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Jeremy Dommu
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585- 0121

Submitted via: https://www.regulations.gov/document/EERE-2017-BT-STD-0007-0056

Re: AHRI Comments in Response to Energy Conservation Standards for Commercial Refrigerators, Freezers, and Refrigerator-Freezers, Notice of Proposed Rulemaking [EERE-2017-BT-STD-0007]

Dear Mr. Dommu:

These comments are submitted by Hussmann Corporation in response to the U.S. Department of Energy's (DOE) notice of proposed rule for Energy Conservation Standards for Commercial Refrigerators, Freezers, and Refrigerator-Freezers. The docket number is EERE-2017-BT-STD-0007. See 88 Fed. Reg. 70196 (October 10, 2023).

Hussmann is a leader in providing display merchandisers, refrigeration systems, installation, and services to food retailers around the world.

Hussmann would first like to thank the DOE staff for the time and effort that went into this standard that aims to reduce overall energy consumption. Hussmann supports many of the changes made in this NOPR and provides comments on areas of concern which are outlined in this letter. However, before providing responses to the DOE's requests for comment, Hussmann would first request the DOE to pause any new rulemakings due to our already burdened resources and requirements that our industry meet new regulations taking effect in the next 1-2 years which include:

1) The Environmental Protection Agency (EPA) has proposed implementing the AIM Act, shifting the industry's focus from product development to meeting AIM Act requirements. Hussmann is actively working on adapting our manufacturing processes, retooling equipment, and investing in research and development to comply for CRE and also for walk-in cooler regulations. The industry-wide move towards AIM compliance has resulted in challenges in the supply chain, particularly with A2L components lacking Underwriters Laboratory (UL) certification and availability. R-290 is not suitable for all case types and those cases will require the use of A2L refrigerants. A2L components are awaiting third-party Regulatory Compliance because they are so new to the industry and will be required to be purchased, designed, installed in our models and then go through performance validation as well as safety validation.

   Due to the shift in the industry, Hussmann is dedicating resources to redesigning and modifying existing products, aiming not only to meet current industry standards but also to uphold performance levels crucial for food safety and customer expectations. Beyond developing models to work with new refrigerants and components, each model must undergo testing to comply with UL and National Sanitation Foundation (NSF) standards. Concerns arise about potential bottlenecks at third-party certification labs due to the industry-wide shift toward new refrigerant technology. This, in-turn reduces the availability of lab space that is needed to test any new DOE regulations by the Nationally Recognized Test Laboratories (NRTL's), thereby causing certification delays not only for our own products but also for the components that must be tested by our suppliers. Additionally, Hussmann labs and personnel are at capacity in testing to the same requirements.

2) UL/CSA 60335-1 and 60335-2-89 are set to replace the longstanding UL 471 and CSA C22.2 #120 standards which have been in effect for many years. Hussmann is currently going through the learning curve associated with these new standards and incorporating the required changes into each model. This process is consuming critical resources, lab space, and time.

   The shift to the 60335 standards has redirected resources not only towards design modifications but also the addition of new components essential in complying with the standard. This introduces complexity and increased costs. The new standard has also altered UL listing requirements, potentially extending the time to gain approval to use the UL mark by up to 14 weeks. The testing requirement for each model is crucial for assessing resource allocation and the limited availability of lab space needed to meet any new DOE requirements.

   Manufacturers, including Hussmann, may face a substantial commitment of 1-3 years of lab time to fulfill the new UL standard after having to validate the performance using new A3/A2L components in accordance with the EPA AIM Act. This underlines the significant time and resource investment required for compliance in the evolving regulatory landscape.

3) SNAP Rule 26 is still in the proposal stage. Because it has not been finalized, Hussmann has been unable to finalize and release equipment that uses higher charge R-290 refrigerant or new A2L refrigerants. Consequently, a complete understanding of how these refrigerants impact energy consumption is not yet known.

   In the transition of display case models to A3 and A2L refrigerants, the effect on energy consumption will be better understood after design, testing, and manufacturing. The new baseline for energy consumption is unknown and will only be found after the transition of models to use A3 refrigerants and larger cases requiring A2L refrigerants. This information is critical in order to provide a thorough response to DOE's requests.

   Hussmann urges DOE to refrain from new rulemakings until SNAP 26 is finalized and cases have been redesigned with new refrigeration components which will then be followed by performance validation testing. This approach is essential for providing accurate and informed responses that will align with the current regulatory landscape.

4) Further complicating the picture are state and local building codes, many of which prohibit the use of A2Ls and therefore must be updated outside of the normal cycle of building code revisions, which otherwise commonly take two to five years to complete. At present, only eight states have updated their codes and more than twenty (as well as all U.S. territories) have yet to pass legislation authorizing the use of A2L refrigerants for commercial refrigeration. AHRI, of which Hussmann is a member, is leading the effort on codes and remains dedicated to a 50 state plus territories effort to clear the way for the use of A2Ls in building codes by the middle of 2024. However, significant uncertainty for HVACR manufacturers will persist until such changes are finalized.

