO.RC.M, SVO.SC.M, and SOC.RC.M), TSL 5 resulted in negative LCC savings compared to the purchase of baseline equipment. For all other equipment classes, TSL 5 showed positive LCC savings. For equipment classes with lighting, including LED lighting at TSL 5 had a significant impact on the calculated LCC savings. For equipment classes without lighting (*i.e.*, VCS.SC.I, HZO.RC.L, HZO.SC.M, HZO.SC.L, and HCT.SC.I), the difference in LCC savings between TSL 3 and TSL 5 was small, between $0 and $35 less at TSL 5 than at TSL 3. For VCT.RC.L, VCT.RC.I, and VCT.SC.I, the difference in LCC savings between TSL 3 and TSL 5 was small as well (between $17 and $36 less savings at TSL 5 than at TSL 3). VOP.RC.L showed a more significant reduction in LCC savings at TSL 5 compared to TSL 3 at $672.

b. Commercial Customer Sub-Group Analysis

Using the LCC spreadsheet model, DOE estimated the impact of the TSLs on small businesses, a customer sub-group. DOE estimated the LCC and PBP for small food sales businesses defined by the Small Business Administration (SBA) by presuming that most small business customers could be represented by the analysis performed for small grocery and convenience store owners. DOE further assumed that the smaller, independent grocery and convenience store chains may not have access to national accounts, but would instead purchase equipment primarily through distributors and grocery wholesalers. DOE modified the distribution channels for remote condensing and self-contained equipment to these small businesses as follows:

- For remote condensing equipment, 15 percent of the sales were assumed to pass through a manufacturer-to-distributor-to-contractor-to-customer channel, and 85 percent were assumed to be purchased through a manufacturer-to-distributor-to-customer channel.
- For self-contained equipment, 35 percent of sales were assumed to pass through a manufacturer-to-distributor-to-contractor-to-customer channel, and 65 percent were assumed to be purchased through a manufacturer-to-distributor-to-customer channel.

In both cases, the distribution chain markups were calculated with these revised shipment weights. Table VI–20 shows the mean LCC savings from proposed energy conservation standards for the small business sub-group, and Table VI–21 shows the mean payback period (in years) for this sub-group. More detailed discussion on the LCC sub-group analysis and results can be found in chapter 12 of the TSD.

TABLE VI–20—MEAN LIFE-CYCLE COST SAVINGS FOR COMMERCIAL REFRIGERATION EQUIPMENT PURCHASED BY LCC SUB-GROUP (SMALL BUSINESS) (2007$)*

| Equipment class | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
|---|---|---|---|---|---|
| VOP.RC.M | 1,746 | 1,764 | 2,443 | 2,443 | (3,463) |
| VOP.RC.L | 4,534 | 5,882 | 6,064 | 5,549 | 5,549 |

TABLE VI–20—MEAN LIFE-CYCLE COST SAVINGS FOR COMMERCIAL REFRIGERATION EQUIPMENT PURCHASED BY LCC SUB-GROUP (SMALL BUSINESS) (2007$)*—Continued

| Equipment class | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
|---|---|---|---|---|---|
| VOP.SC.M | 1,094 | 1,624 | 2,145 | 2,145 | 131 |
| VCT.RC.M | 416 | 868 | 3,484 | 3,458 | 3,458 |
| VCT.RC.L | 1,001 | 5,639 | 7,454 | 7,447 | 7,447 |
| VCT.SC.I | 3,811 | 6,451 | 6,944 | 6,949 | 6,949 |
| VCS.SC.I | 902 | 1,703 | 2,314 | 2,314 | 2,314 |
| SVO.RC.M | 1,177 | 1,209 | 1,738 | 1,738 | (2,637) |
| SVO.SC.M | 752 | 1,138 | 1,565 | 1,565 | 61 |
| SOC.RC.M | 521 | 1,106 | 1,290 | 1,290 | (948) |
| HZO.RC.M | 538 | 1,152 | 1,397 | 1,383 | 1,383 |
| HZO.RC.L | 875 | 1,383 | 1,466 | 1,466 | 1,466 |
| HZO.SC.M | 440 | 803 | 1,156 | 1,129 | 1,129 |
| HZO.SC.L | 857 | 1,574 | 2,364 | 2,352 | 2,352 |
| HCT.SC.I | 272 | 1,022 | 1,055 | 1,057 | 1,057 |

*Numbers in parentheses indicate negative savings.

TABLE VI–21—MEAN PAYBACK PERIOD FOR COMMERCIAL REFRIGERATION EQUIPMENT PURCHASED BY LCC SUB-GROUP (SMALL BUSINESS) (YEARS)

| Equipment class | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
|---|---|---|---|---|---|
| VOP.RC.M | 0.71 | 1.19 | 1.77 | 1.77 | 51.97 |
| VOP.RC.L | 0.64 | 0.99 | 1.10 | 2.53 | 2.53 |
| VOP.SC.M | 0.70 | 1.43 | 2.17 | 2.17 | 9.50 |
| VCT.RC.M | 0.73 | 1.14 | 3.54 | 3.64 | 3.64 |
| VCT.RC.L | 1.00 | 2.17 | 2.32 | 2.42 | 2.42 |
| VCT.SC.I | 0.90 | 1.32 | 1.47 | 1.57 | 1.57 |
| VCS.SC.I | 0.33 | 0.53 | 1.17 | 1.17 | 1.17 |
| SVO.RC.M | 0.70 | 1.19 | 1.73 | 1.73 | 106.71 |
| SVO.SC.M | 0.55 | 1.26 | 2.09 | 2.09 | 9.71 |
| SOC.RC.M | 0.48 | 0.75 | 1.55 | 1.55 | 15.62 |
| HZO.RC.M | 0.46 | 0.72 | 1.13 | 1.47 | 1.47 |
| HZO.RC.L | 0.93 | 1.26 | 1.50 | 1.50 | 1.50 |
| HZO.SC.M | 0.36 | 0.92 | 1.66 | 2.06 | 2.06 |
| HZO.SC.L | 0.29 | 0.71 | 1.35 | 1.55 | 1.55 |
| HCT.SC.I | 0.58 | 1.24 | 1.32 | 1.74 | 1.74 |

For commercial refrigeration equipment, the LCC and PBP impacts for small businesses are similar to those of all customers as a whole. While the discount rate for small grocery stores is higher than the rate for commercial refrigeration equipment customers as a whole and equipment prices are higher due to the higher markups, these small business customers appear to retain commercial refrigeration equipment over longer periods. Also, smaller stores generally tend to pay higher electric prices. The average LCC savings for the small business sub-group is slightly higher than that calculated for the average commercial refrigeration equipment customer, and the average PBP is slightly shorter than the national average. DOE concluded that the small food sales businesses defined by SBA will not experience economic impacts significantly different from or more negative than those impacts on food sales businesses as a whole.

2. Economic Impact on Manufacturers

DOE determined the economic impacts of today's standard on manufacturers, as described in the proposed rule. 73 FR 50118–21. For the final rule, DOE analyzed manufacturer impacts under two distinct markup scenarios: (1) The preservation-of-gross-margin-percentage markup scenario, and (2) the preservation-of-gross-margin (absolute dollars) markup scenario. 73 FR 50107. Under the first scenario, DOE applied a single uniform ''gross margin percentage'' markup that represents the current markup for manufacturers in the commercial refrigeration equipment industry. This markup scenario implies that as production costs increase with efficiency, the absolute dollar markup will also increase. DOE calculated that the non-production cost markup—which consists of selling, general, and administrative (SG&A) expenses; research and development (R&D) expenses; interest; and profit—is 1.32. This markup is consistent with the one DOE used in its engineering and GRIM analyses for the base case.

The implicit assumption behind the second scenario is that the industry can only maintain its gross margin from the baseline (in absolute dollars) after the standard. The industry would do so by passing its increased production costs on to customers without passing on its increased R&D and SG&A expenses so the gross profit per unit is the same in absolute dollars. DOE implemented this markup scenario in the GRIM by setting the production cost markups at each TSL to yield approximately the same gross margin in the standards cases in 2012 as they yielded in the base case.

Together, these two markup scenarios characterize the range of possible conditions the commercial refrigeration equipment market will experience as a result of new energy conservation standards. See chapter 13 of the TSD for additional details of the markup scenarios and analysis. DOE also examined both of these scenarios for this final rule.

a. Industry Cash-Flow Analysis Results

Using two different markup scenarios, 73 FR 50107, 50118–20, DOE estimated the impact of new standards for commercial refrigeration equipment on the INPV of the commercial refrigeration equipment industry. The impact consists of the difference between INPV in the base case and INPV in the standards case. INPV is the primary metric used in the MIA, and represents one measure of the fair value of the industry in today's dollars. DOE calculated the INPV by summing all of the net cash flows, discounted at the commercial refrigeration equipment industry's cost of capital or discount rate.

Table VI–22 and Table VI–23 show the changes in INPV that DOE estimates would result from the TSLs DOE considered for this final rule. The tables also present the equipment conversion expenses and capital investments that the industry would incur at each TSL. Product conversion expenses include engineering, prototyping, testing, and marketing expenses incurred by a manufacturer as it prepares to comply with a standard. Capital investments are the one-time outlays for tooling and plant changes required for the industry to comply (*i.e.*, conversion capital expenditures).

TABLE VI–22—MANUFACTURER IMPACT ANALYSIS RESULTS, INCLUDING INPV ESTIMATES, FOR COMMERCIAL REFRIGERATION EQUIPMENT UNDER THE PRESERVATION OF GROSS MARGIN PERCENTAGE MARKUP SCENARIO

[Preservation of gross margin percentage markup scenario with a rollup shipment scenario]

| | Units | Base case | Trial standard level | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| INPV | 2007$ millions | 540 | 540 | 548 | 530 | 501 | 560 |
| Change in INPV* | 2007$ millions | | 0 | 8 | (11) | (39) | 20 |
| | (%) | | 0.02 | 1.42 | 1.95 | (7.29) | 3.73 |
| New Energy Conservation Standards Equipment Conversion Expenses. | 2007$ millions | | 0.5 | 2.8 | 20.6 | 40.4 | 51.6 |
| New Energy Conservation Standards Capital Investments. | 2007$ millions | | 0.8 | 5.0 | 36.3 | 71.2 | 90.8 |
| Total Investment Required | 2007$ millions | | 1.3 | 7.8 | 57.0 | 111.6 | 142.4 |

*Values in Table VI–22 may not appear to sum due to rounding.

