Appliance Standards Awareness Project
Natural Resources Defense Council
Alliance to Save Energy
American Council for an Energy-Efficient Economy
Northeast Energy Efficiency Partnerships

May 11, 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–2014–BT–STD–0058: Request for Information for Clothes Dryers

Dear Ms. Edwards:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Natural Resources Defense Council (NRDC), Alliance to Save Energy (ASE), American Council for an Energy-Efficient Economy (ACEEE), and Northeast Energy Efficiency Partnerships (NEEP) on the request for information (RFI) for clothes dryers. 80 Fed. Reg. 16309 (March 27, 2015). We appreciate the opportunity to provide input to the Department.

We are pleased that DOE has initiated a process to consider amended standards for clothes dryers in accordance with the six-year review provision. We believe that strong new standards for clothes dryers, based on an amended test procedure that better reflects energy consumption in the field, could yield very large national energy savings and savings for consumers.

We continue to urge DOE to develop an amended test procedure that would better reflect clothes dryer energy consumption in the field. In particular, we encourage DOE to consider incorporating real-world clothes, adding a test for small loads, and including testing at multiple cycle settings. In our comments on the test procedures notice of public meeting (NOPM), we encouraged DOE to include the test load developed by the Northwest Energy Efficiency Alliance (NEEA) and the California Investor Owned Utilities (IOUs), which is composed of real clothing, as part of its investigative testing.[1] We also encouraged DOE to include testing using the AHAM 1992 load, which is the most realistic test load that we are aware of other than the test load recently developed by NEEA and the California IOUs. We believe that these test loads would better reflect actual loads that consumers are drying in the field than the current DOE test load, and that using either of these alternative test loads would better ensure energy savings in the field and ensure that the benefits of new technologies for clothes dryers are appropriately captured in clothes dryer ratings. As we noted in our comments on the test procedures NOPM, testing

[1] Comment ID: EERE-2014-BT-TP-0034-0005.

conducted by NEEA and the California IOUs found that the relative ranking of clothes dryers in terms of efficiency changed significantly when dryers were tested with real clothing compared to testing using Appendix D2.[2]

In terms of test load size, as we noted in our comments on the test procedures NOPM, NEEA's field study found that more than one-third of all loads are 5 lb or less.[3] Incorporating a smaller load as part of the test procedures would ensure that the test procedures are not discouraging technologies that could improve the efficiency and reduce the energy consumed when drying small loads. As NEEA notes in their comments on the RFI, they found in their testing using both Appendix D2 and real-world clothing that for conventional electric dryers, the CEF using a small load (4.2 lb) was 47-74% of the CEF using a large load (16.8 lb). These results suggest that not only does load size have a significant impact on drying efficiency, but that the magnitude of the impact varies significantly across models.

Finally, in our comments on the test procedures NOPM, we encouraged DOE to evaluate a range of cycle settings in order to bound the performance of clothes dryers and to prevent gaming of the test procedures. While testing using only a "normal" cycle may have been reasonable in the past, we believe that it will be important to test at multiple settings in the future as clothes dryers continue to offer an increasing number of settings and testing at a single setting could allow for gaming of the test procedures. For example, a dryer could be designed with a "normal" setting where the dryer performed very efficiently but with a very long cycle time, which could result in most consumers instead choosing a faster cycle.

We encourage DOE to continue its clothes dryer testing and to publish its interim results so that stakeholders are provided with timely data access and the ability to provide input for DOE's consideration as it pursues additional testing. We welcome DOE's supplemental clothes dryer testing to gather additional data as the Department considers updates to the test procedures and standards. We understand that NEEA is submitting supplemental testing data and trust that DOE will review it carefully and based on its findings make minor modifications to its testing plans as needed.

We encourage DOE to release interim test results as the data become available rather than waiting to publish test data as part of a test procedures NOPR. Releasing interim test data will provide stakeholders sufficient time to review the data and findings and for any supplemental data to be collected and submitted to DOE for the Department's consideration before it issues a test procedures NOPR. We also encourage DOE to report the cycle time of the test runs conducted. Data on cycle time will allow for evaluating how different cycle settings impact drying time and will provide DOE with the option of considering standards that incorporate cycle time (see below for further discussion of this point).