Hussmann does not have the luxury of considering UL, NSF, FDA, EPA and DOE rulemakings independently of each other. Because of this, Hussmann is actively addressing challenges posed by the EPA's AIM Act while simultaneously striving to meet the new requirements from UL 60335-2-89. Hussmann is investing in redesigning products to meet the new regulatory requirements but faces supply chain issues related to A2L components, standard supply chain issues prevalent since COVID, time restraints, resource restraints, and lab space/capacity limitations. Uncertainties also surround the impact of A3 and A2L refrigerants on energy consumption due to the still-proposed SNAP Rule 26.

Hussmann urges DOE to delay new rulemakings until SNAP 26 is finalized, building codes are updated, and a new baseline understanding of energy usage is determined as the industry works to align itself with the current regulatory landscape.

Hussmann Corporation is a member of AHRI and NAFEM. We support their comments and additionally provide further information regarding DOE's NOPR below.

Hussmann Response to DOE Request for Comment:

1. **DOE requests comments on its proposal to require that the proposed standards, if adopted, would apply to all CRE listed in table I.1 manufactured in, or imported into, the United States on or after the date that is 3 years after the date on which the final new and amended standards are published. More generally, DOE requests comment on whether it would be beneficial to CRE manufacturers to align the compliance date of any DOE amended or established standards as closely as possible with the refrigerant prohibition dates proposed by the December 2022 EPA NOPR.**

   Hussmann requests a delay in new rulemakings until SNAP 26 is finalized, building codes are updated, and a new baseline understanding of energy usage is determined from new product resulting from the AIM Act.

2. **DOE requests comment on the impacts to CRE manufacturers and consumers from the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA).**

   Hussmann has no comment.

3. **DOE requests comment on the proposed definitions for "cold-wall evaporator," "forced-air evaporator," "pass-through doors," "roll-in door," "roll-through doors," "sliding door," and "rating temperature."**

   - Hussmann has no comments to the proposed definitions.

4. **DOE requests comment on blast chiller or freezer design options, design specifications, and energy consumption data tested per the DOE test procedure located in appendix D of 10 CFR 431.64.**

   Hussmann has no comments as it does not manufacture this type of equipment.

5. **DOE requests comment on refrigerated buffet/preparation table design options, design specifications, and energy consumption data tested per the DOE test procedure located in appendix C of 10 CFR 431.64.**

   The (DOE) has provided insufficient time for manufacturers to conduct testing, analyze the results, and submit test data between the introduction of the new test procedure and the comment deadline. Hussmann is not in agreement that this is a valid test procedure.

   Hussmann agrees that refrigerated buffet/preparation table design options would not be included at this time. Additionally, Hussmann is concerned that the current timeline may hinder manufacturers' ability to adequately test and gather the required test data, emphasizing the importance of allowing a more reasonable timeframe for compliance.

6. **DOE requests comment on publicly available market data on CRE manufacturers or identification of any CRE manufacturers with large market shares not identified in Chapter 3 of the TSD NOPR.**

   No comment.

7. **DOE requests comment on the decision to screen out increased insulation thickness, vacuum-insulated panels, linear compressors, and air curtain design as design options for improving the energy efficiency of CRE.**

   Hussmann agrees with DOE's decision to screen out increased insulation thickness, vacuum-insulated panels, linear compressors, and air curtain design as design options.

   However, in the Engineering Spreadsheet and Appendix 5A of the Technical Support Document (TSD), the design specifications for the various equipment classes show insulation thicknesses of 2.0 in. or 2.5 in. This is not representative of the CRE products on the market today. Standard insulation thickness for medium-temp commercial refrigeration equipment is 1.5 in. and for low-temp equipment is 2.0 in. This should be considered when determining the energy limits.

   DOE's baseline design options listed in the Engineering Spreadsheet and Appendix 5A of the TSD show shaded pole or permanent split capacitor (PSC) evaporator fan motors for the following primary equipment classes in which Hussmann produces units. Hussmann has used, as standard, electronically commutated evaporator fan motors in all of its CRE units sold since the 2017 standards went into effect. Hussmann believes that its competitors do the same and the DOE's baseline design option assumptions should reflect this.
   - SVO.SC.M
   - HZO.SC.M
   - HZO.SC.L
   - VCT.SC.L
   - SOC.SC.M

8. **DOE requests comment on its proposal to use baseline levels for CRE equipment based upon the anticipated design changes that will be made by manufacturers in response to the December 2022 EPA NOPR.**

   Hussmann does not agree with the DOE estimated baselines. In the Engineering Spreadsheet and Appendix 5A of the TSD, the design specifications for the various equipment classes show insulation thicknesses of 2.0 in. or 2.5 in. This is not representative of the CRE products on the market today. Standard insulation thickness for medium-temp commercial refrigeration equipment is 1.5 in. and for low-temp equipment is 2.0 in. This should be considered when determining the energy limits.