TABLE VI–23—MANUFACTURER IMPACT ANALYSIS RESULTS, INCLUDING INPV ESTIMATES, FOR COMMERCIAL REFRIGERATION EQUIPMENT UNDER THE PRESERVATION OF GROSS MARGIN (ABSOLUTE DOLLARS) MARKUP SCENARIO

[Preservation of gross margin absolute dollars markup scenario with a rollup shipment scenario]

| | Units | Base case | Trial standard level | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| INPV | 2007$ millions | 540 | 533 | 502 | 442 | 392 | 200 |
| Change in INPV* | 2007$ millions | | (7) | (39) | (99) | (148) | (340) |
| | (%) | | (1.27) | (7.16) | (18.26) | (27.35) | (63.01) |
| New Energy Conservation Standards Equipment Conversion Expenses. | 2007$ millions | | 0.5 | 2.8 | 20.6 | 40.4 | 51.6 |
| New Energy Conservation Standards Capital Investments. | 2007$ millions | | 0.8 | 5.0 | 36.3 | 71.2 | 90.8 |
| Total Investment Required | 2007$ millions | | 1.3 | 7.8 | 57.0 | 111.6 | 142.4 |

*Values in Table VI–23 may not appear to sum due to rounding.

The August 2008 NOPR discusses the estimated impact of new commercial refrigeration equipment standards on INPV for each equipment class. 73 FR 50118–20. See chapter 13 of the TSD for details.

b. Cumulative Regulatory Burden

DOE's assesses manufacturer burden through the cumulative impact of multiple DOE standards and other regulatory actions that affect manufacturers of the same covered equipment and other equipment produced by the same manufacturers or their parent companies. 73 FR 50120. For the August 2008 NOPR, DOE listed the EPA-mandated phaseout of HCFCs as refrigerants and blowing agents, and energy conservation standards for residential central air conditioners and heat pumps and room air conditioners as examples of other Federal regulations that could affect manufacturers of commercial refrigeration equipment. 73 FR 50120.

Following the August 2008 NOPR, public comments made DOE aware that commercial refrigeration equipment manufacturers must test equipment using the NSF 7 test procedure in addition to the DOE test procedure. As mentioned previously, NSF 7 measures product temperature for food safety requirements, while the DOE test procedure measures energy consumption for energy conservation standards. Although NSF 7 is not a Federal regulation, the commercial refrigeration equipment industry in general already tests its equipment using this procedure to meet food safety requirements.

For this final rule, DOE also identified the other DOE regulations commercial refrigeration equipment manufacturers are facing for other equipment. DOE identified several regulations that go into effect 3 years before and after the effective date of the new energy conservation standards for commercial refrigeration equipment. DOE recognizes that each regulation can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can quickly reduce manufacturers' profits and possibly cause an exit from the market.

DOE requested information about the cumulative regulatory burden during manufacturer interviews. Manufacturers indicated that they had already begun using other non-HCFC refrigerants and blowing agents. Manufacturers did not indicate that the DOE regulations on residential central air conditioners and heat pumps or room air conditioners were a great concern. DOE sought comment on these and other potential regulations affecting manufacturers for the final rule. From its own research, DOE learned that manufacturers of commercial refrigeration equipment or their parent companies could also be affected by rulemakings on PTACs and PTHPs, room air conditioners, residential furnaces, and walk-in freezers and coolers. DOE identified the costs of additional regulations when these estimates were available from other DOE rulemakings. For example, two commercial refrigeration equipment manufacturers (or their parent companies) also manufacture PTACs and PTHPs. DOE estimated that in the PTAC and PTHP industry, manufacturers may incur an estimated total conversion expense of $17.3 million (2007$). However, DOE has limited data on the importance of these other regulated products for manufacturers of commercial refrigeration equipment. Differences in market shares and manufacturing processes of other regulated products for each manufacturer could cause varying degrees of burdens on these manufacturers. See chapter 13 of the TSD for additional information regarding the cumulative regulatory burden analysis.

c. Impacts on Employment

As discussed in the August 2008 NOPR, DOE expects that employment by commercial refrigeration equipment manufacturers would increase under all of the TSLs considered for today's rule. However, this does not take into account any relocation of domestic jobs to countries with lower labor costs that might be influenced by the level of investment required by new standards. 73 FR 50120–21. Table VI–24 shows the direct employment impacts at each TSL. Further support for this conclusion is set forth in chapter 13 of the TSD.

TABLE VI–24—COMMERCIAL REFRIGERATION EQUIPMENT ESTIMATED EMPLOYMENT IMPACTS IN 2012

| Trial standard level | Base case | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
|---|---|---|---|---|---|---|
| Total Number of Domestic Production Employees in 2012 | 2,199 | 2,205 | 2,291 | 2,371 | 2,396 | 2,978 |
| Change in Total Number of Domestic Production Employees in 2012 Due to Standards * | ............ | 6 | 92 | 172 | 197 | 779 |
| Total Number of Domestic Non-Production Employees in 2012 * | 681 | 683 | 709 | 734 | 742 | 922 |
| Total Number of Domestic Employees in 2012 * | 2,880 | 2,888 | 3,000 | 3,105 | 3,137 | 3,900 |

* Figures do not take into account any relocation of domestic jobs to countries with lower labor costs that might be influenced by the level of investment required by new standards.

d. Impacts on Manufacturing Capacity

According to the majority of commercial refrigeration equipment manufacturers, new energy conservation standards will not significantly affect manufacturers' production capacity. Any necessary redesign of commercial refrigeration equipment will not change the fundamental assembly of the equipment. However, manufacturers anticipate some minor changes to tooling. Thus, manufacturers will be able to maintain manufacturing capacity levels and continue to meet market demand under new energy conservation standards.

e. Impacts on Manufacturers That Are Small Businesses

As discussed in the August 2008 NOPR, DOE expects today's standard to have little or no differential impact on small manufacturers of commercial refrigeration equipment. 73 FR at 50121, 50130–31. DOE found that small manufacturers generally have the same concerns as large manufacturers regarding energy conservation standards. DOE also found no significant differences in the R&D emphasis or marketing strategies between small and large manufacturers. Therefore, DOE believes the GRIM analysis, which models each equipment class separately and aggregates the results to produce an industry-wide impact, is representative of the small manufacturers that would be affected by standards. The impacts on small manufacturers are discussed further in section VII.B of this preamble (''Review Under the Regulatory Flexibility Act'').

3. National Net Present Value and Net National Employment

The NPV analysis estimates the cumulative benefits or costs to the Nation that would result from particular standard levels. While the NES analysis estimates the energy savings from each standard level DOE considers, relative to the base case, the NPV analysis estimates the national economic impacts of each level relative to the base case. Table VI–25 provides an overview of the NPV results for each TSL considered for this final rule, using both a 7-percent and a 3-percent real discount rate.

Table VI–25 shows the estimated cumulative NPV for commercial refrigeration equipment resulting from the sum of the NPV calculated for each of the 15 primary equipment classes analyzed. Table VI–25 assumes the *AEO2008* reference case forecast for electricity prices. At a 7-percent discount rate, TSLs 1–4 show positive cumulative NPVs. The highest NPV is provided by TSL 3 at $1.45 billion. TSL 4 provided $1.41 billion, close to that of TSL 3. TSL 5 showed a negative NPV at − $2.59 billion, the result of negative NPV observed in five equipment classes (VOP.RC.M, VOP.SC.M, SVO.RC.M, SVO.SC.M, and SOC.RC.M).

At a 3-percent discount rate, the picture is similar across the equipment classes. TSL 5 showed a negative NPV at − $3.79 billion, whereas the highest NPV was provided at TSL 3 (*i.e.*, $3.97 billion). TSL 4 provided a near equivalent NPV at $3.93 billion. TSL 5 provided a NPV of − $3.79 billion dollars. Five equipment classes (VOP.RC.M, VOP.SC.M, SVO.RC.M, SVO.SC.M, and SOC.RC.M) were determined to have negative NPVs at a 3-percent discount rate at TSL 5. See TSD chapter 11 for more detailed NPV results.

TABLE VI–25—OVERVIEW OF NATIONAL NET PRESENT VALUE RESULTS

| Trial standard level | NPV (billion 2007$) | |
|---|---|---|
| | 7% Discount rate | 3% Discount rate |
| 1 | 0.33 | 0.83 |
| 2 | 0.98 | 2.60 |
| 3 | 1.45 | 3.97 |
| 4 | 1.41 | 3.93 |
| 5 | (2.59) | (3.79) |

DOE also estimated the national employment impacts that would result from each TSL. As discussed in the August 2008 NOPR, 73 FR 50107–08, 50122–23, DOE expects the net monetary savings from standards to be redirected to other forms of economic activity. DOE also expects these shifts in spending and economic activity to affect the demand for labor. As shown in Table VI–26, DOE estimates net indirect employment impacts—those changes of employment in the larger economy (other than in the manufacturing sector being regulated)—from commercial refrigeration equipment energy conservation standards to be positive but very small relative to total national employment. These impacts might be offset by other, unanticipated effects on employment. For details on the employment impact analysis methods and results, *see* TSD chapter 15.

TABLE VI–26—NET NATIONAL CHANGE IN INDIRECT EMPLOYMENT, THOUSANDS OF JOBS IN 2042

| Trial standard level | Net national change in jobs | | | |
|---|---|---|---|---|
| | 2012 | 2022 | 2032 | 2042 |
| 1 | 0 | 202 | 289 | 332 |
| 2 | (6) | 1,056 | 1,482 | 1,699 |
| 3 | (15) | 1,591 | 2,238 | 2,559 |
| 4 | (18) | 1,658 | 2,337 | 2,670 |
| 5 | (40) | 1,856 | 2,645 | 3,011 |
| Maximum Job Impact | (40) | 1,856 | 2,645 | 3,011 |

4. Impact on Utility or Performance of Equipment

As indicated in section V.B.4 of the August 2008 NOPR, the new standards DOE is adopting today will not lessen the utility or performance of any commercial refrigeration equipment. 73 FR 50123.

5. Impact of Any Lessening of Competition

As discussed in the August 2008 NOPR, 73 FR 50079, 50123, and in section III.D.1.e of this preamble, DOE considers any lessening of competition likely to result from standards. The Attorney General determines the impact, if any, of any lessening of competition.

DOJ concluded that the commercial refrigeration equipment standards contained in the proposed rule would not adversely affect competition. In reaching this conclusion, DOJ noted that the proposed standards took into account comments from commercial refrigeration equipment manufacturers, ASHRAE, ACEEE, and electric utilities. DOJ noted further that all key components are available for purchase by any manufacturer; therefore, no manufacturer has a technological advantage in meeting the proposed standards. Finally, DOJ noted that DOE found no significant differences between the concerns of large and small manufacturers, and DOJ found no evidence that certain manufacturers would be placed at a competitive disadvantage to other manufacturers.

