August 29, 2022

Dr. Stephanie Johnson
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies, EE-2J
1000 Independence Avenue SW
Washington, DC 20585-0121

Submitted electronically via www.federalregister.gov

Re: NAMA Comments on U.S. Department of Energy's Notice of Proposed Rulemaking and Preliminary Technical Support Document on Commercial Refrigeration Equipment; Docket No. EERE-2017-BT-STD-0007

Dear Ms. Speakes-Backman and Dr. Johnson:

The National Automated Merchandising Association (NAMA) respectfully submits the following comments to the Department of Energy (DOE or Department) on its Notice of Proposed Rulemaking on Commercial Refrigeration Equipment; EERE–2017–BT–STD–0007.

Founded in 1936, NAMA is the association representing the U.S. convenience services industry, with its core membership comprised of owners and operators of vending machines, micro markets, office coffee, tea, water and pantry services, as well as the manufacturers of refrigerated vending machines and other commercial refrigeration equipment. With nearly 1,000 member companies – including many of the world's most recognized brands – NAMA provides advocacy, education and research for its membership. The convenience services industry employs nearly 160,000 Americans – the majority employed by small businesses – contributing a total economic impact of over $31 billion to the U.S. economy annually.

Regarding the DOE Proposed Rulemaking on energy efficiency of Commercial Refrigeration Equipment (CRE), NAMA is presenting testimony and response on behalf of the manufacturers of the machines that provide food and beverages to millions of consumers in a safe and environmentally responsible manner.

NAMA appreciates the opportunity to submit comments on the Federal Register Volume 87, No. 123, June 28, 2022, #38296 by the Department of Energy (DOE or Department) regarding future DOE energy conservation standards rulemakings on CRE. The U.S. Energy Policy and Conservation Act, as amended ("EPCA"), authorizes DOE to regulate the energy efficiency of certain industrial equipment. (42 U.S.C. 6295 (v)). Title III, Part B 2 of EPCA established the

1777 N. Kent Street
Suite 1010
Arlington, VA 22209

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Energy Conservation Program for Consumer Products Other than Automobiles. These products include Commercial Refrigeration Equipment, the subject of this document.

NAMA will respond to several aspects of this rulemaking:

1. Hearing on Preliminary Technical Support Document
2. Information on Manufacturers and Trade Associations for CRE
3. Comment Period
4. Preliminary Technical Support Document (pTSD)
5. Product Classes
6. Examples of Possible Energy Efficiency Changes
7. CRADA with US DOE
8. Economic Case for New Energy Efficiency Levels
    a. Availability of Components
    b. Labor
9. Lessening of Utility and Performance
    a. Capacity
    b. Performance
10. Marketing Forecast—Refurbished Machines
11. Overlapping Comments and DOE Actions
12. Cumulative Regulatory Burden

Annex A: In Depth Review of pTSD Design Options

NAMA is responding for the following categories

Vertical, Closed, Transparent, Self-Contained, Medium Temperature	VCT/SC/M
Vertical Open, Self-Contained, Medium Temperature	VOP/SC/M
Horizontal Open, Self-Contained, Medium Temperature	HZO/SC/M
Horizontal Closed Transparent, Self-Contained, Medium Temp	HCT/SC/M

In the rulemaking NOPR, DOE asked 24 questions.

On March 27, 2017, the new DOE energy efficiency regulations took effect which reduced the minimum energy efficiency standard levels for commercial refrigeration equipment (CRE) and,

coupled with both new ENERGY STAR® levels, the regulations on refrigerants from the California Air Resources Board (and several other states), the Global Pandemic, record inflation, difficulties with finding and retaining skilled workers, our industry has suffered greatly over the past three years. Soon after the new energy efficiency regulations took effect, the US and many other countries entered a new era because of the COVID-19 Pandemic. This virtually shut down the manufacturing, distribution, and sales of CRE for more than two years. It also shut down most of the sites that utilize small CRE. Offices using CRE closed. Public schools and universities using CRE closed. Hotels, which are converting many operations to refrigerated bottle/food coolers in the lobbies saw virtually no business due to restrictions on travel. Small convenience stores operating near these sites saw a considerable reduction in business. Many downtown office areas remain closed or at minimal staffing. Our industry is just now beginning to recover from this very onerous economic time. Several of the NAMA manufacturing companies qualify as Small and Medium Enterprise (SME) businesses with less than 1000 employees in the United States. One of the larger manufacturers of CRE decided to close a major factory and greatly reduce operations, resulting in the loss of many jobs in an already economically endangered location. This is not something to read in a newspaper and quickly forget; this is very real to our industry.

During this same time, the CRE industry has been affected by the pressure to change the refrigerants used in these machines from HFCs to lower Global Warming Potential (GWP) chemicals. NAMA has not only made the change but has welcomed the opportunity to demonstrate its environmental sustainability initiatives. But this came at a huge cost. At the same time the industry is changing to meet the environmental requirements, COVID 19 reduced sales and manufacturing volumes. The Pandemic kept many companies' staffs away from the factories and engineering sites and caused supply chain disruption that reduced or eliminated the availability of many components. Our industry is also "regulated" by the safety standards that did not, until November 2020, allow placement at the current time in public spaces when using natural refrigerants which are classified A3 by ASHRAE Standard 34. DOE assumed in the new energy efficiency standards levels (MEPS) that the industry would be using natural refrigerants, but at present the industry has not fully completed this transition, due to the factors mentioned above. Part of this is due to the changes in the safety standard, where we are still limited to 114-gram refrigerant charge in public buildings and sites. Part of this is due to the recession following the Pandemic shutdowns and partly to the cost of redesign and manufacturing. The cost of re-designing equipment for lower GWP chemicals, the design changes necessary for safety compliance to low-GWP chemicals, capital improvements to factories, changes to service, and training of factory employees and service providers are a huge burden to smaller manufacturers.

NAMA is requesting that DOE pay considerable attention to the economic impacts of a new set of energy regulations on an industry that is already under extreme pressure.

NAMA wishes to comment on the following 12 areas:

I. Hearing on Energy Efficiency Changes

NAMA is appreciative of the Department's willingness to organize a hearing on the proposed energy efficiency standards levels. We recognize that these virtual webinar hearings, while required, do present considerable work to utilize an electronic meeting format. The webinar on the Standards held on 8 August 2022 was extremely rushed. Several people asked questions which were not answered. The webinar was abruptly terminated. NAMA respectfully asks that DOE return to an "in-person" format meeting. While electronic meetings provide value, they do present challenges and limit full dialogue on these important subjects.

II. Manufacturers and Trade Associations for CRE

NAMA notes that NAMA is not listed in the Proposed Regulation nor the list of manufacturers. Also, the names of the manufacturers of CRE equipment represented by NAMA and filed in CCMS are not mentioned.

III. Comment Period

The number of product classes contained within DOE's classification of CRE is very large at 28 different categories. With the addition of some of the buffet equipment, the number of classes of equipment is growing and the numbers of manufacturers are also exceptionally large. This is one of the most complex rulemakings DOE would have within the EERE section. We find it strange that with so many manufacturers, so many different pieces of equipment and such a large scope of products, that DOE has decided to reduce the time allowed for members of the public to comment on the proposed rulemaking. The time for comment should have been no less than 60 and more likely 90 days.

NAMA is adding our comment and requesting that DOE extend the comment period on this regulation until 31 October 2022. After a formal request by other trade associations, DOE released the spreadsheets on 8 August 2022. This allowed just 7 working days from release of the information until comments were due to respond. This violates all elements of notice and comment in the Administrative Procedures Act, which is a principle on which the U.S. has admonished other countries for regulatory actions.

IV. The Preliminary Technical Support Document

The pTSD presented in the public document filing by DOE has numerous errors. First, it seems that the pTSD was prepared several years ago. Most of the analysis appears to have been performed prior to 2020, whereas the industry has experienced considerable change during the time of 2019-2022. [Consider that the pTSD states the current price of gasoline is $3.00/gallon.

This may indicate that the pTSD is not current or accurate.] The pTSD and teardown analysis appear to have used commercial refrigeration equipment (CRE) which were available on the market far before even 2019. The Technical Screening points to what DOE seems to believe are future improvements to design. In fact, many of these items have already been employed, in many cases years before. This might be beneficial to the full discussion because we have more accurate information on both the true energy impact as well as the true cost.

NAMA would ask DOE to consider that the assumptions about efficiency options outlined in the pTSD are flawed, as are the baseline efficiency levels, and the assumptions about incremental costs. The baseline assumptions should include the use of LED, higher efficiency compressors, higher efficiency fan motors, better, a high-performance door, and several other design options for the last several years. See Annex A to this document. This means that including these in the efficiency options is erroneous as they are already part of manufacturers' designs. DOE may have underestimated the payback period in their technology and design options. To achieve the efficiency levels outlined in the pTSD, manufacturers would have to incorporate design elements that are not economically or technically feasible.

Several of the other design options are simply not feasible in commercial refrigeration equipment.

