September 6, 2015
Via Electronic Mail

Melissa Fiffer
ENERGY STAR Appliances
U.S. Environmental Protection Agency

Re: EPA Most Efficient Draft Clothes Dryer Specification

The Northwest Energy Efficiency Alliance (NEEA) is a non-profit organization working to encourage the development and adoption of energy-efficient products and services through market interventions to remove barriers. 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.

NEEA and the NW utilities have been active participants in the evolution of energy efficient clothes dryers since 2010 when it initiated a detailed field study of clothes washer and dryer performance as part of its Residential Building Stock Assessment (link). NEEA was a founding member of the Super-Efficient Dryer Initiative (SEDI) administered by the Vermont Energy Investment Corporation (VEIC), collaborated with PG&E on lab testing and development of supplemental testing protocol for clothes dryers, conducting field validation of

Overview

NEEA has spent considerable NW resources to improve technical understanding of dryer performance and develop an improved metric by which to measure the energy use of clothes washing and clothes drying. NEEA investigations revealed that the DOE metric (appendix D in 10 CFR part 430 subpart B of Title 10 of the Code of Federal Regulations) was inaccurate in both magnitude and relative rank-ordering of energy use between clothes dryers. During the subsequent years NEEA provided testimony to the DOE recommending improvements to the test procedure. In February of 2013 the DOE adopted a revised test procedure (appendix D1) and an optional test procedure (appendix D2) that improved the energy use resulting from automatic termination settings. While the appendix D2 test procedure may provide basic consumer information about energy use, it does not generate a sufficiently accurate metric for utility planning purposes.

NEEA has continued testing and evaluating clothes washer and dryer performance. The experience gained has shown accurate measurement of dryer performance is improved when the test procedure includes: more than one load size, a variety of operational cycle settings, and the inclusion of realistic clothing in one or more test cycles. As a consequence NEEA and PG&E co-developed a "supplemental test procedure" (link) that includes the DOE appendix D2 test, plus 4 additional tests using real clothing in a variety of cycle settings and load sizes (See Table 1). The resulting performance metric is a straight average of the 5 tests to generate a utility combined energy factor (UCEF) metric.

Table 1: Supplemental Test Procedure Test Runs

Run #	Short Name	Load Type and Weight	RMC Threshold
Test Run 1	Appendix D2	The standard Department of Energy (DOE) clothes dryer test procedure	2%
Test Run 2	Small Load/Normal Setting	4.2 lbs load of real clothes	4%
Test Run 3	Large Load / Normal Setting	16.8 lbs load of real clothes	4%
Test Run 4	Fast Load / Highest Heat	8.4 lbs load of real clothes	4%
Test Run 5	"Eco" Load / Lowest Heat	8.4 lbs load of real clothes	4%

NEEA used this UCEF metric to establish a performance specification with multiple tiers (link). These performance tiers provide utilities with a means of accurately estimating performance gains, and manufacturers with a roadmap for future emergent technologies seeking higher tier performance values. In addition, this approach enables utilities to support consumer awareness of energy efficiency and highlight more efficient products.

Gas Dryer Lab Testing

In Q4 2015-Q1 2016, NEEA contracted Underwriters Laboratories (UL) to test seven gas dryers – four conventional, non-ENERGY STAR models and three ENERGY STAR-qualified. The purpose of the testing was to understand gas dryer performance and energy use in a lab setting. The following pages summarize findings of the lab tests. Following that summary, NEEA makes recommendations to the Energy Star Most Efficient product category proposal for gas clothes dryers.

Summary of Lab Test Findings

Utility Combined Energy Factor (UCEF) Results & Key Findings

Table 2 lists the UCEF results for each dryer tested. We also separate out the Appendix D2 test run (Test Run 1), because it is the federal test procedure that ENERGY STAR uses to qualify its dryers and is a consistent data point in the market.

