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Characterization of the Super-Efficient Dryer Market

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Executive Summary

This report presents the results of a characterization study of the super-efficient dryer market in the Northwest. Evergreen Economics conducted the study for the Northwest Energy Efficiency Alliance (NEEA) to help inform NEEA initiatives to promote energy-efficient clothes dryers.

Clothes dryers are becoming a valuable target in efforts to increase the energy efficiency of North American homes. While most major energy-using residential appliances have undergone efficiency advances, clothes dryers continue to rely on unchanged decades-old technology and represent an ever-increasing share of residential energy use.

In recent years, two developments have presented themselves as opportunities to reduce the energy consumption associated with residential clothes drying. Three manufacturers have rolled out heat pump-based clothes dryers (super-efficient dryers) in the North American market that offer energy savings in the 25 to 70 percent range. Secondly, introductory ENERGY STAR® specifications mean consumers can now distinguish more energy-efficient dryers from less efficient ones.

Evergreen Economics' study of the residential clothes dryer market identified several key market factors that NEEA should take into account in developing its market interventions.

Findings

ENERGY STAR and super-efficient heat pump-based dryers represent the first real step toward energy efficiency for clothes dryers in decades, but with substantially different market trajectories. Rollout of super-efficient dryers does not yet mirror the European market, where market share is about 40 percent.

Manufacturers have begun to offer ENERGY STAR dryers in North America alongside conventional dryers, and they expect ENERGY STAR models to become the market standard. A few manufacturers have developed super-efficient dryers that operate either fully on a heat pump or a combination of a heat pump and an electric resistance heater (hybrids). Manufacturers are concerned about low sales of these models so far, and are treading cautiously. While some with super-efficient dryers are wondering whether these models are best suited to niche markets (multifamily developers wanting compact ventless models, households with high energy costs), other manufacturers not yet offering super-efficient models have been moving toward market entry. Notably, manufacturers usually pair similar washers and dryers for combination sales, and most consumers buy both appliances together. In their marketing, manufacturers primarily emphasize the benefits of their washers, and the benefits of their (matching) dryers secondarily.

Most retailers have been conservative in stocking and allocating floor space to more efficient dryers, although they do offer them. National and regional retailers stock some ENERGY STAR models, and some expect these models to increase their market share in the

coming years. They offer super-efficient dryers only through "catalog sales," however, because the market share of these dryers is currently less than 1 percent. These retailers tend to rely on selling quick replacement dryers at a good value to customers whose existing machine has stopped functioning. They estimate that these "emergency sales" represent 60 to 70 percent of sales, and they are waiting for clear evidence of demand before stocking efficient dryers in greater numbers. Some independent retailers, however, have embraced super-efficient dryers, and are stocking them and presenting them on their showroom floors.

Similarly, retailers are carrying only limited numbers of natural gas dryers. They estimate that between 80 and 97 percent of their sales are from electric dryers.

Consumers are clearly interested in energy-efficient dryers and showed a strong desire for efficiency options during a focus group comparison exercise and a survey-based stated choice exercise conducted as part of this study. The majority of consumers showed an inclination to pay a marginal cost increase of $100 for an ENERGY STAR electric or natural gas dryer for energy savings of 5 to 20 percent. Meaningful minorities of participants in the focus groups and survey also showed interest in heat pump and hybrid dryers. Selling points included energy savings and the adoption of new technology. Gentleness on clothes and benefits associated with not needing to vent the dryer exhaust are of interest to a more limited number of consumers. Purchase price, cycle length and reliability are potential concerns. The stated choice analysis suggests that a rebate of at least $200 is necessary to materially increase the likelihood that a consumer will purchase a super-efficient dryer.

Recommendations

Continue to support technical research, standards development and market transformation at a national level. Key needs at the national level include:

- Support of future updates of federal regulatory and voluntary efficiency standards;
- Independent, in-field product performance information for use in consumer messaging (with an emphasis on verifying energy performance, user satisfaction, drying times and heat pump durability);
- Finalization of a single federal testing protocol and issuance of Energy Guide labels for dryers;
- Awareness—and influence of—manufacturers' offerings, strategies and intentions; and
- Support of stocking practices by national retailers that increase consumer exposure to super-efficient and ENERGY STAR dryers.

Focus a substantial share of the initiative on general consumer awareness prior to dryer purchases and exposure to energy efficient dryers during the purchasing process. In particular:

- Support independent retailers that already stock super-efficient dryers through cooperative advertising, point-of-purchase materials and consumer-facing product demonstrations; and
- Implement an education campaign to increase consumers' pre-purchase exposure to the existence of super-efficient dryers and the availability of ENERGY STAR models.

Work with NEEA's utility partners to offer rebates for super-efficient dryers. This study's stated choice research suggests that:

- Rebates of at least $200 would be most effective; and
- Rebates are more likely to increase demand for hybrid dryers than for heat pump dryers.

Consider supporting matched pair purchasing of ENERGY STAR washers and dryers, but seek to direct dryer-only purchasers to super-efficient dryers.

- Paired purchases of ENERGY STAR washers and dryers of the same brand are a logical fit for consumers.
- Super-efficient dryers could be offered as an advanced alternative to the ENERGY STAR dryer, but should also be promoted when consumers are making stand-alone dryer purchases.

For natural gas dryers, work with NEEA's regional partners to promote the ENERGY STAR label as a valuable consumer guide for purchases of natural gas appliances and expand existing efforts to work with retailers to include natural gas-fired appliances (including dryers).

1 Introduction

This report presents the results of a characterization study of the super-efficient dryer market in the Northwest. Evergreen Economics conducted the study for the Northwest Energy Efficiency Alliance (NEEA) to help inform NEEA initiatives to promote energy efficient dryers.

1.1 Background

Clothes dryers are becoming an increasingly valuable target in efforts to increase the energy efficiency of American homes. While most major energy-using residential appliances have undergone technological and efficiency advances, clothes dryers continue to rely on a long-standing technology with little improvement in efficiency. The vast majority of dryers manufactured, sold and used in the United States use electric resistance heating to warm clothes in a spinning drum and exhaust the warm moist air. As other appliances have become more efficient, clothes dryers are becoming one of the larger energy users in most homes.

There have been some developments in clothes dryers in recent years. The U.S. Environmental Protection Agency began labeling comparatively more efficient dryers with its ENERGY STAR® label in January 2015. ENERGY STAR certified dryers offer efficiency gains of 20 percent over the base traditional models through such features as moisture sensors or lower drying temperatures.

Furthermore, several manufacturers have begun offering dryers that use a different technology entirely to make a more substantial leap in efficiency. Dryers using heat pump technology have been widely used in Europe for many years and have recently become available in the North American market. These dryers use heat pumps to replace or complement the electric resistance heater in conventional dryers; they also use a condenser to recycle the heat in the dryer instead of exhausting it with the moisture that is removed from the laundry during the drying process. Depending on the model, heat pump dryers and their hybrid counterparts use 25 to 70 percent less energy than non-ENERGY STAR dryers that use conventional technology.

Representatives of a national initiative called the Super-Efficient Dryer Initiative (SEDI) have been working with the appliance industry and energy efficiency advocates, including NEEA, to explore and promote dryers that make a substantial leap in energy efficiency. Although technology neutral, these efforts have focused on heat pump and hybrid dryers because these are the only dryers currently available that make substantial efficiency gains.

Many electric dryer models have a natural gas counterpart generally with a purchase price of about $100 more but costing 50 to 75 percent less to operate at current gas prices.

In the Northwest, NEEA is developing a market transformation initiative to increase market adoption of more efficient clothes dryers. Early plans have focused on promoting super-

efficient dryers, but NEEA seeks to be informed in its initiative strategy and design by the results of this characterization study. Furthermore, NEEA has started a natural gas initiative to promote efficiency for natural gas appliances, including for dryers.

NEEA designed this market characterization study to inform the following key strategic issues and questions:

- Should a NEEA initiative focus specifically on promoting super-efficient dryers or more generally ENERGY STAR-labeled dryers?
- What is the consumers' willingness to pay for more efficient dryers?
- Which non-energy benefits and attributes of super-efficient dryers would attract purchasers?
- Are super-efficient dryers suited for the mainstream market or more promising for a niche market, like multifamily buildings with venting constraints?
- Can a NEEA initiative for dryers focus on just clothes dryers, or does it need to address clothes washer purchases too?
- What is the value proposition NEEA can provide to supply chain actors in a regional initiative?

Specific objectives for the characterization study included:

- Describing the supply-side of the market for heat pump clothes dryers (for example, firms, relationships, production/stocking practices, pricing);
- Describing the demand-side of the market, such as:
    - Consumer awareness and understanding of dryer technology types
    - Consumers' dryer preferences and purchasing behavior
    - Opportunities and barriers to changing consumer purchases
    - Awareness, interest, and perceptions concerning natural gas dryers;
- Characterizing U.S. regional dryer shipments and household dryer types; and
- Validating specific NEEA planning assumptions.

Evergreen studied each of these aspects of the market and topics to build a foundation of market insights on which NEEA can make design and implementation choices for its dryer-related initiatives.

1.2 Report Organization

Below, Evergreen presents methodologies, results and insights from each of its major research tasks, divided into (1) background and exploratory research, (2) supply chain research, and (3) consumer research.

Following these sections, Evergreen discusses overall implications of its research for NEEA's dryer initiative and makes related recommendations. Insights that Evergreen obtained about the gas dryer market are included throughout the report.

2 Background Information and Exploratory Research

This section provides background information about the dryer market from a literature review and interviews with NEEA staff and others involved in national efforts to promote super-efficient dryers, as well as a short exploratory study of the potential for promoting super-efficient dryers in the multifamily sector. Additional insights from the literature review and program interviews are included in Supply Chain Research and Consumer Research sections of the report.

More information about the literature reviewed and the program staff interviews can be found in the appendices. The References page before Appendix A lists sources cited in the report, and Appendix A lists other documents and literature Evergreen reviewed for its research. Topics included in program interviews are summarized in Appendix F.

2.1 Background Information

2.1.1 Existing Types of Clothes Dryers

The conventional electric resistance "tumble" dryer was first developed in the 1930s and 1940s. The underlying technology—the use of an electric resistance heating element that heats clothes while they spin in a drum—has remained largely unchanged since then (Acton, Adams, and Packer 2006; Wisconsin Historical Society). Today, conventional electric resistance clothes dryers comprise approximately 75 percent of the national dryer market (closer to 90 percent in the Northwest) (NRDC 2014). The remaining 25 percent are predominantly natural gas dryers, a somewhat modest penetration considering that 60 percent of U.S. households have natural gas service.

Table 1 shows how the U.S. Department of Energy (DOE) classifies clothes dryers by fuel (electric and natural gas) and whether they are vented.

Table 1: Clothes Dryer Product Classes

U.S. DOE Product Classes (as shown in 10 CFR 430.32(h))	
Vented	Electric, Standard (4.4 cu. ft. or greater capacity)
	Electric, Compact (120V) (less than 4.4 cu. ft. capacity)
	Electric, Compact (240V) (less than 4.4 cu. ft. capacity)
	Gas
Ventless	Electric, Compact (240V) (less than 4.4 cu. ft. capacity)
	Electric, Combination Washer-Dryer

Note: These product classes correspond to the energy conservation standards for which manufacturers must comply beginning January 1, 2015.
Source: U.S. Environmental Protection Agency. 2011. *ENERGY STAR Scoping Report.*

Unlike other common household appliances, clothes dryer technology had not made significant energy efficiency improvements in over thirty years. Analysis performed by Ecova found that while annual energy consumption of washers, dishwashers and refrigerators combined had dropped by more than half from 2,500 kWh per year in 1981 to below 1,000 kWh per year in 2012, energy consumption of electric dryers decreased by only 10 percent from 1,100 kWh per year to 990 kWh per year during that same time frame (NRDC 2014).

The more recent incorporation of heat pump technology to replace or supplement the electric resistance heating element in conventional dryers offers the potential for substantial reductions in the energy consumption of electric dryers. These heat pump dryers have been available in Europe for over a decade and are now offered for the North American market as well.

The European market has adopted heat pump dryers with widespread participation by the major manufacturers. The thirty heat pump dryer models now available in Europe comprise a total market share of about 40 percent, ten years after initial market introduction of the technology. This level of adoption has not been mirrored in North America, however.

Two types of heat pump-based dryers are now available in the North American market. These super-efficient dryers offer reduced energy use of between 25 and 70 percent—depending on type and operating mode—compared to minimally efficient conventional dryers. One manufacturer offers a model that relies solely on the heat pump to generate heat in the drum. This unit dries six or more pounds of laundry per kWh. Two other manufacturers offer hybrid models that include a heat pump and an electric resistance heater. In its most energy-efficient mode, the hybrid starts the drying process with electric resistance to warm up the machine and then switches to the heat pump for the remainder of the cycle. These units dry about three and a half pounds of laundry per kWh, which is better than the two and a half pounds of laundry per kWh that conventional dryers can dry.

NEEA has been conducting additional research on the technical performance of super-efficient dryers. This work includes investigation into the energy performance of super-efficient dryers and their effect on clothing life.

Although NEEA and others emphasize the energy savings of super-efficient dryers, there are other benefits of interest and possible value to consumers. These include:

- Lower risk of dryer fires due to the lower operating temperatures of the super-efficient dryers;
- The absence of any need to vent the dryer exhaust (for those models that are ventless), which eliminates infrastructure and allows dryers to be located in more locations within a home or building;
- The possibility that super-efficient dryers are gentler on clothes; and

- The use of new technology, which is of appeal to some consumers.

In 2014, the Environmental Protection Agency (EPA) awarded its Emerging Technology Award to advanced dryers that met aggressive efficiency targets. The Whirlpool HybridCare™ Heat Pump Dryer and LG EcoHybrid Heat Pump Dryer (both hybrids) were two of the three dryers recognized with the award. Blomberg's "pure" heat pump dryer has since been recognized as meeting the same standards. Two other companies (Bosch and Miele) are reportedly planning to introduce full heat pump models in the United States. However, while emerging technology awards confer an honor on a product, NEEA staff commented that they do not necessarily translate into increases in market share because "emerging technology" may carry the stigma that the products are not quite ready for the market yet.

2.1.2 New Regulatory and Voluntary Standards

Regulatory and promotional attention on clothes dryer efficiency has lagged behind that of most residential appliances and consumer electronics. The most recent regulatory DOE standard for residential clothes dryers took effect on June 1, 2015, while the previous standard covered dryers manufactured as far back as 1994 (that is, dryer standards have evolved very slowly) (U.S. DOE 2016). Table 2 lists the current standards.

Table 2: Current Energy Conservation Standards for Clothes Dryers*

Dryer Type	Energy Factor (pounds/kWh)
Vented Electric, Standard (4.4 ft^3 or greater capacity)	3.73
Vented Electric, Compact (120V) (less than 4.4 ft^3 capacity)	3.61
Vented Electric, Compact (240V) (less than 4.4 ft^3 capacity)	3.27
Vented Gas	3.30
Ventless Electric, Compact (240V) (less than 4.4 ft^3 capacity)	2.55
Ventless Electric Combination Washer/Dryer	2.08

*For appliances manufactured or distributed into commerce on or after June 1, 2015

Voluntary ENERGY STAR standards for dryers were not adopted until January 1, 2015. According to federal ENERGY STAR staff, NEEA was a strong advocate for the ENERGY STAR Version 1.0 specification. 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 (for example, electric versus gas, compacts versus non-compacts, etc.).[1]

However, clothes dryers still do not carry an Energy Guide label—the yellow sticker that communicates expected energy costs for an appliance and how it compares to other models in its class. One of the main barriers is the lack of an agreed-upon test standard for dryer performance, which prevents the issuance of Energy Guide labels.

2.1.3 Dryer Features and Marketing

While the underlying technology for most dryers remained constant, dryer models differ on a multitude of features and other characteristics, including price, size, cycle time, capacity, energy efficiency, front load versus top load, ease of use, ease of installation. Manufacturers also promote features such as auto-termination, moisture sensors, steam injection, "eco-modes," and low temperature options to care for delicates on some dryer models.

According to the *2016 Consumer Reports Clothes Dryer Buying Guide*, there are four primary features that consumers are advised to consider in selecting a new clothes dryer. These features include a moisture sensor that detects the laundry's dampness and shuts off the machine when clothes are dry, auto-dry cycles that provide custom drying settings, extended tumble settings that reduce wrinkles by tumbling the clothes slowly after the drying cycle has completed, and an end-of-cycle signal to let consumers know when the drying cycle is complete (Consumer Reports 2016).

The following marketing message for the Whirlpool HybridCare™ Ventless Duet Dryer with Heat Pump Technology illustrates the range of features manufacturers present on their websites (Whirlpool 2016).

> "*Now enjoying exceptional care for clothes while using less energy is easier than ever with the 7.3 cu. ft. large capacity HybridCare™ Duet Dryer with Heat Pump Technology. The Energy Star® Certified high-efficiency electric dryer easily installs in more places thanks to the HybridCare™ true ventless heat pump technology. With Advanced Moisture Sensing, three active built-in sensors read incoming and outgoing air temperatures while monitoring moisture levels inside the dryer.*"

2.1.4 Dryer Pricing

Prices of dryers have increased as manufacturers have integrated new features into their models. The top twenty-five recommended electric dryers in the *2016 Consumers Report Buying Guide* have an average cost of approximately $1,089, ranging from $600 to $1,600. The top twenty-five recommended gas dryers averaged slightly more at $1,185, ranging

[1] Interview with ENERGY STAR program staff March 2, 2016.

from $600 to $1,700. Typically, gas models cost about $100 more than their electric fuel counterparts. High-end hybrid and heat pump (super-efficient) dryers such as the LG EcoHybrid™ and the Whirlpool HybridCare™ tend to cost around $1,600 unless discounted. Both natural gas and electric super-efficient dryers cost less to operate, however.

As the costs of higher-end dryers have increased with the incorporation of new features and technologies, manufacturers and retailers advertise the lower ongoing operating costs and energy savings of more efficient dryer models to help account for the additional up front retail price. For example, on its website, LG promotes its EcoHybrid™ model by advertising that the dryer uses "53% less energy every time you dry." (LG Electronics 2016)

2.1.5 Barriers to Super-Efficient Purchases

Currently, market penetration of super-efficient dryers is very low (nearly zero). Higher equipment costs have been one of the primary barriers for super-efficient dryer purchases. Additionally, consumers will have to accept longer drying times for heat pump technology adoption rates to increase in the near future. Historically, the U.S. consumer market has favored large dryers that run at high temperatures that dry clothes as quickly as possible. However, these models often over-dry clothes and consequently waste considerable amounts of energy.

Participants in the Super-Efficient Dryer Initiative (SEDI) provided several explanations for why heat pump dryers have not taken off in North America as much as they have in Europe. These include:

- The European market adopted heat pump dryers from a different baseline. Condensing dryers[2] were common in Europe previously, so the incremental cost to adoption of heat pump dryers was less than it is in North America.
- Regulatory and voluntary specifications in Europe encouraged dryers with higher performance.
- Newness of the technology, lack of diversity among models, and their invisibility on retail showroom floors have proven to be barriers in the North American market.

Additionally, according to research conducted by the Natural Resources Defense Council (NRDC), manufacturers tend to design their dryers to precisely match the size, style and color of their matching clothes washers. Subsequently, the washer and dryer pairs are commonly sold together and for the same price even though washers are far more expensive to produce.[3] As a result, the NRDC argues that because manufacturer profits

[2] A condensing dryer is one with a standalone condenser to remove moisture but with traditional electric resistance heating.
[3] An estimated 70 percent of all dryers are sold as half of a laundry pair (NRDC 2014).

come primarily from dryers, manufacturers are motivated to keep the production cost of dryers as low as possible to increase margins rather than produce more costly energy-efficient models.

High margins on dryers allow manufacturers to sell washers at a lower margin thereby balancing the margin they get on the pair. Manufacturers may not want to add heat pump technologies to the dryer out of concern that they would need to reduce their profit margins on the dryers in order to stay within consumers' ability and willingness to pay.

The NRDC argues that U.S. policies for clothes dryers lag behind other appliances and will require additional resources to update test methods for measuring dryer energy use, increase the number of available super-efficient dryers in the market and provide utility rebates for high efficiency dryers (NRDC 2014). According to the NRDC, some of the current problems with dryer testing include unrealistic test loads that do not accurately reflect "real-world" laundry loads and a lack of testing on multiple types of dryer settings that cover a variety of load sizes and speeds.[4]

2.1.6 Market Interventions for Super-Efficient Dryers

One of the initial efforts to increase consumer adoption of super-efficient dryers was the creation of SEDI in 2010 (Badger et al. 2012). Several prominent energy efficiency organizations, including NEEA, formed this national coalition focused on introducing heat pump dryers into the U.S. market.

In addition, there have been several program efforts by Efficiency Vermont, the Sacramento Municipal Utility District, PSEG Long Island, Puget Sound Energy and NEEA.

Efficiency Vermont runs one of the nation's most active programs to promote super-efficient dryers. Efficiency Vermont's perspective is that the key to obtaining a foothold for super-efficient dryers is increased consumer awareness of the products, technology and applicable rebates. Manufacturer promotion has been modest and tends not to promote the heat pump attribute of the super-efficient dryers. Making the products ubiquitous on showroom floors is part of Efficiency Vermont's program strategy, which it pursues through retail circuit riders, point of purchase materials, cooperative advertising grants and substantial rebates. A $400 consumer rebate offered recently is one of the highest appliance rebates Efficiency Vermont has ever offered. In response to these efforts, 20 percent of independent appliance stores are now flooring super-efficient dryers.

[4] One example provided by NRDC states that U.S. DOE tests dryers with a load composed of thin, synthetic cloths that do not resemble heavy or thick items that are commonly found in traditional household laundry loads.

NEEA's initiative is in its planning stages, but the organization has already worked with manufacturers during their product rollouts, which involved substantial rebates in the $300 to $400 range.

Interim steps to advance the market for super-efficient dryers involve a regulatory and consumer oriented strategy. On the regulatory side, the organization and its national partners through SEDI are working toward a single national test procedure and tighter regulatory standards for clothes dryers. On the consumer side, NEEA believes that it needs to establish consumer confidence in the super-efficient dryers, which involves getting dryers into early adopters' homes and promoting them through utility efficiency programs.

For natural gas dryers, the ENERGY STAR standard currently requires efficiency gains of 5 to 10 percent over the current federal minimum standards. NEEA seeks to increase these standards as well, which also requires agreement on a single test procedure. NEEA is also working with the Gas Technology Institute to identify new technologies for increased efficiency of natural gas dryers. Currently, the focus is on heat recovery and modulating burner technology.

2.2 Multifamily Market Exploration

The Evergreen team conducted a limited number of exploratory interviews with property managers and listing agents for multifamily properties to better understand the potential for super-efficient dryers in multifamily properties. This exploration focused on dryers that would be placed in these buildings in bulk quantities by building owners, operators, developers or third-party laundry equipment operators, not by residents.

Evergreen staff conducted "ghost shopper" research by telephone in Portland, Oregon; Vancouver, Seattle and Bellevue in Washington; Boise, Idaho; and Missoula, Montana. Questions addressed the characteristics and decision-making criteria for the selection of laundry equipment in multifamily buildings and what property managers tell prospective renters about the equipment.

2.2.1 Findings

Over the course of two weeks, the Evergreen Economics team contacted nine property managers from across the Northwest market and reviewed data collected by NEEA on residential building stock. Some of the key findings from the multifamily exploratory research include:

- Prospective renters generally care about only the basic aspects of the laundry equipment such as location and the general age of the equipment.
- All of the multifamily buildings in the sample purchased their laundry equipment in bulk at the time of construction (mostly electric), with repairs and replacements occurring on an individual basis as required.

- Based on the sample, the building owners are responsible for the laundry in a majority of the larger and newer multifamily buildings, while some smaller multifamily buildings use shared equipment that is rented from an independent provider.
- Large multifamily buildings built in the last five to eight years in Evergreen's sample tend to include in-unit laundry equipment (generally in a bathroom closet or small separate room) while older and smaller multifamily buildings in the sample include a variety of shared space and in-unit laundry equipment options.
- Prospective renters appear to care about laundry equipment as they would other appliances, although their primary interest is in regards to whether the equipment is located in the unit or not.
- Property managers and listing agents said price, energy efficiency (especially in newer multifamily buildings) and modern aesthetics were the most important factors in selecting laundry equipment, especially as they relate to the overall unit's theme or style.
- Based on the RBSA data, laundry equipment is found in 85 percent of existing buildings and includes a mix of in-unit and common area laundry equipment; however, newer buildings almost always include in-unit laundry equipment.
- The RBSA report stated that about a third of laundry equipment units in common areas are horizontal axis washers while only 9 percent of in-unit unit washers are horizontal axis (Ecotope 2012).