6. Need of the Nation To Conserve Energy

When economically justified, an improvement in the energy efficiency of commercial refrigeration equipment is likely to improve the security of the Nation by reducing overall energy demand, thus reducing the Nation's reliance on foreign sources of energy. Reduced demand is also likely to improve the reliability of the electricity system, particularly during peak-load periods. As a measure of this reduced demand, DOE expects the new standards covered under this rulemaking to eliminate the need for the construction of approximately 121 megawatts to 2,989 megawatts of new power by 2042.

Enhanced energy efficiency also produces environmental benefits. The expected energy savings from new standards for the equipment covered by this rulemaking will reduce the emissions of air pollutants and greenhouse gases associated with electricity production. Table VI–27 provides DOE's estimate of cumulative $CO_2$, $NO_X$, and Hg emissions reductions that would result from the TSLs considered in this rulemaking. The expected energy savings from new standards for commercial refrigeration equipment may also reduce the cost of maintaining nationwide emissions standards and constraints.

TABLE VI–27—SUMMARY OF EMISSIONS REDUCTIONS FOR COMMERCIAL REFRIGERATION EQUIPMENT (CUMULATIVE REDUCTIONS FOR EQUIPMENT SOLD FROM 2012 TO 2042)

| | Trial standard levels †† | | | | |
|---|---|---|---|---|---|
| | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
| $CO_2$ (Mt*) | 8.5 | 32.8 | 50.7 | 52.6 | 66.0. |

TABLE VI–27—SUMMARY OF EMISSIONS REDUCTIONS FOR COMMERCIAL REFRIGERATION EQUIPMENT (CUMULATIVE REDUCTIONS FOR EQUIPMENT SOLD FROM 2012 TO 2042)—Continued

| | Trial standard levels †† | | | | |
|---|---|---|---|---|---|
| | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
| $NO_X$ (kt **) | 0.59 to 14.58 | 2.27 to 56.04 | 3.51 to 86.77 | 3.64 to 89.97 | 4.56 to 112.84. |
| Hg (t †) | 0 to 0.224 | 0 to 0.86 | 0 to 1.332 | 0 to 1.381 | 0 to 1.732. |

* Mt = million metric tons.
** kt = thousand tons.
† t = tons.
†† Negative values indicate emission increases. Detail may not appear to sum to total due to rounding.

The estimated cumulative $CO_2$, $NO_X$, and Hg emissions reductions for the new energy conservation standards range up to 66 Mt for $CO_2$, 1.56 to 112.84 kt for $NO_X$, and 0 to 1.732 t for Hg for commercial refrigeration equipment from 2012 to 2042. In the EA (chapter 16 of the TSD), DOE reports estimated annual changes in $CO_2$, $NO_X$, and Hg emissions attributable to each TSL. As discussed in section IV.L of this final rule, DOE does not report $SO_2$ emissions reduction from power plants because reductions from an energy conservation standard would not affect the overall level of $SO_2$ emissions in the United States due to emissions caps for $SO_2$.

The NEMS–BT modeling assumed that $NO_X$ would be subject to CAIR, issued by the U.S. Environmental Protection Agency on March 10, 2005.[21] 70 FR 25162 (May 12, 2005). On July 11, 2008, the U.S. Court of Appeals for the District of Columbia Circuit (DC Circuit) issued its decision in *North Carolina* v. *Environmental Protection Agency*,[22] in which the court vacated the CAIR. 531 F.3d 896 (DC Cir. 2008). If left in place, CAIR would have permanently capped emissions of $NO_X$ in 28 eastern States and the District of Columbia. As with the $SO_2$ emissions cap, a cap on $NO_X$ emissions would have meant that energy conservation standards are not likely to have a physical effect on $NO_X$ emissions in states covered by the CAIR caps. While the caps would have meant that physical emissions reductions in those States would not have resulted from the energy conservation standards that DOE is establishing today, the standards might have produced an environmental-related economic impact in the form of lower prices for emissions allowance credits, if large enough. DOE notes that the estimated total reduction in $NO_X$ emissions, including projected emissions or corresponding allowance credits in States covered by the CAIR cap, was insignificant and too small to affect allowance prices for $NO_X$ under CAIR.

Even though the DC Circuit vacated CAIR, DOE notes that the DC Circuit left intact EPA's 1998 $NO_X$ SIP Call rule, which capped seasonal (summer) $NO_X$ emissions from electric generating units and other sources in 23 jurisdictions, and gave those jurisdictions the option to participate in a cap and trade program. 63 FR 57356, 57359 (Oct. 27, 1998).[23] The SIP Call rule may provide a similar, although less extensive, regional cap and may limit actual reduction in $NO_X$ emissions from revised standards occurring in states participating in the SIP Call rule. However, the possibility that the SIP Call rule may have the same effect as CAIR is highly uncertain. Therefore, DOE established a range of $NO_X$ reductions due to the standards being established in today's final rule. DOE's low estimate was based on the emission rate of the cleanest new natural gas combined-cycle power plant available for electricity generated, assuming that energy conservation standards would displace the generation of only the cleanest available fossil fuels. DOE used the emission rate, specified as 0.0341 t of $NO_X$ emitted per TWh of electricity generated, associated with an advanced natural gas combined-cycle power plant, as specified by NEMS–BT. To estimate the reduction in $NO_X$ emissions, DOE multiplied this emission rate by the reduction in electricity generation due to the new energy conservation standards considered. DOE's high estimate of 0.843 t of $NO_X$ per TWh was based on a nationwide $NO_X$ emission rate for all electrical generation. Use of such an emission rate assumes that future power plants displaced are no cleaner than the plants that are being used currently to generate electricity. Under the high estimate assumption, energy conservation standards also would have little to no effect on the generation mix. Based on *AEO2008* for 2006, when no regulatory or non-regulatory measures were in effect to limit $NO_X$ emissions, DOE multiplied this emission rate by the reduction in electricity generation due to the standards considered. Table VI–27 shows the range in $NO_X$ emission changes calculated using the low and high estimate scenarios by TSL. $NO_X$ emission reductions range from 0.59 to 112.84 kt for the TSLs considered. These changes in $NO_X$ emissions are extremely small, ranging from 0.001 to 0.168 percent of the national base case emissions forecast by NEMS–BT, depending on the TSL.

As noted in section IV.L, DOE is able to report an estimate of the physical quantity changes in Hg emissions associated with an energy conservation standard. Rather than using the NEMS–BT model, DOE established a range of Hg rates to estimate the Hg emissions that could be reduced through standards. DOE's low estimate assumed that future standards would displace electrical generation from natural gas-fired power plants, resulting in an effective emission rate of zero. The low-

[21] On December 23, 2008, the DC Circuit decided to allow CAIR to remain in effect until it is replaced by a rule consistent with the court's earlier opinion. *North Carolina* v. *EPA*, No. 05–1244, 2008 WL 5335481 (DC Cir. Dec. 23, 2008). Neither the July 11, 2008, nor the December 23, 2008, decisions of the DC Circuit change the standard-setting conclusions reached in this rule. See *http://www.epa.gov/cleanairinterstaterule*.

[22] Case No. 05–1244, 2008 WL 2698180 at *1 (DC Cir. July 11, 2008).

[23] In the $NO_X$ SIP Call rule, EPA found that sources in the District of Columbia and 22 ''upwind'' states were emitting $NO_X$ (an ozone precursor) at levels that significantly contributed to ''downwind'' states not attaining the ozone NAAQS or at levels that interfered with states in attainment maintaining the ozone NAAQS. To ensure that downwind states attain or continue to attain the ozone NAAQS, EPA established a region-wide cap for $NO_X$ emissions from certain large combustion sources and set a $NO_X$ emissions budget for each State. Unlike the cap that CAIR would have established, the $NO_X$ SIP Call Rule's cap only constrains seasonal (summertime) emissions. To comply with the $NO_X$ SIP Call Rule, states could elect to participate in the $NO_X$ Budget Trading Program. Under this program, each emission source is required to have one allowance for each ton of $NO_X$ emitted during the ozone season. States have flexibility in how they allocate allowances through their State Implementation Plans, but states must remain within the EPA-established budget. Emission sources are allowed to buy, sell, and bank $NO_X$ allowances as appropriate. On April 16, 2008, EPA determined that Georgia is no longer subject to the $NO_X$ SIP Call rule. 73 FR 21528 (April 22, 2008).

end emission rate is zero because natural gas-fired power plants have virtually zero Hg emissions associated with their operation.

DOE's high estimate was based on a nationwide mercury emission rate from *AEO2008*. Because power plant emission rates are a function of local regulation, scrubbers, and the mercury content of coal, it is extremely difficult to identify a precise high-end emission rate. Therefore, DOE believes the most reasonable estimate is based on the assumption that all displaced coal generation would have been emitting at the average emission rate for coal generation as specified by *AEO2008*. As noted previously, because virtually all mercury emitted from electricity generation is from coal-fired power plants, DOE based the emission rate on the tons of mercury emitted per TWh of coal-generated electricity. Based on the emission rate for 2006, DOE derived a high-end emission rate of 0.0255 tons per TWh. To estimate the reduction in mercury emissions, DOE multiplied the emission rate by the reduction in coal-generated electricity due to the standards considered in the utility impact analysis. The estimated changes in Hg emissions are shown in Table VI–27 for commercial refrigeration equipment from 2012 to 2042. Hg emission reductions range from 0 to 1.732 tons for the TSLs considered. These changes in Hg emissions are extremely small, ranging from 0 to 0.003 percent of the national base case emissions forecast by NEMS–BT, depending on the TSL.

The NEMS–BT model used for today's rulemaking could not estimate Hg emission reductions due to new energy conservation standards, as it assumed that Hg emissions would be subject to EPA's Clean Air Mercury Rule [24] (CAMR). CAMR would have permanently capped emissions of mercury for new and existing coal-fired plants in all states by 2010. As with $SO_2$ and $NO_X$, DOE assumed that under such a system, energy conservation standards would have resulted in no physical effect on these emissions, but might have resulted in an environmental-related economic benefit in the form of a lower price for emissions allowance credits, if large enough. DOE estimated that the change in the Hg emissions from energy conservation standards would not be large enough to influence allowance prices under CAMR.

On February 8, 2008, the DC Circuit issued its decision in *New Jersey* v. *Environmental Protection Agency* [25] to vacate CAMR. In light of this development and because the NEMS–BT model could not be used to directly calculate Hg emission reductions, DOE used the current Hg emission rates discussed above to calculate the emissions reductions in Table VI–27.

