March 27, 2013

Abigail Daken
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

RE: ENERGY STAR® Clothes Dryers Draft 1 Version 1.0 Specification

Dear Ms. Daken:

Northwest Energy Efficiency Alliance is a non-profit organization working to encourage the development and adoption of energy-efficient products and services. NEEA is supported by the region's electric utilities, public benefits administrators, state governments, public interest groups and efficiency industry representatives. This unique partnership has helped make the Northwest region a national leader in energy efficiency.

ENERGY STAR specifications are an important first step in accelerating the manufacturing and adoption of more efficient residential technologies. Much like clothes dryers, electric resistance water heater technology offered a very limited range of energy efficiency for many years, and, as a result, were not a significant source of cost effective energy savings in our region. However, in 2007 ENERGY STAR helped to change that equation by recognizing the arrival in the marketplace of much more efficient technologies, and taking the bold step of setting the electric water heater Energy Factor specification at 2.0 – a level that most major manufacturers were not able to achieve with commercially available products at the time. Since then, several of the largest water heater manufacturers in the world have introduced advanced, ENERGY STAR-qualifying water heaters. Before ENERGY STAR's involvement, several small manufacturers had attempted to penetrate the market, but they had little success because their products were not cost-effective and didn't have the quality and service support common to the industry leaders. Today, the water heater picture has fundamentally changed in our region – we now have 10 manufacturers offering 19 compliant heat pump models for sale in the Northwest.

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NEEA now seeks to replicate this regional success story, with ENERGY STAR's help, with clothes dryers. Other residential appliances have reached fairly high typical levels of efficiency in our region, while dryers remain one of our best hopes for procuring additional cost-effective energy savings from residential appliances. A combination of product labeling, better consumer and retailer education, and incentives can help transform purchasing patterns and behaviors in our region, allowing our utility partners to begin capturing significant cost-effective energy savings from dryers in late 2013.

To that end, it is vital that the ENERGY STAR specification be broad in scope, sufficiently stringent and realistic to capture meaningful and quantifiable energy savings, and prompt enough to bring labeled products to market during the 2013 calendar year. It is also essential for test procedure, on which the specification relies, measure energy use realistically so that savings can be accurately estimated. An aggressive and realistic ENERGY STAR specification will be critical to attracting major manufacturers to bring products to market that are cost-effective and provide the service and quality required by Northwest consumers.

Rather than waiting for a large number of models to qualify, we encourage ENERGY STAR to begin its labeling program at a pilot scale in 2013, even if only a few models qualify, and then update its specification to a more stringent and comprehensive Tier 2 that would become effective in early 2015. Planning now for a second tier would also allow ENERGY STAR to provide advance guidance regarding the approximate level of stringency it is aiming for in the next upgrade of its specification. ENERGY STAR did this successfully a few years ago by simultaneously announcing versions 4 and 5 of its television specification, giving manufacturers sufficient time to plan for the needed technologies to achieve version 5 efficiency levels.

Our specific recommendations, detailed in the remainder of this letter, can be summarized as follows:

Tier 1 – Launch labeling program no later than Q3 2013. Utilize the 2005 DOE test procedure for which product test data are already broadly available. Adjust measured energy consumption per cycle and average cycles/year values on the basis of field research findings for purposes of publishing ENERGY STAR estimates of annual energy consumption and savings. Encourage use of advanced automatic termination technology as you have done in the Emerging Technology specification.

Tier 2 – Launch revised specification no later than January 1, 2015 to coincide with date of new DOE standards and test procedure. Work with DOE to encourage revision of 2013 draft test procedure to better reflect real world energy consumption and to capture drying time data, so that test procedure results do not require the use of after-the-fact correction factors. Include maximum drying time requirements in specification to discourage performance tradeoffs. Pre-announce (in 2013) ENERGY STAR's target savings percentage for Tier 2 relative to its Tier 1 to give manufacturers maximum lead time to make needed technology improvements.[1]

The Need for Realistic Energy Data

To help inform future program and policy activities, NEEA conducted a comprehensive field study in 2011 and 2012 that measured plug load energy use in over 1,700 homes across the Northwest. We monitored laundry energy use and behavior in 50 of those homes for a period of one month to more deeply understand that element of home energy use. The resulting data indicate that dryer energy use may now exceed lighting energy use in the home, contributing an average of **920 kWh per year** to a home's energy bill in our region. Residential clothes dryer efficiency has been largely unexamined for many years, but we increasingly believe dryers offer a very large, untapped opportunity for energy savings.

Measuring real-world dryer energy use and drying time is essential to accurately understand the energy savings potential of more advanced dryer technologies, and assess the potential barriers to consumer acceptance of those technologies. Realistic representation is, in fact, required by law: the U.S. Department of Energy's statutory requirement in 42 U.S.C. 6293(b)(3) states that DOE must promulgate a test procedure that "shall produce results which measure the energy efficiency, energy use or estimated annual operating cost of a covered product over an average or representative period of use, and is not overly burdensome to conduct." We do not believe that the current (2005) or recently proposed (2011 and 2013) USDOE test procedures meet this test. To the extent ENERGY STAR relies upon an unrepresentative test procedure, it risks under-estimating or over-estimating the resulting savings and cost-effectiveness in its efforts to promote more efficient products.

This is also true for all the manufacturer and retailer partners that rely on ENERGY STAR data when promoting labeled products. But accuracy of the test procedure is even more important for utilities, who bear legal and financial responsibility to their public utility commissions for the veracity of claimed energy savings from rebated products. Our member utilities need to be confident that claimed savings are really occurring when they provide incentives for an energy efficient product, and they rely on NEEA to help provide that confidence through our test procedure work with government agencies. In 2010 and 2011, our region met more than 85% of its load growth with energy efficiency resources at an average levelized cost of only 1.8 cents/kWh.[2] However, the agency that forecasts energy supply and demand for our region, the Northwest Power and Conservation Council, depends upon accurate product-level energy consumption data from federal agencies to do so. The 44% annual energy use

[1] Tier 2 may have to be adjusted if the DOE test procedure changes significantly.
[2] See http://www.nwcouncil.org/library/2012/2012-13.pdf

discrepancy between our field results for dryers and EPA's baseline energy use estimate is already prompting reexamination of this measure for cost-effective energy savings potential in our region.

