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

August 29, 2022

Dr. Stephanie Johnson
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-0009: Energy Conservation Standards for Walk-In Coolers and Freezers

Dear Dr. Johnson:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), Natural Resources Defense Council (NRDC), and Northwest Energy Efficiency Alliance (NEEA) on the preliminary technical support document (PTSD) for walk-in coolers and freezers. 87 Fed. Reg. 39008 (June 30, 2022). We appreciate the opportunity to provide input to the Department.

DOE's preliminary analysis presented in the PTSD suggests that amended efficiency standards for walk-ins could net 2.8 quads of cost-effective full-fuel-cycle energy savings. These energy and cost savings are primarily attributable to efficiency improvements for non-display doors, dedicated condensing units (DCUs), and unit coolers (UCs). However, there are several important issues that should be addressed. First, we encourage DOE to clarify why certain technologies do not appear to result in meaningful energy savings. Second, we urge DOE to consider walk-in refrigeration system standards that are a function of capacity. Finally, we urge DOE to clarify the discrepancy between the current standard levels and the baseline Annual Walk-In Efficiency Factor (AWEF) ratings in the engineering analysis. These considerations and others are described in more detail below.

We support DOE's proposed changes regarding non-display door equipment classes. Currently, non-display doors are divided into either passage or freight doors. Passage doors are smaller doors meant to permit access for people or smaller items, while freight doors are larger doors meant to allow access for larger items such as forklifts. However, DOE discusses in the PTSD that manufacturers may not be interpreting the definitions of passage and freight doors consistently.[1] Thus, DOE evaluated different equipment classes for display doors wherein they were instead differentiated by their opening mechanism: swinging (manual) vs. sliding (motorized). Typically, swinging or manual doors would be analogous to smaller passage doors while sliding or motorized doors would be analogous to larger

[1]EERE-2017-BT-STD-0009-0024, p. 3-17. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024

freight doors. We support these designations as a more clear and appropriate means of distinguishing different types of non-display doors.

We encourage DOE to evaluate efficiency levels (ELs) that implement multiple-capacity and/or variable-speed compressors as a design option. As discussed in the PTSD, the April 2022 test procedure NOPR proposed provisions that would allow for separate ratings of stand-alone, variable-capacity condensing units.[2] The proposed test procedure would thus allow variable-speed and multiple-capacity compressors to be analyzed as a design option. For example, in contrast to single-speed compressors that cycle on and off in response to a load, variable-speed units can reduce speed and output (i.e., capacity) to match the load; this can result in significant energy savings versus conventional single-speed compressors**.** However, DOE did not evaluate multiple-capacity or variable-speed compressors in the preliminary analysis. We encourage DOE to evaluate multiple-capacity and variable-speed compressors as a design option for the next stage of the rulemaking.

We encourage DOE to clarify why certain technologies do not appear to result in meaningful energy savings. For the smallest representative unit (RU) for medium temperature outdoor DCUs, 9 kBtu/hr, DOE's analysis suggests that the design options above the baseline level (a variable speed condensing fan, ambient subcooling, and self-regulated crankcase heater control) reduce energy usage by less than 0.15%, or 0.01 AWEF. Additionally, for the low-temperature UC RUs, addition of a variable speed evaporator fan and improved fan blades reduces energy usage by only about 2%, or 0.1 AWEF. Overall, we would expect that these design options would result in real-world energy savings exceeding those estimated in the analysis.