   DOE's baseline design options listed in the Engineering Spreadsheet and Appendix 5A of the TSD show shaded pole or permanent split capacitor (PSC) evaporator fan motors for the following primary equipment classes in which Hussmann produces units. Hussmann has used, as standard, electronically commutated evaporator fan motors in all of its CRE units sold since the 2017 standards went into effect. Hussmann believes that its competitors do the same and the DOE's baseline design option assumptions should reflect this.
   - SVO.SC.M
   - HZO.SC.M

- HZO.SC.L
- VCT.SC.L
- SOC.SC.M

DOE's assumption of the R-value per inch of the equipment insulation is unrealistic. With the most advanced HFO blowing agents available today, at foam densities required to provide the compressive strength necessary for the robustness of the equipment, R-values per inch of the foam itself for CRE are much closer to 6.5 per inch than they are to the 8.0 shown in the DOE's Engineering Spreadsheet. Hussmann agrees with DOE's determination in the TSD to use an adjusted R-value per inch of 4.0 for the finished foam panels to account for edge effects and gasket heat losses.

DOE is applying a design option of R-290 variable speed compressor to classes like SVO.SC.M. For Hussmann, some of the models in this class are very large pieces of equipment. One example is a 12-feet long by 6-feet wide shop around island case with a refrigeration load of approximately 24,000 Btu/hr. Even with the larger 494g charge size allowed by UL 60335-2-89 ed. 2, these larger charges of R-290 are not yet SNAP approved. Additionally, R-290 is not a practical refrigerant to use because multiple separate condensing units/refrigerant circuits would be needed. This is prohibited by a lack of physical space and by product cost constraints. These models will have to be transitioned to a new A2L refrigerant by January 1, 2025 to comply with EPA's Technology Transition rule under the AIM Act. Therefore, the assumed R-290 energy efficiency improvement in DOE's analysis does not apply.

Hussmann's experience with microchannel condensers is that they do not provide any additional energy efficiency. While microchannel condensers have a smaller internal volume than a comparable fin and tube coil, temperature differences (TDs) and therefore condensing temperatures are very similar for both coil technologies due to the inherent space constraints of the equipment. Thus, compressor/system efficiency is unaffected.

DOE is applying the design option of lighting controls to HZO equipment that typically do not use any lighting.

For the equipment classes VOP.RC.M and SVO.RC.M, the design options applied in the DOE's analysis are night curtains and lighting controls. DOE's assumption that these options will lead to new energy savings is flawed. These equipment options have been available to order on Hussmann's merchandisers for nearly 20 years in the case of night curtains and for 15 years for lighting controls. Simply put, if retailers are not ordering these options now, they do not want them and will not use them in their stores, even if they are automatically applied to the merchandisers they purchase.

- Regarding lighting controls, if a store is closed during nighttime hours, it is a widely used practice by retailers to separately wire all the display case lighting to dedicated electrical circuits. These circuits are then turned off centrally and automatically on a fixed schedule. This is a much more cost-effective way of saving merchandiser lighting energy when the store is closed than using individual lighting controllers on each display case.
- Retailers have also provided feedback to Hussmann over the years that they do not want the case lighting to be dimmed or turned off by an occupancy sensor during store open hours because shoppers often assume that a merchandiser is not working properly if they see its lights off from a distance. As a result, they will not approach the case and purchase food products from it. This is by far the primary reason that very few of

Hussmann's customers purchase the occupancy sensor option when they order equipment.

9. **DOE further requests comment on its estimates of energy-use reduction associated with the design changes made by manufacturers in response to the December 2022 EPA NOPR.**

   The baseline only accounts for one refrigerant and we need to determine the baseline for other refrigerants. Not all self-contained product types are switched over to R-290 yet, especially large CRE products that require larger charges of R-290 or an A2L refrigerant. Regarding the self-contained equipment that will transition to an A2L refrigerant, Hussmann anticipates that there is no appreciable reduction in energy consumption based on preliminary lab testing. Hussmann urges the DOE to establish baselines with what is currently available in the market.

   The US EPA's effective dates for self-contained equipment classes is January 1, 2025. However, the same equipment classes for remote condensing products is January 1, 2026/27 based on the type of connected refrigeration system. For these remote condensing classes, it is too soon to comment on energy use reduction for equipment that will be transition to A2L refrigerants not even yet allowed by EPA SNAP and many building codes around the nation.

10. **DOE requests comment on its proposal to apply an energy use multiplier to certain equipment classes that contain CRE with unique utility and energy use characteristics. DOE additionally requests comment on the proposed multiplier values and equipment classes for which these multipliers would be applied.**

    Hussmann agrees in principle, but DOE has not allowed enough time for manufacturers to test and validate. This would require a year to perform testing.

11. **DOE seeks comment on the method for estimating manufacturing production costs.**

    Hussmann seeks more clarity on DOE's request for comment on estimating production costs. DOE needs to clarify if they are referring to 2014 or 2023 production costs. The TSD discusses 2014, but since 2014 refrigeration component and material costs have increased substantially.

12. **DOE requests comment on the CRE distribution channels and overall on the markups analysis.**

    Hussmann has no comment.

13. **DOE requests comment on its approach for the energy use analysis.**

    Hussmann does not agree with setting figures that are unattainable. See also responses in items #8 and #9 where DOE is in error with the assumptions of current available case options.

