Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy
Northwest Energy Efficiency Alliance

September 27, 2024

Mr. Jeremy Dommu
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-2B
1000 Independence Avenue SW
Washington, DC 20585

RE: Docket Number EERE-2017-BT-STD-0007: Energy Conservation Standards for Commercial Refrigerators, Freezers, and Refrigerator-Freezers

Dear Mr. Dommu:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), and the Northwest Energy Efficiency Alliance (NEEA) on the notification of data availability (NODA) for commercial refrigerators, refrigerator-freezers, and freezers, herein referred to as commercial refrigeration equipment (CRE). 89 Fed. Reg. 68788 (August 28, 2024). We appreciate the opportunity to provide input to the Department.

We are generally supportive of DOE's updates to the analysis presented in the NODA and believe the updated analysis provides a strong basis for finalizing amended CRE standards. We continue to support adopting the highest efficiency levels (ELs) that have positive life-cycle cost savings; based on DOE's updated analysis for the NODA, we estimate that amended standards meeting this criteria would yield about 1.5 quads of energy savings and up to about $4.5 billion in net present value savings for purchasers. While we generally support DOE's analysis, we encourage DOE to consider approaches to address the capacity cut-off between "large" and "non-large" units in order to reduce the potential for market distortions. We also summarize below how several of DOE's updates to the analysis result in the analysis being conservative.

DOE should consider refining the updated analysis for large CRE. Consistent with the ongoing transition to low global warming potential (GWP) refrigerants, DOE assumed in the NOPR that all CRE units would use R-290 refrigerant in meeting amended CRE standards. Since R-290 is generally more efficient than conventional refrigerants, DOE adjusted the baseline ELs to account for this inherent efficiency improvement from switching refrigerants. However, feedback from manufacturers indicated that larger CRE units may require more refrigerant than the allowable R-290 charge limits specified in UL 60335-2-89.[1] Thus, DOE evaluated a second, large-capacity representative unit (RU) for seven equipment classes[2] assuming the use of A2L refrigerant (e.g., R-454C, R-455A) with baseline efficiencies equivalent to the current standards.

[1] 89 Fed. Reg. 68790.
[2] VOP.SC.M, SVO.SC.M, HZO.SC.L, SOC.SC.M, VCT.SC.M, VCT.SC.L, and VCS.SC. L.

While we believe that DOE's approach to these large CRE is reasonable, we have some concern about the potential for market distortions near the capacity cut-off between "large" and "non-large" units. For example, if DOE were to adopt EL 3 for the VCS.SC.L[3] equipment class, the highest cost-effective EL, the standard for a 100 ft^3 unit would be about 18 kWh/day while the standard for a 101 ft^3 unit would be nearly 22 kWh/day.[4] Thus, a unit could use about 20% more energy by having a volume just above the assumed cut-off for "large" CRE. We therefore encourage DOE to consider approaches to address the capacity cut-off for certain equipment classes which would reduce the potential for market distortions while maintaining the assumed use of R-290 as the refrigerant at smaller capacities.[5]

Additionally, we encourage DOE to clarify why the efficiency differences between the "non-large" and "large" RUs are significantly larger at higher ELs compared to the baseline. For example, the baseline energy use equation for the VCS.SC.L "non-large" (R-290) RU is 6% lower than the "large" (A2L) baseline equation that is equivalent to the current standards;[6] this 6% difference matches DOE's assumption of the energy use reduction achieved by switching from conventional refrigerants to R-290. However, for the highest cost-effective efficiency level (EL 3), the energy use equation for the "non-large" unit is about 16% lower than that of the "large" unit. Although the percent energy savings associated with additional design options may not be the same across all refrigerant types or capacities, it is unclear why employing design options like variable-speed compressors and BLDC motors have a much bigger relative efficiency impact on smaller units using R-290 compared to larger units using A2L refrigerants.

DOE's updated analysis is conservative. In DOE's updated analysis, evaporator fan controls were screened out as a design option; the energy savings associated with occupancy sensors were reduced; and compressor energy use increased. Each of these updates, which are described in more detail below, contribute to DOE's analysis being conservative.