We urge DOE to consider standards for walk-in refrigeration equipment as a function of capacity. The current standards for walk-in refrigeration systems are a function of capacity only for low-temperature DCUs and UCs.[3] However, DOE's preliminary analysis suggests that standard levels should increase with refrigeration capacity for all equipment classes. For example, the medium-temperature outdoor DCU results show that larger capacity units are able to achieve higher maximum-technologically feasible (max-tech) levels and reach the baseline level with fewer design options. As summarized in Table 1, the max-tech level for the largest (54 kBtu/hr) RU is 8.95 AWEF versus 6.86 AWEF for the smallest (9 kBtu/hr) RU. Furthermore, five design options are needed to reach the baseline level for the smaller RU versus none for the larger RU.[4] Similar results are observed for UCs, as shown in Table 1. The current standard for low-temperature UCs is a function of capacity below 15.5 kBtu/hr (i.e., smaller units have a lower AWEF requirement); however, DOE's engineering analysis shows that larger units reach higher max-tech AWEF levels and reach the baseline level with fewer design options. For example, the baseline for the small 9 kBtu/hr low-temperature UC RU is already at max-tech, requiring two additional design options (variable speed evaporator fans and improved fan blades) that are not needed at the baseline EL for the larger 25 kBtu/hr RU. While this discussion has focused on two refrigeration equipment classes with large potential energy savings, similar trends are seen in other DCUs, UCs, and single-packaged unit RUs analyzed by DOE.

[2] 87 Fed. Reg. 23920, 23963 (April 21, 2022).

[3] 10 CFR § 431.306, www.law.cornell.edu/cfr/text/10/431.306

[4] The max-tech level for the 9 kBtu/hr RU is also only 0.01 AWEF, or less than 0.15%, greater than the baseline level.

Table 1: Max-tech AWEF, baseline AWEF, and number of design options needed to reach the baseline as a function of capacity (kBtu/hr) for medium-temperature outdoor DCUs and low-temperature UCs from Appendix 5A.[5]

Capacity (kBtu/hr)	Max-tech AWEF	Baseline AWEF	Number of Baseline Design Options
Medium-temperature outdoor DCUs			
9	6.86	6.85	5
25	8.11	7.25	1
54	8.95	7.52	0
Low-temperature UCs			
9	4.01	4.01	3
25	4.28	4.18	1

Additionally, the life-cycle cost (LCC) analysis further highlights the need for ELs as a function of capacity for walk-in refrigeration systems. For example, Table 8.6.8 of the PTSD shows that the average LCC savings for affected consumers range between $105 and $206 for ELs 2 through 8 for medium-temperature outdoor DCUs; the percent of consumers with net cost ranges from 68-72%. However, examination of the savings for each RU, as highlighted in Appendix 8C of the PTSD, shows that most of the cost-effective energy savings opportunities exist for the two larger RUs while most consumers with net cost are purchasers of the smaller RU. For example, the percent of consumers with net cost at the highest evaluated EL for the 9 kBtu/hr is 100% versus only 2% for the 54 kBtu/hr RU.[6] Standard levels as a function of capacity would help address this disparity.

Finally, Figure 1 illustrates examples of how both a linear and logarithmic relationship could be used in setting potential ELs as a function of capacity. Figure 1 plots all models of medium-temperature outdoor DCUs (blue dots) in the Compliance Certification Database (CCD),[7] the market max-tech level per the CCD database (gray triangles) as well as DOE's max-tech (orange diamonds) and EL1 (yellow squares) levels. Figure 1 (left) shows how a logarithmic function could be used to set potential ELs as a function of capacity. Alternatively, Figure 1 (right) illustrates how ELs could be evaluated that are linear at lower capacities and constant above a certain capacity (i.e., analogous to the current standards for low-temperature DCUs and UCs). Either of these options would reflect our understanding that large-capacity refrigeration units are inherently more efficient. The plots in Figure 1 are meant as illustrative examples, as we understand that the DOE analysis and market AWEF values may not be directly comparable due to test procedure changes.

[5] EERE-2017-BT-STD-0009-0024, pp. 5A-31, 49. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024
[6] EERE-2017-BT-STD-0009-0024, pp. 8C-8-10. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024
[7] Accessed on July 18, 2022. www.regulations.doe.gov/certification-data/CCMS-4-Walk-In_Coolers_and_Freezers_-_Refrigeration_Systems.html#q=Product_Group_s%3A%22Walk-In%20Coolers%20and%20Freezers%20-%20Refrigeration%20Systems%22

