Appliance Standards Awareness Project
Natural Resources Defense Council
Northwest Energy Efficiency Alliance

December 14, 2020

Dr. Stephanie Johnson
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-5B
1000 Independence Avenue SW
Washington, DC 20585

RE: Docket Number EERE–2017–BT–STD–0022/RIN 1904–AE47: Request for Information for Energy Conservation Standards for Automatic Commercial Ice Makers

Dear Dr. Johnson:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Natural Resources Defense Council (NRDC), and Northwest Energy Efficiency Alliance (NEEA) on the request for information (RFI) for energy conservation standards for automatic commercial ice makers. 85 Fed. Reg. 60923 (September 29, 2020). We appreciate the opportunity to provide input to the Department.

In summary, DOE should evaluate potential amended standards for automatic commercial ice makers given the significant potential for energy efficiency gains. DOE may also be able to achieve large water savings by lowering the condenser water use limits for water-cooled ice makers and establishing standards for potable water use for all machine types. Further savings could be achieved by expanding the scope of the current standards to include ice makers with capacities less than 50 lb/24 hr. In evaluating potential amended standards, we urge DOE to consider alternative refrigerants as technology options. Finally, we encourage DOE to explore the potential to set standards for ice storage bins, which can be the source of 30-70% of the total daily energy consumption of an ice maker.

DOE should conduct a full analysis to evaluate potential amended standards for automatic commercial ice makers (ACIM). We evaluated the models currently listed in the DOE Compliance Certification Database (CCD) and found that there is significant potential for energy efficiency improvements. As shown in Tables 1 and 2[1] for batch-type and continuous-type machines, respectively, the maximum available efficiency levels represent energy savings of 14-85% relative to the current standards, depending on the equipment class.

[1] Models in the DOE Compliance Certification Database as of 10/2/20.

Table 1. Maximum available efficiency levels for batch-type ACIM

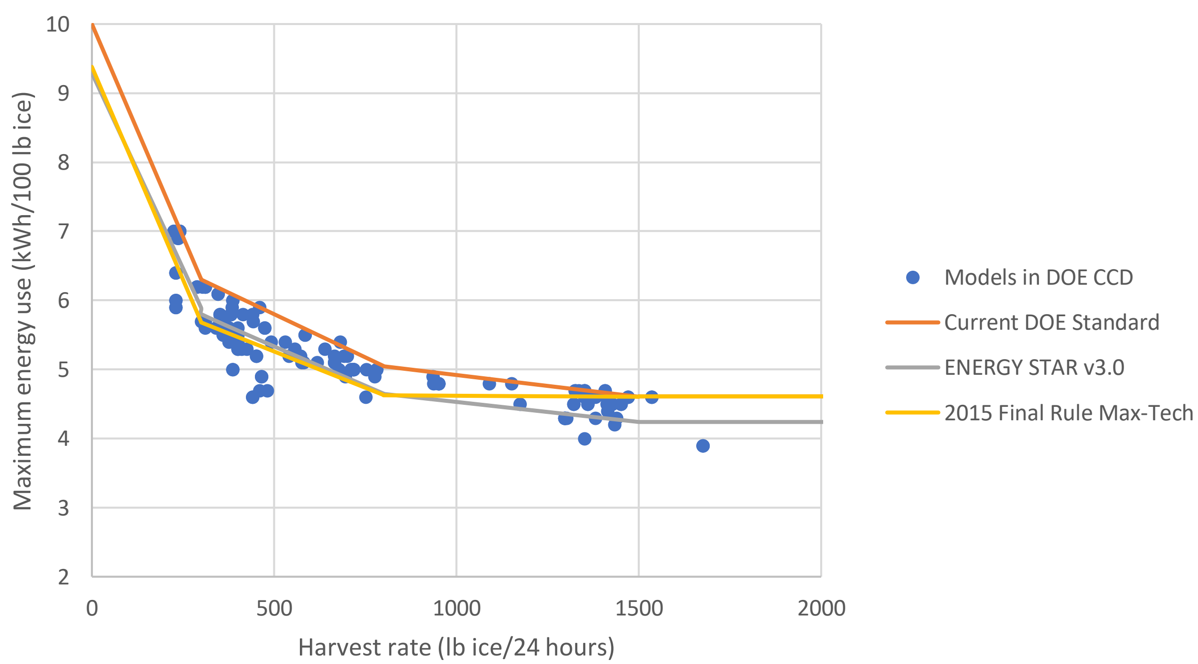
Equipment type	Type of cooling	Max % savings relative to current DOE standard
Ice-Making Head	Water	28%
Ice-Making Head	Air	23%
Remote Condensing (but not remote compressor)	Air	24%
Remote Condensing and Remote Compressor	Air	14%
Self-Contained	Water	20%
Self-Contained	Air	37%

