

CLEAResult

Energy Trust of Oregon Existing Homes Gas Water Heater Market Research Report

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Executive Summary

Energy Trust of Oregon's Existing Homes program has long been working to increase savings from the water heating channel. Energy Trust has offered incentives for efficient gas tank water heaters since 2004, and has aligned with the ENERGY STAR® standard since it was launched in 2009. Water heating savings represent approximately two percent of the program's overall savings portfolio across fuels and this study estimates that the program is currently capturing approximately one percent of the water heater replacement market annually.

Upon completion of the *Domestic Hot Water Research and Programs Summary*, which was submitted to Energy Trust in June 2015 (*Appendix I*), CLEAResult launched this Gas Domestic Hot Water Research Project. The overarching goal of this study is to assess the state of the water heater market in Oregon and SW Washington to inform program design strategies that will acquire more energy-efficiency savings through this channel. The focus is on the gas water heater market as the electric water heater market has been thoroughly assessed by the Northwest Energy Efficiency Alliance (NEEA). While the emphasis is on the gas water heater market, the review of existing research, key findings and recommendations address opportunities across fuel types.

RESEARCH GOALS

The purpose of this research is to provide Energy Trust and program implementation contractors with:

- An understanding of current market characteristics, including the impact of 2015 federal code changes, savings potential, and supply chain relationships.
- Barriers to program participation and opportunities to overcome the market and installation challenges.
- Recommendations for program design enhancements and new strategies to influence the water heating market and drive residential savings.

METHODOLOGY

As part of this study, CLEAResult analyzed Residential Building Stock Assessment (RBSA) data, Energy Trust data, past NEEA research, and federal code changes. Additionally, CLEAResult conducted interviews with a wide range of water heater market actors to discover barriers to installing high-efficiency gas water heaters and to participating with the program, as well as understand market perceptions. Market actors interviewed include manufacturers, manufacturer's representatives, distributors, retailers, and contractors. Interview guides were developed in collaboration with NEEA and Energy Trust (see *Appendix III*).

KEY FINDINGS AND RECOMMENDATIONS

There is large potential for savings. While energy savings benefits to the individual end user are relatively low, the gas water heater replacement market represents one of the largest cost-effective residential measures available in the region. If all the water heaters in Energy Trust territory were replaced with a 0.67+ energy factor (EF) rather than a 0.62 EF, it would represent first-year savings of up to 910,000 therms per year.¹ Additionally, missing a significant portion of the replacement market represents a true lost opportunity as water heaters are only replaced periodically, unlike other measures, like insulation, that can be accomplished at any point. The savings potential for heat pump water heaters (HPWHs) in the replacement market is large as well, at around 50 million kWh annually.²

- Recommendation: Given the market potential, Energy Trust programs should continue to pursue this resource.

¹ We have calculated an approximate annual market size of 30,000 gas water heaters replaced per year; see the *Market Size and Savings Potential* section for details. Annual unit savings are 29 therms/year.

² We have calculated an approximate annual market size of 33,000 electric water heaters replaced per year; see the *Heat Pump Water Heaters* section for details. Annual unit savings are 1512 kWh/year.

Upstream incentives alone may not lead to success. Distributors respond to contractor demand for products and contractors demonstrate loyalty to preferred distributors. Because of this market dynamic, distributor and manufacturer incentives alone may not be the most effective avenue to increase the installations of 0.67+ EF water heaters³.

- Recommendation: Manufacturers and distributors are well positioned to help educate their installers about 0.67+ EF water heaters and program offers. Focus manufacturer and distributor efforts on opportunities to help these market actors educate their installers.

Contractors are the key players in the supply chain. In the majority of bids, 0.67+ EF water heaters are not offered as an option. While distributors play a role in educating contractors about product capabilities and benefits, it is up to the contractor to complete the sale. And, as noted above, contractors drive distributors' stocking practices.

- Recommendation: Identify ways to generate leads for contractors through marketing activities. Successful contractors value qualified leads and marketing that rewards them for installing qualifying water heaters. Finding methods that promote an individual contractor with Energy Trust's endorsement in some manner is critical, particularly large volume contractors.
- Recommendation: Develop a marketing strategy that contractors can use to address the real and perceived barriers to purchase and installation of 0.67+ EF water heaters. Develop educational materials around the different technology options and considerations for various types of installation.
- Recommendation: Combine marketing efforts for gas and electric water heaters.

Contractors are not familiar with high efficiency technology. There are a number of common misperceptions about 0.67+ EF water heaters, such as the need to be power vented or that the tanks are larger, that discourage contractors from promoting these products. This education gap is further exacerbated by the recent standards change.

- Recommendation: Educate contractors on the best applications for various 0.67+ EF water heater products.

Many 0.67+ EF water heaters have a low incremental cost. The current incentive levels are not influencing contractors to upsell to 0.67+ EF water heaters, but they may be enough to offset the incremental cost in many cases. If combined with a simplified incentive redemption process and marketing leads, an incentive could be an important part of the program design.

- Recommendation: Maintain \$100 instant incentive payable to contractor.

Paperwork inhibits participation. For sales of the 0.67+ EF water heaters and HPWHs to increase, the process of capturing the required information in order for an incentive to be issued has to be extremely fast and easy. All installers and distributors cited paperwork as a barrier for their participation in energy efficiency programs; this included all parts of the process, not just a specific part (such as getting the customer signature). It is the overall time investment and impact on their relationship with their customer that is perceived as onerous.

- Recommendation: Eliminate the requirement for the homeowner's signature in order to receive an incentive. Consider only requiring a geo-stamped picture of an installed water heater or only an invoice as proof of install. This documentation must contain the model number and verify the installation is in the service territory.

Non-energy programs are potential stakeholders. The Northwest and the Portland area specifically are stressing the need for earthquake preparedness and resilience planning. Entities working on this include the City of Portland, Red Cross, PREP, neighborhood associations, and more. Installing new water heaters with electronic ignition could easily be coupled with the message of proper seismic strapping. Energy efficiency programs could partner with these entities to align messaging and leverage marketing efforts.

- Recommendation: Explore potential partners for this approach with local governments, organizations, and gas companies.

³ This approach is in use today with one local retailer, where the program makes it extremely easy for the retailer to claim the incentive and pass it on to the installer. While this approach has increased the number of 0.67+ EF water heaters being claimed in the program, it has failed to make a significant increase in the market share of the more efficient water heaters.

Drivers of HPWH sales exist that don't transfer to 0.67+ EF water heater sales. HPWHs have large energy savings; multiple NEEA reports mentioned that the primary and most effective sales message to homeowners is “save money on your bills”. The incentive is also significantly larger – large enough to move the market and large enough to counteract the perceived hassle on the part of the contractor to participating with energy efficiency programs. Neither of these factors applies to 0.67+ EF water heaters.

- Recommendation: Enhance 0.67+ EF water heater installer engagement by incorporating HPWH offers into a unified participation pathway for contractors who install both technologies.

Condensing gas tank water heaters are uncommon. None of the contractors interviewed install condensing gas tank water heaters on a regular basis. Contractors reported that they are quite expensive. Condensing gas tank water heaters are effectively mandated in the 55 gallon + range by the National Appliance Energy Conservation Act (NAECA) efficiency standards; in the face of these standards, most interview respondents stated that they expected contractors to install two smaller water heaters, tankless water heaters, or HPWHs for households with high water use requirements.

- Recommendation: Do not incorporate condensing gas tank water heaters in program strategies due to lack of contractor experience with and high cost of these products.

Tankless water heaters continue to be popular. After 0.62 EF (code minimum) tank water heaters, tankless water heaters are the biggest seller for the two manufacturers interviewed; for one of them, condensing tankless models are the most popular. Not all contractors install tankless models, but those that do prefer to sell them over 0.67+ EF water heaters. They have benefits that the 0.67+ EF water heaters do not, such as space savings, infinite hot water, and larger energy savings.

- Recommendation: Acknowledge the popularity of tankless water heaters when designing contractor education and outreach.

Drivers of cost are complex. In this report, costs were broken out by water heater type and whether a contractor was a plumber or a home performance contractor; it is possible that more detailed analysis of invoices would yield additional information on the drivers of water heater installation costs.

- Recommendation: Analyze differences in cost by model number, manufacturer, contractor, and other variables to identify any important trends.

ADDITIONAL CONSIDERATIONS

In addition to the key findings and recommendations identified in this report, CLEARResult identified a number of additional research and planning opportunities that came up through this research, yet were outside of the scope. Energy Trust and Program Management Contractors may want to address these in future research and program designs. The following considerations address gaps and opportunities identified throughout the research and review process. Many of these will be addressed by CLEARResult as the program(s) redesign water heater offerings in 2016.

- Future research and planning should address the following gaps in the current understanding of the water heating market:
 - Identify the potential for promotion of 0.67+ EF water heaters at retail. Much of this will be determined by whether or not Energy Trust considers a self-install measure for gas appliances.
 - Determine which retail strategies used for HPWHs can be applied to 0.67+ EF water heaters.
 - Determine the market shares of the different market channels to better identify the focus for new Energy Trust water heating strategies.
 - Continue to evaluate the market baseline and incremental costs for gas efficient tank water heaters and potentially incorporate into measure analysis.
- Future stakeholder outreach should consider engagement with:
 - ENERGY STAR to understand their perspectives on the market supply chain and technology adaptations to meet their requirements.
 - NEEA to identify if there are opportunities for NEEA's gas initiative to support gas water heating.

- Additional data analysis should be planned to better understand:
 - If there is a relationship between market channel and emergency versus planned replacement.
 - Differences and trends in cost by model, manufacturer, contractor, or other variables to identify the most cost-effective applications of 0.67+ EF gas tank water heaters.

MEMO

Date: April 25, 2016
To: Energy Trust Board of Directors
From: Erika Kociolek, Evaluation Project Manager
Adam Shick, Planning Project Manager
Marshall Johnson, Existing Homes Program Manager
Mark Wyman, New Homes and Products Program Manager
Subject: Staff Response to Gas Water Heater Market Research

Energy Trust's Planning and Evaluation group worked with the Existing Homes Program Management Contractor (PMC) to undertake research focused on gas water heaters. The goal of this research was to understand market characteristics, savings potential, and supply chain structure, with an eye to identifying barriers to program participation and recommendations for increasing engagement with the market. The work included interviews with a wide variety of market actors, including manufacturers, manufacturers' representatives, distributors, retailers, and contractors, as well as review of existing literature and data, and data analysis.

The results of this research indicate that Energy Trust is reaching a small fraction of the water heater market, which represents a significant source of gas and electric savings potential for the Existing Homes program.

A key finding from the research indicates that broadening the reach of the program to include additional market actors, particularly distributors and contractors, may yield greater results. Distributors are often contractors' source for water heaters; what they stock impacts what contractors can offer customers. And contractors are the ultimate decision-makers when it comes to which products are offered to customers; distributors report that contractors are the "key" to their overall sales. Interestingly, a number of interviewed distributors and contractors did not appear to be familiar with high-efficiency technology, particularly 0.67+ EF gas water heaters. Given the importance of these market actors in the water heater market, it may be useful for the program to consider directing marketing and education about efficient technologies and products towards distributors and contractors in addition to consumers. The research also assisted program staff supporting the retail Products program in better understanding the supply chain, and revealed growth opportunities for the program's engagement of leading appliance retailers. Overall, the report underscores a need for broader engagement of the supply chain, including distributors, contractors, and leading retailers.

As a result of this research, Residential sector staff are working to expand the promotion of efficient water heaters through the Existing Homes and retail Products programs by streamlining program and reporting requirements to qualify for incentives, including

reduced data requirements for current incentive application, elimination of the requirement for contractor installation of gas water heaters, elimination of the ducting requirements for heat pump water heaters, and elimination of the exception that heat pump water heaters must replace only electric water heaters. Staff are also developing plans to further transition to mid-stream incentive designs for the 2017 program year.

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1 Introduction

Water heating is the second largest source of residential energy consumption⁴, and Energy Trust is seeking strategies that more successfully engage the market to capture greater project volume and savings across the residential sector. To date, the Existing Homes program has typically engaged with contractors and distributors to drive high efficiency products in the market (and seen modest results); there have been no related Energy Trust offers at retail. Currently, the water heater market is in a state of flux as new products emerge, new sales channels develop, and significant changes to federal standards come into effect. In light of these past challenges and changing market conditions, the program determined it was necessary to perform research to better understand the water heater market before implementing new program designs intended to unlock this source of savings.

The electric water heater market is not the focus of this research because it has been covered extensively by NEEA and a summary of the research done by NEEA is presented later in the report. In addition, the region has had extensive market pushes in the electric water market centered on heat pump technology. However, there have been no regionally coordinated marketing efforts for efficient gas water heaters and the challenges in bringing them to market are different. Based on these factors, for this research, CLEARResult focused on the gas water heater market, with the intent that many findings would be applicable to both fuels. Within the gas water heater market, CLEARResult additionally focused on ENERGY STAR 0.67+ EF gas tank non-condensing water heaters. CLEARResult did not look at condensing gas water heaters in detail because condensing water heaters have a high incremental cost and are not common in the market. Throughout this paper, the ENERGY STAR 0.67+ EF gas tank non-condensing water heater is referred to as a 0.67+ EF water heater.

