CHAPTER 1. INTRODUCTION

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CHAPTER 1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This preliminary technical support document (preliminary TSD) is a stand-alone report that documents the technical analyses and results supporting the preliminary analysis for establishing energy conservation standards for automatic commercial ice-making (ACIM) equipment with harvest capacities between 50 and 4,000 pounds of ice per 24 hours (lb/24 hours).[a]

1.2 OVERVIEW OF APPLIANCE STANDARDS

Part B of Title III of the Energy Policy and Conservation Act of 1975 (EPCA), Pub. L. 94-163, as amended by the National Energy Conservation Policy Act of 1978 (NECPA), Pub. L. 95-619; the National Appliance Energy Conservation Act of 1987 (NAECA), Pub. L. 100-12; the National Appliance Energy Conservation Amendments of 1988 (NAECA 1988), Pub. L. 100-357; and the Energy Policy Act of 1992 (EPACT 1992), Pub. L. 102-486; established the Energy Conservation Program for Consumer Products other than Automobiles. (42 U.S.C. 6291–6309) Part 3 of Title IV of NECPA amended EPCA to add Part C of Title III, which established an energy conservation program for certain industrial equipment.[b] (42 U.S.C. 6311–6317) EPACT 1992 included amendments to EPCA that expanded Title III to include additional commercial equipment. The Energy Policy and Conservation Act of 2005 (EPACT 2005), Pub. L. 109-58, updated several existing standards and test procedures; prescribes definitions, standards, and test procedures for certain new consumer products and commercial equipment; and mandates that the Secretary of Energy (the Secretary) commence rulemakings to develop test procedures and standards for certain new consumer products and commercial equipment, including ACIM equipment, the subject of this rulemaking.

Pursuant to EPCA, the U.S. Department of Energy (DOE) is required to design each standard for this equipment to (1) achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified; and (2) result in significant conservation of energy. (42 U.S.C. 6295(o)(2)(A) and (o)(3)(B), 42 U.S.C. 6313(d)(4)) To determine whether a proposed standard is economically justified, DOE will, after receiving comments on the proposed standard, determine whether the benefits of the standard exceed its burdens to the greatest extent practicable, considering the following seven factors:

1. the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard;
2. the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for maintenance expenses of, 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;

[a] For brevity, pounds of ice per 24-hour period is abbreviated as lb/24 hours.
[b] For editorial reasons, upon codification in the U.S. Code, Parts B and C were re-designated as Parts A and A-1, respectively.

4. any lessening of the utility or the performance of the covered 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 considers relevant.

(42 U.S.C. 6295(o)(2)(B)(i); 6313(d)(4))

EPCA also directs that DOE may not prescribe an amended or new standard if the standard is likely to result in the unavailability in the United States 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 that the standard is prescribed. (42 U.S.C. 6295(o)(4) and 6313(d)(4))

For automatic commercial ice makers, DOE is applying those factors in a manner consistent with its other energy conservation standards rulemakings to ascertain the maximum improvement in energy efficiency that is technologically feasible and economically justified for this equipment.

1.3 OVERVIEW OF AUTOMATIC COMMERCIAL ICE MAKER STANDARDS

EPCA, as amended by EPACT 2005, set energy conservation standards for ACIM equipment making cube type ice with harvest capacities between 50 and 2,500 lb/24 hours. (42 U.S.C. 6313(d)(1)) In addition, EPCA requires DOE to establish a final rule no later than January 1, 2015 to determine whether to amend the standards prescribed in 42 U.S.C. 6313(d)(1). (42 U.S.C. 6313(d)(3)) EPCA also granted DOE the authority to issue standards for types of ACIM equipment not covered by the standards included in 42 U.S.C. 6313(d)(1). (42 U.S.C. 6313(d)(2))

1.3.1 Definitions

Section 136(a)(4) of EPACT 2005 amended section 340 of EPCA by inserting definitions for the following terms that describe ACIM equipment:

> (19) The term ‘automatic commercial ice maker’ means a factory-made assembly (not necessarily shipped in one package) that—
>
> (A) consists of a condensing unit and ice-making section operating as an integrated unit, with means for making and harvesting ice; and
>
> (B) may include means for storing ice, dispensing ice, or storing and dispensing ice.
>
> (42 U.S.C. 6311(19))

1.3.2 Current Automatic Commercial Ice Maker Energy Conservation Standards

Section 136(d) of EPACT 2005 amended EPCA to prescribe energy conservation standards for cube type ACIM equipment with harvest capacities between 50 and 2,500 lb/24 hours, consisting of ice-making heads using either air or water cooling, self-

contained ice makers using either air or water for cooling, and ACIM equipment with remote condensing and either a remote compressor or a compressor contained in the same cabinet as the other non-condenser components. (42 U.S.C. 6313(d)(1)) These standards became effective on January 1, 2010. DOE adopted these standards and placed them under 10 CFR 431, subpart H, "Automatic Commercial Ice Makers." Table 1.3.1 shows the current standards for ACIM equipment.