As EPA noted in its ENERGY STAR residential clothes dryer specification version 1 webinar presentation, "EPA will factor in relevant [per unit energy use and savings] findings from recent field studies as they become available." NEEA is pleased to share initial findings from our recent field study to help inform this important ENERGY STAR specification. In this letter we will also share early results from our laboratory testing comparing DOE tests to tests completed in conditions similar to those we observed in the field.

Both field and lab studies indicate that ENERGY STAR's draft 1 specification, based on an unrealistic test procedure, underestimates dryer energy use and drying time. On January 2, 2013 DOE published a Notice of Proposed Rulemaking (NOPR) for the Clothes Dryer Test Procedure. The NOPR addresses one of the previous procedure's most significant shortcomings – energy use in an automatic termination cycle in drying clothes below the current 5 percent remaining moisture test termination point. There are other relevant proposed changes that may help improve the accuracy of the test procedure, but it will be some months before DOE will publish a Final Rule. If we understand the wording of the NOPR correctly, use of that revised test procedure for purposes of reporting energy consumption and efficiency data will be mandatory on January 1, 2015 and optional (for interested parties) between 30 days after the publication date of the Final Rule and that date.

We will be engaging with DOE and other stakeholders throughout 2013 to ensure to the extent possible that the revised federal test procedure accomplishes the following important goals:

- As accurately as possible estimates the real-world efficiency and annual energy use and drying time of all clothes dryers, regardless of which technologies are used.
- Effectively differentiates the efficient dryer technologies from inefficient ones and correctly predicts the amount of energy savings that will result from choosing a better product.
- Helps consumers, retailers and utilities make the most cost effective laundry choices.

In the meantime, for a Tier 1 specification, we recommend introducing a correction factor for ENERGY STAR's annual energy use estimates to more accurately characterize actual energy use in the near term, until a more realistic test procedure can be adopted.

Field research shows that ENERGY STAR underestimates dryer energy use and drying time

NEEA's 2012 field study of clothes washer and dryer energy use and performance helped answer key questions regarding usage profiles and duty cycles. Our analysis of those field research results, the most recent residential laundry energy use study in the country, points to some of the assumptions that may be causing EPA to underestimate dryer energy use. In brief, our analysis suggests that the existing US test procedure underestimates energy use per load, and the use of Residential Energy Consumption Survey self-reported results instead of field monitoring data underestimates the number of loads per year. The product of these two leads to a significant underestimate of total annual energy use, and the amount of energy that can be saved by improving dryer efficiency.

The DOE test procedure and the NEEA field data aligned well when it came to load weight. However, some differences appeared in moisture content, water removed per load, vent airflow, setting selections, load composition, percentage of washer loads that go to the dryer and average number of dryer loads per year, as illustrated in Table 1.

Table 1: Comparison of Key Values: DOE 2005 Standard vs. EPA Estimates vs. NEEA Field Data

	DOE 2005 Standard/ Test Procedure	EPA Estimates w/ DOE 2015 Standard/ 2013 Test Procedure	NEEA Data Average	Likely Impact of NEEA Data on Energy Use Per Load vs EPA
Initial Moisture Content of Load (%)	66.5%-73.5%	57.31%-57.69%	62%#	Increase
Final Moisture Content of Load (%)	2.5%-5%	2.5%-5%	N/A	N/A
Water Removed per Load (lb)	4.6	4.6	4.5#	Decrease
Dry Weight of Load (lb)	7.0	8.45	7.5#	Decrease
Duct restriction level (cap hole diameter in inches)	2 7/8	2 7/8	2 11/16	Decrease
Auto vs. Manual Termination	Manual	Auto	Auto	Increase@
Temperature Setting	High	High	Medium	Decrease
Dryness Setting	N/A	Normal	Normal	Increase@
Load Composition	2-dimensional, uniform thickness	2-dimensional, uniform thickness	Mostly 3-dimensional of varying thickness	Increase
Average Drying Time (minutes)	23	23	58	
Energy Use/Load (kWh)	2.33	2.27	3.1*	
Washer cycles that go to dryer (%)	107%	91%	124%&	
Loads per Year	416	283	337*	
Energy Use per Dryer (kWh/y)	967	641	920*	
Energy Factor (EF) (lbs/kWh)	3.01	3.73	2.4#	

#These data include the cycles with valid energy, weight, etc. measurements and reflect a 3.6% MC adjustment to account for the fact that clothes were not bone dry when initially measured by field study participants.

@Though automatic termination in the field saves energy relative to timed dry, here we are comparing to termination in the laboratory to a final moisture content that is greater than the automatic termination moisture content.

**These data include all cycles originally included in NEEA study (1640 cycles).*

&The field data showed that many users would commonly run "touch up" loads after the main drying cycle had completed to get particular articles fully dried. As a result, the data showed more drying cycles than washing cycles, even though some items that were washed were not subsequently machine-dried.

Load Composition and Moisture Content

Based on the field research results, DOE's test procedure assumes a reasonable load size (weight), but the composition of that load is very different from what laundry users in our region typically dry. Specifically, the clothes placed in dryers tend to have greater thickness and greater variation in thickness than DOE's test cloths. Additionally, common items such as shirts, pants, socks, and other articles of clothing are three dimensional, and therefore contain interior sides that are more challenging to dry than the two dimensional DOE test clothes. These items vary quite widely in their moisture retention capability but, on average, retain more moisture per pound than DOE's uniform test cloths and require more energy to dry. They also differ significantly in how much moisture they tend to retain from one article of clothing to the next because of differences in thickness and synthetic content, so present automatic termination circuitry with a greater challenge than DOE's test cloths in determining when the load is dry.