A thorough review of the current state of the gas water heating market was conducted along with interviews of contractors, distributors, manufacturers' representatives, and manufacturers to better understand the barriers to adoption for 0.67+ EF water heaters.

The remainder of the report is structured as follows:

- The *Background* section summarizes Energy Trust's water heater offerings, federal standards, market size and savings potential, and a summary of analysis using Energy Trust's Project Tracking data.
- The *Water Heat Market Actor Interviews* section summarizes findings from the interviews conducted with market actors.
- The *Barriers to Participation and Product Installation* section synthesizes the market actor findings, and outlines the key barriers to increasing the installation of efficient gas water heaters.
- The *Conclusions* section discusses next steps.

1.1 RESEARCH OBJECTIVES

This research was conducted in three phases. First, CLEARResult reviewed existing information that was available on the water heater market. Second, CLEARResult conducted a qualitative and quantitative assessment of the market. Finally, CLEARResult conducted interviews with market actors across the supply chain. These activities were undertaken to help answer the following questions:

1. What is the current state of Energy Trust's water heater offerings? What offerings and initiatives have been in place in the past?
2. What is the current state of the water heater market? Where is the market headed in the future, and how do various activities (for example, Energy Trust's program and NEEA initiatives) and changes (for example, federal standards) affect the market?
3. How does the water heater market work? Who are the market actors and how do they interact?
4. What considerations are involved in selecting, selling, and installing water heaters?
5. How and to whom are efficient water heaters promoted?
6. What are the key barriers to stocking and installing high efficiency water heaters?

⁴ Ecotope 2014.p. xvi.

7. What can be done to increase the number of high efficiency water heaters that are stocked and installed (for example, SPIFs, market lift, etc.)? What are the pros and cons of the various strategies?

The review of existing information included a review of existing research on electric water heaters that has been done by NEEA, which includes four reports written between 2006 and 2015.⁵ Using Energy Trust data from Project Tracking, CLEARResult analyzed past program participation and measure costs, and used this information to identify contractors for interviews. The qualitative and quantitative assessment of the market was achieved by evaluating the impact of the new federal efficiency standards contained in the National Appliance Energy Conservation Act (NAECA) and using the Residential Building Stock Assessment (RBSA) and the 2011 Verinnovation study to assess market size and potential from two different directions.

Market actor interviews were conducted with three manufacturers and manufacturer's representatives; five distributors; and eight contractors (both Energy Trust trade allies and non-trade allies).⁶ Interviewees were very generous with their time and interviews often went beyond the confines of the questionnaires. A considerable amount of useful information was surfaced in this way and is included in this report for reference.

Key barriers and potential solutions were identified, which will be the foundation of building an improved program design in 2016 and beyond.

⁵ Evergreen Economics, 2013; ILLUME Advising, 2015; KEMA, 2006; Verinnovation, 2012.

⁶ CLEARResult completed an interview with one retailer, but due to concerns about respondent confidentiality, the findings from that interview are not included in this report.

2 Background

This section brings together all of the relevant information that is available on 0.67+ EF water heaters in the replacement market in the Northwest. In order to understand the market for 0.67 EF+ waters, at times it was necessary to look at the overall water heater market. For this reason the research included information on the new homes market and other water heater product categories such as heat pump, gas tankless, and gas condensing tank water heaters.

The Existing Homes program has been offering incentives on ENERGY STAR gas tank water heaters since 2004 (see Table 1). When ENERGY STAR released a gas tank water heater standard in 2009, Energy Trust adopted ENERGY STAR certification as a requirement and continues to follow this standard today. The most recent ENERGY STAR specification, released in 2010, requires gas tank water heaters to meet an energy factor rating of 0.67 or greater. Program participation has historically been low as shown in Table 2. While savings on individual water heaters are not large, the total annual potential is estimated to be up to 910,000 therms.

The incremental cost of a 0.67+ EF water heater depends on the technology used to achieve the EF rating. Atmospheric draft water heaters cost about \$400 more than a standard 0.62 EF gas tank water heater, while power vented water heaters can cost \$1,200 more.

2.1 ENERGY TRUST WATER HEATING OFFERINGS

2.1.1 EXISTING HOMES

The Existing Homes program currently has customer-facing incentives for heat pump water heaters (HPWH) and 0.67+ EF gas tank water heaters. In the past, the program also incentivized electric tank water heaters and gas tankless water heaters. Table 1 below shows the customer-facing incentives, program requirements, and type of water heaters incented by the Existing Homes program since 2004. Contractor SPIFs and limited time bonuses are not included below.

Table 1. Existing Homes water heater incentives over time

Water Heater Type	Program Requirements	Year												
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Electric tank WH	0.93+ EF	\$25	\$25	\$25	\$25	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35	-
Electric tank WH	0.94+ EF, with a 20 year warranty	-	-	-	-	\$75	\$75	\$75	\$75	\$75	\$75	\$75	\$75	-
HPWH	Tier 2	-	-	-	-	-	-	-	-	-	-	\$500	\$500	\$500
HPWH	Tier 1, <60 gallons	-	-	-	-	-	-	-	-	-	-	-	\$150	\$150
HPWH	Tier 1, ≥60 gallons	-	-	-	-	-	-	-	-	-	-	-	\$500	\$500
HPWH	Tier 3	-	-	-	-	-	-	-	-	-	-	-	-	\$500
Gas Tankless	0.80+ EF	-	-	-	\$200	\$200	\$200	\$200	\$200	-	-	-	-	-
Gas Tank WH	0.62-0.66 EF*	\$25	\$25	\$25	\$25	\$35	\$35	\$35	\$35	-	-	-	-	-
Gas Tank WH	0.67+ EF, Energy Star Approved	-	-	-	-	-	-	\$100	\$100	\$200	\$125	\$125	\$125	-

*Incentives for 0.62-0.66 EF were offered in Southwest Washington only after 2011.

In 2004, Existing Homes began offering incentives for gas water heaters with an EF rating of at least 0.62. Beginning in 2007, Energy Trust and a number of other energy efficiency program implementers began following the emergence of mid-efficiency gas tank water heaters. This new product category was thought to hold promise as a cost-effective, high-volume gas efficiency measure. New sources of natural gas savings were especially important at that time as efficient gas furnaces became more common practice and programs looked towards water heating as the next major end use after space heat, and source of conservation savings. In January of 2009, ENERGY STAR released the first specification for mid-efficiency gas tank water heaters, which required models to be rated at 0.62 EF or better. On September 1, 2010 the requirement increased to 0.67

EF⁷. As shown in Table 2, participation since that time has hovered between 400 and 500 units per year and has not seen the rise in adoption that was initially expected as the technology matured.

Table 2 and Table 3 below show historic gas water heater incentive activity and total savings, respectively. Based on the market estimates for existing construction in Energy Trust service territory, the 414 incented qualified units in 2014 represent approximately 1 percent of the annual replacement gas water heating market. The market is estimated to be between 30,000-32,000, with the range driven by variances between the RBSA and the 2011 Verinnovation study. Market size will be further discussed in the *Market Size* and *Savings Potential* sections of this report.

Table 2. Existing Homes number of incented gas water heater units by type, 2004-2014

Water Heater Type	Efficiency Rating	Units per Year										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Tankless	0.80+ EF	-	-	-	475	908	1,018	1,335	851	347	3	-
Tank	0.62-0.66 EF	20	124	168	127	76	154	396	247	23	4	3
Tank	0.67+ EF, ENERGY STAR	-	-	-	-	-	-	10	434	503	555	414
Total Units		20	124	168	602	984	1,172	1,741	1,532	873	562	417

Table 3. Existing Homes gas water heater savings by type, 2004-2014

Water Heater Type	Efficiency Rating	Therms per Year										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Tankless	0.80+ EF	-	-	-	17,348	33,282	43,549	93,672	36,154	16,008	118	-
Tank	0.62-0.66 EF	233	1,442	2,001	1,188	701	1,430	6,972	2,623	278	65	48
Tank	0.67+ EF, ENERGY STAR	-	-	-	-	-	-	223	14,367	15,654	17,599	12,918
Total Therms		233	1,442	2,001	18,536	33,983	44,979	100,867	53,144	31,941	17,781	12,966

In addition to the customer-facing incentives, the Existing Homes program launched a Water Heater Installer Network (WHIN) in 2012 to support trade allies who install a high volume of water heaters and strengthen their relationship with the program. WHIN allowed participating trade allies to provide an instant incentive for qualifying water heater installations. The network was designed to provide plumbers with the training, sales tools, and the program information they need to sell energy efficiency. Website improvements, marketing support, and a customization of the contractor referral system were designed to generate leads to grow their businesses. WHIN participants were required to participate in any pilots geared towards water heaters as well as participate in instant (contractor-paid) incentives and trade ally direct install (TADI). The ability to offer instant incentives was the most popular part of this offering at the time.

Ultimately, WHIN was phased out in 2013, and all water heater installer trade allies were invited to participate in the relevant offerings of the network - instant incentives, marketing support via business development funds, and referrals via the 'service and specialties' feature in the contractor search portion of the website. Although 48 trade allies initially signed participation agreements, only two actively participated in WHIN in 2013.

The current (2015) program design for water heating includes customer-facing incentives for HPWH and 0.67+ EF water heaters, instant incentives for qualified trade allies, and stocking incentives (SPIFs) for distributors to drive sales of HPWHs and high efficiency gas water heaters. The SPIFs are a relatively new program design with early results showing some positive indications.

⁷ US Department of Energy, 2010.

2.1.2 NEW HOMES

With the overlap of trade ally subcontractors in the New Homes and Existing Homes programs, it is important to review the recent uptake of 0.67+ EF water heaters in the New Homes program to understand how key findings could impact overall residential water heating savings.

The New Homes program offers two types of water heater incentives: one through standalone incentives and another as part of a whole-home performance incentive (EPS). The standalone incentive is currently \$125 for a 0.67+ gas tank water heater. Through the EPS incentive, any water heater that is better than Oregon Residential Code is eligible and contributes to the REM/Rate modeled percent improvement of the home measured against a code baseline.

Table 4 shows recent water heater volume through the EPS track in 2014 and 2015⁸.

Table 4. New homes gas tank water heater incented units by efficiency rating, 2014-2015 (EPS track only)

Efficiency rating	Number installed	
	2014	2015
0.58-0.62 EF	624	474
0.63-0.66 EF	0	2
0.67-0.70 EF ⁹	25	39
0.71-0.79 EF	0	1
0.80-0.89 EF	0	23

Uptake of water heating incentives through the EPS track far outweighs the standalone incentives. Approximately 7 percent of new construction EPS homes, or 88 homes, installed a 0.67+ EF gas tank water heater. For the standalone incentive, no 0.67+ EF water heaters were incented in 2014, and only one has been incentivized in 2015 to date.

2.1.3 HEAT PUMP WATER HEATERS

The backdrop for HPWHs differs from that of 0.67+ EF gas tank water heaters in two key ways. First, NEEA research showed that the most effective place to apply leverage with HPWHs was at the distributor level, or by getting a manufacturer to participate in a buy down. This is most likely explained by the higher consumer demand for HPWHs which is a function of potential savings, regional market pushes by electric utilities and NEEA, and higher incentives and tax credits. Second, HPWHs have been the focus of an extensive regional education effort spanning multiple years. Contractors are more aware of their features, constraints, and benefits. Marketing messages for HPWHs are different from those that market actors interviewed for this study reported for 0.67+ EF gas water heaters. According to the Northwest Heat Pump Water Heater Market Test Assessment¹⁰, the major messages for HPWHs are saving energy, lower monthly operating cost, and rebate availability. In the report Consumer Messaging for DHPs and HPWHs¹¹, the most important consumer message was identified as “saving money on energy bills”, followed by “saving energy”. The utility bill cost savings and incentive are compelling in the case of HPWHs because the unit energy savings are significant.

While not the focus of this report, it is important to note that the market potential for HPWHs is significant. Based on an assumption of approximately 32,835 electric water heaters being replaced per year, the technical potential is 49,646,520 kWh per year. The market potential was determined using the methodology discussed in the *Market Size and Savings Potential* section of this report.

Because of this large potential, interviews for this study included questions about the barriers to installation for HPWHs. The most common concerns were cost (four respondents out of 15), space constraints (three respondents) and noise (two respondents). Additionally, concerns about the newness of the technology, and low awareness (on both contractors' and

⁸ Data limitations made it challenging to look at activity prior to 2014. In addition, since savings are custom to each home and part of a bundle it is difficult to separate savings. For these reasons only volumes are shown for the last 2 years.

⁹ These are noncondensing tanks. Higher efficiencies are condensing.

¹⁰ Evergreen Economics 2013.

¹¹ ILLUME Advising 2015.

homeowners' parts) were identified as barriers for HPWH adoption. These concerns were mentioned in both of the reports cited above. As with 0.67+ EF water heaters, relatively few HPWHs are sold in emergency replacement situations; installers indicated that although they do not stock HPWHs, they can get them immediately from distributors, and stocking is not what keeps them from being deployed in emergency replacement situations.