We encourage DOE to evaluate whether the current product class structure for clothes dryers should be amended. In their comments on the RFI, NEEA suggests that standards that are a function of clothes dryer capacity may make sense and would eliminate the need to

[2] See comments from the California IOUs on the test procedures NOPM; Comment ID: EERE-2014-BT-TP-0034-0007, pp. 3-4.
[3] http://neea.org/docs/default-source/reports/neea-clothes-dryer-field-study.pdf?sfvrsn=4. Table 40. p. 82.

distinguish between standard and compact clothes dryers. The NEEA comments also explain how the current product class structure may be biased against large compact clothes dryers, which are smaller than standard full-size dryers in the US but can dry the same load sizes as standard dryers. We encourage DOE to consider this potential approach of establishing standards that are a function of clothes dryer capacity.

We encourage DOE to consider radio frequency clothes dryers as a technology option. The RFI notes that DOE plans to consider microwave technology as a technology option for electric clothes dryers.[4] In addition to microwave technology, we encourage DOE to also consider radio frequency clothes dryers, which employ technology similar to microwave technology but at much longer wavelengths. Unlike microwave dryers, radio frequency dryers do not heat metal objects, and radio frequency dryers also provide better penetration of the fabric to yield more even drying of the clothes compared to microwave technology.[5] The company Cool Dry has developed a radio frequency clothes dryer prototype, which they claim reduces energy consumption by 24% and drying time by 14% compared to conventional clothes dryers.[6]

We encourage DOE to consider air-to-air heat exchangers as a technology option for ventless clothes dryers. The RFI notes that DOE plans to consider methods of exhaust heat recovery as technology options, but only for vented clothes dryers.[7] For ventless clothes dryers, the air coming out of the condenser could pass through an air-to-air heat exchanger with the air coming out of the drum on the other side of the heat exchanger. Adding this air-to-air heat exchanger would warm up the air coming out of the condenser so that less electric resistance heat is necessary. In addition, the air coming out of the drum would be cooled down, which would mean that the condenser would not need as much room air to condense the water.

We encourage DOE to consider the range of design options associated with heat pump clothes dryers. The RFI notes that DOE plans to consider heat pump technology as a technology option for electric clothes dryers.[8] We encourage DOE to consider the full range of design options associated with heat pump technology including pure heat pumps (i.e. without electric resistance elements), hybrid heat pumps that include electric resistance elements, and different options for the design of heat pumps, as opposed to just considering "heat pump technology" as a single technology option. We understand that most heat pump clothes dryers available in the EU are pure heat pumps. In contrast, the three models of heat pump clothes dryers that met the 2014 ENERGY STAR Emerging Technology Award (ETA) level are hybrid heat pumps and include electric resistance elements.

In addition to considering both pure heat pump clothes dryers and hybrid heat pumps, we also encourage DOE to consider higher-efficiency compressors and larger-capacity compressors as design options for heat pump clothes dryers. Higher-efficiency compressors include compressors utilizing permanent magnet motors and variable-speed compressors. Panasonic has developed a heat pump clothes dryer that utilizes inverter technology.[9] We also understand that heat pump

[4] 80 Fed. Reg. 16312. Table II.3.
[5] http://cooldryrf.com/microwave-comparison.
[6] http://cooldryrf.com/performance.
[7] 80 Fed. Reg. 16312. Table II.3.
[8] 80 Fed. Reg. 16312. Table II.3.
[9] See http://www.panasonic.com/nz/consumer/household/whiteware/heat-pump-dryers/nh-p70g2wau.html.

capacity can have a significant impact on the efficiency of heat pump clothes dryers, and that larger-capacity compressors in hybrid heat pumps can both reduce the amount of electric resistance heat required and reduce cycle time.

For ventless heat pump clothes dryers, we encourage DOE to consider as a technology option the addition of an air-to-air heat exchanger. The air coming out of the cold side of the heat pump could pass through an air-to-air heat exchanger with the air coming out of the drum on the other side of the heat exchanger. Adding this air-to-air heat exchanger would warm up the air that comes out of the cold side of the heat pump so that less heating would be required by the hot side of the heat pump. In addition, the air coming out of the drum would be cooled down, which would mean that the cold side of the heat pump would not need to remove as much heat. This design may allow for achieving similar or higher efficiency levels as ventless heat pump clothes dryers without air-to-air heat exchangers, but at a lower cost.

We encourage DOE to consider design options employed in the most-efficient clothes dryers available in the EU. In the EU, pure heat pump clothes dryers are very common and deliver very high efficiency. The energy efficiency and market tracking group Topten has published a list of the most-efficient clothes dryers in the EU with capacities of 7 kg, 8 kg, and 9 kg.[10] While the capacity, voltage, and test procedures differ from those in the US, much can be learned from this European data. We also note that 14 different brands are represented on the Topten list, reflecting a wide variety of product offerings and price points. We also encourage DOE to review the clothes dryer standards that took effect in Switzerland in 2012 and which require efficiency levels equivalent to the efficiency of heat pump clothes dryers.

