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# ENERGY STAR® Clothes Dryers Naturally Occurring Baseline Review

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## ENERGY STAR® Clothes Dryers Naturally Occurring Baseline Review

### MEMORANDUM

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March 15, 2016

**To:** Amy Webb and Ryan Brown, NEEA

**From:** John Boroski and Ted Helvoigt, Evergreen Economics

**CC:** Ingo Bensch, Evergreen Economics

**Re:** Review of NEEA ENERGY STAR Clothes Dryers Baseline and Growth

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#### Introduction

In order to measure NEEA's success in transforming the market for ENERGY STAR® dryers, it is necessary to develop a reasonable baseline of the market penetration for ENERGY STAR dryers without NEEA's market intervention. NEEA asked Evergreen Economics to review and comment on NEEA's baseline projection of market penetration, which is contained in the workbook *Clothes Dryers ES Baseline Justification.xlsx* accessed on January 25, 2016.

#### Federal Standards Assumptions

According to federal ENERGY STAR staff Evergreen interviewed, NEEA was a strong advocate for the ENERGY STAR Version 1.0 specification that took effect January 1, 2015. The Version 1.0 specification requires energy savings of 20 percent, on average, compared to standard dryer products. This percentage varies somewhat across different dryer types (e.g., electric versus gas, compacts versus non-compacts, etc.).<sup>1</sup> To set the stage for the new ENERGY STAR specification, NEEA helped to create the Emerging Technology award for efficient clothes dryers, which started in 2012.

NEEA's model assumes that, without the intervention of NEEA and others, the Department of Energy (DOE) would not implement a federal standard comparable

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<sup>1</sup> Interview with ENERGY STAR program staff March 2, 2016.



to the ENERGY STAR Version 1.0 specification until 2029. DOE staff contacted for this research would not comment on the timing or rigor of future standards for clothes dryers. The current standard took effect June 1, 2015 while the previous standard covered dryers manufactured as far back as 1994 (i.e., dryer codes have evolved very slowly).

ENERGY STAR staff stated that currently DOE “is moving fast on appliances” when ENERGY STAR labeling creates supportive market conditions (i.e., increases the share of efficient products already in the market). Still, ENERGY STAR staff expected that the next DOE code update will follow the typical 6-7 year cycle, noting that the next dryer proceedings are scheduled to commence in 2017, and the next standards will likely take effect around 2023 after multi-year negotiations between DOE and industry representatives. Complicating matters, however, are dryer testing protocols. DOE recently developed the Appendix D2 Testing Protocol, which is used to qualify ENERGY STAR models, however the existing *federal* standard still uses an earlier D1 protocol. DOE continues to solicit input from market actors on optimal testing protocols to accurately reflect “real world” laundry usage in the U.S., and EPA staff noted that the issue remains unresolved. Further consideration and ultimate resolution of this issue, however, makes it more likely that the next code implementation will be after 2023 (i.e., delayed) than before 2023. At this time it is difficult to know if and how the future dryer testing protocol will affect the targeted savings level.

It is impossible to predict what future standards will be, since they are determined by technological advancement, changing market preferences and political negotiation between producers and regulators. In the case of clothes dryers, future standards may also be influenced by standards changes for clothes washers, since they are produced by the same manufacturers and often sold as paired products. As noted by the ENERGY STAR staff, “every product is unique.” Currently we do not have any strong evidence to prove or disprove NEEA’s assumption that DOE will implement a federal standard comparable to the ENERGY STAR Version 1.0 specification in 2029. That said, we believe that NEEA’s current assumption of modest DOE standard improvements (i.e., 20 percent energy savings over 13 years), without NEEA’s interventions to date, is reasonable, especially since the short-term focus will be on dryer testing protocols .

### **Adoption Curve Shape**

NEEA’s baseline projection utilizes information on the following inputs:

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- Market penetration at the start of NEEA's clothes dryer initiative (Initial);
- Estimate of technically achievable market saturation (Saturation);
- Assumed year in which market adoption will accelerate (Take-off);
- Number of years required for ENERGY STAR dryers to be widely accepted (Takeover); and
- Growth rate factor (Factor)

NEEA used these inputs in the product-adoption function shown in Equation 1 to estimate the annual baseline market share of ENERGY STAR dryers.

#### Equation 1: New Product Adoption Function

$$Penetration_t = Initial + \frac{Saturation}{1 + Factor^{\left( Take-off + \frac{Takeover}{2} - Year_t \right)}}$$

In the baseline spreadsheet model, NEEA utilized information on the rate of adoption for other ENERGY STAR household appliances and internally derived assumptions specific to clothes dryers.