In the August 2008 NOPR, DOE considered accounting for a monetary benefit of $CO_2$ emission reductions associated with this rulemaking. To put the potential monetary benefits from reduced $CO_2$ emissions into a form that is likely to be most useful to decision-makers and interested parties, DOE used the same methods it used to calculate the net present value of consumer cost savings. DOE converted the estimated year-by-year reductions in $CO_2$ emissions into monetary values, which were then discounted over the life of the affected equipment to the present using both 3-percent and 7-percent discount rates.

In the August 2008 NOPR, DOE proposed to use the range $0 to $14 per ton. These estimates were based on an assumption of no benefit to an average benefit value reported by the Intergovernmental Panel on Climate Change (IPCC).[26] DOE derived the IPCC estimate used as the upper bound value from an estimate of the mean value of worldwide impacts due to climate change, and not just the effects likely to occur within the United States. As DOE considers a monetary value for $CO_2$ emission reductions, the value should, if possible, be restricted to a representation of those costs and benefits likely to be experienced in the United States. DOE explained in the August 2008 NOPR that it expects such values would be lower than comparable global values; however, there currently are no consensus estimates for the U.S. benefits likely to result from $CO_2$ emission reductions. However, it is appropriate to use U.S. benefit values, where available, and not world benefit values, in its analysis.[27] Because U.S.-specific estimates are unavailable, and DOE did not receive any additional information that would help narrow the proposed range of domestic benefits, DOE used the global mean value as an upper bound U.S. value for purposes of the sensitivity analysis.

DOE received several comments in response to the proposed estimated value of $CO_2$ emissions reductions. In a comment submitted by Earthjustice on behalf of itself and NRDC, Earthjustice questioned both the upper and lower bounds of DOE's range of estimated $CO_2$ values, which it argued were too low. (Earthjustice, No. 38 at p. 7) Earthjustice also stated that it would be inappropriate to limit the consideration to the value of $CO_2$ to a domestic value. (Earthjustice, No. 38 at p. 13) Earthjustice suggested that DOE consider relying on the estimate used in DOE's analysis of the impacts of the Lieberman-Warner Climate Security Act of 2007 (S. 2191).[28] (Earthjustice, No. 38 at p. 2) AHRI stated that DOE should not rely on the IPCC study or values under the European Union cap and trade program, because such a program has not yet been established in the United States. (AHRI, No. 33 at p. 6)

Given the uncertainty surrounding estimates of the social cost of carbon, relying on any single estimate may be inadvisable because any estimate will depend on many assumptions. Working Group II's contribution to the Fourth Assessment Report of the IPCC notes the following:

The large ranges of SCC are due in the large part to differences in assumptions regarding climate sensitivity, response lags, the treatment of risk and equity, economic and non-economic impacts, the inclusion of potentially catastrophic losses, and discount rates.[29]

Because of this uncertainty, DOE used the SCC value from Tol (2005), which was presented in the IPCC's Fourth

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[24] 70 FR 28606 (May 18, 2005).

[25] No. 05–1097, 2008 WL 341338, at * (DC Cir. Feb. 9, 2008).

[26] During the preparation of its most recent review of the state of climate science, the IPCC identified various estimates of the present value of reducing $CO_2$ emissions by 1 ton over the life that these emissions would remain in the atmosphere. The estimates reviewed by the IPCC spanned a range of values. Absent a consensus on any single estimate of the monetary value of $CO_2$ emissions, DOE used the estimates identified by the study cited in ''Summary for Policymakers,'' prepared by Working Group II of the IPCC's Fourth Assessment Report, to estimate the potential monetary value of $CO_2$ reductions likely to result from standards finalized in this rulemaking. According to IPCC, the mean social cost of carbon (SCC) reported in studies published in peer-reviewed journals was $43 per ton of carbon. This translates into about $12 per ton of $CO_2$. The literature review (Tol 2005) from which this mean was derived did not report the year in which these dollars were denominated. However, DOE understands this estimate was denominated in 1995$. Updating that estimate to 2007$ yields a SCC of $15 per ton of $CO_2$.

[27] In contrast, most of the estimated costs and benefits of increasing the efficiency of commercial refrigeration equipment include only economic values of impacts that would be experienced in the United States. DOE generally does not consider impacts on manufacturers that occur solely outside of the United States.

[28] According to Earthjustice's analysis of the Lieberman-Warner Climate Security Act of 2007, implementation of this legislation would lead to a $CO_2$ allowance price of $30 per ton in 2020, rising to $61 per ton in 2030.

[29] Climate Change 2007—Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC, 17. Available at *http://www.ipcc-wg2.org* (last accessed Aug. 7, 2008).

Assessment Report and provided a comprehensive meta-analysis of estimates for the value of SCC. Earthjustice commented that this value was out of date, because Tol released an update of his 2005 meta-analysis in September 2007. This update reported an increase in his mean estimate of SCC from $43 to $71/ton carbon. Earthjustice stated that DOE should not continue to use old data and should update its sources. (Earthjustice, No. 38 at p. 9)

Although the Tol study was updated in 2007, the IPCC has not adopted the updated Tol study for its report. As a result, DOE continues to rely on the same study used by the IPCC. Moreover, DOE notes that the conclusions of Tol (2007) are similar to the conclusions of Tol (2005). Tol (2007) continues to indicate that there is no consensus regarding the monetary value of reducing $CO_2$ emissions by 1 ton. The broad range of values in both Tol studies are the result of significant differences in the methodologies used in the studies Tol summarized. According to Tol, all of the studies have shortcomings, largely because the subject is inherently complex and uncertain and requires broad multidisciplinary knowledge. Thus, it is not certain that the values reported in Tol (2007) are more accurate or representative than the values reported in Tol (2005).

In today's final rule, DOE is relying on the range of values proposed in the August 2008 NOPR, which was based on the values presented in Tol (2005), as proposed. DOE does note that DOE mistakenly assumed that the values presented in Tol (2005) were in 2000 dollars. In actuality, the values in Tol (2005) were indicated to be approximately 1995 values in 1995 dollars. Had DOE at the NOPR stage applied the correct dollar year of the values presented in Tol (2005), DOE would have proposed the range of $0 to $15 in the August 2008 NOPR. Additionally, DOE has applied an annual growth rate of 2.4 percent to the value of SCC, as suggested by the IPCC Working Group II (2007, p. 822). This growth rate is based on estimated increases in damage from future emissions that published studies have reported. As a result, for today's final rule, DOE is assigning a range for SCC of $0 to $20 ($2007) per ton of $CO_2$ emissions.

Earthjustice questioned the use of the mean estimated social cost of $CO_2$ as an upper bound of the range. (Earthjustice, No. 38 at p. 9) However, the upper bound of the range DOE used is based on Tol (2005), which reviewed 103 estimates of SCC from 28 published studies. Tol concluded that when only peer-reviewed studies published in recognized journals are considered, ''climate change impacts may be very uncertain but [it] is unlikely that the marginal damage costs of carbon dioxide emissions exceed $50 per ton carbon [comparable to a 2007 value of $20 per ton carbon dioxide when expressed in 2007 U.S. dollars with a 2.4 percent growth rate.]''

Earthjustice also questioned using $0 as the lower bound of DOE's estimated range. (Earthjustice, No. 38 at p. 10) In setting a lower bound, DOE agrees with the IPCC Working Group II (2007) report that ''significant warming across the globe and the locations of significant observed changes in many systems consistent with warming is very unlikely to be due solely to natural variability of temperatures or natural variability of the systems'' (p. 9), and thus tentatively concludes that a global value of zero for reducing emissions cannot be justified. However, it is reasonable to allow for the possibility that the U.S. portion of the global cost of $CO_2$ emissions may be quite low. In fact, some of the studies examined by Tol (2005) reported negative values for the SCC. As stated in the August 2008 NOPR, DOE is using U.S. benefit values, and not world benefit values, in its analysis. Further, U.S. domestic values will be lower than the global values. Additionally, the statutory criteria in EPCA do not require consideration of global effects. Therefore, DOE is using a lower bound of $0 per ton of $CO_2$ emissions in estimating the potential benefits of today's final rule.

Table VI–28 presents the resulting estimates of the potential range of net present value benefits associated with reducing $CO_2$ emissions.

TABLE VI—28 ESTIMATES OF SAVINGS FROM $CO_2$ EMISSIONS REDUCTIONS UNDER COMMERCIAL REFRIGERATION EQUIPMENT TRIAL STANDARD LEVELS AT A SEVEN-PERCENT DISCOUNT RATE AND THREE-PERCENT DISCOUNT RATE

| TSL | Estimated cumulative $CO_2$ (Mt) emission reductions | Value of estimated $CO_2$ emission reductions (million 2007$) at 7% discount rate | Value of estimated $CO_2$ emission reductions (million 2007$) at 3% discount rate |
|---|---|---|---|
| 1 | 8.52 | $0 to $76.01 | $0 to $154.73. |
| 2 | 32.76 | $0 to $292.26 | $0 to $594.94. |
| 3 | 50.71 | $0 to $452.49 | $0 to $921.1. |
| 4 | 52.59 | $0 to $469.19 | $0 to $955.1. |
| 5 | 65.95 | $0 to $588.44 | $0 to $1,197.85. |

DOE also investigated the potential monetary impact from today's energy conservation standards of reducing $SO_2$, $NO_X$, and Hg emissions. As previously stated, DOE's initial analysis assumed the presence of nationwide emission caps on $SO_2$ and Hg, and caps on $NO_X$ emissions in the 28 states covered by CAIR. In the presence of these caps, DOE concluded that no physical reductions in power sector emissions would occur, but that the lower generation requirements associated with energy conservation standards could put downward pressure on the prices of emissions allowances in cap and trade markets. Estimating this effect is very difficult because of factors such as credit banking, which can change the trajectory of prices. DOE has further concluded that the effect from energy conservation standards on $SO_2$ allowance prices is likely to be negligible, based on runs of the NEMS–BT model. See chapter 16 (Environmental Assessment) of the TSD for further details.

Because the courts have vacated the CAIR rule, projected annual $NO_X$ allowances from NEMS–BT are no longer relevant. In DOE's subsequent analysis, $NO_X$ emissions are not controlled by a nationwide regulatory system. DOE estimated the national monetized benefits of $NO_X$ and Hg emissions reductions from today's rule based on environmental damage estimates from the literature. Available estimates suggest a very wide range of monetary values for $NO_X$ emissions, ranging from $370 per ton to $3,800 per ton of $NO_X$ from stationary sources, measured in 2001$,[30] or a range of $432 per ton to $4,441 per ton in 2007$.

