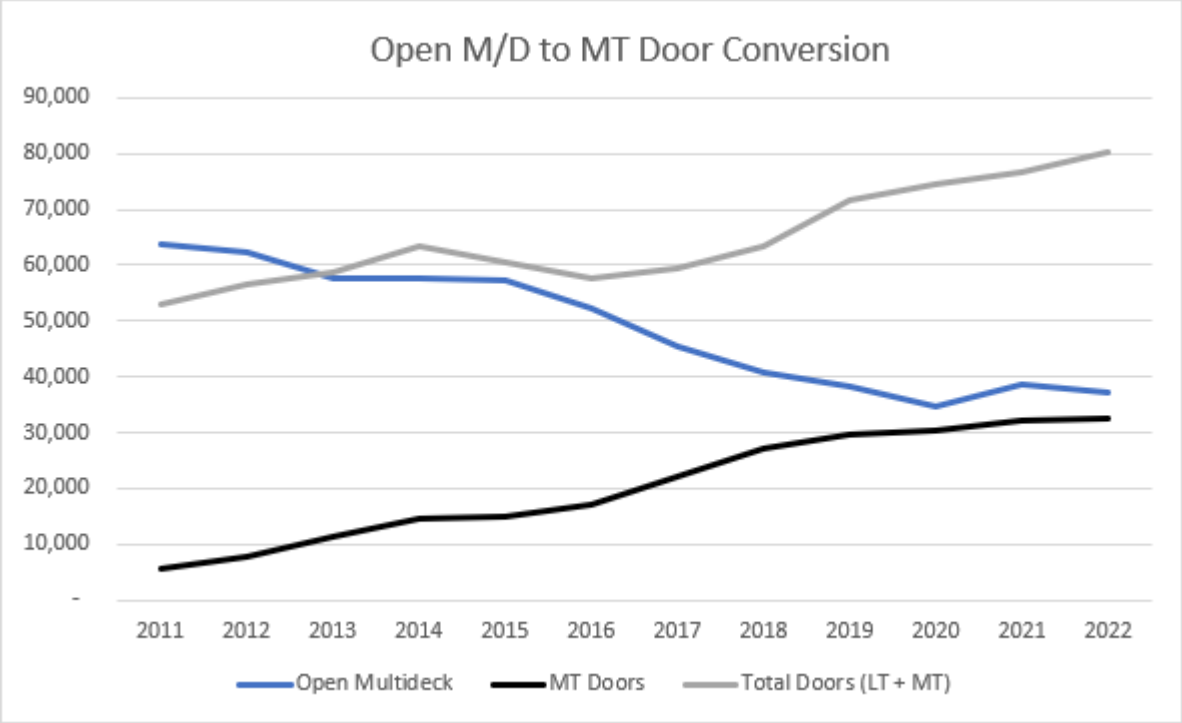
Hillphoenix Comments on the DOE NOPR for Commercial Refrigeration Equipment Products (CRE) Energy Conservation Standard and Technical Support Document

For over 130 years Hillphoenix has been an Industry Leader in the production of Commercial Refrigeration products. We appreciate the opportunity to provide DOE comments regarding the Energy Conservation Standard NOPR and TSD for CRE.

Many of the technologies presented in the NOPR as possible enhancements to current production CRE have already been implemented to meet the Energy limits from the 2017 regulations, and thus provides very little opportunity for further energy reduction available to manufacturers. Furthermore, many of the proposed technologies discussed require significant engineering development, product design and manufacturing changes. The substantial costs for most of these technologies far outweigh the perceived energy efficiency gains, which has driven Hillphoenix to not pursue their implementation in CRE products. Previous energy limit legislation has required elimination of many less efficient models that were previously offered in a tiered efficiency-based pricing strategy. Additional regulation in certain categories will force OEMs to discontinue products, which may lead to loss of business and puts US manufacturers at a significant disadvantage in international markets. Overreaching energy regulation stifles innovation and places manufacturers in the same category that eventually leads to commoditization of products where manufacturers can only compete on price versus value-added options and features.

