Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy
Natural Resources Defense Council

December 11, 2023

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 Natural Resources Defense Council (NRDC) on the notice of proposed rulemaking (NOPR) for commercial refrigerators, refrigerator-freezers, and freezers, herein referred to as commercial refrigeration equipment (CRE). 88 Fed. Reg. 70196 (October 10, 2023). We appreciate the opportunity to provide input to the Department.

We strongly support DOE's proposed standards for CRE, which would provide large national energy savings of over 3 quads and considerable savings for businesses of up to about $7 billion over 30 years of sales.[1] Most of the energy and cost savings from the proposed standards reflect the use of more efficient components like brushless DC fan motors and variable-speed compressors. While we are generally supportive of DOE's proposed standards and the Department's engineering analysis, we note that there are some equipment classes where the max-tech levels are exceeded by a significant number of models on the market today. Thus, we encourage DOE to further investigate these products and consider whether higher standards may be appropriate. We also encourage DOE to consider amended standards for pull-down (PD) equipment.

We support DOE's proposed amended standards for CRE. In the NOPR, DOE has proposed to adopt Trial Standard Level (TSL) 5, which represents the highest efficiency level for each equipment class with positive life-cycle cost (LCC) savings.[2] For self-contained equipment classes, TSL 5 reflects the use of more efficient brushless DC evaporator/condenser fan motors and variable-speed compressors.[3] For most equipment classes with transparent doors, DOE expects manufacturers would also need to incorporate improved glass doors as well as occupancy sensors with light dimming capability. Open equipment classes are expected to require use of occupancy sensors and night curtains.

DOE's proposed standards provide meaningful cost savings for purchasers of CRE. The average LCC savings for vertical, self-contained, medium-temperature CRE with solid doors (VCS.SC.M) and

[1] 88 Fed. Reg. 70199.
[2] 88 Fed. Reg. 70293.
[3] *Ibid*.

transparent doors (VCT.SC.M), together representing about 60% of estimated CRE shipments,[4] are $129 and $83, respectively.[5] Cost savings are even greater for vertical, self-contained, low-temperature, solid door CRE (VCS.SC.L), which represent about 10% of total shipments, and vertical open, remote condensing, medium-temperature CRE (VOP.RC.M), with average LCC savings of $261 and $707, respectively.[6]

We support DOE's proposed standards for chef bases and griddle stands. As part of the recent CRE test procedure Final Rule, DOE finalized test methods for chef bases and griddle stands.[7] Chef bases and griddle stands were not previously covered, and DOE has proposed the first standards for these products in the NOPR. DOE's proposed standards for medium- and low-temperature chef bases/griddle stands (CB.SC.M, CB.SC.L), which would reduce energy usage by over 50% versus a baseline unit,[8] would provide significant cost savings for purchasers. For example, DOE projects average LCC savings of $567 for the CB.SC.L class.[9]

We support DOE's proposed standards for high-temperature refrigerators. While high-temperature CRE are currently subject to the existing medium-temperature standards, these units are tested at an internal air temperature (IAT) higher than medium-temperature CRE (e.g., 55 °F vs. 38 °F);[10] this effectively means that these high-temperature units are more easily able to meet the current standards. DOE addressed this in the CRE test procedure final rule by defining high-temperature CRE separately and creating uniform testing conditions (e.g., 55 °F IAT). As part of the standards NOPR, DOE has proposed new standards for these high-temperature CRE that better account for expected differences in energy use between medium- and high-temperature units.

We support DOE's approach for the engineering analysis. Supported by testing, physical and catalog teardowns, and manufacturer feedback,[11] DOE's engineering analysis estimates both the energy use and manufacturer production cost (MPC) resulting from use of additional design options in CRE that increase efficiency. In total, DOE tested 70 CRE models and reverse engineered 47 CRE models[12] in support of developing the cost-efficiency curves (MPC vs. kWh/day) for each design option analyzed for 28 of the CRE equipment classes.[13] In this design option approach, technology options were added incrementally to the baseline configuration. We believe this methodology represents a robust method for estimating the incremental cost and expected efficiency improvements associated with specific design options for CRE and note that this approach is consistent with DOE's analysis for other rulemakings.

