Appliance Standards Awareness Project
Alliance to Save Energy
American Council for an Energy-Efficient Economy
Northwest Energy Efficiency Alliance
Northwest Power and Conservation Council

August 24, 2017

Catherine Rivest
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–TP–0018 / RIN 1904–AD93: Request for Information for Test Procedures for Certain Categories of Commercial Air Conditioning and Heating Equipment

Dear Ms. Rivest:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Alliance to Save Energy, American Council for an Energy-Efficient Economy (ACEEE), Northwest Energy Efficiency Alliance (NEEA), and Northwest Power and Conservation Council (NPCC) on the request for information (RFI) for test procedures for certain categories of commercial air conditioning and heating equipment. 82 Fed. Reg. 34427 (July 25, 2017). We appreciate the opportunity to provide input to the Department.

Overview

As part of this test procedure rulemaking, DOE should implement important recommendations that were included in the term sheets for the ASRAC working groups for commercial package air conditioners and commercial and industrial fans and blowers. These recommendations include the following:

- The ASRAC working group for commercial package air conditioners recommended that DOE initiate a rulemaking no later than January 1, 2016 to be completed no later than January 1, 2019 with the primary focus of better representing total fan energy use including considering a) alternative external static pressures and b) fan operation for other than mechanical cooling and heating.[1]
- The ASRAC working group for commercial and industrial fans and blowers recommended that test procedure modifications be considered for fans embedded in regulated equipment to more fully capture fan energy use.[2]

[1] https://www.regulations.gov/document?D=EERE-2013-BT-STD-0007-0093. Recommendation #2.
[2] https://www.regulations.gov/document?D=EERE-2013-BT-STD-0006-0179. Recommendation #3.

As described below, we also encourage DOE to adopt a metric for computer room air conditioners (CRACs) that incorporates part-load performance and a metric for dedicated outdoor air systems (DOAS) that captures the benefits of demand-controlled ventilation. These amendments are necessary in order to provide equipment ratings that adequately represent performance in the field and that provide good information to consumers to make purchasing decisions. Further, these amendments would encourage the adoption of features such as variable-speed fans, which provide additional control and flexibility for building owners and operators in addition to reducing energy waste.

There also appear to be a number of ambiguities in the current industry test procedures, which are outlined in the RFI.[3] It is important that DOE address any ambiguities in order to provide a level playing field by ensuring that manufacturers are testing their equipment in a consistent manner. Further, this protects manufacturers by ensuring that any verification or enforcement testing is conducted the same way as manufacturers conduct their own testing.

Computer Room Air Conditioners (CRACs)

We encourage DOE to adopt an efficiency metric for CRACs that incorporates part-load performance. DOE notes in the RFI that CRACs typically operate at part-load in the field. The RFI further notes that as part of the 2012 final rule analysis, DOE estimated that CRACs operate on average at a sensible load of 65% of the full-load sensible capacity.[4] This information indicates that the current efficiency metric for CRACs (SCOP), which reflects full-load performance, is not representative of performance in the field. As DOE notes in the RFI, EPCA requires that DOE test procedures "provide a measurement that is representative of an average use cycle for the tested equipment."[5] Further, since CRACs rarely (if at all) operate at full-load in the field, the current full-load efficiency ratings are not providing good information to consumers.

In the RFI, DOE requests comment on how the test procedures could be amended to reduce the cost of new or additional features and make it more likely that such features are included on the equipment.[6] Incorporating part-load performance in the efficiency metric for CRACs would encourage the adoption of technologies that can improve part-load performance, such as variable-speed fans and compressors, which would ultimately provide savings for consumers. A case study prepared for DOE's Federal Energy Management Program found that when constant-speed fans on CRAC units were retrofitted with variable-speed controls, cooling system energy use was reduced by 22-32%.[7] Variable-speed compressors can significantly reduce cycling losses in addition to providing more precise cooling.[8] However, the benefits of variable-speed technology are not captured in the current test procedure. If manufacturers were incentivized to

[3] See, for example, Issues CRAC-11, CRAC-22, CRAC-23, DOAS-4, DOAS-9, DOAS-10, DOAS-12, DOAS-22, CUAC-7, CUAC-14, VRF-2, and VRF-7.
[4] 82 Fed. Reg. 34432.
[5] 82 Fed. Reg. 34436.
[6] 82 Fed. Reg. 34448.
[7] https://energy.gov/sites/prod/files/2013/10/f3/dc_fancasestudy.pdf
[8] http://www.dataaire.com/wp-content/uploads/2016/02/Data-Aire-Product-of-the-Year-Flyer-gForce-Ultra.pdf.

adopt these technologies by appropriately capturing their benefits in the test procedures, this would also likely have the effect of lowering their cost, which could further increase adoption.

