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

August 29, 2022

Dr. Stephanie Johnson
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-2J
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 Dr. Johnson:

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 preliminary technical support document (PTSD) for commercial refrigerators, refrigerator-freezers, and freezers, herein referred to as commercial refrigeration equipment (CRE). 87 Fed. Reg. 38296 (June 28, 2022). We appreciate the opportunity to provide input to the Department.

DOE's preliminary analysis shown in the PTSD indicates that amended efficiency standards for CREs could net approximately 4 quads of cost-effective full-fuel-cycle energy savings. However, there are several issues in DOE's analysis that should be addressed during the next phase of the rulemaking. First, we encourage DOE to analyze evaporator technologies for horizontal, closed CREs as well as propane refrigerant for additional equipment classes. Next, we encourage DOE to evaluate maximum technologically feasible (max-tech) levels for CREs that are at least as high as the most efficient models currently on the market. Finally, we encourage DOE to consider evaluating additional efficiency levels (ELs) for certain equipment classes. These issues and others are discussed in more detail below.

We support DOE considering potential standards for additional equipment categories. As part of the CRE test procedure notice of proposed rulemaking (NOPR), DOE proposed test methods for high-temperature refrigerators, buffet and preparation tables, chef bases and griddle stands, and blast chillers and freezers. In the PTSD, DOE analyzed chef bases/griddle stands and high-temperature refrigerators and found cost-effective potential energy savings. Thus, we support DOE setting standards for these additional equipment classes analyzed in the PTSD. Further, while DOE states that they did not have sufficient information to fully analyze buffet/preparation tables and blast chillers/freezers,[1] we encourage DOE to further investigate the energy usage and savings potential of these products. For example, the California Energy Commission (CEC) Modernized Appliance Efficiency Database System (MAEDbS) includes over 100 buffet/preparation tables with a broad range of energy usage.[2]

[1]EERE-2017-BT-STD-0007-0013, pp. 2-19, 2-21. www.regulations.gov/document/EERE-2017-BT-STD-0007-0013
[2]Accessed on August 17, 2022. cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx

We encourage DOE to consider eliminating the equipment class for pull-down CREs. A pull-down temperature CRE is a commercial refrigerator with doors that, when fully loaded with 12-ounce beverage cans at 90 °F, can cool the beverages to 38 °F in 12 hours or less. In the PTSD, DOE requests comment on whether the pull-down equipment class should be maintained.[3] While there are currently no pull-down models certified in DOE's Compliance Certification Database (CCD), we are concerned that models could be certified as a pull-down CRE in the future as a means of being subject to a less stringent standard. Given these considerations, we encourage DOE to consider eliminating the separate equipment class for pull-down CREs.

We encourage DOE to analyze additional equipment classes. In the PTSD, DOE directly analyzed 28 CRE equipment classes. While the equipment classes analyzed by DOE are generally representative of the range of CRE available on the market, there are several additional classes the Department should consider analyzing directly. In particular, DOE did not analyze the VCS.RC.M, VCS.RC.L, HCT.RC.M, or HCT.RC.L classes. We assume this was due to the low estimated volume of shipments for these classes in the analysis for the 2014 Final Rule,[4] which was based on 2005 shipment data from ARI. While we are not aware of newer shipment data for these classes, the number of models for each of these classes in the CCD suggests their market share could be significant. For example, there are nearly 500 VCS.RC.M models certified in the CCD. Additionally, there are more HCT.RC.M models in the CCD than HCT.SC.M, an equipment class that was analyzed by DOE in the PTSD. Taken together, these results suggest that the market share of these four equipment classes may be larger than previously estimated. Thus, we encourage DOE to analyze, at minimum, these additional equipment classes.

We encourage DOE to analyze evaporator technologies for horizontal, closed CREs. For the majority of the CRE equipment classes analyzed in the PTSD, evaporator technologies such as improved fan motors (e.g., brushless DC, synchronous reluctance motors) and enhanced evaporator coils were considered as technology options. For example, these technologies were considered at higher ELs for the vertical, closed and horizontal, open equipment classes. However, DOE excluded these evaporator-related technologies for the horizontal, closed CREs (i.e., HCT.SC.M/L/I, HCS.SC.M/L classes). DOE's analysis found that these evaporator-related technology options result in significant energy savings for other equipment classes analyzed. For example, addition of a brushless DC evaporator fan motor and an enhanced evaporator coil for the VCS.SC.M equipment class result in an estimated 14% and 5% reduction in daily energy usage, respectively.[5] Thus, it is unclear why DOE excluded evaporator technology options for horizontal closed CREs.