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[4]Table 9.3.2. TSD, p. 9-8. www.regulations.gov/document/EERE-2017-BT-STD-0007-0051
[5]Tables V.40, V. 52. 88 Fed. Reg 70268, 70270.
[6]Tables V.38, V.56. 88 Fed. Reg. 70267, 70271.
[7]88 Fed. Reg. 66152 (September 26, 2023). This Final Rule also includes test methods for buffet/preparation tables and blast chillers/freezers, but DOE did not propose standards for these categories, citing a lack of information.
[8]TSD, pp. 5-54, 5-55. www.regulations.gov/document/EERE-2017-BT-STD-0007-0051
[9]Table V.4. 88 Fed. Reg. 70259.
[10]High-temperature refrigerators are tested at their lowest application product temperature (LAPT), which is higher than the test IAT for commercial refrigerators (38 °F). The LAPT can also vary by unit (e.g., 45 °F vs. 55 °F).
[11]88 Fed. Reg. 70234, 70235.
[12]These consisted of all CRE equipment families except pull-down temperature applications and all temperature classes. Analyzed CRE volumes ranged from 3 cu. ft. to 69 cu. ft. and total display areas ranged from 5 sq. ft. to 32 sq. ft. Public meeting transcript, p. 65. www.regulations.gov/document/EERE-2017-BT-STD-0007-0064
[13]TSD, pp. 5-2, 5-3. www.regulations.gov/document/EERE-2017-BT-STD-0007-0051

We encourage DOE to evaluate max-tech levels that are at least as high as the most efficient models available on the market. For several of the equipment classes analyzed, many models available on the market using R-290 refrigerant[14] appear to exceed the max-tech efficiency level. For example, as shown in Figure 1, many ENERGY STAR-rated models for the VCS.SC.L equipment class, which represents 10% of CRE shipments, exceed DOE's max-tech level across a broad range of volumes.[15] Additionally, per DOE's Compliance Certification Database (CCD), there are available models for the SVO.SC.M, VOP.RC.M, and SOC.RC.M that also exceed DOE's max-tech levels. Importantly, for several of these equipment classes (e.g., VCS.SC.L, SVO.SC.M, VOP.RC.M), DOE has proposed to adopt the max-tech level as evaluated in the engineering analysis. This suggests that if DOE were to evaluate higher efficiency levels for these equipment classes, it is plausible that these higher levels would be cost-effective for purchasers.

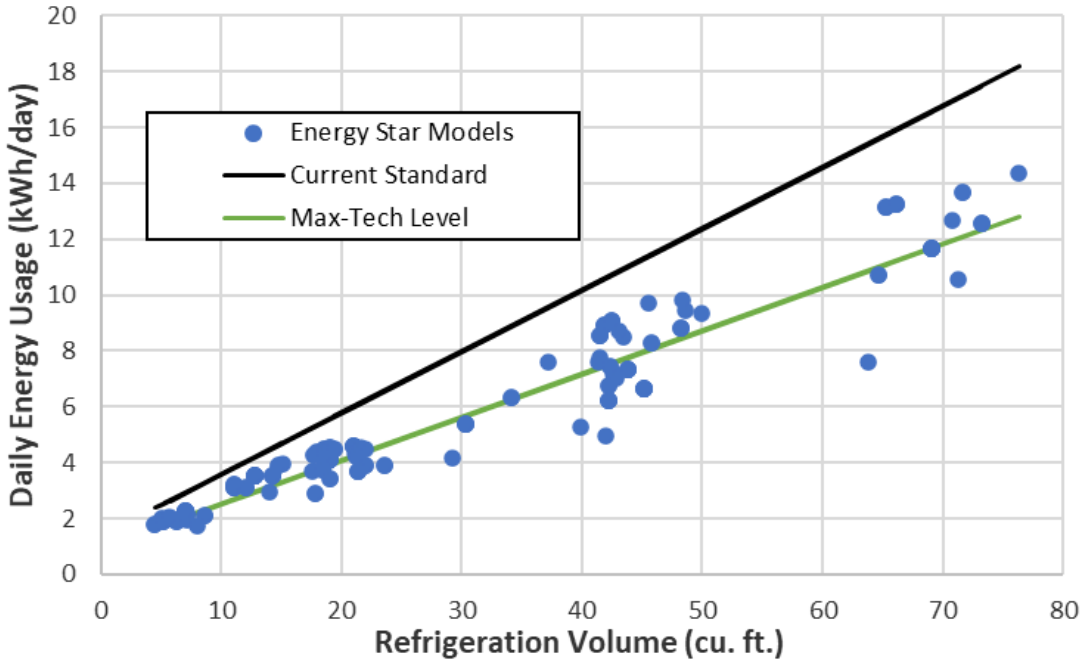

Figure 1: Daily energy usage (kWh/day) versus refrigeration volume (cu. ft.) for ENERGY STAR-rated VCS.SC.L models using R-290 refrigerant. DOE's current standard level (black line) and max-tech level (green line) are also shown.