2.2 NATIONAL APPLIANCE ENERGY CONSERVATION ACT STANDARDS

One goal of this study was to better understand the types of changes that manufacturers made to products as a result of changes to the National Appliance Energy Conservation Act (NAECA) standards that went into effect in April 2015. It was equally important to separate the changes made to products as a result of the NAECA standard change and those made to products as a result of achieving the ENERGY STAR specification. By understanding these specific aspects of different products, the program will be able to further identify the barriers and challenges to installing 0.67+ EF water heaters.

Interviews with manufacturers provided insights into how they responded to the changes required by NAECA. In order to meet the higher federal standards, manufacturers reported they primarily increased the R-value of the insulation jacket surrounding the storage tank. In order to achieve efficiency levels necessary to achieve ENERGY STAR certification, they incorporated a variety of technologies, each requiring some sort of a power supply. A summary of the changes can be found in Figure 1.

Figure 1. Summary of standards change impacts

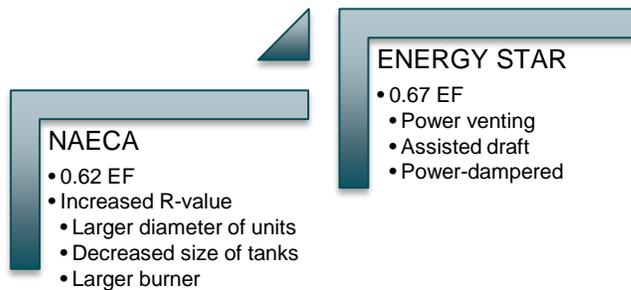


Table 5 shows the old and new EF requirements for gas tank water heater sizes. For water heaters with tank sizes at or below 55 gallons, a 4-5 percent efficiency improvement became the new requirement. For products with tanks larger than 55 gallons, a 30 percent efficiency improvement¹² was mandated.

Table 5. NAECA efficiency requirements for water heaters

NAECA EF Requirements for Residential Water Heaters							
Calculation	20-55 Gallons				Greater than 55 Gallons		
		EF = 0.675 - (0.0015 x volume)			EF = 0.8012 - (0.00078 x volume)		
Rated Storage Volume	Tankless	30	40	50	60	65	75
Pre-2015 Standard	0.62	0.61	0.59	0.58	0.56	0.55	0.53
2015 Standard	0.82	0.63	0.62	0.60	0.75	0.75	0.74

2.2.1 INSULATION CHANGES

The predominant strategy used by manufacturers to meet the new NAECA standards was to increase tank R-values primarily by increasing the overall diameter or height of the water heater by two to three inches. These increased dimensions can result in installation challenges for replacements in existing homes as the installer could need to conduct minor remodels in order for a larger tank to be installed.

¹² US Department of Energy, 2010.

The alternate strategy for increasing the R-value of the insulation jacket is reducing the storage capacity slightly, making the tank smaller internally and allowing for a thicker insulation jacket. The smaller storage tank and increase in insulation allows the overall tank diameter to stay the same, and in some cases decreases the overall tank size. To compensate for the decrease in storage capacity, manufacturers installed a larger 60,000 BTU per hour burner which typically provides a higher first hour rating and recovery rate compared to an older generation 50 gallon water heater. One manufacturer offers a 29 gallon, 60,000 Btu/h model that exemplifies this strategy. It has a 0.70 EF rating with a tank diameter of 17-3/4", making it a good fit for the retrofit market where an installer may need a new product the same size as the existing unit.

It is important to note that the increased diameter of newer water heaters is typically the result of a change that manufacturers made in response to the NAECA standards change to 0.62 EF, and is not due to the ENERGY STAR specification of 0.67 EF. This was a frequent point of confusion in contractor interviews (see the *Market Actor Interviews* section).

2.2.2 TECHNOLOGY CHANGES

In order to increase a water heater's EF rating from 0.62 to the ENERGY STAR requirement of 0.67, manufacturers deployed a number of existing technologies. Importantly, all of these technologies require that the unit have an electrical supply. The electric supply is needed to power electronic ignitions in all units and, depending on the product, may also power fans, dampers, powered anodes, and displays. The electrical supply requirement causes two significant issues: first, there needs to be a 110 V outlet near the water heater, and second, there will be no hot water during power outages. In the majority of cases, the need for an electrical connection may be the only significant difference between an installation of a 0.67+ EF water heater versus a 0.62 EF water heater. This is discussed in more detail in the *Barriers to Participation* section of this report.

The three main technologies identified were:

- **Power venting.** Power venting technology was not originally intended as an efficiency measure. Some manufacturers added it to equipment as a way to safely vent combustion gases in difficult to vent situations. This change requires a new venting system, which may impact costs as shown in Figure 5 in the *Incremental Costs* section.
- **Induced or assisted draft.** These types of units are atmospherically vented and use traditional venting materials such as B-Vent. Although these units have a fan, the purpose of the fan is not to push the combustion air through the venting system. They are natural draft appliances and the venting system is under negative pressure and can use the existing venting if it meets current code. The induced draft allows for a more precise control over the amount of air involved in the combustion process and for more surface area of internal baffling, allowing for greater heat exchange.
- **Power-dampened.** These units close a damper at the top of the tank when the gas burner is off. This allows for more heat to be transferred into the storage tank and minimizes flue losses during off cycle times. These systems can also use the existing venting system if it meets current code. These types of units are atmospherically vented and use traditional venting materials such as B-Vent.

While potentially more challenging for installers, the required electrical connection of 0.67+ EF water heaters does allow manufacturers to build in other technology components including:

- Improved NO_x control
- Digital displays of water settings
- Elimination of standing pilot lights
- Home automation, demand response and smart connectivity
- Powered anodes

2.3 MARKET SIZE AND SAVINGS POTENTIAL

The market size for gas tank water heater replacements in Energy Trust territory was estimated by comparing and overlaying the RBSA and the 2011 Verinnovation¹³ study. Both studies provided a thorough overview of the water heater market. The 2011 Verinnovation study focused on the supply chain, with interviews of about 100 retailers/distributors/wholesalers and an equivalent number of contractors. The RBSA is a field survey of over 1,850 sites in the Northwest including over 1,400 single

¹³ Verinnovation 2012.

family homes. It is designed to provide an overall profile of regional building stock. The two studies yielded similar estimates of market size, increasing confidence that the results are reliable.

Neither of these reports cover what percent of the market is currently efficient equipment. However, both reports provide some insight into what percent of replacements are planned versus necessitated by an emergency. The Verinnovation study reports that just over 50% of water heater replacements in the U.S. as a whole are planned, rather than being emergency replacements. The KEMA report cites a similar number.

2.3.1 VERINNOVATION-BASED MARKET SIZE ESTIMATE

Using a combination of residential building permits and national estimates on water heater replacement rates, the Verinnovation report estimated total water heater sales at 94,000 units in Oregon during 2010. This total includes all housing and fuel types. The Verinnovation study contacted plumbing installers and retailers to estimate the relative split between new and existing residential market size of water heater sales.

Table 6 below summarizes the results with nearly 90 percent of water heaters being installed in existing residential construction, including both gas and electric fuel types.

Table 6. Oregon estimated new and existing construction water heating market across fuels

Market	Installers (Online)	Installers (Phone)	Retailers	Average	Estimated Market Sizes
New Construction	12%	17%	80%	13%	12,220
Existing Construction	88%	83%	92%	87%	81,780
Survey Respondents	12	101	85	-	-

RBSA data indicates the Oregon state-wide split of gas and electric water heaters is 42 percent gas and 55 percent electric, (total does not equal 100 percent due to other water heating fuels). These statewide RBSA splits are applied to Verinnovation’s existing construction estimate to obtain the statewide existing construction hot water heater market by fuel type. To estimate the total annual Energy Trust gas and electric water heater market using this method, the fraction of residential utility accounts belonging to Energy Trust utilities are applied to the RBSA fuel splits¹⁴.

This approach estimates just over 30,000 gas residential water heater sales annually within Energy Trust’s service territory for the existing construction residential market that would be eligible for the Existing Homes program. Table 7 shows Energy Trust’s existing construction gas and electric annual water heater market.

Table 7. Estimated existing construction gas water heater market size

Market Size Calculation	
Oregon replacement market	81,780
RBSA Oregon water heating % gas ¹⁵	42%
Percent of Energy Trust gas residential customers	88%
Estimated gas DHW replacement market in Energy Trust territory (annual)	30,226

2.3.2 RBSA-BASED MARKET SIZE ESTIMATE

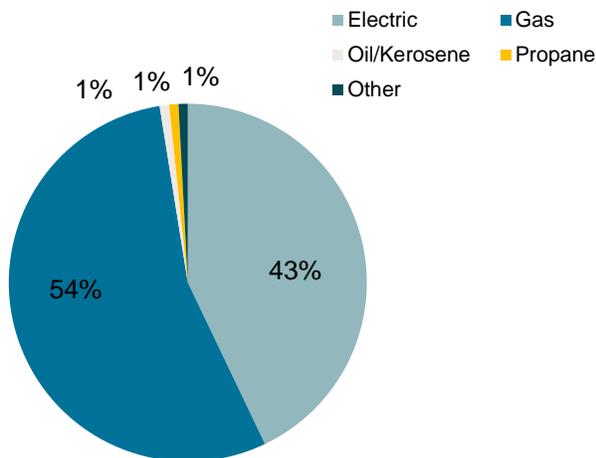
To determine potential market size from a different starting point, RBSA data for the total number of existing water heaters in Energy Trust territory was combined with an estimate for the fraction of the market replaced each year. Figure 2 shows the

¹⁴ Public Utility Commission 2013.

¹⁵ RBSA gas water heater fuel distribution for the entire state of Oregon.

fuel-type distribution of an RBSA-weighted estimate of 994,952 water heaters in Energy Trust's service territory. As shown below, the RBSA data indicate 54 percent of water heaters in Energy Trust territory are gas. After accounting for overlapping Avista units, there are an estimated 468,138 in Energy Trust service territory.¹⁶

Figure 2. Water heater fuel distribution – Energy Trust of Oregon territory



In order to use the RBSA to estimate the annual market size of replacement water heaters, it is necessary to estimate the annual replacement rate of water heaters. There is a wide range of estimates for both the replacement and the failure rate of gas water heaters. In a report prepared by Pacific Northwest National Laboratory (PNNL), the life span of a water heater ranges between 8 and 20 years depending on water and maintenance practices.¹⁷ NEEA uses the estimate of 13 years.¹⁸ In an investigation of water damage claims, the Institute for Business and Home safety (IBHS 2007) found that of the 700 water heater related damage claims they investigated, the average rate of failure was 10.7 years.

The Verinnovation report estimates a replacement rate of 6.2 percent, which corresponds closely to a 15 year useful life¹⁹. For the purpose of estimating the annual rate of replacement, CLEARResult used 6.7 percent or a useful life of 15 years to be consistent with the Verinnovation report and close to the NEEA standard.

Given an annual rate of replacement at 6.7 percent or a useful life of 15 years, it is estimated that there is a market size of over 31,000 gas water heater replacements a year in Energy Trust territory, as shown in Table 8.

Table 8. Estimated Energy Trust territory existing construction gas water heater market size

Annual Replacement Calculation	
Existing gas water heaters in Oregon	468,138
Annual replacement rate	6.7%
Estimated annual replacements	31,365

¹⁶ RBSA gas water heater fuel distribution for Energy Trust territory only.

¹⁷ SH Widder and MC Baechler 2013.

¹⁸ Northwest Energy Efficiency Alliance 2006.

¹⁹ The inverse of the replacement rate is equal to the expected useful life or the measure life. In this case $1/0.067 = \sim 15$.

2.3.3 RESOURCE POTENTIAL

The gas water replacement market represents one of the largest cost-effective residential measures available in the region. If all the replacement tanks were converted from a 0.62 to a 0.67+ EF, it would represent a savings of up to 910,000 therms per year.²⁰ Table 9 shows the potential savings the program could achieve at a variety of market share percentages.

Table 9. 0.67+ EF water heater savings for different market shares

Annual Water Heater Replacements (N=31,365)	Therms	Equivalent Number of 0.67+ EF Units
1% of total replacement market	9,096	314
10% of total replacement market	90,959	3,137
25% of total replacement market	227,396	7,841
50% of total replacement market	454,793	15,683
85% of total replacement market	773,147	26,660
100% of total replacement market	909,585	31,365

In order to put this in perspective, Table 10 (below) displays the top five Existing Homes measures in terms of annual savings based on projected savings for 2016. The middle column displays the equivalent number of 0.67+ EF gas water heater incentives that would be needed to reach the same amount of therm savings, while the column on the right indicates the percent of the total annual water heater replacement market that these units would represent.

Table 10. Annual savings estimates for top Existing Homes gas measures and equivalent water heater

Measure	2016 Projected Therms	Equivalent Number of 0.67+EF Units	% of Estimated Water Heater Replacement Market
Aerators/Showerheads	431,864	14,892	47.5%
Fireplaces	125,787	4,337	13.8%
Windows	108,908	3,755	12.0%
Ceiling Insulation	34,056	1,174	3.7%
0.67+ Water Heaters	24,107	873	2.7%
Furnaces	21,052	726	2.3%

Annual Resource Potential Based on Age Distribution of Water Heaters

In order to inform future program efforts, the RBSA distribution of the ages of water heaters and homes was reviewed. Figure 3 shows the range of ages of gas water heaters in Energy Trust territory from the RBSA. Of 468,138 total gas water heaters in the territory, over 40 percent (190,000) are greater than 10 years old and would be a good candidate for replacement.

