



May 16, 2011

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program
Mailstop EE-2J
1000 Independence Avenue, SW
Washington, DC 20585-0121

**RE: Docket Number EERE-2010-BT-STD-0003: Preliminary Technical Support Document for Commercial Refrigeration Equipment**

Dear Ms. Edwards:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP) and the Natural Resources Defense Council (NRDC) in response to the Department of Energy (DOE) request for comments on the preliminary technical support document (TSD) for commercial refrigeration equipment. 76 Fed. Reg. 17573 (March 30, 2011).

ASAP is a coalition group dedicated to advancing cost-effective energy efficiency standards for appliances and equipment. ASAP works at both the state and federal levels and is led by a steering committee with representatives from consumer groups, utilities, state government, environmental groups, and energy-efficiency groups.

NRDC is a national environmental advocacy organization with over 1.3 million members and online activists. NRDC has spent decades working to build and improve DOE's federal appliance standards programs because of the important energy, environmental, consumer, and reliability benefits of appliance efficiency standards. NRDC participated in the enactment of the first federal legislation establishing efficiency standards, and has been active in all significant rulemakings since then.

We appreciate the opportunity to provide input to the Department. Below we provide comments on three issues in the preliminary TSD.

**We encourage DOE to consider technologies that improve efficiency under part-load conditions in the engineering analysis.** In the test procedures proposed rule for commercial refrigeration equipment, DOE noted that "some variation in refrigeration load is experienced in display cases with doors as part of the door opening requirement included in the test" and that "if the equipment being tested has more efficient operation at variable refrigeration load, the case will use less energy overall." 75 Fed. Reg. 71601 (November 24, 2010). DOE further stated that the test procedures will rely "on the transient effects inherent in the proposed test procedure to

capture part-load performance." 75 Fed. Reg. 71601. However, in the preliminary TSD, DOE screened out technologies including variable-speed condenser fans and fan motor controllers, anti-sweat heater controllers, and higher-efficiency expansion valves, asserting that these technologies will not affect calculated daily energy consumption (CDEC) as measured by the test procedures.[1] DOE also did not consider variable-speed compressors as a compressor design option, stating that "the ASHRAE 72 test procedure prescribes steady-state conditions" and that "the EER would be no better than a properly sized single-speed compressor, and no appreciable energy savings would result."[2]

DOE refers to the ASHRAE 72 test procedure as a steady-state test. ASHRAE 72 is conducted at constant ambient conditions (temperature and relative humidity) and the refrigerated case maintains a relatively constant temperature during the test. However, there is clearly variation in refrigeration load during the test for equipment with doors. ASHRAE 72 requires that during the first eight hours of the test, each door be in the fully open position for six seconds, six times per hour, which means that the refrigeration load is significantly higher during the door-opening period due to infiltration of warm air. If the refrigeration load is higher during the first eight hours of the test compared to the remainder of the test, the equipment must be operating at varying loads during the test.

It is also important to distinguish between steady state and full load. Open cases may experience a relatively constant refrigeration load during the test. However, this does not necessarily mean that the equipment is operating at full load. In fact, for self-contained equipment, if the compressor cycles on and off during the test (which we understand to be the case), this indicates that the equipment is operating at part load. In addition, if a commercial refrigerator or freezer did operate at full load during the test, the equipment would not be able to maintain desired case temperatures in the field when the ambient temperature and/or relative humidity were higher than that specified by the test, which would pose a risk to food safety. Therefore, while we are not familiar with the specific design requirements of commercial refrigeration equipment, it seems likely that equipment is designed to meet a higher refrigeration load than that experienced during the test and that technologies which improve part-load performance could reduce energy consumption for both doored and open cases.

We note that in the proposed rule for energy conservation standards for residential refrigerators and freezers, variable-speed compressors were considered as a design option for meeting higher efficiency levels.[3] If single-speed compressors on self-contained commercial refrigerators and freezers cycle on and off during the test, there is likely opportunity for variable-speed compressors to reduce energy consumption by increasing the operating effectiveness of heat exchangers (more surface area available relative to the mass flow of refrigerant) and by reducing cycling losses. We also note that at the public meeting on April 19, 2011, Zero Zone commented that anti-sweat heater controllers have the potential to save energy because they can be designed to have additional capacity for more humid conditions.[4]

[1]Preliminary Technical Support Document. p. 4-2.
[2] *Ibid*. p. 5-25.
[3] Proposed Rule for Residential Refrigerators, Refrigerator-Freezers, and Freezers. 2010. Technical Support Document. p. 5-56.
[4] Transcript from public meeting on preliminary technical support document. p. 53.