Table 2. Maximum available efficiency levels for continuous-type ACIM

Equipment type	Type of cooling	Max % savings relative to current DOE standard
Ice-Making Head	Water	21%
Ice-Making Head	Air	29%
Remote Condensing (but not remote compressor)	Air	23%
Remote Condensing and Remote Compressor	Air	85%
Self-Contained	Water	24%
Self-Contained	Air	39%

Additionally, as shown in Figure 1 below and the figures in Appendix A, many models available today use less energy than the "max-tech" levels from the 2015 final rule,[2] and many air-cooled models also use less energy than models that just meet the latest ENERGY STAR specification.[3]

Figure 1. Maximum energy use of batch-type air-cooled ice-making head models



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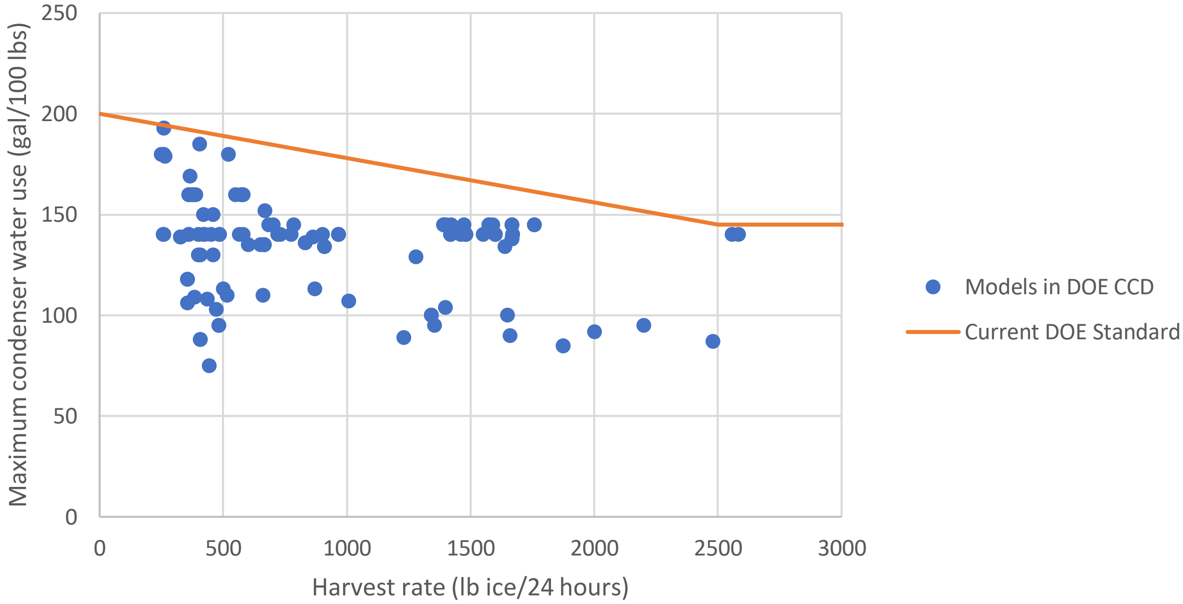
[2] https://www.regulations.gov/document?D=EERE-2010-BT-STD-0037-0136. pp. 10C-9 - 10C-10.
[3] https://www.energystar.gov/sites/default/files/Final%20V3.0%20ACIM%20Specification%205-17-17_1_0.pdf.