Many of the closed equipment classes, including HCT, VCT, and VCS, are concerning as the industry continues to transition to closed cases for additional energy savings. Requiring further reductions in energy use for these classes will require design changes to achieve minimal efficiency gains, while driving a cost increase for closed equipment classes. This cost increase of closed vs. open CRE will slow the transition from open cases to more energy efficient closed/door models. These classes already have very stringent energy limits with little room left for further energy reduction. Any CRE with lids or doors saves approximately 60% energy over their open display counterparts. See the growth of CRE VCT.RC.M Equipment class (MT Door Cases) and the decline of VOP.RC.M (MT open cases) in Chart 1 below. Many retailers have converted their VOP/HZO equipment class open cases to VCT/HCT classes by retrofitting doors in existing installations to capture the afore-mentioned energy savings. Requirements for further energy reduction will lead to many closed products being discontinued from the market, which is counter to the goal of reducing energy consumption.

CHART 1



Another unintended consequence of increasing the cost of all CRE products is driving the increase in remanufactured/refurbished CRE vs new CRE that are much more energy efficient than older products. Unregulated CRE remanufactured/refurbished growth is driven by the fact that these products are historically 50% the cost of new products. Several companies in the remanufactured/refurbished market were surveyed and they all have experienced significant growth over the last few years because of the price increases of new CRE products due to supply chain shortages, component cost increases, etc. to CRE OEM's. Two Large US retailers are currently evaluating the possibility of establishing their own in house remanufacturing/refurbishing programs to delay the purchase of new CRE products as long as possible. DOE should consider reaching out to refurbishers as there are now more than 20 companies that refurbish and remanufacture used display cases to resell in lieu of new products in order to understand the size, growth, and equipment pricing of the remanufactured/refurbished market.

Hillphoenix respectfully requests DOE to consider a pause in its current rulemakings relating to energy conservation for CRE products given the extraordinary efforts now underway across the HVACR industry to transition to new classes of refrigerants with low global warming potential (GWPs) pursuant to *The American Innovation and Manufacturing (AIM) Act of 2020*. 42 USC § 7675. The US EPA's regulations (the AIM act) are a massive effort for all CRE OEMs and will have an impact on energy performance of all CRE products. In addition, there are many other changes underway that will have a multi-year impact on CRE manufacturers. These changes include regulations and standards driven by federal, state, local, and industrial safety authorities. Regulatory burden has drastically influenced the availability of options affecting energy efficiency and is narrowing manufacture's ability to explore new technologies.

Hillphoenix would like to address the lack of concern and attention from DOE regarding Food Safety for CRE products. CRE products must maintain strict product temperatures according to the FDA Food Code - NSF/ANSI Standard 7. DOE should categorize different CRE products based on the type of product / food displayed. Currently, beverage or bottle coolers operate at warmer temperatures that require less energy than CRE displaying perishable products that require more energy in order to maintain product temperatures at 41°F or less. However, both beverage and perishable product CRE, have the same energy limits established by a single category. The current energy limits for CRE displaying perishable products are difficult to obtain while meeting the FDA Food Code - NSF/ANSI Standard 7 for the maximum product temperatures of Dairy, Fresh Meat, or Fish and would be impossible in nearly all offerings if the proposed limits are adopted.

Another example of regulatory burden is UL 60335-2-89 Second Edition published October 27, 2021 (and the 3rd edition set to release in 2024). This safety standard is required for most end-uses of A2Ls and larger charges or R290. UL 471 is being replaced by UL 60335-2-89 as of September 29, 2024, and all new Commercial Refrigeration Equipment (CRE) products must be certified to UL 60335-2-89. CRE products using A2L refrigerant, or R290 with charges larger than 150 grams, can only be certified to UL 60335-2-89. UL 60335-2-89 requires significantly more testing to meet the new safety requirements and substantial modifications may be needed to meet the safety requirements for products and components. UL 60335-2-89 also includes significant new requirements for product markings and instructions. Nationally Recognized Testing Laboratories (NRTLs) and manufacturers are still learning the requirements for UL 60335-2-89, and there is still a lack of clear interpretation in some areas.