DOE has conducted research for today's final rule and determined that the basic science linking mercury emissions from power plants to impacts on humans is considered highly uncertain. However, DOE identified two estimates of the environmental damage of mercury based on two estimates of the adverse impact of childhood exposure to methyl mercury on IQ for American children, and subsequent loss of lifetime economic productivity resulting from these IQ losses. The high-end estimate is based on an estimate of the current aggregate cost of the loss of IQ in American children that results from exposure to mercury of U.S. power plant origin ($1.3 billion per year in year 2000$), which works out to $32.6 million per ton emitted per year (2007$).[31] The low-end estimate was $664,000 per ton emitted in 2004$ or $729,000 per ton in 2007$, which DOE derived from a published evaluation of mercury control using different methods and assumptions from the first study, but also based on the present value of the lifetime earnings of children exposed.[32] Table VI–29 and Table VI–30 present the resulting estimates of the potential range of present value benefits associated with reducing national $NO_X$ and Hg emissions.

TABLE VI–29—ESTIMATES OF SAVINGS FROM REDUCING $NO_X$ AND HG EMISSIONS UNDER COMMERCIAL REFRIGERATION EQUIPMENT TSLS AT A SEVEN-PERCENT DISCOUNT RATE

| TSL | Estimated cumulative $NO_X$ (kt) emission reductions* | Value of estimated $NO_X$ emission reductions (thousand 2007$) | Estimated cumulative Hg (tons) emission reductions* | Value of estimated Hg emission reductions (thousand 2007$) |
|---|---|---|---|---|
| 1 | 0.59 to 14.58 | $64 to $1,578 | 0 to 0.224 | $0 to $46. |
| 2 | 2.27 to 56.04 | $245 to $6,067 | 0 to 0.86 | $0 to $177. |
| 3 | 3.51 to 86.77 | $380 to $9,394 | 0 to 1.332 | $0 to $274. |
| 4 | 3.64 to 89.97 | $394 to $9,741 | 0 to 1.381 | $0 to $284. |
| 5 | 4.56 to 112.84 | $494 to $12,216 | 0 to 1.732 | $0 to $356. |

*Values in Table VI–29 may not appear to sum to the cumulative values in Table VI–27 due to rounding.

TABLE VI–30—ESTIMATES OF SAVINGS FROM REDUCING $NO_X$ AND HG EMISSIONS UNDER COMMERCIAL REFRIGERATION EQUIPMENT TSLS AT A THREE-PERCENT DISCOUNT RATE

| TSL | Estimated cumulative $NO_X$ (kt) emission reductions* | Value of estimated $NO_X$ emission reductions (thousand 2007$) | Estimated cumulative Hg (tons) emission reductions* | Value of estimated Hg emission reductions (thousand 2007$) |
|---|---|---|---|---|
| 1 | 0.59 to 14.58 | $135 to $3,329 | 0 to 0.224 | $0 to 91. |
| 2 | 2.27 to 56.04 | $518 to $12,799 | 0 to 0.86 | $0 to $349. |
| 3 | 3.51 to 86.77 | $802 to 19,815 | 0 to 1.332 | $0 to $540. |
| 4 | 3.64 to 89.97 | $831 to $20,547 | 0 to 1.381 | $0 to $560. |
| 5 | 4.56 to 112.84 | $1,042 to $25,769 | 0 to 1.732 | $0 to $702. |

*Values in Table VI–30 may not appear to sum to the cumulative values in Table VI–27 due to rounding.

7. Other Factors

EPCA allows the Secretary of Energy, 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(e)(1)) Under this provision, DOE considered LCC impacts on identifiable groups of customers, such as customers of different business types who may be disproportionately affected by any national energy conservation standard level. DOE also considered the reduction in generated capacity that could result from the imposition of any national energy conservation standard level.

*D. Conclusion*

EPCA contains criteria for prescribing new or amended energy conservation standards. It provides that any such standard for commercial refrigeration equipment 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 42 U.S.C. 6316(e)(1)) As stated above, the Secretary must determine whether the benefits of the standards exceed its burdens considering the seven factors discussed in section II.A. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(e)(1)) A determination is not made based on any one of these factors in isolation. The Secretary must weigh each of these seven factors in total. Further, the Secretary may not establish a new or amended standard if such standard would not result in ''significant conservation of energy.'' (42 U.S.C. 6295(o)(3)(B) and 42 U.S.C. 6316(e)(1))

In selecting today's energy conservation standards for commercial refrigeration equipment, DOE started by examining the maximum technologically feasible levels to determine whether those levels were economically justified. Upon finding the maximum technologically feasible levels not to be justified, DOE analyzed the next lower TSL. DOE followed this procedure until it identified a TSL that is economically justified.

[30] 2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities. Office of Management and Budget Office of Information and Regulatory Affairs, Washington, DC.

[31] Trasande, L., *et al.*, ''Applying Cost Analyses to Drive Policy that Protects Children,'' 1076 Ann. N.Y. Acad. Sci. 911 (2006).

[32] Ted Gayer and Robert Hahn, ''Designing Environmental Policy: Lessons from the Regulation of Mercury Emissions,'' Regulatory Analysis 05–01. AEI-Brookings Joint Center for Regulatory Studies, Washington, DC, 2004. A version of this paper was published in the *Journal of Regulatory Economics* in 2006. The estimate was derived by back-calculating the annual benefits per ton from the net present value of benefits reported in the study.

Table VI–31 summarizes DOE's quantitative analysis results for each TSL it considered for this final rule. This table presents the results or a range of results for each TSL, and will aid the reader in understanding the costs and benefits of each one. The range of values for industry impacts represents the results for the different markup scenarios that DOE used to estimate manufacturer impacts.

TABLE VI–31—SUMMARY OF RESULTS BASED UPON THE AEO2008 REFERENCE CASE ENERGY PRICE FORECAST *

| | TSL 1 | TSL 2 | TSL 3 | TSL 4 | TSL 5 |
|---|---|---|---|---|---|
| Primary Energy Saved (quads) | 0.168 | 0.645 | 1.013 | 1.035 | 1.298 |
| 7% Discount Rate | 0.041 | 0.159 | 0.250 | 0.256 | 0.321 |
| 3% Discount Rate | 0.088 | 0.339 | 0.532 | 0.544 | 0.683 |
| Generation Capacity Reduction (GW) ** | (0.121) | (0.465) | (0.720) | (0.747) | (0.936) |
| NPV (2007$ billion) | | | | | |
| 7% Discount Rate | $0.33 | $0.98 | $1.45 | $1.414 | $(2.59) |
| 3% Discount Rate | $0.83 | $2.60 | $3.97 | $3.930 | $(3.79) |
| Industry Impacts | | | | | |
| Industry NPV (2007$ million) | 0–(7) | 8–(39) | (11)–(99) | (39)–(148) | 20–(340) |
| Industry NPV (% change) | 0–(1) | 1–(7) | (2)–(18) | (7)–(27) | 4–(63) |
| Cumulative Emissions Impacts † | | | | | |
| $CO_2$ (Mt) | 8.52 | 32.76 | 50.71 | 52.59 | 65.95 |
| $NO_X$ (kt) | 0.59–14.58 | 2.27–56.04 | 3.51–86.77 | 3.64–89.97 | 4.56–112.84 |
| Hg (t) | 0–0.224 | 0–0.86 | 0–1.332 | 0–1.381 | 0–1.732 |
| Employment Impacts | | | | | |
| Indirect Employment Impacts (2042) | 332 | 1,699 | 2,559 | 2,670 | 3,011 |
| Direct, Domestic Employment Impacts (2012) †† | 6 | 92 | 172 | 197 | 779 |
| Life-Cycle Cost | | | | | |
| Net Savings (%) | 18–45 | 36–65 | 61–89 | 70–92 | 0–92 |
| Net Increase (%) | 0–0 | 0–0 | 0–0 | 0–0 | 0–99 |
| No Change (%) | 55–82 | 35–64 | 11–39 | 8–30 | 1–19 |
| Mean LCC Savings (2007$) | 211–3501 | 615–4893 | 797–5450 | 785–5419 | (3959)–5419 |
| Mean PBP (years) | 0.3–1.1 | 0.6–2.4 | 1.2–3.8 | 1.3–3.9 | 1.3–196.8 |

* Parentheses indicate negative (−) values. For LCCs, a negative value means an increase in LCC by the amount indicated.
** Change in installed generation capacity by 2042 based on *AEO2008* Reference Case.
† $CO_2$ emissions impacts include physical reductions at power plants. $NO_X$ emissions impacts include physical reductions at power plants as well as production of emissions allowance credits where $NO_X$ emissions are subject to emissions caps.
†† Change in total number of domestic production employees in 2012 due to standards.

First, DOE considered TSL 5, the most efficient level for all equipment classes. TSL 5 would likely save an estimated 1.298 quads of energy through 2042, an amount DOE considers significant. Discounted at 7 percent, the projected energy savings through 2042 would be 0.321 quads. For the Nation as a whole, DOE projects that TSL 5 would result in a net decrease of $2.59 billion in NPV, using a discount rate of 7 percent. Five equipment classes (VOP.RC.M, VOP.SC.M, SVO.RC.M, SVO.SC.M, and SOC.RC.M) show negative NPV at TSL 5, primarily due the use of LED lighting for these cases.[33] The emissions reductions at TSL 5 are 65.95 Mt of $CO_2$ and up to 112.84 kt of $NO_X$. DOE also estimates that under TSL 5, total generating capacity in 2042 will decrease compared to the base case by 0.936 gigawatts (GW).

At TSL 5, DOE projects that the average commercial refrigeration equipment customer will experience a reduction in LCC compared to the baseline for 10 of the 15 equipment classes analyzed, while they will experience an increase in LCC for five equipment classes (VOP.RC.M, VOP.SC.M, SVO.RC.M, SOC.RC.M). These equipment classes are the five that DOE showed had negative NPV. Mean LCC savings for all 15 equipment classes vary from −$3,959 to $5,419. At TSL 5, DOE estimates the fraction of customers experiencing LCC increases will vary between 0 and 99 percent depending on equipment class. The mean payback period for the average commercial refrigeration equipment customer at TSL 5 compared to the baseline level is projected to be between 1.3 and 196.8 years, depending on equipment class.

At TSL 5, there is the risk of very large negative impacts on the industry if manufacturers' profit margins are reduced. The investments required to modify all equipment lines at the max-tech levels are large. At this level, manufacturers have to make costly changes to their production lines. In addition, the incremental cost of adding LED lights at TSL 5 are extremely large. Because customers put a much higher priority on marketing and displaying their goods than they do on energy efficiency, most manufacturers expressed a concern that they would be unable to fully recover the additional cost incurred when only manufacturing the most efficient equipment possible. If manufacturers are not able to fully pass along these large incremental production costs, the industry could lose up to 63 percent of the INPV.