Table 2: Energy Factor Values – All Tested Dryers

Dryer	Type	Appendix D2 - CEF (lbs/kWh)	UCEF (lbs/kWh)
Manufacturer 1	Conventional	2.43	2.19
Manufacturer 2	Conventional	2.60	2.51

Manufacturer 3	Conventional	2.05	1.92
Manufacturer 4	Conventional	3.03	2.47
Manufacturer 5	ENERGY STAR	3.87	2.91
Manufacturer 6	ENERGY STAR	3.76	2.58
Manufacturer 7	ENERGY STAR	2.95	2.45

Key UCEF Findings

- The average UCEF for ENERGY STAR dryers is 2.65; the average UCEF for conventional dryers is 2.27.
- It is interesting to note that two of the four conventional dryers performed equally as well or better than the lowest performing ENERGY STAR dryer.
- Manufacturers 5 and 6 exceeded the minimum ENERGY STAR efficiency standard of 3.48 CEF; however, Manufacturer 7 fell short by 15%.
- The average Appendix D2 CEF for ENERGY STAR dryers was 3.53. The average Appendix D2 CEF for conventional dryers was 2.53.

Remaining Moisture Content (RMC) Results & Key Findings

Almost all of the dryers hit the 2% Remaining Moisture Content (RMC) threshold for the Appendix D2 test (one conventional dryer only got down to 2.3% RMC). Whenever possible, NEEA ran Test Runs 2-5 with the following settings:

1. Once with its "Save Energy" or "Eco" setting enabled[1]; and
2. Again with the "Eco" setting turned off or disabled.

Figures 1-3 show the RMC findings for each ENERGY STAR-qualified dryer and applicable test runs. We found that on the majority of runs where the "Eco" setting was enabled, RMC values were very high. Once the "Eco" setting was disabled and the test was run again, the RMC values dropped.

[1] Manufacturers use different terms to describe their energy saving settings. For simplicity, these are referred to as "Eco" from this point forward.