2.2.2 Potential Future Multifamily Research

The listing agents who participated in the initial exploratory investigation were able to provide only limited information about the decision-making behind the initial laundry equipment selections and, as expected, referred the researchers to others who were involved in the equipment selection. These decision-makers were available only sporadically, and interviewing them was beyond the scope of this study.

Given a focus on multifamily by at least one manufacturer of hybrid dryers, additional research and effort targeting property managers, building owners and other key decision makers may be worthwhile to provide further insight into the true market possibility for efficient dryers in multifamily buildings. Two options include follow up interviews with (1) large property managers and building owners of multifamily buildings in the Northwest and (2) laundry equipment rental services in the Northwest.

3 Supply Chain Research

Supply chain research for this study drew from sources including secondary market data, manufacturers and retailers.

3.1 Secondary Market Data

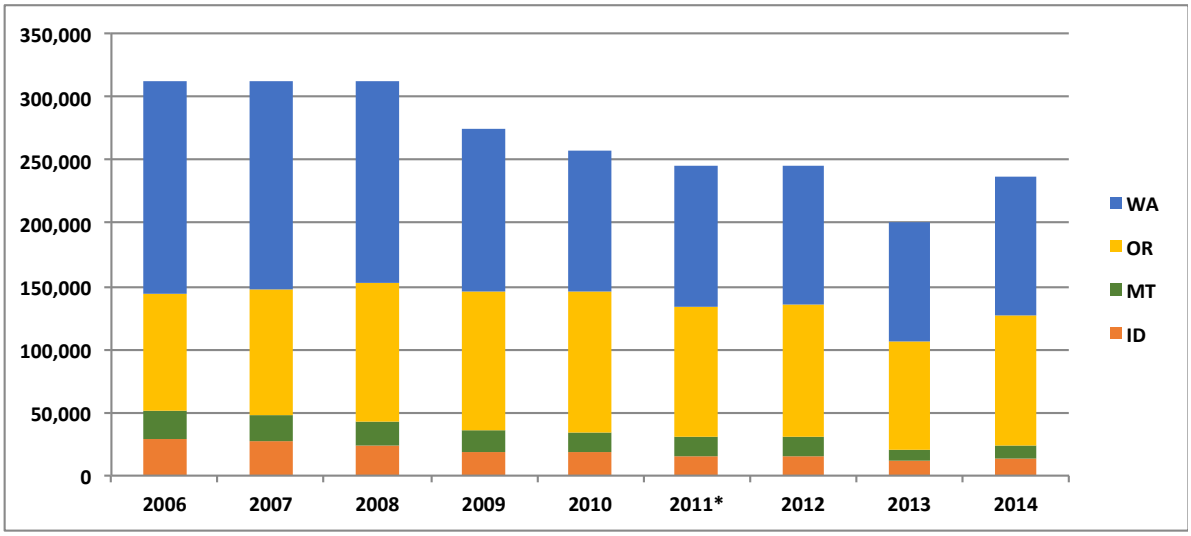
To help NEEA understand the market potential for a future dryers initiative in the Northwest, Evergreen reviewed and refined NEEA's market size estimation model by checking the data sources and model calculations used, and by researching alternative model parameters (for example, dryer turnover rates).

According to NEEA's latest Residential Building Stock Assessment (RBSA) data, approximately 90 percent of residential clothes dryers in the Northwest are electric models, and there are about five million electric clothes dryers installed in single-family, multifamily and manufactured homes. The vast majority of single family and manufactured homes have clothes dryers installed (98% and 95%, respectively), while only 47 percent of multifamily units (typically in newer buildings) are estimated to have in-unit clothes dryers.

See Appendix D for additional details on how NEEA estimates the regional stock of electric clothes dryers.

Each year, new clothes dryers are shipped to the Northwest region, and the shipping data are tracked by the Association of Home Appliance Manufacturers (AHAM). According to the shipments data that NEEA receives from AHAM, on average about 266,000 electric clothes dryers were shipped to the region annually from 2006 through 2014. In the period 2011 through 2014, however, annual shipments to the region declined to about 228,000 per year, a drop of about 15 percent. Figure 1 shows how annual shipments of electric clothes dryers have fluctuated by state since 2006.

Figure 1: Annual Shipments of Electric Clothes Dryers to Northwest States



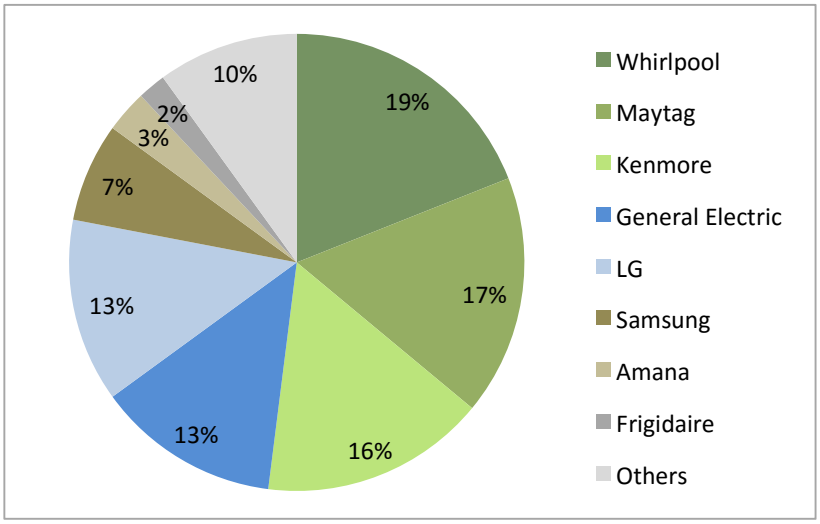
* 2011 AHAM data on dryers was not available; the 2011 figures are an average of the two preceding and two following years.
Source: NEEA compilation of AHAM data

3.2 Supply Chain Insights - Manufacturers

The dryer market consists of several large manufacturers that account for a majority of residential sales in the U.S. market. Whirlpool, General Electric and LG are the three largest manufacturers, accounting for approximately 78 percent of the dryer market. Some manufacturers produce products under only one brand, while others make models for multiple brands.[5,6] Figure 2 shows a detailed breakdown of U.S. market shares for major clothes dryer brands in 2013.

[5] In addition to the Whirlpool brand, Whirlpool also manufactures the Maytag and Amana brands.
[6] Kenmore dryers are manufactured by multiple companies and sold under the Kenmore brand by Sears.

Figure 2: Clothes Dryer Brand Market Shares, 2013



Note: Chart based on *Heat Pump Clothes Dryers: Will Life Ever Be the Same?* from the Emerging Technologies Showcase in 2015. Analysis based on Traqline data from 2013.

Further insights about the manufacturing part of the supply chain are based on interviews with program and initiative staff and with manufacturers.

3.2.1 Program and Initiative Interviews

Program and initiative staff indicated that all of the major manufacturers provide electric dryers to the market—and many have complementary natural gas models. Three manufacturers have introduced super-efficient dryers in the U.S. market. Their offerings comprise one heat pump dryer (Blomberg) and three hybrid dryers that use both heat pump and electric resistance heaters (Whirlpool, LG and an LG-based model sold under the Kenmore brand).

The manufacturers have followed different strategies, but outcomes have been modest for all of them so far. Whirlpool and LG both opted for hybrid technology. These two manufacturers believed consumers would want the faster dryer speeds available with hybrid models and have sought to direct their marketing efforts to the eco-friendly market through their North American distribution network.

Furthermore, the Whirlpool hybrid dryer is ventless, exhausting the moisture removed from the dried clothes as liquid through a drain pipe. Low initial sales of the Whirlpool hybrid and interest from multifamily customers whose buildings are not well suited to venting appear to have shifted Whirlpool's focus for its hybrid from the general market to multifamily customers.

In contrast, Blomberg introduced full heat pump technology in a more European style compact dryer. This dryer relies solely on the heat pump and thus achieves greater efficiency, but with longer drying times. Unlike LG and Whirlpool, Blomberg does not have

brand recognition or well-developed distribution channels in the U.S., relying instead on specialty retailers and Internet sales. As a result of the manufacturers' choices, there really is not an American-sized dryer that embodies the full savings available from heat pump technology, which is a barrier to understanding how far the market might go.

NEEA staff estimate that the production of heat pump dryer models costs $500 to $550 more than conventional dryers with comparable features. In comparison, ENERGY STAR models cost $25 to $50 more to produce. However, if heat pump models were produced at higher volumes, production costs could drop to about $150 more for heat pump models than conventional dryers, which would amount to about $200 to $300 more at the retail level. In Europe, the incremental cost for heat pump models is about $300 more than for conventional dryers.

3.2.2 Interviews with Manufacturers

Evergreen completed in-depth interviews with staff from three firms that manufacture clothes washers and dryers for the U.S. market. Collectively, these companies offer five different brands of clothes dryers. Some of the primary objectives of the interviews were to document the types of dryers the companies offer and their target markets, understand how the companies and their customers value energy efficiency, identify dryer features that customers care most about, and understand the future prospects for hybrid and heat pump dryers in the U.S. market. Evergreen completed the interviews in December 2015 and March 2016. The manufacturer interview guide can be found in Appendix F.

Products and Target Markets

The three companies are very different in their product offerings and target markets, offering a broad and diverse perspective on the U.S. market.

One company has been selling compact, twenty-four-inch ventless dryers in major U.S. cities since 2012.[7] This company is primarily targeting large, newly constructed multifamily buildings and secondarily, older single-family home retrofits where the owners no longer want to have vent holes.[8] In its marketing of ventless dryers, this company emphasizes flexibility ("they can be placed anywhere"), energy savings and special cycles to protect clothes from damage.

This company started offering heat pump clothes dryers (not hybrids) to the U.S. market in 2015, and will be targeting older single-family home retrofits. As these models are currently very expensive ($1,000 more than an average dryer), the company representative acknowledged that customers are likely to select their standard, vented

[7] According to this interviewee, the industry standard in the U.S. is a thirty-inch dryer.
[8] This interviewee reported that LEED certified apartments do not allow vent holes for laundry equipment.

dryer models if they are also purchasing a clothes washer at the same time.[9] This company promotes its heat pump dryers by emphasizing a woolen program setting that prevents shrinkage, and no abrasion/damage to clothes or lint formation due to the lower drying temperatures.[10]

The second manufacturer offers three brands of standard dryers in the U.S. to cover low, mid and high price points; prices for its dryers range from $399 to $1,099. This company does not do any detailed demographic targeting and all three brands have "featured products with something for everyone" so all buyer types are potentially attracted. According to the interviewee, lower cost models emphasize functionality for ten years (that is, emphasizing reliability), middle range models emphasize steam settings and aesthetics (that is, non-white colors) and the highest cost models emphasize automatic detergent dispensing washers (that is, load-and-go), higher capacities and the most appealing aesthetics. This company also offers a hybrid dryer model, which costs $600 more than an average dryer.

The third manufacturer does not produce any heat pump or hybrid dryers. Company staff stated that they are not really targeting specific households for dryers, but noted that many of its customers are "millennials, early adopters and tech savvy households." Sales for this company's products are strongest in the eastern and southern U.S. states. In marketing its "feature heavy" dryers, this company primarily relies on its well-known but relatively young brand name in the U.S. market.

Two of the manufacturers sell matching gas and electric dryer models, while one only sells electric models. For the two companies with gas models, these models comprise about 20 percent of all annual sales, and sales are strongest (and increasing) on the East Coast.

Role of Energy Efficiency

All of the manufacturers Evergreen spoke with place high value on energy efficiency and are aggressively expanding their ENERGY STAR product offerings. In particular, the company that specializes in ventless and heat pump dryers (all ENERGY STAR certified) is trying to become a market leader of efficient clothes dryers, marketing its heat pump dryers as "the most efficient on the market." The other two companies are also focused on ENERGY STAR for all but their lowest priced models, encouraging customers to match their ENERGY STAR clothes washers with ENERGY STAR dryers. One manufacturer stated that ENERGY STAR models are quickly replacing older models "with no incremental (manufacturing) cost," and that laundry equipment "must be ENERGY STAR to compete."

[9] In Europe, this company targets its heat pump dryers to customers that are buying dryers separate from washers.

[10] Lint accumulation in the dryer and/or venting is a leading cause of dryer fires.

One manufacturer was optimistic that heat pump dryers will gain U.S. market share, noting that it has taken ten years for the technology to take hold in Europe. This manufacturer thinks that growing demand for less water and energy consumption (and lint-free dryers) will make heat pump dryers more appealing over time.

The other two manufacturers were less certain about the prospects for hybrid and heat pump dryers, providing the following observations:

- Dryer capacity and costs are consumers' primary decision factors for models with similar feature sets.
- Consumers are very price sensitive, and the equipment costs for hybrid and heat pump dryers are currently too high to generate much interest. The payback period for a pure heat pump dryer is currently about ten years assuming $100 in annual energy savings.[11] Future demand is likely to be region- and customer-specific, as most households have moderate energy costs.
- The difference in energy efficiency between hybrid and other ENERGY STAR dryers is not large enough to justify the additional equipment costs.[12]
- Retailers are reluctant to floor expensive hybrid models over strong-selling standard models.
- It is hard for retail sales staff to explain heat pump technology, which is not visible from outside the unit.
- Most single-family households already have a vent run, and it will be challenging to get them to prefer ventless dryers, which are still considered to be a "new" technology.[13]
- Clothes washers typically drive the sale of laundry equipment, and most equipment is purchased in pairs. Manufacturers focus on their clothes washer marketing first, with less emphasis on their clothes dryers. This makes it more difficult to differentiate most energy efficient clothes dryers.

Pricing

The manufacturers reported that buyers are most focused on the price of the washing machine, and that matching washers and dryers are usually sold at the same prices.[14] In the past two years, average consumer prices have declined due to increased manufacturer

[11] One manufacture noted that customers are more responsive to marketing about monetary savings than energy savings percentages.
[12] One interviewee stated that some companies are trying to add fans to get fresher air, which "may be the only thing to change the landscape," but the costs for these changes were still unknown.
[13] The manufacturer of ventless dryers conceded that "vented models are not declining as fast as expected."
[14] On average, $699 to $799, according to one interviewee.

competition, sluggish housing demand and continued household frugality in a fragile economy. Going forward, one manufacturer believed that prices will not drop much further as manufacturers increasingly meet ENERGY STAR water and energy standards for clothes washers. Another manufacturer hoped that they will be able to increase prices for their premium products with new features as the economy continues to improve.

Customer Demand and Expected Trends

In recent years, most manufacturers increased the capacities of their average laundry equipment, and going forward the market may become more segmented. For example, one manufacturer noted that the fastest growing residential segments are smaller households (for example, only two people) and large, multigenerational households, and thus future demand will be for both very large and smaller dryers. Another manufacturer also noted that there are more urban dwellers living in smaller spaces now, and that laundry rooms have become smaller.

The manufacturers made the following observations about future demand for clothes dryers:

- ENERGY STAR certification will be a key requirement for customers and manufacturers.
- Steam injection will be a standard feature for most dryers. Steam is used to prevent wrinkling and to sanitize items.
- Dryers may integrate additional sensors, to detect blocked vents, for instance.
- Condensing dryers[15] are not likely to gain significant market share going forward, although more manufacturers are launching these in the U.S. These models cost less than heat pump and hybrid models and are well suited to smaller dwellings; however, the long drying times will not be palatable to most U.S. households.
- More hybrid models may appear in the U.S. market, and the best models will likely be ventless.
- Smart laundry equipment is in the early stages of development now but seems to offer limited benefits compared to other products (for example, thermostats). In particular, each brand has its own protocols covering all of its own appliances, which is a significant barrier to consumers who do not want to buy a "whole suite" of one manufacturer's products.[16]
- One manufacturer is confident that consumers will increasingly want to eliminate dryer vent holes, while other manufacturers are doubtful that vent holes are disappearing.

[15] As distinguished from heat pump-based dryers that also use condensers.
[16] One manufacturer has produced smart washers since 2012 and is considering smart dryers.

3.3 Supply Chain Insights - Retailers

The Evergreen team obtained insights about the retail environment and practices from interviews with program and initiative staff and with retailers.

3.3.1 Program and Initiative Interviews

NEEA staff highlighted several challenges in advancing super-efficient dryers at the retail level. Floor space is expensive, and facilitating effective sales and promotions through retail stores requires extensive effort. Effective promotions require both retail sales staff training and administrative work to ensure rebate forms and point of sale information is present.

There is a distinction between big box retailers and independent appliance stores. Big box stores tend to follow a national approach, so they are less able to incorporate regional initiatives and tailor their strategy on which models are on the showroom floor. Independent retailers are better able to customize their offerings.

3.3.2 Retailer Interviews

The Evergreen Economics team completed four in-depth interviews with clothes dryer retailers in the Northwest, including two large national chains, one regional chain and one local retailer. Interviewees comprised a director of sales, two senior dryer managers and one dryer retail representative. The objectives of the retailer interviews included understanding stocking and procurement practices for clothes dryers, identifying the most popular dryer brands, and understanding customer preferences and potential dryer market trends. Appendix F includes the interview questions.

All four participants said they have at least some influence on dryer stocking for their retail company, although the two larger national chain representatives explained that final stocking decisions are commonly done by associate level buyers at the national level.

Stocking, Procurement, Sales and Installation

Overall, all four retailers said that while they do offer natural gas dryers to their retail customers, a large majority of their dryer sales in the Northwest come from electric dryer models, which comprise approximately 80 percent of sales for national retailers and over 97 percent for regional retailers. Additionally, the two large national retailers and the regional chain retailer said they stock all of the major clothes dryer brands including LG, Whirlpool, Electrolux, Maytag, GE, Frigidaire and Samsung, along with various smaller brands in larger retail locations.[17] Conversely, the smaller Oregon retailer noted it stocks Electrolux and Frigidaire dryers but primarily focuses on energy efficient and high-quality dryers, stocking smaller brands such as ASKO, Miele and Blomberg. All retailers said they

[17] One of the national retailers also mentioned that a majority of dryer options it stocks are from its own proprietary brand.

focus on sell-through rates, profit margins and rebate offerings in deciding which dryer models to stock.

All four retailers mentioned that they also offer clothes dryers that are not kept in stock. Both large national retailers mentioned that they offer, but do not stock, heat pump clothes dryers because of their comparatively infrequent sales. The smaller retailers noted that they sell some dryer models on a per-order basis to provide more variety in color choices and operating options. The two national retailers purchased all of their dryers directly from the manufacturers, while the two smaller retailers purchased some dryers from manufacturers and others, especially European and Asian brands, from local distributors.

The four retailers varied in the levels of importance they attributed to a model's energy efficiency in their purchasing and stocking processes. While one of the national retailers, along with the smaller Oregon retailer, said energy efficiency has become a relatively high priority in their stocking decisions, the other national retailer said that it remains somewhat unimportant given that its customer base is "easily priced out of energy efficiency options."

However, despite the varying importance levels of energy efficiency, all four retailers said they do offer a variety of energy efficient dryers, including ENERGY STAR models and some heat pump-based models. The retailers noted that they offer all of the ENERGY STAR dryer models across the major manufacturers (approximately 20% of all dryers for large retailers). While the local retailer also offered heat pump models in-store, the three larger retailers noted they offer super-efficient dryers online only.

As shown in Table 3, because of the variety of sizes and customer bases, the four participating retailers had varying levels of dryer sales across the main dryer types. Overall, the larger national and regional retailers noted the vast majority of their dryer sales in 2015 came from standard dryer models, while the local retailer that is focusing on energy efficiency said that over 20 percent of its sales are coming from heat pump models as they become more accepted in the Northwest market. The overall product mix has not changed over the last year, although two retailers anticipate heat pump dryer sales to increase as more options become available and the price-point lowers.

Table 3: Approximate Percentage of Annual Clothes Dryer Sales*

Dryer Type	Retailer 1 (National)	Retailer 2 (National)	Retailer 3 (Regional)	Retailer 4 (Local)
Standard-vented dryer	97%	50%	10%	0%
Standard-vented dryer, with moisture sensors		50%	60-85%	50-60%
Ventless dryers	2%	<1%	5%	10%
Heat pump dryers	<1%	<1%	<1%	20-30%
Hybrid dryers	<1%	<1%	<1%	0%

*Percentages were estimated by participants and may not equal 100%. Retailers reported very small numbers of natural gas dryer sales.

Additionally, the three larger retailers said sales of their most popular clothes dryers are commonly dictated by their washer sales, as customers frequently purchase the appliances as part of a matching set. The large retailers estimated that between 50 and 70 percent of their dryer sales are purchased as part of a laundry pair, while the regional and local retailers estimated that between 80 and 95 percent of dryer sales are part of a paired purchase. The retailers also noted that the price-points for most electric clothes dryers have remained the same over the last year; the regional retailer noted that the average price-point may continue to increase slightly as more features become available on newer models and customers begin to target energy efficient and higher technology models.

Customers purchasing a new dryer as a stand-alone purchase typically try to match their current washer on capacity and overall aesthetics, but are less inclined to try to purchase an exact model match, according to the retailers.

Some of the retailers provide training for sales staff and their in-house or third-party installers. One national retailer provides annual ENERGY STAR training. For installation, the main technical issues revolve around placement of the venting and dryer ducting. None of the retailers pursue additional manufacturer training sessions that are available.

Overall, the retailers were uncertain what share of their dryer installations are for multifamily homes. However, the regional retailer estimated that approximately 65 percent of its clothes dryers from 2015 went into multifamily homes, a 25 percent increase from the previous year.

Marketing and Customer Demand

Similar to stocking and sales practices, retailer marketing varied between the larger chains and the local retailer. While the larger national and regional retailers said they regularly

market to customers through online, print, television and radio advertisements, the local retailer said it relies on small trade shows and industry meetings which are "less expensive but actually pay off a lot better." All of the retailers also said they use at least some in-store or point of sale materials provided directly from manufacturers or distributors in their retail store. However, the retailers noted that they never have special promotions with specific dryer manufacturers, primarily because a majority of their customers are purchasing the dryer as part of a matching washer and dryer set.

Additionally, the larger retailers cited different target markets for their clothes dryers than the smaller local retailer, primarily due to their overall market size. The national and regional retailers tend to focus more on customers who need an affordable replacement right away, while the local retailer focused more on remodelers, architects and custom home builders who may be more interested in higher-end and more efficient clothes dryers. Overall, the retailers estimated that about 60 to 70 percent of dryer purchases are emergency replacements overall, although this percentage varies by retailer.

Given the varying target markets, the larger retailers' primary marketing messages focus on available incentives and their larger variety of brands, while the local retailer emphasizes the improved technology and the "latest and greatest" options for customers.[18]

Currently, all four retailers said the size and capacity of the clothes dryer are the most important product features for their customers. Other product features that retailers noted include newer technology, energy efficiency, dry-time and steam injection capability. However, all of the retailers noted that as consumers become more familiar with ENERGY STAR labeling on other appliances, the marketing for dryers will begin to shift toward more efficient ENERGY STAR models with rebate incentives. The larger national and regional retailers have started to train their sales staff on discussing energy efficiency benefits and the ENERGY STAR labeled dryers.

For customers interested in energy efficient dryers, the national retailers said they focus on ENERGY STAR models, while the regional and local retailers said they promote the heat pump and hybrid dryers. Specifically, the regional and local retailers said the heat pump and hybrid dryer models are especially promoted to builders that are looking for energy efficient models because of the scale of their purchases and their desire to lower usage costs in custom home and multifamily projects. However, while the local retailer said that 50 percent of its customers are very receptive to the newer heat pump technology, the regional retailer estimated only 5 percent of its larger customer base was currently very receptive to the technology. Retailers said that the initial price-point and lack of customer awareness continue to be the biggest challenges in selling heat pump and hybrid clothes dryers in the Northwest market.

[18] One of the national retailers also said it heavily markets its own proprietary dryer brand because of its well-known brand name and its exclusivity in offering the brand's appliance line.

4 Consumer Research

To understand the market potential of super-efficient dryers and the potential drivers behind their purchase, Evergreen Economics reviewed literature about consumer practices and conducted two types of consumer research: focus groups and a general population household survey. The focus groups are intended to provide depth of understanding and *qualitative* insights about household laundry practices, perceptions and preferences. The survey then built on those same topics in less depth, but with a sufficient sample size to draw *quantitative* conclusions.

4.1 Insights from the Literature

Research previously conducted by Energy Trust of Oregon and Portland State University found that consumers prioritize performance including drying effectiveness as well as initial equipment cost, followed by the service warranty and convenience of the dryers. Equipment price is one reason consumers have historically preferred electric dryers over gas dryers (and more recently, heat pump dryers) (Portland State University and Energy Trust of Oregon 2014).