DOE should consider lowering the condenser water use limits. As shown in Figure 2 below, many water-cooled products on the market use significantly less condenser water than models just meeting the current DOE standards.[4] For example, for batch-type ice-making head machines, condenser water savings are about 25% on average, and the most efficient models use up to 61% less water than the current DOE standards. Similar findings apply to models in the other water-cooled equipment classes as shown in Appendix B.

Figure 2. Maximum condenser water use for batch-type water-cooled ice-making head models



Furthermore, as shown in Figure 3, there are multiple models with similar energy use but significantly different condenser water use, which suggests that reducing condenser water use does not imply an increase in energy use.[5] These differences in condenser water use are present across models, including those with similar ice harvest rates. For example, the Hoshizaki KM-1301SWJ3 and Manitowoc IDT1500W-261 models are both batch-type, water-cooled, ice-making head machines and have similar ice harvest rates (1355 lb/24 hr and 1480 lb/24 hr, respectively); while the two models have the same rated energy use (3.3 kWh/100 lb), the condenser water use per 100 lbs for the Hoshizaki model is 30% lower than that of the Manitowoc model.[6]

Potential reductions in condenser water use are particularly important since DOE estimated in the 2015 final rule that half of all water-cooled ice makers are used in "open systems," where the water is drained after passing through the ice maker.[7] Therefore, we encourage DOE to investigate the potential to lower the condenser water use limits.

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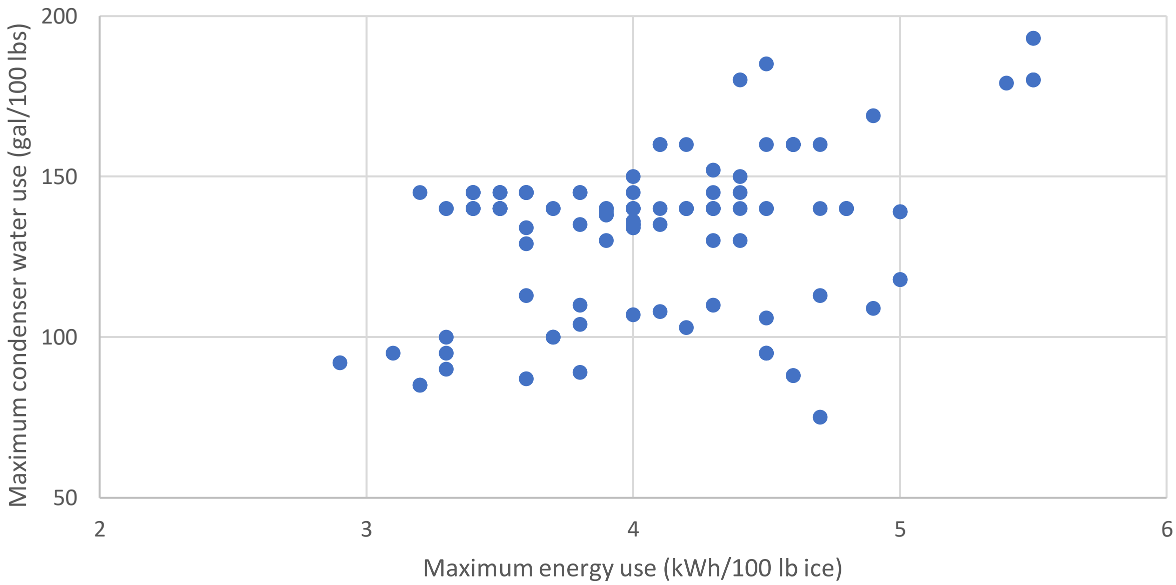
[4] Models in the DOE Compliance Certification Database as of 10/2/20.