Table 1.3.1 Automatic Commercial Ice Maker Standards Prescribed by EPCA – Effective January 1, 2010

Equipment Type	Type of Cooling	Harvest Rate *lb ice/24 hours*	Maximum Energy Use *kWh/100 lb ice*	Maximum Condenser Water Use* *gal/100 lb ice*
Ice-making head	Water	<500	7.80–0.0055H**	200–0.022H
		≥500 and <1,436	5.58–0.0011H	200–0.022H
		≥1,436	4.0	200–0.022H
	Air	<450	10.26–0.0086H	Not applicable
		≥450	6.89–0.0011H	Not applicable
Remote condensing (but not remote compressor)	Air	<1,000	8.85–0.0038H	Not applicable
		≥1,000	5.10	Not applicable
Remote condensing and remote compressor	Air	<934	8.85−0.0038H	Not applicable
		≥934	5.3	Not applicable
Self-contained	Water	<200	11.40–0.019H	191–0.0315H
		≥200	7.60	191–0.0315H
	Air	<175	18.0–0.0469H	Not applicable
		≥175	9.80	Not applicable

Source: 42 U.S.C. 6313(d)(1)
* Water use is for the condenser only and does not include potable water used to make ice.
** H = harvest rate in pounds per 24 hours, indicating the water or energy use for a given harvest rate.

1.3.3 Current Rulemaking Process

As discussed in section 1.3, EPCA grants DOE authority to set standards for additional types of equipment, and requires DOE to review and, if appropriate, amend the existing standards. Thus, DOE initiated this rulemaking to set standards for additional equipment types and to fulfill the statutory requirement to review the existing standards.

As the first step, in November 2010 DOE published the *Rulemaking Framework for Automatic Commercial Ice-Makers*,[1] describing the procedural and analytical approaches DOE anticipated using to evaluate the establishment of energy conservation standards for ACIM equipment. DOE then held a public meeting on December 16, 2010 to discuss procedural and analytical approaches to the rulemaking, and to inform interested parties and facilitate their involvement in the rulemaking process. The analytical framework presented at the public meeting described different analyses, such as the engineering analysis and the life-cycle cost (LCC) and payback period (PBP) analyses, the methods proposed for conducting them, and the relationships among the various analyses. Table 1.3.2 lists the analyses discussed at the public meeting to be undertaken in each of the formal public rulemaking phases.

Table 1.3.2 Automatic Commercial Ice-Making Equipment Analyses

Preliminary Analysis	Notice of Proposed Rulemaking	Final Rule*
Market and technology assessment	Revised preliminary analyses	Revised NOPR analyses
Screening analysis	Life-cycle cost sub-group analysis	
Engineering analysis	Manufacturer impact analysis	
Energy use characterization	Utility impact analysis	
Markups to determine equipment price	Employment impact analysis	
Life-cycle cost and payback period analyses	Emissions analysis	
Shipments analysis	Regulatory impact analysis	
National impact analysis		
Preliminary manufacturer impact analysis		

NOPR = notice of proposed rulemaking.
* During the final rule phase, DOE considers the comments submitted by the U.S. Department of Justice in the NOPR phase concerning the impact of any lessening of competition that is likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(v))

As part of the information gathering and sharing process, DOE interviewed ACIM equipment manufacturing companies that represented production of all types of ACIM equipment, ranging from small to large manufacturers, and including Air-Conditioning, Heating, and Refrigeration Institute (AHRI) member companies and non-AHRI member companies. DOE had four objectives for these interviews: (1) solicit feedback on the draft engineering analysis, including methodology, production costs, manufacturing processes, and findings; (2) solicit feedback on topics related to the preliminary manufacturer impact analysis (MIA); (3) provide an opportunity early in the rulemaking process to express specific concerns to DOE; and (4) foster cooperation between the manufacturers and DOE.

Six general topics related to the preliminary MIA were discussed during each of the interviews: (1) general key issues; (2) automatic commercial ice maker shipment projections; (3) capital conversion costs; (4) equipment mix and profitability; (5) market shares and industry consolidation; and (6) cumulative regulatory burden.

DOE incorporated the information gathered at the meetings into its engineering analysis (see chapter 5 of the preliminary TSD) and the preliminary MIA (see chapter 12 of preliminary TSD). Following the publication of the preliminary analysis and the preliminary analysis public meeting, DOE intends to hold additional meetings with manufacturers as part of the consultative process for the MIA conducted during the NOPR phase.