We find that our customers' washers may have high spin speed capability, *but may not be used* to the same extent DOE assumes in its 2011 dryer test procedure and standards analysis. Therefore the clothing entering dryers in our region is wetter than DOE assumes, and requires more energy to dry. There are two likely reasons for this. First, the spin speed and spin time settings on washers are typically user-selectable, and therefore not routinely chosen to the optimal extent even on washers that have that capability. Another study has also found this to be true, especially for higher performance washers that offer high spin speeds, but also more user-selectable settings.[3] Secondly, we find that high spin speeds and times in washers occur only to the extent that the washer is able to sufficiently balance the load before the spin cycle, so some loads simply emerge wetter than they should, given the spin settings chosen.

Loads per Year

Our data are between DOE's prior assumption of 416 cycles per year in 2005 and the 283 cycles per year EPA and DOE assumed starting in 2011. Users may not have consolidated their loads to the extent EPA assumed as average washer and dryer drum volumes have increased. This assumption has a significant effect on the annual energy use calculation, increasing it by approximately **19%**.

Dryer Venting

In many homes in the U.S., clothes dryers operate with less-than-ideal venting. These ducts, which exhaust the warm, moist air from the dryer, are at least partially clogged with lint that accumulates as the dryers run hundreds of cycles every year. This is especially true where significant lengths of ducting pass through unconditioned volumes of the house, such as crawl spaces, where cold temperatures can allow moisture to

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[3] David Korn and Scott Dimetrosky, "Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems." 2010 ACEEE Summer Study on Energy Efficiency in Buildings, 9-143 to 9-156.

condense. Dryer duct cleaning is rarely performed in routine home maintenance schedules. Ducting can be made of plastic or metal that has been unintentionally perforated or crimped and may not be secured tightly to the dryer exhaust. In addition, ducts in older homes sometimes run long distances (20 or more feet) and through multiple 90 degree bends before venting to the outside, further restricting the air flow and making the duct more challenging to clean. NEEA's field research confirms a wide range of flow rates from dryers, representing various levels of duct restriction. Air flow rates at the output of the vent were found to be as low as 6 cubic feet per minute (CFM) and as high as 146 CFM, with an average of 79 CFM. This is significantly lower than air flow rates of approximately 96 CFM we measured in the laboratory when a set of dryers similar to those metered in the field were tested under the current U.S. DOE test procedure (Figure 1).

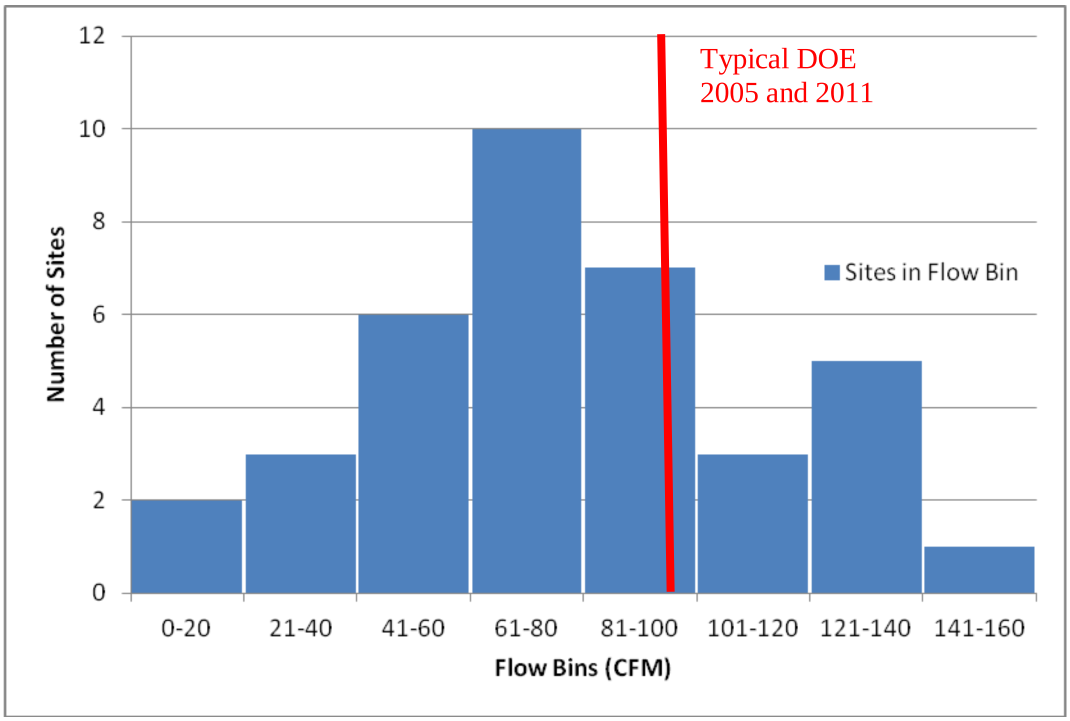

Figure 1: Air flow rates measured in field study vs. the DOE 2011 typical flow rate

Dryer Settings

The fact that consumers in our region selected automatic termination for more than 70% of the cycles (see Figure 2) suggests that it is essential for ENERGY STAR to assess the actual cycle time of the dryers it plans to label when operating in automatic termination mode. The DOE 2005 and 2011 methods of measuring dryer energy use in timed drying mode and then awarding a fixed energy savings credit to dryers that offer automatic termination capability fails to accurately account for the impact on energy use of automatic termination. It also fails to account for the measured differences among dryers in accurately sensing when to stop the drying process. While the magnitude of this difference might be modest when drying thin, synthetic test cloths, it is greater when drying diverse loads of real world clothing. The recently-released DOE 2013 test procedure NOPR helps to correct this issue by testing with automatic termination enabled.

