Appliance Standards Awareness Project
Alliance to Save Energy
Natural Resources Defense Council
Northwest Energy Efficiency Alliance
Northwest Power and Conservation Council

October 19, 2015

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program
Mailstop EE-5B
1000 Independence Avenue, SW
Washington, DC 20585

RE: Docket Number EERE–2013–BT–STD–0022/RIN 1904–AD00: Notice of Proposed Rulemaking for Energy Conservation Standards for Beverage Vending Machines

Dear Ms. Edwards:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Alliance to Save Energy (ASE), Natural Resources Defense Council (NRDC), Northwest Energy Efficiency Alliance (NEEA), and Northwest Power and Conservation Council (NPCC) on the notice of proposed rulemaking (NOPR) for energy conservation standards for beverage vending machines. 80 Fed. Reg. 50462 (August 19, 2015). We appreciate the opportunity to provide input to the Department.

DOE has proposed strong, cost-effective standards for beverage vending machines that would reduce energy use by 25-65% depending on the equipment class. However, by separately analyzing machines using propane and CO_2 as the refrigerant instead of treating the use of propane as a technology option, DOE has overestimated both the cost to customers and the impacts on manufacturers of the proposed standards. While there may be implications of setting a standard level that can only be met by a single refrigerant, this is a policy decision in setting the standards and should not drive how the analysis is conducted.

Based on DOE's analysis for the NOPR, we support the proposed standard levels for beverage vending machines. DOE estimates that the proposed standards would save 0.22 quads of energy over 30 years of sales and save customers $0.4-1.1 billion in net present value savings.[1] At the public meeting on September 29, DOE noted that the Department tested both a Class A machine and a Class B machine that meet the proposed standard levels.[2] These two machines use R-134A, which is the most common refrigerant used today in beverage vending machines. As of January 1, 2019, R-134A will no longer be an acceptable refrigerant under EPA's SNAP program,[3] and manufacturers will likely switch to propane or CO_2 as refrigerants.

[1] 80 Fed. Reg. 50464-65.
[2] Public Meeting Transcript. p. 180.
[3] 80 Fed. Reg. 50464.

DOE estimates that propane compressors consume 15% less energy than R-134A compressors,[4] which suggests that if the currently-available machines that meet the proposed standard levels were converted to use propane, the energy consumption of these machines would likely be even lower.

DOE should treat refrigerants that can improve equipment efficiency as a technology option. For the NOPR, DOE separately analyzed beverage vending machines using propane and CO_2 and constrained the efficiency levels analyzed such that beverage vending machines using CO_2 could meet all of the potential efficiency levels.[5] Table 1 below shows the max-tech levels evaluated in the NOPR (expressed as energy use as a percentage of the baseline) along with the max-tech levels irrespective of refrigerant. The max-tech levels irrespective of refrigerant represent energy consumption levels that are roughly 10% lower than those for the max-tech levels analyzed in the NOPR. In effect, the max-tech levels analyzed for the NOPR represent the max-tech levels for CO_2 machines rather than true max-tech levels.

Table 1. Max-Tech levels in the NOPR vs. max-tech levels irrespective of refrigerant.

Equipment Class	Max-Tech Level (Energy Use as % of Baseline)	
	NOPR[6]	Irrespective of Refrigerant[7]
Class A	59%	53%
Class B	35%	31%
Combo A	28%	25%
Combo B	27%	24%

By separately analyzing beverage vending machines using propane and CO_2 rather than treating propane as a technology option, DOE's analysis has overestimated the cost to meet the proposed standard levels for a large portion of customers. For example, for Class A machines, DOE estimates that the incremental installed cost for machines meeting the proposed standard level is $133 for CO_2 machines, while that for propane machines is only $40.[8] DOE's analysis for the NOPR assumes that 60% of beverage vending machines will use CO_2 as the refrigerant while the remaining 40% will use propane.[9] While some manufacturers may choose to use CO_2, the analysis should reflect the least-cost way to meet a given efficiency level, which in this case would include the use of propane.

The approach of separately analyzing beverage vending machines using propane and CO_2 also overestimates the impact on manufacturers of the proposed standards. Since CO_2 is less efficient than propane, more technology options must be employed to meet a given standard level using

[4] Technical Support Document. p. 5-24.
[5] 80 Fed. Reg. 50484.
[6] Technical Support Document. pp. 7-15 to 7-17. Tables 7.4.1, 7.4.2, 7.4.3, 7.4.4.
[7] Max-tech level for each representative unit calculated as the energy consumption with all design options employed (as shown in Tables 5.6.1 to 5.6.30 of the TSD) divided by the allowable energy consumption under the current standards (for Class A and Class B machines) or by the baseline energy consumption (for Combo A and Combo B machines). Within each equipment class, we choose the max-tech level of the representative unit with the highest energy consumption (as a % of the baseline) to represent the max-tech level for a given equipment class.
[8] 80 Fed. Reg. 50508-09. Tables V.3, V.5. Difference in installed cost between TSL 4 and the baseline level.
[9] Technical Support Document. p. 9-13.