Figure 1: Manufacturer 5: ENERGY STAR-qualified RMC values comparison

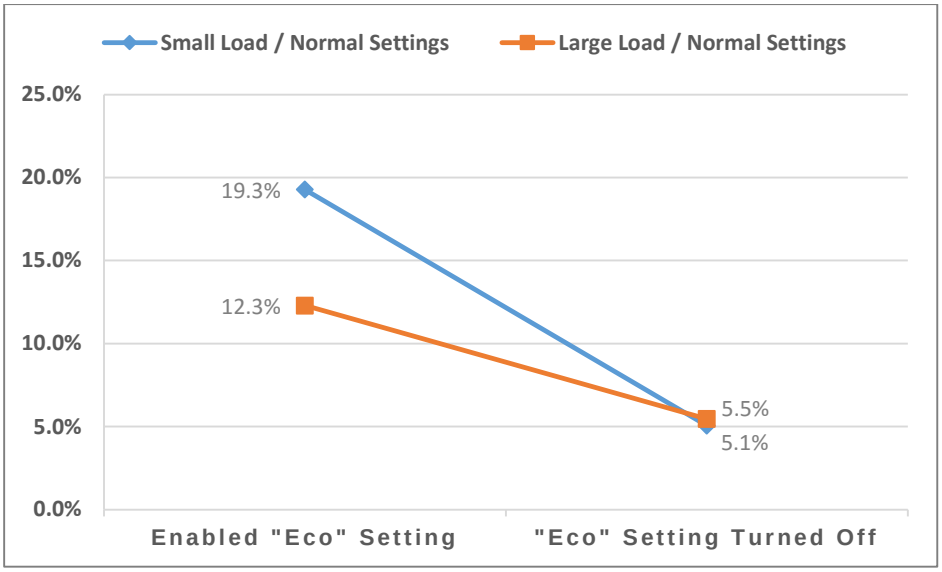


Figure 2: Manufacturer 6: ENERGY STAR-qualified RMC values comparison

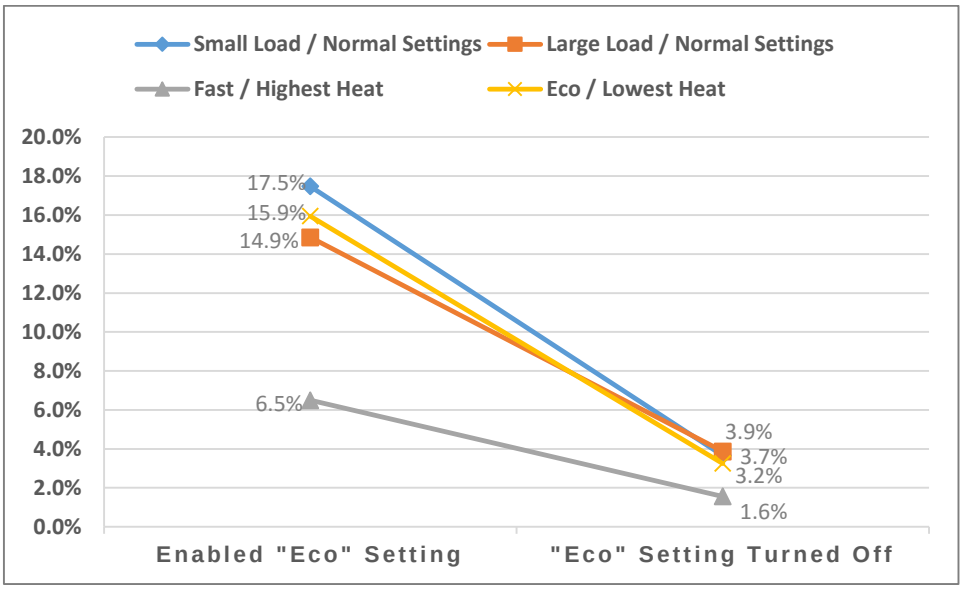
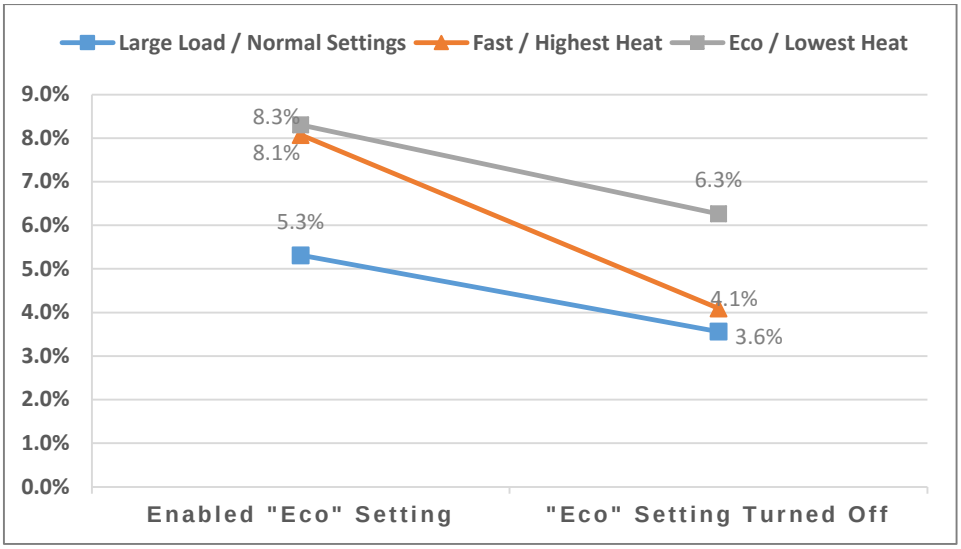


Figure 3: Manufacturer 7: ENERGY STAR-qualified RMC values comparison



Key Findings

- The RMC results of Test Runs 2-5 indicate that ENERGY STAR gas clothes dryers have difficulty drying real clothing to acceptable levels when using the "Eco" setting.
- The trend of high RMCs in each dryer's "Eco" setting was not seen in the testing NEEA has completed of electric clothes dryers to the same test procedure, which indicates there is opportunity for improvement in fine-tuning auto termination in gas-fueled clothes dryers.
- While Manufacturer 7 appeared to dry the real clothing loads more successfully than the other ENERGY STAR-qualified dryers, its CEF values were much lower than the other two ENERGY STAR-qualified dryers.
- For the most part, the ENERGY STAR dryers were able to dry the test loads if the "Eco" setting was turned off.