We encourage DOE to conduct additional investigation on the operation of CRACs in air circulation mode. In the RFI, DOE notes that redundant CRAC units are often installed in computer rooms and that these redundant units can be controlled to operate in air circulation mode.[9] The current efficiency metric for CRACs does not capture energy consumption in air circulation mode. As noted above, the term sheet for the ASRAC working group for commercial and industrial fans and blowers recommended that test procedure modifications be considered for fans embedded in regulated equipment to more fully capture fan energy use.[10] Appendix B of the term sheet lists CRACs as one of these types of regulated equipment.

We encourage DOE to conduct additional investigation on the operation of CRACs in air circulation mode. If CRACs on average spend any significant amount of time in air circulation mode, this energy use should be captured in the test procedure in order to adequately capture fan energy use. Similar to capturing part-load performance, adequately capturing fan energy use would encourage the adoption of more-efficient fan designs and variable-speed fan control, which would provide savings for consumers. We understand that measuring power consumption in air circulation mode would require little additional test burden, as air circulation mode could likely be tested immediately following the refrigeration system test, similar to what is specified in the new test procedures for testing dehumidifiers in "off-cycle" mode.[11]

We agree with DOE that it is important to verify that the external static pressures specified for CRACs reflect field conditions. ASHRAE 90.1-2016 references AHRI 1360 as the test procedure for CRACs. Previous versions of ASHRAE 90.1 had referenced ANSI/ASHRAE 127 as the test procedure. The RFI notes that the external static pressure values specified in AHRI 1360-2016 are significantly lower than those specified in both the 2007 and 2012 versions of ANSI/ASHRAE 127. For example, for ducted units, ASHRAE 127 specified a minimum external static pressure of 0.8 or 1.0 in. w.c., depending on capacity, while the external static pressures specified in AHRI 1360-2016 are between 0.2 and 0.5 in. w.c.[12] The RFI notes that DOE received no information from ASHRAE indicating why lower static pressures are more representative of field performance.

We agree with DOE that it is important to verify that the external static pressures specified for CRACs reflect field conditions. As noted above, the ASRAC working group for commercial and industrial fans and blowers recommended that test procedures for regulated equipment be revised to better capture fan energy use. If the external static pressures specified in the DOE test procedure are lower than those typically found in the field, the ratings of CRACs will neither provide an adequate representation of actual efficiency nor provide good information to consumers. We urge DOE to attempt to ensure that the external static pressure values specified in the CRAC test procedures adequately reflect conditions in the field. We note that the

[9] 82 Fed. Reg. 34432.
[10] https://www.regulations.gov/document?D=EERE-2013-BT-STD-0006-0179. Recommendation #3.
[11] 10 CFR 430. Subpart B. Appendix X1.
[12] 82 Fed. Reg. 34433-34.

specification of external static pressure should have no impact on test burden since there would be no change to how the test is conducted.

Dedicated Outdoor Air Systems (DOAS)

We encourage DOE to adopt an efficiency metric for DOAS that captures the benefits of demand-controlled ventilation. DOE notes in the RFI that some DOAS equipment is capable of operating at reduced air flow rates to provide demand-controlled ventilation.[13] The required ventilation for a building is typically calculated based on the building's maximum occupancy. However, since buildings are rarely occupied at maximum capacity, the design ventilation rate is almost always higher than the actual required rate.[14] Further, required ventilation will typically vary based on daily building occupancy schedules. Supplying excess ventilation air wastes both fan energy as well as the energy needed to heat or cool the outside air. DOAS equipment that provides the ability for demand-controlled ventilation gives building operators the flexibility to match the ventilation rate to what is needed at different times during the day, which in turn provides significant savings to building owners. However, the benefit of this DOAS feature is not captured in the current industry test procedure (AHRI 920-2015).

We encourage DOE to adopt an efficiency metric for DOAS that captures the benefits of equipment that can provide demand-controlled ventilation. Such a metric would encourage manufacturers to provide demand-controlled ventilation capability as a feature.

We encourage DOE to capture defrost energy consumption in the metric for air-source heat pump DOASes. DOE notes in the RFI that ASHRAE 198-2013, which is the test method for DOAS referenced in AHRI 920, does not address defrost energy consumption for air-source heat pump DOASes. DOE further notes that "defrost has a real impact on efficiency because of energy use associated with defrost and because a system cannot continue to provide heating during defrost operation, thereby reducing time-averaged capacity."[15] We agree with DOE's conclusion that incorporating defrost energy consumption would provide a better representation of field performance. In addition, capturing defrost energy would encourage manufacturers to develop innovative solutions to reduce defrost energy consumption.