Second, DOE seems to have either forgotten or not fully recognized the existence of smaller refrigerated single and double door beverage (and food) coolers. The analysis of the engineering changes, shipments, economic impact, utility impact on these units are profound and need to be considered. This is critical and we need to explain what we mean. DOE and its consultants have taken a category as being representative of the whole breadth of products. For example, the category of Vertical, Closed, Transparent, Self-contained Medium Temperature units actually includes multiple size ranges. What may be true in energy efficiency for a 60 cubic foot unit may not be applicable to a 24 cubic foot unit. The cost and availability of components to a 60 cubic foot unit are not the same as an under 30 cubic foot unit. Doors, insulation, fan motors, compressors, evaporator coils are simply not the same for a 60 cubic foot and 30 cubic foot appliance. For purposes of DOE analysis, units under 30 cubic feet should be considered as different from those over 30 cubic feet in refrigerated volume.

Another industry has pointed out that DOE seems to be double counting the energy efficiency design options. Some of DOE's design options in the 2014 TSD were so stringent and challenging for industry to meet that industry had to go beyond DOE's 2014 TSD. Examples include, but are not limited to, 1) LED Lighting, 2) Brushless DC Evaporator Fan Motor, 3) High-Performance Door, and 4) Brushless DC Condenser Fan Motor. Now, DOE is taking additional credit for energy efficiency by adding those same technologies beyond the baseline to justify new 2022 pTSD energy reductions or improved efficiency levels. In other words, those technologies have been necessary to meet the 2014 standards so cannot now be "added on" and DOE cannot claim additional projected energy savings above and beyond the 2014 levels. By doing so, DOE is essentially doubling the energy efficiency benefits from certain of these technologies; that were

not listed but were necessary to meet 2014 levels and listing them in 2022 should not generate any energy efficiency benefits. This applies to NAMA products also.

NAMA represents manufacturers of several items within the category of commercial refrigeration equipment, including small self-contained refrigerated beverage and food equipment, self-contained, small, refrigerated display cabinets, and small self-contained refrigerated and frozen food serving products.

We note that there does not appear to have been any contact between the DOE Consultants and our manufacturing members. No interviews were conducted; No emails exchanged; No attempts to contact these companies were made. If this had been done, it is more likely that the information in the pTSD would be closer to accurate information, reflective of today's market.

Engineering Analysis

The primary basis for the entire pTSD appears to be the Marketing and Engineering Analysis. The consultants apparently did not consider present-day marketing or engineering of the NAMA products within CRE. While NAMA does not have any substantial data to challenge the classes listed in the pTSD, we do believe that these analyses miss a fundamental set of facts. 1. The changes necessary to adopt the lower GWP refrigerants are being made but have not been fully realized in all models of CRE. We need more time to complete this transition. 2. The analyses seem to negate or not understand the major changes necessary to the machines to utilize these lower GWP refrigerants. 3. Other design changes (i.e., LED lighting) were made 5-10 years ago and are still being reflected as "future" potential design improvements.

Beginning in 2018, NAMA conducted evaluations of changes necessary to CRE to utilize lower GWP refrigerants, particularly hydrocarbon refrigerants such as R-290. This refrigerant is considered a flammable refrigerant under ASHRAE 34 classification A-3. At that time, neither the ASHRAE 15 safety standard nor the UL 60335-2-89 safety standard allowed commercial refrigeration machines to be placed in public spaces using A-3 refrigerants. This represents nearly all placement locations for CRE. Through extensive research and development undertaken by the NAMA CRE manufacturers, it was demonstrated that machines at or under 114 grams of A-3 refrigerant are safe to use in these public spaces. The ASHRAE 15 standard was changed in summer 2020. This represented a significant change to not only the use of CRE but opened the redesign of machines to use an A-3 refrigerant up to and including 114 grams. The use of Low GWP refrigerants has been an environmental goal of NAMA members for many years. It should be noted that at 114 grams of refrigerant, refrigerated, self-contained bottle coolers and display cabinets located in public spaces will still be limited in the size/capacity, and may not allow a larger capacity machine to be constructed and placed on the market. While the UL standard will allow up to 150 grams, the ASHRAE 15 standard limits units to 114 grams to be placed in hallways or lobbies of public buildings. A 114-gram refrigerant charge will allow a significant number of machine models to change. Beginning as early as Quarter 1 2021, CRE with A-3 refrigerants began to appear in the US market. This change involved not only the refrigerant but

the re-design of the evaporator and condenser system, the use of new compressors, expansion valves and other components. Before this time-period and beginning in 2021, manufacturers experimented with lower energy consuming components anticipating this change to refrigerants. In addition, it must be noted that the UL 471/60335-2-89 standards requires, for all A-3 refrigerant machines, the use of several other changes. All switches, all electrical components, motors (including robotic or vend motors), wiring, connectors as well as the larger components such as compressors, must be compliant with "spark-proof" connections to shield against the possibility of a leak of such refrigerant. Neither this level of re-design nor the use of these expensive components was addressed adequately in the pTSD. To comply with health and safety regulations, factories using A-3 refrigerant machines have had to be re-designed with greater ventilation, safety sensors, and other measures. None of these changes appear to have been addressed in the cost of the design options. The pTSD seems to indicate that the change from R-134a/R410a to R-290 is a mere switch on a tank of compressed gas. This is not even close to what must occur on every model, every product line, every QA facility, every factory, every warehouse, and every service center. In addition, only a handful of the thousands of state and local building codes have been updated to install, warehouse, and service units with R-290 refrigerant. There is significant work to be done in finalizing these codes, which is highly unlikely before 2026 implementation. This can cause manufacturers to build two of every model: one with alternate "blend" refrigerants with higher GWP, and models with the R-290 lower GWP refrigerant. DOE does not address this transition in this pTSD.

NAMA members were extremely surprised and disappointed in the accuracy of the design changes, the projected energy efficiency improvements, and especially the cost data on the 12 design options under consideration. It is as if the consultants' tear-down analyses were conducted on machines more than 10 years old. And it seemed that the tear-down analysis was conducted only on very large machines, greater than 50 cubic feet in volume. The design options are not representative of the possible changes, availability, and costs in refrigerated bottle coolers and small self-contained display cabinets. Several of the design options mentioned in the pTSD are not available in the NAMA products produced and/or they are not realistic regarding utility, size, or production.

We will use one example here. DOE cites the change from R-134 to R-290 compressor as if that is the only change necessary. This is not accurate. If the refrigerant is changed to one with a classification of A-3, nearly a dozen components must change. The compressor alone is one element of a complex system. The capital costs associated with setting up a production operation to process R-290 machines is extremely expensive for a machine manufacturer in today's market. An example of this is the test cell which was constructed at DOE's Oak Ridge National Laboratories to study the change to R-290 machines, the production processing area must meet the demanding requirements of the Class 1, Division 2 OSHA standards for safety and capability of ensuring that the assembly area meet the ASHRAE leak standard of <1.5 grams/year in a production environment. The installation and set-up for such an operation may require helium pressure leak stations, specialized spark-proof leak vacuum pumps, a secure contained

refrigeration charge-area with leak detection, alarm systems, automatic exhaust capability, an R-290 safe charging production area, ultrasonic welding, flammable gas leak detection systems, refrigeration discharge, and repair equipment areas. In addition, the machine assembly areas must be outfitted with leak detection devices at strategic locations and separate containment areas with spark-free exhaust fans to dissipate any discharge which may occur. This type of infrastructure could easily cost between $500,000 and $1,000,000 per production line depending on the scale of operation. These costs are spread out among very small production numbers in contrast to large supermarket units. This also applies to service centers and transportation, warehousing operations where machines may be stored or serviced. None of this seems to have been captured in the DOE preliminary Technical Support Document. This is a serious error.

Instead of ignoring this important change, DOE should be championing and celebrating the changes that the industry has been making. DOE should reduce the demands to make additional changes and celebrate that the manufacturers have made changes which will have far more impact on the Administration's climate change initiatives than the design options for energy reduction being shown in the pTSD Engineering Analysis.

Regarding the actual energy savings, once you remove those design options that are technically not feasible, or were accomplished many years ago, the actual savings from the remaining item might, repeat "might," result in a 5-10% reduction from the baseline energy. This is a far distance from the 41% DOE estimated. See Table 5.8.8.

In the opinion of NAMA members this Technical Support Document is systemically flawed and needs to be entirely re-written from the beginning. These categories need to be split up into ranges by size. If the engineering analysis is wrong, then the technology screening is wrong, then the baseline machine design is not correct, then none of the rest of the report can be used. NAMA requests that the consultants begin this process again. Current machines on the market today using low GWP refrigerants and which incorporate most of the design options shown in Table 5.8.10 (and other similar tables) should be used together with CURRENT costs. These should be the baseline machines. Or, if that is not possible, DOE should acknowledge the costs already incurred by manufacturers to meet the goals stated by the Biden Administration to reduce Global Warming. See the analysis performed by NAMA on Table 5.8.10 in Annex A.