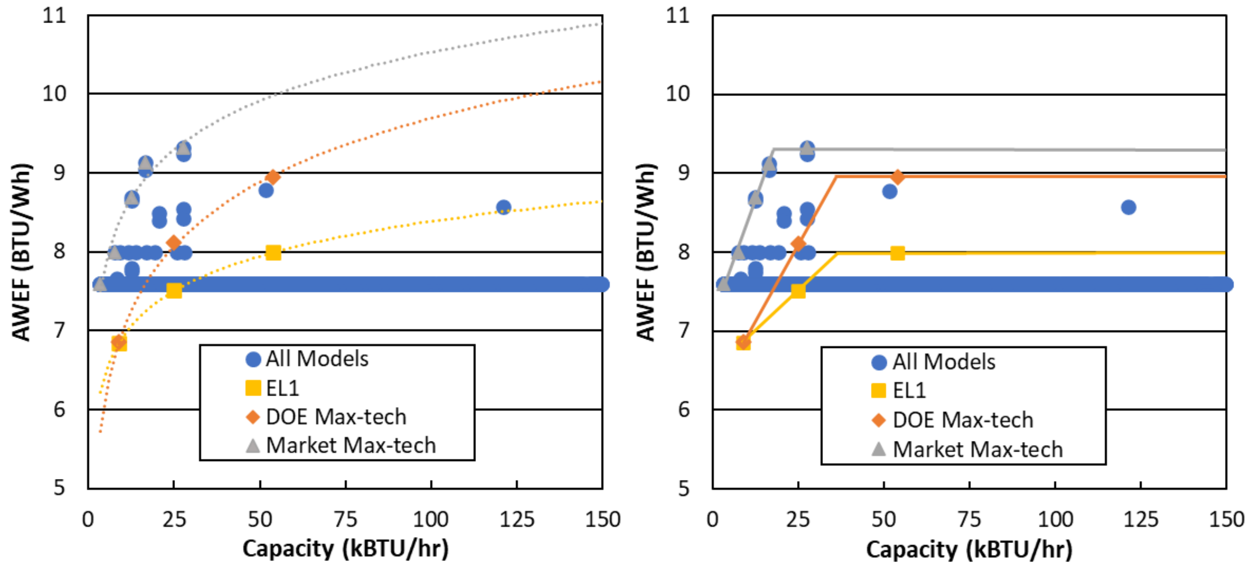

Figure 1: Medium-temperature outdoor DCU AWEF ratings as a function of capacity for a) models in the CCD database (blue circles), b) EL1 from DOE's engineering analysis (yellow squares), c) the max-tech EL from DOE's analysis (orange diamonds), and d) the market max-tech levels from the CCD (gray triangles). The left and right graphs fit each data set using logarithmic (left) and linear (right) functions.

DOE should also consider analyzing additional RUs. The PTSD states that DOE focused its analysis on RUs within a range of capacities where the most energy would be used, but that the Department may analyze more RUs for the NOPR.[8] More RUs across a broader range of capacities would assist in the development of refrigeration system ELs that are a function of capacity.

We urge DOE to clarify the discrepancy between the baseline AWEF ratings in the engineering analysis and the current standards levels. DOE states in the PTSD that a typical baseline unit in the engineering analysis is a unit that just meets the current efficiency standard.[9] However, many of DOE's estimated baseline AWEFs for walk-in refrigeration equipment RUs fall below the current standard.[10] For example, the baseline EL for the 9 kBtu/hr medium-temperature outdoor DCU is 6.85 AWEF, while the current standard is 7.60 AWEF. Chapter 5 of the PTSD states that the engineering analysis is based on the proposed changes discussed in the April 2022 test procedure NOPR.[11] These proposed changes, particularly those involving off-cycle power measurements (e.g., including crankcase heater power), are expected to impact AWEF values.[12] Thus, it is plausible that the changes to the test procedure are partially responsible for baseline AWEF ratings that are below the current standard.