²⁰ Savings estimate uses 29 therms per water heater from Existing Homes current measure savings.

Figure 3. Gas water heater age distribution

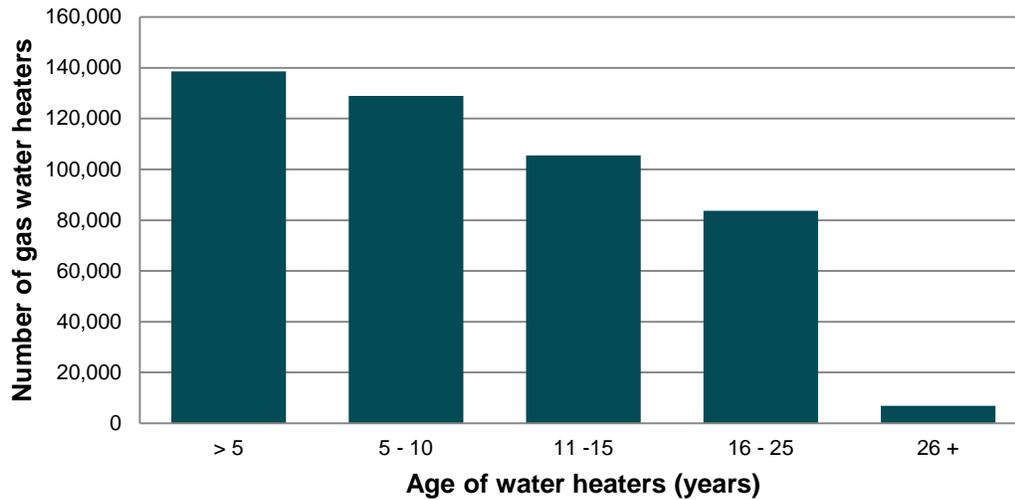
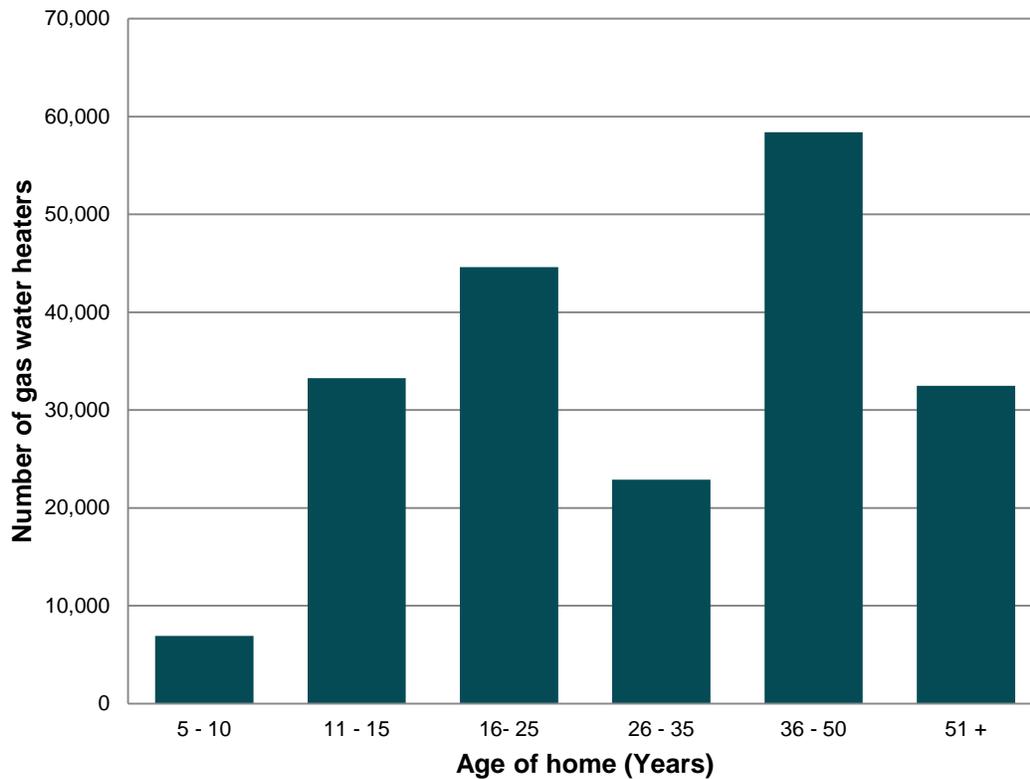


Figure 4 shows the number of potential water heater replacements for single family, multi-family, and manufactured homes in Energy Trust territory by the age of the home. The RBSA data shows potentially the greatest number of possible replacements in the home age range of 16-25 years, with over 70,000 water heaters over 10 years old. By further refining this analysis and combining with other data sources, the program will be able to increase its effectiveness at reaching the replacement market.

Figure 4. Gas water heaters (older than 10 years) distribution by age of home



2.4 INCREMENTAL COSTS OF 0.67+ EF TANKS

One perceived cause of very low market adoption of 0.67+ EF water heaters that surfaced in the interviews for this study is the perception that there are significant costs associated with installing 0.67+ EF water heaters compared to installation of a standard efficiency unit. With relatively small unit savings, gas water heater cost-effectiveness is highly sensitive to increases in cost. To examine these costs, data was collected from past program participation and online retail sources, allowing a comparison of water heater units and total installed costs for qualifying Energy Trust gas storage water heater costs relative to the new federal baseline. Cost information was then segmented by efficiency category and venting arrangements to estimate incremental costs between storage water heater technologies.

2.4.1 ENERGY TRUST PAST PARTICIPANT COST DATA

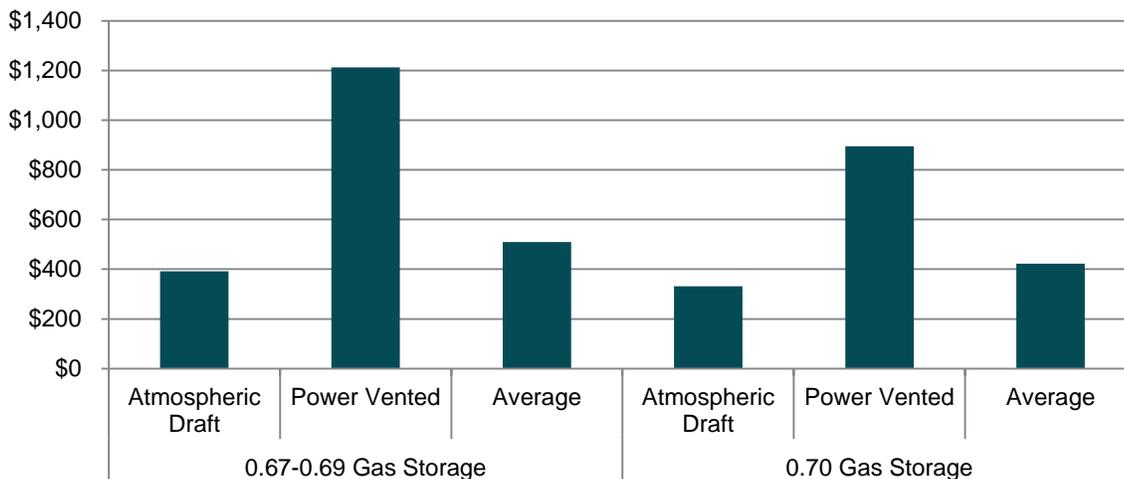
Past participation data can provide insights into total installation and incremental costs. With the adoption of new federal minimum efficiency requirements, recently discontinued program offerings for 0.62-0.66 EF gas water heaters have become the new baseline. This past participation data allows for detailed analysis of equipment, installation and the impact of venting configurations on costs of currently qualifying 0.67+ EF water heaters.

Data was sourced from Energy Trust’s Project Tracking database for the years 2011 - June 2015 and is comprised of projects installed in both Oregon and Washington. To ensure comparability of recorded installation costs, 8.2-8.4 percent sales tax was removed from Washington projects depending on year of entry in the project database (tax levels represent statewide and Clark County, WA specific total tax). All project data entered prior to 2015 uses the consumer price index to adjust installed costs to 2015 dollars²¹.

Venting configurations were identified through a combination of the ENERGY STAR qualified product list for 0.67+ EF models²² and manufacturer websites for baseline equipment.

Figure 5 shows program recorded incremental costs for 0.67-0.69 and 0.70+ EF efficiency levels and venting configurations relative to an atmospherically vented baseline efficiency unit. These incremental costs represent the unit, materials, and labor associated with the complete installation of the unit. Incremental costs for all 0.67+ EF units average nearly \$500. Large variances in costs are observed between atmospherically vented and power vented units within both efficiency tiers.

Figure 5. Average incremental installation cost from 0.62 baseline to 0.67-0.69 and 0.70 EF by venting configuration



²¹ Consumer Price Index Calculator: <http://data.bls.gov/cgi-bin/cpicalc.pl>.

²² ENERGY STAR Product Finder: <https://www.energystar.gov/productfinder/>.

Table 11 shows the number of units that contributed to the analysis. Of the 2,286 units recorded in the project tracking database incented from 2011 through June 2015 venting configurations were identified for 881, or 40%, of units via online model lookups, with 825 of these 881 (94%) having valid cost information available.

Program data for 0.67-0.70 EF units was segmented by delivery channels, standalone prescriptive installations and water heaters installed via the Home Performance with ENERGY STAR program. Venting for qualifying equipment varied significantly between the two program channels with 11% of standalone installations being power vented compared to 36% of Home Performance installs.

Home Performance projects are considered premium services and often, as shown in **Table 11**, carry an additional cost of roughly \$1,000 compared to a standalone installation through the prescriptive program, regardless of the venting configuration or efficiency level. A factor in the significant price differences between Home Performance and standalone installations is the difficulty in itemizing cost information on projects which have multiple components or measures installed, which is often the case with Home Performance projects.

The standalone installations are likely more representative of installation costs for Energy Trust incented projects, as the water heater and associated installation are likely to be the only items included in the project's invoice.

Table 11. Energy Trust gas storage water heaters by technology and program delivery channel, 2011-June 2015

Efficiency Level	Venting	Standalone Installation		Home Performance with Energy Star		Total	
		Average Cost	Unit Count	Average Cost	Unit Count	Average Cost	Unit Count
0.62-0.66 EF Gas Storage - Baseline	Atmospheric	\$1,003	56		0	\$1,003	56
	Total	\$1,003	56		0	\$1,003	56
0.67-0.70 EF Gas Storage	Atmospheric	\$1,274	622	\$2,245	82	\$1,387	704
	Power Vent	\$1,815	74	\$2,746	47	\$2,176	121
	Total	\$1,332	696	\$2,428	129	\$1,503	825

2.4.2 RETAIL GAS WATER HEATER DATA COLLECTION

To assess availability and costs of 0.67+ EF gas water heaters, data was collected online from two major retailers in September 2015. Gas water heater search results were sorted by most to least popular based on the website's custom algorithm. **Table 12** shows the count of each available type by venting technology with the corresponding cost and efficiency data points.

This retail data also indicates, despite small sample sizes, that there are atmospheric draft units available that qualify for incentives with a relatively small incremental cost of just over \$100. As with the past participant data, the power vented category shows significantly higher costs relative to the atmospheric draft units, with an incremental cost ranging from just over \$300 to almost \$600 depending on efficiency category. Retail data for tankless units revealed incremental costs from the federal minimum of just under \$300 to \$511, depending on the efficiency level of the unit. While the retail prices for the tankless units were comparable to retail prices of power vented storage units, modifications to a home's gas line during installation may drive up costs substantially relative to storage units.

Table 12. Online retail cost collection

Venting	EF Range	Sample Count	Avg. EF	Avg. Online Retail Price	Incremental Cost from 0.60-0.63
Atmospheric Draft	0.60 - 0.63 EF	32	0.62	\$540	-
	0.67 - 0.69 EF	6	0.68	\$652	\$112
Power Vent	0.67 - 0.69 EF	2	0.67	\$854	\$314
	0.70 EF	3	0.70	\$1,124	\$584
Tankless	0.82 - 0.89 EF	4	0.84	\$819	\$279
	0.90+ EF	4	0.94	\$1,051	\$511

From the program and retail data analysis it can be seen that 0.67+ EF atmospherically drafted units are available, and incremental costs are relatively low, ranging from \$112 at the retail level and \$391 installed compared to units in the federal minimum range within the program tracking database. The incremental cost for power vented water heaters is steeper. A finding from the market actor interviews (described in the next section) is that a number of market actors had a misperception that 0.67+ EF units are all power vented, potentially necessitating extensive modification to the venting for the unit.

3 Water Heater Market Actor Interviews

CLEAResult reached out to a variety of market actors to conduct a total of 15 interviews. Another 20 candidates were contacted but declined to participate. Interviewees were a mix of well-known program participants and new contacts. Interviews with all market actors emphasized gathering market intelligence on the 0.67+ EF water heaters; however, at times it was necessary to focus on the larger water heater market.