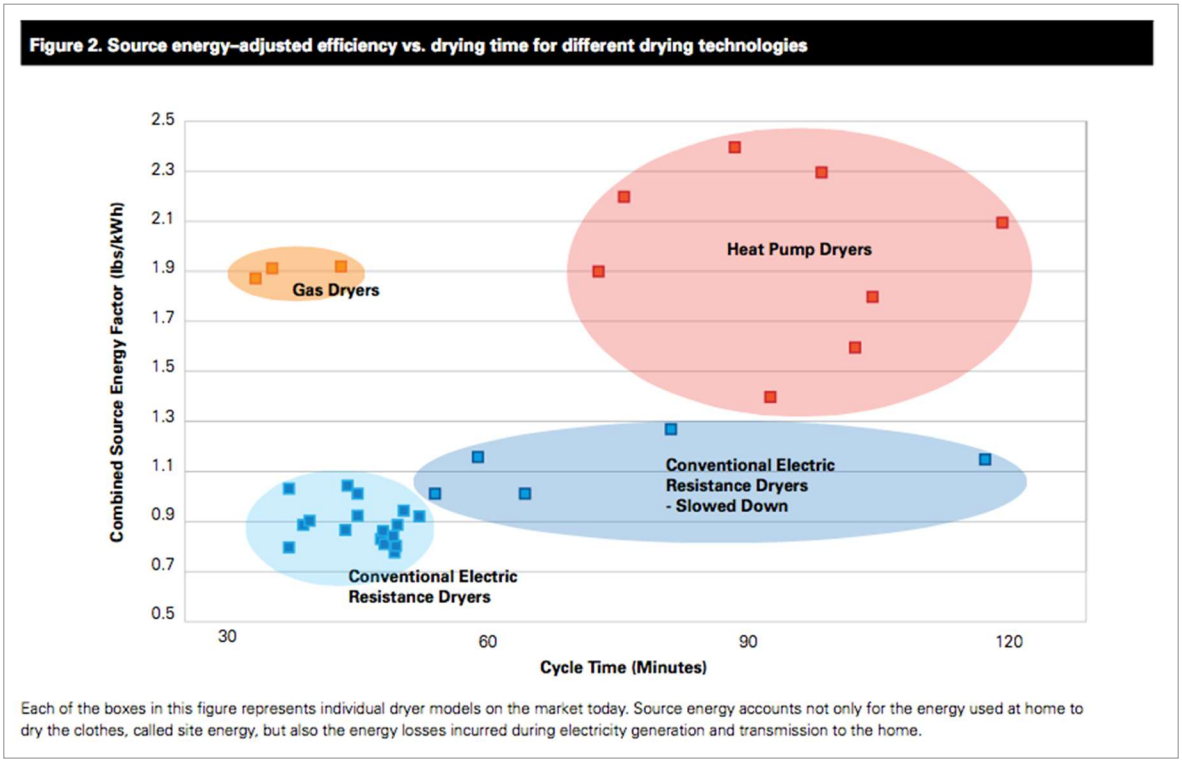
Additionally, consumers consider the operational lifetime of the dryer, the installation cost of the dryer, and available incentives or rebates. Cycle time is also an important motivating factor for consumers purchasing a clothes dryer. Factors such as annual maintenance costs, potential energy savings, cost of installation and visual appearance were found to be significantly less important to consumers by Energy Trust of Oregon's and Portland State University's research.

4.1.1 Cycle Time

As shown in Figure 3, while heat pump dryers are considerably more efficient than conventional electric dryers, the average cycle time has been reported to be more than double that of the conventional electric dryer cycle time to which American consumers are accustomed (Zahnzinger 2015).

However, due to inconsistent testing procedures, the additional drying time for super-efficient dryers is not entirely clear. While Figure 3 shows longer dry times for heat pump dryers versus conventional dryers, these findings may be based on European laundry tests that are not necessarily a good comparison to American laundry tests, given that the load sizes are twice as large in the U.S as in Europe. Current field testing by NEEA found that across the ten homes tested, the hybrid heat pump dryers averaged only fifteen minutes longer than conventional dryers (roughly 20% longer). NEEA staff believe that their testing methods are more reflective of American laundry practices based on the load settings, clothing types and load sizes.

Figure 3: Energy Factors and Cycle Times by Dryer Type (NRDC Report)



Source: NRDC 2014

4.2 Focus Groups

Evergreen Economics, together with Curtis Research Associates, conducted six focus groups in four cities in February 2016. The focus group facilities recruited participants who owned their own homes and had either been shopping for a new dryer or had an older dryer that suggested a need for replacement in the foreseeable future.[19] In addition, for two focus groups, participants also needed to have natural gas service to their homes.

Table 4 lists the focus groups Evergreen and Curtis Research conducted. The recruitment guide and the moderator's guide for the groups that focused on electric dryers are attached as Attachments A and B in Appendix E. The moderator's guide for the natural gas groups covered much of the same content, but with modest customization to spur more discussion on natural gas dryers and issues.

[19] Participants' dryers needed to be either less than one year old or more than ten years old unless the household reported that they had been shopping for a dryer.

Table 4: Focus Group List

Location	Date	Number of Participants	Fuel Focus
Billings	Feb 2, 2016	9	Electric
Portland 1	Feb 4, 2016	8	Electric
Portland 2	Feb 4, 2016	8	Natural gas
Boise	Feb 9, 2016	8	Electric
Seattle 1	Feb 10, 2016	9	Electric
Seattle 2	Feb 10, 2016	8	Natural gas

4.3 Focus Group Discussion Summary

This section summarizes key themes from the focus groups that have implications for future NEEA market interventions in the dryer market. This summary is organized around the following set of questions:

- What are the prevalent laundry habits?
- What does the shopping process for dryers look like?
- What kind of dryer would consumers buy and what drives their choices?

A longer, more detailed summary is attached as Appendix E.

4.3.1 What are the prevalent laundry habits?

The focus groups revealed wide variety in household laundry habits, although individual households each have their own well-established practices and habits. Several characteristics of household laundry habits have implications for dryer purchases and, therefore, NEEA's dryer initiative.

There is no typical person in charge of laundry across households. Both men and women take care of the laundry. In some households, one person does everyone's laundry; in others, everyone washes his or her own clothes. As a result, purchases of new laundry appliances have multiple stakeholders in many households and may not be just one person's domain.

The timing and sequencing of the laundry varies. Some households do laundry on specific days of the week and others wait until hampers are full or particular clothes are needed. Those with fixed laundry days seemed more interested in being able to do multiple loads back-to-back, for which alignment of washer and dryer cycle times is valued. However,

while these households value wash and dry times that align, they understand that drying times depend on the load being dried as well as on the dryer itself.

Several participants commented that a household member either does not want others to wash particular clothes or singles out these items for special treatment. Often, this includes not drying those particular garments out of concern that the drying process would harm the fabric or cause the item to shrink. Others remove such items from the dryer after a short time. The idea of a dryer that is gentler on clothes appealed to these households. It should be noted that Evergreen heard this sentiment in most of the focus groups, but generally only from one or two participants per group. These participants had developed work-arounds that seem to satisfy their concern.

4.3.2 What does the shopping process for dryers look like?

The decision to buy a new dryer is most commonly linked to either an equipment failure or worsening performance by an older dryer, but participants also acknowledged that the need for a new washer could trigger a dryer purchase (as supply chain actors have also indicated). Hence, a share of dryer purchases comprises "emergency replacements" that households would want to complete in a span of a few days to no more than a week. For households that care about matching sets (for aesthetics, fit and consistency in controls), the washer choice is likely to dominate the purchase decision and be the appliance that needs replacing sooner.

Overall, ventless drying did not generally resonate as a desirable feature except for a small number of people who connected it with reduced fire danger. People were somewhat interested when they heard that some heat pump dryers do not need a vent, but this topic did not come up on its own before the focus group moderator raised it.

Participants indicated that they would turn to multiple information sources to educate themselves about dryer choices, including friends and family, repair technicians, ratings from other consumers and independent consumer organizations, and general Internet searches where they are likely to encounter manufacturer and retailer information.

Two information sources that are important to NEEA did not get much mention. People would not think to seek out information from utilities, although they do trust their utility providers and would consider their recommendations if they were aware of them. Retail salespeople and retail-based information also were not at the front of people's minds. Retail salespeople—especially those at big box retailers—were not seen as well informed. However, participants were probably understating the actual influence of the retail experience, especially for emergency replacements.[20]

[20] Focus group participants appeared to describe the ideal purchase process that allows for research and contemplation and did not seem to consider the time pressures of an emergency replacement. Shortcuts in

When asked unprompted what features matter to them in a dryer, participants commonly cited size and capacity, energy efficiency (discussed in more detail below), reliability, drying time, and price and value. Size and capacity referred to the exterior dimensions and the loading capacity of the dryers. As signs of reliability, participants look at the reputation of the brand, the extensiveness of the warranty and consumer ratings.[21] Price and value represented more than just a low purchase price. While purchase price is clearly one of the key drivers of which dryer a household will buy, participants do seek value, which they define as a balance of purchase cost, features and characteristics of the dryer, and operating cost. Some participants mentioned discounts as well, tending to see value as getting the product they are purchasing for a lower (that is, discounted) price.

Energy efficiency resonated well with many of the participants as a desirable concept and feature—especially in the Portland and Seattle groups—but was not well understood. Participants seemed to be widely aware of the ENERGY STAR label and the Energy Guide, thinking of both as positives. With few exceptions, they did not have a good sense of how much energy dryers use or how much an ENERGY STAR certified product will save them. In some cases, participants also had varied senses of what energy efficiency means, thinking that an efficient dryer dries laundry more quickly. Others combined the concept of energy efficiency with other resource efficiencies, such as for water.

Participants were generally aware of both fuels (electric and gas), but tend to think primarily of replacing their dryer with a new one that uses the same fuel as the one they currently have. When exposed to the alternate fuel (as in the natural gas groups), some electric dryer owners were attracted to the thought of a natural gas dryer because they think of natural gas appliances as less expensive to operate and either better for the environment or more efficient. Their interest was subject to obtaining more information about what would be involved, however. They had previously heard mixed messages on the infrastructure needs and installation costs of a natural gas dryer. Also, there were some impressions that gas dryers run hotter than electric dryers, but it was not clear if that was seen as a pro or a con.

4.3.3 What would consumers buy and what tends to drive their decision?

The study team built a "purchase simulation" exercise into the focus group to gauge interest in—and willingness to pay for—heat pump, hybrid and ENERGY STAR dryers. Comparison dryers were a low-cost conventional dryer and a high-cost feature-filled dryer—neither were ENERGY STAR certified. The exercise also explored interest in natural gas dryers generally and the choice between conventional non-ENERGY STAR and conventional ENERGY STAR natural gas dryers. This exercise was placed at the end of the

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the purchase process seem likely when consumers are faced with the need to get a new dryer quickly, which would increase reliance on readily available information, such as in-store displays and salespeople.

[21] Ease of repair was also volunteered in some groups and took on greater importance after the discussion turned to heat pump dryer technology.

focus group, so participants were likely to take into account the previous discussions in the group and the information about dryer options already presented to them.

Overall, ENERGY STAR dryers (electric and natural gas) were the participants' top choice and would figure most prominently in their shopping search if they were to look into new dryers. Interestingly, nearly a quarter of participants included a super-efficient dryer among their top two choices, with most of these participants preferring the hybrid over the heat pump option (see Table 5).

Table 5: Focus Group Participant Dryer Choices

	Number of Participants Who Selected (Among Top Two)	Percentage Within Fuel[22]	Percentage of Total
Conventional Electric	6	9%	6%
Conventional Electric - ENERGY STAR	24	36%	25%
Conventional Electric – High End	17	25%	18%
Hybrid Electric (ENERGY STAR)	14	21%	14%
Heat Pump Electric (ENERGY STAR)	6	9%	6%
Conventional Natural Gas	13	43%	13%
Conventional Natural Gas – ENERGY STAR	17	57%	18%

Natural gas dryers also rated highly, drawing interest from nearly a third of participants, although the share that currently had natural gas dryers was closer to a sixth of participants. Among natural gas dryers, participants also preferred ENERGY STAR certified models, despite the increased cost of $100 shown to them in the exercise for energy savings of about 5 percent.

In explaining their choices, participants indicated that they want value—especially for those who selected an ENERGY STAR dryer that did not feature heat pump technology. Among those who showed interest in hybrid dryers—which were shown as costing $600 more than a basic dryer—the energy savings and the choice between eco and speed modes drove their interest.

[22] These percentages indicate the distribution among those who chose a dryer of the given fuel (electric or natural gas).

Heat pump technology was well received by some in the Portland and Seattle focus groups. Some (but still the minority of) respondents already had familiarity with heat pump technology and had it in their homes via an HVAC system.

Interestingly, neither gentleness nor dry time differences received much attention from the participants when selecting a dryer during the exercise, despite previously stated interest in both.

4.4 Household Survey

The study also included a survey of households in NEEA's four-state region to explore similar issues as in the focus groups, but across a large enough sample to provide quantifiable results. The survey also included an inquiry into households' interest in—and willingness to pay for—clothes dryers at different levels of efficiency.

Evergreen Economics conducted the household survey among households in Idaho, Montana, Oregon and Washington that own a dryer. SSI provided the sample from a proprietary web panel it maintains for consumer research. Evergreen hosted the survey as an online instrument. The survey was fielded between April 15 and April 22, 2016, and yielded 620 completions, as shown in Table 6.

Table 6: Household Survey Completions by State and Access to Natural Gas[23]

	State				
Natural Gas Service	**Idaho**	**Montana**	**Oregon**	**Washington**	**Total**
With Gas	104	70	106	94	**374**
No Gas	72	34	66	74	**246**
Total	**176**	**104**	**172**	**168**	**620**

The survey results provide insight about three primary subtopics: laundry practices and attitudes, laundry purchase tendencies, and degree of interest in—and willingness to pay for—heat pump and hybrid dryers. The discussion below also provides selected natural gas-specific insights.

4.4.1 Laundry Practices and Attitudes

Survey respondents all own laundry equipment, which was a requirement for participation in the survey. The majority own a top loading washer (62%), and nearly all own an electric

[23] The 620 completed surveys include 525 single-family detached homes (standalone), 27 single-family attached homes (shared walls), 30 mobile or modular homes, and 38 multifamily homes (for example, condominiums and apartments).

dryer (92%). On average, respondents do six loads of laundry per week, or about two loads per person.

Evergreen explored four key issues concerning laundry practices and attitudes that have implications for potential interest in super-efficient dryers. These issues were:

- Whether households do laundry sequentially (that is, one load after another) or in a staggered fashion throughout the week;
- How they feel about the length of their current dryer cycles;
- Whether they intentionally refrain from drying some of their clothes; and
- How much energy they think their laundry equipment uses.

On average, 51 percent of laundry is done in a staggered fashion rather than sequentially. Arguably, households that do laundry sequentially would care more about how long a dryer cycle takes and how closely it matches the wash cycle time of their clothes washer, whereas those who do laundry in a staggered fashion can more easily deal with a dryer that takes longer.

Along similar lines, the Evergreen team found that the majority of respondents are content with the amount of time their washer and dryer takes to complete their cycles, with 20 percent reporting being frustrated or annoyed by the dryer cycle time and 9 percent annoyed by their washer cycle time. Interestingly, those who expressed dissatisfaction with the length of their dryer times self-reported longer cycles averaging sixty-five minutes, compared to forty-five minutes among those who were satisfied with their dryer cycle time (on their most recently completed load of laundry).

The Evergreen team found that a small but meaningful fraction of washed laundry is not dried in the clothes dryer. In general, respondents reported that 17 percent of the laundry they wash at home is not dried in their dryer. When asked about their most recent load of laundry, only 3 percent said they did not put any of it in the dryer, but 15 percent said they put part of that load in the dryer. While Evergreen did not ask why these respondents pulled aside some of their laundry for air drying (presumably), one can assess from the focus groups that wanting to treat some articles more gently and protecting them from perceived wear caused by heated tumble drying was a key factor for a subset of the population. Pulling a share of their laundry for alternate drying would be consistent with this motivation and could point to potential interest in dryers that people believe are more gentle on clothes.

Finally, the Evergreen team examined people's perceptions of how much energy their laundry equipment uses, both in absolute terms and in comparison to other major household end-uses (that is, lighting, refrigeration, water heating and HVAC). On a scale of 0 to 100, where 0 is *"very little"* and 100 is *"a lot"*, respondents rated the energy used by their clothes washer as 53 and drying as 59, indicating they believe their laundry

equipment uses a moderate (and similar) amount of energy. However, individual ratings ranged from 0 to 100 in both cases. Eighteen percent of respondents believe their dryer uses more energy than all the other end-uses, and over half believe it is at least above average among the end-uses, in terms of energy usage. Similarly, 11 percent of respondents believe their clothes washer's energy use is greater than all other end-uses, and 43 percent believe it is at least above average.

4.4.2 Laundry Purchase Tendencies

Only 74 percent of respondents actually have purchased a dryer previously, while the remaining quarter appear to have little experience with such a purchase and presumably acquired their existing dryer when they purchased their home.

Whether experienced equipment purchasers or not, respondents anticipated that their next dryer purchase would be prompted by failure of their current dryer. Seventy-nine percent of respondents listed equipment failure as a likely trigger for their next dryer purchase, which suggests that they would be in a hurry to replace their dryer. About a quarter of respondents also anticipated that signs of age by the dryer (29%), a desire for new dryer features or functionality (23%) or the need for a new clothes washer (21%) could prompt a new dryer purchase.

When asked, the majority of respondents would consider purchasing dryers with standard dimensions (77%) and capacities (67%), although a minority of respondents would consider somewhat larger or smaller equipment. Only 6 percent of respondents would consider purchasing a dryer with both smaller dimensions and capacity, but 12 percent would consider purchasing a dryer with smaller dimensions and 9 percent with smaller capacity.

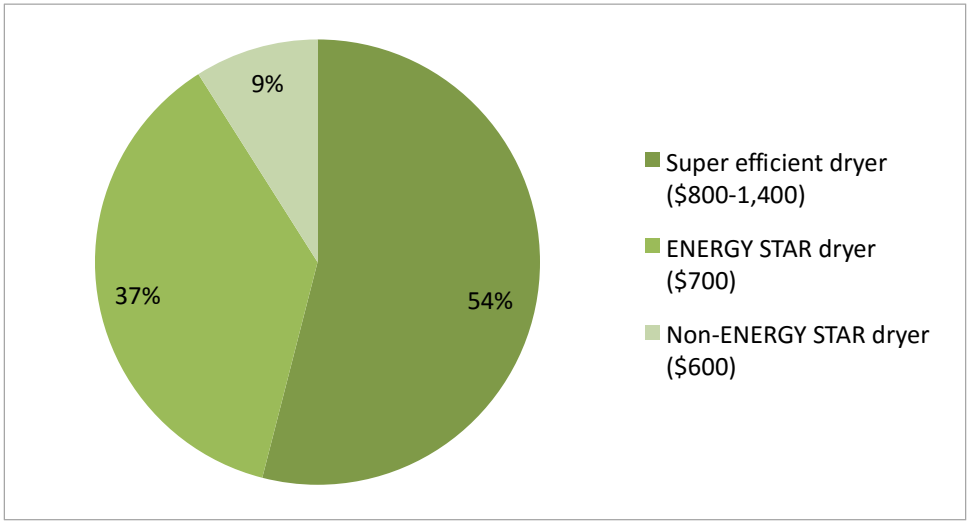
Typical information sources that respondents say they are "very likely" to use when selecting their next dryer are ratings and reviews by product owners and users (63%), *Consumer Reports* (54%), and friends or family (45%). They also report being "unlikely" to use advertisements, appliance repair professionals or retail sales staff as sources for information about dryers.

Interest in Super-Efficient Dryers

One of the key results from the survey is a greater understanding of how consumers might respond if super-efficient dryers (and ENERGY STAR dryers) were offered on an equal footing alongside more conventional dryers when people make their purchase decisions. In a series of survey questions, the Evergreen team offered conventional non-ENERGY STAR, conventional ENERGY STAR, heat pump and hybrid dryers side-by-side with brief descriptions of their key attributes and costs and asked respondents to choose the dryer they would purchase (but without direct reference to the technologies employed). The characteristics by which the dryers varied were purchase cost, energy consumption, presence of an ENERGY STAR label and dryer temperature (with implications for length of cycle time and the dryer's gentleness on clothes).

Results suggest that—in a side-by-side selection process—heat pump, hybrid and conventional ENERGY STAR dryers all do well. In fact, Evergreen's modeling of results (discussed in more detail in Appendix C) indicates that 37 percent of respondents would choose a conventional ENERGY STAR dryer and 54 percent would choose a super-efficient dryer even at a $1,400 price point. Only 9 percent chose a conventional non-ENERGY STAR dryer even though it was the lowest-priced option at $600, as shown in Figure 4.

Figure 4: Customer Dryer Efficiency Preferences, from Choice Modeling



Actual market shares are much lower than in Evergreen's survey—probably for two primary reasons:

1. Consumers tend to overstate their willingness to pay in stated choice research. If the respondents had needed to actually write a check for the purchase amounts, the Evergreen team would have expected a shift toward the lower cost dryers.
2. Actual retail experiences are more complicated and less neutrally presented than the choice the Evergreen team gave respondents. As noted earlier, heat pump and hybrid dryers are generally not available for viewing in retail stores, and ENERGY STAR models tend to occupy only a fraction of the floor space. Furthermore, consumers are inundated with many other differences between individual dryer models and their particular features, so the characteristics the team featured in Evergreen's survey question would be diluted in importance.

Nevertheless, Evergreen believes that the much greater interest in ENERGY STAR and super-efficient dryers shown by the study participants in the focus groups and the general population survey does suggest interest and openness to energy efficient dryers, even at higher purchase prices. The difference between study participant choices and actual market share highlights, among other things, barriers to the more efficient dryers at the retail level. Currently, for example, the retail environment tends to favor conventional dryers by giving them more visibility, floor space and attention in marketing.

Separately, the Evergreen team analyzed survey results to understand the relative impact of incentives in bringing down the cost of super-efficient dryers. Overall, the team estimates that a price reduction of $300 on the heat pump or hybrid dryer could boost market share by 18 and 40 percent, respectively. A price reduction of $500 could boost market share by 28 and 62 percent, respectively. Generally speaking, the shift would come from consumers who would otherwise purchase either the ENERGY STAR dryer or the undiscounted super-efficient dryer.[24]

At the undiscounted price of $1,400 for the hybrid and heat pump dryers, Evergreen finds that of those respondents who chose the super-efficient dryer option, 43 percent chose hybrid and 57 percent chose the heat pump, suggesting that consumers are willing to forego faster drying times for greater energy savings.

These proportions reverse when Evergreen considers the heavily discounted price of $800 for either the heat pump or hybrid dryers. Of respondents who chose a super-efficient option, 57 percent chose the hybrid dryer and 43 percent chose the heat pump dryer. This increased interest in the hybrid dryer is not due to respondents switching from the heat pump dryer at the lower price, but rather is due to respondents switching from the conventional non-ENERGY STAR and ENERGY STAR dryers to the hybrid dryer when the price of the hybrid dryer is reduced to the point where it is only marginally greater than the price of the conventional non-ENERGY STAR and ENERGY STAR dryers.

These results suggest that, while energy savings is important to consumers, it is but one factor they consider. Comparatively short dry times are an important consideration to many consumers.

Table 7 shows the modeled results for various discount levels and two levels of energy savings for ENERGY STAR dryers.

[24] It is important to note that these estimates of *change in market share* are based on the stated preferences of consumers who were presented with an equal quantity of information on each of the four dryer types.

Table 7: Market Share Simulation of Stated Preference Model Results

		Percentage of Respondents			
Scenario	**Description**	**Conven-tional**	**ENERGY STAR (ES)**	**Hybrid**	**Heat Pump**
Base	Price of Hybrid Dryer is $1,400 Price of Heat Pump Dryer is $1,400 ES Dryer reduces energy use by 10%	*9.3%*	*37.2%*	*23.0%*	*30.5%*
1	Price of Hybrid Dryer is $1,400 Price of Heat Pump Dryer is $1,400 ES Dryer reduces energy use by 20%	8.1%	46.6%	19.5%	25.8%
2	Price of Hybrid Dryer is $800 Price of Heat Pump Dryer is $800 ES Dryer reduces energy use by 20%	5.2%	30.5%	37.0%	27.3%
3	Price of Hybrid Dryer is $800 Price of Heat Pump Dryer is $1,400 ES Dryer reduces energy use by 10%	6.5%	25.7%	47.4%	20.4%
4	Price of Hybrid Dryer is $1,400 Price of Heat Pump Dryer is $800 ES Dryer reduces energy use by 10%	7.8%	30.9%	18.6%	42.6%
5	Price of Hybrid Dryer is $800 Price of Heat Pump Dryer is $800 ES Dryer reduces energy use by 10%	5.8%	22.6%	41.2%	30.5%

*Note these percentages represent estimates based on stated preferences of respondents.

The characteristics of respondents that chose a super-efficient dryer differ from those who chose either of the conventional dryers, but the differences are not great. Respondents who chose a super-efficient dryer option were much more likely to indicate that they "tend to like trying the newest technology" (60 percent versus 39 percent). These respondents also had greater average household income ($79,000 versus $67,000) and were slightly more likely to have earned at least a bachelor's degree (54 percent versus 48 percent).