[5] Ibid.

[6] Ibid. The condenser water use for the Hoshizaki and Manitowoc models are 95 gal/100 lbs and 140 gal/100 lbs, respectively.

[7] https://www.regulations.gov/document?D=EERE-2010-BT-STD-0037-0136. p. 5-24.

Figure 3. Maximum energy use vs. maximum condenser water use in batch-type water-cooled ice-making head models



We encourage DOE to adopt potable water use standards for ice makers. There are 12 gallons of potable water contained in 100 pounds of ice. However, batch-type machines consume additional potable water as a way of cleaning the evaporator to remove contaminants that could interfere with the ice-making process.[8] Yet this additional potable water use is not consistent across models. In the 2015 final rule, DOE estimated that batch-type ice makers use an additional 3 to 38 gallons of water to produce 100 pounds of ice.[9] Similarly, for batch-type models currently listed in the Air Conditioning, Heating, and Refrigeration Institute (AHRI) directory, the additional water use ranges from 2 to 23 gallons per 100 pounds of ice.[10] DOE confirmed in the 2015 final rule that the Department has the authority to regulate potable water use.[11] Furthermore, ENERGY STAR and the Consortium for Energy Efficiency (CEE) both have requirements in their respective ACIM specifications for potable water use, and AHRI's certification program requires manufacturers to certify the potable water use rate for each ice maker model. We encourage DOE to adopt standards for potable water use for ice makers.

DOE should consider expanding the scope of the ACIM energy conservation standards to include ice makers with harvest rates less than 50 lb/24 hr. The current standards cover ice makers with harvest rates between 50 and 4000 lb/24 hr. Expanding the scope of the ACIM standards to include small capacity ice makers would provide consumers with consistent efficiency information across all unit sizes and may represent a significant opportunity for energy savings. In the 2014 preliminary technical support document for miscellaneous refrigeration products (MREFs), DOE estimated the stock of small ice makers in 2014 to be 5.5 million; annual shipments of small ice makers were forecasted to be around

[8] 80 Fed. Reg. 4668.
[9] Ibid.
[10] Products in AHRI directory as of 11/20/20.
https://www.ahridirectory.org/Search/QuickSearch?category=9&searchTypeId=3&producttype=21.
[11] 80 Fed. Reg. 4668.

800,000 in 2021 and above 1.1 million by 2050.[12] Furthermore, as shown in Table 3[13], DOE's 2014 analysis found that these small ice makers can consume up to 1075 kWh per year and that existing technologies have the potential to significantly reduce energy consumption.

Table 3. 2014 DOE analysis of potential per-unit energy savings for small capacity ice makers

Product Class	Baseline Energy Consumption (kWh/yr)	Max-Tech Energy Consumption (kWh/yr)	% Energy Savings of Max-Tech from Baseline
Portable Ice Maker	256	89	65%
Cooled-Storage Ice Maker	552	411	26%
Uncooled-Storage Ice Maker	1075	672	37%

Given the large annual shipments and the significant potential efficiency gains, we encourage DOE to consider expanding the scope of the ACIM energy conservation standards to include ice makers with harvest rates less than 50 lb/24 hr.

DOE should consider alternative refrigerants such as R-290 (propane) as technology options. While most ice makers use R404a, propane is a more efficient refrigerant with a global warming potential of close to 1 and is already a SNAP-approved refrigerant for self-contained commercial ice makers.[14,15] In part due to European Union regulations to phase out the use of hydrofluorocarbon (HFC) refrigerants, global ice maker manufacturers have begun to transition to natural refrigerants. For example, Hoshizaki has an ice maker product line in Europe that exclusively uses propane; the company asserts that these products can produce more ice and provide energy savings of 30-40% compared to similar machines that use HFCs.[16] DOE should investigate propane and other potential alternative refrigerants as technology options for ACIM.