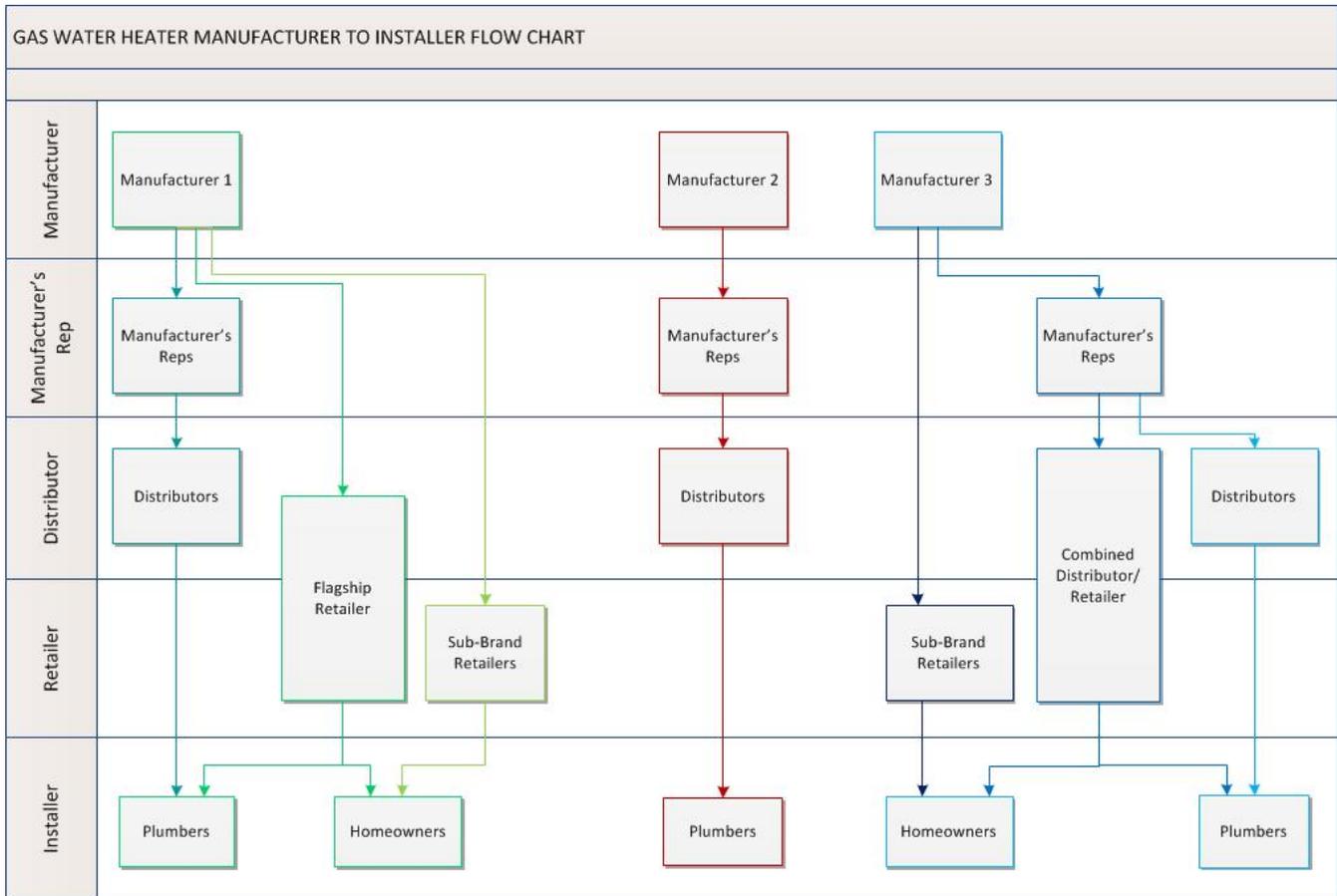
The interview guides were developed in close collaboration with Energy Trust Planning & Evaluation staff, and coordinated with NEEA's most recent HPWH market characterization report. Interviews were conducted by CLEAResult staff Bruce Manclark and Erin Connor. Their experience in working with contractors and current program offerings enabled them to capture significant insights beyond the interview questions. Before getting into the results of the interviews, it is important to understand the structure of the water heating market and the reasoning behind the interview selection process.

3.1 SUPPLY CHAIN STRUCTURE

The traditional water heater supply chain of manufacturer→ distributor→ retailer→ installer has evolved over the last several decades. In the past, manufacturers sold to distributors with the assistance of manufacturer representatives, and then the distributors resold products to plumbers or directly to homeowners. If a manufacturer produced sub-brands, they were typically sold at retail directly to homeowners. The current market structure breaks from this sub-brands to retailers only model with one manufacturer selling their flagship brand directly to customers at a large retailer.

Today it is often hard to distinguish between a distributor and an installer, or between a distributor and a retailer. The primary changes in the market are the emergence of national installation companies focused on the water heater replacement market and big-box retailers acting as hybrid distributor-retailers. In both cases, these newer business models afford market actors the ability to directly negotiate with manufacturers on matters of price, warranty, and marketing support, allowing them to offer more competitive products. In addition to supply chain evolution, consolidation has also occurred at the manufacturer level; today only three major manufacturers remain in the residential water heater market. Figure 6 shows the current structure of the market in Oregon. This is a comprehensive overview of the overall market based on interviews with market actors, and includes companies that both were and were not interviewed for this report. The figure shows the complexity of the supply chain from the top three manufacturers to the installer and homeowner level and highlights the various sub-brands, retailers and distributors engaged in this market.

Figure 6: Gas water heater supply chain



3.2 MARKET ACTOR INTERVIEWS

Interviews were conducted with market actors in all levels of the supply chain, including manufacturers, manufacturers' representatives, distributors and installers. Interviews started on August 28th and were completed October 15th, 2015 (see *Appendix III for interview questions*).

Fewer market actors were interviewed than planned. Factors stated by those who declined to participate include negative past experiences, privacy concerns, and lack of time or compensation for time. Those interviewed represent a wide range of market actors; they were very willing to share their knowledge, and provided thoughtful responses. Table 13 shows the number of interviews planned and the number that were completed.

Table 13. Summary of market actor interviews by target group

Target group	Target # of interviews	Completed # of interviews	Unsuccessful attempts
Manufacturers	No goal	2	1
Manufacturers' Representatives	0	1	1
Distributors	10-12	4	7
Contractors	12-15	8	8
Total	27	15	20

Although conversations generally followed the outline of the interview guides, interviewees were very forthcoming with information, and the conversations were often much richer and more informative than anticipated. To capture this, the summary of interviews below is organized by market actor type. Within each section, a high-level discussion covers the major

issues that were addressed during the interviews, and then a discussion of the answers to specific questions follows. Interview results are presented in this fashion to best capture the wide-ranging lessons learned from the interviews, especially those that arose naturally during the conversations.

3.2.1 MANUFACTURERS & MANUFACTURER'S REPRESENTATIVES

Manufacturers

Three manufacturers, AO Smith, Bradford White, and Rheem, account for 96 percent of the of the gas tank water heater market²³. Note that this reflects the entire water heater market, which is significantly larger than the replacement market and includes new construction, multi-family, and some commercial. Of these three manufacturers, two agreed to be interviewed. The third declined to be interviewed. Each of the manufacturers label and sell their products under a variety of consumer brand names. The reason for this practice is to allow their primary brands to be sold at wholesale only, while other brands are offered directly to consumers through retail stores.

Manufacturer's Representatives

One manufacturer's representative was interviewed as a part of this research (and represents one of the two manufacturers who were interviewed for this study). A second manufacturer's representative was solicited but declined to be interviewed. Manufacturers' representatives are the sales force for manufacturers, serving as brand ambassadors, technical assistants, and market managers for their manufacturer's various brands. Manufacturer's representatives typically receive a commission on their sales, and are utilized by manufacturers because they reduce marketing costs and allow the manufacturer's staff to cover a greater service territory than would otherwise be possible. These benefits translate to better customer service for the professional plumber and distributor.

Manufacturer's representatives call on distributors, plumbers, contractors, architects, engineers, and builders to promote their manufacturer's products. Although representatives are free to recommend and promote one model over another, manufacturers reportedly encourage their representatives to promote high-efficiency units to their customers. For this reason, manufacturer's representatives are potentially good candidates to increase participation in programs for 0.67+ EF water heaters.

Because of their product and market expertise, manufacturer's representatives are often called on by energy efficiency programs to predict where the market is headed. For this reason, the program may want to involve them in program design and be careful not to appear to favor one manufacturer over another. During the interview process, the manufacturer's representative who declined to be interviewed indicated they had attempted to participate with a program in the past, and they expressed frustration with the process.

3.2.2 INTERVIEW RESULTS – MANUFACTURERS AND MANUFACTURER'S REPRESENTATIVES

The results from interviews with manufacturers and the single manufacturer's representative are summarized together below because of the relatively low number of interviews and because the same interview guide was used for both groups.

Demographics

CLEARResult conducted interviews with two manufacturers and one manufacturer's representative (referred to as 'the representative'). The representative interviewed represented one of the interviewed manufacturers. All three respondents reported that storage electric water heaters contributed over half their total water heater sales for 2015. Of gas water heaters, sales of units with an EF less than 0.62 contributed approximately 30 percent of sales for one manufacturer and 80 percent for the other. Tankless gas water heaters were the next biggest seller, contributing 15 percent of sales for one and 10 percent for the other. The representative reported that the best-selling efficient gas water heaters for 2014 and 2015 were powered damper models. Both manufacturers, however, reported that tankless water heaters were their best-selling efficient gas water heaters of the last two years. In general, respondents reported that distributors typically decide what to stock based on

²³ Verinnovation 2012, p. 9.

recommendations from manufacturer sales representatives and responses to market needs. One manufacturer mentioned that deciding on stocking needs is an issue they struggle with.

Water Heater Pricing

The representative estimated the average installation price charged by installers for 0.67+ EF water heaters is \$1,200 and for tankless models is \$2,000-\$3,000. The manufacturers did not know installation costs. One manufacturer and that manufacturer's representative believe that the price for an efficient water heater installation will increase by up to 10 percent over the next two to five years; the other manufacturer indicated they believe pricing will remain constant over the same time period. Both manufacturers expressed concerns over the installation prices and practices of contractors selling efficient water heaters. Their concerns about prices were driven by: contractors not pulling permits, high replacement costs for tankless systems, contractors bidding too high on tankless systems to cover all contingencies, and price increases (it was not clear what was driving price increases).

Marketing

In response to questions about each manufacturer's target market, one manufacturer reported they focus mainly on distributors and contractors, but do some consumer-focused marketing online. This manufacturer's representative also reported that they reach out to a mix of distributors, plumbers, architects, engineers, and builders. The other manufacturer indicated their target market has been shifting since they began selling their primary brand directly to consumers. The representative reported that they typically conduct door-to-door sales to plumbers and distributors, while the other manufacturer focuses on marketing through a major home improvement chain.

One manufacturer and their representative reported they use energy savings, "American-made," wholesale-only product, and increased hot water volume in their marketing messages, while the other manufacturer stated they use rebates and new technology to market their products.

Both manufacturers provide some discounts. The discount amount typically depends on what is required to maintain market share. One manufacturer reported discounts to be useful when coupled with education, while the other viewed discounts as mainly a method for maintaining brand loyalty with their distributors. Both manufacturers provide discounts to either the distributor or retailer, but never to the individual making the sale. Neither manufacturer offers discounts to installers.

Both manufacturers highlighted the need to eliminate paperwork in order to promote high efficiency gas water heater sales. One suggested NEEA's upstream approach of working with distributors/manufacturers, while the representative of the other manufacturer stated that the best way to promote high efficiency gas water heater sales is to focus on education and provide the homeowner with the correct marketing message and available incentives.

Interaction Between Market Actors

Both manufacturers expressed concerns about how their gas water heaters are being installed. One mentioned that they get more returns on tankless systems compared to tank water heaters due to homeowners purchasing the tankless equipment directly, getting it home and then deciding installation is too complicated to perform themselves, and returning it to the store. The other was concerned that installers are not following venting rules, and not upsizing gas lines when necessary. Since this can cause units to fail, it is a major concern for them.

All three respondents stated there are technical challenges holding back installations of efficient gas water heaters. They identified venting, power source, and installer education as the greatest challenges. One manufacturer and that manufacturer's representative believed the average installer always installs seismic strapping and makes other code-required changes to venting, combustion air, and gas pipe sizing.

The manufacturer and that manufacturer's representative reported that they rely on contractors to promote efficient gas water heaters. They conduct training classes and supply marketing materials to contractors to ensure they are using effective messaging. That manufacturer pointed to web-based training as a method that has worked for technical education, and stated that they plan to use this approach for sales training as well.

Only one of the two manufacturers works with a Northwest retailer to promote 0.67+ EF water heaters. The other manufacturer does not work with Northwest retailers, and has had challenges working with specific retailers to promote these units. They mention problems convincing retailers to stock models that do not sell quickly. Their representative highlighted their exclusive support of professional plumbers as a reason that their manufacturer does not work with retailers on 0.67+ EF water heaters, tankless gas water heaters, or condensing gas water heaters.

Experience With Energy Trust

All three respondents reported they have had limited interactions with Energy Trust of Oregon in the past year, and any program interactions were related to NEEA. All report that Energy Trust's work has had little impact on sales. One manufacturer and that manufacturer's representative reported minimal but positive interactions with Energy Trust, and the other manufacturer reported that while they've never worked with Energy Trust, they would like to in the future.