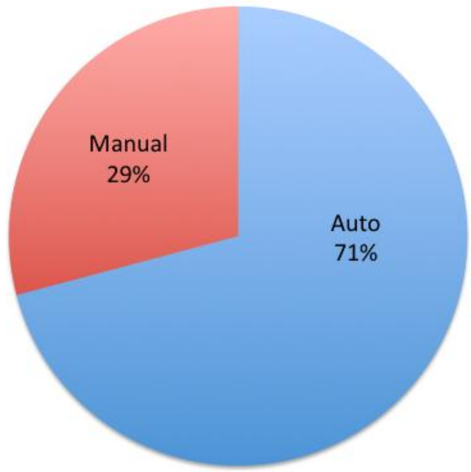

Figure 2: Automatic vs. Manual Cycles[4]

The DOE test procedure uses the high temperature setting, but the majority of Northwest consumers use the medium temperature setting (see Figure 3).

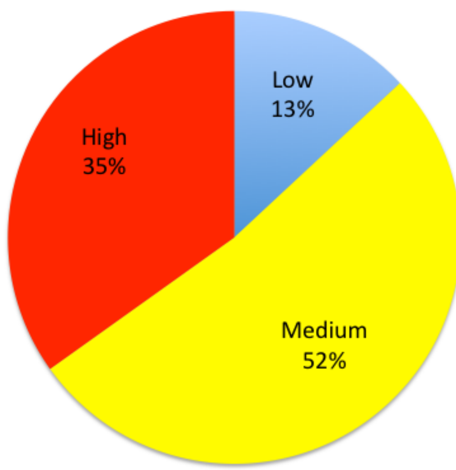

Figure 3: Dryer Temperature Settings[5]

The petition from the manufacturers and energy efficiency advocates proposes to use the normal dryness setting.[6] This is the most commonly used setting according to our

[4] Only clearly labeled data was included in this comparison, for a total of 1112 data points.
[5] Based on 1064 dryer cycles for which temperature setting information was recorded.

field data (see Figure 4). However, many people also use the very dry setting. This means that the assumption of the petition that people are satisfied with the dryness of their clothing on normal dryness is not universally true. This is consistent with the NRDC 2011 study[7] finding that real world clothing (as opposed to test clothes) would have to be dried to approximately 2% final moisture content in order to feel uniformly dry to the touch. Since DOE test cloths are much easier to dry, they would need to be significantly lower than 2% final moisture content with that same dryer to approximate a 2% final moisture content in real world clothing. With a test load that more closely approximates real-world clothing, such as the AHAM 1992 load, we believe a 2% final moisture content is appropriate.

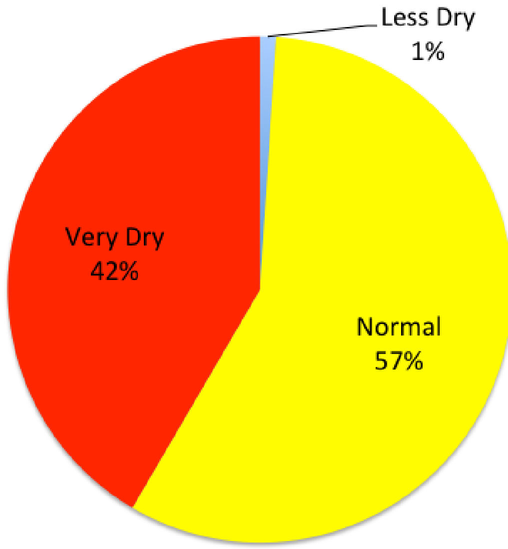

Figure 4: Dryness Level Settings[8]

Drying time

In addition to underestimating energy use, the field data also indicate that ENERGY STAR significantly underestimates drying time. Factors that increase the drying time in the NEEA data set relative to the ENERGY STAR parameters include higher initial moisture content, automatic termination, greater duct restriction, medium instead of high heat, and more diverse and complex load composition (three-dimensional articles).[9]

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[6] Department Of Energy, "Request To Consider Automatic Termination Controls." Federal Register 10 CFR Part 430 Vol. 76, No. 196 Tuesday, October 11, 2011.

[7] Denkenberger, Serena Mau, Chris Calwell, and Eric Wanless. 2011. Residential Clothes Dryers: A Closer Look at Energy Efficiency Test Procedures and Savings Opportunities. Ecova and NRDC.

[8] Based on the 592 cycles in which automatic termination was selected.

[9] Running a dryer on a medium temperature setting tends to reduce the dryer cycle's energy use because the heater is on a smaller percentage of the time. [Paul Bendt, Chris Calwell, and Laura Moorefield. 2009. Residential Clothes Dryers: An Investigation of Energy Efficiency Test Procedures and Savings Opportunities. Ecos report for Natural Resources Defense Council, November 6, 2009.]

One factor that decreases the drying time in the field study versus ENERGY STAR is a smaller dry weight of the load. Figure 5 illustrates the range of drying times measured in NEEA's field study. The degree of divergence between measured field data and the current federal test procedure is remarkable. The average measured drying time in the field is *more than double* the drying time typically measured by the DOE test procedure for full-size vented electric dryers. Put another way, *more than 80%* of the drying cycles measured in the field ran for a longer period of time than a typical dryer runs on the DOE test procedure.