Each time a product changes, OEMs must retest to all of these regulations and specific test standards from DOE, UL, NSF, ASHRAE, AHRI, etc. all the while remaining in compliance with the US EPA's GWP limits. There is substantial industry concern over the availability of NRTL's to meet the evolving regulatory landscape. A significant portion of engineering, supply chain, manufacturing, and marketing resources are being consumed just to meet these evolving regulations. All CRE products must meet NSF sanitation, UL - Electrical and Mechanical Safety Regulations and ASHRAE safety standards.

Hillphoenix would like to point out several issues and discrepancies in the NOPR and TSD:

1. Insulation Thickness

When DOE adopts or amends energy conservation standards, the Energy Policy and Conservation Act (EPCA) directs it to consider product utility and provides that DOE may not adopt a standard that "*is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding.*" 42 U.S.C. §§ 6295(o)(2)(B)(i)(IV) and (o)(4). Note the following statement from the TSD NOPR:

"*4.2.1 Increased Insulation Thickness - As discussed in chapter 3 of this TSD, increasing insulation thickness increases the thermal resistivity of the exterior of the unit, which in turn reduces the heat load that must be removed by the CRE's refrigeration system. However, to increase insulation thickness, either an increase to the size of the unit or a decrease to the refrigerated volume of the unit must occur.*

Because CRE is typically required to meet standard dimensions to fit into a fixed amount of space, the refrigerated volume of the unit may need to be decreased to accommodate increased insulation thickness, thus limiting the capacity of the unit. As a result, DOE has tentatively determined that increased insulation thickness meets the screening criterion of "impacts on product utility." In this NOPR, DOE has screened out increased insulation thickness as a design option for improving the energy efficiency of CRE."

Despite the statement that DOE has screened out the design option of increased insulation thickness, DOE has increased the 2023 baseline from the 2017 Energy Conservation Standard selected design levels. The information below lists all equipment classes that had an insulation thickness increase for the baseline:

1) The following equipment classes increased from 2" to 2.5" of insulation for the baseline: HZO.RC.M, HZO.RC.L, HZO.SC.M, HZO.SC.L (from VIP), VCT.RC.M, VCT.RC.L, VCT.SC.M, VCT.SC.L (from VIP), VCT.SC.I, VCS.SC.M, VCS.SC.L, VCS.SC.I, HCT.SC.M, HCT.SC.L, HCT.SC.I, HCS.SC.L,
2) The following equipment classes increased from 1.5" to 2" of insulation for the baseline: SOC.RC.M, SOC.SC.M
3) The following equipment classes increased from 1.5" to 2.5" of insulation for the baseline: HCS.SC.M

Doing so violates the prohibition in EPCA of adopting energy standards that impair the functionality of a pre-existing product by varying the product footprint external alignment or the product storage area.

Equipment used to manufacture insulated structures is typically used to produce products in multiple covered DOE classes. Changes in insulation thickness of one product would require changes in multiple products leading to an increase in testing, re-certification, and validation, which is an unnecessary financial burden on manufacturers that DOE has not included in the cost evaluation of the proposed regulation.

2. Anti-Sweat Heat Values

For the equipment classes SOC.SC.M and SOC.RC.M with the same case design options, DOE utilized different amounts of Anti-Sweat heat when calculating Remote vs Self-Contained. These two equipment classes are identical products (with exception of an added compressor) and should use the same amount of Anti-Sweat wattage. In the Engineering Analysis Worksheet (EAW), the SC class uses 90 watts of heat vs. the remote class's 200 watts. The lower wattage in the SC class will create sweating and condensation issues and again violates the prohibition in EPCA of adopting energy standards that impair the functionality of a pre-existing product - in this case identical products.