Barriers and Challenges

The barriers to offering incentives that were cited by respondents included: hassle, lack of contractor/homeowner awareness, not having units on the truck, high first cost, low energy savings, and low incentives. One manufacturer reported that contractors don't sell value enough, but rather gravitate towards price point. They reported that HVAC contractors are better at selling efficiency than plumbers. The other manufacturer reported that consumers who don't have to modify their water heater space extensively to accept an 0.67+ EF water heater are most amenable to purchasing them. The representative for this manufacturer also suggested long-term residents were an important segment. The other manufacturer reported that consumers making planned purchases; educated, older consumers; and consumers willing to invest in their house were the most common consumer segments for 0.67+ water heaters. First-time home buyers and short-term residents were reported as more resistant to purchasing 0.67+ EF water heaters.

Only one of the two manufacturers reported having 0.67+ EF water heaters returned due to technical failures. Of the few cases where products were returned, the manufacturer cited issues relating to incorrect venting and gas pipe sizing as the cause of the problem. The same manufacturer recommended pushing the incentive upstream to help Energy Trust increase sales. The representative for this manufacturer did not mention upstream sales, but recommended educating distributors and contractors on what to stock and sell. The other manufacturer doesn't see an easy answer, but suggests providing more information at point of purchase at retailers.

Two respondents (one manufacturer and their representative) believed the new federal standards, which require tanks larger than 55 gallons to be more efficient than smaller tanks, will prompt some installers to install two small tanks in place of one large tank. The other manufacturer thinks that some contractors may switch to tankless water heaters instead.

One manufacturer believes that using upstream incentives would be a successful strategy for increasing the number of efficient gas water heaters that are stocked and installed, and points out that if the distributor is offering a large buy-down, then contractors will start offering the same. This manufacturer's representative believes that contractor/distributor awareness would help increase the number of efficient gas water heaters that are stocked and installed. They thought that a distributor SPIF would help. The other manufacturer disagreed, and stated a SPIF would only work with upstream incentives. They pointed to incentives of less than \$100 as an unsuccessful strategy for increasing stock and installation of 0.67+ EF water heaters.

3.2.3 DISTRIBUTORS & RETAILERS

Distributors

Distributors serve as the local wholesale and, in some cases, retail outlets for the various brands of water heaters. Program staff interviewed four distributors of gas water heaters, including all but one of the major distributors in the Oregon market. All interviewed distributors indicated that the installer is the key to their overall sales. For this reason, the distributor-contractor relationship is highly valued. Each distributor's internal sales team maintains contractor relationships. These relationships have often existed for years and involve not only a business relationship but also friendship. Each contractor is also likely to have unique price points for products. In general, those contractors purchasing more units receive lower prices. These lower price points are earned over time and discourage installers from brand jumping.

Distributor sales teams are trained on new technologies and equipment so that they can support contractors. Each of the interviewed distributors reported that they conduct contractor trainings and educational seminars and will, at times, send their high volume contractors to manufacturer training sessions out of state. This perk to high volume contractors is seen as an opportunity to increase distributor sales of higher margin equipment. During the interviews it became apparent that some distributors were not current with the newer technologies. This was evident when distributors were questioned about the stocking practices of condensing storage units as three of the four interviewees, who were the sales managers for each distributor, were under the impression that if a unit was "condensing" it had to be tankless. Additionally, interviewees typically could not elaborate on the different design techniques that allow a storage tank to meet the 0.67+ EF rating. If the distributors

conducting contractor trainings themselves lack knowledge about newer products and design techniques this could have an impact on the sales of high efficiency water heaters.

While the distributors interviewed are clearly competitors, there also exists a certain level of support and cooperation among them. An example of this cooperation is that, while distributors maintain and primarily sell one particular manufacturer's equipment, they often purchase amongst themselves so that they can provide all brands to their contractors. This allows them to sidestep non-compete clauses with the manufacturers and provide good customer service to their contractors.

Stocking practices of 0.67+ EF products reflect consumer demand. One of the largest distributors in the region is currently stocking only eleven 0.67+ EF units across multiple warehouses throughout the state of Oregon. The eleven in stock were primarily sold to one contractor in the Albany area. Stocking practices such as these, although not seen across the board, are common due to the lack of demand in the marketplace. For this distributor specifically, if a contractor requests a 0.67+ EF unit, they have to order it from the manufacturer.

Distributors were in agreement that SPIFs to distributors would do little to move the market, citing the paperwork burden as a barrier. Distributors reported that the best way to apply a SPIF would be at the contractor level as the contractors are the ones making the sale.

Retailers

Retailers can be divided into three groups: smaller retailers such as hardware stores; big box stores or plumbing storefronts that also serve as distributors; and plumbing retail outlets. The lines between distributors, retailers, and installers are sometimes not well defined. One major home improvement store in particular is an example of these blurred lines and represents a sort of vertical integration of sorts. Because this retailer purchases water heaters directly from a preferred manufacturer and contracts with a nationwide water heater specialist to install products, they represent a different approach to water heater sales than the average retail store. Program staff interviewed one retailer of gas water heaters, a major home improvement store, but due to concerns about respondent confidentiality, the findings from that interview are not included in this report.

3.2.4 INTERVIEW RESULTS – DISTRIBUTORS

Demographics

Interviews were conducted with four distributor representatives. Each interviewee was in either a regional or national role with their company. Each distributor firm has been in the water heater business for multiple decades, ranging from 40 to 87 years, and are companies of varying sizes. Interviewees represent the majority of distributors in Oregon.

Table 9 shows a list of the equipment that the distributors stocked, and the percentage of total business that each represents. Totals do not necessarily sum to 100% because these were approximate estimates rather than analyses of sales data, which was beyond the scope of the interviews.

Table 9. Equipment Stocked

Unit Type	Number that stocked	Percent of business
Tankless water heaters	All stocked	4-30%
Condensing water heaters	3 stocked	<5%
0.67+ EF tank water heaters	2 stocked	1-15%
Code minimum water heaters	All stocked	20-90%

The highest selling efficient gas water heater products in 2014 and 2015 were identified to be: Navien, Rinnai, Rheem, and Bradford White. Specific high volume tank models included: Bradford White M4 Model - 0.67 EF, Rheem PROG50-42N RH67

PV – 0.67 EF, and Rheem PRO+G29-60N RH70 ID – 0.70 EF. The distributor representatives identified the following factors responsible for driving sales of these products:

- New construction builders have driven demand for high efficiency units due to their desire to maximize space in homes (tankless units) and drive higher EPS scores (all units)
- Builders, engineers and architects have driven sales of 0.67+ EF water heaters as it is specified in building plans
- For existing home retrofits, the unit size has often been a major driver, i.e., what fits in the space is what gets installed
- For both existing homes and new construction, price point, performance, warranty, public demand, and marketing are also contributing factors

Market Supply

Distributors sourced 0.67+ EF water heaters from AO Smith, Rheem, and Bradford White. Tankless water heaters were sourced from Navien, Rinnai, Rheem, and others. Condensing gas tank water heaters were sourced from AO Smith, Bradford White and Rheem. None of the companies reported having problems getting the high efficiency gas water heaters they need. Two of the distributors noted that there was a longer lead time of eight to 10 weeks when the federal standards first increased. However, the lead time reduced back to three to four weeks once assembly lines were adjusted. Three of the distributors maintain a stock of 0.67+ EF water heaters while one of the distributors only purchases them upon receiving an order.

Demand was the primary explanation for why each company was motivated to stock 0.67+ EF water heaters. One distributor noted that they have been trying to educate their company and contractors about the next “latest and greatest” products. They have also used state, federal and utility rebates to help drive sales. Another distributor mentioned that the company stocks tankless water heaters because the interviewee, who is high up in the hierarchy of his company, really likes the product. Another distributor specified that their company did not stock 0.67+ EF storage tank water heaters because of the lack of demand due to venting and power requirements.

Only two of the distributors had a sense of the type of homes where the high efficiency gas water heaters they sold were installed. For one distributor, 70 percent of units were estimated to be installed in new single family homes, less than 20 percent were installed in existing single family homes and none were installed in new or existing multifamily residences. For another distributor, 30 percent of units were installed in new single family homes, 60 percent were installed in existing single family homes, and 10 percent were unknown. Three of the distributors believed the cheapest units available were being installed in multifamily projects; the fourth had no opinion. The cheapest option was identified by two respondents as electric tank water heaters.

Four distributors estimated the demand for high efficiency gas water heaters will increase by over 25 percent over the next five years. One distributor estimated that their company’s stocking practices for 0.67+ EF water heaters will increase by over 25 percent over the next five years. The other three respondents estimated their companies to increase stocking of this product type by 11-25 percent. The distributors identified the drivers of these changes to be demand and new federal standards.

Distributors explained that a contractor’s wholesale source was a big factor on influencing what 0.67+ EF water heaters to stock. Additional factors that influence the products contractors select included: utility rebates, especially with contractors that are driven to get a better EPS score to get a higher incentive, and the sales teams with which the contractor interacts.

Two distributors estimated that 90% of 2014 efficient gas water heater installations had a permit pulled. The other two did not have an estimate.

Water Heater Pricing

When asked about the future of 0.67+ EF water heater pricing, three of the four distributors anticipate an increase in the price of 0.67+ EF water heaters by 11-25 percent over the next five years. The fourth anticipates an increase of 0-10 percent. The interviewees also identified the following concerns about installation prices and practices of contractors selling efficient water heaters: the large physical size of the efficient water heaters has already been an issue in retrofit applications (2 reported); venting, gas line sizing, and electrical requirements have already been an issue with installation and will increase installation prices (1 reported); and the largest price increase is expected with the tankless models due to contractors not staying on top of the new technology or installation requirements (1 reported).

Marketing

All four distributors identified contractors and installers as their primary market. One distributor specified that new construction builders are a large market for them due to large custom homes with radiant floor heat. Two interviewees identified homeowners as an additional target market. The main reason identified for why the distributors have chosen not to market 0.67+ EF water heaters was due to a lack of consumer demand.

Two distributors said their company has marketed 0.67+ EF water heaters through mailers to contractors and in-store training. Another distributor said their company does not specifically market water heaters; rather, they focus more on promoting high end finishes to the consumer.

The distributors identified their key marketing messages for 0.67+ EF water heaters as rebates (2 reported) and technology - especially the smart technology that allows people to see what's going on with their water heater (1 reported).

Two of the four distributors have offered discounts to customers on 0.67+ EF water heaters. One distributor specified that they have offered a 10 percent discount to contractor companies and noted that the discount was not very effective. Another distributor has offered a 20 percent discount to a contractor company and said it had ten times the impact when compared to other forms of marketing.

Interaction between Market Actors

Distributors identified several challenges that have held back installations of 0.67+ EF water heaters, such as venting and size; electrical and gas line changes; and the average plumber not being up to speed on the 0.67+ EF technology and utility incentives.

Overall, the distributors seemed confident in 0.67+ EF water heater installers. All four of the distributors thought the average contractor takes the following actions when efficient or inefficient gas water heaters are replaced: installs seismic strapping to code, makes venting and combustion air improvements required by code, and makes any adjustment needed to satisfy gas piping requirements in code. None of the distributors had any concerns about how 0.67+ EF water heaters were being installed. However, one distributor identified that when contractors have undersized tankless units, it has negatively changed public perception of that product.

Three of the distributors rely on contractors to promote 0.67+ EF water heaters. To ensure effective messaging to households, two distributors have provided specific rebate and energy factor information to contractors; the other company provided education and training through a manufacturer's representative.

Overall, most of the distributors had positive relationships with the water heater manufacturers with whom they work. Better literature, lead time, product changes, and defective water heater issues were identified as areas for improvement. No distributor identified any challenges working with specific manufacturers. One distributor identified that two manufacturers had made a good decision to stick with a brass boiler drain while the third manufacturer chose to change the drain to plastic. Two other distributors noted that one of the manufacturers did a better job at designing 0.67+ EF models and have a wide range of models available.

None of the distributors interviewed have worked with any Northwest retailers to promote 0.67+ EF water heaters. Explanations for why this was the case included: the large volume retailers buy product directly from the manufacturer and retailers sell based on price and buy through their own channels.

One distributor incorrectly stated that there were a few models of 0.67+ EF water heaters that did not require being plugged in, but did not know the specifics. The other distributors were not aware of any such models.

Experience with Energy Trust

The distributors had little to no interaction with Energy Trust over the past year. One interviewee had a vague knowledge of Energy Trust rebates via the website and another had very limited involvement. Two of the companies had not had any interactions with Energy Trust. When asked about the impact that Energy Trust had had on the company's sales of residential high efficiency gas water heaters over the past year, two of the interviewees noted that there was great impact in new construction due to the marketing and available incentives but there was not as much impact on the existing homes side. The impact in new construction was primarily on sales of tankless water heaters, which builders install as a means to increase their Energy Performance Score (EPS), leading to higher incentive amounts from the Energy Trust of Oregon New Homes program. That being said, each distributor was aware that these units were moving in the market and explained that the reason was due to the available incentives and tax incentives.

None of the distributors identified any challenges working with Energy Trust in 2014 and 2015. When asked to rate their satisfaction working with Energy Trust on a scale of 1 to 5, with 1 meaning “not at all satisfied” and 5 meaning “very satisfied,” three interviewees rated their experience as a three and one ranked their experience as a two. However, they explained that these numbers were just a neutral choice reflecting no opinion because they did not work directly with Energy Trust.