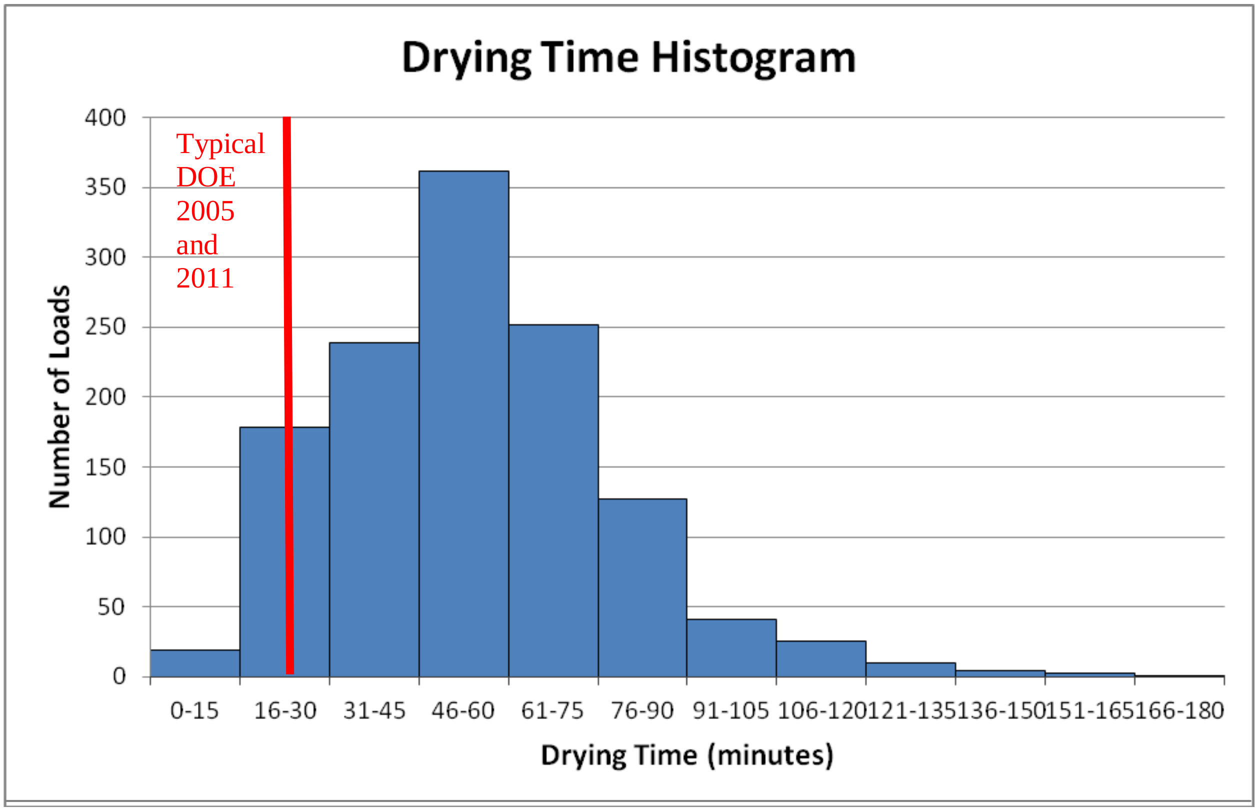

Figure 5: Drying Time Histogram

Lab research points to methods for achieving more realistic estimates

To understand how all of the differences in field conditions noted above affect dryer energy use, NEEA collaborated with Ecova to conduct sequential laboratory measurements of six vented electric dryer models. Four of those models are currently available in the marketplace, while the other two are no longer sold, but match models specifically identified in our field research. Each model was first tested according to the standard 2011 DOE test procedure. It was then retested with the AHAM test load, automatic termination settings, temperature and moisture content as noted above, and a comparable degree of duct restriction to what we observed in Northwest homes. Appendix 1 provides a summary of the real world test implemented based the NEEA field study results. The purpose of this research was to begin developing a correction factor for Tier 1 and an improved test procedure for Tier 2 to characterize the effect of real world conditions on efficiency and drying time compared with the DOE test procedure.

As shown in Figure 6 and Table 2 below, in this research we observed an average combined energy factor (CEF) of 2.8 – approximately 30% lower than the average CEF measured for those same six dryers on the DOE test procedure. Note that the percentage efficiency differences observed among the dryer models are greater when testing them with real world clothing – a more realistic load does a better job of differentiating efficient from inefficient models. Employing a test procedure more similar to this would yield energy consumption values much more consistent with what we have observed in the field.

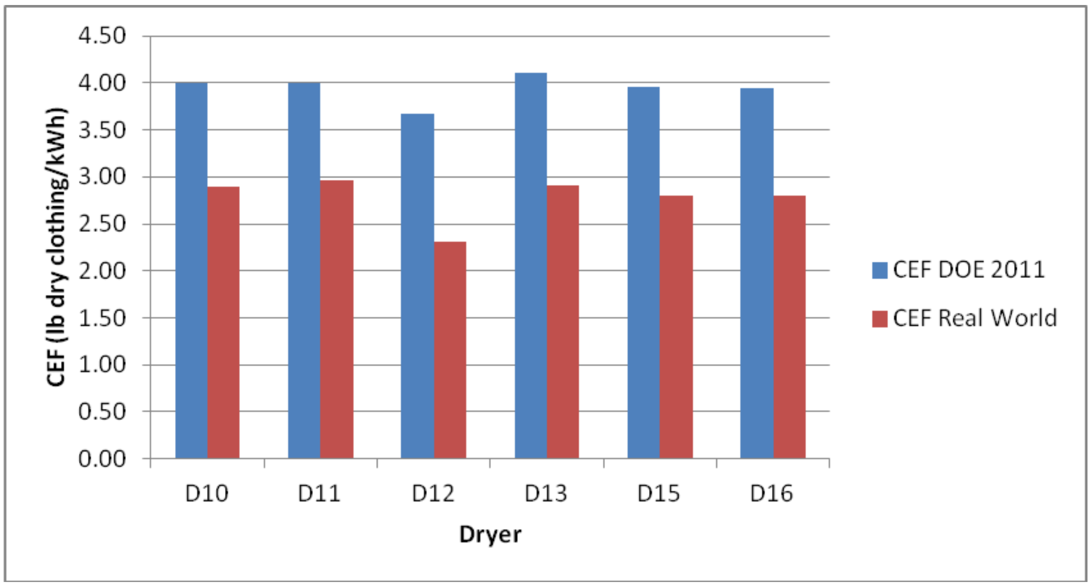

Figure 6. CEF with six dryers and two test procedures.[10]

[10] D11, D13 and D16 real world values are based on the average of 3 tests; others are based on a single test.