We encourage DOE to consider propane refrigerant for additional equipment classes. As discussed in our RFI comments,[6] over 80% of ENERGY STAR-certified CREs use propane (R-290) refrigerant. DOE did include propane compressors as a design option for many of the analyzed equipment classes, but the Department excluded some classes due to propane charge limits.[7] However, we understand that ASHRAE 15 is proposing to increase the charge limits for higher flammability refrigerants consistent with changes implemented by the IEC and Underwriters Laboratory (UL). Further, models are available on the

[3]EERE-2017-BT-STD-0007-0013, p. ES-31. www.regulations.gov/document/EERE-2017-BT-STD-0007-0013
[4]EERE-2010-BT-STD-0003-0102, pp. 3-18, 19. www.regulations.gov/document/EERE-2010-BT-STD-0003-0102
[5]EERE-2017-BT-STD-0007-0013, p. 5-35. www.regulations.gov/document/EERE-2017-BT-STD-0007-0013
[6]EERE-2017-BT-STD-0007-0008, p. 4. www.regulations.gov/comment/EERE-2017-BT-STD-0007-0008
[7]EERE-2017-BT-STD-0007-0013, p. 2-26. www.regulations.gov/document/EERE-2017-BT-STD-0007-0013

market in some of the equipment classes for which DOE excluded propane technology options. These include the VOP.SC.M,[8] SVO.SC.M,[9] and HCT.SC.I[10] categories. Thus, we encourage DOE to consider propane refrigerant for these additional equipment classes in their subsequent analysis.

We encourage DOE to evaluate max-tech levels for CREs that are at least as high as the most efficient models available on the market. For several of the equipment classes analyzed, multiple models at comparable sizes in DOE's compliance certification database (CCD) exceed the max-tech efficiency level in the engineering analysis. For example, as shown in Figure 1 (left), DOE's max-tech level for the representative service over counter, remote condensing, medium-temperature (SOC.RC.M) unit is 14.7 kWh/day. However, there are multiple models in the CCD at a comparable size, ~45-55 ft^2 total display area (TDA), with energy consumption as low as about 10 kWh/day.[11] Figure 1 (right) similarly shows multiple models of vertical, open, self-contained, medium temperature (VOP.SC.M) units that significantly exceed DOE's max-tech level of 23.5 kWh/day at similar TDAs.[12] While a complete list of design options for these models was not readily available, high-efficiency evaporator fans, improved evaporator coils, and LED lighting are listed for certain SOC.RC.M units, while the referenced VOP.SC.M models use R-290 refrigerant. Similar results, wherein models are available beyond DOE's max-tech level, are found for additional equipment classes.[13]

Importantly, DOE's analysis shows that the Department's max-tech level is cost-effective for some of the evaluated classes, including both the SOC.RC.M and VOP.SC.M classes discussed. This suggests the potential for additional cost-effective energy savings opportunities at higher ELs. Thus, we encourage DOE to set max-tech levels that are at least as high as efficiencies currently available on the market.

[8]See for example: www.webstaurantstore.com/documents/specsheets/189bvac28hc_spec_14may.pdf; www.webstaurantstore.com/documents/specsheets/specsheet_for_beverage-air_vmhc-18-1-b_open_air_merchandiser.pdf; www.webstaurantstore.com/documents/specsheets/turbo_air_tom20-60n_specsheet.pdf

[9]See for example: www.webstaurantstore.com/documents/specsheets/avantco_refrigeration_178dlc82hcb_specsheet_32.pdf; www.webstaurantstore.com/documents/specsheets/tcdd-72l-w_r_-n_2.pdf

[10]See for example: www.webstaurantstore.com/documents/specsheets/master-bilt_msf-an_series_flat_lid_display_freezers_specsheet.pdf

[11]See for example: southerncasearts.com/products/case.aspx?series=Service&case=SCHV-DMS4B; www.arnegusa.com/sites/default/files/asset/model/aspen-2-vca/technicaldata/aspen2vca.pdf; www.structuralconcepts.com/products/ghs456rlb-ghs556rlb-ghs656rlb-ghs856rlb-ghs1056rlb-ghs1256rlb

[12]See for example: www.hussmann.com/products/display-cases/insight-merchandisers/id5sm-w; www.webstaurantstore.com/beverage-air-vmhc12-1-w-vuemax-35-1-8-white-air-curtain-merchandiser/185VM12HCWHT.html; www.webstaurantstore.com/avantco-bvac-36hc-36-black-refrigerated-air-curtain-merchandiser/189BVAC36HC.html

[13]For example: SVO.RC/SC.M, VOP.RC/SC.M, VCT.RC/SC.M, HZO.RC/SC.M, HZO.RC/SC.L. Some entries, such as for SVO.RC.M, may be in error (e.g., incorrect TDA, miscategorized as self-contained, etc.).