We encourage DOE to consider establishing test procedures and standards for ice storage bins. The energy consumption associated with the replacement of melted ice in the ice storage bin can be a significant portion of the total energy use of ACIM. DOE previously found that this energy use ranged from 30-70% of the total ice maker daily energy consumption, and on average, it was equivalent to the energy consumed to make useful ice. [17] AHRI has a standard for rating the "theoretical storage effectiveness" of ice storage bins.[18] In the 2012 final rule for test procedures for ACIM, in declining to regulate storage bins of self-contained ice makers only, DOE stated that "it would be more consistent to promulgate test procedures and subsequent standards for ice storage bins and the bins of self-contained ice makers at the same time."[19] We encourage DOE to pursue that approach here and to

[12] https://www.regulations.gov/document?D=EERE-2011-BT-STD-0043-0024. pp. 9-8 - 9-9.
[13] Ibid. pp. 5-37 - 5-38.
[14] https://www.achrnews.com/articles/120384-refrigeration-trends-toward-natural-refrigerants.
[15] https://www.epa.gov/snap/substitutes-commercial-ice-machines.
[16] http://hydrocarbons21.com/articles/6596/hoshizaki_shines_bright_with_its_new_gems_the_emerald_class_ice_makers.
[17] https://www.energy.gov/sites/prod/files/2017/12/f46/acim2-tp-rfi.pdf.
[18] http://www.ahrinet.org/App_Content/ahri/files/STANDARDS/AHRI/AHRI_Standard_820_I-P_2017.pdf.
[19] 77 Fed. Reg. 1604 (January 11, 2012).

consider test procedures and standards for all ice storage bins. Such standards could apply equally to all storage bins regardless of whether they are produced by the ice maker manufacturer (e.g., in the case of self-contained ice makers) or by another manufacturer.

Thank you for considering these comments.