CO_2 compared to using propane. For example, as shown in Tables A1 through A6 in the Appendix, for Class A machines, DOE's analysis shows that enhanced glass packs are necessary to meet the proposed standard levels for CO_2 machines, while they are not necessary for propane machines. (The highlighted design options in the tables represent the levels at which the proposed standards for Class A machines—75% of the energy consumption of the current standards—are met.) The TSD states that manufacturer feedback indicated that enhanced glass packs were one of the most costly design options to implement.[10] Manufacturers will have the option of using propane, which according to DOE's analysis would eliminate the need to incorporate enhanced glass packs in Class A machines to meet the proposed standard levels.

Treating the use of propane as a technology option for beverage vending machines would be similar to the approach taken in the 2011 residential refrigerator rulemaking, where DOE analyzed a switch to isobutane as a technology option for compact refrigerators.[11]

Variable-speed compressors may allow for significant additional energy savings in beverage vending machines. DOE notes in the Technical Support Document (TSD) that variable-speed compressors can reduce refrigeration system energy consumption by matching the compressor capacity to the refrigeration load. However, for the analysis for the NOPR, DOE did not consider variable-speed compressors in the engineering analysis. The TSD states that "DOE is concerned that the distinct operating characteristics of beverage vending machines, which can include extended pull-down periods, may differ from those experienced by other refrigeration systems in which variable speed compressors have been effectively implemented, such as residential refrigerators. As such, DOE believes that the residential refrigerator experience does not provide adequate assurance of viability."[12] At the public meeting on September 29, one manufacturer stated that they have used variable-speed compressors in the past, and that they worked very well for pull-down in addition to providing good efficiency. The same manufacturer also noted that a variable-speed compressor for propane systems that can be used in beverage vending machines may now be available.[13] A DOE analysis of potential energy savings from high-efficiency electric motors found that applying VFDs to compressors in beverage vending machines could reduce site energy consumption by 15%.[14] While variable-speed compressors were not considered in the analysis, manufacturers may have the option of using variable-speed compressors to help meet new standards for beverage vending machines.

DOE's analysis is likely overestimating the cost and underestimating the performance of vacuum insulation panels (VIPs). The TSD states that data on VIPs were gathered from VIP manufacturers in conjunction with past rulemakings on residential refrigerators and walk-in coolers and freezers. While we do not know exactly when DOE obtained information on VIPs, the preliminary TSD for residential refrigerators was published in 2009 and the preliminary TSD for walk-in coolers and freezers was published in 2010. Therefore, it appears that the information on the cost and performance of VIPs may be more than five years old. VIPs are still a relatively

[10] Technical Support Document. p. 12-18.
[11] DOE did not consider isobutane as a technology option for standard-size refrigerators due to the UL charge limitation of 57 g.
[12] Technical Support Document. p. 5-13, 5-14.
[13] Public Meeting Transcript. pp. 36-37.
[14] http://energy.gov/sites/prod/files/2014/02/f8/Motor%20Energy%20Savings%20Potential%20Report%202013-12-4.pdf. pp. 55-56.

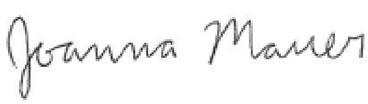
new technology, and we understand that manufacturing volumes may have increased substantially in the last few years. Therefore, DOE's analysis is likely overestimating the cost and underestimating the performance of VIPs.

DOE's shipment projections may be conservative. For the analysis for the NOPR, DOE estimated a persistent reduction in stock for each individual building sector where beverage vending machines are installed.[15] Overall, DOE estimates that the stock of beverage vending machines will decrease by 20% between 2014 and 2048,[16] and that the average saturation will decline during the same period from 0.77 to 0.35 beverage vending machines per building.[17] In other words, DOE's analysis for the NOPR assumes that the number of beverage vending machines per building will decline by more than 50% between now and 2048. At the public meeting on September 29, one manufacturer suggested that due to the increase in healthy options that are being offered in beverage vending machines, rather than decrease, the stock may actually increase over time.[18] Therefore, it appears that DOE may be underestimating the total number of shipments over time.

Minimum efficiency standards and ENERGY STAR specifications are complementary. At the public meeting on September 29, one manufacturer questioned the role of new minimum efficiency standards given the presence of the ENERGY STAR specification for beverage vending machines.[19] While the ENERGY STAR specification has been very successful in the beverage vending machine market, new DOE standards can achieve significantly greater energy savings than those achieved by the ENERGY STAR specification. The current ENERGY STAR specification represents savings of 5% for Class A machines and 10% for Class B machines relative to the current DOE standards,[20] while the standards proposed in the NOPR would achieve savings of 25% and 55% for Class A and Class B machines, respectively. In addition, once a new DOE standard takes effect, the ENERGY STAR specification would likely be revised, which can drive even greater savings. In this way, the DOE standards and the ENERGY STAR specification are complementary.

Thank you for considering these comments.

