CHAPTER 9. TRIAL STANDARD LEVELS

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CHAPTER 9. TRIAL STANDARD LEVELS

9.1 INTRODUCTION

Title III of Energy Policy and Conservation Act (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 types of commercial and industrial equipment. This part was originally titled Part C; however, it was renamed Part A-1 after Part B of Title III was repealed by the Energy Policy Act of 2005 (EPACT 2005). This Act, Pub. L. 109-58, included an amendment to Part A-1 requiring that the U.S. Department of Energy (DOE) prescribe energy conservation standards for the beverage vending machines that are the subject of this rulemaking (EPACT 2005, section 135(c)(4); 42 U.S.C. 6295(v)) The test procedures for beverage vending machines appear at Title 10 Code of Federal Regulations (CFR) sections 431.293 and 431.294.

Because of its placement in Part A of Title III of EPCA, the rulemaking for beverage vending machine energy conservation standards is bound by the requirements of 42 U.S.C. 6295. However, since beverage vending machines are commercial equipment and consistent with DOE's previous action to incorporate the EPACT 2005 requirements for commercial equipment into Title 10 CFR, part 431 Energy Efficiency Program for Certain Commercial and Industrial Equipment, DOE has placed the requirements for beverage vending machines in subpart Q of 10 CFR part 431. The location of the provisions within the CFR does not affect either their substance or applicable procedure, so DOE is placing them in the appropriate CFR part based on their nature or type. The EPCA as amended specifies that any new or amended energy conservation standard DOE prescribes for the equipment covered by this notice shall be designed to "achieve the maximum improvement in energy efficiency . . . which the Secretary determines is technologically feasible and economically justified." (42 United States Code (U.S.C.) 6295(o)(2)(A), and (v)). Further, the new or amended standard must "result in significant conservation of energy." (42 U.S.C. 6295(o)(3)(B) and (v)) In accordance with these and other statutory criteria discussed in this notice, DOE proposes to adopt new energy conservation standards for refrigerated bottled or canned beverage vending machines, hereafter referred to as "beverage vending machines."

On August 8, 2005, section 135(c)(4) of EPACT 2005 amended section 325 of EPCA, in part, to direct DOE to issue energy conservation standards for the equipment covered by this rulemaking, which standards would apply to equipment manufactured three years after publication of the final rule establishing the energy conservation standards. (42 U.S.C. 6295(v)(1), (2) and (3)) The relevant statutory provisions were renumbered pursuant to section 316 of the Energy Independence and Security Act of 2007, Pub. L. 110–140. The energy use of this equipment has never been regulated at the Federal level.

9.2 TRIAL STANDARD LEVELS

DOE analyzed seven energy consumption levels for Class A equipment and six energy consumption levels for Class B equipment in the life-cycle cost (LCC) analysis and national impact analysis (NIA). For the notice of proposed rulemaking (NOPR), DOE determined that

each of these levels should be presented as a possible trial standard level (TSL) and correspondingly identified seven TSLs for Class A and six TSLs for Class B equipment. For each equipment class, the range of TSLs selected includes the energy consumption level providing the maximum national energy savings (NES) level for the class, the level providing the maximum NES while providing a positive net present value (NPV), the level providing the maximum NPV, and the level approximately equivalent to ENERGY STAR Tier 2. Many of the higher levels selected correspond to equipment designs which incorporate specific noteworthy technologies that can provide energy savings benefits. For Class A, DOE also included two intermediate efficiency levels to fill in significant energy consumption gaps between the levels identified above the ENERGY STAR Tier 2 equivalent level. For Class A machines, the ENERGY STAR Tier 2 equivalent TSL level, TSL 1, allows for the highest energy consumption. For Class B, DOE included one TSL with energy consumption higher than that provided by ENERGY STAR Tier 2.

For the advance notice of proposed rulemaking (ANOPR), DOE proposed four candidate standard levels for each equipment class based on the levels that provided maximum energy savings, maximum efficiency level with positive LCC savings, maximum LCC savings, and the highest efficiency level with a payback of less than 3 years.

DOE preserved energy consumption levels that met the same economic criteria as was used in the ANOPR in the NOPR, but in addition, included the Tier 2 equivalency level and several additional TSLs. These additional levels, as discussed previously, either provide additional intermediate efficiency levels or include specific noteworthy technologies examined in the engineering analysis.