Although TSL 5 is the most efficient level and thus saves the most energy of all TSLs, four of the 15 equipment classes show a reduction in LCC compared to the baseline. The energy savings at TSL 5 would reduce installed generating capacity by 0.94 GW, or roughly 2.5 large, 400-MW power plants. DOE estimates the associated emissions reductions at 66 Mt of $CO_2$. DOE concludes that at TSL 5, the benefits of energy savings, generating capacity reductions, and emission reductions would be outweighed by the economic burdens on customers as indicated by the net decrease in NPV, long payback periods of up to 197 years, and a drop in INPV of up to 63 percent. Consequently, DOE concludes that TSL 5 is not economically justified.

DOE then considered TSL 4, which provides for all equipment classes the maximum efficiency levels that the analysis showed to have positive NPV to the Nation. DOE projects that the

[33] LED lighting for open cases was updated from the August 2008 NOPR to reflect LED lighting fixtures currently available for, and specific to, open cases. DOE also increased the amount of LED lighting assumed for open cases. See section V.A.2.a and appendix B of the TSD.

average commercial refrigeration equipment customer will experience a reduction in LCC compared to the baseline for all 15 equipment classes analyzed, ranging from $785 to $5,419 depending on equipment class. The mean payback period for the average commercial refrigeration equipment customer at TSL 4 is projected to be between 1.3 and 3.9 years compared to the purchase of baseline equipment.

TSL 4 would likely save an estimated 1.035 quads of energy through 2042, an amount DOE considers significant. Discounted at 7 percent, the projected energy savings through 2042 would be 0.256 quads. For the Nation as a whole, DOE projects that TSL 4 would result in a net increase of $1.41 billion in NPV, using a discount rate of 7 percent. The estimated emissions reductions at TSL 4 are 42.6 Mt of $CO_2$ and up to 90 kt of $NO_X$.

Similar to TSL 5, there is a risk at TSL 4 of large negative impacts on the industry if manufacturers' profit margins are reduced. The investments required at TSL 4 are also large because, based on the construction of the TSL, many equipment classes are at the max-tech level. Because a large portion of the equipment classes are at max-tech, the incremental manufacturing costs are also large. If manufacturers are not able to fully pass along these large incremental production costs, the industry could lose up to 27 percent of the INPV.

After carefully considering the analysis and weighing the benefits and burdens of TSL 4, DOE concludes that the benefits of TSL 4 (in terms of energy savings to the Nation of 1.035 quads through 2042, economic benefits of $1.41 billion in NPV using a discount rate of 7 percent, significant environmental benefits in terms of reduced emissions from power plants, and national employment benefits) outweigh the burdens in terms of the range of possible reductions in INPV of up to 27 percent, and that TSL 4 represents the maximum improvement in energy efficiency that is technologically feasible and economically justified. Therefore, DOE is adopting the energy conservation standards for this equipment at TSL 4.

## VII. Procedural Issues and Regulatory Review

### *A. Review Under Executive Order 12866*

Section 1(b)(1) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (October 4, 1993), requires each agency to identify in writing the market failure or other problem that it intends to address that warrants agency action such as today's final rule, and to assess the significance of that problem in evaluating whether any new regulation is warranted.

In the August 2008 NOPR for this rulemaking, DOE requested feedback related to the possible existence of a market failure in the commercial refrigeration equipment industry. Because the commercial refrigeration equipment industry is part of the food merchandising industry, energy efficiency and energy cost savings are not the primary drivers of the business. Selling food products to shoppers is the primary driver. It is difficult for store personnel to identify cost-effective efficiency levels for commercial refrigeration equipment given reasons identified in the NOPR, and doing so may incur transaction costs, thus reducing cost-effectiveness of the energy efficiency investment. 73 FR 50128. DOE sought data on the efficiency levels of existing commercial refrigeration equipment by owner, electricity price, and equipment class. Following the publication of the August 2008 NOPR and subsequent public comment period, DOE did not receive any feedback related to this request.

Because today's regulatory action is a significant regulatory action under section 3(f)(1) of Executive Order 12866, section 6(a)(3) of the Executive Order requires DOE to prepare and submit for review to the Office of Information and Regulatory Affairs (OIRA) in OMB an assessment of the costs and benefits of today's rule. Accordingly, DOE presented to OIRA for review the draft final rule and other documents prepared for this rulemaking, including a regulatory impact analysis (RIA). These documents are included in the rulemaking record and are available for public review in the Resource Room of DOE's Building Technologies Program, 950 L'Enfant Plaza, SW., 6th Floor, Washington, DC 20024, (202) 586–9127, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays.

The August 2008 NOPR contained a summary of the RIA, which evaluated the extent to which major alternatives to standards for commercial refrigeration equipment could achieve significant energy savings at reasonable cost, as compared to the effectiveness of the proposed rule. 73 FR 50128–29. The complete RIA (*Regulatory Impact Analysis for Proposed Energy Conservation Standards for Commercial Refrigeration Equipment*) is contained in the TSD prepared for today's rule. The RIA consists of: (1) A statement of the problem addressed by this regulation and the mandate for government action, (2) a description and analysis of the feasible policy alternatives to this regulation, (3) a quantitative comparison of the impacts of the alternatives, and (4) the national economic impacts of today's standards.

As explained in the August 2008 NOPR, none of the alternatives DOE examined would save as much energy or have an NPV as high as the proposed standards. That same conclusion applies to the standards in today's rule. Also, several of the alternatives would require new enabling legislation, because authority to carry out those alternatives does not exist. Additional detail on the regulatory alternatives is found in the RIA report in the TSD.

### *B. Review Under the Regulatory Flexibility Act*

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, and a final regulatory flexibility analysis (FRFA) for any such rule that an agency adopts as a final rule, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. A regulatory flexibility analysis examines the impact of the rule on small entities and considers alternative ways of reducing negative impacts. Also, 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 General Counsel's Web site: *http://www.gc.doe.gov*.

Small businesses, as defined by the Small Business Administration (SBA) for the commercial refrigeration equipment manufacturing industry, are manufacturing enterprises with 750 employees or fewer. DOE used the small business size standards published by SBA to determine whether any small entities would be required to comply with the rule. 61 FR 3286 and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description. Commercial refrigeration equipment manufacturing is classified under NAICS 333415.

DOE interviewed two of the nine manufacturers of commercial refrigeration equipment it identified as small businesses affected by this rulemaking. 73 FR 50130. DOE reviewed the proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. *Id.* On the basis of this review, DOE determined that it could not certify that the proposed standards (TSL 4) would have no significant economic impact on a substantial number of small entities. *Id.* DOE made this determination because of the potential impacts of the proposed standard levels on commercial refrigeration equipment manufacturers generally, including small businesses. *Id.*

Because of these potential impacts on small manufacturers, DOE prepared an IRFA during the NOPR stage of this rulemaking. DOE provided the IRFA in its entirety in the August 2008 NOPR, 73 FR 50130–31, and also transmitted a copy to the Chief Counsel for Advocacy of the SBA for review. Chapter 13 of the TSD contains more information about the impact of this rulemaking on manufacturers.

The IRFA divided potential impacts on small businesses into two broad categories: (1) Impacts associated with commercial refrigeration equipment design and manufacturing, and (2) impacts associated with the effect on customers' ability to merchandise products by limiting the flexibility in choosing design options. The commercial refrigeration industry is highly customized, and manufacturers were concerned that limiting the choices in design options would commoditize the industry and reduce profit margins. However, this concern was echoed by all manufacturers, not just small business manufacturers.

DOE has prepared a FRFA for this rulemaking, which is presented in the following discussion. DOE has transmitted a copy of this FRFA to the Chief Counsel for Advocacy of the SBA for review. The FRFA below is written in accordance with the requirements of the Regulatory Flexibility Act.

1. Reasons for the Final Rule

Part A–1 of Title III of EPCA addresses the energy efficiency of certain types of commercial and industrial equipment. (42 U.S.C. 6311–6317) EPACT 2005, Public Law 109–58, included an amendment to Part A–1 requiring that DOE prescribe energy conservation standards for the commercial refrigeration equipment that is the subject of this rulemaking. (EPACT 2005, Section 136(c); 42 U.S.C. 6313(c)(4)(A)) DOE publishes today's final rule pursuant to Part A–1. The commercial refrigeration equipment test procedures appear at 10 CFR parts 430–431.

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

EPCA requires new and amended standards to be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified (see section II.B of this preamble). To determine whether economic justification exists, DOE reviews comments received and conducts analysis to determine whether the economic benefits of the new standard exceed the burdens to the greatest extent practicable, taking into consideration seven factors set forth in 42 U.S.C. 6295(o)(2)(B) and 6316(e)(1) (see section II.B of this preamble). Further information concerning the background of this rulemaking is provided in chapter 1 of the TSD.

3. Description and Estimated Number of Small Entities Regulated

DOE reviewed AHRI's listing of commercial refrigeration equipment manufacturer members and surveyed the industry to develop a list of every manufacturer. DOE also asked interested parties and AHRI representatives within the industry if they were aware of any other small business manufacturers. DOE then looked at publicly available data and contacted manufacturers, when needed, to determine if they meet the SBA's definition of a small business manufacturing facility and if their manufacturing facilities are located within the United States. Based on this analysis, DOE identified nine small commercial refrigeration equipment manufacturers and conducted on-site interviews with two of them. See chapter 13 of the TSD for further discussion about the methodology DOE used in the manufacturer impact analysis.

4. Description and Estimate of Compliance Requirements

Potential impacts on manufacturers, including small businesses, come from impacts associated with commercial refrigeration equipment design and manufacturing. All manufacturers, including small businesses, would have to develop designs to comply with higher TSLs. Product redesign costs tend to be fixed and do not scale with sales volume. Thus, small manufacturers would be at a relative disadvantage at higher TSLs because research and development efforts would be on the same scale as those for larger companies. Furthermore, the level of research and development needed to meet energy conservation standards increases with more stringent energy conservation standards. DOE expects that small manufacturers will have more difficulty funding the required research and development necessary to meet energy conservation standards than larger manufacturers. However, as explained in part 6 of the IRFA, ''Significant Alternatives to the Proposed Rule,'' DOE explicitly considered the impacts on small manufacturers of commercial refrigeration equipment in selecting TSL 4, rather than selecting a higher standard level. DOE expects that the differential impact on small manufacturers of commercial refrigeration equipment would be smaller in moving from TSL 3 to TSL 4 than it would be in moving from TSL 4 to TSL 5.

5. Significant Issues Raised by Public Comments

DOE summarized comments from interested parties, including commercial refrigeration equipment manufacturers, in sections IV and V of this preamble. However, DOE did not receive any comments regarding impacts specific to small business manufacturers for the adoption of TSL 4 or the alternatives identified in section 6 of the IRFA, ''Significant Alternatives to the Rule.''