For a deeper discussion of Evergreen's stated choice analysis and modeling, please see Appendix C.

4.4.3 Natural Gas Insights

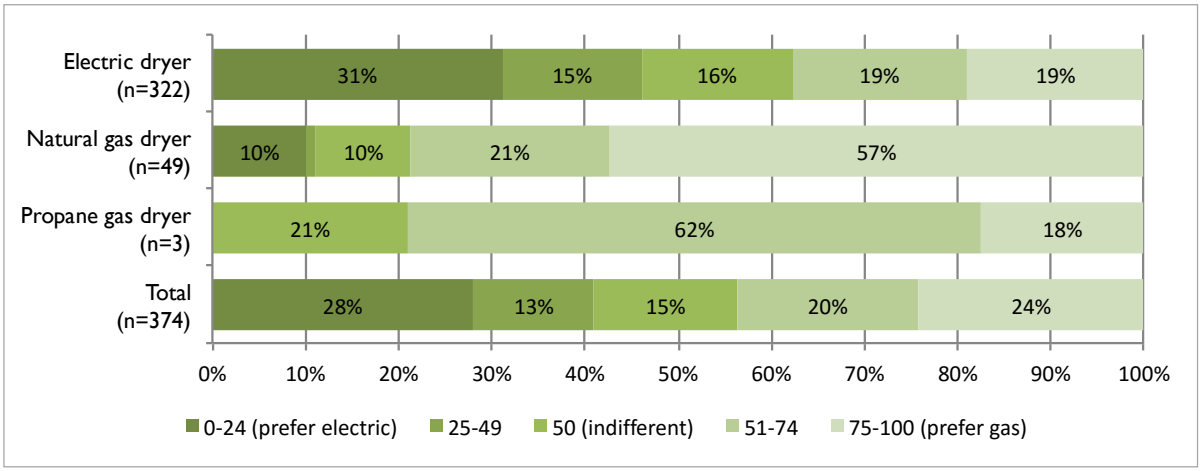
Over half of the survey respondents (374 of 620) reported having natural gas service to their home. Presently, 86 percent of them have an electric dryer, while only 14 percent have a gas dryer. In addition, 1 percent of respondents reported having a propane dryer.

Natural gas dryer penetration rates among respondents were similar across the eight most commonly reported gas utilities. They ranged from 5 percent among Energy West customers (n=18) to 20 percent among Avista Utilities customers (n=42).

There were no statistically significant differences between the dryer types (by fuel) in terms of how much energy respondents believe the dryers use (on an absolute scale).

As noted, 374 of the survey respondents could purchase a natural gas model as their next dryer because they already have natural gas service to their home. When asked to contemplate whether they would buy an electric or natural gas dryer, the preferences were diverse. Just over a quarter (28%) had a strong preference for electric dryers, another quarter (24%) had a strong preference for gas dryers, and 15 percent were indifferent.[25] Respondents who currently own gas dryers were significantly more likely to report having a strong preference for purchasing the same type of dryer in the future (57%) than respondents who currently own electric dryers (31%), as is shown in Figure 5.

Figure 5: Dryer Fuel Preferences by Current Dryer Fuel, Among Those With Gas Service

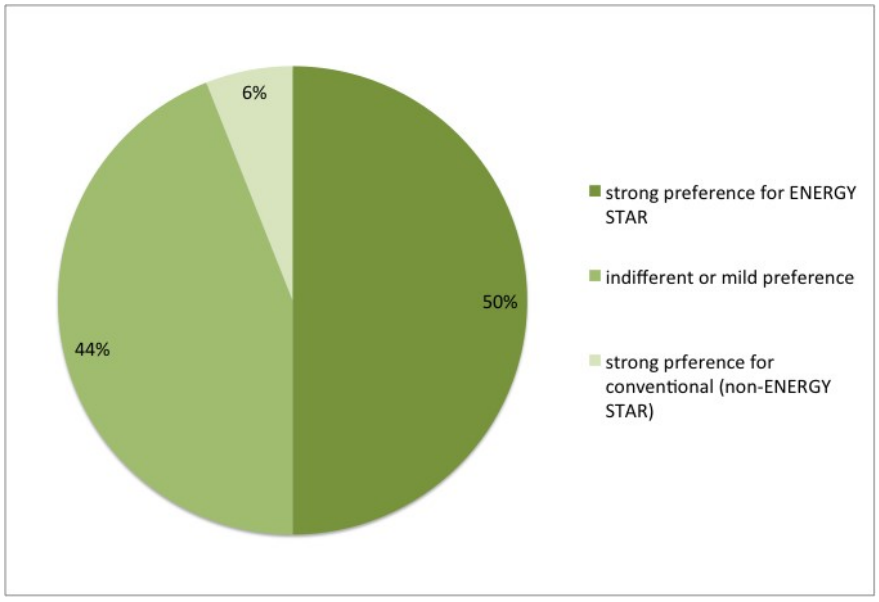


[25] Evergreen is defining a "strong preference" as any time a respondent said there was a 75 percent or greater likelihood that they would purchase that type of dryer (for example, gas) over the alternative (for example, electric). Indifference means they reported a 50 percent likelihood of purchasing each type.

The most common reasons respondents gave for preferring electric dryers to gas dryers were that they would have to install a gas hookup for the dryer (37%), they believe electric is safer than gas (11%), or they have no experience with gas dryers and would prefer to purchase technology they are more familiar with (10%). The most common reasons respondents gave for preferring gas dryers to electric were that they were more energy efficient (28%) or were less costly to operate and/or purchase (23%), which seems to point to a disconnect between consumer attitudes, retail stocking practices and sales.

The Evergreen team asked the respondents who said they would at least consider a natural gas dryer whether they were inclined toward a conventional non-ENERGY STAR or ENERGY STAR-labeled dryer. Although the question framed the ENERGY STAR choice as increasing the purchase price by $100 and saving $5 annually in operating cost, respondents showed a tendency toward the ENERGY STAR-labeled natural gas dryer. Half had a strong preference for ENERGY STAR-labeled dryers and 6 percent had a strong preference for conventional non-ENERGY STAR dryers, as shown in Figure 6. Only 8 percent were completely indifferent. The small number of people who rated their dryer's energy use as quite high (in absolute terms) were significantly more likely to have a strong preference for ENERGY STAR-labeled dryers (73%) than those who believe it uses a moderate or low amount of energy (48%).[26]

Figure 6: Natural Gas Dryer Preferences



[26] Evergreen is defining "quite high" as any time a respondent rated the energy usage of their dryer as 75 or above on a scale of 0 to 100, where 0 is "very little" and 100 is "a lot" of energy.

5 Key Findings and Recommendations

In this section, Evergreen Economics presents some of the key findings from the research activities, and recommendations for NEEA's future initiative planning.

5.1 Market Conditions Findings

1. **In the United States, efficiency gains for residential clothes dryers have historically lagged other residential appliances, and federal standards have recently changed to require more efficient products.** The first ENERGY STAR specification for clothes dryers took effect on January 1, 2015, and new federal efficiency standards for clothes dryers took effect on June 1, 2015.

2. **Super-efficient electric clothes dryers have high theoretical market potential, but low market share in the U.S. currently.** In Europe, super-efficient dryers meet the needs of many mainstream consumers and have attained market penetration of roughly 40 percent. The market share of super-efficient dryers in the U.S., however, is less than 1 percent.

3. **The availability of only four super-efficient dryer models in the U.S. constrains consumer choice, exposure and selection of these products.** Also, there is no pure heat pump dryer available from manufacturers well known to U.S. consumers.

4. **There are no consistent, federally approved test procedures for clothes dryers in the U.S., and thus no Energy Guide label for dryers to inform consumer purchases.** The Energy Guide would be a key information source for consumers in retail stores to understand energy consumption of dryers.

5.2 Supply Chain Findings

1. **Manufacturers are focused primarily at the national level or even at a continental level.** The products manufacturers develop for the North American market, their pricing and their promotions are based on national and broader considerations, and applicable decisions are made at their headquarters.

2. **Retailer stocking practices result in few consumers ever seeing a super-efficient dryer, because retailers tend to stock what sells best in the current market**. ENERGY STAR dryers are stocked widely, but in modest numbers compared to non-ENERGY STAR conventional dryers. Both manufacturers and retailers, however, anticipate that the visibility of non-heat pump ENERGY STAR dryers on retail sales floors will increase in the short-term. In contrast, very few appliance retailers stock dryers with heat pump technology, and these dryers are unlikely to get much retailer attention until demand increases.

3. **According to both manufacturers and retailers, consumers tend to buy clothes washers and dryers together as a single purchase, and usually the washer drives the purchase decision.** In these cases, it may be feasible—or even natural—for a consumer to choose an ENERGY STAR dryer if the washer is also an efficient model. Adding a more expensive super-efficient dryer, however, may be beyond most consumers' capacity or interest if they are buying two laundry appliances.

4. **Manufacturers tend to focus their product development and marketing on clothes washers rather than dryers.**

5.3 Consumer Research Findings

1. **Consumers have limited information on super-efficient dryers.** Popular and trusted information sources, such as *Consumer Reports*, have reported about super-efficient dryers to a limited extent, while product ratings from consumers do not generally exist yet. Manufacturers' specifications and retail sales staff information are not as credible to consumers as third party assessments.

2. **Evergreen's survey research found sales and stocking practices for both ENERGY STAR and heat pump dryers lag behind apparent consumer interest.**

3. **Based on Evergreen's consumer research, it seems unlikely that ENERGY STAR dryers need much price support.** The anticipated energy savings and related benefits consumers associated with ENERGY STAR may be enough to result in growing market share for qualified dryers.

4. **The sticker price of $1,400 (or more) for super-efficient dryers with heat pumps is likely to be a deterrent to many consumers.** This is especially true during emergency replacements when purchasers have little time to conduct product research and recognize the benefits.

5. **Evergreen's consumer research suggests that more consumers are willing to consider hybrid dryers, while interest in heat pump dryers, at higher prices, is comparatively "fixed" (that is, demand is fairly inelastic).** This may be because people perceive hybrid dryers as being similar to conventional dryers, but with greater energy saving and additional dryer temperature options, while heat pump dryers are seen as categorically different, which is appealing to consumers who want the most efficient or newest technologies.

6. **Evergreen's consumer research suggests that energy efficiency is the strongest driver of interest in super-efficient dryers, while new technology has appeal as well.** Other non-energy benefits, such as ventless exhausting and gentleness on clothes have more limited and less widespread potential appeal.

7. **Evergreen's consumer research shows that there is interest in natural gas dryers from households using all current dryer fuels.** In particular, there is interest in ENERGY STAR natural gas dryers despite the modest savings. Households with natural gas service have a tendency to favor gas models, apparently because they view gas as less expensive and more environmentally benign.

5.4 Recommendations

Based on the research findings, Evergreen Economics makes the following recommendations:

1. **Continue to support federal standards updates for incremental and long-term efficiency gains.** Federal standards and ENERGY STAR specifications will continue to evolve, and NEEA should be involved in those deliberations directly or indirectly through collaboration with the Super-Efficient Dryer Initiative (SEDI). Regulatory standards can be one of the most cost-effective ways to lift the average efficiency of energy-using appliances.

2. **Continue testing heat pump and hybrid dryers to determine actual in-field energy and drying performance.** Independent information consumers are likely to find valuable includes verification that the dryers actually save the energy claimed by manufacturers, assurance that the dryers effectively dry clothes and actual users' satisfaction with their performance, actual drying times and the durability of heat pumps.

3. **Continue to support finalization of a federal testing protocol and new Energy Guide for dryers.** NEEA should work with its national partners to advocate for a single test procedure and issuance of Energy Guide labels for dryers. These labels and utilities' messaging are the only sources of information most consumers have about the relative energy use of dryers. It is also imperative that super-efficient dryers be compared to conventional dryers and not classified separately.

4. **Work with SEDI to stay aware of manufacturers' offerings, strategies and intentions.** NEEA needs to be aware of any upcoming changes in product availability and marketing. Furthermore, the development of a greater range of super-efficient clothes dryers would likely increase demand. Encouraging more manufacturers to offer a variety of heat pump dryers and matching them with clothes washers would be useful as well.

5. **Work with SEDI and/or NEEA's regional stakeholders to engage national big box retailers to overcome their informational barriers and influence their stocking practices.** It is plausible that consumer demand will naturally drive retailers to display more ENERGY STAR dryers, but super-efficient dryers may require incentives or other support.

6. **Support independent retailers that currently stock super-efficient dryers with cooperative advertising, well-designed point-of-purchase materials and consumer-facing product demonstrations.** Independent and regional appliance retailers offer a good opportunity for building initial market share in the region.

7. **Implement a public awareness and information campaign for both ENERGY STAR and super-efficient dryers.** Evergreen's survey research indicates that actual consumer interest in efficient dryers is likely greater than demonstrated by current market shares, and thus NEEA's dryer initiative should dedicate a substantial share of its efforts on general consumer education prior to dryer purchases, and exposure to energy efficient dryers during the purchase process. Elements of a public awareness/education campaign could include:

   <u>for ENERGY STAR</u>

   - Messaging on the emergence of ENERGY STAR dryers; and
   - Information about rebate availability.

   <u>for Super-Efficient Dryers</u>

   - Information on actual third-party (or NEEA) testing results (energy savings, drying times, user satisfaction, heat pump durability);
   - Show-and-tell demonstrations of heat pump/hybrids at selected stores or consumer events (including condensate removal for ventless dryers);
   - Information about rebate availability;
   - Heat pump dryer messaging on "the new and coming dryer technology," which will resonate with consumers who prefer the latest technology; and
   - Targeting of current owners of heat pump products, such as ductless heat pumps and/or heat pump water heaters.

8. **Work with NEEA's utility partners to offer rebates for super-efficient dryers.** This study's stated choice research suggests that rebates of at least $200 would be needed to materially increase the likelihood that a consumer will purchase a super-efficient dryer. Rebates are likely to have a greater effect on demand for hybrid dryers than for heat pump dryers. Evergreen recommends varying the incentives over time and carefully tracking rebate applications and purchase volumes to optimize the incentive levels. Detailed records can support valuable analyses in future market progress evaluation studies.

9. **Consider supporting matched pair purchases of ENERGY STAR washers and dryers, but direct dryer-only purchasers to super-efficient dryers.** In particular, NEEA should consider identifying combinations of washers and dryers within the same brand that meet consumer preferences for matching appearances and

controls. Ideally, these models would be presented together on retail floors and both be ENERGY STAR certified. Super-efficient dryers could be presented as an advanced alternative to the ENERGY STAR certified dryer in these pairs.

10. **Work with NEEA's regional partners to promote the ENERGY STAR label as a valuable consumer guide for purchases of natural gas appliances (as well as electric ones) and expand its efforts to work with retailers to include natural gas-fired appliances, including dryers.**

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Appendix A: Additional Literature Reviewed

Following are the additional sources Evergreen Economics reviewed:

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Appendix B: Web Survey Instrument and Results

Introduction

Thank you for participating in Evergreen Economics' study of household laundry practices, equipment, and preferences. This survey should take less than 15 minutes to complete. Your responses will remain confidential.

Please note: When we ask about your laundry practices and choices, we are interested in the entire household, including you and anyone with whom you share your home. Please answer the questions from the household's perspective.

Laundry equipment and habits

A1. What type of clothes washer do you have in your home? (n=620)

1) top-loading (door is located on the top of the washer) = 62%

2) front-loading (door is located on the front side of the washer) = 38%

3) other – please describe: _____ = 0%

4) none = 0%

A2. How old is your washer? (Please provide your best estimate in years. If you don't have a washing machine, leave this blank) (n=620)

____ years mean = 6.12, median = 4, range = 41

A3. What kind of clothes dryer do you have in your home? (n=620)

1) electric dryer (uses electricity to heat the drum) = 92%

2) natural gas dryer (uses natural gas to heat the drum and electricity to turn it) = 7%

3) propane gas dryer (uses propane to heat the drum and electricity to turn it) = 1%

4) other – please describe: _____ = 0%

5) none = 0%

A4. How old is your dryer? (Please provide your best estimate in years. If you don't have a dryer, leave this blank.) (n=620)

____ mean = 6.32, median =5 , range = 41

A5. How many people's laundry do you typically wash using the washer in your home? (n=620)

____ mean = 2.98, median = 3, range = 7

A6. About how many loads per week would you estimate that to be? (n=620)

____ mean = 5.61, median = 5, range = 30

A7. Of the [# from A6] loads you do per week, how many do you do as single loads? *(Single loads are loads of laundry that are not immediately preceded or followed by another load.)* (n=620)

____ mean = 2.54, median = 2, range = 20

A8. What share of the laundry you wash at home also gets dried in your dryer? (n=620)

____ percent mean = 83.01, median = 100, range = 100

A9. Please think about the most recent load you personally washed. How long ago was that? (n=620)

____ days mean = 2.44, median = 1, range = 365

A10. Approximately how long did that load take to wash? *(Include washer cycle time only.)* (n=620)

___ minutes mean = 38.43, median = 35, range = 90

A11. Did you dry that load in a dryer? (n=620)

1) yes – all of it = 81%

2) yes – some of it = 15%

3) no – none of it = 3%

4) don't recall = 1%

[if A11 = 1 or 2]
A12. Approximately how long did that load take to dry? (n=592)

___ minutes mean = 48.56, median = 45, range = 110

A13. Generally speaking, how do you feel about the amount of time it takes your clothes washer to finish a load? (n=620)

1) It's fine; we/I never think about the amount of time the washer takes. = 55%

2) It's usually fine, but we occasionally wish the washer would finish faster. = 36%

3) The time the washer takes is a little frustrating. = 7%

4) The time the washer takes is a source of annoyance. = 2%

A14. Generally speaking, how do you feel about the amount of time it takes your clothes dryer to finish a load? (n=620)

1) It's fine; we/I never think about the amount of time the dryer takes. = 44%

2) It's usually fine, but we occasionally wish the dryer would finish faster. = 37%

3) The time the dryer takes is a little frustrating. = 15%

4) The time the dryer takes is a source of annoyance. = 4%

A14a. Where is your laundry equipment located? (n=620)

1) bathroom = 7%

2) bedroom = 2%

3) kitchen = 5%

4) living/family room = 3%

5) utility room = 62%

6) basement = 11%

7) garage = 7%

8) somewhere else – Specify: _____ = 9%

A15. The questions are about energy usage associated with your laundry and other appliances. Please adjust the sliders below to indicate how much energy you *think* your household uses for each of the following household functions. [slider ends defined as "very little" and "a lot", items randomized] (n=620)

a) refrigerating and freezing food mean = 53.99, median = 53, range = 100

b) heating and cooling the home mean = 62.28, median = 66, range = 100

c) lighting the home mean = 48.38, median = 50, range = 100

d) washing clothes mean = 53.38, median = 51, range = 100

e) drying clothes mean = 58.80, median = 60, range = 100

f) heating water (for washing, bathing, etc.) mean = 58.74, median = 59, range = 100

A16. Suppose you could reduce the amount of energy you use when you dry your laundry by selecting a more efficient model the next time you purchase a dryer. How much would a more

efficient model need to reduce your dryer-related energy usage before it's worth considering? (n=620)

[slider with ends defined as 0% and 100% "your current dryer's energy usage"]

mean = 63.24, median = 66, range = 100

Housing and household information (2-3 mins)

[if A3 <> 2]
B1. Do you have natural gas service in your home? (n=620)

1 yes = 52%

2 no = 48%

[if B1 = 1]

B2. Who is your natural gas utility? (n=374)

1) Avista Utilities = 12%

2) Cascade Natural Gas = 6%

3) Energy West = 5%

4) Intermountain Gas Company = 13%

5) Montana-Dakota Utilities = 5%

6) NorthWestern Energy = 9%

7) Northwest Natural = 22%

8) Puget Sound Energy = 24%

9) Questar Gas = 1%

97) Other – Specify: _____ = 1%

98) Don't know = 2%

B3. Do you use natural gas for any of the following in your home? Please check all that apply. (n=620)

a) heating your home with a natural gas furnace = 41%

b) heating your home with a natural gas fireplace = 14%

c) water heating = 32%

d) cooking = 20%

e) other-specify: _____ = 0%

codes: 0) not checked, 1) checked

B4. For each pair of statements below, please select the one that better fits your household:

pair option a (n=620)

1) We/I tend to like trying the newest technology. = 59%

2) We/I prefer to stick with the tried and true until new technology has become well-established. = 41%

pair option b (n=620)

1) Current clothes dryers are just fine for us/me; there is no need to look at alternatives. = 41%

2) We/I would be interested in trying new clothes dryer technology. = 60%

pair option c (n=620)

1) I am familiar with heat pump technology. = 47%

2) I don't know what heat pump technology is. = 53%

[if B4c = 1]
B5. In your own words, please describe how heat pumps work in a phrase or a sentence. [open-ended question] (n=265)

8) don't know = 26%

B6. Do you have any appliances that use heat pump technology? (n=620)

1) yes – please specify: _____ = 18%

2) no = 82%

[if B6 = 1]
B7. On a scale from 1 to 5, how satisfied are you with your heat pump appliance(s)? *(If you have more than one, please tell us your overall satisfaction with the heat pump appliances you have.)* (n=97)

[scale: 1 (very dissatisfied) – 2 – 3 – 4 – 5 (very satisfied)]

mean = 4.03, median = 4, range = 4

Shopping process for dryer

C1. Have you ever purchased a new clothes dryer? *(Please exclude dryers that were already in a home you purchased.)* (n=620)

1) yes = 74%

2) no = 26%

C2. Under which of the following scenarios would you probably buy a new clothes dryer? Please check all that apply. (n=620)

a) existing dryer stops functioning = 79%

b) existing dryer shows signs of age = 29%

c) want some features or functionality that our/my current dryer doesn't have = 23%

d) need a new clothes washer (and want a matching dryer) = 21%

e) other – please describe = 1%

response options: 0) not checked, 1) checked

[if A3 = 2 or B1 = 1]
C3. Please move the slider below to indicate how likely you are to buy an electric or natural gas dryer when you next purchase a dryer. (n=374)

[slider with ends defined as "definitely an electric dryer" and "definitely a natural gas dryer," middle defined as "undecided"]

mean = 48.91, median = 50, range =100

[if C3 is not left at undecided (value of 50)]
C4. Why do you prefer that type of dryer? [open-ended question] (n=312)

C5. Most dryers on the market have the same exterior dimensions, but there are a few smaller and larger models available. What size dryer would you consider? Please check all that apply. (n=620)

1) small = 12%

2) standard = 77%

3) large = 28%

C6. Most dryers have the same capacity (amount of laundry they can dry at once), but there are a few with somewhat smaller or larger capacity. What dryer capacity would you consider? (n=620)

1) slightly smaller than standard = 9%

2) standard = 67%

3) slightly larger than standard = 39%

C7. How likely will you be to rely on the following information sources when selecting your next dryer? [randomize, response scale: unlikely, maybe, very likely] (n=620)

a) Consumer Reports = 54% very likely

b) ratings and reviews by product owners and users = 63% very likely

c) product descriptions on manufacturer or retailer web sites = 40% very likely

d) product descriptions displayed in stores = 39% very likely

e) advertisements (newspaper, magazine, web) = 16% very likely

f) retail sales staff = 22% very likely

g) appliance repair professionals = 31% very likely

h) friends or family = 45% very likely

i) information provided by water or energy utilities = 43% very likely

response options: 1) unlikely, 2) maybe, 3) very likely)

Shopping selections

We are interested in understanding how you would make trade-offs between different characteristics of available dryers. For this section, please assume you need to replace your clothes dryer in the next week or two.

[if C3 is not moved all the way to "definitely a natural gas dryer" (value of 100)]
D1. Review the offers for *electric* dryers we present below and mark the one you would be most likely to purchase. (n=585)

Info Box

In case it's helpful to you:

Existing dryer models tend to cost between $600 and $1,400. Features vary among the different price categories. Some of the differences are the amount of energy they use, the temperatures at which they dry clothes, and whether or not they are Energy Star qualified. Basic dryers cost households about $95 per year, on average, in energy costs to operate. Most dryers operate at a fairly high internal temperature. Lower dryer temperatures result in longer drying times, but reduce the energy costs and allow you to dry some fabrics you

would not otherwise put in a dryer. Some dryers operate at a lower-than-standard temperature, while others give you a choice.