We encourage DOE to analyze improved single-speed compressor efficiency as a design option. DOE did not consider improved single-speed compressor efficiency in the NOPR, stating that single-speed compressors that comply with the December 2022 EPA NOPR (e.g., R-290 compressors) represent the most efficient available for each equipment class.[16] However, there appears to be a range of R-290 single-speed compressor efficiencies available for a given compressor type, capacity, input voltage, and power supply (i.e., single vs. polyphase).[17] For example, 60 Hz, 115 V single-phase, hermetic reciprocating compressors are available with efficiencies ranging from 8.3 EER to ~12 EER at

[14]DOE expects all self-contained CRE will use R-290 by the compliance date of amended standards.
[15]Accessed on 11/2/2023. data.energystar.gov/Active-Specifications/ENERGY-STAR-Certified-Commercial-Refrigerators-and/wati-2tfp
[16]88 Reg. Reg. 70228.
[17]See: coolselectoronline.danfoss.com

refrigeration capacities of 1.7 kBtu/hr and 3.4 kBtu/hr.[18] While we acknowledge these examples may not be representative of the entire CRE market, they do suggest a range of single-speed efficiencies are available. Thus, we encourage DOE to further consider improved single-speed compressor efficiency.

We encourage DOE to continue analyzing baseline efficiency improvements associated with propane. DOE assumes in the NOPR that all self-contained CRE will use propane (R-290) refrigerant by the compliance date of any amended standards. Importantly, DOE's analysis shows that the use of propane will generally improve efficiency relative to traditional HFC refrigerants. Thus, DOE adjusted the assumed baseline energy usage for each equipment class based on the expected efficiency improvement of a single-speed compressor with propane, which varies widely based on the CRE equipment class.[19] While we agree with DOE's approach for reducing the baseline energy usage for self-contained CRE using propane, we are concerned that DOE could be underestimating the efficiency improvements. For example, at the DOE public meeting, Zero Zone referenced a 40% reduction in energy usage for the VCT.SC.M equipment class when using propane,[20] compared to 18.8% in DOE's analysis. Underestimation of the efficiency gains yielded by switching to propane refrigerant would result in CRE standards that are less stringent (i.e., requiring less additional design options) than anticipated by DOE's engineering analysis. Thus, we encourage DOE to further investigate potential efficiency improvements associated with propane refrigerant.

We encourage DOE to consider amended standards for pull-down (PD) equipment. A PD refrigerator is a type of CRE intended to rapidly cool the temperature of a product (e.g., beverage cans).[21] While there are no PD.SC.M models certified in DOE's CCD, we have previously raised the concern that a unit could be certified as a pull-down unit in order to be subject to a less stringent standard.[22] Current standards for a 49 cu. ft. unit, the VCT.SC.M representative volume in DOE's NOPR analysis, permit about 8% more energy usage (6.20 kWh/day) for a PD.SC.M versus a VCT.SC.M unit of the same volume (5.76 kWh/day). However, under DOE's proposal, the 49 cu. ft. PD.SC.M unit would be permitted to use nearly 80% more energy than a VCT.SC.M of the same volume (3.51 kWh/day). While DOE's recent CRE test procedure Final Rule established verification provisions for pull-down temperature applications,[23] we understand that manufacturers potentially could design equipment such that it meets the "pull-down" definition in order to be subject to less stringent standards. We therefore encourage DOE to consider adopting amended standards for pull-down units that are consistent with the efficiency improvements required for other CRE equipment classes.

Thank you for considering these comments.

Sincerely,

[18]These refrigeration capacities are comparable to representative unit refrigeration loads in DOE's engineering analysis for the VCS.SC.L (1.4 kBtu/hr) and for the horizontal, open, self-contained, medium-temperature (2.6 kBtu/hr) equipment classes. www.regulations.gov/document/EERE-2017-BT-STD-0007-0055
[19]Table IV.6. 88 Fed. Reg. 70228.
[20]Public meeting transcript, pp. 88, 89. www.regulations.gov/document/EERE-2017-BT-STD-0007-0064
[21]88 Fed. Reg. 70211.
[22]p. 2. www.regulations.gov/comment/EERE-2017-BT-STD-0007-0039
[23]88 Fed. Reg. 66152, 66187 (September 26, 2023).

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