Table 9.2.1 and Table 9.2.2 show the TSL levels DOE selected for the equipment classes and sizes analyzed. For Class A equipment, TSL 7 is the max-tech level for three equipment sizes: small (S), medium (M), and large (L). TSL 6 is the maximum efficiency level with a positive NPV at the 7-percent discount rate, achieved through incorporation of a condenser fan motor that is an electronically commutated motor (ECM). TSL 5 is the efficiency level with the maximum NPV and maximum LCC savings, achieved through the use of an advanced refrigerant condenser design. TSL 4 is the level that first incorporated light-emitting diode (LED) lighting for products as a design feature in the engineering analysis. TSL 3 and TSL 2 were intermediate efficiency levels chosen to bridge the gap between TSL 4, and the ENERGY STAR Tier 2 equivalent level, TSL 1.

For Class B equipment TSL 6 is the max-tech level. TSL 5 is the level that first incorporated LED lighting for the machine as a design option in the engineering analysis. TSL 4 is the next highest efficiency level including incorporation of an ECM condenser fan motor. TSL 3 was achieved through the use of an advanced refrigerant condenser design and provided essentially an NPV of essentially $0, with total capital expenditures for new equipment balanced by total operating cost savings over the NIA period, based on a 7-percent discount rate. TSL 2 is the ENERGY STAR Tier 2 level for Class B equipment, and provided the maximum LCC savings and maximum NPV savings at a 7-percent discount rate. TSL 1, which provided an energy consumption level approximately 4 percent higher than TSL 2, was also included in the analysis, and represented the first level incorporating an evaporator fan driven by an ECM in the engineering analysis.

Table 9.2.1 Trial Standard Levels for Class A Equipment Expressed in Terms of Daily Energy Consumption

Size	TSL	TSL in Order of Efficiency							
		Baseline	1	2	3	4	5	6	7
	LCC Efficiency Level	1	2	3	4	5	6	7	8
Small	Engr. Level	1	5	N/A*	N/A	6	7	9	11
	kWh/day	6.10	5.27	4.75	4.25	3.95	3.73	3.58	3.25
Medium	Engr. Level	1	5	N/A	N/A	6	7	9	11
	kWh/day	6.53	5.51	5.25	4.75	4.19	3.95	3.79	3.43
Large	Engr. Level	1	4	N/A	N/A	5	6	8	10
	kWh/day	6.75	6.21	5.75	5.25	4.89	4.60	4.41	3.94

* N/A means not available. These levels established as intermediate points along the engineering cost curves

Table 9.2.2 Trial Standard Levels for Class B Equipment Expressed in Terms of Daily Energy Consumption

Size	TSL	TSL in Order of Efficiency						
		Baseline	1	2	3	4	5	6
	LCC Efficiency Level	1	2	3	4	5	6	7
Small	Engr. Level	1	2	4	4	5	6	7
	kWh/day	4.96	4.62	4.31	4.31	4.28	3.78	3.69
Medium	Engr. Level	1	2	4	5	6	7	8
	kWh/day	5.56	5.20	4.99	4.76	4.72	4.22	4.12
Large	Engr. Level	1	2	3	4	5	6	7
	kWh/day	5.85	5.48	5.33	5.07	5.03	4.52	4.41

As determined in the ANOPR, DOE chose to characterize the proposed TSL levels in terms of proposed equations that establish a maximum daily energy consumption (MDEC) limit through a linear equation of the form:

$$MDEC = A \times V + B \quad \textbf{Eq. 9.1}$$

Where:

A = expressed in terms of kWh/day/ft^3 of measured volume,
V = the measured refrigerated volume (ft^3) calculated for the equipment, and
B = an offset factor expressed in kWh/day.

Coefficients A and B are uniquely derived for each equipment class based on a linear equation passing between the daily energy consumption values for equipment of different refrigerated volumes. For the development of the A and B coefficients, DOE used the energy consumption values shown in Table 9.2.1 and Table 9.2.2 for the medium and large equipment sizes respectively (two-point weighting strategy) within each class of beverage vending machine. Also, the equations corresponding to each of the TSLs and for the two equipment classes are listed in Table 9.2.3.