DOE should evaluate the potential of technologies that improve part-load performance to reduce energy consumption as measured by the test procedures. At the public meeting, DOE stated that the model used in the engineering analysis is based upon the stipulations of the test procedure.[5] The model should therefore be able to capture the potential benefits of technologies that improve part-load performance. If this is not the case, DOE should consider a different methodology for evaluating these technologies.

**DOE should not assume that LED prices will remain constant.** At the public meeting, DOE stated that current prices for LEDs were used in the engineering analysis.[6] DOE's solid-state lighting multi-year program plan published in March 2011 projects that between 2010 and 2015 prices of cool-white and warm-white LED packages will decrease by about 85 percent while efficacy will increase by 48 percent for cool-white packages and by 88 percent for warm-white packages.[7] DOE noted in the preliminary TSD that the likely compliance date for amended commercial refrigeration standards will be 2016.[8] Therefore, an assumption that LED prices will remain constant between now and 2016 will almost certainly significantly overestimate 2016 prices.

In February 2011, DOE issued a notice of data availability (NODA) regarding a new methodology for appliance standards analyses incorporating "learning" or "experience" curves to reflect historical data that suggests that the real costs of covered products and equipment tend to decrease over time. 76 Fed. Reg. 9696 (February 22, 2011). We strongly support this methodology for all appliance standards rulemakings as reflected in our comments on the NODA.[9] However, since LEDs are an emerging technology experiencing a dramatic decline in cost, it is important to not only capture projected cost decreases over the analysis period (2016-2045) but to also capture the significant drop in prices for LEDs that will almost certainly occur between now and 2016.

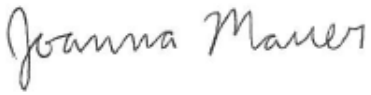
A price estimate for LEDs for the first year the standard goes into effect that reflects market trends is necessary in order to determine the maximum improvement in energy efficiency which is technologically feasible and economically justified since the life-cycle cost (LCC) analysis is conducted as if each new purchase occurs in the year the standard takes effect. The LED price projections noted above suggest that if DOE assumes in this rulemaking that LED prices will remain constant, this will likely result in an overestimate of cost per kilolumen by more than six-fold. If LED prices are significantly overestimated, the LCC analysis will necessarily discount the value of potential energy savings from the use of LEDs. Therefore, we urge DOE to develop cost estimates for LEDs that reflect the well-documented price decline being observed in the market.

[5] *Ibid*. p. 66.
[6] *Ibid*. p. 75.
[7] U.S. Department of Energy. Solid-State Lighting Research and Development: Multi-Year Program Plan. March 2011. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2011_web.pdf. p. 42.
[8] Preliminary Technical Support Document. p. ES-13.
[9] Comment IDs: EERE-2008-BT-STD-0012-0108; EERE-2008-BT-STD-0012-0104.

**Maintenance costs that are expected to be incurred in specific years should not be annualized.** The preliminary TSD states that the total costs for lamp, ballast, or LED fixture replacements were annualized.[10] While it is reasonable to use annualized maintenance costs for maintenance that occurs on an annual or semi-annual basis such as preventative maintenance activities, annualizing maintenance costs that occur only in specific years during the life of the equipment can distort the results of the LCC analysis. The present value of annualized costs will be greater than the present value of the cost in the year the maintenance activity actually occurs. We note that in the TSD for the proposed rule for energy conservation standards for fluorescent lamp ballasts, DOE describes the process the Department used for incorporating lamp replacement costs whereby "each year in which a lamp reaches the end of its life, a new lamp is purchased and installed at the beginning of that year, and the first cost and installation cost are discounted back to the base year of the analysis period" and "for the years when no replacement is necessary, the replacement costs were set to zero."[11] We suggest that the Department use a similar methodology for addressing maintenance costs in this rulemaking for commercial refrigeration equipment.

Thank you very much for considering these comments.

Sincerely,



Joanna Mauer
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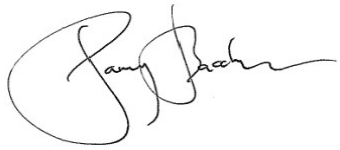

Jamy Bacchus, PE
Staff Engineer
Natural Resources Defense Council

[10] Preliminary Technical Support Document. p. 8-24.
[11] Proposed Rule for Fluorescent Lamp Ballasts. 2011. Technical Support Document. p. 8-15.