Barriers and Challenges

Distributors identified several barriers to purchasing 0.67+ EF water heaters, including cost, installation time, education, and footprint. When asked about the technological trends of 0.67+ EF water heaters, two distributors mentioned that needing an electrical outlet added more cost to the installation.

With respect to federal standard changes, interviewees identified the following impacts (one each): light duty commercial water heaters have been selling because homeowners still want volume; the cost of installation will increase; on the electric side 60-, 80-, and 120-gallon tanks will disappear from the market and it will shift to heat pump water heaters; on the gas side, there will be more efficient units; tank dimensions due to increased insulation will impact the market; and two smaller tanks may be a good option instead of one larger tank.

The distributors identified a few strategies and approaches that have *not* been successful at increasing the number of 0.67+ EF water heaters that are stocked and installed. They would not recommend including rebate paperwork that is annoying or challenging to complete, speaking from their experience in how challenging it can be to acquire paperwork from contractors, and distributor SPIFs (two distributors mentioned this specifically).

Distributors identified several strategies to help increase the number of 0.67+ EF water heaters stocked and installed. Recommendations included (one distributor mentioned each): homeowner rebates; customer rebate at point of sale with contractor instead of any additional paperwork; and Energy Trust marketing focused on homeowners instead of contractors, similar to the NEEA marketing materials.

One challenge to promoting 0.67+ EF water heaters is distributor product knowledge. As noted above, three of four respondents were unaware that there are condensing tank water heaters.

3.2.5 CONTRACTORS

In general, water heater contractors can be divided into three categories:

- Contractors who focus on the replacement water heater market
- Traditional full service plumbing companies that install water heaters as a part of their offerings
- Home Performance with ENERGY STAR contractors

CLEAResult interviewed eight high and low volume installation companies throughout Energy Trust territory representing all three categories of contractors. Five are current Energy Trust trade allies and three are non-trade ally contractors. One contractor focuses on the replacement water heater market; five are traditional full-service plumbers; and two are Home Performance contractors.

One of the interviewed contractors is a national organization that focuses solely on water heater replacement. It serves as an installer and distributor inasmuch as they purchase some of their products directly from the manufacturer. Their role as the primary installer for a major national home improvement chain also gives them influence at the retail level. Due to these relationships, this contractor has lower price points than the traditional plumber and can offer longer warranties than even other installers offering the same product.

The installer discussed above also has a sales process that is more sophisticated than the typical plumber. Upon receiving a telephone or email they assign an account manager to oversee the project. They, like the retailer they work with, typically offer “good”, “better” and “best” options to their customers. The sales team for this contractor has also integrated energy incentives and tax credits into their sales model. They understand the value a tax credit and incentive provide, both from a financial perspective as well as a third-party endorsement of their products. A further example of this understanding is this installer chooses to represent the Energy Trust \$125 incentive for 0.67+ tanks as \$200, funding the difference themselves. Crews for this installer also carry multiple models of tanks on their trucks and can adapt to onsite conditions as necessary, allowing them to install efficient water heaters the same day, even in an emergency replacement scenario.

More traditional full-service plumbers purchase their products from distributors. Generally, contractors have relationships with between one and three distributors. Distributor-contractor relationships are often long term and deeply valued. The benefits to contractors include volume purchasing, expedited service and, in some cases, an extended due date on invoices. Although beneficial from a business perspective for both parties, these relationships limit the brands a contractor will purchase. While some manufacturers offer easy-to-install efficient options, the distributor relationship may be a barrier to a contractor's ability to diversify the products they offer.

Home performance contractors represent a business model that is very different from that of the average installer. Home performance is paperwork intensive, often has a higher profit margin than conventional work, and home performance contractors often replace water heaters for reasons other than unit failure. These contractors promote sealed combustion power-vented and tankless units as an indoor air quality (IAQ) measure. They report that they typically offer the water heater at or near cost as a loss leader to bring in more extensive home performance work²⁴. The home performance contractor interviewed stated the real value of the Energy Trust gas water heater incentive was as a third-party endorsement. While these contractors successfully promote and install 0.67+ EF tanks as part of more extensive remodels, the market share of these contractors represents a very small percentage of the overall replacement market.

Based on Dun & Bradstreet data, there are approximately 900 residential plumbing companies in Oregon. Most are small – 76 percent have three or fewer employees.

3.2.6 INTERVIEW RESULTS – CONTRACTORS

Demographics

Eight contractors were interviewed. Respondents were owners, vice presidents, or managers. The companies have been in business for an average of 40 years, with the oldest having been in business since 1907.

Market Supply

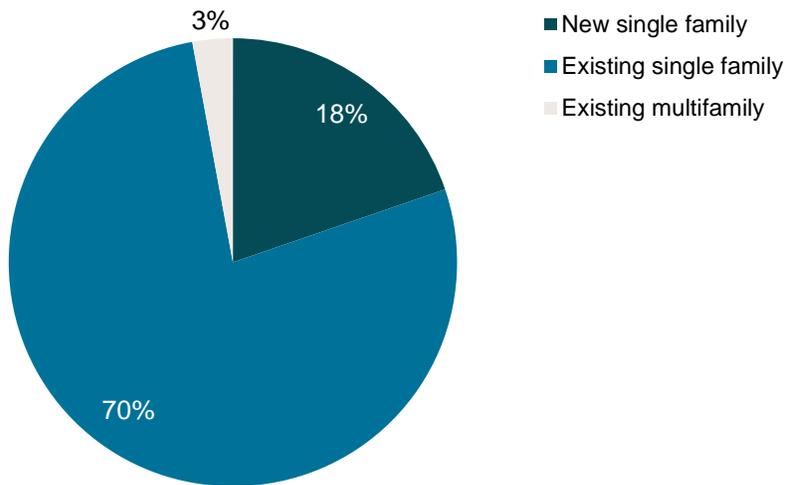
Although respondents reported sourcing their water heaters from a variety of different companies, the most frequently cited sources for 0.67+ gas tank water heaters were George Morlan, Ferguson, Consolidated Supply, and Keller Supply. Tankless water heaters were also sourced from the same companies. Most contractors reported using multiple distributors. Interviewed contractors were less familiar with sourcing for condensing gas storage water heaters because five of those surveyed either sell very few or do not sell this type of equipment at all.

The contractors reported that they did not have any issues getting the 0.67+ EF water heaters when they needed them and six out of eight reported that they did not maintain them in stock, generally due to lack of demand from consumers. Contractors reported that the lack of demand makes it expensive to carry these units in stock because they can't guarantee when a customer will request one.

With respect to the distribution of sales between single and multifamily, contractors estimated that roughly 85 percent of their residential-grade 0.67+ EF water heater sales in 2014 were installed in existing single family homes. The existing multifamily market only accounted for 3 percent of these contractors' 2014 residential sales while none of the interviewed contractors did any work in the new multifamily market. Of these sales, the contractors interviewed estimated that about two-thirds of all gas water heater installations in the market had a permit pulled for the job in 2014. Figure 7 shows the distribution of home types that the installers worked with. Since these are primarily single-family residential contractors, the low percentage of multifamily and new construction is to be expected.

²⁴ The participant cost data analyzed in section 2.4 indicates that home performance contractor prices are much higher than standalone water heater replacement prices; that may be partially an artifact of the way home performance invoices are structured, or it may represent actual higher pricing on the part of home performance contractors. It would take further research to resolve this apparent contradiction.

Figure 7. Percentage of residential 0.67+ EF water heaters by home type



Contractors consider four factors when selling and installing 0.67+ EF water heaters: 1) whether the water heater fits and if there are any foreseeable installation challenges, 2) the reliability of the product, 3) customer interest, and 4) noise level. One contractor reported that the price of higher efficiency water heaters does seem to decrease customer interest while another stated that promoting higher efficiency units increases the chances that they won't be able to install the unit in one day.

Water Heater Pricing

Contractors quoted a wide range of prices for 0.67+ EF water heaters, ranging from \$500 - \$2,500. Figure 9 shows the average water heater installation price for a variety of efficient water heaters; Figure 10 shows the average number of hours of labor that contractors bid to install these systems, including a standard basic water heater for comparison. The drivers of increased labor hours include venting and electrical requirements for 0.67+ EF water heaters; venting, electrical and gas line upgrades for tankless water heaters; and venting, electrical, gas line and condensate pump upgrades for condensing water heaters. Contractors noted that they expected prices of their jobs to increase 10-25 percent in the next 2-5 years.

Figure 8. Average water heater installation price

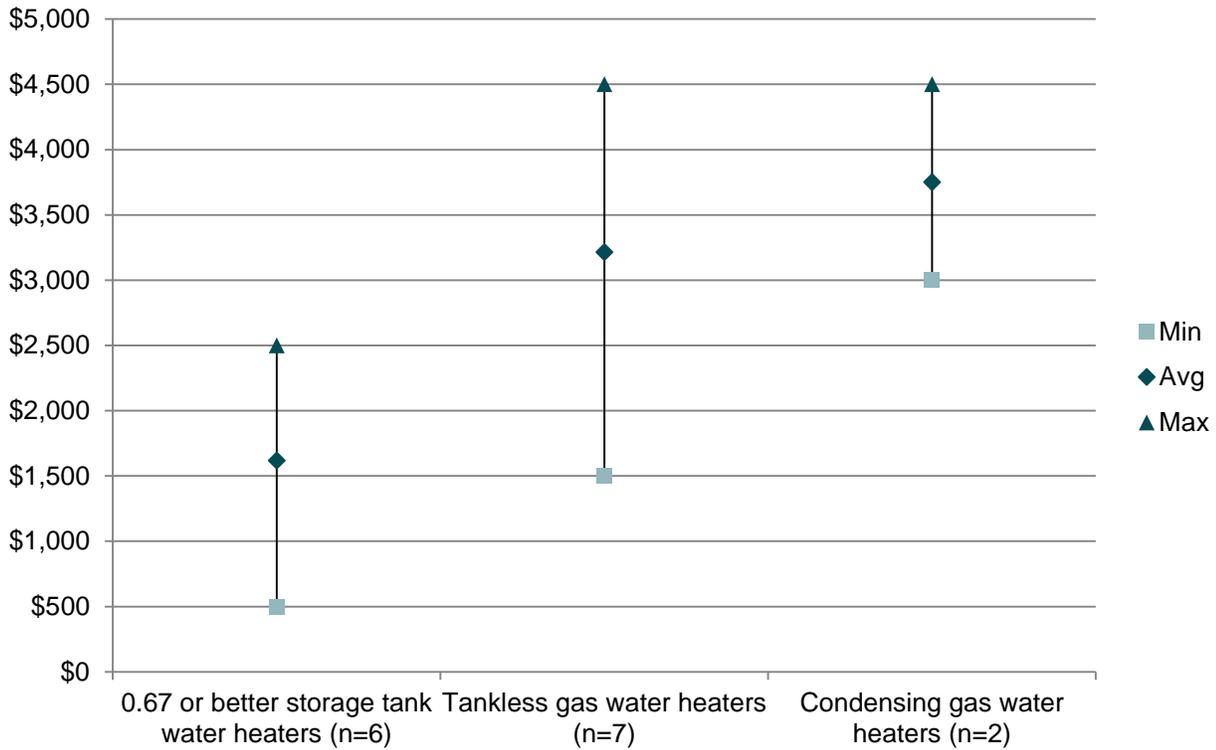
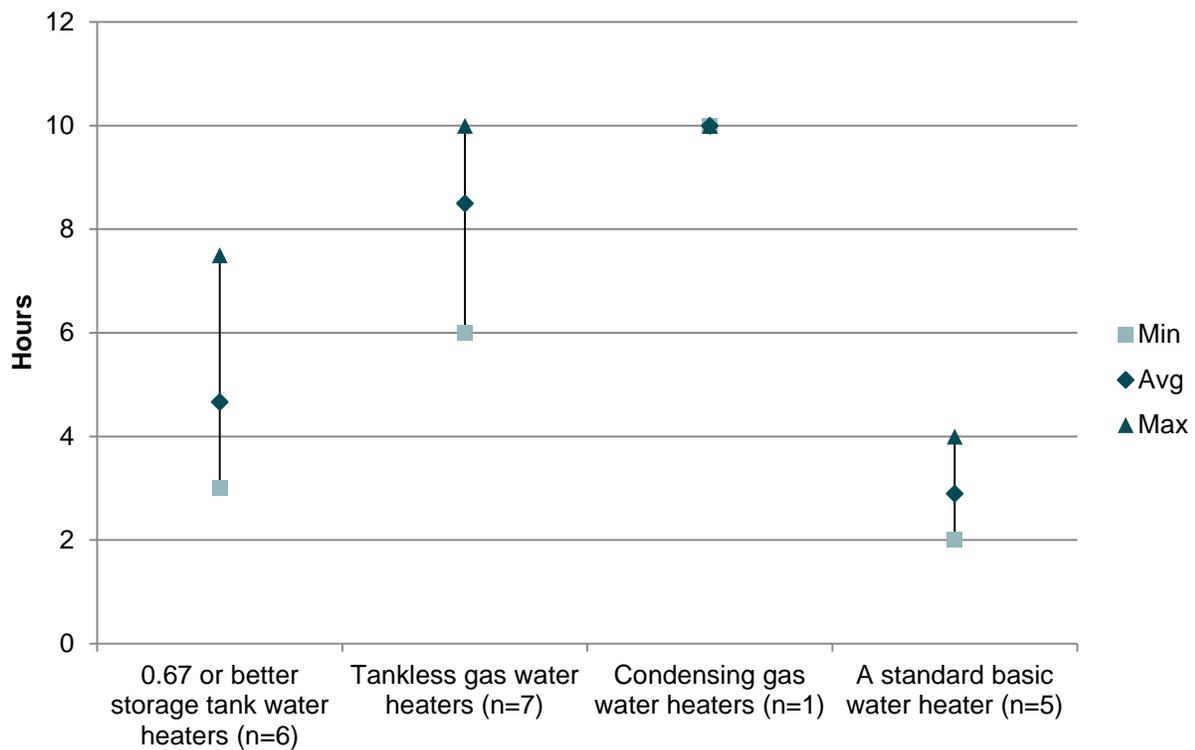