Evaporator fan controls: In the NOPR, DOE analyzed evaporator fan controls as a design option for self-contained, closed CRE, and the proposed standard levels for several equipment classes assumed the use of this design option. Evaporator fan controls can provide large energy savings. For example, DOE's NOPR analysis estimated that this technology option would reduce daily energy use by nearly 30% for the VCS.SC.M[7] equipment class. However, based on feedback expressing concern about food safety, wherein reduced fan speed could decrease air circulation and temperature uniformity, DOE opted to screen out evaporator fan controls as a design option.[8] This contributed to a significant reduction in potential energy savings for several equipment classes relative to the NOPR analysis. However, DOE discussed previously that the Department tested CRE units that incorporated evaporator fan controls,[9] and the Department acknowledges in the NODA that National Sanitation Foundation (NSF) 7 food safety requirements do not preclude the use of evaporator fan controls. We therefore expect that many closed, self-contained CRE will use evaporator fan controls to meet amended standards even though this technology has been screened out of DOE's analysis.

[3]Vertical, closed, solid door, self-contained, low-temperature (freezer).
[4]Support Document, Tables 3.18, 3.35, pp. 28, 34. www.regulations.gov/document/EERE-2017-BT-STD-0007-0090
[5]One potential option would be to set a single linear capacity-based standard equation that fits both the small and large RU efficiencies rather than having separate equations on either side of the capacity cut-off.
[6]Support Document. Tables 3.18, 3.35, pp. 28, 34. www.regulations.gov/document/EERE-2017-BT-STD-0007-0090
[7]Vertical, closed, solid door, self-contained medium-temperature (refrigerator).
[8]89 Fed. Reg. 68793.
[9]NOPR Technical Support Document (TSD), p. 5-18. www.regulations.gov/document/EERE-2017-BT-STD-0007-0051

Occupancy sensors: Both DOE's NOPR and NODA analyses consider occupancy sensors as a design option for open and transparent door CRE equipment classes. In the NOPR, DOE's proposed levels assumed the use of occupancy sensors for most open and transparent door classes. However, based on feedback received that some purchasers would de-activate occupancy sensors during installation, DOE assumed in the NODA that only 75% of purchasers would accrue energy savings from occupancy sensors (i.e., 25% of purchasers would de-activate them). In addition to this assumption reducing the energy savings of a given EL associated with use of occupancy sensors for each relevant equipment class, it also resulted in occupancy sensors no longer being included in the highest cost-effective levels for the non-large VCT.SC.M[10] and VCT.SC.I[11] equipment classes. While this assumption may more accurately reflect the energy savings of occupancy sensors in the field, manufacturers will be able to utilize occupancy sensors to meet any amended standards and the test procedure does not include any comparable assumption about de-activation (i.e., the test procedure gives full credit to occupancy sensors).

Compressor efficiency: In the NODA analysis, DOE has applied a 5% increase in energy use for all compressors to account for the performance uncertainty of curve-fitted compressor performance maps used in the engineering analysis.[12] DOE also modified their analysis to use the average compressor efficiency for R-290 compressors rather than the maximum compressor efficiency assumed in the NOPR analysis even though manufacturers will have the option of using the maximum efficiency compressors in their equipment. We also would expect that additional high-efficiency compressors will be introduced to the market in advance of the compliance date of amended standards. The combination of these adjustments to assumed compressor energy use likely mean that the analysis is overstating the actual energy use of many compressor models that will be used to meet amended standards.

Thank you for considering these comments.

Sincerely,

Jeremy Dunklin, PhD
Senior Technical Advocacy Associate
Appliance Standards Awareness Project

Matt Malinowski
Director, Buildings Program
American Council for an Energy-Efficient Economy

Blake Ringeisen
Sr. Engineer, Codes and Standards
Northwest Energy Efficiency Alliance

[10]Vertical, closed, transparent door, self-contained, medium-temperature (refrigerator).
[11]Vertical, closed, transparent door, self-contained, ice cream freezer.
[12]89 Fed. Reg. 68793.