3. Night Curtains

At present, Hillphoenix does not require night curtains on CRE products to meet the 2017 energy requirements. Hillphoenix has reduced energy consumption using other technology design options in order to not require the use of Night Curtains as they are not typically ordered by customers as an energy reduction option because of their shorter lifespan, the additional costs of installation, maintenance, and operating expense due to the labor or power to close the curtains each night. Night curtains should not be considered a preferred option to achieve lower energy consumption.

4. Payback Period

The Food Retail industry has long been in favor of technologies and components to reduce energy consumption and have adopted many of these technologies. A few examples are Electronic Expansion valves with associated controls, ECM evaporator and condensing unit fan motors, enhanced evaporator coils, LED lights, etc. The Simple PBP for the food retail industry is 2-3 years with very few adopters beyond the 3-year payback mark. In this NOPR, DOE has adopted Simple PBP ranging from 2.8-13.8 years. See Table 1 below for equipment classes commonly used in supermarket applications. This PBP has sparked outrage over the equipment cost increases that these new energy levels will require.

Table 1

Class	Energy Level	Simple PBP
VOP.RC.M	2	5.7
VOP.SC.M	5	3.6
VCT.RC.M	3	10.9
VCT.RC.L	2	6.4
VCT.SC.M	3	7.6
VCT.SC.L	6	5.8
SVO.RC.M	2	7.3
SVO.SC.M	7	4.3
SOC.RC.M	3	3.3
SOC.SC.M	7	5.4
HZO.RC.M	1	13.8
HZO.RC.L	1	13
HZO.SC.M	5	5.2
HZO.SC.L	5	2.8
HCT.SC.M	0	0
HCT.SC.L	0	0

Retailers had just adjusted to the increased equipment costs from the 2017 Energy conservation standard effective date for DOE's CRE products, when the global pandemic hit and drove supply chain, labor shortage, etc. increases of retail food prices. The US Government Accountability Office (GAO) cited this impact in a March 28, 2023 study that stated, *"From 2021-22, U.S. retail food prices rose*

by 11%—the largest annual increase in over 40 years. Rising food prices particularly impact low-income consumers, who spend about 30% of their income on food.

Many factors influencing the food supply chain can affect retail food prices, such as global trade issues, pandemics, animal and plant disease outbreaks, and war.

Federal agencies don't control food prices, but may indirectly affect them. For example, by relaxing regulations to let food made for restaurants be diverted to grocery stores, the FDA helped to avert food shortages that could've further increased prices during the COVID-19 pandemic."

This NOPR will perpetuate the problem cited by GAO into 2027 and beyond, by continuing to increase equipment costs and thus indirectly the cost of food to the consumer and specifically the low income consumer as referenced in the GAO study "*Rising food prices particularly impact low-income consumers, who spend about 30% of their income on food*."

GAO 2023 Study https://www.gao.gov/products/gao-23-105846

5. Occupancy Sensors

[Redacted]

In addition to the cost of the Occupancy Sensor itself, there are cost(s) associated with installation and field-wiring, programming into the retailer's onsite control systems. Many retailers prefer not to use motion-controlled Occupancy Sensors for energy savings because a dark aisle in a Supermarket gives the shopper the impression that something may be wrong with the refrigeration equipment and potentially provoking a concern over food safety.

6. 2 Panes vs. 3 Panes of Glass / Krypton vs. Argon Gas Fill / Vacuum Insulated Glass (VIG)

Medium temperature doors are currently manufactured with double pane glass that is filled with Argon gas. Low temperature doors are currently manufactured with triple pane glass that is filled with Argon gas. The cost of Krypton gas is more than double the cost of Argon gas and there is a limited supply of Krypton gas available to the market.