Table 2. CEF and drying time data for the six dryers

	CEF				Drying time			Key Dryer Model Attributes
Dryer	DOE 2011	DOE 2005 (published)	Real World 2011	DOE 2011 Adder to Efficiency	DOE 2011	Real World 2011	Real World Adder to Drying Time	
D10	4.00	N/A	2.89	38%	0:25:15	0:44:29	76%	Moisture sensor
D11	3.99	3.03	2.97	35%	0:24:38	0:46:07	87%	Moisture sensor
D12	3.67	N/A	2.31	59%	0:22:41	1:02:55	177%	In NEEA field study; moisture sensor
D13	4.10	N/A	2.91	41%	0:23:30	0:49:28	111%	In NEEA field study; no moisture sensor
D15	3.96	3.31	2.80	42%	0:27:30	0:57:42	110%	Fourth most efficient dryer in DOE dataset; moisture sensor
D16	3.94	3.7	2.80	41%	0:40:08	0:53:59	35%	Most efficient dryer in DOE dataset; moisture sensor on drum bar
Average	3.94		2.78	42%	0:27:17	0:52:27	92%	

The results also showed a significant difference in drying time between the two procedures, yet not a consistent difference (Figure 7 and Table 2). The lack of consistent difference indicates that it is not feasible to create a drying time correction factor for the DOE test procedure. In order to accurately specify and report meaningful drying times, ENERGY STAR needs to measure them directly.

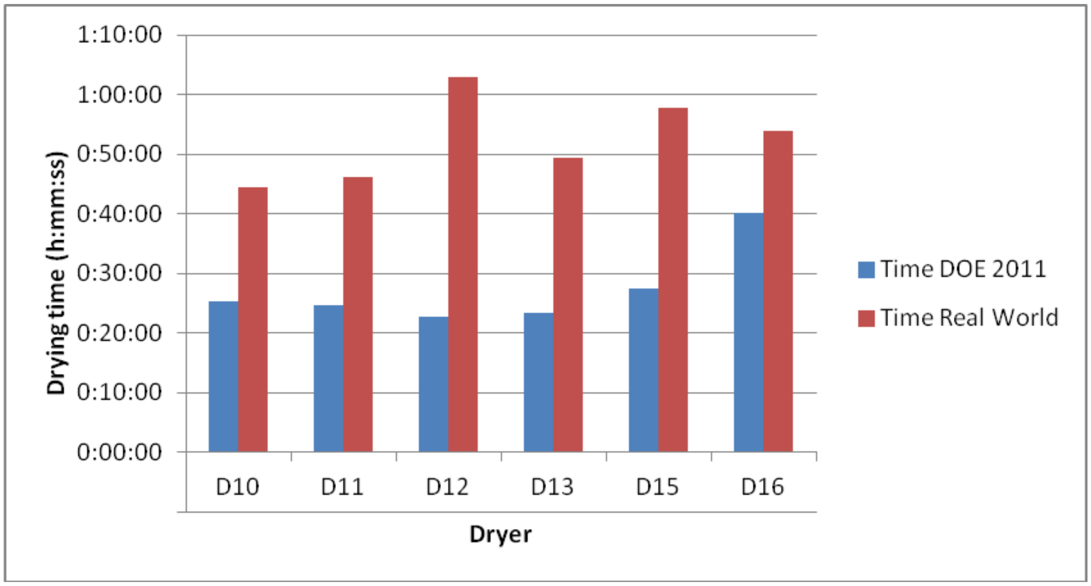

Figure 7: DOE 2011 versus real-world test procedure drying time for six dryers[11]

Lessons from Australia: the Benefits of Testing and Reporting Energy Use *and* Drying Time

Australia's government testing program already makes energy use and drying time data available to prospective purchasers of all dryers (see http://www.energyrating.gov.au/products-themes/washing-drying/clothes-dryers/star-rating/). Since 1989, Australia has employed a mandatory categorical labeling system for energy efficiency under which dryers can earn 1 star (very low efficiency) to 6 stars (very high efficiency). It has recently begun calculating efficiency differences across a 10 "star rating index" range as the best models have continued to improve. However the most efficient models remain capped at 6 stars for labeling purposes for the moment, while the government deliberates whether to expand the label range to 10 stars as it has already done for refrigerators and air conditioners.

The Australian test procedure employs three-dimensional articles of real clothing in a mix of thicknesses and cotton content, posing a greater and more realistic challenge to their dryers than the 50% synthetic, thin, uniformly-sized, two-dimensional US test cloths. This helps to differentiate the market on the basis of efficiency and drying time, encouraging the sale of more efficient units with more effective moisture sensing capabilities.

[11] D11, D13 and D16 real world values are based on the average of 3 tests; others are based on a single test.

The US test procedure yields Energy Factor or Combined Energy Factor values that are all fairly similar to each other for current dryer models, and the Federal Trade Commission does not place that information on dryers. Therefore, US consumers currently lack the means and motivation to purchase on the basis of efficiency. Full disclosure of that information would give manufacturers a stronger incentive to produce dryers optimized for both energy efficiency and drying time.

Figures 8 and 9 below reveal a number of interesting things about Australia's dryers:

- Most Australian dryers, whether condensing or vented, cluster around a star rating index (SRI) of 2. Fewer than 40 models manage a star rating index (SRI) above 3.5, but the best of those achieve an SRI of 7 to 9. Each additional star represents a 15% absolute improvement in efficiency over the star level below it, so the Australian data reveal an energy efficiency difference of approximately **3.8:1** between the least and most efficient dryer models sold in their country.