Table 9.2.3 Trial Standard Levels Expressed in Terms of Equations and Coefficients for Each Equipment Class

TSL	Test Metric	Class A	Class B
Baseline	kWh/day	MDEC = 0.019 x V + 6.09	MDEC = 0.068 x V + 4.07
1	kWh/day	MDEC = 0.062 x V + 4.12	MDEC = 0.066 x V + 3.76
2	kWh/day	MDEC = 0.044 x V + 4.26	MDEC = 0.080 x V + 3.24
3	kWh/day	MDEC = 0.044 x V + 3.76	MDEC = 0.073 x V + 3.16
4	kWh/day	MDEC = 0.062 x V + 2.80	MDEC = 0.073 x V + 3.12
5	kWh/day	MDEC = 0.058 x V + 2.66	MDEC = 0.070 x V + 2.68
6	kWh/day	MDEC = 0.055 x V + 2.56	MDEC = 0.068 x V + 2.63
7	kWh/day	MDEC = 0.045 x V + 2.42	N/A*

* N/A means not available. There is no TSL 7 for Class B machines.

DOE did not use the small equipment sizes for either Class A or Class B, as information from the ANOPR indicated that there are no significant shipments of the small equipment sizes.

At and after the NOPR public meeting, DOE received comments for using the two-point versus a three-point weighting strategy (including the small-sized equipment market share) in developing final TSL correlations. Using this three-point strategy, the correlation for TSL 3 (proposed standard level in the NOPR) for Class B equipment was compared to the curve obtained using the two-point strategy as reported in the NOPR. Because the difference between the two curves is small (1.5 percent for small-sized equipment (17 ft^3) and less than 1 percent for large-sized equipment (27 ft^3 of refrigerated volume) as seen in Figure 9.2.1, DOE used the same correlations for all TSLs as developed in the NOPR for Class B equipment for the final rule (FR) analysis (Table 9.2.3).

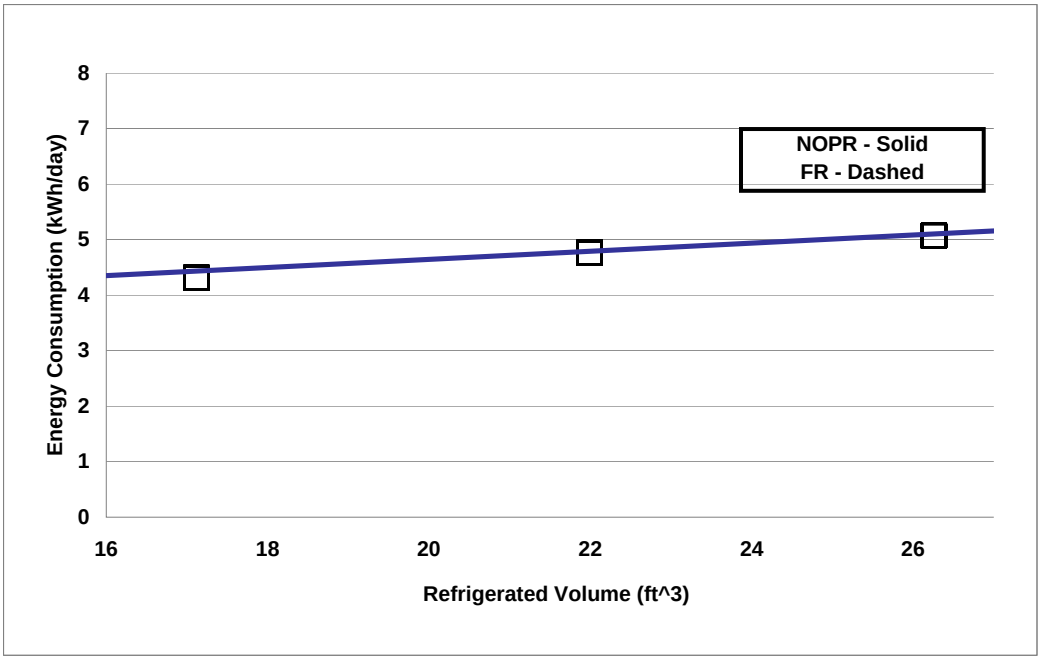

Figure 9.2.1 Comparison of Trial Standard Level 3 Correlations Between NOPR and Final Rule for Class B Equipment