    DOE's proposed energy limits for Hussmann cases when calculated using TDA and Volume are up to 70% less than 2017 values, which is unattainable with current technology. Many more Hussmann models would be required to meet 20%-40% drops in energy limits while already using ECM motors, LED lights, and optimized air curtains/doors and insulation—see detailed examples below. Due to these limits being unattainable, Hussmann would need to weigh the benefit between feasibility, increased cost, development time and customer interest with the

decision to discontinue certain product lines entirely. A new set of baselines should be established after the transition to low GWP refrigerants is completed and data is collected with the models that are actually available in the industry.

Example 1: VRM3B in the VCT.SC.M equipment class

- Volume: 66.10 ft^3
- Current TDEC: 6.33 kWh/day
- 2017 Standard Level: 0.1 * V + 0.86 = 7.47 kWh/day
- Energy Star 5.0 (released Nov. 2022) Required Level: 0.105 * V - 1.111 = 5.83 kWh/day
- Proposed (~2027) Standard Level: 0.5 * V + 0.86 = 4.17 kWh/day, a reduction of 44% from the 2017 level
- Design options currently used:
    - Electronically commutated fan motors for both evaporator and condenser
    - LED lighting
    - R-290 refrigerant with single-speed compressor
    - 2" thick foam insulation (same cabinet used as low-temp model)
    - Condensate evaporator pan using compressor discharge line for heat (no electric heater)
    - High-efficiency, triple pane, no heat gasketed door
    - Non-metallic door frame with 13 W of anti-sweat heat per door (39 W total)
    - Evaporator and condenser coils are 3/8" copper tube with Al fins
- The VRM3B's current TDEC is approximately 52 percent higher than the proposed 2027 standard level of 4.17 kWh/day.
    - The only truly viable design option available to Hussmann to reduce the energy consumption of this model is a variable speed R-290 compressor. It may be possible to reduce the energy consumption by 15-25 percent compared to the single speed compressor model, but to achieve a reduction of 52 percent or greater will not be possible.

Example 2: RMN5W in the VCT.SC.M equipment class

- Water-cooled, R-290 micro-distributed, 5-door display case
- Volume: 155.20 ft^3
- Current TDEC: 13.56 kWh/day
- 2017 Standard Level: 0.1 * V + 0.86 = 16.38 kWh/day
- Proposed (~2027) Standard Level: 0.5 * V + 0.86 = 8.62 kWh/day, a reduction of 47% from the 2017 level
- Design options currently used:
    - Electronically commutated fan motors for evaporator (no condenser fan)
    - LED lighting (93 W total)
    - R-290 refrigerant with highest efficiency single-speed compressors available
    - 2" thick foam insulation (same cabinet used as low-temp model)
    - No condensate evaporator pan—case piped to floor drain
    - High-efficiency, triple pane, no heat gasketed door
    - Non-metallic door frame with 23.6 W of anti-sweat heat per door (118 W total)
    - Evaporator coil is 7/16" Al tube with Al fins
    - Condenser is high-efficiency microplate heat exchanger
- The RMN5W's current TDEC is approximately 36 percent higher than the proposed 2027 standard level of 8.62 kWh/day.

14. DOE requests comment on its price learning assumptions and methodology.

No Comment.

15. DOE requests comment and data to inform how any of the analyzed design options would require additional installation time, training, or other related skills compared to the baseline equipment.

The efficiency of units is influenced by various technologies that impact manufacturing time, installation time, as well as maintenance and repair costs. Achieving high efficiency ratings may require the use of EEVs, case controllers, lighting controllers, and anti-sweat energy controllers. The inclusion of these extra components introduces the need for ongoing maintenance and servicing throughout the product's lifespan. The added complexity is not desirable for the end user and provides little over-all benefit while requiring more robust maintenance programs.

Electronic controllers and their programming are critical for the seamless functioning of these components, preventing excessive energy consumption in CRE products. The programming, commissioning, and validation processes demand a higher level of technician skill. Unfortunately, technicians with a basic skill set are in short supply due to low backfill. Both existing and future technicians require an expanded knowledge of newer refrigeration systems and the additional complexities. Manufacturers will also have to develop new training materials and programs to educate existing technicians on the integration of these additional electronic components.

In addition to higher levels of technical skill being required, there will be a negative impact to production rates and plant capacity if all merchandisers become more complex to assemble. This will lead to longer lead times and higher cost.

16. DOE requests comment and data on its assumptions and approach regarding consideration of repair and maintenance costs in the LCC and PBP analyses. Specifically, DOE requests data on the expected lifetimes and repair and maintenance frequencies of the considered design options in this NOPR.

In Hussmann's many decades of experience serving this marketplace, retailers purchasing this equipment will not consider payback periods greater than 3 years for design options and prefer paybacks under 2 years. If new DOE regulations require options with long payback periods, end users will move more towards less expensive refurbished equipment that uses more energy.