	Choice A	Choice B	Choice C	Choice D
Cost	$600	$700	$1,100	$1,100
Energy savings (reduced energy consumption compared to a basic dryer)	0%	10%	25%	50%
Drying temperature and time	Normal temp (with standard drying times of 45-60 mins)	Normal temp (with standard drying times of 45-60 mins)	Normal and lower temp (setting that lets you choose)	Lower temp (with drying times that are 50% longer, but safe for a fuller range of clothes)
ENERGY STAR	No	Yes	Yes	Yes
Your preferred choice	____	____	____	____

D1a. [This question will repeat D1, but with altered price options for choices C and D. The prices will be lower if the respondent chose A or B initially and higher if the respondent chose C or D initially. See attachment for more detail.] (n=585)

D1b. [Asked if respondent chose A or B in D1a. This question will repeat D1, but showing only choices C and D and forcing a choice between them. See attachment for more detail.] (n=585)

[if C3 is not moved all the way to "definitely an electric dryer" (value of 0) and B1 <> 2]
D2. Review the information about natural gas dryers below and indicate how strongly you would lean toward the standard or ENERGY STAR® dryer by adjusting the slider.

A standard natural gas dryer costs about $700 and costs the average household about $60 in natural gas per year to operate. ENERGY STAR® labeled natural gas dryers save energy. They cost about $100 more to purchase and cost about $55 in natural gas per year to operate (a savings of 5-10 percent in operating costs over non-ENERGY STAR® natural gas dryers). (n=620)

[slider with ends defined as "standard" and "ENERGY STAR"]

mean = 71.47, median = 75, range = 100

Demographics

E1. What is your gender? (n=620)

1) male = 36%

2) female = 64%

E2. What is your age? (n=620)

____ mean = 42.74, median = 39, range = 62

E3. How many people live in your household in each of the following age groups? (n=620)

a) 0-5 years old: ____ mean = 0.36, median = 0, range = 3

b) 6-18 years old: ____ mean = 0.71, median = 0, range = 5

c) 19-34 years old: ____ mean = 0.66, median = 0, range = 4

d) 35-54 years old: ____ mean = 0.85, median = 1, range = 4

e) 55-64 years old: ____ mean = 0.35, median = 0, range = 2

f) 65+ years old: ____ mean = 0.15, median = 0, range = 2

E4. Do any cats or dogs live with you in your home? (n=620)

1) yes = 78%

2) no = 22%

E5. In what kind of home do you live? (n=620)

1) single family detached home (stand-alone house) = 83%

2) single family attached home (shared walls) = 5%

3) mobile or modular home = 4%

4) apartment / condo / townhouse = 9%

5) other – specify: _____ = 0%

E6. Do you own or rent? (n=620)

1) own = 100%

2) rent = 0%

E7. In what state do you live? (n=620)

1) Idaho = 12%

2) Montana = 8%

3) Oregon = 29%

4) Washington = 51%

5) other = 0%

E8. Do you live in...? (n=620)

1) a city = 37%

2) a suburb = 47%

3) the country = 17%

E9. Which of the following best describes the highest level of education attained by an adult in your household? (n=617)

1) some high school = 1%

2) high school degree = 11%

3) some college = 22%

4) two-year college degree = 10%

5) four-year college degree = 36%

6) advanced degree = 20%

E10. Which of the following best describes your annual household income? (n=612)

1) less than $25,000 = 8%

2) $25,000 to less than $50,000 = 17%

3) $50,000 to less than $100,000 = 52%

4) $100,000 to less than $150,000 = 17%

5) $150,000 or more = 7%

E11. What is your zip code? (n=620)

_____

Questions D1-D1b – Stated Choice Questions

The survey includes three "stated choice" questions to be used to determine willingness to pay and the importance of price, energy savings, dryer temperature/drying time, and ENERGY STAR® designation. Those questions (or panels) are D1, D1a, and D1b.

Question D1 above shows the layout of the question, although the response options will vary by respondent. We have included a screen shot from the programmed survey here as well to illustrate how the choice box will appear. [The "preferred choice" option will be blank upon initial presentation. The image below shows a completed question.]

	Choice A	Choice B	Choice C	Choice D
Cost	$1,200	$1,400	$600	$700
Energy savings (reduced energy consumption compared to a basic dryer)	25%	50%	0%	10%
Drying temperature and time	Normal and lower temp (setting that lets you choose)	Lower temperature (with drying times that are 50% longer, but safe for a fuller range of clothes)	Normal temp (with standard drying times of 45-60 mins)	Normal temp (with standard drying times of 45-60 mins)
ENERGY STAR	yes	yes	no	yes
Your preferred choice	○	○	◉	○

Every respondent will see all three questions, or "panels."

Panel 1 (Question D1) will provide an initial set of four dryer choices representing a traditional non-ENERGY STAR dryer, a traditional ENERGY STAR dryer, a hybrid dryer, and a heat pump dryer. Characteristics of the dryers will be as shown in the image above, except that the prices will vary for the respondents. The prices for the hybrid and heat pump dryers will be uniformly randomly selected to be $800, $1000, $1200, or $1400 for all individuals. The four dryer choices will be shown in random order to mitigate order effects.

Panel 2 (Question D1a) will repeat the four choices the respondent saw in panel 1, but the prices shown will change based on the respondent's selection in panel 1. If the respondent chose a traditional dryer in panel 1 (either non-ENERGY STAR or ENERGY STAR), we will reduce the prices shown for the hybrid and heat pump dryers by a random amount, in increments of $100, to a minimum possible price of $800. If the respondent chose the hybrid or heat pump dryer in panel 1, we will increase the price of the respondent's selected dryer and reduce the price of the other super-efficient (hybrid or heat pump) dryer. The increments of change will be in $100 increments, selected randomly, with minimum and maximum dryer prices of $800 and $1,400.

Panel 3 (Question D1b) will only allow choice between the hybrid and heat pump dryers, newly randomly ordered, with newly random prices ($200 increments between $800 and $1400, uniform distribution).

Appendix C: Survey Stated Choice Analysis

This appendix provides more information about the methodology and analysis of the stated choice questions included in this study's general population survey.

Data Collection Methodology

Respondents to the web survey completed a series of three panels of a stated preference questionnaire. In the first panel, respondents were asked to choose which one of four dryers they would purchase. The dryers represented:

- A basic dryer using conventional technology;
- An ENERGY STAR® dryer using conventional technology;
- A hybrid dryer; and
- A heat pump dryer.

The four dryer choices were labeled using letters A through D, and the survey question showed purchase price (cost), energy savings (reduced consumption compared to a basic dryer), drying temperature, cycle length, and the ENERGY STAR certification status of each dryer.

Table 1 shows an example of the first panel of the dryer choice questionnaire a respondent may have seen. In this panel, Choice A represents the basic dryer, Choice B the heat pump dryer, Choice C the hybrid dryer, and Choice D the ENERGY STAR dryer. Evergreen asked the respondent to select one of the four dryers. In this example, Choice D (ENERGY STAR dryer) is the preferred choice of the respondent.

Table 1: Example of the First Panel of Stated Preference Questionnaire

	Choice A	Choice B	Choice C	Choice D
Cost	$600	$1,200	$1,000	$700
Energy Savings (reduced energy consumption compared to basic dryer	0%	50%	25%	10%
Drying temperature and time	Normal temp (with standard drying times of 45-60 minutes)	Lower temp (with drying times that are 50% longer, but safe for a fuller range of clothes)	Normal and lower temp (setting that lets you choose)	Normal temp (with standard drying times of 45-60 minutes)
ENERGY STAR	No	Yes	Yes	Yes
Your Preferred Choice	○	○	○	●

In the second panel, Evergreen presented the same four dryers, but in a new random order and with a changed price for the hybrid and/or the heat pump dryer. Table 2 shows an example of the second panel. In this case, Choice A represents the heat pump dryer, Choice

B represents the basic dryer, Choice C represents the ENERGY STAR dryer, and Choice D represents the hybrid dryer. Because the respondent chose the ENERGY STAR dryer in the first panel, the second panel shows costs for the hybrid and heat pump dryers that are lower than in the first panel.[27]

Table 2: Example of Second Panel of Stated Preference Questionnaire

	Choice A	Choice B	Choice C	Choice D
Cost	$900	$600	$700	$900
Energy Savings (reduced energy consumption compared to basic dryer	50%	0%	10%	25%
Drying temperature and time	Lower temp (with drying times that are 50% longer, but safe for a fuller range of clothes)	Normal temp (with standard drying times of 45-60 minutes)	Normal temp (with standard drying times of 45-60 minutes)	Normal and lower temp (setting that lets you choose)
ENERGY STAR	Yes	No	Yes	Yes
	●	○	○	○

As Table 2 shows, the respondent chose the heat pump dryer (Choice A) in the second panel seemingly due to the lower cost of the heat pump dryer relative to the first panel ($900 in the second panel versus $1,200 in the first panel). Each of the two dryer choices made by the respondent represents an observation used in the statistical model (described below). By presenting each respondent with two four-choice panels, Evergreen obtained twice the number of observations for the model compared to presenting each respondent with only one panel.

[27] For all respondents for all choice panels, the costs shown for the hybrid and heat pump dryers ranged between $800 and $1,400 in increments of $100. If the respondent chose the basic or ENERGY STAR dryer in the first panel, the cost of the hybrid and heat pump dryers were decreased by a randomly chosen $100 increment, but were not reduced below $800. If the respondent chose the hybrid dryer in the first panel, then in the second panel Evergreen raised the cost of the hybrid dryer and reduced the cost of the heat pump dryer by a random increment of $100. Likewise, If the respondent chose the heat pump dryer in the first panel, Evergreen then in the second panel raised the cost of the heat pump dryer and reduced the cost of the hybrid dryer by a random increment of $100.

In the third panel, Evergreen asked respondents to choose between only two dryers: hybrid and heat pump. The order in which Evergreen presented these two dryers and the prices shown were random as well. Evergreen's primary reason for including this third panel was to confirm each respondent's choice made in the second panel.[28]

Evergreen used the dryer choice results from panels 1 and 2 to conduct its statistical modeling. In total, 620 persons successfully completed the web survey, resulting in 1,240 observations for the statistical model. Evergreen used a multinomial logistic regression modeling approach to analyze the stated preference data. Multinomial logistic regression modeling is a standard econometric approach used when the dependent variable is categorical (that is, cannot be ordered in any meaningful way) and there are more than two possible choices.[29] The dependent variable in a multinomial logistic regression model is either "1" indicating the selection (for example, of a dryer) the respondent chose or "0" indicating the selections the respondent did not choose. For each survey respondent, Evergreen's modeling data set includes two values of "1" (one each for the dryers chosen in panels 1 and 2) and six values of "0" (three for the dryers not chosen in each of the two panels).

Evergreen had two primary objectives in presenting the survey respondents with the panels of alternative dryers choices. First, Evergreen wanted to gain an understanding of how characteristics of the dryers (for example, variation in energy efficiency) and characteristics of the respondents lead to dryer choice. Second, Evergreen wanted to estimate how variation in the price of the hybrid and heat pump dryers affected demand for those dryers. The multinomial logistic model allows researchers to achieve both of these objectives, but it is important to note that Evergreen did so within the context of a *stated* preference framework that may or may not adequately represent the actual dryer purchasing experience of any of the respondents.

Hybrid and heat pump dryers currently represent no more than 1 percent of the regional and national dryer market. Most appliance retailers provide no floor space for super-efficient dryers, but do provide space for numerous conventional models. In contrast, each of Evergreen's stated preference panels provides equal space for conventional and energy efficient options (both ENERGY STAR and super-efficient dryers). Thus, while the results of Evergreen's analysis reveal which dryer a respondent says he or she would choose out of a selection of just four dryers, one would not want to necessarily extrapolate these results to the actual dryer marketplace where consumers are either not aware of or have not, for whatever reason, *revealed* a preference for high efficiency dryers. Rather, the results of this

[28] Specifically, if a respondent chose the hybrid (heat pump) dryer in panel 1 and panel 2, but then chose the heat pump (hybrid) dryer in panel 3 at a lower price relative to the hybrid (heat pump) dryer than in panel 2, we "corrected" the respondent's panel 2 choice to heat pump (hybrid) dryer. There were only a small number of instances where we made this correction.

[29] For cases with exactly two possible outcomes, the standard modeling approaches are the (binary) logit or probit models.

analysis reveal that many consumers assert they would choose a super-efficient dryer given the option.

Table 3 shows an example of how Evergreen configured the information obtained from the stated preference and other survey questions for the multinomial logistic regression model. In this example, Evergreen shows a subset of information for two survey respondents (ID 101 and 102). Each respondent completed panel 1 and panel 2 of the stated preference questionnaire.

Table 3: Example of Data from Stated Choice and Other Survey Questions

ID	Panel	Dryer	Choice	Dryer Price	Household Income	Dryer Age in Years
101	1	Basic	0	$600	$25,000 - $50,000	3
101	1	ENERGY STAR	0	$700	$25,000 - $50,000	3
101	1	Hybrid	**1**	$900	$25,000 - $50,000	3
101	1	Heat Pump	0	$1,400	$25,000 - $50,000	3
101	2	Basic	0	$600	$25,000 - $50,000	3
101	2	ENERGY STAR	0	$700	$25,000 - $50,000	3
101	2	Hybrid	**1**	$1,100	$25,000 - $50,000	3
101	2	Heat Pump	0	$1,100	$25,000 - $50,000	3
102	1	Basic	0	$600	$50,000 - $100,000	10
102	1	ENERGY STAR	**1**	$700	$50,000 - $100,000	10
102	1	Hybrid	0	$1,100	$50,000 - $100,000	10
102	1	Heat Pump	0	$1,000	$50,000 - $100,000	10
102	2	Basic	0	$600	$50,000 - $100,000	10
102	2	ENERGY STAR	0	$700	$50,000 - $100,000	10
102	2	Hybrid	0	$900	$50,000 - $100,000	10
102	2	Heat Pump	**1**	$800	$50,000 - $100,000	10

Respondent 101 chose the hybrid dryer in the first panel at a price of $900 and chose it again in the second panel at a price of $1,100. Respondent 102 chose the ENERGY STAR dryer in the first panel at a price of $700 and the heat pump dryer in the second panel at a

price of $800 (down from a price of $1,000 in the first panel.)[30] Also included in Table 3 are responses to two of the survey questions: household income and age of the household's current dryer. While Table 3 shows 16 rows of data, these 16 rows in fact represent only four observations for the model—the two respondents' dryer choice for each of the two dryer choice panels.

Empirical Model

For the analysis, Evergreen specified indirect utility functions for each of the four dryer alternatives and estimated these functions using a multinomial logistic regression model. An indirect utility function is a mathematical equation used to estimate the maximum "utility" an individual can achieve given a set of observed attributes on the individual and the product of interest. Of interest for this study is the impact that each characteristic has on the (estimated) probability an individual will choose each of the four dryers. The multinomial logistic model of dryer choice Evergreen estimated is as follows:

Equation 1: Multinomial Logistic Model of Dryer Choice

$$Prob(Choice_i = Dryer_j) = \frac{e^{\beta'_j x_i}}{\sum_{k=1}^{4} e^{\beta'_j x_i}}$$

Where:

$Dryer_j =$ *Indicator of dryer choice (j=1 for Basic, j=2 for ES, j=3 for Hybrid, j=4 for HP)*

$\beta_j =$ *Estimated coefficients from indirect utility function for dryer j*

$x_i =$ *Values of explanatory variables for respondent i*

$e =$ *Exponential function*

It is important to point out that Equation 1 actually represents four separate equations, one each for the four dryer choices. Thus, for each individual that completed the dryer choice panels, Evergreen estimated the probability that they would select each of the four dryers given the observed characteristics of the respondent, which is fixed for each respondent, and the characteristics of the dryers (also fixed, except for the price of the hybrid and heat pump dryers).

Variables Used in the Model

The dependent variable in each equation of the multinomial logistic model is the binary value of either 0 or 1 indicating whether or not the respondent chose the respective dryer. For explanatory variables, Evergreen considered more than 40 respondent characteristics

[30] Note: the basic non-ENERGY STAR dryer and the basic ENERGY STAR dryer were presented at a price of $600 and $700, respectively, for all respondents for both panel 1 and panel 2.

and other variables. Most of these variables either were not predictive of dryer choice or provided no *additional* predictive power beyond one or more other variables. Several explanatory variables—namely expected electricity savings, price, and household income—are standard variables for explaining consumer demand and were included in the equations for the hybrid and heat pump dryers without consideration of statistical significance. In total, Evergreen included 11 explanatory variables in the regression model, with different subsets of these variables included in each of the four dryer-specific equations. The explanatory variables Evergreen included are as follows (a scale of 0 – 100 indicates the degree of preference the respondent had for natural gas over electric dryers):

- **Prefer Gas:** Respondent reported preference for gas dryer (0 - 100)
- **Dryer Tech Ok:** Respondent reported current dryer technology is fine (0, 1)
- **Dryer Energy:** Respondent's estimate of relative dryer energy usage (0 - 100)
- **kWh Save:** Expected annual electricity savings in kWh for ENERGY STAR, hybrid, and heat pump dryer
- **Prefer ES:** Respondent reported preference for ENERGY STAR products (0, 1)
- **Dryer Price:** Price of hybrid and heat pump dryers, which varied randomly by respondent
- **Early Adopter:** Respondent reported a preference for latest technology (0, 1)
- **Income:** Reported household income
- **Male:** Respondent is male (0, 1)
- **Savings Required:** Percent energy savings respondent requires to consider SED
- **Dryer Time Ok:** Respondent reported drying time of current dryer is fine (0, 1)

Modeling Results

The estimated coefficients from the multinomial logistic model provided limited information on the impact the respective explanatory variable has on dryer choice. The negative or positive sign of the coefficient indicates whether an increase in the value of the independent variable increases or decreases the probability that a respondent will choose that dryer. The value of the t-statistic computed for each estimated coefficient is a test of whether or not the explanatory variable has an impact on the probability of choosing the respective dryer. The P-value[31] is a measure of the likelihood that the value of the estimated coefficient occurred by chance. All else equal, the larger the t-statistic, the smaller the P-value, and the lower the probability that the value of the coefficient resulted by chance. For P-values equal to or less than 0.10 (that is, 1 in 10), Evergreen concluded the value of the coefficient did not happen by chance and is, therefore, statistically significant.

Table 4 shows the estimated coefficients from the multinomial logistic model with the results segmented by dryer choice. The number and choice of explanatory variables differs

[31] The P-value or "probability value."

for each dryer equation; this is because the variables that explain dryer choice differ by dryer choice. For example, agreeing with the statement "*Current clothes dryers are just fine for us/me; there is no need to look at alternatives*" helps explain why a respondent would choose a conventional dryer. Likewise, household income helps explain why a respondent would choose either the hybrid or heat pump dryer.

Each of the coefficients is of the expected sign (negative or positive) and nearly all or statistically significant. For example, in the hybrid and heat pump equations, the coefficients on *Expected Annual kWh Savings* is positive indicating that the greater the energy savings the respondent expects to achieve with either of these dryers, the more likely they are to choose it.[32] Likewise, the coefficients on price in the hybrid and heat pump equations are negative, indicating that the lower the price of either of these dryers, the more likely a respondent is to choose it.

[32] Note: the coefficient on *Expected Annual kWh Savings* is not statistically significant in the hybrid equation, which suggests that expected energy savings did not have a significant impact on the decision to choose the hybrid dryer.

Table 4: Coefficient Estimates from Multinomial Logistic Regression Model

Equation	Variable	Coefficient	t-stat
Basic	Preference for Gas (0 - 100)	-0.0131	-2.87*
	Current Dryer Technology is Fine (Indicator)	0.4802	2.01*
	Estimate of Relative Dryer Energy Usage (0 - 100)	-0.0088	-1.73*
ENERGY STAR	Constant Term for ENERGY STAR Model	0.2154	0.50
	Expected Annual kWh Savings	0.0047	1.91*
	Prefer ENERGY STAR products (Indicator)	-0.0049	-1.59
	Current Dryer Technology is Fine (Indicator)	0.5646	4.13*
Hybrid	Constant Term for Hybrid Model	1.6669	3.21*
	Expected Annual kWh Savings	0.0012	1.26
	Price of Hybrid Dryer	-0.0019	-6.37*
	Early Adopter (Indicator)	0.4804	3.25*
	Household Income	0.0072	3.69*
Heat Pump	Constant Term for Heat Pump Model	-0.3261	-0.58
	Expected Annual kWh Savings	0.0010	1.93*
	Price of Hybrid Dryer	-0.0009	-3.15*
	Early Adopter (Indicator)	0.6021	3.94*
	Household Income	0.0058	2.92*
	Male (Indicator)	0.3338	2.46*
	Percent Savings Needed To Consider SED	0.0057	1.91*
	Dryer Time is Ok	0.3860	2.18*

* Significant at 0.10 level or better

Purchasing Implications

With the estimated coefficients, Evergreen conducted simulation analysis to understand how dryer preference changes as the values of key explanatory variables change. Table 5 shows the impact that self-identifying as an early adopter has on choosing each of the four dryers. As Evergreen would expect, early adopters are more likely to select the hybrid or heat pump dryer. Being a (self-identified) early adopter results in a 4.2 percentage point increase in the likelihood of selecting a hybrid dryer and an 8.9 percentage point increase in selecting an heat pump dryer.

Table 5: Impact of Being an Early Adopter on Dryer Choice

Scenario	Percentage of Respondents Estimated to Choose Each Dryer			
	Conven-tional	ENERGY STAR	Hybrid	Heat Pump
No respondents identify as early adopter	10.7%	42.8%	20.9%	25.7%
All respondents identify as early adopter	8.1%	32.3%	25.0%	34.6%
Percentage point change in probability of selecting dryer if the respondent identifies as an early adopter	-2.6	-10.5	4.2	8.9

*Note these percentages represent estimates based on stated preferences of respondents.

Table 6 shows the results of the simulation analysis Evergreen conducted to understand how dryer preference changes based on alternative prices for the hybrid and heat pump dryers and alternative assumptions about the reduction in electricity usage for the ENERGY STAR dryer, relative to the conventional dryer. For the simulation analysis, Evergreen assumes the base case to be a price of $1,400 for the hybrid and heat pump dryers and that the ENERGY STAR dryer reduces energy use by 10 percent compared to the conventional dryer. Under the base case, about 37 percent of respondent would choose the ENERGY STAR dryer. This proportion increases to 46.5 percent under the assumption that the ENERGY STAR dryer reduces energy use by 20 percent (Scenario 1). However, the proportion of respondents that would choose the ENERGY STAR dryer if both the hybrid and heat pump dryers were available for $800 drops to 30.5 percent (Scenario 2).

Table 6: Market Share Simulation of Stated Preference Model Results

Scenario	Description	Percentage of Respondents			
		Conventional	ENERGY STAR (ES)	Hybrid	Heat Pump
Base	Price of Hybrid Dryer is $1,400 Price of Heat Pump Dryer is $1,400 ES Dryer reduces energy use by 10%	*9.3%*	*37.2%*	*23.0%*	*30.5%*
1	Price of Hybrid Dryer is $1,400 Price of Heat Pump Dryer is $1,400 ES Dryer reduces energy use by 20%	8.1%	46.6%	19.5%	25.8%
2	Price of Hybrid Dryer is $800 Price of Heat Pump Dryer is $800 ES Dryer reduces energy use by 20%	5.2%	30.5%	37.0%	27.3%
3	Price of Hybrid Dryer is $800 Price of Heat Pump Dryer is $1,400 ES Dryer reduces energy use by 10%	6.5%	25.7%	47.4%	20.4%
4	Price of Hybrid Dryer is $1,400 Price of Heat Pump Dryer is $800 ES Dryer reduces energy use by 10%	7.8%	30.9%	18.6%	42.6%
5	Price of Hybrid Dryer is $800 Price of Heat Pump Dryer is $800 ES Dryer reduces energy use by 10%	5.8%	22.6%	41.2%	30.5%

*Note these percentages represent estimates based on stated preferences of respondents.

For the remainder of the scenarios shown in Table 6, Evergreen assumes the ENERGY STAR dryer reduces energy use by 10 percent relative to the conventional dryer. Evergreen estimates that if the hybrid dryer were reduced to $800 while holding the heat pump dryer at $1,400, the proportion of respondents that would choose the hybrid dryer would increase to about 47 percent, more than double the base case proportion (Scenario 3). Comparatively, reducing the heat pump dryer to $800 while holding the hybrid dryer at

$1,400 only increases preference for the heat pump dryer by about 12 percentage points from the base to 42.6 percent (Scenario 4).

Finally, reducing the cost of both the hybrid and heat pump dryers to $800 results in about 41 percent of respondents choosing the hybrid dryer and no change in the number of persons choosing the heat pump dryer. This is an interesting finding. At a price of $1,400 for either of the dryers, the heat pump dryer is preferred to the hybrid dryer (30.5% versus 23%). However, at a price of $800 for either dryer, the hybrid dryer is preferred to the heat pump dryer (41.2% to 30.5%). At the lower price for the hybrid dryer, many of those who would otherwise prefer the ENERGY STAR or conventional dryer switch to the hybrid dryer, but not the heat pump dryer. This suggests that the hybrid dryer is perceived to be a closer substitute to the conventional or ENERGY STAR dryer than is the heat pump dryer and that demand for the hybrid dryer is more price elastic than demand for the heat pump dryer.[33]

[33] Price elasticity of demand is a measure of the responsiveness ("elasticity") in the demand of a good or service due to a change in its price of the product, all else held constant.