The analysis of the environmental impact should also include, particularly in social cost of carbon and other climate change impacts the fact that this industry has spent many millions of dollars converting to lower GWP refrigerant blends or to Hydrocarbon refrigerants such as R-290 which have a much greater direct and immediate impact on climate change than energy savings on a projected 30-year lifespan of machines and the impact of questionable energy efficiency improvements. The pTSD barely addresses this, and this is a serious disappointment to this industry and all that has been done in the last 10 years to improve our environment.

V. Product Classes

The product classes within NAMA's scope that fall within CRE are mostly what are referred to as: Vertical Open/Self Contained/Medium Temperature (38F), Vertical Closed Transparent/Self-Contained/Medium Temperature (38F), Commercial Ice Cream/Horizontal/Self Contained/-10F, Horizontal/Open/Self Contained/Medium Temperature (38F).

While we acknowledge these categories represent a huge spread of product within each class from smaller than 25 cubic foot units to more than 50 cubic foot units, what is applied to the larger units may not be applicable to the smaller units. DOE needs to change its categories and make allowances for the differences in energy efficiency between small and large within the existing categories as well as the cost and cost benefit analysis of the different capacity units. This is especially true when setting the energy efficiency standards.

Between DOE and EPA ENERGY STAR, the US Government has data on shipments with which to modify these percentages according to sales-weighted number. If this were done, we believe effect on the products within the scope of NAMA would be significant.

Proposal: NAMA would like to propose that DOE restructure its categories in the pTSD to be based on the cost of and changes to efficiency of machines in two ranges: Range 1, less than 30 cubic feet and Range 2, 30 feet and over of volume. In this way a more accurate assessment of the energy savings and cost burden may be calculated.

VI. Examples of Energy Efficiency Changes

There seem to be some major difficulties with the AD levels assigned to Vertical, Self-Contained, Transparent Doors, Medium Temperature. There are 12 AD levels. See Annex A.

It may be helpful to review the large inaccuracies in the tables of design options to look at the overall inaccuracy of the pTSD. Since we have the benefit of being able to look back and compare the actual costs and actual energy savings of many of the design options the consultants have included, this additional information might help us to understand why NAMA has raised this issue.

NAMA has reviewed with its members the design options touted in the pTSD, the projected energy efficiency from the pTSD, the actual energy change, the projected cost increases, and the average cost increase over the last 3 years (not including the enormous inflation period of the last 24 months).

NAMA also takes issue with the practice of DOE's consultants not explaining or seemingly not taking into account the enormous capital costs of most of these design options. In times of rising corporate business interest rates, capital improvements in such areas as increased insulation, vacuum panels, increasingly heavier doors, and microchannel coils require hundreds of thousands if not millions of dollars in capital investments. We see no sign that DOE has even

factored these capital-intensive design options into the costs. This is in addition to the millions of dollars our industry is investing to move from high GWP refrigerants to low GWP refrigerants is cumulative burden at its worst case.

Review of Table 5.8.8. This table contains 12 design options related to one category of CRE: Vertical, Closed Door, Transparent Door, Self-Contained Medium Temperature units. These products are ubiquitous in hotel lobbies, convenience stores, airport food courts, and small groceries. It would seem the consultants purposely made it difficult for outside parties to comment on the design options because all we have are very general descriptions such as: "High performance door," "Enhanced UA Evaporator Coil," "LED Lighting." DOE has requested comments on the design options but given the commentors little information on which to base comments.

NAMA has included a very detailed review of each of the Design Options that were considered by the DOE consultants. Please see the Annex A to this letter where NAMA has prepared a more detailed analysis of the design options.

For the design options in Table 5.8.8 for CRE the estimates of energy savings are in many cases very small. Even DOE estimates that the energy savings of Options AD4, 8, 9, 11, 12 and 13 each have improvements of less than 3%. The change suggested by AD4 is completely out of the realm of possibility. We have no knowledge of an improvement to such a door would save 22% of the energy used. Even DOE estimates that AD8, 9, 11, 13 would save a fraction of 1% of the current energy.

Some of these options are extremely expensive. When considered on a $ per kWh basis, the savings potential is extremely expensive for a very small change in energy.

Example: Using true numbers for the cost and the efficiency savings, the cost to implement a VIG Door is $120,000 for every kWh/day saved.

We do not understand why the consultants would still entertain a design option that even using their erroneous numbers for energy and cost, would cost over $49,000 per kWh saved.

From what little information we have, NAMA has projected the actual savings in energy and the more realistic cost of the components. Our chart shows a significant difference to the one projected by the DOE consultants.

Errors in the Design Options

We note the following errors in the pTSD for Design Options

a. High efficiency reciprocating compressor for VCS, SC, M is shown at a cost of $9.23 but for VCT, SC, M it is shown as $4.01.

b. UA Evaporator Coil is shown for VCT, SC, H at $16.01 but for VCT, RC, M is $65.84, for VCS, SC, M is $14.33 and for VCT, SC, M is $22.90

c. Variable Speed Compressor for VCS, SC, M is $72.54, for VCT, SC, M is $79.27 but for VCT, SC, L is $168.34.

d. VIG Door for VCT, SC, M is $837.38 but for VCT, RC, M is projected at $2,095.84

How can DOE justify variations in cost of the same component with little or no technical data with which we can comment?

Design Option	Cost in VCT, SC,M	Cost in VOP/SC/M	Cost in HZO/SC/M	Cost in HCT/SC/M
Brushless DC Cond Fan Motor	$10.26	**$16.01**	**$7.89**	$8.69
Enhanced UA Condenser Coil		**$105.78**	**$42.62**	
Enhanced UA Evap Coil	**$22.90**	**$124.63**	$50.20	
Microchannel	$14.58	**$79.34**	$31.96	**$2.87**
Vacuum Panels	**$77.42**	$74.54	$69.31	**$49.77**
Synchronous Reluctance Cond Fan	$20.41	**$23.70**	$10.27	**$7.90**
Synchronous Reluctance Evap Fan	$15.54	**$20.48**	**$10.17**	
High Performance Door	**$167.63**			**$30.01**

Variable Speed Compressor	$79.27		$100.54	$53.06
VIG Door	$837.38			$153.43

With the inaccuracies stated here and in Annex A, the entire collection of technical support for this rulemaking should be withdrawn and replaced with accurate estimates. And the estimates should be re-calculated for machines under 30 cubic feet capacity.

VII. CRADA with DOE and Oak Ridge National Laboratory

The Department knows of the existence of the CRADA between the NAMA Foundation, the Department and Oak Ridge National Laboratory. There is no mention of this CRADA in the pTSD.

Most of the activities of the 2019-2021 CRADA were directed toward reduction of the risk involved in a possible leak situation if it were ever to occur. ORNL did extensive testing on leak scenarios and proposed new methods to reduce the risk from such a leak in a public space. In nearly all the scenarios tested by ORNL, the use of additional fans to circulate air was required to reduce the mixture of air and refrigerant below the LFL. The energy used by additional ventilation is not accounted for in the pTSD. In fact, as we mentioned above, according to the proposed DOE test procedure, self-contained bottle cooler manufacturers would be penalized to use additional ventilation and thus increase the safety risk.

The COVID 19 Pandemic has caused other difficulties in the CRADA. Out of the 12 items in the original Statement of Work, over half were not attained in the standard two-year period. Therefore, NAMA has requested an extension to the CRADA so that the remaining items, most of which revolve around studying possible energy efficiency gains, can be studied. The lack of the results of this research has put our industry behind the schedule to meet any new energy efficiency requirements from DOE. This is another reason why we ask DOE to delay the further investigation into new DOE minimum energy standards currently. Until we have the critical research from ORNL, we are not able to pursue the R&D on new technologies. [1]

Through the end of the term of this CRADA, DOE will have spent $1,100,000 toward assisting the industry in the changeover to low GWP refrigerants and improving energy efficiency. It seems very strange to us that DOE would not wait until the CRADA is finished and then use this

[1] See CRADA Extension Request Statement of Work, CRADA No. NFE-19-07813

information to decide IF it is necessary to pursue a regulation AND what form that regulation should take.

VIII. Economic Case for New Energy Efficiency Levels

NAMA has conducted an analysis of the present inflation situation regarding cost of components.

We compared the cost increases during the period October 2020 to April 2021 versus October 2021 to April 2022.

NAMA Table 1

Major Components affecting energy	Changes in costs from October 2020 to April 2021	Additional changes in costs from October 2021 to April 2022
Compressors	+5-10%	+15-20%
Evaporator Coils	+10-20%	+10-15%
Condenser Coils	+10-20%	+10-15%
Steel Sheet	+50-80%	+15-25%
Lighting	+5-10%	+15-20%
Payment Systems	+5-10%	+5-10%
Refrigerants	R134 +40-60%	R134 +30-40%, R290 +5-10%
Electrical Wiring (copper)	+30-40%	+50-60%
Electronic controls	+5-10%	+50-75% (components only)
Corrugated	+15-20%	+20-30%
Insulation	+25-30%	+30-35%
Other items not itemized above (i.e., vend motors, vend sensors, displays, plastics, keypads, power cords, power supplies, fuel surcharges, labor)	+15-20%	+40-50%

*The above range is based on averages of the data submitted by NAMA members June 2022.