Sincerely,



Joanna Mauer
Technical Advocacy Manager
Appliance Standards Awareness Project

Kateri Callahan
President
Alliance to Save Energy

---

[15] Technical Support Document. p. 9-7.
[16] Technical Support Document. p. 9-9.
[17] Technical Support Document. p. 9-10.
[18] Public Meeting Transcript. pp. 129-131.
[19] Public Meeting Transcript. pp. 116-17.
[20] http://www.energystar.gov/sites/default/files/specs//private/Vending_v3_FinalDraft_spec.pdf. p. 2.

Elizabeth Noll
Energy Efficiency Advocate
Natural Resources Defense Council

Louis Starr, P.E.
Energy Codes and Standards Engineer
Northwest Energy Efficiency Alliance

Tom Eckman
Manager, Conservation Resources
Northwest Power and Conservation Council

Appendix[21]

Table A1. Class A, CO_2, Small

Design Option Level	Calculated Daily Energy Consumption (kWh/day)	Design Option Added Above the Baseline	Energy Consumption as % of Current Standard
0	3.468	-	-
1	3.238	Automatic Lighting Controls	93.1%
2	2.995	Enhanced Evaporator Coil	86.1%
3	2.905	Refrigeration Low Power State	83.5%
4	2.873	Enhanced Condenser Coil	82.6%
5	2.836	Higher Efficiency Compressor	81.5%
6	2.588	Enhanced Glass Pack	74.4%
7	2.062	Vacuum Insulated Panels	59.3%

Table A2. Class A, CO_2, Medium

Design Option Level	Calculated Daily Energy Consumption (kWh/day)	Design Option Added Above the Baseline	Energy Consumption as % of Current Standard
0	3.767	-	-
1	3.535	Automatic Lighting Controls	93.2%
2	3.256	Enhanced Evaporator Coil	85.9%
3	3.158	Refrigeration Low Power State	83.3%
4	3.117	Higher Efficiency Compressor	82.2%
5	2.835	Enhanced Glass Pack	74.8%
6	2.812	Enhanced Condenser Coil	74.2%
7	2.762	ECM Fan Motor	72.8%
8	2.175	Vacuum Insulated Panels	57.4%

Table A3. Class A, CO_2, Large

Design Option Level	Calculated Daily Energy Consumption (kWh/day)	Design Option Added Above the Baseline	Energy Consumption as % of Current Standard
0	4.404	-	
1	4.172	Automatic Lighting Controls	94.5%
2	4.047	Refrigeration Low Power State	91.7%
3	3.708	Enhanced Evaporator Coil	84.0%
4	3.657	Higher Efficiency Compressor	82.9%
5	3.283	Enhanced Glass Pack	74.4%
6	3.255	Enhanced Condenser Coil	73.8%
7	3.193	ECM Fan Motor	72.3%
8	2.499	Vacuum Insulated Panels	56.6%

[21] Technical Support Document. pp. 5-45 to 5-47, 5-55 to 5-57. Energy consumption as % of current standard calculated using refrigerated volumes of 16.7, 22.4, and 33.7 cu. ft. for small, medium, and large machines, respectively, as shown in Table 5.5.14 of the TSD.

Table A4. Class A, Propane, Small

Design Option Level	Calculated Daily Energy Consumption (kWh/day)	Design Option Added Above the Baseline	Energy Consumption as % of Current Standard
0	3.404	-	
1	3.177	Automatic Lighting Controls	91.3%
2	2.966	Permanent Split Capacitor Condenser Fan Motor	85.3%
3	2.759	Enhanced Evaporator Coil	79.3%
4	2.676	Refrigeration Low Power State	76.9%
5	2.661	Enhanced Condenser Coil	76.5%
6	2.565	ECM Fan Motor	73.7%
7	2.351	Enhanced Glass Pack	67.6%
8	2.326	Higher Efficiency Compressor	66.9%
9	2.280	Electronically Commutated Condenser Fan Motor	65.5%
10	1.850	Vacuum Insulated Panels	53.2%

Table A5. Class A, Propane, Medium

Design Option Level	Calculated Daily Energy Consumption (kWh/day)	Design Option Added Above the Baseline	Energy Consumption as % of Current Standard
0	3.807	-	
1	3.445	Automatic Lighting Controls	90.8%
2	3.004	LED Lighting	79.2%
3	2.787	Enhanced Evaporator Coil	73.5%
4	2.703	Refrigeration Low Power State	71.3%
5	2.677	Enhanced Condenser Coil	70.6%
6	2.645	Higher Efficiency Compressor	69.8%
7	2.423	Enhanced Glass Pack	63.9%
8	1.942	Vacuum Insulated Panels	51.2%

Table A6. Class A, Propane, Large

Design Option Level	Calculated Daily Energy Consumption (kWh/day)	Design Option Added Above the Baseline	Energy Consumption as % of Current Standard
0	4.397	-	
1	4.031	Automatic Lighting Controls	91.3%
2	3.586	LED Lighting	81.3%
3	3.479	Refrigeration Low Power State	78.8%
4	3.203	Enhanced Evaporator Coil	72.6%
5	3.162	Higher Efficiency Compressor	71.6%
6	2.855	Enhanced Glass Pack	64.7%
7	2.837	Enhanced Condenser Coil	64.3%
8	2.775	ECM Fan Motor	62.9%
9	2.208	Vacuum Insulated Panels	50.0%