Appendix D: Northwest Market Size Review

MEMORANDUM

April 15, 2016

To: Amy Webb and Ryan Brown, NEEA

From: John Boroski, Evergreen Economics

CC: Ingo Bensch, Evergreen Economics

Re: Review of Northwest Market Size Estimate for Residential Clothes Dryers

Introduction

To estimate the future stock of electric clothes dryers in the Northwest, NEEA has developed a simplified regional model that builds off estimated clothes dryer saturation rates from NEEA's latest Residential Building Stock Assessment (RBSA) – for multifamily, manufactured and single family homes. The model then incorporates actual clothes dryer shipments data, and allocates these shipments (i.e., sales/installations) to two categories: the replacement of existing clothes dryers and supply for new housholds. In this memo we comment on the suitablity of NEEA's model for estimating the total stock of clothes dryers.

Methods Review

The total regional stock of electric clothes dryers is built up from an estimate of the "base" stock of existing electric clothes dryers in 2011, from the RBSA data. In the years 2011 through 2015, new clothes dryers to the region (those not intended to replace failed equipment, but rather new installations) are added to this "base" estimate, and are derived from actual shipments data from the Association of Home Appliance Manufactures (AHAM).

Evergreen reviewed the RBSA tables and did not find any issues regarding their application in constructing the base stock for 2011. At a high level, AHAM's shipments data are a good proxy for clothes dryers sales and installations, since retail stores try to mininize excess inventory and adjust their shipments as needed in response to customer demand. Evergreen is not aware of more accurate or comprehensive clothes dryer data sources than the AHAM data, and recommends

that NEEA continue to use these data to update its model as it becomes available from AHAM.

After 2015, the last year for which the AHAM data were available, NEEA projects future dryer sales/installations by growing the previous year's AHAM shipments by one percent; a population growth parameter based on NEEA's analysis of U.S. Census data for the Northwest states. (NEEA also uses this regional population growth estimate for other Initiative planning models.)

Evergreen recommends that NEEA adjust this parameter downward, to 0.90 percent, to reflect the fact that only about 90 percent of residential households have a dryer installed in their home or dwelling unit (90 percent is a weighted average using the 2011 RBSA data). Going forward, NEEA can adjust this growth parameter, if needed, based on more current dryer saturation data from RBSA studies underway. In our interviews with clothes dryer manufacturers, we did not obtain any firm evidence of shifting clothes dryer ownership rates.

Evergreen recommends that NEEA continue using a simplified average annual growth factor in the model. While economic activity levels will fluctate over time—and will affect consumer demand for large appliances—the timing and magnitude of recessions and recoveries are difficult to predict.

In each year, annual AHAM shipments data are allocated to two different categories: existing clothes dryer retirements/replacements and new sales (i.e., original installations, not replacements). NEEA currently uses an average measure life of 25 years to retire clothes dryers (4% annually) based on results from a web survey. We suspect that the survey results may reflect some respondent bias, since ENERGY STAR reported the average lifetime of clothes dryers is often estimated to be between 12 and 16 years.[1] Even if NEEA's survey results are accurate for the Northwest, we recommend that NEEA use a lower measure life and higher turnover rate going forward, to reflect the fact that household appliances are becoming less durable as they integrate more electronic and computerized components and are

[1] ENERGY STAR Market & Industry Scoping Report – Residential Clothes Dryers. November 2011. Available at: https://www.energystar.gov/sites/default/files/asset/document/ENERGY_STAR_Scoping_Report_Residential_Clothes_Dryers.pdf

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increasingly produced overseas in countries with lower manufacturing standards.[2] As a starting point, we recommend that NEEA assume a measure life of 20 years in their model.

The following table shows how the stock of electric clothes dryers would grow when our recommended paramater changes are implemented. Using a measure life of 20 years and a .90 percent annual growth rate will result in some negative new sales values for clothes dryers prior to 2015, however, this is due to particularly steep declines in AHAM shipments in 2013 and recovery in 2014 (i.e., an economic anomoly that cannot be addressed in this simplified model), and does not create unrealistic negative values for NEEA's forecast beyond 2015.

Table 1: Projected Growth of Electric Clothes Dryers in Northwest States

Year	Installed Stock of Electric Dryers at Start of Year	Electric Dryers in Installed Stock Retired and Replaced	New Electric Dryers	Total Shipments of Electric Dryers	Cumulative Electric Dryer Shipments From Initiative Start (2015)	Remaining Installed Stock from Initiative Start (2015)
2011	4,865,661	243,283	1,310	244,593		
2012	4,866,970	243,349	1,993	245,342		
2013	4,868,964	243,448	(42,470)	200,978		
2014	4,826,494	241,325	(4,299)	237,026		
2015	**4,822,195**	**241,110**	**(1,951)**	**239,159**	**239,159**	**4,581,085**
2016	4,820,244	241,012	299	241,312	480,471	4,340,073
2017	4,820,544	241,027	2,456	243,483	723,954	4,099,046
2018	4,823,000	241,150	4,525	245,675	969,629	3,857,896
2019	4,827,525	241,376	6,510	247,886	1,217,515	3,616,520
2020	4,834,035	241,702	8,415	250,117	1,467,632	3,374,818
2021	4,842,450	242,122	10,245	252,368	1,720,000	3,132,695
2022	4,852,695	242,635	12,004	254,639	1,974,639	2,890,061
2023	4,864,700	243,235	13,696	256,931	2,231,570	2,646,826
2024	4,878,396	243,920	15,324	259,243	2,490,813	2,402,906
2025	4,893,719	244,686	16,891	261,577	2,752,390	2,158,220
2026	4,910,610	245,530	18,400	263,931	3,016,321	1,912,689
2027	4,929,010	246,451	19,856	266,306	3,282,627	1,666,239
2028	4,948,866	247,443	21,260	268,703	3,551,330	1,418,796
2029	4,970,125	248,506	22,615	271,121	3,822,451	1,170,289
2030	4,992,740	249,637	23,924	273,561	4,096,012	920,652
2031	5,016,665	250,833	25,190	276,023	4,372,036	669,819
2032	5,041,855	252,093	26,415	278,508	4,650,543	417,726
2033	5,068,269	253,413	27,601	281,014	4,931,557	164,313
2034	5,095,870	254,794	28,750	283,543	5,215,101	-
2035	5,124,620	256,231	29,864	286,095	5,501,196	-
2036	5,154,484	257,724	30,946	288,670	5,789,866	-
2037	5,185,430	259,271	31,997	291,268	6,081,134	-
2038	5,217,426	260,871	33,018	293,889	6,375,023	-
2039	5,250,444	262,522	34,012	296,534	6,671,558	-
2040	5,284,457	264,223	34,980	299,203	6,970,761	-
2041	5,319,437	265,972	35,924	301,896	7,272,657	-
2042	5,355,361	267,768	36,845	304,613	7,577,270	-
2043	5,392,206	269,610	37,744	307,355	7,884,625	-
2044	5,429,951	271,498	38,623	310,121	8,194,746	-

[2] See, for instance, http://money.usnews.com/money/personal-finance/articles/2014/05/05/how-long-should-your-household-purchases-last

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Comments on Overall Approach

Overall, NEEA's generalized regional model for estimating the stock of residential electric clothes dryers is suitable for planning purposes. We recommend that NEEA develop a similar model for homes with natural gas dryers to support its emerging initiative, which may affect sales of gas dryer models. As with NEEA's current electric dryer model, NEEA can estimate natural gas dryer saturation rates from the 2011 RBSA data and has access to AHAM gas dryer shipments data.

NEEA staff might also consider developing separate statewide models for the clothes dryers stock. These statewide models could involve the following steps to "sharpen" the forecast for each state:

- Re-analyze the RBSA data to develop clothes dryer saturation rates by state and housing type (if the sample is large enough);
- Integrate state level population forecasts. For instance, state departments of economic analysis often update short-term population growth forecasts (the State of Oregon does this quarterly);
- Include detailed housing construction forecasts, since dryer ownership varies by housing type. Some of the potential sources for housing construction forecasts include: Portland State University for Real Estate, University of Washington Runstad Center for Real Estate Studies, and *Construction Monitor* – a private subscription service NEEA has utilized in the past.

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Appendix E: Focus Group Results Including Recruitment and Moderator Guides

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MEMORANDUM

May 12, 2016

To: Amy Webb
Stephanie Baker
Christine Riegler

Re: Super Efficient Dryer Market Characterization – Focus Group Results

As part of the Super Efficient Dryer Market Characterization Study, we completed six focus groups of residential consumers in the Pacific Northwest. We have completed our analysis of the focus group discussions. Our assessment of key results is attached for your review. Please let us know what comments or questions you have.

The attachment also serves as a draft report section for the overall project deliverable. However, we will further shorten the discussion to focus on the key themes for the final report to stay within the overall report page limit.

Please note also our presentation to NEEA staff on February 18, 2016, as an additional deliverable.

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1 Focus Group Results

Evergreen Economics, together with Curtis Research Associates, conducted six focus groups to better understand household laundry practices, perceptions, and preferences. The study team explored how households do their laundry, what they look for in laundry equipment (especially dryers), and how they would react when offered heat pump and hybrid dryers alongside more conventional options.

The focus groups were held in four cities in February 2016, as shown in Table 1 below. The focus group facilities recruited participants. Eligibility criteria for participation in the focus groups included home ownership and either owning a dryer that was less than a year old (i.e., a recent purchase) or one that was more than ten years old (and thus would need to be replaced in the foreseeable future). We also accepted households that were actively shopping for dryers. In addition, for the two focus groups with a fuel focus on natural gas, participants needed to have natural gas service to their homes, although they did not need to use natural gas to fuel their clothes dryers.

Table 1: Focus Group List

Location	Date	Number of Participants	Fuel Focus
Billings	Feb 2 ,2016	9	electric
Portland 1	Feb 4, 2016	8	electric
Portland 2	Feb 4, 2016	8	natural gas
Boise	Feb 9, 2016	8	electric
Seattle 1	Feb 10, 2016	9	electric
Seattle 2	Feb 10, 2016	8	natural gas

The focus group discussion addressed household laundry practices, features participants value in their dryer, their shopping processes for new dryers, trade-offs among competing dryer characteristics, and what choices participants think they would make among current dryer options if they were shopping for a new dryer now. The recruitment guide and the moderator's guide for the electrically focused groups are attached. The moderator's guide for the natural gas groups covered much of the same content, but with modest customization to spur more discussion on natural gas dryers and issues.

We analyzed participant comments to obtain insights on both laundry practices and various aspects of purchase choices and practices. We have organized our discussion of the results around the following sets of questions:

- What are the prevalent laundry habits?
- What does the shopping process for dryers look like?
- What dryer features are important and how do these rank in shaping their purchase decision?

1.1 What are the prevalent laundry habits?

In exploring prevalent laundry habits, the study team sought to understand who does laundry, how often, and what special considerations there are. Probing focused the discussion on habits—such as the sequencing of loads—that have implications for the laundry equipment that would work best for the participating households.

While household size and presence of pets affect laundry practices, household laundry habits do vary greatly among participants. Participants seemed to have well-established habits, which seemed adapted to their households' needs and individual preferences.

It was reported that in some households, multiple members would do the laundry for the entire household; other participants reported that in their households, everyone did their own laundry. A mix of men and women reported doing laundry.

Timing varies; while some households do laundry on particular days of the week, others base it primarily on need (whether laundry is full, or if there's a particular item or items of clothing the household member needs). Most households do not regard laundry as a carefully timed activity.

Respondents spoke of various practices on setting water temperature and some mentions of separating laundry for special treatment – some use cold water while some a variety of temperature settings; some separate colors while others do not. While most clothes are washed and dried, some households are cautious with particular items of clothing, drying them at a lower setting (including multiple mentions of air drying, mostly for delicate items or seasonally) or not drying them at all to protect the fabric or to keep them from shrinking.

There is some interest among households to time washing and drying cycles so the loads finish simultaneously, but there is wide recognition that the length of the drying cycle is not just a function of the dryer, but of the size of the load and the type of clothes. Moving laundry directly from the washer to the dryer was not a universal preference, though people seemed more likely to leave clothes in the dryer than in the wash, due to concern about mildew.

1.2 What does the shopping process for dryers look like?

Most of the focus group was dedicated to exploring various aspects of dryer purchases and selection processes. This section presents results divided into several sets of subquestions.

What drives the decision to buy a new dryer? How quickly does it need to be replaced? Where do people turn for information? What role might various influencers play?

The decision to buy a new dryer is most commonly linked to either an equipment failure or worsening performance by an older dryer (taking longer to dry), but dryer purchases can also be motivated by the need for a new washer. For households that care about matching sets (for aesthetics, fit, and consistency in controls), the washer choice is likely to dominate the purchase decision and be the appliance that needs replacing sooner. Hence, emergency replacements are only a subset of dryer replacements, and the few who commented on the time span in which they would want to replace a failed dryer tended to allow a couple of days up to a week.

Households turn to multiple information sources to get informed about dryer choices; friends and family, repair technicians, consumer ratings (both technical tests and user ratings, including from Consumer Reports), and general Internet searches feature prominently in the information-gathering stage when people have time to research. The ENERGY STAR brand is also important, although many mistakenly think of the Energy Guide label and expect to see consumption information posted on dryers in the store.

Utilities do not feature prominently as an information source because people do not think utilities would have any information to offer. However, utilities do seem to have credibility, and consumers would consider their recommendations even if they would not think to seek them out when purchasing laundry equipment.

Households do not expect retail salespeople, particularly at big box retailers, to be helpful or informed; participants reported tending to trust customer reviews much more than retail salespeople, but often do talk to retail salespeople (especially at independent retailers) in addition to reading online reviews. Point-of-purchase materials were not top-of-mind for the focus group participants, probably because they were contemplating an carefully researched purchase and not fully appreciating the influence of the retail experience, particularly for emergency replacmeents.

What do people seem to be looking for in a dryer initially (before being influenced by information searches, marketing, or our focus group questions)? What features matter?

Participants listed multiple features that matter to them in a dryer. The most common unprompted features mentioned included size/capacity, energy efficiency, reliability (brand, warranty, ratings), dryer time, and price/value (which is more nuanced that just the sticker price).

Price, value, and energy efficiency seemed to be interrelated for some participants, suggesting that they are looking for a balance of purchase price and operating cost. When asked further, participants clarified that value is not necessarily defined as the lowest purchase price, but getting the features and quality people want for a good price. Some participants mentioned discounts as well, tending to see value as getting the product they are purchasing for a "lower" price.

Size was important to a few people in terms of either capacity for larger load and bulky items or in terms of the exterior dimensions of the appliance so it would fit in either a larger home or in smaller spaces.

Dryer cycle time is important, and more nuanced than just matching washing and drying times. The general consensus was that people do not want to have to keep going back to make sure their clothes are dry—they want their laundry to be dry when the cycle ends and the dryer turns off—but they also seemed to already understand what the dry times were for their machine for a typical load (so did not often end up having to run it for longer than they initially set it for).

Reliability emerged in several ways—as expected durability, recognition of the brand as one that works well and lasts, and the length of warranties offered. Being easily repairable was volunteered before the focus group discussions prompted discussion on the topic and even more so after participants heard about the heat pump option.

Features that participants reported liking included such settings as wrinkle guard, which rotates clothes every so often after the dryer is done; participants also liked having a setting for heavier clothes such as jeans. A few participants expressed enthusiasm for the steam feature included in some higher end dryers.

What role do energy efficiency and ENERGY STAR play in purchase decisions?

Energy cost and energy efficiency matter to people, but appear to affect purchase choices only to a moderate degree. This may be due to a poor understanding of how much dryers cost to operate and because the incremental cost for more efficient

dyers presented to them in the focus groups was large.

Purchase price matters to some participants than operating costs not only because it is a more immediate expense, but also because large cash outlays get more attention than equivalent costs spread out over time. One participant adeptly explained the large ticket items require more financial planning and mental energy.

Dryer operating cost—which stems primarily from energy use—is also important, however. Energy efficiency was top of mind in the groups in Portland and Seattle, somewhat less prominent in Boise and did not come up until someone mentioned energy in Billings.

ENERGY STAR was well recognized, accepted and valued as a sign of energy efficiency, but people would not generally expect energy consumption to vary much among *new* dryers. New technology is seen as being more efficient overall—including more energy efficient—than older appliances. Furthermore, people erroneously confuse ENERGY STAR with Energy Guide expecting to see operating costs on the appliances in the stores. There is some sense that everything on the market is ENERGY STAR, and there is vague understanding of the energy savings related to ENERGY STAR; some people seemed surprised to learn that an ENERGY STAR-rated electric dryer is 20 percent more efficient (they expected that to be lower, or seemed to think it would be more arbitrary).

While well-recognized, the Energy Guide labels is not fully understood. Focus group participants seemed uncertain what the "typical household" is on whose usage the costs shown on the guide are computed. There was a vague sense of how much energy is consumed when doing laundry and when using a dryer, and vague understanding about the differences between dryers models.

There was also confusion around what "efficiency" means. When using the term, some people were obviously referring to energy efficiency and others meant some other kind of efficiency (e.g. water, drying time). Some participants thought that a more efficient dryer would dry clothes faster (i.e. use less energy if they spend less time drying) while other participants seemed to understand that slower drying is associated with lower temperatures that are more efficient to obtain and maintain. Also, many participants think about water and energy together as the resources required to do laundry.

What role do gentleness on clothing, venting, dryer cycle time play in purchase decisions?

Gentleness on clothes clearly mattered in some households, particularly among women in the focus groups or female partners of some male participants, and came

up as a topic before we prompted for it. (Hence, gentleness offers a potentially salient selling point and may be a good marketing point for the heat pump dryer.)

Some households currently do their laundry in a way they consider to be gentle on selected clothes (including hanging clothes to dry to avoid wear). Gentleness seemed to be a way to get more value out of clothing.

As noted elsewhere, households were sophisticated enough in their thinking about drying time to recognize that there is no specific drying time for any given dryer, as the contents of the load affect drying time. Hence, one cannot fully match cycle times for a washer and a dryer. Nevertheless, some do see matched washing and drying times as a desired feature, when possible, while others do not care as much.

Ventless dryers are a little harder to gauge. Ventless drying did not generally resonate as a desirable feature except for a small number of people who connected it with reduced fire danger. People were somewhat interested when they heard that some heat pump dryers do not need a vent but this topic did not come up on its own before the focus group moderator raised it.

Do consumers think of natural gas dryers? What prompts someone to consider a natural gas dryer? What are seen as the main benefits or trade-offs?

Participants were generally aware of both fuels, but tend to think primarily of replacing their dryer with a new one that uses the same fuel as the one they currently have. When exposed to the alternate fuel (as in the natural gas groups), some electric dryer owners were attracted to the thought of a natural gas dryer because they think of natural gas appliances as less expensive to operate and either better for the environment or more efficient. Their interest was subject to obtaining more information about what would be involved, however. They had previously heard mixed messages on the infrastructure needs and installation costs of a natural gas dryer. Also, there were some impressions that gas dryers run hotter than electric dryers, but it was not clear if that was seen as a pro or a con.

What would consumers buy and what tends to drive their decision?

After discussions about features and shopping processes, we asked participants to make explicit decisions about which of several kinds of dryers they were likely to purchase or look at most seriously. Based on their choices and discussion of their considerations, we can identify participant preferences among the dryer options available to them. Readers should note, however, that participants were responding to the information and choice options we presented, whereas they would be exposed to additional information that could alter their choices during an actual purchase process.

Overall, consumers seemed to focus on ENERGY STAR dryers once they had been exposed to the various trade-offs that we or their fellow participants raised. ENERGY STAR dryers (electric and natural gas) were the participants' top choice and would figure most prominently in their shopping search if they were to look into new dryers. About half of the top choices in our comparison exercise went to ENERGY STAR electric and ENERGY STAR natural gas dryers, as shown in Table 2.

Table 2. Focus Group Participant Dryer Choices

	Number of participants who selected (among top two)	Percentage of total
conventional electric	6	6%
conventional electric - ENERGY STAR	24	25%
conventional electric – high end	17	18%
hybrid electric	14	14%
heat pump electric	6	6%
conventional natural gas	13	13%
conventional natural gas – ENERGY STAR	17	18%

In explaining their choices, participants indicated that they want value. It seemed that most of the participants did value energy efficiency enough to choose an ENERGY STAR dryer at a modest incremental cost, but shied away from the higher purchase price, unfamiliar dryer type, and longer drying times of the heat pump and hybrid dryers. They also tended to avoid the lowest cost dryers with the lowest efficiency, defining value as getting good performance and the features they value at a good price rather than as the lowest purchase price available. Purchase price and operating cost both matter, but a bigger one-time outlay received more attention; though participants reported being willing to pay more for efficiency and desired features, a $1,200 dryer (the cost we attached to heat pump and hybrid dryers for our comparison exercise) would be beyond most participants' willingness to consider.

Would consumers consider a heat pump or hybrid dryer? How prevalent is that? What are the key selling points for those who are interested? What concerns or information needs do they have?

There is some interest among a minority of participants in the heat pump or hybrid dryers; a quarter of the focus group participants included either the heat pump or hybrid dryer among their top two choices to consider or explore if they were shopping for a dryer. Most of these participants preferred the hybrid version between the two options.

Selling points for the hybrid dryers were focused on the energy savings (especially among those concerned about either continually increasing electricity prices or the changing environment), the option to eliminate venting, and the control users have about how to operate the machine (presumably the choice to run it in electric or heat pump mode).

Substantial energy savings (in the context of changing electricity prices and the environment) was an attention-getter for the participants; knowing that Energy Star was 20 percent more efficient (less so for natural gas) but that heat pump dryers could be 30 – 50 percent more efficient (as we presented the savings in the comparison exercise) seemed to catch participants' attention.

Heat pump technology also was well-received by some in the Portland and Seattle focus groups. Some (but still the minority of) respondents already had familiarity with heat pump technology and had it in their homes via an HVAC system. It should be noted that these consumers were not ready to commit to purchasing a heat pump or hybrid dryer, but would explore them further. We did not discuss what additional information they would need in sufficient depth to draw conclusions.

Though gentleness does grab the attention of some participants, it was not an explanatory factor in the post-comparison exercise.

Dry time differences did not seem prominent in people's choices toward or away from hybrid and heat pump dryers, but that could be the result of moderate differences in dry time shown in our comparison exercise.

Attachment A:

Household Focus Group Recruitment Guide

Hello, my name is _____ from [name of focus group facility]. I am calling selected households in the [city] area to identify qualified households for a paid discussion group about appliance purchases on [date]. This is part of a research study. I am not selling anything. I would just need a few minutes of your time to ask some questions to determine whether you or someone from your household might qualify.

continue

declined

Q1. Am I speaking with an adult who is familiar with the laundry equipment you currently use?

yes

no

Q2. RECORD GENDER BY OBSERVATION. [DO NOT ASK]

male

female

unable to determine

Q3. Who in your household would be involved in purchase decisions about new washers or dryers if you were to buy one?

respondent

someone else

respondent and someone else

[if Q1 = no or Q3 = someone else]

Could I please speak with the person who is familiar with the laundry equipment you currently have and would be involved in purchase decisions about new laundry appliances?

Reintroduce.

Q4. Do you have natural gas service to your home?

yes

no [for Seattle and Portland only: This household is eligible only for the first focus group of the evening. If that group is filled, THANK AND TERMINATE: I am sorry to say that your household does not qualify for this particular study. Thank you for answering my questions. Have a good day/evening.]

don't know [for Seattle and Portland only: same as a no response]

Q5. Do you currently own a clothes washer, a clothes dryer, both, or neither?

washer

dryer

both

neither

[if Q5 = washer or both]
Q6. Approximately how old is your washer?

less than 1 year

1-5 years

6-10 years

more than 10 years

don't know

[if Q5 = dryer or both]
Q7. Approximately how old is your dryer?

less than 1 year [eligible]

1-5 years

6-10 years

more than 10 years [eligible]

don't know

[if Q5 = dryer or both]
Q8. Is your dryer an electric or natural gas dryer?

electric

natural gas

don't know

Q9. Are you currently shopping for or considering buying new laundry equipment in the next 12 months?

yes

no [SKIP Q10]

Q10. Are you (potentially) looking into a washer, dryer, or both?

washer only

dryer only [eligible]

both [eligible]

something else

[If none of the following applies, household is NOT eligible: Q7 = less than 1 yr OR Q7 = 10 yrs or more OR Q10 = dryer or both. THANK AND TERMINATE: I am sorry to say that your household does not qualify for this particular study. Thank you for answering my questions. Have a good day/evening.]

Q11. How many adults live in your household?

____

Q12. How many children or youth under 18 live in your household?