We believe DOE should factor the unprecedented increase in inflation of basic constituents of the CRE machine and its manufacturing into the costs shown for Design Options and also into the Economic Analysis. From what we can tell, none of this was included in the Economic Analysis from the contractor.

Availability of Components in the Supply Chain

During the last 24 months, our industry, as well as many others, have suffered through shortages in the supply chain of critical parts. We read about the difficulties of acquiring fabricated computer chips, but this also applies to many other components in the electronics, displays and electrical area. This has caused major problems for many of our industry members.

While the current DOE Economic Analysis does not factor this into the calculations, it should be noted that lack of availability causes many disruptions to the businesses. It is one thing to make a chart of all the design options, and another to shift production to entirely new suppliers. We believe DOE should consider the impact of these supply chain issues as part of the impact of new energy efficiency standards levels.

For example, Fan Motors suitable for R-290 applications are still subject to supply chain disruptions or are unavailable.

The lack of availability of components translates to manufacturers rapidly changing parts, increasing complexity of the design, and jeopardizes the lifespan of the machines. NAMA members have a long and great reputation for producing machines that can stay in service, with minimal service, for approximately 10 years in a very hard use environment of small business retail stores. For DOE to increase this complexity by forcing manufacturers to again make changes based on perceived energy efficiency is not helping the customer.

Labor

As we indicated above, the cost of labor is part of the overall significant increases in business expense that are causing deep issues for this industry. This is part of the overall Economic Impact Analysis, but we are asking that DOE and its contractors use real cases from 2021 and 2022, not the cost of labor in 2018.

In addition, shortages in labor mean that many companies have had to pay overtime or additional benefits, all of which contribute to increased costs.

While we acknowledge that this may be a point in time challenge, it is reality today and needs to be considered. It is highly unlikely that the labor rates of 2022 will ever be reduced to 2020 levels. Thus, this is the "new normal" and must be reflected in any cost analysis.

IX. Lessening of Utility and Performance

A. Capacity

Several of the design options shown in the pTSD may have an impact on the overall machine capacity. Any design option that requires more space inside the machine must reflect the reduction of overall capacity. The space inside the CRE is not infinite or elastic. Larger condensers or evaporators, more insulation, changes to type of glass resulting in new structural components all reflect on the overall capacity. The external dimensions of a CRE appliance are limited by height of the building structure in break rooms or built-in areas. The width and length are limited by the footprint of the machine and integration with other machines (i.e., snack machines) to which CRE are paired. DOE and its contractor do not discuss the resultant change in Utility or Performance in this pTSD document. It is a huge factor. The best example of this is the Design Option to add ½ inch of insultation to each of the product classes. This will result in smaller capacity, longer times for consumers to keep the doors open, and more frequent re-stocking. It makes it more difficult for business owners to operate the equipment. Most of all, it causes a major utility issue for the manufacturers.

B. Performance of the CRE

The overall performance of the appliance is critical to the manufacturer and to the companies that specify these elements. The difference of 1 degree C is critical to the overall performance. This is especially, but not only, reflected in CRE that are used for perishable food items, prepared food, and beverages (i.e., juice). The specifications are dictated by the purchaser or the brand owner of the equipment as well as consumer preference. Consumers do not want "warm" beverages. These criteria are often *not* open to the CRE appliance manufacturer to set. They are reflected in such areas as: the holding temperature, the time to reduce temperatures (i.e., "pull down time"), the drift in temperature, and the ability of the machine to recover from power outage or changes in the environmental conditions.

In this pTSD, DOE has suggested several Design Options that can affect the overall performance of the machine. We use here examples of lower wattage refrigeration systems, vacuum panel insulation, different evaporators or condensers, and lower wattage fan motors. We request that these be reviewed not only for their energy efficiency but also the ability to maintain the critical design features and performance of these machines. Currently, the pTSD does not address this.

X. Marketing Forecast—Refurbished Machines

NAMA does not have data on the balance between sale of new machines versus the refurbishment of older CRE appliances. However, we suggest that DOE needs to develop a model to show the impact of increasing the retail price of a new CRE, on the delay in purchase and the possible purchase of refurbished machines. DOE needs to estimate the numbers of refurbished machines which increase energy to those that put a machine back into service with the same energy profile.

Because of safety certifications, very few of the refurbishment of machines change or update the refrigeration system.[2] Refurbishing often involves swapping out lighting, door hinges, ventilation fans, or racks. Therefore, a refurbished machine uses roughly the same energy as its original platform. We also know that a practice called "re-skinning" includes changing out the sheet metal panels on a piece of equipment as well as the front panels to give the unit a "new" look. Not only does this give the CRE unit a longer life, but it means that a new unit with improved energy efficiency is not sold into the market. Thus, the DOE model of models in the field is not indicative of the energy used.

While refurbished machines offer an alternative to the customer, any sale of a refurbished machine reduces the sale of a new machine designed to the new energy standards. The estimated change-over of the stock is increased in time and the change in time that the overall impact on the net change to energy of the US by commercial refrigeration machines would occur. The current DOE model which ignores refurbished machines is inaccurate. The current DOE model assumes all models entering the market are built to the 2027 DOE standards. The model needs to include refurbished machines as a significant portion of the "sales" of CRE, and thus reduce the overall National Energy Savings accordingly.

ES.4.6 Market Efficiency Distributions

NAMA also reminds DOE that that the market dynamic is currently distorted due to the pandemic, and the lack of available equipment. As such, efficiency is a secondary priority to availability, and is weighted less heavily than in the past.

XI. Overlapping Comments

DOE has requested comments from all parties to the CRE test procedure at the same time as comments to the NOPR on the future standards levels. In addition, DOE began the rulemaking

[2] The NRTL conformity assessment bodies in the United States have very strict rules about "refurbishing." If the products electrical components or refrigeration deck are changed, this must be done in a safety certification organization-approved facility. However, if the refurbishing company only makes "cosmetic" changes, this may allow the company to avoid costly re-certification. Nevertheless, if these "cosmetically-improved" units are sold back into the market they can either delay the replacement cycle or they can reduce the number of new units sold, which would need to meet the DOE regulations.

for CRE right in the middle of actions being taken on Beverage Vending Machines, which affects the same manufacturers. This is not only unfortunate, but also adds considerable complexity to the responses.

Currently we don't know what the final test procedure will be for CRE. Therefore, setting future standards levels without a final test procedure is illogical. Therefore, most of the manufacturing groups (and even some of the energy efficiency advocacy groups) have historically commented that DOE should finish the test procedure before they start the rulemaking process on the DOE standards levels. Therefore, the Process Rule requires DOE to finish the test procedure before engaging in cost and energy calculations of a new standard level. Otherwise, we are calculating future energy savings before we know what the current machine energy use is from a new test procedure.

Particularly, in the case of this rulemaking the separation of low, medium, and high temperature self-contained CRE equipment is critical to the proper estimates of energy efficiency and cost. DOE should cease the rulemaking on this category of CRE equipment until after the BVM rulemaking is in Final Rule stage and until the test procedure for CRE equipment is finalized.

XII. Cumulative Regulatory Burden—Included in Regulatory Impact Analysis Section ES 4.23 of the TSD

Cumulative Regulatory Burden Is Significant

A complete analysis of cumulative regulatory burden must consider the number of products the regulated manufacturers make, in addition to the one being regulated in a particular rule that are subject to proposals to amend standards or to promulgate standards for the first time. Manufacturers of Commercial Refrigeration Equipment (CRE) must comply with regulations from States, such as California, Oregon, Washington, and several other states which have changed the regulations on the retirement of HFC refrigerants. Manufacturers must also comply with the regulations from US EPA on Ozone Depleting Chemicals, and with new OSHA regulations on workplace safety because of the COVID 19 Pandemic. DOE should not discount the time and resources needed to evaluate and respond to all proposed test procedures and energy conservation standards for multiple products proposed over a short period, as is currently the case. When these rulemakings occur simultaneously, as they are now, and have in the past, the cumulative burden increases dramatically.

Manufacturers of CRE are in the middle of transition from HFC refrigerants to newer, lower GWP refrigerants. This transition must take place across multiple platforms using considerably different components. With a small staff in many of these companies as well as supply chain issues, any additional requirements from DOE would increase the time of full transition, which NAMA believes to be far more impactful to the environment than the implementation of new energy efficiency requirements shown in this rulemaking pTSD.

In addition, the six-year "lock-in" provision in the statutory structure is designed to give manufacturers time to generate sufficient cash flow to recoup any necessary investments and financial costs/returns. See 42 U.S.C. § 6295(m)(4)(B).