Recommendations

While NEEA recommends the use of more accurate test procedure for utility purposes, we understand that EPA is confined to the existing test DOE test procedures in appendix D1 or appendix D2 and federal specification limitations. Given this limitation, **NEEA supports the proposed "Most Efficient 2017" specification for both electric and gas dryers with minor changes.** The recommended changes and support for specification elements are described in the section below.

NEEA recommends use a "roadmap" specification approach. Ideally, the EPA should maintain mulit-tier specification with at least three performance levels. These performance tiers should be stable so that manufacturers can use them as part of their product roadmap development process. These tiers should not be tied to market fraction. Should the average efficiency of products improve such that a lower tier is no longer used, it could be de-activated. Should products emerge in the market with performance higher than the top tier, the EPA should consider adding additional tiers.

NEEA strongly recommends not separating efficiency tiers by drum size. EPA should only have the same dryer performance tiers regardless of drum sizes. While dryers with less than 4ft^3 are considered "compact" all current Tier 1 and better dryers are capable of handling 15.4 (7 kg) pound loads. For simplicity and for performance consistency it is important the Most Efficient designation apply to any dryer. If there is concern about allowing "tiny" dryers not intended for average households into the qualified product list, the EPA should set a minimum load size requirement of 15.4 pounds rather than a cubic foot distinction as done in the DOE standard.

NEEA recommends the EPA requiring additional data. Data requirements for ENERGYSTAR and Most Efficient qualified products listing is important to utilities and to the maturation of future test procedures and federal standards. The EPA should require dryer data that includes:

1. Testing at the dryers most energy consuming cycle setting
2. D2 test procedure run time (for 8.45lb test loads)
3. 8.45 lb test load results for all dryers (even those with drum sizes less than 4.4 ft3)
4. 3.0 lb test load results for all dryers (even those with drum sizes equal to or greater than 4.4 ft3)
5. Rated machine capacity both volume and weight
6. Indication if the dryer has a "steam cycle"
7. Indication if the dryer can be connected to the internet

NEEA recommends the basis of annual energy use be based annual pounds of clothing that is dried. Northwest testing revealed that a typical household dries 2342 pounds of clothing per year. The clothing type, size, and settings vary considerably between households. Each utility should determine if this is a reasonable representation of the types of households and clothing for their region. It likely that warm weather climates differ significantly from cold weather climates in this regard.

Gas Dryer Specific Recommendations

NEEA is concerned that consumer experience of ENERGY STAR-qualified may be lower than expected. Given the high RMC results of ENERGY STAR-qualified gas dryers when tested with real clothing (and especially with the "Eco" setting enabled), NEEA is concerned consumers may experience lower than expected drying performance in this product category. This trend of high RMCs in each dryer's "Eco" setting was not seen in NEEA's testing of electric dryers.

NEEA strongly supports the proposed Normal Cycle Setting requirement of 3.80 and, most importantly, the addition of Most Energy Consuming Setting requirement of 3.48 CEF. NEEA believes the addition of the Most Energy Consuming Setting requirement may shield against lower than expected drying performance with all dryer settings by incenting manufacturers to improve the auto termination overall, and not just to one specific cycle within a test procedure.

NEEA believes gas dryers are capable of higher performance and that a future Most Efficient specification should support this. To incent manufacturers to continue product development with gas clothes dryers and improve desirableness in the market, we believe a higher CEF of 4.2

and a maximum cycle time requirement of 55 minutes (using Appendix D2 methodology) is possible. A modulating valve study shows that 25% reduction in gas usage is possible with existing technology. This study also references non-energy benefits of 35% reduction in drying time, which could significantly pull through this technology even at higher pricing levels. Conversations NEEA has had with manufacturers indicate that product fuel differentiation (with the launch of heat pump dryers) has paved the way for high efficiency gas-specific dryer technology to enter the market.

Concluding Remarks

NEEA appreciates speed and diligence that the EPA has taken to develop a most efficient specification for both gas and electric dryers. This has not been a simple task, as there were conflicts between utility need for accurate energy estimation, manufacturer support, simplification for consumer awareness campaigns, and alignment with the CEE's dryer specification. NEEA believes the proposed dryer specification with recommended changes will serve all stake holders well.

Christopher Dymond
Sr Product Manager – Electric Dryers
Direct 503.688.5454
cdymond@neea.org