____

Q13. Do you own or rent your residence?

own

rent

Q14. Is anyone in your household involved in designing, testing, marketing, or selling laundry equipment or otherwise involved in advocating for the use of some laundry-related technologies or choices over others?

yes [not eligible ==> THANK AND TERMINATE: I am sorry to say that your household does not qualify for this particular study. Thank you for answering my questions. Have a good day/evening.]]

no

Q15. Which of the following income ranges best describes your annual household income?

less than $25,000

more than $25,000, but less than $50,000

more than $50,000 but less than $100,000

more than $100,000, but less than $150,000

more than $150,000

don't know / prefer not to answer

Based on your responses, I would like to invite you to participate in a small group discussion so we can learn more about what is important to consumers when selecting laundry equipment. We are looking for consumer opinions. We will not be selling anything. The discussion will last about 90 minutes. As a token of our appreciation for your time and input, you would receive [incentive amount], and we

will provide sandwiches and refreshments. Could you take part in a group scheduled for [date] in the evening in [city]?

If interested: Explain where the focus group will be held and obtain the following information to send a confirmation letter.

Name:

Street address:

City:

Zip Code:

Day Phone

Evening Phone:

E-mail Address:

We are only asking a few people to take part in this discussion, so your presence is very important. If something comes up and you are unable to attend, please give us a call. Our telephone number is [_____]. That number will also be on the confirmation letter we will send you. Please plan to arrive 10 minutes early so we can check you in and so you have some time to have some refreshments before we start.

Thank you for your time. We look forward to seeing you on [date].

NOTE TO FOCUS GROUP RECRUITER: Please keep all responses for recruits and provide them to Evergreen Economics so we can prepare profiles of the participants and compare participant demographics to the broader population.

Attachment B:

Household Focus Group Moderator's Guide

Electric Version

I. Introduction & Background Information (5 minutes)

A. Moderator introduction
B. Purpose & format of the group
C. Ground rules:
   - One person speak at a time;
   - Be candid; and
   - Allow everyone an equal opportunity to participate in the discussion.
D. Participant Introductions:
   - Please briefly introduce yourself to the group and tell us a little about yourself and your household.

II. Laundry Habits (25 minutes)

A. General Habits

To start off, let's talk about your household's laundry routine.

- Who does the laundry in your household? Does one person typically take care of it or does it vary? If it varies, how?
- What is your (their) typical laundry routine? Tell me about it.

As needed, probe the following:

- How often do you typically do laundry?
- How many loads do you do in a typical week?
- When do you do laundry? Do you have a routine such as a day of the week and/or time of day you do laundry, or does it vary?
- If it varies, how do you decide when to do laundry? Is it is a matter of finding the time to do it or having the need to do it?

- What percentage of the time would you say you do one load of laundry at a time and what percentage do you do two or more loads in a row? How many loads do you typically do in a row?

B. Drying Habits

- How often do you use a clothes dryer to dry your laundry?
- Do you ever hang laundry to dry? If so, how often? Does that vary during warm weather?
- When you are using the dryer, do you typically transfer the load into the dryer soon after the wash cycle has finished or is there typically a lag between the two? If a lag, why? How long is the lag?
- Do you use your dryer in other ways besides drying laundry? (If needed) For example, fluffing pillows? What else do you use it for?

C. Satisfaction with Current Equipment

Washer:

- How old is your washing machine?
- How satisfied are you your washer?
- On average, how long does it take to run one wash load? Does it matter to you how long a cycle of wash takes?

Dryer:

- How old is your dryer?
- How satisfied are you with your dryer?
- What do you like about your dryer?
- What don't you like about it?
- (If not satisfied) What would you like from a dryer that yours does not do or provide?
- On average, how long does it take to dry a load of laundry? Does it matter to you how long it takes to dry a load?

For those who indicated that the wash cycle is shorter than the dry cycle:

- Do you ever find yourself waiting for a load to dry? If so, can you give me some examples of when this happens?
- For those who do multiple loads of laundry in a row, are you ever waiting around for your dryer to finish one load so you can get on to the next or has that not been an issue for you?

D. Purchase of new equipment

- Do you have any plans to replace your washer and/or dryer? If so, when are you likely to do that? Why?
- What will/did cause you to replace your washer and/or dryer?
  - Probe planned replacement vs. emergency
- If your dryer were to break down and could not be fixed, or the cost of the repair didn't justify having it fixed, how long would you wait until you purchased a replacement? How long are you willing to go without a dryer?
- Are you most likely to purchase a washer and dryer as a set or to purchase them individually? Why?
- What is the benefit of purchasing them individually?
- What is the benefit of purchasing them as a set? Probe importance of aesthetics of having a matched set that look alike and fit together.
- If purchasing them as a pair, did/would you focus more attention on selecting the washer, selecting the dryer, or would you give them equal attention?
- If washer is more important, probe how much more important and why. Probe:
  - Particular features of interest/concern
  - Are there more differences between washer models than there are dryer models?
  - Are washers more complex than dryers?

Hold off on any discussion of dryer features and attributes until later in the session.

E. Information Resources

- Where would/do you get information to help you decide what type or model of dryer to purchase?
- How much research would you/did you do to help you decide?
- Would the amount of research or the resources you use vary depending on whether you were planning to replace your dryer or if you needed to replace it because it broke down unexpectedly? If so, how would it vary?

If not mentioned, probe use and importance of each of the following resources:

- Input or recommendations from friends or family members
- In-store sales associates
- Online searches
- Reviews from other buyers

III. Dryer Feature & Attribute Priorities (30 minutes)

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A. Unaided priorities – Written Exercise

Those with older dryers: Please assume that something has happened to your dryer and you need to replace it. With that in mind, make a list of the features and attributes that would be most important to you as you shop for a new dryer.

Those with new dryers: Please make a list of the features and attributes that were most important when you decided which dryer to purchase.

B. Discuss feature & attribute priorities

Starting with those with older dryers first:

- What feature and attributes did you write down as being important to you?
- For each feature mentioned, get a show of hands of how many included it on their list of features.
- Why is that important to you?
- Relative to other features we've been talking about, how important is it?
- How do others feel about that? Do you agree or disagree?

Repeat for each feature/attribute. If not mentioned, discuss the importance of each of the following features as time allows, listed in order of priority:

1. Drying time
    a. Is drying time something you would consider? Does it matter? If so, why?
    b. For a typical load, what is an acceptable length of time for drying?
    c. How long is too long? At what point would it become an issue?
    d. If the dryer cycle time is the same as the wash cycle, or longer, how much does it still matter?
2. Vented/Ventless – *Only discuss if mentioned by participants*
    a. What do you initially think of these two terms?
    b. What are your perceptions of the differences between a vented and a ventless dryer?
    c. Do you have concerns for one or the other?
    d. Do you have a preference? Why?

3. Gentleness on clothing
4. Capacity (full/standard vs. compact)
    a. For those who consider full size capacity to be important, why? What are the benefits of buying big washer/dryer pairs?
    b. What do you think of compact dryers?
    c. Would you consider buying a compact laundry pair if it could wash and dry the same weight of clothing?
5. Energy Use/Energy Efficiency - *Only discuss if mentioned by participants*
    a. If energy efficiency is important to you, why? Probe to understand if consumers equate this with monetary savings.
    b. Compared to a standard dryer, how much more energy efficiency do you want or expect from a dryer? (i.e. levels – 15%, 30%, 50% more efficient than conventional)
6. Cycle preferences
    a. What cycle settings are most important to you? Why?
    b. What cycle do you use most often? What percentage of the time are you using this setting?
    c. What other cycles do you use and how often?
7. Reduced Environmental Impact/Reduced energy waste - *Only discuss if mentioned by participants*
8. Fuel Type - *Only discuss if mentioned by participants*
9. Stackable
10. Brand
    a. How much consideration do you give to brand? How important is the brand when buying a dryer?
    b. Are there any brands that you are more likely to consider? Why?
    Are there any brands that you are likely to disregard? Why?

C. Rank Top 3

Written Exercise: Of all the things we've talked about, please make a list of the 3 features/attributes that are most important to you when selecting a new dryer.

- What features and attributes did you write down?
- For each feature mentioned, get a show of hands of how many included it among their top three.

IV. Energy Efficiency (15 minutes)

A. Rank of Energy Efficiency and/or Energy Star
Only discuss if already mentioned by participants, otherwise, skip to part C then backtrack to parts A & B.

- For those who included energy use/energy efficiency or Energy Star among the most important features, why? Probe saving money on energy bills versus minimizing their eco footprint/reducing energy waste.
- For those who did not included energy use/energy efficiency or Energy Star in their top 3, where does it fall in your list of desired features and attributes? Is it relatively high, in the middle or low? Why?

B. Trade-off attributes/explore the relative importance of the following:

- Low purchase price vs. pay more for energy efficiency/save money over time
- Gentler on clothes vs. faster drying time
- Faster drying vs. more energy efficient
- Compact vs. large capacity
- Lower cost with basic features vs. higher cost with advanced features

C. Perceptions of dryer energy use & Energy Star certification

- How energy efficient is your current dryer? As far as you know, is it doing a good job for you?
- Do you have any idea how much you spend per year drying laundry or what portion of your electric bill goes toward drying laundry? What is your best guess?
- Over the course of a year, how does the energy use of a dryer compare to other major appliances, such as a washer, refrigerator or dishwasher?
- How much variability is there in energy efficiency between different dryers? What's your best guess?
- If you wanted to get a more energy efficient dryer, what would you look for? Listen for mention of Energy Star (if not already mentioned earlier).
- (If not mentioned) Are you familiar with Energy Star? If so, what does it mean to you when you see Energy Star? If some are unfamiliar with it, have someone in the group can explain Energy Star certification.
- As far as you know, is your current dryer Energy Star certified?
- When buying a new dryer, how much value or importance would/did you place on Energy Star certification?

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- How much more energy efficient would you expect an Energy Star dryer to be?
- How likely are you to purchase a dryer that is Energy Star certified?
- How much more, if any, are you willing to pay for a more energy efficient dryer?
- Assuming you found two dryers with comparable features but one was Energy Star certified and one was not, how much extra would you expect it to cost?

To be Energy Star certified, a dryer must use 20% less energy than a comparable non-Energy Star model.

- What do you think of that?
- Does knowing that impact the likelihood that you would purchase an Energy Star certified dryer? Why?

V. Gas & Super Efficient Dryers (25 minutes)

A. Awareness and initial perceptions

- Other than the standard electric resistance dryers we have been talking about, are you aware of any other types of dryers that use less energy?
- If yes, what are they?
- How much more energy efficient are they than a standard electric dryer?
- How do they work to achieve better energy efficiency?
- What are the advantages and disadvantages of those dryers?

B. Natural Gas Dryers

- (If not mentioned) Are you aware that you can purchase dryers that operate on natural gas?
- Do you have natural gas at home? If yes, do you have any gas appliances?
- Have you ever considered purchasing a gas dryer? Why or why not? If yes, why didn't you purchase one?
- If no, would you consider purchasing a gas dryer? Why or why not?
- What are the pros and cons of a gas dryer?

Gas dryers typically cost a little more than a comparable electric model—typically about $100 more— but they are generally less expensive to operate because gas dryers heat and dry laundry more quickly.

- What do you think about that?

- Knowing that, would you be any more or less likely to consider a gas dryer? Why?

C. Briefly explain heat pumps/super-efficient dryers

There is a new class of "super-efficient" dryers that use heat pump technology. From the outside you can't tell the difference, but on the inside this kind of dryer uses both an air heater and a dehumidifier to dry your clothing. This combination uses 30-50% less energy than a typical dryer that uses just an air heater. Dryers like this are common in Europe.

If questions arise about the 30-50% range, explain that it can vary with the setting selected and the type of clothes being dried

- What do you think of a dryer that is super energy efficient?
- What do you like about it?
- What do you see as the drawbacks or what concerns do you have? *Listen for any concerns about it being a new, unfamiliar technology.*
- Are you familiar with heat pumps? Does the term heat pump mean anything to you?
- Are you familiar with heat pump technology in other types of products?
- Do you own any heat pump products? Probe heating/cooling and heat pump water heaters.
- Would you be likely to consider purchasing a SED? Explore openness to new dryer technology with greater savings.
- If not interested, what are the biggest deterrents?
- If interested, how much more, if any, would you be willing to pay for a super efficient dryer?
- Assuming you found two dryers with comparable features but one was super efficient and one was not, how much more would you expect it to cost?

D. Dryer Comparison

Hand out 1-page matrix summarizing key details of several hypothetical dryers. Explain matrix to participants.

Written Exercise: Please assume that you are in the market to purchase a new dryer.

1. Given the information you have about each model, which dryer would you consider your front-runner and examine more closely? Why?
2. Which dryer would you consider your 2nd choice to examine more closely? Why?

- Get a show of hands for how many selected each model as a 1st or 2nd choice.
- In rank order, discuss why they selected the models they did.
- Which would you be least inclined to consider purchasing? Why?
- If interest in SEDs is low, probe why, including the impact of price on willingness to consider SEDs.

E. Additional topics to explore

- Explore the relative importance of energy savings vs. gentler on clothes.
- How much longer, if any, would you be willing to wait for your clothing to dry if it was gentler on clothing? 10 minutes? 20 minutes? 30? 45?"
- Explore the relative importance of energy savings vs. speed of drying.
- Would you be more likely to choose a low heat setting that takes longer, but would use less energy or would you prefer a higher heat setting cycle that used a higher heat to get your clothing dry faster? Why?
- How much longer, if any, would you be willing to wait for your clothing to dry in exchange for energy savings? 10 minutes? 20 minutes? 30? 45?"
- For those not motivated by the energy efficiency of SEDs, how much more energy efficient would a dryer need to be to in order to generate interest? What would it take to catch your attention?
- Would you be interested in information from your utility to help you learn about specific dryer technologies or groups of products that were more energy efficient?

VI. Wrap-up (5 minutes)

Before dismissing the group, the moderator will confer with research observers to determine if there are any additional questions that need to be addressed.

- We've talked about a lot of different aspects of dryers but is there anything we haven't covered that you wanted to add?

Thank you for taking the time to talk with me. I appreciate your willingness to share your insights and opinions.

Natural Gas Version

VII. Introduction & Background Information (5 minutes)

E. Moderator introduction
F. Purpose & format of the group
G. Ground rules:
   - One person speak at a time;
   - Be candid; and
   - Allow everyone an equal opportunity to participate in the discussion.
H. Participant Introductions:
   - Please briefly introduce yourself to the group and tell us a little about yourself and your household.

VIII. Laundry Habits (25 minutes)

F. General Habits

To start off, let's talk about your household's laundry routine.

- Who does the laundry in your household? Does one person typically take care of it or does it vary? If it varies, how?
- What is your (their) typical laundry routine? Tell me about it.

As needed, probe the following:

- How often do you typically do laundry?
- How many loads do you do in a typical week?
- When do you do laundry? Do you have a routine such as a day of the week and/or time of day you do laundry, or does it vary?
- If it varies, how do you decide when to do laundry? Is it is a matter of finding the time to do it or having the need to do it?
- What percentage of the time would you say you do one load of laundry at a time and what percentage do you do two or more loads in a row? How many loads do you typically do in a row?

G. Drying Habits

- How often do you use a clothes dryer to dry your laundry?
- Do you ever hang laundry to dry? If so, how often? Does that vary during warm weather?
- When you are using the dryer, do you typically transfer the load into the dryer soon after the wash cycle has finished or is there typically a lag between the two? If a lag, why? How long is the lag?
- Do you use your dryer in other ways besides drying laundry? (If needed) For example, fluffing pillows? What else do you use it for?

H. Satisfaction with Current Equipment

Washer:

- How old is your washing machine?
- How satisfied are you your washer?
- On average, how long does it take to run one wash load? Does it matter to you how long a cycle of wash takes?

Dryer:

- How old is your dryer?
- Does your dryer operate on electricity or natural gas?
- How satisfied are you with your dryer?
- What do you like about your dryer?
- What don't you like about it?
- (If not satisfied) What would you like from a dryer that yours does not do or provide?
- On average, how long does it take to dry a load of laundry? Does it matter to you how long it takes to dry a load?

For those who indicated that the wash cycle is shorter than the dry cycle:

- Do you ever find yourself waiting for a load to dry? If so, can you give me some examples of when this happens?
- For those who do multiple loads of laundry in a row, are you ever waiting around for your dryer to finish one load so you can get on to the next or has that not been an issue for you?

I. Purchase of new equipment

- Do you have any plans to replace your washer and/or dryer? If so, when are you likely to do that? Why?
- What will/did cause you to replace your washer and/or dryer?

- Probe planned replacement vs. emergency
- If your dryer were to break down and could not be fixed, or the cost of the repair didn't justify having it fixed, how long would you wait until you purchased a replacement? How long are you willing to go without a dryer?
- Are you most likely to purchase a washer and dryer as a set or to purchase them individually? Why?
- What is the benefit of purchasing them individually?
- What is the benefit of purchasing them as a set? Probe importance of aesthetics of having a matched set that look alike and fit together.
- If purchasing them as a pair, did/would you focus more attention on selecting the washer, selecting the dryer, or would you give them equal attention?
- If washer is more important, probe how much more important and why. Probe:
  - Particular features of interest/concern
  - Are there more differences between washer models than there are dryer models?
  - Are washers more complex than dryers?

Hold off on any discussion of dryer features and attributes until later in the session.

J. Information Resources

- Where would/do you get information to help you decide what type or model of dryer to purchase?
- How much research would you/did you do to help you decide?
- Would the amount of research or the resources you use vary depending on whether you were planning to replace your dryer or if you needed to replace it because it broke down unexpectedly? If so, how would it vary?

If not mentioned, probe use and importance of each of the following resources:

- Input or recommendations from friends or family members
- In-store sales associates
- Online searches
- Reviews from other buyers

IX. Dryer Feature & Attribute Priorities (30 minutes)

D. Unaided priorities – Written Exercise

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Those with older dryers: Please assume that something has happened to your dryer and you need to replace it. With that in mind, make a list of the features and attributes that would be most important to you as you shop for a new dryer.

Those with new dryers: Please make a list of the features and attributes that were most important when you decided which dryer to purchase.

E. Discuss feature & attribute priorities

Starting with those with older dryers first:

- What feature and attributes did you write down as being important to you?
- For each feature mentioned, get a show of hands of how many included it on their list of features. Listen for dryer fuel among features listed as important.
- Why is that important to you?
- Relative to other features we've been talking about, how important is it?
- How do others feel about that? Do you agree or disagree?

Repeat for each feature/attribute. If not mentioned, discuss the importance of each of the following features as time allows, listed in order of priority:

11. Fuel Type
    a. Were you aware that you have a choice between electric and natural gas dryers?
    b. When shopping for a dryer, would/did you consider both gas and electric? Why or why not?
    c. How likely would you be to consider switching? If likely to stay with the same type, probe to understand if it is due to inertia or a considered preference for their existing fuel.
    d. For those who currently have electric dryers, why did you choose electric? Have you ever had a natural gas dryer?
    e. For those who currently have gas dryers, why did you choose gas? Have you ever had an electric dryer?
12. Drying time
    a. Is drying time something you would consider? Does it matter? If so, why?
    b. For a typical load, what is an acceptable length of time for drying?

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c. How long is too long? At what point would it become an issue?
d. If the dryer cycle time is the same as the wash cycle, or longer, how much does it still matter?

13. Vented/Ventless – *Only discuss if mentioned by participants*
    a. What do you initially think of these two terms?
    b. What are your perceptions of the differences between a vented and a ventless dryer?
    c. Do you have concerns for one or the other?
    d. Do you have a preference? Why?
14. Gentleness on clothing
15. Capacity (full/standard vs. compact)
    a. For those who consider full size capacity to be important, why? What are the benefits of buying big washer/dryer pairs?
    b. What do you think of compact dryers?
    c. Would you consider buying a compact laundry pair if it could wash and dry the same weight of clothing?
16. Energy Use/Energy Efficiency - *Only discuss if mentioned by participants*
    a. If energy efficiency is important to you, why? Probe to understand if consumers equate this with monetary savings.
    b. Compared to a standard dryer, how much more energy efficiency do you want or expect from a dryer? (i.e. levels – 15%, 30%, 50% more efficient than conventional)
17. Cycle preferences
    a. What cycle settings are most important to you? Why?
    b. What cycle do you use most often? What percentage of the time are you using this setting?
    c. What other cycles do you use and how often?
18. Reduced Environmental Impact/Reduced energy waste - *Only discuss if mentioned by participants*
19. Fuel Type - *Only discuss if mentioned by participants*
20. Stackable
21. Brand
    a. How much consideration do you give to brand? How important is the brand when buying a dryer?
    b. Are there any brands that you are more likely to consider? Why? Are there any brands that you are likely to disregard? Why?

F. Rank Top 3

Written Exercise: Of all the things we've talked about, please make a list of the 3 features/attributes that are most important to you when selecting a new dryer.

- What features and attributes did you write down?
- For each feature mentioned, get a show of hands of how many included it among their top three.

X. Energy Efficiency (15 minutes)

D. Rank of Energy Efficiency and/or Energy Star
Only discuss if already mentioned by participants, otherwise, skip to part C then backtrack to parts A & B.

- For those who included energy use/energy efficiency or Energy Star among the most important features, why? Probe saving money on energy bills versus minimizing their eco footprint/reducing energy waste.
- For those who did not included energy use/energy efficiency or Energy Star in their top 3, where does it fall in your list of desired features and attributes? Is it relatively high, in the middle or low? Why?

E. Trade-off attributes/explore the relative importance of the following:

- Low purchase price vs. pay more for energy efficiency/save money over time
- Gentler on clothes vs. faster drying time
- Faster drying vs. more energy efficient
- Compact vs. large capacity
- Lower cost with basic features vs. higher cost with advanced features

F. Perceptions of dryer energy use & Energy Star certification

- How energy efficient is your current dryer? As far as you know, is it doing a good job for you?
- Do you have any idea how much you spend per year drying laundry or what portion of your electric or gas bill goes toward drying laundry? What is your best guess?
- Over the course of a year, how does the energy use of a dryer compare to other major appliances, such as a washer, refrigerator or dishwasher?
- How much variability is there in energy efficiency between different dryers? What's your best guess?
- How similar or different are gas and electric dryers when it comes to the cost to operate? If you're not sure, what is your best guess?

- If you wanted to get a more energy efficient dryer, what would you look for? Listen for mention of Energy Star (if not already mentioned earlier).
- (If not mentioned) Are you familiar with Energy Star? If so, what does it mean to you when you see Energy Star? If some are unfamiliar with it, have someone in the group can explain Energy Star certification.
- As far as you know, is your current dryer Energy Star certified?
- When buying a new dryer, how much value or importance would/did you place on Energy Star certification?
- How much more energy efficient would you expect an Energy Star electric dryer to be?
- How much more energy efficient would you expect an Energy Star gas dryer to be?
- How likely are you to purchase a dryer that is Energy Star certified?
- How much more, if any, are you willing to pay for a more energy efficient dryer?
- Assuming you found two dryers with comparable features but one was Energy Star certified and one was not, how much extra would you expect it to cost?

To be Energy Star certified, an **electric dryer** must use **20%** less energy than a comparable non-Energy Star model. For a **gas dryer**, it must use **5%** less energy than a comparable non-Energy Star model

- What do you think of that?
- Does knowing that impact the likelihood that you would purchase an Energy Star certified dryer? Why? Probe willingness to spend more upfront for Energy Star to save on energy use over time.

XI. Gas & Super Efficient Dryers (25 minutes)

F. Natural Gas Dryers

We talked earlier about gas versus electric dryers. Gas dryers typically cost a little more than a comparable electric model—typically about $100 more— but they are generally less expensive to operate because gas dryers heat and dry laundry more quickly.

- What do you think about that?
- Knowing that, would those of you with electric dryers be any more or less likely to consider a gas dryer? Why or why not?

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G. Awareness and initial perceptions of other energy efficient dryers

- Other than the standard natural gas and electric resistance dryers we have been talking about, are you aware of any other types of dryers that use less energy?
- If yes, what are they?
- How much more energy efficient are they than a standard electric dryer?
- How do they work to achieve better energy efficiency?
- What are the advantages and disadvantages of those dryers?

H. Briefly explain heat pumps/super-efficient dryers

There is a new class of "super-efficient" dryers that use heat pump technology. From the outside you can't tell the difference, but on the inside this kind of dryer uses both an air heater and a dehumidifier to dry your clothing. This combination uses 30-50% less energy than a typical dryer that uses just an air heater. Dryers like this are common in Europe.

If questions arise about the 30-50% range, explain that it can vary with the setting selected and the type of clothes being dried

- What do you think of a dryer that is super energy efficient?
- What do you like about it?
- What do you see as the drawbacks or what concerns do you have? *Listen for any concerns about it being a new, unfamiliar technology.*
- Are you familiar with heat pumps? Does the term heat pump mean anything to you?
- Are you familiar with heat pump technology in other types of products?
- Do you own any heat pump products? Probe heating/cooling and heat pump water heaters.
- Would you be likely to consider purchasing a SED? Explore openness to new dryer technology with greater savings.
- If not interested, what are the biggest deterrents?
- If interested, how much more, if any, would you be willing to pay for a super efficient dryer?
- Assuming you found two dryers with comparable features but one was super efficient and one was not, how much more would you expect it to cost?