When there are multiple regulations on the same product within the six-year lock-in period (such as refrigerant transition and a completely new test procedure on new energy efficiency regulations), the second regulation violates the recoupment assumption inherent in the first one. The existing Government Regulatory Impact Analysis Model (GRIM) does not consider this situation. In fact, the GRIM produces an increase in value from the early write-off of any past investment. The GRIM accelerates depreciation (a non-cash item) due to the early write-off of past investment, lowering tax cash costs. This is a known weakness in the GRIM that was somewhat conceptually difficult to resolve in the earliest versions. Moreover, the spreadsheet technology generally available at that time did not support this type of branching analysis.

The simplest way to resolve this is to do a consolidated analysis for multiple regulations starting from the time of the first regulation. DOE has noted that such an analysis would require counting both the costs/investments and revenues/profits for both products. This is correct and is a feature, not a deficiency. DOE should be analyzing and assessing the change in combined industry value for these products, or for the same product multiple times. Alternatively, if this is not possible, then DOE should incorporate a value reduction factor in the first post-regulation year of the analysis that subtracts the value lost from the remaining years of the previous regulation.

NAMA urges DOE to incorporate the financial results of the current Cumulative Regulatory Burden analysis directly into the Manufacturer Impact Analysis (MIA). This can be done by adding the combined costs of complying with multiple regulations into the Product Conversion Costs in the GRIM model. An appropriate approach would be to include the costs to manufacturers of responding to and monitoring regulations.

Regarding this rulemaking specifically, there are several ongoing regulations that impact commercial refrigeration equipment. Many of these are related to the environmental changes associated with changes to a lower GWP refrigerant, but also include the radical changes to the design of the product to comply with the safety standards in the United States. But this also includes the most recent changes to the DOE standards levels effective 1 January 2019.

As mentioned before, the changes necessary to the state and local building codes are a regulatory burden that needs to be factored into the DOE pTSD. So far, there is no mention of this.

DOE relies now more and more on the environmental improvements and the environmental impact of energy efficiency regulations. However, the enormous changes required by the EPA Clean Air Act and the California Air Resources Board (and other states) regulations to require lower GWP refrigerants have all occurred in the same time frame. In the future, NAMA is

requesting that DOE stage its energy efficiency regulations at least 3, and preferably 5, years away from other significant overlapping governmental body regulations.

Conclusion

In summary, NAMA believes that this pTSD and documents prepared for this rulemaking do not reflect the state of the industry in 2022 nor the projections for products manufactured after this rule becomes effective. We are respectfully requesting that DOE and its contractors conduct a complete revision of all possible energy efficiency changes, the base case, the standards cases, and the economic analysis after the test procedure final standard is issued and after the CRADA is finished.

NAMA believes that once the accurate information is presented, it will show that a new set of standards levels for those classes of CRE equipment covered by NAMA is unwarranted. The alternative would be to not change the DOE Minimum Energy Levels for the equipment mentioned above. When using correct data, the payback analysis will show that the purchasers and installers of machines under such a set of new requirements will take more than 10 and possibly more than 30 years to ever realize any economic gains from such regulations. In addition, many environmental gains will already be realized by the time the new regulations become effective. When the Net Present Value is re-calculated using accurate numbers, the payback period will grow significantly.

In addition, now is not the time for such onerous regulations. At the very least, we should wait until the CRADA extension is completed. More appropriately, we should wait until this period of hyper-inflation has drawn to a close. And we should allow manufacturers to complete the change to hydrocarbon refrigerants, which will have up to 10 times the environmental impact of any DOE new standards.

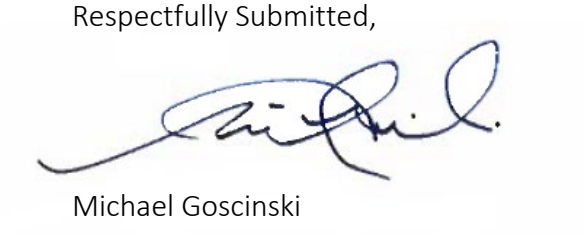
NAMA and its industry members are willing to work with the U.S. Department of Energy, Energy Efficiency and Renewable Energy section. However, the use of inaccurate information makes it difficult to work together on new energy efficiency changes which both harm our industry, provide no real benefit to the purchasers of the machines, and provide no energy improvement to the American consumer. NAMA members are well on their way to implementing new environmental regulations voluntarily. To require manufacturers to re-design machines based on a flawed set of analyses will only take away from the main gain, which will come through encouraging manufacturing to implement the change to hydrocarbon refrigerants more rapidly, and not through spending money on upgrading CRE to energy regulations that have no value.

“Under EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified.” In our opinion, the preliminary Technical Support Document presented with this NOPR does neither.

NAMA appreciates the opportunity to submit these comments on DOE's Notice of Proposed Rulemaking on Commercial Refrigeration Equipment and would be glad to discuss these matters in more detail should you so request.

An Annex to this filing is attached with detailed answers to the specific questions asked in the pTSD.

Respectfully Submitted,



Michael Goscinski
Senior Director, External Affairs

Cc: Ms. Kristin Koernig, U.S. Department of Energy, Office of the General Counsel
Prianka Sharma, Small Business Administration Office of Advocacy

Annex A to NAMA Presentation on Commercial Refrigeration Equipment

Details on Design Options

We used Table 5.8.8 for VCT, SC, M Category as it represents the largest share of products within NAMA scope.

DOE and its contractors have given us 12 Design Options:

AD2 High Efficiency Reciprocating Compressor[3]

AD3 Brushless DC Condenser Fan Motor

AD4 High Performance Door[4]

AD5 UA Evaporator Coil[5]

AD6 Add ½ inch additional insulation

AD7 LED Lighting with Occupancy Sensors[6]

AD8 Synchronous Reluctance Evaporator Fan Motor

AD9 Microchannel Condenser[7]

AD10 Variable Speed Compressor

AD11 Synchronous Reluctance Condenser Fan Motor

AD12 Vacuum Insulated Panels[8]

AD13 VIG Door[9]

Approximately seven (7) of these design options are vague and undefined*. It is very difficult for anyone to return information to DOE on these design options when all we have are general words and no examples or technical descriptions. Five (5) of these design options are not available for machines with R-290 as a refrigerant or not available for machines <30 cubic feet.

[3] There is no information in the TSD as to what is a "high efficiency reciprocating compressor." The term is undefined making it very difficult to comment on efficiency gains or cost.
[4] Ibid It is not clear what "high performance door" is and how that is different from VIG door

[5] Ibid It is unclear what is meant by UA Evaporator Coil
[6] Ibid Nearly every VCT, SC, M unit includes LED Lighting, but no information presented on what is an occupancy sensor and how that would operate in a bottle cooler
[7] Ibid No information as to what is meant by "microchannel condenser"
[8] Ibid No information presented on what constitutes a" Vacuum Insulated Panel"
[9] Ibid Very little information on VIG door and how that is different from high performance door

Three (3) of these design options were implemented many years ago. Three (3) of these options were implemented but do not show energy savings even close to what DOE projects.

In many of these new Design Options, DOE has projected an Engineering cost of several hundred thousand dollars. This is not realistic in today's labor and engineering environment. The actual cost is several times more. Just one example: DOE included the Design Option of adding ½ inch of insulation but the tooling cost of reconfiguring the entire inner liner of the cooler can run more than $1 million. This was not included. In addition, DOE estimates "one month of testing" in some cases. The testing and certification time is more than one year. Testing at an independent laboratory, which is necessary to make energy claim statements, is at least 6 months.

It also appears that the DOE costs do not include a fully burdened amortized cost of engineering, design, creation of test models, testing, tooling, factory assembly line upgrades, fixtures, molding changes and other costs. None of these estimates seem to include changes to packaging for larger and heavier machines.

Estimated Energy Savings

NAMA Table 2—DOE Information on Energy Savings—VCT, SC, M

DOE Information on Table 5.8.8				
	Design Options	DOE Estimate of Energy Use kWh/day	DOE Estimate of Savings kWh/day	DOE Est of Savings by %
AD1	Baseline	5.76*		
AD2	High Efficiency Reciprocating Compressor	5.552	0.208	3.61%
AD3	Brushless DC Condenser Fan	5.287	0.265	4.60%
AD4	High Performance Door	4.017	1.270	22.05%

AD5	UA Evaporator Coil	3.897	0.120	2.08%
AD6	Add ½ in insulation	3.59	0.307	5.33%
AD7	LED Lighting with occupational sensors	3.239	0.351	6.09%
AD8	Synchronous Reluctance Evap Fan Motor	3.193	0.046	0.80%
AD9	Microchannel	3.155	0.038	0.66%
AD10	Variable Speed Compressor	2.978	0.177	3.07%
AD11	Synchronous Reluctance Cond Fan Motor	2.938	0.040	0.69%
AD12	Vacuum Insulated Panels	2.841	0.097	1.68%
AD13	VIG Door	2.824	0.017	0.3%
Total			2.936	

- * For a bottle cooler VCT, SC under 30 cubic feet the estimate of 5.76 kWh/day is wrong. A scan of CCMS would show this.