The Energy Policy and Conservation Act (EPCA) establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. (42 U.S.C. 6295(o)(2)(B)(iii) and 42 U.S.C. 6316(e)(1)(A)) DOE's payback periods at the proposed standard levels for many of the equipment classes are far above the rebuttable presumption threshold of 3 years—see Table 1 below. For example, it is unclear how DOE justifies a rebuttable payback period of 12.3 years (and a simple payback period of 13.8 years) for the HZO.RC.M equipment class that has an average lifetime of 13.0 years according to DOE's analysis. Hussmann does not understand how this can be economically justified.

Table 1: DOE's Simple and Rebuttable Payback Periods for Several Equipment Classes

Equipment Class	Simple PBP (years) @ Proposed TSL	Rebuttable PBP (years) @ Proposed TSL
HZO.RC.M	13.8	12.3
HZO.RC.L	13.0	11.6
VCT.RC.M	10.9	9.7
VCT.SC.M	7.6	6.7
SVO.RC.M	7.3	6.6
HCT.SC.I	7.1	6.3
VCT.RC.L	6.4	5.7
VCT.SC.L	5.8	5.1
VOP.RC.M	5.7	5.1

17. DOE requests comment and data regarding the CRE lifetime assumptions and methodology.

Hussmann supports the statement from AHRI. "AHRI agrees in principle with the lifetime assumptions made by DOE for CRE. However, there is a concern about the use of technology options that have a lower lifespan, e.g., night curtains, and new technology options that have not been validated in CRE product applications to establish a lifetime expectation, e.g., variable speed compressors."

18. DOE requests comment and data on the assumed business types and the corresponding CRE lifetimes at which refurbishment may occur.

Hussmann estimates that remote cases are used in the range of 10-12 years before being refurbished. Self-contained equipment is refurbished less often, but if it is 7-9 years is a more typical duration of use prior to refurbishment. Smaller independent retailers tend to have less capital available and may hold onto CRE longer and continue to refurbish and replace parts to avoid purchasing new cases.

If new DOE regulations add additional cost and complexity with long payback periods, retailers will move more towards replacing old equipment with refurbished equipment that uses more energy than new equivalents. More retailers will also refurbish the cases themselves by reskinning them in place and continuing to use them rather than opting for replacement. This behavior will decrease the demand for new energy efficient cases and counteract DOE's desire to reduce energy consumption from CRE.

Hussmann has studied the refurbished display case market over the past several years. Hussmann sells aftermarket parts to case refurbishers and has seen significant growth over the past three years. The compound annual growth rate (CAGR) of sales to refurbishers in FY'20 was 23%. This upward trajectory continued in FY'21, with a CAGR of 25%. In FY'22, the CAGR was 11%. The overall outcome shows this market is expanding rapidly.

Hussmann's estimation of the US Refurbished Equipment market in 2015 ranged from $200 to $250 million, based on the visibility at that time. According to data and intelligence collected

by Hussmann, there has been a consistent annual growth rate of over 10% in this market since 2015. Based on this trend, the refurbished CRE market estimate for 2022 ranged from $430 million to $530 million. Furthermore, Hussmann is aware of at least 13 different major refurbishing companies in the marketplace in 2023 with other OEM's citing near 20 active refurbishing companies and a growing market.

19. **DOE requests comment on its methodology and data to better inform the no-standards-case efficiency distribution for CRE.**

Hussmann has explained our request for no new standards in the initial comments.
A delay in new regulations would provide time to:

- Collect actual data on our models after they are transitioned to new refrigerants (After SNAP rule 26 refrigerant charge volumes are finalized)
- Collect actual data on models that are in the market
- Assess the impact of safety mitigation measures required for new refrigerants would be known
- Assess the impact of technician repair and maintenance knowledge and costs
- Reduce burden on manufacturers and end-users
- Increase time between product redesign from two years to six years

With the industry transitioning to new low GWP refrigerants it must be understand that a new baseline of models utilizing A3/A2L's should be determined which will be after the EPA transition is complete and sufficient data has been collected through lab testing and field analysis. This will also allow time for new technology to catch-up or be invented that may achieve some of the proposed energy limits.

20. **DOE requests comment on the price elasticity assumptions for the CRE shipments analysis as they relates to the overall CRE market and the market for refurbished CRE.**

See comments above in item number 18 regarding the refurbished CRE market growth.

21. **DOE requests comment on its assumption of no efficiency trend for CRE and seeks historical CRE efficiency data, ideally by equipment class or alternatively by equipment family, or overall for the CRE market as a whole.**

For Hussmann equipment, when comparing DOE 2017 limits and the proposed limits using actual case TDA and Volume, there are nearly 1200 models that would be required to meet energy levels 10% or lower, over 3700 models that are required to meet energy levels 10% - 20% lower, over 140 models that are required to meet energy levels 20% - 30% lower, and 160 models that are required to meet energy levels greater than 40% lower.

Hussmann did much work to meet the 2017 limits for several equipment classes and have continuously improved case energy performance to stay competitive in the industry regardless of DOE regulations—see Figure 1 below. Since DOE 2017, all cases are shipping with ECM motors, LED lights, and optimized air curtains/doors and insulation as standard. Hussmann is not clear where else cases can be improved to meet such drastic cuts in energy consumption.