For other RUs, the baseline EL is actually higher than the current standard.[13] For example, the baseline EL for the 54 kBtu/hr low-temperature outdoor DCU is 3.98 AWEF compared to the current standard

[8]EERE-2017-BT-STD-0009-0024, p. 2-29. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024
[9]EERE-2017-BT-STD-0009-0024, p. ES-11. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024
[10]For example: all DC.M.O, DC.M.I.009, UC.L.009.
[11]87 Fed. Reg. 23920 (April 21, 2022).
[12]EERE-2017-BT-STD-0009-0024, p. 3-9. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024
[13]For example: UC.L.025, DC.L.O.009, DC.L.O.025, DC.L.O.054, DC.M.I.025, DC.M.I.054, all UC.M, and all DC.L.I.

level of 3.15 AWEF. We are concerned that baseline ELs above the current standard could result in underestimated potential energy savings at higher ELs. More generally, it is unclear why some DCUs (e.g., medium-temperature outdoor) would have baseline ELs below the current standard level while others (e.g., low-temperature indoor) would have baseline ELs above the current standard. Thus, DOE should clarify the discrepancy between the baseline AWEF ratings in the engineering analysis and the current standards levels.

We encourage DOE to evaluate max-tech levels that are at least as high as the highest efficiencies available on the market. For various refrigeration equipment classes, including medium-temperature outdoor DCUs shown in Figure 1, there are models in the CCD with AWEF ratings exceeding DOE's max-tech level. While we understand that current ratings cannot be directly compared to the max-tech levels due to the proposed test procedure changes, these results suggest there could be models on the market that exceed DOE's max-tech level. We also note that there were even more efficient models in the CCD last fall, as highlighted in our previous request for information comments.[14] Thus, we encourage DOE to ensure that the max-tech ELs are at least equivalent to the most efficient products on the market.

We encourage DOE to attempt to ensure that the standard levels are equally stringent for single-packaged units and DCUs. DOE evaluated separate walk-in equipment classes for single-packaged units in the PTSD. DOE noted that differences, such as additional thermal losses and different evaporator airflow and fan power, can affect single-packaged unit energy consumption in comparison to split systems; these differences were incorporated into the engineering analysis for evaluation of single-packaged unit ELs.[15] Generally, DOE's engineering analysis determined lower baseline AWEFs for low- and medium-temperature single-packaged units relative to comparable DCUs. For example, the baseline AWEF for the 9 kBtu/hr medium-temperature outdoor single-packaged unit RU is 5.31 vs. 6.85 AWEF for the medium-temperature outdoor DCU. However, in some instances the max-tech AWEF for the single-packaged unit is higher than that of the comparable DCU. For example, the max-tech level for that same 9 kBtu/hr medium-temperature outdoor single-packaged unit is 7.30 AWEF compared to 6.86 for the comparable DCU. We acknowledge that single-packaged units may rate differently than a comparable DCU or split system of a similar capacity. However, we encourage DOE to ensure that standards for single-packaged units are equally stringent (e.g., incorporate similar assumed design options) in comparison to DCUs to prevent potential market distortions wherein the market shifts towards equipment subject to less stringent standards permitting higher energy usage.

We encourage DOE to consider evaluating potential standards for refrigerated shipping containers. A walk-in is defined as "an enclosed storage space refrigerated to temperatures, respectively, above, and at or below 32 °F, that can be walked into, and has a total chilled storage area of less than 3,000 square feet." As highlighted in our prior comments to the test procedure NOPR,[16] refrigerated shipping containers, known as "reefers", appear to fall within the scope of this definition, and a recent EU study

[14] EERE-2017-BT-STD-0009-0018, p. 2. www.regulations.gov/comment/EERE-2017-BT-STD-0009-0018
[15] EERE-2017-BT-STD-0009-0024, p. 2-11. www.regulations.gov/document/EERE-2017-BT-STD-0009-0024
[16] EERE-2017-BT-TP-0010-0037, pp. 4, 5. www.regulations.gov/comment/EERE-2017-BT-TP-0010-0037

suggested the potential for significant energy savings.[17] We therefore encourage DOE to consider evaluating potential standards for reefers.

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

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

[17]Table 2-18, p. 109. C.A. Lundsgaard et al. Ecodesign Preparatory study on Refrigerated Containers, 2020. circabc.europa.eu/d/a/workspace/SpacesStore/8d75ce4c-4ff9-4a36-b059-17826a763d61/Refrigerated%20Containers%20Prep%20Study_Task%201%20-%202%20and%20alternative%20policy%20options_report%20_2020-06_v1.1%20FINAL.pdf