NAMA Table 3

NAMA's corrected assessment and information on energy savings—VCT, SC, M

NAMA Information on Table 5.8.8		DOE Est of Savings kWh/day	NAMA Est of Savings kWh/day	Actual % improvement	Comments	Issues
AD1	Baseline	5.76	Significantly under 5.76 kWh/day baseline for <30 ft3			
AD2	High Eff Recip Compressor	0.208	0.00	0%	Implemented years ago. Should not be used for TSD.	Comes with R-290
AD3	Brushless DC Condenser Fan Motor	0.265	0.16	2-2.5%	Implemented years ago	Should not be used for TSD
AD4	High Perf Door	1.270	0.3-0.6	~10%, however less in reality	Already use improved door. Unknown what high perf is	More glass causes structural issues, increases weight
AD5	UA Evap Coil	0.120	~0.04	<1%	Unknown what this is	Not applicable and not available
AD6	Add ½ in Insulation	0.307	0.2	2-3%	Very high capital cost and reduces	

					capacity/utility	
AD7	LED Lighting with Occ Sensor	0.351	0.05-0.07	2-3%	Implemented without sensor.	Sensor not applicable
AD8	Synch Reluc Evap Fan Motor	0.046	Unknown savings since not available	??	Not suitable for this application	Not available
AD9	Microchannel	0.038	Some narrowing of tubes est 0.01	~1% improvement	Not suitable for application. Experiments have shown pin-hole leaks. POTENTIAL SAFETY ISSUE.	Causes blockages. Can use more energy
AD10	Variable Speed Compressor	0.177	0.1	1-1.5%	Available in small quantities for R-290. Costs exceedingly high. Does not substantially improve energy efficiency in this size product.	Requires additional electronic components to operate—not included in DOE estimate.
AD11	Synch Reluc Cond Fan Motor	0.04	Unknown savings	??	Not suitable for this application	Not available

			since not available			
AD12	Vacuum Insul Panels	0.097	Not available	??	Not feasible in <30ft3 units	Very high cap cost
AD13	VIG Door	0.017	0.01	0.5% with any improvement in door insulation	Unknown what this means	Unavailable. Causes Structural Issues
Total		2.936	0.87			

Comments on the Design Options for Improvements to Energy Efficiency

AD2 High Efficiency Reciprocating Compressor

As we have said several times, the change to just the compressor alone is not the complete picture. The energy savings from a "future" change to a reciprocating compressor would net no additional savings as nearly all manufacturers changed from low efficiency compressors when they transitioned or are changing to high efficiency compressors while making the transition to R-290 refrigerant.

We have not shown an energy savings as this change comes with several others in combination and it is difficult to show the individual savings.

AD3 Brushless DC Condenser Fan Motors

This change was also made several years ago. We do not see additional savings from the fan motors which are available for these machines. The amount of savings for this change WAS in the vicinity of 0.16 kWh/day or 2 to 2.5% improvement when it was introduced several years ago.

AD4 High Performance Door

It is nearly impossible to discern what is meant by "high performance" door. The TSD contains no information. The manufacturers have in many cases improved the energy performance of the

door, using insulation, low-e glass, and multiple panes. As we have consistently mentioned, additional panes of glass pose major problems. The more glass you add, the heavier the door becomes. It becomes potentially unstable when the owner of the establishment does not safely install the door according to instructions. In addition, the manufacturer must re-design the entire frame of the appliance to support the weight and moment of the force. Heavier weight then adds problems for shipping and increases cost for shipment, which comes in increased gasoline or diesel fuel. What DOE is advocating may save in one place and increase CO2 emissions in another.

DOE projected savings of 1.270 kWh/day. This is unrealistic and savings might be in the range of 0.3 to 0.6 kWh/day. The DOE estimated savings is off by a factor of 4.

AD5 Enhanced UA Evaporator Coil

Again, we do not know what this is. The pTSD does not describe this design option with specific information making it very difficult to prepare a response.

This seems to be indicating a different evaporator coil design. This is another case where we question if the consultants really understand the design of a refrigerated beverage cooler. Any increase in fin density may necessitate increase fan motor power required and increase the energy consumption. In addition, increasing fan pitch causes less airflow to pass through the evaporator and leads to ice formation. This increases energy used, not decreases. The current designs are optimized based on cost vs. energy efficiency. Changes in the evaporator coil necessitate increased capital costs.

In addition, if you change the evaporator coils, the manufacturer will need to re-balance the system, which could require larger charge or compressor. This could use more energy, not less.

DOE seems to estimate that this will save 2.08% energy. Our review of design option indicates that this would improve energy by approximately 0.04% DOE has overstated the energy savings by a factor of 52 times

AD6 Add ½ inch of insulation

Again, we have no information what "add ½ inch" of insulation means. Does this refer to the ceiling of the compartment, walls, or floor? DOE's description in Section 5.5.1 refers to embedding vacuum panel in the walls and then using spray foam around the panel. We know of no reliable studies that have shown this technique will work and will in fact save energy. Vacuum panels have shown to be very unreliable in many applications. They leak and ultimately lose their R value over time. Our members have studied vacuum panels and where possible may use small panels.

The fact that DOE has divided this design option from Design Option 10 on something called "VIG Door", we can only speculate that this is a limited option that involves a more insulation.

Extra insulation has a direct impact on wall thickness and therefore on the physical size of the machine and internal volume. Internal volume must be maximized to optimize product storage capacity. External dimensions are constrained by standard sizes for machine placement. For example, machines must maintain a height of no more than 72 inches. Many areas have specialized soffits and headers that are physically designed as part of the installation. Placement of CRE is constrained by the banks of machines in a break room area. Additional insulation has a direct impact on machine cost that cannot be recovered from the market. Even an additional ½ would influence the footprint of the machine and/or the capacity. The manufacturing cost shown may be the cost of purchasing the foam material. However, the cost to redesign the basic internal shell of the machine and fixtures may require an investment of more than $1 million. This fully burdened and amortized cost is not reflected in the estimates shown.

Extra insulation, whatever this is referring to, means a likely immediate impact on the Utility (capacity) of the machine. Increasing insulation has already been designed into CRE more than 15 years ago and the only way to do an additional increase as mentioned in this design option would be to reduce the food capacity.

DOE seems to estimate that this will save 5.33% energy or reduce energy consumption by 0.307 kWh/day. Our review of design option indicates that this is overstated and any increase possible in insulation might save 0.2 kWh/day.

AD7 LED Lighting with Occupancy Sensors

Again, very little information is given about the type and construction of such "occupancy sensors." LED lighting was implemented many years ago. Thus, any further reductions would more likely be in the control mechanism used to regulate the timing of such "occupancy sensors." These sensors are not preferred by most customers. Consumers want to walk quickly to a convenience store cooler, select their food item, withdraw it, and pay. The time delay to implement occupancy sensors can cause consumers to think something is wrong with the equipment. Design options that interfere with the normal function of the product, or reduce sales, may cause the storeowner to by-pass this function. We do not want to encourage aftermarket changes to the operation of the equipment.

AD8 Synchronous Reluctance Evaporator Fan Motor

This technology is new and in concept only for bottle coolers. It has not been proven to withstand the climate, environment, and lifespan of a bottle cooler. So far, samples of this type of evaporator fan motor are not available in the sizes for refrigerated bottle/food coolers.

Particularly and most important, we are not aware that such a motor is available in a "spark-proof" configuration which is critical for use with a R-290 propane bottle cooler.

The discussion of this design option demonstrates the lack of knowledge about the status of industry machines and the changes occurring. In the discussion of TSD Item 5.5.6, DOE discusses the use of ECM and PSC motors as if they are the same today as in the tear-down analysis of the 2014 rulemaking. This is not true. Considerable advancement in the design of ECM and PSC motors have been made. In fact, most of the manufacturers changing to R-290 have already incorporated ECM motors into their machines. These motors are available in a "spark proof" configuration for R-290 refrigerant.

In addition, current designs of PSC motors are much more energy efficient than they were 5 or 10 years ago and approximate the energy use of an ECM motor. Thus, the energy savings DOE displays in the pTSD are overstated.

None of our manufacturers have seen examples of Synchronous Reluctance Motors which are found in the range of the Table 5.5.12 indicating 66% efficiency. When placed in an evaporator or condenser, the advertised efficiency of ECM and new generation PSC motors were significantly greater than what our companies have found to be the case with these SRFMs.

DOE estimated a change in energy use from 3.239 to 3.193 kWh/day, or 0.046 kWh. This represents 0.8% of the inflated DOE estimate of Baseline of 5.76. Since even samples of this type of motor are not available, it is impossible for our engineers to evaluate the real energy savings.

AD9 Microchannel

The vaguely used term of "microchannels" in design of the condenser and evaporator area are in early stages of concept in NAMA sizes of CRE. Some slight reduction of the tube diameter may be more likely but extremely small tube diameters can often increase pressures in the system. The true microchannel designs are prone to significant clogging. They have been shown to exhibit pin-hole size leaks and thus are not advisable with a flammable refrigerant. Many appliance manufacturers tried this approach in the early 2000s and have since moved away from this in non-air conditioning applications. Many of the tube manufacturers simply do not supply these designs at this time and there are no plans to do so.