Sincerely,

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Appendix A

Figure A1. Maximum energy use of batch-type water-cooled ice making head models

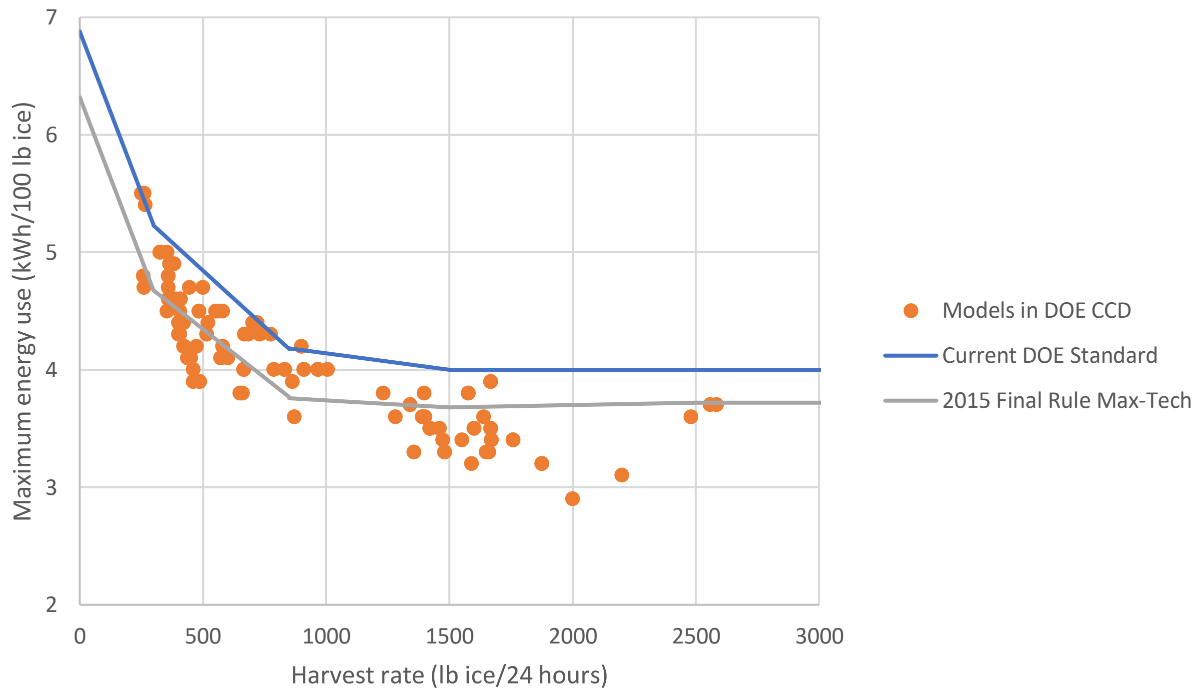


Figure A2. Maximum energy use of batch-type