### Review Findings

**Initial:** NEEA estimated an initial market penetration of 14.4 percent for 2015, based on a weighted analysis of historical data on other ENERGY STAR home appliances (clothes washers, dishwashers, and refrigerators).<sup>2</sup> We believe NEEA's approach to estimating the initial market penetration for clothes dryers and estimate of 14.4 percent are reasonable. Below is additional information supporting NEEA's estimate:

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<sup>2</sup> ENERGY STAR residential clothes dryers will use, on average, approximately 20 percent less energy than required by minimum efficiency standards effective January 1, 2015.

- The Super Efficient Dryer Initiative (SEDI), in which NEEA participates, was launched in 2010 to support the market introduction of advanced clothes dryers and was instrumental in launching the scoping process for ENERGY STAR clothes dryers. SEDI was involved in the selection for the 2012 ENERGY STAR Emerging Technology award, and also developed a rough estimate of potential early market adoption for ENERGY STAR dryers.<sup>3</sup> Specifically, SEDI conservatively estimated that early market growth of qualifying models would be 2 percent annually starting in 2013, which would result in a baseline market share of 6 percent in 2015. This growth estimate, however, was based primarily on heat pump model sales (in Switzerland), and thus it is reasonable to assume that EPA's lower efficiency standard and decision to label other types of efficient clothes dryers that were currently in the market would lead to a market share greater than 6 percent in 2015.
- One of the clothes dryer manufacturers that we interviewed stated that the ENERGY STAR program "wants 20 percent market share as soon as possible, but this will be hard to achieve since less expensive (standard) vented models are not going away quickly."<sup>4</sup> In other words, ENERGY STAR market share should be below 20 percent starting in 2015, in their view.<sup>5</sup>

**Saturation:** NEEA estimated the technically achievable market saturation—without a change in the federal standard—for ENERGY STAR dryers is 45 percent, which they acknowledge to be a "rough" estimate. We believe this to be a conservative assumption as it primarily relies on market forces for motivating manufacturers to increase the market share of ENERGY STAR dryers.<sup>6</sup>

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<sup>3</sup> Chris Badger and Rebecca Foster, Vermont Energy Investment Corporation; Chris Granda, Grastau Associates; and Christopher Wold, Collaborative Labeling & Appliance Standards Program. *Bringing North American Clothes Dryers into the 21st Century: A Case Study in Moving Markets*. Paper presented at 2012 ACEEE Summer Study on Energy Efficiency in Buildings.

<sup>4</sup> The other manufacturer that was interviewed would not provide estimates of ENERGY STAR market share. Evergreen is attempting to interview other dryer manufacturers too.

<sup>5</sup> EPA staff reported that no formal market share estimates were developed, however the program hopes for 25 percent market share in the initial years, followed by growth to 35 percent. No precise time periods were given. EPA is currently compiling industry unit shipment data to estimate 2015 market share, and NEEA can adjust its model when the data are available.

<sup>6</sup> Note: The higher the assumed rate of technically achievable market saturation, the more conservative the estimate because the higher the baseline market saturation the smaller the gain associated with NEEA's initiative.



**Take-off:** NEEA assumes that 2020 will be the first year to experience “dramatic and sustained increase” in sales of ENERGY STAR dryers due to “word of mouth and presence of ES dryers on [the] market.” This is only five years out from 2015 and once again is a conservative assumption as it implies that even without NEEA’s efforts, the rate of growth in the adoption of ENERGY STAR dryers would increase in the near future. NEEA’s estimated baseline market share in 2020 is about 17 percent. This is consistent with input from the interviewed manufacturer, who stated that “up to 20 percent market share in 5 years is feasible.”

**Takeover:** NEEA assumes that it will take 10 years after 2020 for the “late majority” of customers to adopt ENERGY STAR dryers. NEEA states that this is “quick for a MT [market transformation] initiative.” The smaller the value of the takeover rate, the faster the rate of adoption. We believe that 10 years is reasonable assumption for the takeover rate for ENERGY STAR dryers because the savings are for energy only (i.e., no water savings) and the energy savings are moderate relative to clothes washers and refrigerators. The interviewed manufacturer noted that 50 percent market share for ENERGY STAR could be feasible in 10 years (i.e., 2026) but would require utility market interventions and rebates, since “ENERGY STAR models are expensive now and will need to stay in average cost range of \$699-\$799.”

**Factor:** NEEA assumes a growth rate factor of 81. The growth rate factor influences the shape of the sigmoid curve. NEEA assumes a value of 81 for the ENERGY STAR dryer baseline, which we believe to be reasonable. It is worth noting that even if NEEA had chosen a growth rate factor that was half or double the value they chose, it would not have any material impact on the baseline. We believe that NEEA’s choice of the function for developing the baseline is reasonable and is a standard approach for developing estimates of market penetration.