DOE's own estimate is to change the kWh per day from 3.193 to 3.155. This is a change of 0.038 kWh/day. This represents about ½ of 1% of the energy used by the machine, and that is using DOE's inflated Baseline of 5.76 kWh/day.

AD10 Variable Speed Compressor

Variable Speed Compressors are available but in very small quantities, on only certain models for use in R-290 compatible configurations and the cost is extremely high. VSC have an impact on the energy use but mostly in units with changing loads. This is not the type of product within the 4 classes mentioned above. Our experience in non-R290 applications is that the energy savings is not as shown in the pTSD at 0.177 kWh/day but rather closer to 0.1 kWh/day in the configurations required for Bottle Coolers.

NAMA advises DOE that VSC doesn't contribute significantly to energy savings and presents additional technical challenges for servicers.

DOE estimated that the energy use would change from 3.155 to 2.978 kWh/day, a change of 0.177 kWh/day, which represents about 3.07% of the total energy if we were to use the inflated Baseline of 5.76 kWh/day. Using the correct estimate of about ½ of the DOE estimate of 5.76 kWh/day total, this represents an improvement of about 1.5% of the actual total use per day where we can use them.

AD11 Synchronous Reluctance Condenser Fan Motor

This technology is new and in concept for bottle coolers. It has not been proven to withstand the climate, environment, and lifespan of a bottle cooler. So far, samples of this type of condenser fan motor are not available in the sizes for refrigerated bottle and food coolers. Particularly and most importantly, we are not aware that such a motor is available in a "spark-proof" configuration which is critical for use with a R-290 propane bottle cooler.

The discussion of this design option demonstrates the lack of knowledge about the status of industry machines and the changes occurring. In the discussion of pTSD Item 5.5.6, DOE discusses the use of ECM and PSC motors as if they are the same today as in the tear-down analysis of the 2014 rulemaking. This is not true. Considerable advancement in the design of ECM and PSC motors have been made. In fact, most of the manufacturers changing to R-290 have already incorporated ECM motors into their machines. These motors are available in a "spark proof" configuration for R-290 refrigerant.

In addition, current designs of PSC motors are much more energy efficient than they were 5 or 10 years ago and approximate the energy use of an ECM motor. Thus, the energy savings DOE displays in the pTSD are negligible.

None of our manufacturers have seen examples of Synchronous Reluctance Motors which are found in the range of the Table 5.5.12 indicating 66% efficiency. When placed in an evaporator or condenser, the advertised efficiency of ECM and new generation PSC motors were significantly greater than what our companies have found to be the case with these SRFMs.

DOE estimated a change in energy use from 2.978 to 2.938 kWh/day, or 0.040 kWh. This represents 0.69% of the inflated DOE estimate of Baseline of 5.76. Since even samples of this type of motor are not available, it is impossible for our engineers to evaluate the real energy savings.

AD12 Vacuum Insulated Panels

One of the known characteristics of Vacuum Insulated Panels is that they do not retain their insultation properties over life. In many cases, they lose R value over time as the seal degrades. We recognize that DOE mandates testing in "new" condition, but it would seem to be false promises to require a design option where we know that they do not maintain their properties over life.

DOE and its contractors have been discussing vacuum panels for nearly all refrigeration appliances since the first DOE rulemaking discussion with the passage of the Energy Policy Conservation Act. The idea of vacuum panels holds some interest and have been studied extensively, in extremely high-volume production (i.e., household refrigeration). In lower volume manufacturing, with multiple variations of size and features and designs as shown in the CRE industry for small bottle coolers, vacuum panels are not feasible as a design option.

Vacuum panels are very costly as a part but even more so in tooling costs spread over very small volumes. Note, each panel would be designed for one bottle cooler. Current studies in the CRE industry show a possible energy savings of 2-2.5% but with cost estimates far more than $100 without considering tooling and restructuring of manufacturing. Vacuum panels are shown to be very inflexible in the overall engineering/design/manufacturing of the appliance. Once the vacuum panel is designed and built to a specific set of dimensions, manufacturers cannot adapt the machine design to other changes, such as changes from beverage cans/bottles to food items. In addition, when the vacuum panel is designed for one shape/size a completely different set of tooling is necessary for other size appliances. In these products new fixtures and molds would need to be designed to properly distribute foam insulation around the panel so as to not have voids.

DOE has estimated the energy change from implementing vacuum insulated panels would move from 2.938 to 2.841 kWh/day, a change of 0.097 kWh/day. This represents a change of 1.68% at a highly inflated amount of 5.76 kWh Baseline. The problem is that vacuum insulated panels are not available in the form required for smaller bottle coolers. We will discuss the cost issue later.

AD13 Using a Vacuum Insulated Glass (VIG) Door

Multiple layers of insulated glass are a design option which is under consideration by DOE. However, the cost estimates our industry has seen are 3 to 4 times the cost of vacuum glass

mentioned in the pTSD, and the efficiency improvements are less than 0.3% gain in energy use. See comments on Design Option #4 on High Performance Door above.

As we mentioned above in item 4, the discussion used in the pTSD for Section 5.5.3 is very confusing. There is very little difference other than the vacuum draw of the door glass to equate the energy efficiency. We note that DOE's estimate of the energy savings of this design option is an improvement of approximately 0.017 kWh per day, or less than 1% of the overall energy usage.

Additional Design Option:

(The following design option is discussed but does not have a number assigned.)

1. ADX. Change from HFC blends or A2L refrigerants to A3 refrigerants

In Section 5.5.4.2 of the pTSD, DOE discusses the use of propane compressors as if this is the only component that needs to change in a refrigerated food/beverage storage appliance using R-290. This is false. The written text states that DOE has considered a transition to propane compressors a design option. However, in the Section on Vertical, Transparent, Self-Contained units with Medium Temperature, there is no mention of the change to R-290 Propane.

Our industry has made significant strides in a change to R-290 as a refrigerant. This was not without considerable effort to the external safety requirements (see discussion above on the changes to the safety standards of ASHRAE 15 and UL) but also and internally with the changeover of designs, factories, service locations, training, and transportation. Section 5.5.4.2 treats this change as a "flip the switch" change and does not seem to understand that changing the use of R-290 involves the radical change and development of new switches, motors, lighting, and power supplies.

In Table 5.8.10, DOE and its consultants seem to gloss-over the change to R-290 whereas our industry has invested hundreds of millions of dollars in research, development, factory changes and others to utilize R-290. DOE gives no credit to the change and instead seems to have no appreciation for the investment necessary to make this change.

For those models of Vertical, Transparent, Self-Contained, Medium Temperature as well as several types of small Horizontal, Transparent, Self-contained, Medium and High Temperature units, the industry has invested in the change to R-290. All of these units are utilizing less than 150 grams of R-290 in compliance with UL 471/UL 60335-2-89 but also must be less than 114 grams to be in compliance with ASHRAE 15 if placed in a public area.

Cost of DOE's Design Options

NAMA Table 4—Using DOE Estimates of Cost and Energy Savings—VCT, SC, M

Table 5.8.8					
	Design Options	DOE Estimate of Cost ($)	DOE Estimate of Cost Increase ($)	DOE Est of Cost Increase by %	DOE Est of Cost per kWh saved
AD1	Baseline	$1637.05			
AD2	High Efficiency Reciprocating Compressor	$1641.06	$4.01	0.245%	$19.27
AD3	Brushless DC Condenser Fan	$1651.32	$10.26	0.6267%	$38.71
AD4	High Performance Door	$1818.95	$167.63	10.2398%	$131.99
AD5	UA Evaporator Coil	$1841.85	$22.90	1.3989%	$190.83
AD6	Add ½ in insulation	$1880.57	$38.72	2.3652%	$126.12
AD7	LED Lighting with occupational sensors	$1981.21	$100.64	6.1476%	$286.72
AD8	Synchronous Reluctance Evap Fan Motor	$1996.75	$15.54	0.9493%	$337.82
AD9	Microchannel	$2011.33	$14.58	0.8906%	$383.68
AD10	Variable Speed Compressor	$2090.60	$79.27	4.8422%	$447.85

AD11	Synchronous Reluctance Cond Fan Motor	$2111.01	$20.41	1.2468%	$510.25
AD12	Vacuum Insulated Panels	$2188.43	$77.42	4.7292%	$798.14
AD13	VIG Door	$3025.81	$837.38	51.1518%	$49,256.65
Total			$1388.76		

We believe the Baseline cost of $1637.05 is based on a 67 cubic foot machine with more than 1 door. This is not the Bottle Cooler produced by NAMA members. As we have detailed before this machine is roughly twice the size of the machines from NAMA members. Thus, the cost in this analysis is erroneous.

However, even if we used the DOE estimates, this is to say that anything beyond Design Option 2 would cost a customer more than $100 for each kWh saved per day.