air-cooled remote condensing models

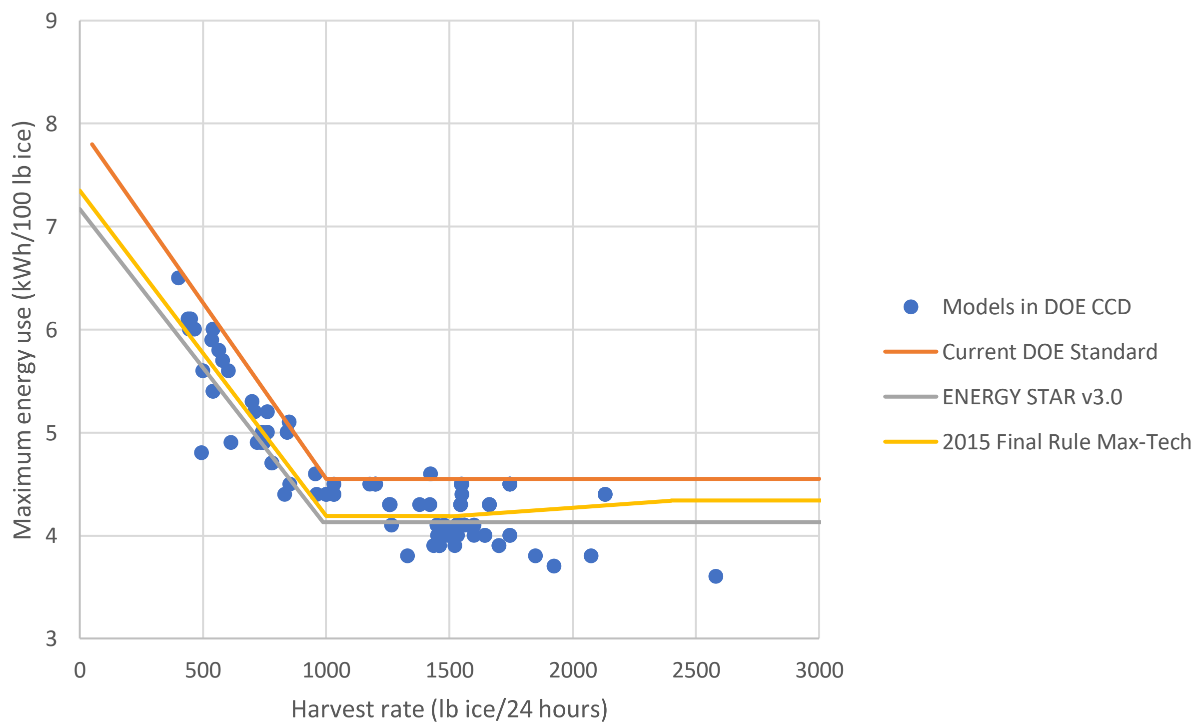


Figure A3. Maximum energy use of batch-type air-cooled self-contained models

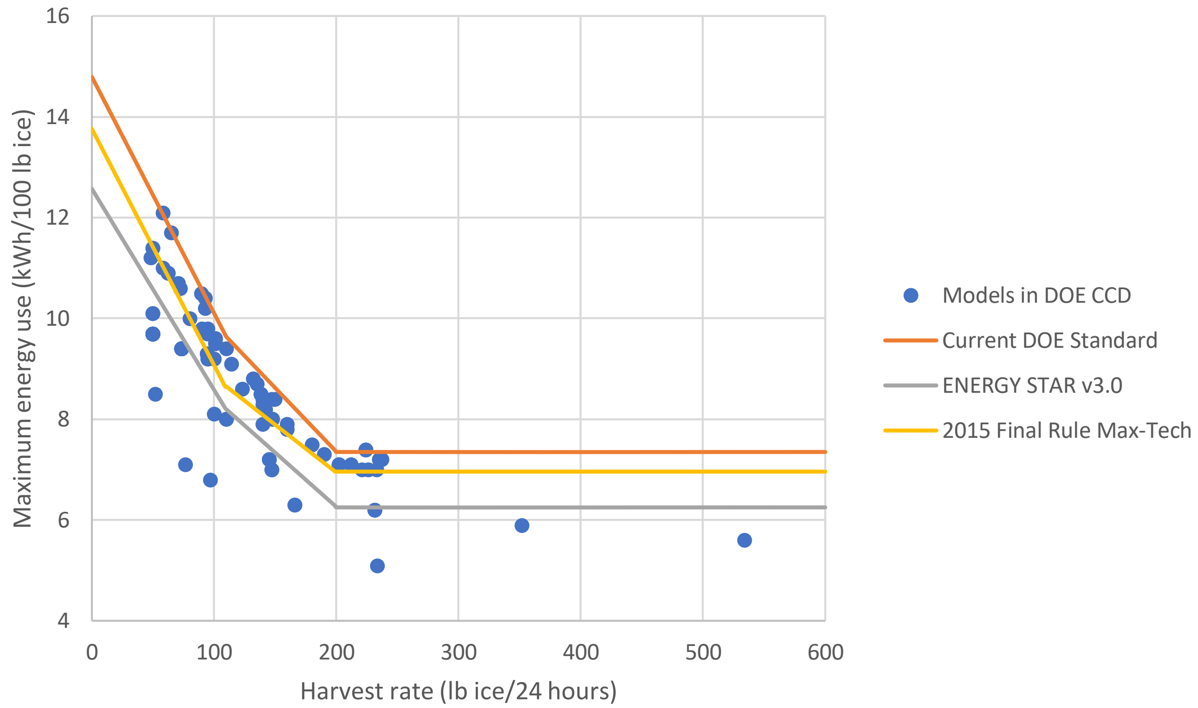
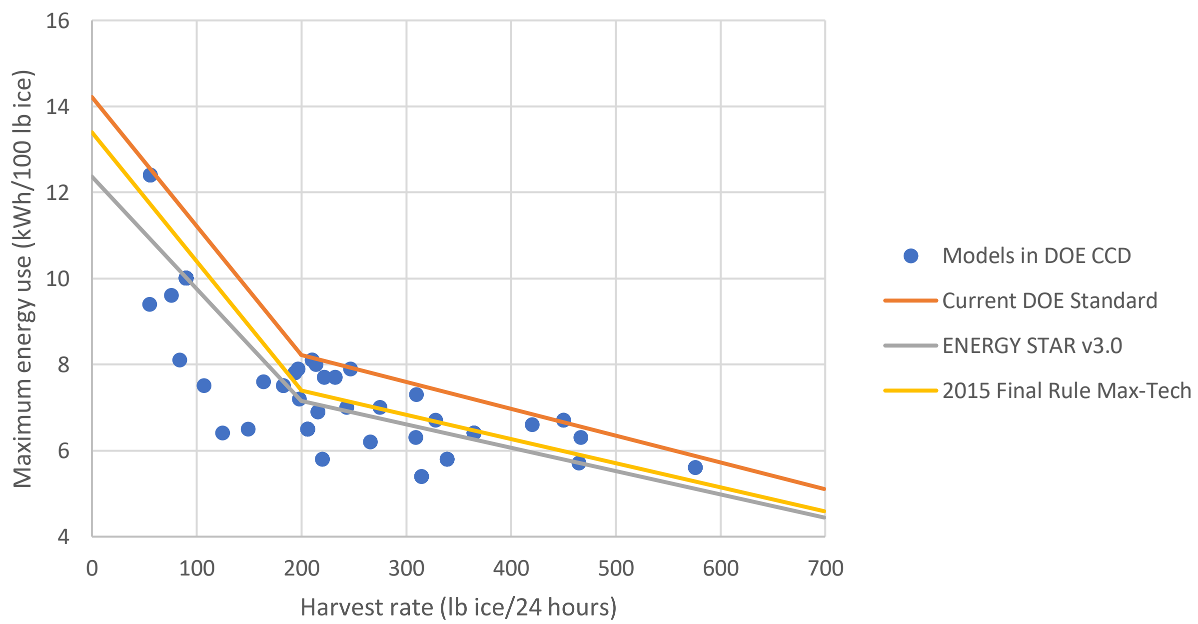