There has been a slow but continuous conversion from open cases to door cases in the grocery store industry because door cases are inherently 70 – 80% more efficient. If reduced energy limits reduce door and lighting options available for these cases, it will delay the conversion and prolong the use of open cases using far more energy than saved by tighter limits on door cases.

Some VCT equipment may become obsolete altogether, driving customers to substitute products in the VOP classes that consume more energy.

Table 2: Approximate Standard Level Reductions Across Several Primary Equipment Classes

Equipment Class	2009/12 Standard Level Formula	2017 Standard Level Formula	Proposed 2027 Standard Level Formula	2009 - 2027 Approx. Reduction in Allowable Energy
HCT.RC.L	0.34 × TDA + 0.26	0.34 x TDA + 0.26	0.34 x TDA + 0.26	0%
HZO.RC.M	0.35 × TDA + 2.88	0.35 x TDA + 2.88	0.34 x TDA + 2.81	3%
HZO.RC.L	0.57 × TDA + 6.88	0.55 x TDA + 6.88	0.54 x TDA + 6.81	4%
VCT.SC.I	0.67 × TDA + 3.29	0.62 x TDA + 3.29	0.6 x TDA + 3.2	9%
SVO.RC.L	2.27 × TDA + 6.85	2.2 x TDA + 6.85	2.04 x TDA + 6.36	10%
VOP.RC.L	2.27 × TDA + 6.85	2.2 x TDA + 6.85	2.04 x TDA + 6.36	10%
HCT.SC.I	0.56 × TDA + 0.43	0.56 x TDA + 0.43	0.48 x TDA + 0.43	12%
VCT.RC.L	0.56 × TDA + 2.61	0.49 x TDA + 2.61	0.47 x TDA + 2.51	15%
HZO.SC.L	1.92 × TDA + 7.08	1.9 x TDA + 7.08	1.48 x TDA + 5.5	23%
SOC.RC.L	1.08 × TDA + 0.22	0.93 x TDA + 0.22	0.83 x TDA + 0.2	23%
SOC.RC.M	0.51 × TDA + 0.11	0.44 x TDA + 0.11	0.39 x TDA + 0.1	23%
VOP.SC.M	1.74 × TDA + 4.71	1.51 × TDA + 4.09	1.25 x TDA + 3.48	28%
SVO.RC.M	0.83 × TDA + 3.18	0.66 x TDA + 3.18	0.58 x TDA + 2.79	29%
VOP.RC.M	0.82 × TDA + 4.07	0.64 x TDA + 4.07	0.56 x TDA + 3.57	30%
SVO.SC.M	1.73 × TDA + 4.59	1.7 x TDA + 4.59	1.18 x TDA + 3.18	32%
VCS.SC.I	0.38 × V + 0.88	0.34 x V + 0.88	0.25 x V + 0.88	33%
VCT.RC.M	0.22 × TDA + 1.95	0.15 x TDA + 1.95	0.13 x TDA + 1.74	36%
HZO.SC.M	0.77 × TDA + 5.55	0.72 x TDA + 5.55	0.48 x TDA + 3.71	36%
SOC.SC.M	0.60 x TDA + 1.0	0.52 x TDA + 1	0.3 x TDA + 0.59	49%
VCS.SC.L	0.40 x V + 1.38	0.22 x V + 1.38	0.16 x V + 0.97	59%
VCT.SC.M	0.12 x V + 3.34	0.1 x TDA + 0.86	0.05 x TDA + 0.86	75%
VCS.SC.M	0.10 x V + 2.04	0.05 x V + 1.36	0.02 x V + 0.54	78%
VCT.SC.L	0.75 x V + 4.10	0.29 x TDA + 2.95	0.23 x TDA + 2.38	79%
HCT.SC.L	0.75 x V + 4.10	0.08 x TDA + 1.23	0.08 x TDA + 1.23	85%
HCT.SC.M	0.12 x V + 3.34	0.06 x TDA + 0.37	0.06 x TDA + 0.37	85%

Below is the energy efficiency evolution of Hussmann's highest volume dairy case from 1985 – 2023. All data for this chart is based on published application data from the time and calculated according to AHRI 1200. As shown, energy consumption has been reduced by 46+% over this time period for this equipment class. Other equipment classes like VCT.RC.L have similar efficiency improvements.

Hussmann has been continuously innovating for years because the marketplace demands it. These efficiency improvements have been a result of working with retailers to utilize technologically feasible components which the retailers support. Advances in efficiency driven and supported by our customers (e.g., EC motors and LED lighting) have payback periods that the market readily accepts.