- Drying times differed by a factor of 2 to 3 among dryers of similar size and efficiency.[12] While many condensing models took longer to dry than their vented counterparts, the best condensing designs had similar drying times to vented models of similar capacity. By measuring and reporting both efficiency and drying time, Australia confers a market advantage to those technologies that can optimize both instead of providing one at the expense of the other.

- Heat pumps are now commonly available in Australia in the most popular capacity (6 to 7 kg), but are still not available in the US in any size, even though the greater average usage of dryers in the US would make them more cost effective here.

Implications for the US Market

The history of Australia's testing and labeling for dryers suggests that significant differences in product efficiency and performance do not emerge in the marketplace until buyers are made aware of how consequential those differences might be. Once buyers express a purchase preference for products that objectively perform better, more manufacturers begin to offer those technologies for sale at competitive prices.

[12] The Australian test procedure generally yields longer drying times than the US test procedure for four reasons: 1) the clothes have an initial moisture content of 84 to 90% (vs. 54 to 61%), 2) the test clothing is more realistic, 3) the load size, matching manufacturer ratings, is typically larger than 8.45 pounds, and 4) typical household outlet wattage is capped at 2,400 watts by their 10 amp electrical breakers, so electric heating elements in Australian dryers are much less powerful than those found in US dryers.