DOE conducted the LCC and PBP analyses based on an approach that establishes an annual energy expense using regional average electric utility costs for affected businesses and projected those electricity costs into the future using electricity price projections for the commercial sector from the DOE Energy Information Agency (EIA). Under this approach, LCC results are based on the assumption that manufacturing plants and commercial building customers in the future will face electricity costs similar to those that exist in today's electricity markets.

DOE developed spreadsheets for the LCC and PBP analyses, and for the national impact analysis (NIA). The LCC spreadsheet calculates national distributions of LCC savings at various energy efficiency levels above the baseline and also can provide LCC savings based on typical input values for several business types that use ACIM equipment as well as distributions of

energy costs. DOE also developed an NIA spreadsheet that calculates the national energy savings and net present value at various energy efficiency levels for individual types of equipment. This spreadsheet includes a model that forecasts shipments for the various equipment classes of automatic commercial ice makers at different efficiency levels.

1.4 STRUCTURE OF THE DOCUMENT

This preliminary TSD outlines the analytical approaches used in this rulemaking. The TSD consists of 16 chapters as well as appendices.

- **Chapter 1, Introduction**: provides an overview of the appliance and equipment standards program and how it applies to the automatic commercial ice maker rulemaking, and outlines the structure of the document.
- **Chapter 2, Analytical Framework, Comments from Interested Parties, and DOE Responses**: describes the rulemaking process step by step, summarizes comments made by interested parties during the framework document comment period, and provides DOE responses to those comments.
- **Chapter 3, Market and Technology Assessment**: characterizes the ACIM equipment market and the technologies available for increasing equipment efficiency.
- **Chapter 4, Screening Analysis**: determines which technology options are viable for consideration in the engineering analysis.
- **Chapter 5, Engineering Analysis**: discusses the methods used for developing the relationship between increased manufacturer price and increased efficiency.
- **Chapter 6, Markups for Equipment Price Determination**: discusses the methods used for establishing markups for converting manufacturer prices to customer equipment prices.
- **Chapter 7, Energy and Water Use Analysis**: discusses the process used for generating energy use estimates of ACIM equipment for a variety of equipment classes and standard levels.
- **Chapter 8, Life-Cycle Cost and Payback Period Analyses**: discusses the economic effects of standards on individual customers and users of the equipment and compares the LCC and PBP of equipment with and without higher efficiency standards.
- **Chapter 9, Shipments Analysis**: discusses the methods used for forecasting shipments with and without higher efficiency standards.
- **Chapter 10, National Impact Analysis**: discusses the methods used for forecasting national energy consumption and national economic impacts based on annual equipment shipments and estimates of future equipment efficiency distributions in the absence and presence of higher efficiency standards.
- **Chapter 11, Life-Cycle Cost Subgroup Analysis**: discusses the effects of standards on a subgroup of ACIM equipment customers and compares the LCC and PBP of equipment with and without higher efficiency standards for these customers.

- **Chapter 12, Preliminary Manufacturer Impact Analysis**: discusses the effects of standards on the finances and profitability of equipment manufacturers.
- **Chapter 13, Utility Impact Analysis**: discusses the effects of standards on the installed generation capacity of electric utilities.
- **Chapter 14, Employment Impact Analysis**: discusses the effects of standards on national employment.
- **Chapter 15, Emissions Analysis**: discusses the effects of standards on airborne emissions of electric utilities.
- **Chapter 16, Monetization of Emissions Reductions Benefits**
- **Chapter 17, Regulatory Impact Analysis**: discusses the present regulatory actions as well as the impact of non-regulatory alternatives to setting energy efficiency standards.
- Appendix 5A, Engineering Data: accompanies chapter 5, Engineering Analysis.
- Appendix 6A, Data for Equipment Price Markups: accompanies chapter 6, Markups for Equipment Price Determination.
- Appendix 8A, User Instructions for Life-Cycle Cost Spreadsheet: accompanies chapter 8, Life-Cycle Cost and Payback Period Analyses.
- Appendix 8B, Detailed Life-Cycle Cost and Payback Period Results: accompanies chapter 8, Life-Cycle Cost and Payback Period Analyses.
- Appendix 8C, Development of Experience (Price) Learning Values: accompanies chapter 8, Life-Cycle Cost and Payback Period Analyses.
- Appendix 10A, User Instructions for National Energy Savings and Net Present Value Spreadsheet: accompanies chapter 10, National Impact Analysis.
- Appendix 10B, Detailed National Energy Savings and National Net Present Value Results: accompanies chapter 10, National Impact Analysis.
- Appendix 10C, Development of Experience (Price) Learning Values: accompanies chapter 10, National Impact Analysis.

REFERENCES

1. U.S. Department of Energy. *Rulemaking Framework for Automatic Commercial Ice-Makers*. 2010. Washington, D.C. <http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/acim_framework_2010_11_04.pdf >