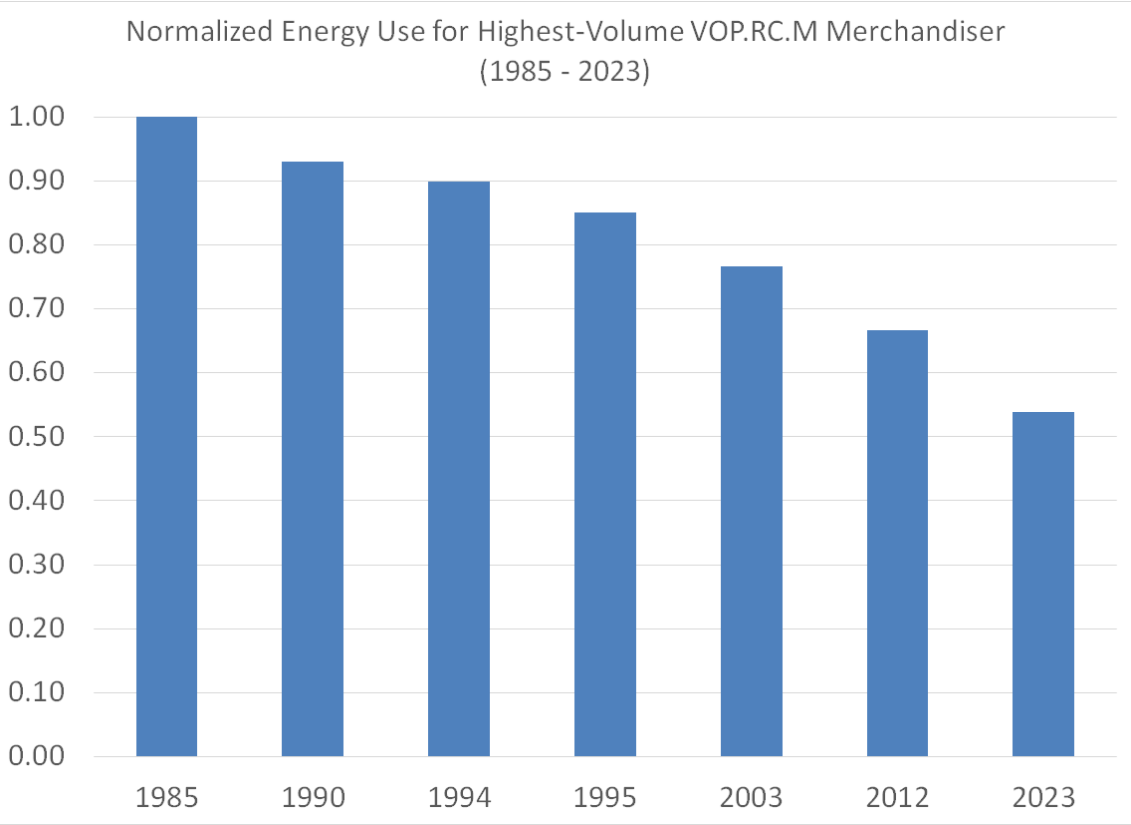

Figure 1: Normalized energy use for Hussmann's highest volume five-deck dairy display case in the VOP.RC.M equipment class from 1985 – current.

22. **DOE seeks comment on the use of a 1.40 manufacturer markup for all CRE equipment classes analyzed in this proposed rule. DOE also seeks comment on the estimated manufacturer markups and incremental MSPs that result from the analyzed energy conservation standards.**

    No Comment.

23. **DOE requests detailed comment and information on the capital investments associated with each analyzed design option. In particular, DOE requests detailed comment and feedback on the specific changes in equipment and tooling required to incorporate microchannel heat exchangers, as DOE currently models microchannel heat exchangers as a purchased part that can be substituted for tube and fin heat exchangers with minor production line changes.**

    Hussmann's experience with microchannel condensers is that they do not provide any additional energy efficiency. While microchannel condensers have a smaller internal volume than a comparable fin and tube coil, temperature differences (TDs) and therefore condensing temperatures are very similar for both coil technologies due to the inherent space constraints of the equipment. Thus, compressor/system efficiency is unaffected. Microchannel condensers also add complexity and require more frequent servicing/cleaning in the field by retailers.

24. **DOE requests comment on the availability of computer chips and other electrical components used in CREs and specifically if these components are used to achieve higher efficiency levels.**

Hussmann has experienced shortages of computer chips that are used in several refrigeration components. The company has had to use alternate controllers and other chip-driven components from different suppliers due to the computer chip and controller shortages. This effort is made more difficult as each component undergoes reliability testing test in our labs, performance validation testing on our cases, and then completed with UL/NSF Regulatory approval testing/validation. This additional effort adds upwards of $10k to open projects with NRTLs to have our files revised to include the new components. Adding the requirement to use additional controllers will multiply this effort for every controller plus the number of suppliers for that component. If additional chip components are necessary to meet the new DOE standards, more shortages may be encountered. Consequently, Hussmann will not be able to ship a case that requires these components for DOE compliance reasons even though the entire case meets EPA/UL/NSF requirements.

Additional Examples:

- Electronic component shortages drove one of Hussmann's evaporator fan suppliers to discontinue manufacturing several fan motors/assemblies that Hussmann was using. Hussmann had to find and test alternate fan assemblies, taking months of time and tying up Engineering and other resources.
- Electronic component shortages for Hussmann's Fan Speed Selector forced them to abandon adjustable speed motors in Insight cases. The redesign has taken months and tied up many Engineering and other resources.
- Supply chain issues have also forced Hussmann to find, test, and approve other components such as Electronic Expansion Valves (EEV) and case controllers, taking months of time and tying up Engineering and other resources.