We are presenting our cost estimates on the Design Options

NAMA Table 5 VCT, SC, M—Using NAMA Cost and Energy Savings Information

DOE & NAMA Information on Table 5.8.8				
	Design Options	DOE Estimate of Cost Increase ($)	NAMA Estimate of Cost Increase $	NAMA est cost per kWh saved
AD1	Baseline			
AD2	High Efficiency Reciprocating Compressor	$4.01	>$50	$5900.00

AD3	Brushless DC Condenser Fan	$10.26	>$20	$187.50
AD4	High Performance Door	$167.63	>175	$400.00
AD5	UA Evaporator Coil	$22.90	Not applicable	Not applicable
AD6	Add ½ in insulation	$38.72	>$200	$1250.00
AD7	LED Lighting with occupational sensors	$100.64	>$125	$2500.00
AD8	Synchronous Reluctance Evap Fan Motor	$15.54	Not available	Not available
AD9	Microchannel	$14.58	>$100	$15,000.00
AD10	Variable Speed Compressor	$79.27	>$200	$2,500.00
AD11	Synchronous Reluctance Cond Fan Motor	$20.41	Not available	Not applicable
AD12	Vacuum Insulated Panels	$77.42	>$125	$ not available
AD13	VIG Door	$837.38	>$1000	$120,000.00
Total				

Cost Information by Design Option

AD2—High Efficiency Reciprocating Compressor

It is again difficult to understand what "high efficiency" means. However, as we have said before, any change to any compressor must be with the understanding that such compressors are available for use with R-290 refrigerant and are compatible with other components.

Our understanding of a "high efficiency" reciprocating compressor is that with the cost of the component, changing other components to be compatible, and the cost of engineering, design, and testing would push the cost to more than $50.

Initial reports indicate that the amount of actual energy savings is very small. Thus, the true cost of making this change results in a cost of over $5,000 for each kWh/day saved.

AD3—Brushless DC Condenser Fan Motor

As we have pointed out, manufacturers changed to brushless designs for fan motors when they elected to use R-290 as a refrigerant. The savings is thus negligible. However, this was a very expensive change. These motors are over $20 more than previous motors and do not save much energy. As we mentioned above, our experience having implemented this motor are that the savings might approximate 0.16 kWh/day.

AD4—High Performance Door

We will not repeat our previous comments about the vague descriptors. However, our companies have continued to make improvements to the transparent doors. Any further change would be very costly. This type of improvement described in rough terms by DOE and its consultants would substantially increase the weight of the door. This means that the moment of force of the open-door changes. Manufacturers would need to increase hinges, locks, and the basic frame of the appliance. DOE's estimate of $167 increase in cost is in the region but low. And the savings of energy is 0.3-0.6 kWh/day. This means that the cost of such a design change is likely above $400 for each kWh/day.

AD5—UA Evaporator Coil

As we have mentioned, any change to the evaporator coil is problematic. Changes to fin and tube construction can cause buildup of ice and requires re-balancing the system. This could likely cause an increase in compressor power and thus an increase in energy used. Our engineers have not seen samples of this type of construction. It is difficult to make an accurate prediction on the energy savings or costs.

AD6—Add ½ inch of Additional Insulation

Just suggesting an increase in insulation is simplistic but not realistic in view of the utility of the product. There is not some magical void that will be filled in the gap between inner and outer walls. Therefore, any increase in the insulation translates to smaller capacity. It means the product must be manually filled more often driving up labor costs for the store owner. It increases the weight of the appliance and requires changes to ventilation to prevent condensation. The capital cost of new fixtures, and molds are very high with marginal return. We see a 0.2 kWh/day improvement but at more than $200 in cost per machine. And this comes with loss of utility and smaller volume. The overall cost is $1250 per kWh/day. Even over 30 years, this is a negative payback with the losses in utility.

AD7—LED Lighting with Occupancy Sensors

We understand the "occupancy sensor" idea with a grocery store cooler, but in a convenience store, this does not translate. An occupancy sensor has a delay to ramp up lumens. This translates to a dark cooler when the consumer tries to find their beverage or food item. Consumers and business owners do not like this. Our experience is that this will improve energy by 0.05-0.07 kWh/day and at a cost of over $125 per machine. Such a "feature" would require additional electronics and thus more energy. The cost per kWh/day savings is over $2500. Even over 30 years this is a negative payback.

AD8-Synchronous Reluctance Evaporative Fan Motors

While these are an interesting change, our engineers have not seen these in the sizes and types (compatible with flammable refrigerants) which can be used in our machines. We are not able to evaluate the energy savings potential or the cost increase. What little we have seen indicates that the cost is much more than an increase of $15.

AD9—Microchannels

We have explained the problems with microchannels in our description above.

Even if we could make them work without leaks of flammable refrigerants, they are prone to blockage and increase the service calls and service costs. Our experience investigating this design option shows that the use of microchannels requires more frequent servicing and cleaning of coils. The cost is not $14.58 per machine, from even cursory discussions with suppliers. Estimates including significant fittings, machinery for insertion, and other capital improvements are well over $100. In addition, we believe the cost needs to reflect this additional servicing. The cost DOE has shown do not appear to reflect these additional service calls and thus even our

estimate of well over $100 is lower than it would be. This results in a cost per kWh/day to over $15,000.

As we have indicated above, these are not yet available in configurations for R-290 refrigerants, and we have no information to suggest that they will be in the years ahead. If in fact, microchannels do show greater likelihood of pin-hole leaks, their use with flammable refrigerants would possibly constitute a SAFETY HAZARD. This design option should not be considered.

AD10—Variable Speed Compressor

As mentioned above, these compressors are not available for use with R-290 refrigerant at this time and no suppliers have given us indications that they will be in the future.

The cost in other applications is not $79 but well over $200 cost increase. While DOE's projection of an improvement of 0.177 in energy is not borne out by the discussions with suppliers. Our indications are about a 0.1 kWh/day improvement at costs well over $200. This means that for every 1 kWh/day improvement, the cost would be $2,500.

AD11—Synchronous Reluctance Condenser Fan Motor

As we stated above, we have not seen any examples for the applications in these machines. The amount of actual energy improvement is unknown, and the cost is unknown but in other applications, the cost increase is certainly more than the $20 DOE estimated.

AD12—Vacuum Insulated Panels

We have explained in many places that these are interesting ideas in extremely high-volume production. However, in limited production runs by our small manufacturers, the capital cost is extremely high. DOE estimates $77+ but our experience is that this has a cost increase of more than $125. The capital costs must be amortized over the actual production numbers. While the cost to make this change is not accurately estimated, for the amount of improvement, the cost is likely to be hundreds of dollars for each kWh/day savings.

AD13—VIG Door

This is a very expensive option. Even DOE's estimate is over $850 increase in cost. The energy efficiency savings that DOE estimated was 0.017 kWh/day. Using DOE's estimates this would result in an increase of over $49,000 for each kWh/day. Our engineers have estimated the cost is over $1,000. This would bring the cost benefit to nearly $120,000 for each kWh/day saved.

Annex B to NAMA Presentation on Commercial Refrigeration Equipment

Recap of Reasons for Not Pursuing a Change to the Standards Levels for the Following Categories of Small (≤30 ft^3) VCT/SC/M, VOP/SC/M, HZO/SC/M, HCT/SC/M

1. Economic status of the industry is in flux due to Pandemic recovery.
2. Change to Lower GWP refrigerants is still occurring, contrary to DOE estimate.
3. Engineering analysis in pTSD is based on a review of significantly older machines.
4. pTSD analysis is not based on real costs of components/engineering options.
5. The single largest design option would be to convert to lower GWP refrigerants, but the DOE pTSD assumption that only 1 component needs to be changed to move to lower GWP refrigerants is in serious error.
6. Capital costs to implement all design options not included or seriously understated.
7. Estimated energy savings by design options are mistaken by an order of magnitude.
8. Customer who purchases the machine is not the one who pays the energy bill. This error is not reflected in the pTSD.
9. pTSD analysis does not include refurbished machines.
10. Many design options in pTSD were either implemented many years ago or impractical in CRE.
11. DOE/ORNL CRADA on implementing A3 refrigerants is significantly behind schedule.
12. DOE/ORNL CRADA extension on ways to improve energy efficiency has not started.
13. Cost of components do not reflect extreme inflation of 2022.
14. Cost of implementing design options do not reflect supply chain issues or cost of labor in 2022.
15. Many design options under consideration have impacts to utility and performance.
16. The Test Procedure is not settled.
17. Comments to Test Procedure and Standards Change for BVM are overlapping with CRE.
18. DOE Analysis does not include Cumulative Regulatory Burden.
19. Very few of the design options will reduce the energy use of bottle coolers by more than 3% and with extremely high cost per kWh.

20. Even though the DOE Design Options are wrong, the shipment estimates are wrong, the estimate on size of machines is wrong, if we still used DOE's estimates the Quads of Energy savings over 30 years ranges from -1.077 to 0.047 in Net Present Value of 7%.