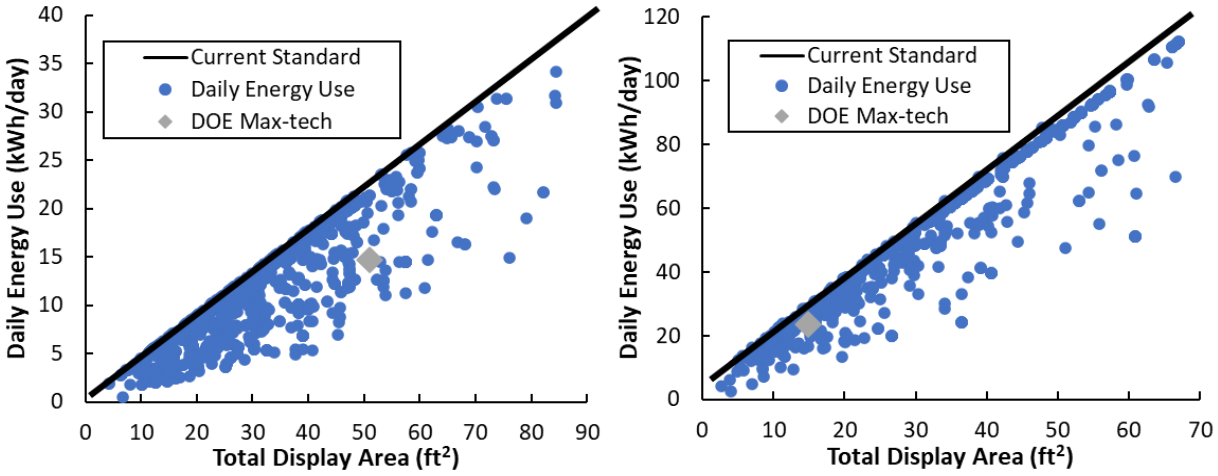

Figure 1: Daily energy usage (kWh/day) of SOC.RC.M (left) and VOP.SC.M (right) CREs as a function of TDA (ft^2) for models in the CCD database[14] (blue circles). DOE's current standard level (black line) and DOE's max-tech level (gray diamond) are also shown.

We encourage DOE to evaluate additional ELs for certain equipment classes. In the engineering analysis, each EL considers a single design option above the baseline level. However, in the downstream energy savings and economic analyses, between 3 and 6 ELs above baseline are analyzed depending on the equipment class; we understand that these downstream ELs are primarily based on a percentage reduction in energy consumption relative to the baseline level. For example, the baseline and max-tech levels (EL6) the VSC.SC.M are the same as in the engineering analysis, while ELs 1, 2, 3, 4, and 5 represent a 10%, 20%, 30%, 40%, and 50% reduction in energy usage relative to the baseline EL0 level.[15]

We are concerned that this approach could fail to capture additional cost-effective savings for certain equipment classes. For example, EL5 for the VSC.SC.M equipment class is cost-effective but EL6 is not. However, there are 5 design options considered in the engineering analysis needed to go from EL5 to EL6. Thus, it is possible that an intermediate level between EL5 and EL6 (a so-called "EL5.5") could be cost-effective. Table 1 lists examples of classes where an intermediate EL may be cost-effective.

Table 1: Potential additional ELs for select CRE equipment classes. For example, "EL4.5" specifies a level with energy usage (kWh/day) between current EL4 and EL5.

Equipment Class	Additional EL (kWh/day)
VSC.SC.M	EL "5.5"
VCT.RC.L	EL "3.5"
VCT.SC.L	EL "4.5"
VCT.SC.I	EL "4.5"
HZO.RC.L	EL "2.5"
HCT.SC.M	EL "4.5"
HCS.SC.M	EL "2.5"

[14]Units included were not subject to test waivers and were tested at the standard 38°F storage temperature.
[15]Per the Energy Usage sheet in the LCC analysis spreadsheet. EERE-2017-BT-STD-0007-0015, www.regulations.gov/document/EERE-2017-BT-STD-0007-0015

We encourage DOE to incorporate price trends for additional design options. In the PTSD, DOE includes price trends for lighting design options, but did not include estimates for other design options that may experience price declines in the future.[16] As discussed in our RFI comments,[17] we would expect that the prices of certain design options (e.g., variable-speed compressors and high-efficiency fan motors) will decline faster than the total price of CRE. As part of the analysis for the room air conditioners NOPR, DOE applied a separate price learning trend to the electronic controls used with variable-speed compressors.[18] A similar approach was also used for variable-speed controls in the recent preliminary standards analysis for dehumidifiers.[19] Thus, we continue to encourage DOE to incorporate price trends for additional CRE design options.

Thank you for considering these comments.

Sincerely,

Jeremy Dunklin, PhD
Technical Advocacy Associate
Appliance Standards Awareness Project

Amber Wood
Director, Buildings Program
American Council for an Energy-Efficient Economy

Joe Vukovich
Energy Efficiency Advocate
Natural Resources Defense Council

[16]EERE-2017-BT-STD-0007-0013, p. 2-44. www.regulations.gov/document/EERE-2017-BT-STD-0007-0013
[17]EERE-2017-BT-STD-0007-0008, pp. 4-5. www.regulations.gov/comment/EERE-2017-BT-STD-0007-0008
[18]EERE-2014-BT-STD-0059-0030, pp. 8-10, 10-21. www.regulations.gov/document/EERE-2014-BT-STD-0059-0030
[19]EERE-2019-BT-STD-0043-0015. p. 2-23. www.regulations.gov/document/EERE-2019-BT-STD-0043-0015