We encourage DOE to consider efficiency levels that are higher than the ENERGY STAR 2014 Emerging Technology Award (ETA) level and to also consider potential intermediate efficiency levels between the ENERGY STAR specification and the ETA level. The RFI notes that DOE plans to consider various efficiency levels including the current standard (since the current CEF, based on Appendix D1, is higher than the baseline based on Appendix D2), gap fill levels between the baseline and the current standard, the ENERGY STAR specification, and the ENERGY STAR 2014 ETA level.[11]

We believe that the true "max-tech" level is significantly higher than the CEF equivalent to the ENERGY STAR 2014 ETA level. For example, for vented electric standard clothes dryers, the ETA level represents a CEF of 4.3 lb/kWh. However, while the vented clothes dryers that achieved the 2014 ETA level utilize heat pump technology,[12] we understand that optimized heat pump clothes dryers can achieve significantly higher efficiency levels. For example, in the California IOU comments on the test procedures NOPM, they showed test results for a European heat pump clothes dryer that achieved a CEF of about 7.0 lb/kWh using Appendix D2.[13] And in their comments on the RFI, NEEA notes that they have tested a heat pump clothes dryer that achieves a CEF of greater than 10 lb/kWh using Appendix D2. We encourage DOE to consider

[10] http://www.topten.eu/.
[11] 80 Fed. Reg. 16314-15.
[12] http://www.energystar.gov/sites/default/files/asset/document/2014%20Emerging%20Technology%20Award-winning%20Advanced%20Clothes%20Dryer%20Models_0.pdf. The Kenmore and LG models are vented.
[13] Comment ID: EERE-2014-BT-TP-0034-0007. p. 4.

multiple efficiency levels higher than the 2014 ETA level, including a level that better represents the true "max-tech" level.

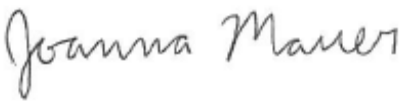
We also believe that it will be important for DOE to consider efficiency levels based on clothes dryer designs incorporating technology options beyond those required to meet the current ENERGY STAR specification, but that do not incorporate heat pump technology, in order to fully capture the range of potential efficiency levels. We understand that clothes dryers can achieve the ENERGY STAR specification with minimal design changes beyond the implementation of improved automatic termination controls. While improved automatic termination controls can achieve significant energy savings, we believe that there are additional technology options short of heat pump technology that could also achieve significant energy savings including inlet air preheat, modulation, and improved motor and fan efficiency. We encourage DOE to consider one or more efficiency levels based on technology options beyond the use of improved automatic termination controls that could improve efficiency without the use of heat pump technology in order to fully capture the range of potential efficiency levels.

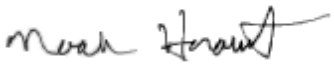
We encourage DOE to consider the importance of cycle time in the analysis of potential amended standards for clothes dryers. We also encourage DOE to consider whether it may make sense to establish standards that are a function of cycle time.[14] Standards that are a function of cycle time would ensure that manufacturers could not meet a given efficiency level simply by increasing cycle time without any limit. If standards were met simply by increasing cycle time significantly, this could result in consumers choosing a faster, more-energy consuming cycle. Standards that are a function of cycle time would also provide consumers the option of choosing clothes dryers with longer cycle times but that also save more energy.

Alternatively, the test procedures could specify different weightings of energy use results for different settings based on cycle time. For example, if cycle time with an efficient setting selected is less than X minutes, then that setting could be more heavily weighted than for models where the "eco" mode has a very long drying time, which would greatly reduce the likelihood of that setting being selected or the associated energy savings being achieved.

Thank you for considering these comments.

Sincerely,





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[14] See, for example: http://aceee.org/files/proceedings/2014/data/papers/9-501.pdf.

Kateri Callahan
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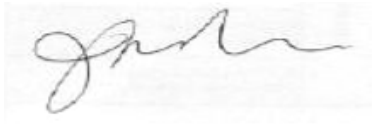

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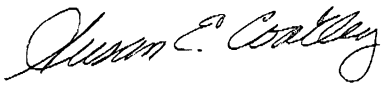

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