DOE's estimate for the price increase to go from 2 pane Argon to 3 pane Krypton is $23.32/door. The total price increase for a 5-door case is $116.58.

Code	Description	Overall U-Factor [Btu/hr-f-	Cost per Door [$]	Heater Power [W/door]
DR1	Double Pane, Ar Fill Door	0.263	$171.00	20
DR2	Triple Pane, Ar Fill Door	0.239	$189.90	20
DR3	Triple Pane, Kr Fill Door	0.231	$194.32	20
DR4	Double Pane, Vacuum Insulated Door	0.213	$590.52	20
-	-			

[Redacted]

[Redacted]

Requiring triple pane on medium temperature CRE would increase cost for a minimal efficiency gain. Requiring Krypton gas on CRE products would cause an exorbitant price increase with minimal efficiency gain and there may not be enough Krypton to supply the market.

VIG glass is not applicable for Low Temperature applications due to the glass bending in the extreme temperature difference between room temperature and Frozen Food and Ice Cream display temperatures. More importantly, all suppliers of VIG pulled production for CRE products due to the low demand and refused to supply the market.

Please note, DOE referenced the following information in the 2023 TSD that is no longer valid, and Anthony discontinued VIG in 2019.

"28. Anthony International. "Vacuum Insulated Glass." https://www.anthonyintl.com/docs/default-source/literatures/vacuum_insulated_glass_(vig)_literature.pdf?sfvrsn=2 (Accessed October 6, 2021)"

7. Estimated Manufacturer Markup Response to Question 22 from the NOPR

"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."

The question above referencing manufacturer markup from the NOPR states 1.40. However, the Engineering Analysis Worksheet (EAW) has increased the markup to 1.42. Both 1.40 and 1.42 are high based on the current competitive market pricing conditions.

[Redacted]

8. R290 vs. R404A Baseline Efficiency Gains.

According to DOE's EAW, the R290 vs. R404A efficiency gains attributed to the compressor are 34.7% for Medium Temperature and 5.6% for Low Temperature applications.

Hillphoenix requested Copeland, the largest US based Refrigeration Compressor manufacturer to compare Low Temperature (LT) and Medium Temperature (MT) compressor efficiencies. See results below:

LT R404A vs R290 EER Comparison

Type	R404A Compressor Model	R290 Compressor Model	R404A Capacity (BTUH)	R290 Capacity (BTUH)	R404A Compressor EER	R290 Compressor EER	EER Delta
Scroll	ZF04KAE-TF5	ZB07KAU-TF5	5,140	4,750	5.22	6.18	18%
Scroll	ZF05KAE-TF5	ZB09KAU-TF5	6,260	5,460	5.42	5.77	6%
Scroll	ZF06KAE-TF5	ZB11KAU-TF5	7,350	7,600	5.63	6.55	16%
						Average	**14%**

Condition: LT = -15 SST / 90F SCT / 40RG / 0 SC

MT R404A vs R290 EER Comparison

Type	R404A Compressor Model	R290 Compressor Model	R404A Capacity (BTUH)	R290 Capacity (BTUH)	R404A Compressor EER	R290 Compressor EER	EER Delta
Recip	ASE45C5E-CAA	ASE39C5U-CAA	6,560	5,900	7.51	9.64	28%
Recip	RST55C1E-CAA	RST53C1U-CAA	7,900	7,650	8.68	10.00	15%
						Average	**22%**

Condition:MT = 23 SST / 90F SCT / 40 RG / 0 SC

Based on Copeland's actual compressor performance and EER data, the percentage in energy savings for R290 vs R404A in LT applications averages ~14% compared to the calculated values from DOE's Engineering Analysis Worksheet of 5.7%. Based on Copeland's actual compressor performance and EER data, the percentage in energy savings for R290 vs R404A in MT applications averages ~22% compared to the calculated values from DOE's Engineering Analysis Worksheet of 34.7%.