6. Steps DOE Has Taken To Minimize the Economic Impact on Small Manufacturers

In consideration of the benefits and burdens of standards, including the burdens posed on small manufacturers, DOE concluded that TSL 4 is the highest level that can be justified for commercial refrigeration equipment. As explained in part 6 of the IRFA, ''Significant Alternatives to the Rule,'' DOE explicitly considered the impacts on small manufacturers of commercial refrigeration equipment in selecting TSL 4. Levels at TSL 5 would place excessive burdens on manufacturers, including small manufacturers, of commercial refrigeration equipment. Such burdens would include research and development costs and also a potential reduction of profit margins by limiting the flexibility of customers to choose design options. However, the differential impact on small businesses is expected to be lower in moving from TSL 3 to TSL 4 than in moving from TSL 4 to TSL 5, because research and development efforts are less at lower TSLs. Chapter 13 of the TSD contains additional information about the impact of this rulemaking on manufacturers.

Section VI.C.2 discusses how small business impacts entered into DOE's selection of today's standards for commercial refrigeration equipment.

DOE made its decision regarding standards by beginning with the highest level considered (TSL 5) and successively eliminating TSLs until it found a TSL that is both technically feasible and economically justified, taking into account other EPCA criteria. As discussed in section VI.C.2.e, DOE expects today's standard to have little or no differential impact on small manufacturers of commercial refrigeration equipment.

Finally, in the NOPR, DOE requested comment on the impacts on small business manufacturers of TSL 4 and any other alternatives to the proposed rule. DOE received no comments in reference to any undue burden placed on small manufacturers.

*C. Review Under the Paperwork Reduction Act*

DOE stated in the August 2008 NOPR that this rulemaking would impose no new information and recordkeeping requirements, and that OMB clearance is not required under the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). 73 FR 50131–32. DOE received no comments on this in response to the August 2008 NOPR, and, as with the proposed rule, today's rule imposes no information and recordkeeping requirements. Therefore, DOE has taken no further action in this rulemaking with respect to the Paperwork Reduction Act.

*D. Review Under the National Environmental Policy Act*

DOE prepared an environmental assessment of the impacts of today's standards which it published as chapter 16 within the TSD for the final rule. DOE found the environmental effects associated with today's various standard levels for commercial refrigeration equipment to be insignificant. Therefore, DOE is issuing a Finding of No Significant Impact (FONSI) pursuant to the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (40 CFR parts 1500–1508), and DOE's regulations for compliance with NEPA (10 CFR part 1021). The FONSI is available in the docket for this rulemaking.

*E. Review Under Executive Order 13132*

DOE reviewed this rule pursuant to Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 4, 1999), which imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. In accordance with DOE's statement of policy describing the intergovernmental consultation process it will follow in the development of regulations that have federalism implications, 65 FR 13735 (March 14, 2000), DOE examined the proposed rule and determined that the rule would not have a substantial direct effect on the States, on the relationship between the National Government and the States, or on the distribution of power and responsibilities among the various levels of Government. 73 FR 50132. DOE received no comments on this issue in response to the August 2008 NOPR, and its conclusions on this issue are the same for the final rule as they were for the proposed rule. Therefore, DOE is taking no further action in today's final rule with respect to 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,'' 61 FR 4729 (February 7, 1996), 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. 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, the final regulations meet the relevant standards of Executive Order 12988.

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

As indicated in the August 2008 NOPR, DOE reviewed the proposed rule under Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) (UMRA), which imposes requirements on Federal agencies when their regulatory actions will have certain types of impacts on State, local, and Tribal governments and the private sector. 73 FR 50132. DOE concluded that although this rule would not contain an intergovernmental mandate, it may result in expenditure of $100 million or more in one year by the private sector. *Id.* Therefore, in the August 2008 NOPR, DOE addressed the UMRA requirements that it prepare a statement as to the basis, costs, benefits, and economic impacts of the proposed rule, and that it identify and consider regulatory alternatives to the proposed rule. *Id.* DOE received no comments concerning the UMRA in response to the August 2008 NOPR, and its conclusions on this issue are the same for the final rule as they were for the proposed rule. Therefore, DOE is taking no further action in today's final rule with respect to the UMRA.

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

DOE determined that, for this rulemaking, it need not prepare a Family Policymaking Assessment under Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277). *Id.* DOE received no comments concerning Section 654 in response to the August 2008 NOPR, and, therefore, takes no further action in today's final rule with respect to this provision.

*I. Review Under Executive Order 12630*

DOE determined under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 18, 1988), that today's rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution. 73 FR 50132. DOE received no comments concerning Executive Order 12630 in response to the August 2008 NOPR, and, therefore, takes no further action in today's final rule with respect to this Executive Order.

*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 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 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). DOE has reviewed today's 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 a Statement of Energy Effects for any significant energy action. DOE determined that the proposed rule was not a ''significant energy action'' within the meaning of Executive Order 13211. 73 FR 50133. Accordingly, it did not prepare a Statement of Energy Effects on the proposed rule. DOE received no comments on this issue in response to the August 2008 NOPR. As with the proposed rule, DOE has concluded that today's final rule is not a significant energy action within the meaning of Executive Order 13211, and has not prepared a Statement of Energy Effects on the 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, issued its ''Final Information Quality Bulletin for Peer Review (the Bulletin). 70 FR 2664 (January 14, 2005). The purpose of the Bulletin is to enhance the quality and credibility of the Government's scientific information. The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government. As indicated in the August 2008 NOPR, this includes influential scientific information related to agency regulatory actions, such as the analyses in this rulemaking. 73 FR 50133.

As set forth in the August 2008 NOPR, DOE held formal in-progress peer reviews of the types of analyses and processes that DOE has used to develop the energy efficiency standards in today's rule, and issued a report on these peer reviews. *Id.*

*M. Congressional Notification*

As required by 5 U.S.C. 801, DOE will submit to Congress a report regarding the issuance of today's final rule prior to the effective date set forth at the outset of this notice. 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). DOE also will submit the supporting analyses to the Comptroller General in the U.S. Government Accountability Office (GAO) and make them available to each House of Congress.

## VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of today's final rule.

Issued in Washington, DC, on December 31, 2008.

**John F. Mizroch,**

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

**List of Subjects in 10 CFR Part 431**

Administrative practice and procedure, Confidential business information, Energy conservation, Incorporation by reference.

■ For the reasons set forth in the preamble, chapter II of title 10, Code of Federal Regulations, part 431 is amended 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 431.62 of subpart C is amended by adding in alphabetical order new definitions for ''air-curtain angle,'' ''commercial hybrid refrigerator, freezer, and refrigerator-freezer,'' ''door angle,'' ''horizontal closed,'' ''horizontal open,'' ''semivertical open,'' ''vertical closed,'' ''vertical open,'' and ''wedge case'' to read as follows:

**§ 431.62 Definitions concerning commercial refrigerators, freezers, and refrigerator-freezers.**

*Air-curtain angle* means:

(1) For equipment without doors and without a discharge air grille or discharge air honeycomb, the angle between a vertical line extended down from the highest point on the manufacturer's recommended load limit line and the load limit line itself, when the equipment is viewed in cross-section; and

(2) For all other equipment without doors, the angle formed between a vertical line and the straight line drawn by connecting the point at the inside edge of the discharge air opening with the point at the inside edge of the return air opening, when the equipment is viewed in cross-section.

* * * * *

*Commercial hybrid refrigerator, freezer, and refrigerator-freezer* means a commercial refrigerator, freezer, or refrigerator-freezer that has two or more chilled and/or frozen compartments that are:

(1) In two or more different equipment families,

(2) Contained in one cabinet, and

(3) Sold as a single unit.

* * * * *

*Door angle* means:

(1) For equipment with flat doors, the angle between a vertical line and the line formed by the plane of the door, when the equipment is viewed in cross-section; and

(2) For equipment with curved doors, the angle formed between a vertical line and the straight line drawn by connecting the top and bottom points where the display area glass joins the cabinet, when the equipment is viewed in cross-section.

* * * * *

*Horizontal Closed* means equipment with hinged or sliding doors and a door angle greater than or equal to 45°.

* * * * *

*Horizontal Open* means equipment without doors and an air-curtain angle greater than or equal to 80° from the vertical.

* * * * *

*Semivertical Open* means equipment without doors and an air-curtain angle greater than or equal to 10° and less than 80° from the vertical.

* * * * *

*Vertical Closed* means equipment with hinged or sliding doors and a door angle less than 45°.

*Vertical Open* means equipment without doors and an air-curtain angle greater than or equal to 0° and less than 10° from the vertical.

*Wedge case* means a commercial refrigerator, freezer, or refrigerator-freezer that forms the transition between two regularly shaped display cases.

■ 3. Section 431.63 of subpart C is revised to read as follows:

**§ 431.63 Materials incorporated by reference.**

(a) *General.* We incorporate by reference the following standards into Subpart C of Part 431. The material listed has been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR 51. Any subsequent amendment to a standard by the standard-setting organization will not affect the DOE regulations unless and until amended by DOE. Material is incorporated as it exists on the date of the approval and a notice of any change in the material will be published in the **Federal**

**Register**. All approved material is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030 or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. Also, this material is available for inspection at U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024, 202–586–2945, or go to: *http://www1.eere.energy.gov/buildings/appliance_standards/*. Standards can be obtained from the sources listed below.

(b) *ANSI.* American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, 212–642–4900, or go to *http://www.ansi.org:*

(1) ANSI /AHAM HRF–1–2004, *Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers*, approved July 7, 2004, IBR approved for § 431.64.

(2) [Reserved]

(c) ARI. Air-Conditioning and Refrigeration Institute, 4100 N. Fairfax Dr., Suite 200, Arlington, VA 22203, or *http://www.ari.org/std/standards.html:*

(1) ARI Standard 1200–2006, *Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets*, 2006, IBR approved for §§ 431.64 and 431.66.

(2) [Reserved]

■ 4. Section 431.66 of subpart C is amended by adding new paragraphs (a)(3) and (d) to read as follows:

**§ 431.66 Energy conservation standards and their effective dates.**

(a) * * *

(3) The term ''TDA'' means the total display area ($ft^2$) of the case, as defined in the ARI Standard 1200–2006, appendix D (incorporated by reference, see § 431.63).