Additionally, the US government is pushing a ban on semi-conductors from China and other countries which will further strain the supply chain (Section 5949 of the National Defense Authorization Act).

25. DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each TSL.

No Comment.

26. DOE seeks comment on whether manufacturers expect that manufacturing capacity constraints, engineering resource constraints, or laboratory constraints would limit equipment availability to consumers in the timeframe of the new and amended standards compliance date (2028).

Hussmann has explained our request for no new standards in the initial comments, but the focus should not be on timing but rather the proposed energy limits themselves not being achievable. The energy reduction from 2017 to the proposed identified in item #21 is not achievable for a large portion of our models as they are already using ECM motors, LED lights, and optimized air curtains/doors and insulation. Given more time than 2028, it would still not be achievable without help from new technology.

Hussmann is already investing in redesigning products to meet the new regulatory requirements for the AIM Act and new UL Standards, but faces supply chain issues related to A2L components, time restraints, resource restraints, and lab space/capacity limitations. The regulatory requirements to meet the AIM Act and the new UL Standards has halted any new

development and shifted our focus to meeting these new requirements. Engineering resources are at its limit, lab resources are booked for two years, and manufacturing is preparing the transition to new refrigerants with new equipment, new procedures, and safety guidelines.
A delay in new regulations would provide time to:

- Collect actual data on our models after they are transitioned to new refrigerants (After SNAP rule 26 refrigerant charge volumes are finalized)
- Collect actual data on models that are in the market
- Assess the impact of safety mitigation measures required for new refrigerants would be known
- Assess the impact of technician repair and maintenance knowledge and costs
- Reduce burden on manufacturers and end-users
- Increase time between product redesign from two years to six years

27. DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of CRE associated with multiple DOE standards or equipment/product-specific regulatory actions of other Federal agencies.

Hussmann supports AHRI's comment. "AHRI appreciates DOE's recognition that there is a cumulative burden associated with the regulatory initiatives of multiple federal agencies and standards setting bodies. In parallel to DOE's conservation standards changes for commercial refrigeration similar rulemakings for WICF, ACIM are occurring simultaneously, EPA is requiring a transition to Low GWP refrigerants, and Underwriter Laboratories is changing its safety standard to UL 60335-2-89, 60335-2-40, etc. All these changes entail costs, engineering design time, testing validation/verification time, establishing new supply chains, and finally independent laboratory testing, the capacity of which is in short supply due to the new Safety Standards and the transition to Low GWP refrigerants. Details of associated time, money, and resources are reflected in other comments. The impact of related state regulations, safety codes and various standards changes must not be disregarded as the impact is quite significant.

Another item that may impact products is DOE proposed changes to motors (medium electric motors (MEM) and small not-small electric motors (SNEM) efficiency levels that would become effective in 2027. These motor changes may require equipment changes to account for larger motors, additional testing, safety agency approval, and backward compatibility for replacement market. Aside from physical changes, there likely will also be a cost increase to go along with the higher efficiency motors. Finally, PFAS/PFOA regulations by the EPA and states could prohibit the use of A2L, Maine has PFAS reporting requirements starting January 1, 2025, and Minnesota has PFAS reporting requirements starting in January 2026.

As noted above, DOE is anticipating that the proposed standards will go into effect 3 years after publication of final standards in the Federal Register. Such a timeline is infeasible, due to other significant federal and state regulatory developments affecting the refrigeration sector and the continual denial of comment deadline extension requests.
As noted above, meeting DOE's proposed energy conservation standards would require substantial investment, resources, and innovation by manufacturers. Many resources, however, are currently dedicated to meeting the AIM Act regulatory requirements and will not be available as companies complete the required technology transition."

28. DOE requests comments on the magnitude of costs associated with transitioning CRE designs and production facilities to accommodate low-GWP refrigerants that would be incurred between the publication of this NOPR and the proposed compliance date of new and amended standards. Quantification and categorization of these costs, such as

engineering efforts, testing lab time, certification costs, and capital investments (e.g., new charging equipment), would enable DOE to refine its analysis.

Table 3: Example for one Hussmann factory

Expense Item	**Estimated Expense**
Engineering Effort	$700k
Testing lab time	$500k
Lab Equipment	$600k (Annex CC, CO2, vibration, 60335 test equipment)
Manufacturing Effort	$300k (initial cost for self-contained SC only)
Manufacturing equipment	$500k for SC Remote Cases: TBD
Certification Costs	$100k

29. **DOE seeks comments, information, and data on the number of small businesses in the industry, the names of those small businesses, and their market shares by equipment class. DOE also requests comment on the potential impacts of the proposed standards on small manufacturers.**

    No Comment.

30. **Additionally, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this document.**

    In future rulemakings DOE needs to engage manufacturers, component suppliers, retailers, and other stakeholders early in the process. We have already reached a point of very slight returns with excessive costs for any available technologies. DOE must conduct a full study on the refurbish market prior to any future rulemakings. DOE must do an assessment on the 2017 final rule and any subsequent final rules prior to any future rulemaking. DOE must also consider other regulations that are changing the industry and understand that the effects of those regulations regarding energy consumption are not yet fully known.

Sincerely,

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