Variable speed compressor technology can have a ~15% minimum efficiency improvement to the overall CRE product's energy due to less starts and stops, and continuous compressor speed control to match the load requirement. Copeland commented that the variable speed compressor motor itself only adds ~5% efficiency gain due to compressor motor enhancements. The calculated compressor energy reduction from DOE's Engineering Analysis Worksheet shows a 44.9% energy savings when comparing a R290 reciprocating vs an R290 variable speed compressor.

The energy values DOE used to represent the impact of changing refrigerants to R290 with variable speed compressors are broad assumptions and are not reflective of actual tested values.

> *"5.5.3.1 Variable-Speed Compressor - To estimate the performance impacts of transitioning to a variable-speed compressor…"*

DOE should use values established by testing physical units to ASHRAE / NSF 7, Type I and Type II conditions for both Open and Closed equipment classes, and LT / MT applications to validate any energy saving claims prior to using them as the basis for the rule making.

9. Cold Wall vs. Traditional Forced Air Evaporators

In the Engineering Analysis Spreadsheet for HCT.SC.M, L, and I product classes, there was no energy included for the evaporator fans motors or anti-sweat heat. This assumes all products in this class are considered by DOE to utilize 'Cold Wall' evaporators. The majority of products in this class include glass in the side walls and cold wall technology cannot be utilized and must include evaporator fan

energy and anti-sweat energy. Cold wall evaporators are only applicable in these product classes when solid walls (without glass) are utilized. See product photos below for additional clarification:

HCT.RC, HCT.SC, HZO.RC, HZO.SC with Glass Sides <u>are not</u> suitable for Cold Wall

HCT.RC, HCT.SC, HZO.RC, HZO.SC with Solid Sides are suitable for Cold Wall

10. The Engineering Analysis Worksheet (EAW) Contains an Error for Calculating the Efficiency of Variable Speed Compressors

The 2023 EAW utilized a "variable speed compressor – CP4" across multiple self-contained classes listed below. All except three classes that used the CP4 code as a selected option show "VALUE" in the kWh cell for evaporator fan motors, condenser fan motors, and compressors for the selected TSL5 energy level. Since the term "VALUE" is shown, indicating a calculation error, it is unclear how new energy limits were created without a working mathematical model.

Classes with CP4 code and "VALUE" showing in Excel: VOP.SC.M, SVO.SC.M, HZO.SC.M, HZO.SC.L, SOC.SC.M, VCT.SC.L, VCS.SC.H, VCS.SC.L, VCS.SC.I

11. The VCT.SC.M Equipment Class Selected EL Level Does Not Pass the Proposed Energy Limit

The formula for this error from the NOPR is: $(0.05 * 49ft^3 + 0.9)$ and equals a 3.35 kWh calculated energy limit. EL3 was selected for this class and has an energy consumption of 3.52 kWh which is ~5% over the proposed energy limit.

12. 2023 Baseline Levels vs. Selected TSL from the 2017 Final Engineering Analysis Worksheet

The attached spreadsheet 'Energy Level Summary Attachment A' compares the selected TSL levels from the 2017 Final Engineering Analysis Worksheet which should be the baseline technology options in the 2023 Engineering Analysis Worksheet included in the NOPR. By not including the final 2017 selected TSL as the baseline for 2023, it appears that these technology options are still available for use for energy reduction even though they were used to establish the 2017 Energy Conservation Standard limits. Many of these options have already been utilized to meet the 2017 limits. Because these already employed technology options are not available to reach DOE's proposed new standards, the cost of coming into compliance with the new standards is in fact much higher than DOE has calculated and likely does not pass the "economically justified" requirement of EPCA.

Hillphoenix appreciates the opportunity to participate and share comments and suggestions with DOE on the Energy Conservation Standards and Technical Support Document for Commercial Refrigerators, Freezers, and Refrigerator-Freezers proposed rule. Please do not hesitate to contact us if we can provide any further information or answer any additional questions.

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