Figure A4. Maximum energy use of continuous-type air-cooled self-contained models



Appendix B

Figure B1. Maximum condenser water use for continuous-type water-cooled ice-making head models

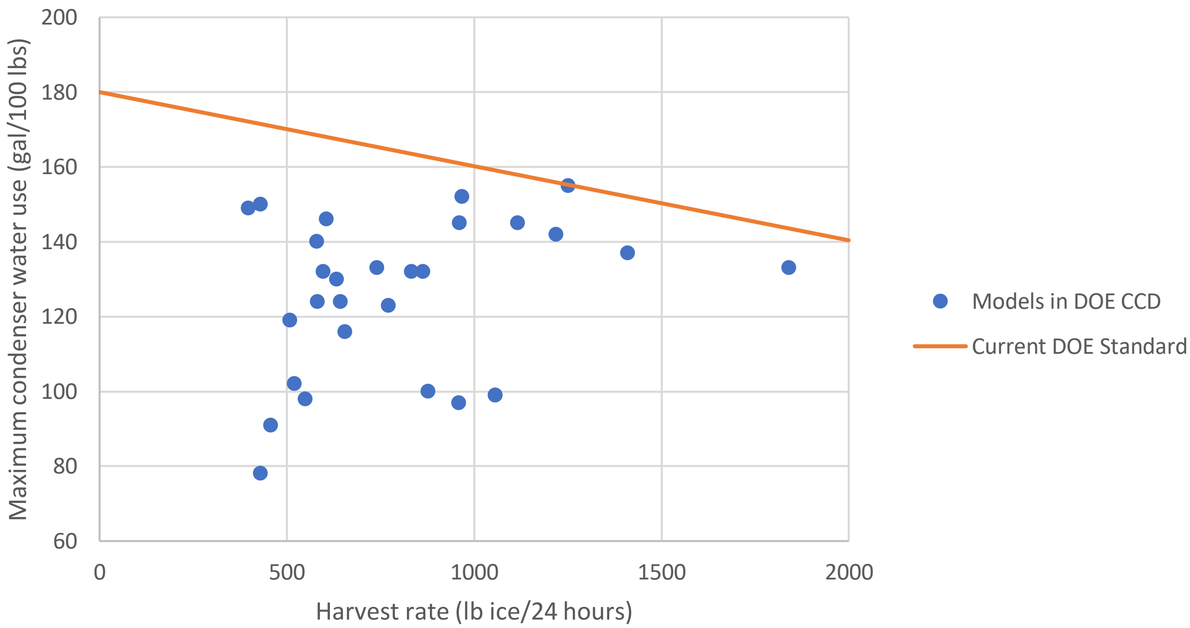


Figure B2. Maximum condenser water use for batch-type water-cooled self-contained models