* * * * *

(d) Each commercial refrigerator, freezer, and refrigerator-freezer with a self-contained condensing unit and without doors; commercial refrigerator, freezer, and refrigerator-freezer with a remote condensing unit; and commercial ice-cream freezer manufactured on or after January 1, 2012, shall have a daily energy consumption (in kilowatt hours per day) that does not exceed the levels specified:

(1) For equipment other than hybrid equipment, refrigerator-freezers or wedge cases:

| Equipment category | Condensing unit configuration | Equipment family | Rating temp. (°F) | Operating temp. (°F) | Equipment class designation * | Maximum daily energy consumption (kWh/day) |
|---|---|---|---|---|---|---|
| Remote Condensing Commercial Refrigerators and Commercial Freezers. | Remote (RC) | Vertical Open (VOP) | 38 (M) | ≥32 | VOP.RC.M | 0.82 × TDA + 4.07 |
| | | | 0 (L) | <32 | VOP.RC.L | 2.27 × TDA + 6.85 |
| | | Semivertical Open (SVO) | 38 (M) | ≥32 | SVO.RC.M | 0.83 × TDA + 3.18 |
| | | | 0 (L) | <32 | SVO.RC.L | 2.27 × TDA + 6.85 |
| | | Horizontal Open (HZO) | 38 (M) | ≥32 | HZO.RC.M | 0.35 × TDA + 2.88 |
| | | | 0 (L) | <32 | HZO.RC.L | 0.57 × TDA + 6.88 |
| | | Vertical Closed Transparent (VCT). | 38 (M) | ≥32 | VCT.RC.M | 0.22 × TDA + 1.95 |
| | | | 0 (L) | <32 | VCT.RC.L | 0.56 × TDA + 2.61 |
| | | Horizontal Closed Transparent (HCT). | 38 (M) | ≥32 | HCT.RC.M | 0.16 × TDA + 0.13 |
| | | | 0 (L) | <32 | HCT.RC.L | 0.34 × TDA + 0.26 |
| | | Vertical Closed Solid (VCS) | 38 (M) | ≥32 | VCS.RC.M | 0.11 × V + 0.26 |
| | | | 0 (L) | <32 | VCS.RC.L | 0.23 × V + 0.54 |
| | | Horizontal Closed Solid (HCS). | 38 (M) | ≥32 | HCS.RC.M | 0.11 × V + 0.26 |
| | | | 0 (L) | <32 | HCS.RC.L | 0.23 × V + 0.54 |
| | | Service Over Counter (SOC). | 38 (M) | ≥32 | SOC.RC.M | 0.51 × TDA + 0.11 |
| | | | 0 (L) | <32 | SOC.RC.L | 1.08 × TDA + 0.22 |
| Self-Contained Commercial Refrigerators and Commercial Freezers without Doors. | Self-Contained (SC). | Vertical Open (VOP) | 38 (M) | ≥32 | VOP.SC.M | 1.74 × TDA + 4.71 |
| | | | 0 (L) | <32 | VOP.SC.L | 4.37 × TDA + 11.82 |
| | | Semivertical Open (SVO) | 38 (M) | ≥32 | SVO.SC.M | 1.73 × TDA + 4.59 |
| | | | 0 (L) | <32 | SVO.SC.L | 4.34 × TDA + 11.51 |
| | | Horizontal Open | 38 (M) | ≥32 | HZO.SC.M | 0.77 × TDA + 5.55 |
| | | | 0 (L) | <32 | HZO.SC.L | 1.92 × TDA + 7.08 |
| Commercial Ice-Cream Freezers. | Remote (RC) | Vertical Open (VOP) | −15 (I) | ≤−5 ** | VOP.RC.I | 2.89 × TDA + 8.7 |
| | | Semivertical Open (SVO) | | | SVO.RC.I | 2.89 × TDA + 8.7 |
| | | Horizontal Open (HZO) | | | HZO.RC.I | 0.72 × TDA + 8.74 |
| | | Vertical Closed Transparent (VCT). | | | VCT.RC.I | 0.66 × TDA + 3.05 |
| | | Horizontal Closed Transparent (HCT). | | | HCT.RC.I | 0.4 × TDA + 0.31 |
| | | Vertical Closed Solid (VCS) | | | VCS.RC.I | 0.27 × V + 0.63 |
| | | Horizontal Closed Solid (HCS). | | | HCS.RC.I | 0.27 × V + 0.63 |
| | | Service Over Counter (SVO). | | | SOC.RC.I | 1.26 × TDA + 0.26 |
| | Self-Contained (SC). | Vertical Open (VOP) | | | VOP.SC.I | 5.55 × TDA + 15.02 |
| | | Semivertical Open (SVO) | | | SVO.SC.I | 5.52 × TDA + 14.63 |
| | | Horizontal Open (HZO) | | | HZO.SC.I | 2.44 × TDA + 9 |
| | | Vertical Closed Transparent (VCT). | | | VCT.SC.I | 0.67 × TDA + 3.29 |
| | | Horizontal Closed Transparent (HCT). | | | HCT.SC.I | 0.56 × TDA + 0.43 |

| Equipment category | Condensing unit configuration | Equipment family | Rating temp. (°F) | Operating temp. (°F) | Equipment class designation * | Maximum daily energy consumption (kWh/day) |
|---|---|---|---|---|---|---|
| | | Vertical Closed Solid (VCS) | | | VCS.SC.I | $0.38 \times V + 0.88$ |
| | | Horizontal Closed Solid (HCS). | | | HCS.SC.I | $0.38 \times V + 0.88$ |
| | | Service Over Counter (SVO). | | | SOC.SC.I | $1.76 \times TDA + 0.36$ |

* The meaning of the letters in this column is indicated in the three columns to the left.

** Ice-cream freezer is defined in 10 CFR 431.62 as a commercial freezer that is designed to operate at or below −5 °F (−21 °C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.

(2) For commercial refrigeration equipment with two or more compartments (*i.e.*, hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers), the maximum daily energy consumption (MDEC) for each model shall be the sum of the MDEC values for all of its compartments. For each compartment, measure the TDA or volume of that compartment, and determine the appropriate equipment class based on that compartment's equipment family, condensing unit configuration, and designed operating temperature. The MDEC limit for each compartment shall be the calculated value obtained by entering that compartment's TDA or volume into the standard equation in paragraph (d)(1) of this section for that compartment's equipment class. Measure the calculated daily energy consumption (CDEC) or total daily energy consumption (TDEC) for the entire case:

(i) For remote condensing commercial hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers, where two or more independent condensing units each separately cool only one compartment, measure the total refrigeration load of each compartment separately according to the ARI Standard 1200–2006 test procedure (incorporated by reference, see § 431.63). Calculate compressor energy consumption (CEC) for each compartment using Table 1 in ARI Standard 1200–2006 using the saturated evaporator temperature for that compartment. The CDEC for the entire case shall be the sum of the CEC for each compartment, fan energy consumption (FEC), lighting energy consumption (LEC), anti-condensate energy consumption (AEC), defrost energy consumption (DEC), and condensate evaporator pan energy consumption (PEC) (as measured in ARI Standard 1200–2006).

(ii) For remote condensing commercial hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers, where two or more compartments are cooled collectively by one condensing unit, measure the total refrigeration load of the entire case according to the ARI Standard 1200–2006 test procedure (incorporated by reference, see § 431.63). Calculate a weighted saturated evaporator temperature for the entire case by:

(A) Multiplying the saturated evaporator temperature of each compartment by the volume of that compartment (as measured in ARI Standard 1200–2006),

(B) Summing the resulting values for all compartments, and

(C) Dividing the resulting total by the total volume of all compartments.

Calculate the CEC for the entire case using Table 1 in ARI Standard 1200–2006 (incorporated by reference, see § 431.63), using the total refrigeration load and the weighted average saturated evaporator temperature. The CDEC for the entire case shall be the sum of the CEC, FEC, LEC, AEC, DEC, and PEC.

(iii) For self-contained commercial hybrid refrigerators, hybrid freezers, hybrid refrigerator-freezers, and non-hybrid refrigerator-freezers, measure the TDEC for the entire case according to the ARI Standard 1200–2006 test procedure (incorporated by reference, see § 431.63).

(3) For remote-condensing and self-contained wedge cases, measure the CDEC or TDEC according to the ARI Standard 1200–2006 test procedure (incorporated by reference, see § 431.63). The MDEC for each model shall be the amount derived by incorporating into the standards equation in paragraph (d)(1) of this section for the appropriate equipment class a value for the TDA that is the product of:

(i) The vertical height of the air-curtain (or glass in a transparent door) and (ii) The largest overall width of the case, when viewed from the front.

## Appendix

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

Department of Justice, Antitrust Division, Main Justice Building, 950 Pennsylvania Avenue, NW., Washington, DC 20530–0001, (202) 514–2401/(202) 616–2645(f, *antitrust@justice.usdoj.gov, http://www.usdoj.gov.*

October 24, 2008.

Warren Belmar, Esq., Deputy General Counsel for Energy Policy, Department of Energy, Washington, DC 20585.

Dear Deputy General Counsel Belmar: I am responding to your August 12, 2008 letter seeking the views of the Attorney General about the potential impact on competition of the proposed energy efficiency standards for commercial refrigeration equipment. The Energy Policy and Conservation Act (''EPCA'') authorizes the Department of Energy (''DOE'') to establish energy conservation standards for a number of appliances where DOE determines that those standards would be technologically feasible, economically justified, and result in significant energy savings.

Your request was submitted pursuant to Section 325(o)(2)(B)(i) of the Energy Policy and Conservation Act, 42 U.S.C. § 6295 (''EPCA''), which states that, before the Secretary of Energy may prescribe a new or amended energy conservation standard, the Secretary shall ask the Attorney General to make a determination of ''the impact of any lessening of competition * * * that is likely to result from the imposition of standard.'' The Attorney General's responsibility for responding to requests from other departments about the effect of a program on competition has been delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR § 0.40(g). In conducting its analysis the Antitrust Division examines whether a proposed standard may lessen competition, for example, by placing certain manufacturers of a product at an unjustified competitive disadvantage compared to other manufacturers, or by inducing avoidable inefficiencies in production or distribution of particular products. In addition to harming consumers directly through higher prices, these effects could undercut the ultimate goals of the legislation.

Along with your request, you sent us the draft final rule and a number of other documents relating to commercial refrigeration equipment, including a hearing transcript and the names of parties interviewed by DOE's consultant.

We have concluded that the proposed standards would not adversely affect competition. In reaching this conclusion, we note that the proposed standards were developed taking into account comments by commercial refrigeration equipment manufacturers, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, the American Council for an Energy Efficient Economy and electric utilities. We note further that all key components are available for purchase by any manufacturer; therefore no manufacturer has a technological advantage in meeting the proposed standards. Finally, DOE found no significant differences between the concerns of large and small manufacturers, and we found no evidence that certain manufacturers would be placed at a competitive disadvantage to other manufacturers.

In conclusion, the Antitrust Division does not believe the proposed final rule would adversely affect competition.

Yours sincerely,

Deborah A. Garza,

*Acting Assistant Attorney General.*

[FR Doc. E8–31449 Filed 1–8–09; 8:45 am]

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