I. Dryer Comparison

Hand out 1-page matrix summarizing key details of several hypothetical dryers. Explain matrix to participants.

Written Exercise: Please assume that you are in the market to purchase a new dryer.

3. Given the information you have about each model, which dryer would you consider your front-runner and examine more closely? Why?
4. Which dryer would you consider your 2nd choice to examine more closely? Why?

- Get a show of hands for how many selected each model as a 1st or 2nd choice.
- In rank order, discuss why they selected the models they did.
- Which would you be least inclined to consider purchasing? Why?
- If interest in SEDs is low, probe why, including the impact of price on willingness to consider SEDs.

J. Additional topics to explore

- Explore the relative importance of energy savings vs. gentler on clothes.
- How much longer, if any, would you be willing to wait for your clothing to dry if it was gentler on clothing? 10 minutes? 20 minutes? 30? 45?"
- Explore the relative importance of energy savings vs. speed of drying.
- Would you be more likely to choose a low heat setting that takes longer, but would use less energy or would you prefer a higher heat setting cycle that used a higher heat to get your clothing dry faster? Why?
- How much longer, if any, would you be willing to wait for your clothing to dry in exchange for energy savings? 10 minutes? 20 minutes? 30? 45?"
- For those not motivated by the energy efficiency of SEDs, how much more energy efficient would a dryer need to be to in order to generate interest? What would it take to catch your attention?
- Would you be interested in information from your utility to help you learn about specific dryer technologies or groups of products that were more energy efficient?

XII. Wrap-up (5 minutes)

Before dismissing the group, the moderator will confer with research observers to determine if there are any additional questions that need to be addressed.

- We've talked about a lot of different aspects of dryers but is there anything we haven't covered that you wanted to add?

Thank you for taking the time to talk with me. I appreciate your willingness to share your insights and opinions.

Attachment C:
Comparison Exercise Handout

Dryer Choices: Which would you pick?

All dryers have typical range of clothing cycle settings (cottons, permanent press, delicates, bulky, towels) and include sensors for automatic termination (stop when clothes are dry). All dryers are assumed to be matched to an appropriately matching washer.

	A	B	C	D	E	F	G
technology	conventional electric	conventional electric	conventional electric	Hybrid heat pump	heat pump	conventional natural gas	conventional natural gas
ENERGY STAR	no	yes	yes	yes	yes	no	yes
purchase price	$600	$700	$1200	$1200	$1200	$700	$800
operating cost for a standard household	~$95/yr	~$80/yr	~$80/yr	~$65/yr	~$40/yr	~$60/yr	~$55/yr
Max clothing temp	high (up to 170F)	high (up to 170F)	high (up to 170F)	medium (up to 150 F)	medium (up to 145F)	Very high (up to 200F)	Very high (up to 200F)
drying time	standard	standard	~ 10 minutes shorter	~0-15 minutes longer	~20 minutes longer	~10 minutes shorter	~10 minutes shorter
extra features	none	none	Steam injection, plus extra settings	Efficiency option, plus extra settings	Wool cycle	none	none
venting	Vents to outside	Vents to outside	Vents to outside	No Vent	No Vent	Vents to outside	Vents to outside
water drain	n/a	n/a	n/a	Water Drain	Water Drain	n/a	n/a
other notable			designer color available (+$100)		No fire risk		

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#1: Which dryer would you consider your front-runner and examine most closely? _____

Please explain why: _____

#2: Which dryer would you consider your 2nd choice to examine more closely? _____

Please explain why: _____

Appendix F: Interview Guides and Questions

Interview Guide for Clothes Dryer Manufacturers

Objectives

The objectives for the manufacturer interviews include:

- Document company product lines and most popular models;
- Understand equipment pricing trends;
- Document marketing techniques and target markets;
- Understand customer product preferences and importance of energy efficiency;
- Document past and desired interactions with SEDI;
- Document expected manufacturing and household demand trends; and
- Understand challenges marketing and selling heat pump/hybrid models

Target Interviewees

We will conduct in-depth interviews with corporate-level representatives from six clothes dryers manufacturers, including some companies that currently offer heat pump or hybrid clothes dryers for the U.S. market. These staff may include regional sales/marketing managers, product development managers or other staff familiar with the company's positioning on dryers.

Recruitment

Hi, this is _____ with Evergreen Economics, an energy program evaluation firm based in Portland, Oregon. We're calling on behalf of the Northwest Energy Efficiency Alliance (NEEA) who engaged us to conduct research on residential clothes dryers. This is not a sales call.

NEEA has asked us to speak with clothes dryer manufacturers to help NEEA and its northwest utility partners understand the market for energy efficient models. Anything you tell us will be kept anonymous.

IF WE DO NOT HAVE A CONTACT FROM NEEA: Can you please direct me to a person at your company that very familiar with your clothes dryer product line and has knowledge of the northwest or national market? This might be a regional sales or marketing manager or a product development manager, for instance.

WHEN CORRECT PERSON IS ON THE PHONE:

Repeat Intro above.

Can we schedule a time to talk about your company's dryer products and your perceptions of the market? I'd like to reserve an hour for our discussion, although I hope we can finish

in less time. We can also email you the questions in advance to make the interview go faster.

IF NEEDED: NEEA is an alliance of more than 140 northwest utilities and energy efficiency organizations working on behalf of more than 13 million consumers with annual spending of about $10 billion.

IF NEEDED: We will also be interviewing retailers and other manufacturers and including summarized findings in a market study report for NEEA in Q3 of 2016. We never identify any company or individual in these reports.

IF THEY HAVE ANY CONCERNS: Ask them to contact Amy Webb (NEEA) at 503-688-5447 for more information about the study.

Interviewee Background

Q1. First, can you briefly describe your role with COMPANY? (Record geography covered too.)

Q2. How long have you been in this role?

Company Product Line

Let's start by getting some information about your overall product line.

Q3. What dryer brand names do you sell in the U.S.?

Q4. And what dryer fuel types do you offer in the U.S.?

a. (IF MORE THAN ONE FUEL TYPE) Do you offer these fuel types for all of your dryer brands? (Get details on break out)

b. (IF MORE THAN ONE FUEL TYPE) What percentage of your total U.S. sales does each fuel type account for?

c. And do you know what these percentages are for the Northwest market?

Q5. Do any of your brands skew more toward electric or gas than the national average of all your brands?

a. IF YES: Do you know why that is?

Q6. Who are your primary target markets?

Q7. How do you try to attract these markets; what features matter most to them? (Probe on capacity, cycle options, drying time, controls configuration, color options).

Q8. What are your most popular clothes dryers in the Northwest (or nationally)?

a. Why are these sales highest?

b. Are your most popular electric and gas dryers the same model?

Q9. What do you see as the trending features or model types that are growing in popularity?

Q10. And what models or features are declining in popularity?

Q11. Are there any new technologies for dryers you see as promising? What are they? What makes them promising?

Q12. How does your company decide if new models or technologies are added – what is the process and criteria?

Q13. How, if at all, are you changing your product mixes to adjust to trends, changing preferences, or changing opportunities?

Role of Energy Efficiency

Q14. How would you rate the importance of energy efficiency in your clothes dryer product line? Would you say it's a high priority, low priority or somewhere in between?

Q15. Do you offer any ENERGY STAR-rated dryers?

a. Why or why not?

b. IF OFFERING ES: Get details on brands, percent of sales, when introduced, electric or gas, and largest US markets.

Q16. What roles do you see for the following technologies in the future U.S. product mix for dryers?

a. Condensers to separate the moisture from the drying air

b. Hybrids that use gas or electric heat pumps and standard drying technology

c. Heat recovery of exhaust air

d. Steam injection

e. Smart phone or internet interactive features

f. Communication with a paired washer

Q17. Are there any other technologies that are changing the market? IF YES: Get details.

Q18. Do any of these technologies have the potential to go mainstream? Why or why not? (Probe on consumer wariness of new technology)

Q19. To what markets might they appeal?

Q20. Is your company offering any of these technologies yet or planning to do so in the future?

Distribution Channels

Q21. How are your different brands distributed for the residential market? For instance, do you sell direct to key retail chains or go through regional distributors? Do you manufacture different models for these channels? (Get details, note any differences by brand or end user)

a. Is this different in the Northwest than in other parts of the country?

Q22. What percentage of your dryers go into multifamily housing?

Q23. How are these units distributed and sold? (Probe on MF builders, management firms, third-party equipment providers)

Q24. How do the dryers purchased for multifamily buildings differ from the single-family market?

Pricing

Now I have some questions about prices for clothes dryers.

Q25. What has changed in prices paid by residential customers for clothes dryers in the past 2 years, and 5 years?

Q26. Why have these prices increased/decreased (PROBE on changing manufacturer/materials costs, strategic product positioning, bulk purchase discounts, improved features, etc.)

Q27. How price sensitive are customers for dryer purchases?

Q28. What is the marginal cost of your most efficient dryer products? (Distinguish models they are referencing, e.g., ENERGY STAR or heat pump models)

Q29. What is the marginal cost of gas dryers over electric, and why do these cost more?

Q30. What price trends do you expect for the next 2 to 5 years? Should we expect to see increasing or decreasing prices for any specific dryer types?

Marketing and Customer Demand

Now let's discuss your marketing activities.

Q31. How does your company market clothes dryers for the residential market? (IF NEEDED: For instance, do you place advertisements online or in newspaper/radio/TV advertising? Do you promote the product on the floor with signage or displays? Do you do direct mail or offer co-operative marketing for retailers to market the product?) Anything else?

a. (If NO marketing) Why do you choose not to market clothes dryers to households? (Probe to see if they just rely on retailers)

Q32. Who are your primary target markets for clothes dryers? For instance, do you focus on specific demographic groups, genders, home remodelers or other groups?

Q33. What are your key marketing messages, and do these vary across your different products? (PROBE on control settings, equipment durability, service/warranty agreements, improved technology, energy efficiency, gas vs. electric, etc.)

Q34. Is your marketing any different in the Northwest than the rest of the country?

a. If YES: How is it different, and why is this?

Q35. In the past year, have you changed your consumer marketing for clothes dryers in any way?

a. IF YES: What changes have you made, and why? (Probe for messaging, modes, amounts and products)

Q36. What dryer features are households most interested in, and how important are these features relative to retail price? (Probe on size/capacity, settings, dry time, clothing impacts, matching washers, brand reputation, fuel source [gas or electric] etc.)

Q37. How important is clothes washer pairing in dryer purchase decisions?

Q38. Does your company focus primarily on new washer models or technologies, new dryers, or both? Why is that?

Heat Pump/Hybrid Dryer Manufacturers only

Now I have a few questions specifically about your heat pump/hybrid dryers.

Q39. How do you get distributors/retailers to stock and promote your heat pump/hybrid clothes dryers?

a. Which distributors/retailers are you working with?

b. Are you trying to get additional distributors/retailers to carry your products?

c. Have you had any challenges working with specific distributors/retailers? (If YES get details)

Q40. Do you have any concerns about how your heat pump/hybrid dryers are being presented to customers in retail stores?

a. If YES: get details on known or potential issues

Q41. What technical training do you provide to retail staff?

Q42. What are the most common barriers to purchasing heat pump/hybrid clothes dryers? (PROBE on new technology concerns, order/delivery time, capital costs, install time/costs)

Q43. How are you trying to overcome these barriers?

Q44. Are there any consumer segments that are most amenable to purchasing heat pump/hybrid clothes dryers? If YES: What makes this segment more amendable?

Q45. Have any consumers called you after a heat pump/hybrid installation needing assistance with their clothes dryer? (If YES get details on problem and resolution)

Q46. What are the main technological challenges associated with the installation and use of heat pump clothes dryers?

Q47. Have any of your heat pump/hybrid dryers been returned due to technical failures?

a. If YES: Get details (percentage and typical models, reasons)

Q48. Five years from now what do you think U.S. market share will be for heat pump clothes dryers, and hybrid models?

a. Why do you say that?

Q49. How could utilities best help to accelerate the market growth of heat pump and hybrid models?

Closing

We have just a few more questions. We're almost done.

Q50. What technological trends are you seeing with clothes dryers?

Q51. What do you think the market share of ENERGY STAR qualifying models will be in 5 years?

a. And in 10 years?

Q52. What demographic trends will affect clothes dryer demand in the next five to 10 years?

Is there anything else that would be important for us to know regarding the market for clothes dryers or your specific products?

Thank you very much for your time and good information!

Interview Guide for Clothes Dryer Retailers

Objectives

The objectives for the retailer interviews include:

- Understand stocking and procurement practices for clothes dryers;
- Identify most popular dryer types, brands;
- Document retailer awareness of heat pump dryer technology and future stocking intentions;
- Identify dryer pricing trends;
- Document marketing techniques and target markets for clothes dryers;
- Understand customer product preferences and importance of energy efficiency; and
- Identify installation costs and technical issues

Note: These objectives pertain to both electric and natural gas clothes dryer models.

Target Interviewees

We will conduct in-depth interviews with up to seven retailers, targeting store or laundry department managers, or corporate purchasing staff that are very experienced with clothes dryers sales. (Some interviewees may still not be able to answer all the questions, depending on their role.) The interviews will include a mix of residential appliance stores and more general "big box" stores.

Recruitment

Hi, this is _____ with Evergreen Economics, an energy program evaluation firm based in Portland, Oregon. We're calling on behalf of the Northwest Energy Efficiency Alliance – NEEA – who engaged us to conduct research on residential clothes dryers. This is not a sales call.

NEEA has asked us to speak with home appliance retailers to help NEEA and its northwest utility partners understand the market for energy efficient models so that NEEA can provide better support to retailers to help them sell more of these models. Anything you tell us will be kept anonymous.

IF WE DO NOT HAVE A CONTACT FROM NEEA: Can you please direct me to the person at your store that is most familiar with your clothes dryer sales? This might be a laundry department manager or the store manager.

WHEN CORRECT PERSON IS ON THE PHONE:

Repeat Intro above.

Is now a good time to talk about the clothes dryers you sell, or can we schedule a time to talk for about 45 minutes?

IF NEEDED: We understand that you are very busy working with your regular customers and we are willing to schedule interview times outside of traditional working hours. We can also email you the questions in advance to make the interview go faster.

IF NEEDED: NEEA is an alliance of more than 140 northwest utilities and energy efficiency organizations working on behalf of more than 13 million consumers with annual spending of about $10 billion.

IF NEEDED: Strategies that NEEA is piloting or may implement in the future include retailer per unit sales incentives, or SPIFs, product trainings and sales staff enter-to-win drawings.

IF NEEDED: We will also be interviewing manufacturers and other retailers and including summarized findings in a market study report for NEEA in Q3 of 2016. We never identify any company or individual in these reports.

IF THEY HAVE ANY CONCERNS: Ask them to contact Amy Webb (NEEA) at 503-688-5447 for more information about the study.

Stocking, Procurement and Sales

First, I'd like to get some general information about you and your store(s).

Q1. (IF RESPONDENT ROLE NOT CLEAR) Which of the following best describes your job responsibilities? Are you:

a. A company owner or key manager
b. A store department manager
c. A sales associate
d. Something else (Specify)

Q2. Do you have a role in ordering clothes dryers to keep in stock?

Q3. Do you sell any dryers that use natural gas?

Q4. IF YES: What percentage of your total dryer sales are for gas models?

NOTE: If selling natural gas dryers, we will probe on electric v. gas models in following questions.

Q5. Which clothes dryer brands do you keep in stock? (Probe on electric v. gas, and if gas are the same/different models than electric)

Q6. Do you offer other clothes dryers that are not kept in stock?

a. If YES: Get details (Probe on electric v. gas, and if same/different models)

Q7. (IF RESPONDENT INVOLVED IN STOCKING DECISIONS) For the clothes dryers you keep in stock, do you purchase these from the manufacturers or from distributors? (Get details – may vary by brand. Record distributors used.)

Q8. (IF RESPONDENT INVOLVED IN STOCKING DECISIONS) How would you rate the importance of energy efficiency when considering which clothes dryers to stock for your customers? Would you say it's a high priority, low priority or somewhere in between?

Q9. What types of energy efficient models do you offer? (Listen for ENERGY STAR, condensing and heat pump models, but do not prompt or probe)

Q10. I'd like to discuss five general types of clothes dryers with you. For each of these types, can you give an approximate percentage of your annual dryer sales that come from each type?

a. "Standard" or "basic" vented dryers with no moisture sensors

b. Standard vented dryers with moisture sensors

c. Ventless dryers with internal condensers to recycle warm air from exhaust moisture

d. Heat pump dryers – These models also reuse warm air from the exhaust moisture but use a heat pump instead of a condenser. The dryers can be vented or ventless.

i. When did you start offering these?

ii. Do you keep these in stock, or do special orders?

e. Hybrid dryers - These models that can be operated in heat pump or standard mode.

i. When did you start offering these?

ii. Do you keep these in stock, or do special orders?

Q11. Do any of the dryers that you stock meet the requirements for ENERGY STAR?

a. If YES: Get details on brands, percent of sales for ES electric and ES gas models.

Q12. What are your most popular clothes dryers?

a. Why are these sales highest? (Probe on influence of any rebates/state tax credits)

Q13. (IF RESPONDENT INVOLVED IN STOCKING DECISIONS) How do you determine which types of clothes dryers to stock at your store?

Q14. How has your product mix changed in the past year?

a. Why were these changes made? (Get details, e.g., new models or price points, want more ENERGY STAR models, cheap natural gas, etc.)

Q15. How is your product mix likely to change in the next year?

a. Why are these changes happening? (Get details, e.g., new models or price points, want more ENERGY STAR models, cheap natural gas, etc.)

Q16. (IF NO PLANS FOR HEAT PUMPS/HYBRIDS MENTIONED) Do you think your company will start selling heat pump or hybrid dryers in the next few years?

a. Why is that?

Pricing

Now I have a question about prices for clothes dryers.

Q17. In the past 2 years, have the prices paid by residential customers for clothes dryers changed, for models with similar feature sets?

If YES:

a. How have prices increased or decreased, and for which models (get details on percentage changes)?

b. Why have these prices increased/decreased (PROBE on changing manufacturer/distributor prices, strategic product positioning, bulk purchase discounts, improved performance, etc.)?

Marketing and Customer Demand

Now let's discuss your store's marketing for clothes dryers.

Q18. How does your store market clothes dryers to the residential market? For instance, do you place online, TV or radio advertisements? Do you use direct mail?

a. Do you do these regularly, or mostly as part of special promotions?

Q19. Do you place in-store displays or point of sale materials and if yes, how much of this material is provided by the manufacturer to place?

Q20. Do you ever run special promotions with specific dryer manufacturers? (If YES: Get details)

i. If YES: How much do special promotions or limited time offers drive dryer sales?

Q21. (If NO marketing) Why don't you market clothes dryers to households?

Q22. Who are your primary target markets for clothes dryers? Do you focus on any specific demographic groups, genders, home remodelers or other groups?

Q23. (If doing dryer marketing) What are your key marketing messages, and do these vary across your different products? (PROBE on rebates/incentives, control settings, equipment durability, service/warranty agreements, improved technology, energy efficiency, etc.)

Q24. In the past year, have you changed your marketing for clothes dryers in any way?

a. IF YES: What changes have you made? (Probe for messaging, channels and amounts)

b. Why did you make these changes?

Q25. What product features are households most interested in? (Probe on size/capacity, settings, dry time, clothing impacts, matching washers, brand reputation, etc.)

Q26. Do customers ever switch to a gas model when they have electric service, or vice versa? (If YES probe on prevalence)

Q27. How important is energy efficiency to residential customers? (Probe on how many ask for ENERGY STAR models)

Q28. For customers that want an energy efficient model, which models do you promote to them?

Q29. Regarding new dryer technologies or features, what percentage of your customers could be classified the following ways, if product price is not a chief consideration?

a. Very receptive of new technology

b. Somewhat receptive

c. Neither receptive or wary

d. Somewhat wary

e. Very wary

Q30. (IF SELLING HEAT PUMP OR HYBRID MODELS) What are the biggest challenges to selling heat pump/hybrid clothes dryers? (PROBE on new technology concerns, sales staff knowledge, order/delivery time, capital costs, install time/costs)

Q31. What percentage of customers are doing an emergency replacement – their clothes dryer broke – versus replacing a functioning dryer?

Q32. Can you estimate the percentage of your clothes dryers that are going into multifamily apartments, versus detached single-family homes? (If YES get details)

Q33. (IF THEY KNOW ABOUT MULTIFAMILY SALES) Do the types of dryers purchased for multifamily buildings differ from the single-family market in any way? (If YES get details)

Q34. What percentage of dryers is sold as a laundry pair (washer and dryer purchased at same time)?

Q35. For customers buying a dryer only, what percentage is trying to match their existing washer? (Probe – same brand, capacity, color?)

Installs

I just have a few questions about clothes dryers your store delivers and installs for residential customers.

Q36. Regarding the dryer installers you use, how are they selected and are they trained by your store or do they receive specific training from one or more manufacturers?

Q37. Are there any technical issues that your installers have more challenges with? (Probe on gas hookups, condensing and heat pump dryers)

Q38. (IF SELLING HYBRID MODELS) During the installations of heat pump hybrid dryers, are these always set to heat pump mode, or do some customers request the standard operation setting?

Q39. Have any customers called you after an installation needing assistance with their clothes dryer? (If YES get details)

a. Was their situation resolved? How so?

Closing

Those are all of our questions. Is there anything else that we should know regarding your store's clothes dryer products?

Thank you very much for your time and good information!

Interview Questions for NEEA and SEDI Staff

SEDI Rep	NEEA Technology & SEDI contact	NEEA Super Efficient Dryer & Gas Initiative Managers	Topics / Questions
●	●		How does SEDI define super efficient dryers?
●	●		How do gas dryers fit in?
●	●		What is the SEDI initiative seeking to accomplish?
●	●		What has it done already?
●	●		What are the next steps?
●	●		How does it interact with regional collaboratives, EPA, and other stakeholders?
●	●	●	How is NEEA involved?
●	●	●	What do we know about the market and market interventions from introductions of hybrid water heaters into the market in other parts of the country?
●	●		Where are manufacturers going with dryers overall? What are the overall trends and developments?
●	●		What has SEDI learned from one-on-one conversations with manufacturers?
●	●		What are manufacturers doing with heat pump dryers? Who offers? Where? How are they positioning them?
●	●		What are manufacturers doing with hybrid dryers? Who offers? Where? How are they positioning them?
●	●		What are the offerings on the natural gas side? What are the differences in energy efficiency? Based on what? Who offers? Where? How are they positioning the more efficient dryers?
●	●		Who at the manufacturer level could inform us further (and objectively) about the direction the dryer market is going and the role of high efficiency dryers?
●	●	●	Where is EPA going with Energy Star dryers?
●	●	●	What are the current standards? Based on what? How many dryers qualify and what kind?
●	●	●	When is the next revision to Energy Star standards for dryers expected? What is being discussed?
	●	●	What does NEEA already know about the performance of super efficient dryers?
	●	●	What are the tiers and their associated efficiency levels?
	●	●	What, if anything, does NEEA know about non-energy benefits so far?
	●	●	What are the incremental costs of a heat pump dryer? Other superefficient dryers?
	●	●	Incremental compared to other high end models?
	●	●	Incremental compared to mainstream models?
	●	●	Anticipated level of financial incentive, if any?
	●	●	What other investigations has NEEA done on the technology that we should know about?

SEDI Rep	NEEA Technology & SEDI contact	NEEA Super Efficient Dryer & Gas Initiative Managers	Topics / Questions
		●	What are NEEA's current plans and intentions for its work on super efficient dryers?
		●	What are the plans with...
		●	its continued relationship with SEDI?
		●	its efforts to influence federal efficiency standards?
		●	its support of manufacturers who are introducing super efficient dryers into the market?
		●	its involvement in supporting Energy Star rated dryers?
		●	its support of utility programs?
		●	What has been the nature of NEEA's contacts with manufacturers about efficient dryers?
		●	With whom?
		●	What has NEEA learned?
		●	Who at the manufacturer level could inform us further (and objectively) about the direction the dryer market is going and the role of high efficiency dryers?
		●	What has been the nature of NEEA's contacts with retailers about efficient dryers?
		●	With whom?
		●	What has NEEA learned?
		●	Who at the retailer level could inform us further (and objectively) about the direction the dryer market is going and the role of high efficiency dryers?
		●	What did NEEA try when it promoted heat pump dryers?
		●	How did it turn out?
		●	What worked?
		●	What didn't work?
	●	●	What are the most important insights NEEA needs from the market characterization?