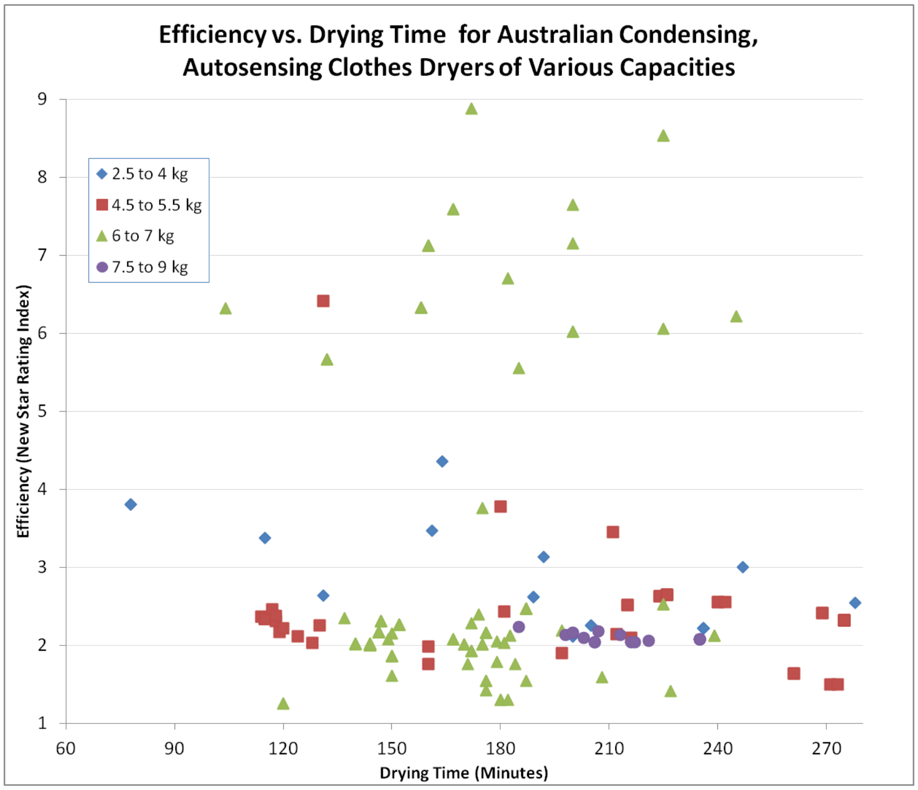

Figure 8: Efficiency and drying time of Australian condensing dryers

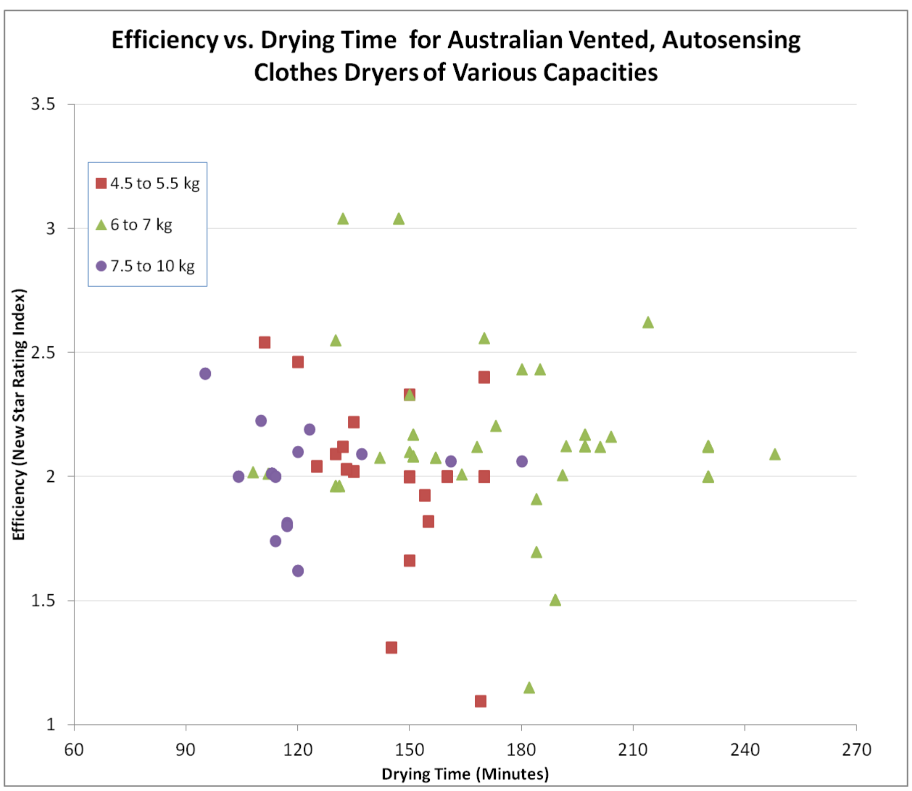

Figure 9: Efficiency and drying time of Australian vented dryers

Currently, various US dryer models make widely different claims about drying times, each employing different assumptions about the size and composition of the load being dried, as well as its initial moisture content. Some manufacturers have made claims that particular dryer models can achieve energy savings of 40% or more, or can dry laundry in as little as 14 minutes.[13] Only when potential buyers examine advertising fine print do they discover that the manufacturer is achieving most of these dryer savings in a *washer* with a high spin speed, or by drying a very small load of synthetics. In the absence of standardized guidelines for how to report drying times and energy savings, manufacturers understandably developed their own for marketing purposes.[14] Manufacturers did this for the key performance and energy attributes of other products like ceiling fans, computer monitors, and light bulbs as well before ENERGY STAR established common ground rules for all of its partners to follow.

The linkage between energy efficiency and drying times in clothes dryers has already been firmly established in laboratory testing. All else being equal, a dryer that reduces the temperature of its heating element and modestly extends average drying times can save energy (the basis for the optional "eco-modes" now being offered in many new dryers). This will not affect consumer satisfaction for loads that are not time-critical. However, if a dryer's *primary* means of saving energy is to slow down the drying process, this could represent an unacceptable tradeoff to many potential buyers. *Therefore, having an accurate sense of drying times will help users purchase those models that can achieve energy savings without sacrificing performance, and will help ENERGY STAR establish a reasonable upper bound for allowable drying times for labeled products*.

Recommendations

Tier 1: Implement a correction factor in Tier 1 to more accurately estimate real-world energy use.

Field data strongly suggest that ENERGY STAR currently underestimates dryer energy use. While the ideal way to address this issue is to revise the DOE test procedure, this option is not realistic in the short time remaining before ENERGY STAR's launch of a 2013 Tier 1 specification. A compromise for improving the accuracy of Tier 1 would be to introduce an energy use correction factor for the DOE 2005 test results. It may be worthwhile for EPA to put out a call for data to other parties that have measured dryer

[13] See, for example: http://www.electroluxappliances.com/laundry-appliances/dryers/eimed60lss and http://www.washerdryerinfo.com/content/Fisher-Paykel-SmartLoad-DE62T27GW2-Dryer-Review/Drying-Speed-and-Performance.htm

[14] See, for example: http://www.maytag.com/-%5BMGD6000XW%5D-1101084/MGD6000XW/ and http://www.maytag.com/-%5BMGDB850YG%5D-1106387/MGDB850YG/

energy use in the field, to understand as fully as possible how that amount tends to differ from what is observed in the federal test procedure. The 44% discrepancy we observed does not suggest that the difference would be that high everywhere in the country, but it does indicate the merit of at least some upward adjustment in assumed energy use. DOE corrected the 641 kWh/year estimate to 718 kWh/year in its 2011 national impact assessment through some modifications to assumed load weight and moisture content, but these adjustments are not sufficient to fully account for all the differences between idealized lab measurements and typical field measurements.

Tier 2: Beginning in 2015, utilize improved DOE test procedure(s) to accurately represent real world energy use and drying time

The best way to correct this situation is to test dryers in a way that reflects real-world use. This would allow differentiation of dryers based on their response to real-world testing conditions. There is still time before 2015, when DOE implements the revised residential clothes dryer standard and test procedure, to address the test procedure issues identified in this letter. NEEA plans to engage with DOE and other stakeholders in support of a revised federal test procedure that realistically represents real world energy use and drying time.

NEEA appreciates the opportunity to offer these comments and data to the EPA. Thank you for considering these comments in the development of the next draft of the ENERGY STAR residential clothes dryer specification.

Sincerely,

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Senior Engineer – Codes and Standards
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APPENDIX 1: Real World Test Based on NEEA Field Study Results

NEEA used the DOE 2011 test procedure with the following modifications in order to mimic the real world conditions observed in our field study.

- Flow restriction of 96 CFM: We tested four full-size electric vented dryers, two of the models matching models in the NEEA field study. The average airflow with DOE duct restriction was 96 CFM. We developed a correlation of airflow with the size of the hole in the flow restrictor. We found that a hole size of 2 11/16 inches would approximately reproduce the measured average airflow in the field.
- Load Weight of 7.5 pounds: The measured dry weight of clothing in the field was 7.8 pounds per load. However, the DOE test procedure uses bone dry weight, so we estimate the relevant comparable weight was 7.5 pounds.
- AHAM 1992 load: The AHAM 1992 load is 100% cotton and has three-dimensional articles of clothing with varying thickness. We believe this represents a more realistic real-world load, and has the advantages of being created under standardized conditions by the relevant US trade association for appliances.
- Initial Moisture Content of 62%: The initial remaining moisture content (RMC) measured in the field was 56% more than the weight going in the washer. Again, since the "dry" weight was in equilibrium with atmosphere, we recommend using an initial RMC of 62% more than bone dry.
- Automatic Termination: We utilized the normal dryness setting most commonly observed in NEEA field research with a 2% or less final RMC requirement. If the cycle terminated and the clothes were not sufficiently dry, the entire process was repeated at the next higher dryness setting until a final RMC of 2% or less was achieved.
- Medium Temperature Setting: As discussed above, the majority of cycles measured in the field study used the medium temperature setting, so we recommend using the medium temperature setting.