Air-Cooled, Water-Cooled, and Evaporatively-Cooled Equipment (ACUACs, WCUACs, and ECUACs)

We encourage DOE to adopt IEER as the metric for WCUACs and ECUACs. As DOE notes in the RFI, the recent rulemaking for ACUACs adopted IEER as the metric.[16] The current metric for WCUACs and ECUACs is EER, although ASHRAE 90.1 specifies minimum IEER levels for this equipment in addition to EER levels. WCUACs and ECUACs provide the same function as ACUACs and, like ACUACs, spend most of their operating hours at part load. Therefore, we believe that it makes sense for DOE to adopt IEER as the metric for WCUACs and ECUACs. This would provide consistency in ratings among the various types of commercial

[13] 82 Fed. Reg. 34437.
[14] https://www.mge.com/images/PDF/high-performance/demand-control-ventilation.pdf.
[15] 82 Fed. Reg. 34436.
[16] 82 Fed. Reg. 34440.

unitary equipment and would better represent the actual field performance of WCUACs and ECUACs. Further, this change would have no impact on test burden since manufacturers are already rating their equipment for both EER and IEER.

The commercial prototype building models used in the analysis in support of the ASHRAE 90.1 Standard may provide useful information on the operation of fans in ventilation mode and economizer mode. In the RFI, DOE requests information on how frequently CUAC supply fans are operated when there is no demand for heating or cooling.[17] This information would help DOE revise the CUAC test procedures to better represent total fan energy use, as recommended by the ASRAC working groups for both commercial package air conditioners and commercial and industrial fans and blowers. We understand that analysis conducted by Pacific Northwest National Laboratory (PNNL) in support of the ASHRAE 90.1 Standard uses commercial prototype building models that include information on fan operating hours in ventilation mode and economizer mode in each climate zone.[18] We believe that this information could be used to develop national average fan operating hours outside of heating and cooling modes.

The external static pressures specified for ACUACs, WCUACs, and ECUACs should be revised to reflect actual field conditions. DOE notes in the RFI that the Department "is interested in ensuring that the external static pressures in the test procedures are representative of those experienced in field installations.[19] We agree that this is necessary in order for CUAC efficiency ratings to provide an adequate representation of actual efficiency and to provide good information to consumers. Appropriate external static pressure values are also important so that innovative designs to reduce fan energy consumption are captured in the test procedures. Revisions to the current external static pressure values would be consistent with the recommendations to better capture fan energy use included in the term sheets from the ASRAC working groups for commercial package air conditioners and commercial and industrial fans and blowers.

DOE notes in the RFI that comments received as part of the 2015 ACUAC test procedure rulemaking indicated that typical external static pressures found in the field are likely significantly higher than those in the industry test standards.[20] The ASRAC working group for commercial package air conditioners agreed to use two values of external static pressure for the analysis for the standards rulemaking: 0.75 and 1.25 in. w.c.[21] The external static pressures specified for ACUACs should be no lower than these values. Absent additional data, we believe that it would be appropriate to use the same static pressures for WCUACs and ECUACs as those for ACUACs.

[17] 82 Fed. Reg. 34440.
[18] https://www.energycodes.gov/development/commercial/prototype_models.
[19] 82 Fed. Reg. 34440.
[20] 82 Fed. Reg. 34440.
[21] https://www.regulations.gov/document?D=EERE-2013-BT-STD-0007-0105. p. 7-5.

Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps (VRF)

We encourage DOE to add IEER as an efficiency metric for VRF equipment. The current metric for VRF equipment is EER. However, as DOE notes in the RFI, "the IEER metric provides a more representative measure of energy consumption in actual operation" since it incorporates part-load performance.[22] ASHRAE 90.1 includes both EER and IEER requirements for VRF equipment. We encourage DOE to add IEER as an efficiency metric for VRF equipment. Adding IEER as a metric would have no impact on test burden since manufacturers are already rating their equipment for both EER and IEER.

Thank you for considering these comments.

Sincerely,

Joanna Mauer
Technical Advocacy Manager
Appliance Standards Awareness Project

Daniel Bresette
Vice President, Policy and Research
Alliance to Save Energy

Christopher Perry
Senior Analyst, Buildings Program
American Council for an Energy-Efficient Economy

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

Tom Eckman
Senior Advisor
Northwest Power and Conservation Council

[22] 82 Fed. Reg. 34445.