Figure 9. Average hours bid to install water heater by type



Market Drivers

Based on interview feedback, installers are the driving force behind the sale and installation of high efficiency units. Contractors generally understood the challenges that high efficiency installations presented, and claimed that they were willing to take on those challenges but that there was no demand in the marketplace. This lack of demand is the primary reason why most contractors aren't up to date with the different high efficiency technologies. A high volume trade ally contractor who has worked extensively with Energy Trust of Oregon program offerings in the past reported that "when products are easy to understand and install, it becomes easier to get them implemented in the marketplace." This same high volume contractor, when asked why he didn't install high efficiency units, stated "I don't think we [contractors] have the knowledge for higher EF gas units." This statement aligns with a frequent lack of product knowledge amongst interviewees. Specifically, contractors were often confused about condensing tank units, as well as the different strategies utilized to achieve efficiencies of 0.67 and higher. To further complicate the matter, contractors reported having a hard time justifying the cost required to move from a standard tank to a high efficiency model to consumers when the gas savings are so low.

Very few of the interviewed contractors are promoting and installing high efficiency units. Of the contractors that have installed high efficiency units in the past, few if any still are, with the exception of the Home Performance contractors. In at least one case, the reason they stopped installing high efficiency units was due to losing a staff member who was knowledgeable about high efficiency units and comfortable with how to install the technology. This aligns with what we were told from a high volume contractor that has been in the business for 70 years, which was, "unless they are just out of school, plumbers don't understand the gas savings, technology and complexities of high efficiency gas units." The majority of high volume contractors, with the exception of the national company that focuses on water heaters, focus on a "like for like" replacement, stating that their primary concern is whether or not the unit will fit without having to make venting, electrical, and/or gas line adjustments. These contractors reported that their primary concern was liability surrounding these changes.

Marketing

The primary market for 0.67+ EF water heaters is generally higher educated, environmentally conscious homeowners and business owners. Six of the eight contractors do not market high-efficiency water heaters at all. The two contractors that did market used messages of "better, smarter" and "we install it fast and right", respectively. The contractors that do not market said that the cost of advertising and the lack of demand for efficient water heaters drove their decision. Six of the eight offer discounts on efficient water heaters, generally of 10-15 percent. Contractors feel that if Energy Trust and Northwest utilities provided more sponsorship and education to homeowners in their territory there would be increased market adoption.

Experience with Energy Trust

Of the contractors interviewed, two reported significant interaction with Energy Trust while six reported no direct interactions other than incentives. Three contractors reported that the Energy Trust program had a positive impact on their sales; five contractors reported little or no impact. When asked about challenges that they experienced with Energy Trust programs, contractors conveyed their impression that there was a lack of educational and training program offerings, that rebates have decreased, and that paperwork is cumbersome. On a scale of 1 to 5 with 1 meaning "not at all satisfied" and 5 meaning "very satisfied", the contractors gave Energy Trust an average score of 3.8.

Barriers and Challenges

Contractors pointed to cost, concerns about the technology, paperwork and eligibility rules, the required electrical connection, the small savings, and a lack of homeowner awareness as barriers to offering 0.67+ EF water heaters and their incentives. Contractors did not expect many >55 gallon condensing tanks to be installed; they expected two smaller tanks, tankless, or a HPWH to be a more common solution for homes that need more hot water. There was a near consensus (n=6) that cost is less important in an emergency situation than in a non-emergency situation. Most contractors felt that higher consumer incentives were key to moving the market, but three also mentioned education.

4 Barriers to Participation and Product Installation

Based on the findings summarized above, CLEAResult identified a number of physical, market and participation barriers that impact the installation of 0.67+ EF water heaters. The following section describes barriers in detail and provides a summary Table 14.

4.1.1 PHYSICAL BARRIERS

During interviews, several distributors and installers stated that there were many physical barriers to installing 0.67+ EF water heaters. These barriers included size of the tank, the availability of a nearby 110V electrical supply and fan noise.

Size. Contractors often reported that the size of the tank was larger than a code tank. This issue appears to be a misunderstanding. Our research shows that the increase in tank diameter is not a result of the efficiency differences between the 0.62 EF units and the 0.67+ EF units but rather the efficiency differences between the old federal standard (0.58 EF) and the new NAECA 2015 standard (0.62 EF). In most cases there is no or minimal increase in diameter between 0.62 and 0.67+ EF units (see Appendix I).

Electrical supply. The electrical requirement for the 0.67+ EF units was identified as a market barrier by many of those interviewed. Installers mentioned that since a high percentage of tanks are sold upon failure of the old tank, the installer is taking a risk by attempting to sell a tank not knowing the distance to the nearest 110V outlet. Not only does it represent an increase in cost to hire an electrician for the outlet installation, it adds delay at a time when speed is of the essence.

Current electrical code requires that no location on a wall can be more than 6 feet from an 110V outlet. However many gas water heater storage tanks are located in unfinished basements and garages as well as in older homes that predated the code requirement. With the exception of one model (noted below), all the 0.67+ EF tanks have an eight or nine foot power supply cord. Considering that the cord in most cases must transverse both vertical and horizontal distances, the tank must usually be within four horizontal feet of an outlet. One model from one manufacturer, a power dampered unit, is a 24 volt system with the transformer located at the plug. This water heater has a 19 foot low voltage power cord, allowing it to be placed in considerably more homes than water heaters with shorter power cords.

Noise level. Many contractors and distributors believe that all 0.67+ EF water heaters are power vent units with a fan and the associated fan noise may cause a consumer complaint and ultimate removal. The induced draft units have a considerably smaller fan with less fan noise. The powered damper units create no additional noise.

4.1.2 MARKET BARRIERS

All those interviewed expressed that certain market barriers are curtailing the market share of 0.67+ EF water heaters. The most frequently mentioned barriers were the relatively small savings attributable to the 0.67+ EF water heaters and the increased risk of the tank not being able easily installed. Cost was also a consideration for some installers.

Small Savings. Contractors are aware of the small savings attributable to 0.67+ EF gas water heaters. To most contractors, the benefits of high efficiency tank water heaters are outweighed by the associated risks, such as noise complaints, lack of hot water during prolonged power outages and the potential lack of a nearby 110 volt power supply.

The appeal of tankless. Several contractors mentioned that those customers seeking higher efficiency water heaters are attracted to tankless systems that, in addition to higher efficiency levels, take up less space, deliver more hot water, and are viewed as desirable by many homeowners.

Lack of consumer demand. Individual annual energy savings are low enough that it is challenging to get the attention of consumers. Tankless water heaters and HPWHs appeal to the segment of the market interested in energy savings and to the early adopters interested in new technologies. Given the influence on contractor bidding reported in the interviews, this is perhaps the most challenging barrier of all for contractors.

Permit requirements. It was the opinion of many of those surveyed that less than half of the water heaters installed are permitted. Permitting represents potential delays and involves the installation of seismic strapping and potential upgrades to the venting system and gas supplies. Permits are technically required in all water heater replacements, regardless of efficiency or technology. This adds costs and the potential of losing a sale to a contractor that will not pull a permit and be able to offer the water heater at a lower price. Requiring a permit to receive an incentive is not recommended, as assessing anything related to code requirements is beyond the scope of practice of the program work quality verification specialists.

Lack of product knowledge. It was apparent from the market actor interviews that many contractors and distributors had an incomplete view of energy efficient water heater products. Many assumed that all 0.67+ EF water heaters were power vented; others assumed all the water heaters were larger than their 0.62 EF counterparts; and others assumed all units have a power supply cord less than 10 feet in length.

Venting requirements for 0.67+ EF units appear to be widely misunderstood among interviewees. There was a general misconception that a 0.67+ EF unit achieved its efficiency by either being a condensing unit or a power vented unit. This misunderstanding appears to stem from an overall lack of product knowledge, as well as a lack of understanding by contractors of the different strategies utilized by manufacturers to obtain the 0.67+ EF rating, which consist of a power damper, a power vent, or assisted draft.

Given that the NAECA 2015 standards are relatively new, this lack of knowledge concerning the technologies is to be expected and will probably decrease with time as manufacturers continue their training on new products.

Increased job complexity and risk. Due primarily to the need for an electrical outlet and fear of customer objection due to increased noise and lack of hot water during a power outage, many contractors see offering a 0.67+ EF water heater as increasing their risk on any given job. An additional risk is losing to the job to a competitor that is offering a 0.62 EF water heater without the additional cost of an electrician.

Installer/ distributor/ manufacturer relationships. For larger volume installers, long-term relationships imply discounted pricing on product. Distributors rely on volume installers to increase their overall buying power. These relationships can serve as a barrier to installing other brands that may more easily overcome the previously discussed barriers.

4.1.3 PARTICIPATION BARRIERS

Paperwork. It became apparent during the interviews that if most contractors could make a sale without the time required to complete paperwork, they would. Contractors object to paperwork and forms in general; they are viewed as hassles that take them away from running their businesses. Many of the installers commented that they invariably fill the form out incorrectly and have it returned to them for further clarification, which delays payment and lowers their customer satisfaction level. Contractors that specialize in home performance reported that offering incentives complicates the sale but is necessary. Not only does it give them an advantage over contractors that don't offer the incentive but it ensures that they come across as an expert to the customer in case that customer is knowledgeable about Energy Trust of Oregon incentives for qualifying equipment.

In order to convince contractors to offer incentives and complete any associated paperwork, the ratio between the incentive and the cost of the installed measure has to be significant. This is especially true when the demand for the measure is low and they can make a sale without offering a more efficient alternative. One contractor referred to it as the "bucks to bureaucracy ratio". In the case of 0.67+ EF water heaters, this ratio is low due to cost-effectiveness constraints.

More important to contractors than rebates was lead generation and marketing. Several contractors commented on the lack of program support to actively promote 0.67+ EF water heaters. They felt the star rating system did not reward contractors for the installation of 0.67+ EF water heaters, but instead rewarded them for correctly filling out paper work. A few contractors felt there was no active lead generation on the part of Energy Trust programs. They commented they felt that leads have decreased in recent years. The same contractors enjoyed the co-op marketing but would rather see the general Energy Trust marketing efforts specifically mention contractors that help Energy Trust achieve their goal related to obtaining a greater market penetration of 0.67+ EF water heaters.

Table 14 below summarizes the barriers described above.

Table 14. Barriers to 0.67 gas tank water heater participation

Barriers	Comments/ additional information
Physical Barriers	
Tank size	This is the impact of the federal standard and not a barrier from 0.62 to 0.67+ EF
Electrical connection	An electrical connection is the only new installation requirement. Units with longer power cords recommended (19 feet)

Cost	The incremental cost of the units often includes the additional cost of having an electrician install an additional circuit, which is typically \$300
Power vent noise	This is only an issue for power vented units
Small savings	Measure needs volume to scale
Market Barriers	
Stock up on 0.58	Contractors and distributors report that the older 0.58 EF tanks have been cycled through
Various business models	Many tank replacement companies view the electrical requirement as an additional risk to same or next day replacement
No consumer demand	Contractors report that consumers do not request bids for these tanks
Lack of product knowledge	Many contractors and distributors are misinformed about the 0.67+ EF units. Many felt these units had to be power vented systems, which are more expensive and may create a noise issue
Participation Barriers	
Paperwork	Paperwork is viewed as a burden and not worth the effort
Star rating not valuable	Contractors report that stars do not equate to leads
No program leads	Contractors reported that if there were solid leads, and the access to leads was based on installing 0.67+ EF tanks, then there would be a reason to install them
No program marketing	Contractors expressed a desire to be mentioned in Energy Trust marketing

5 Conclusion

Water heating represents substantial electric and gas savings potential in Energy Trust territory. Significant promotional and educational activities exist to support HPWH market activity, highlighting a need for comparable efforts to promote high efficiency gas water heaters. Increasing the volume of 0.67+ EF water heaters is a complex market delivery challenge. Energy benefits to the end user are low, installation complications present financial challenges to contractors, and incentives alone are not enough to drive demand.

By understanding market conditions, equipment specifications and supply chain relationships, Energy Trust can address the barriers identified in this report. Energy Trust programs should incorporate the recommendations highlighted in this report to restructure program participation requirements and incentives for contractors while continuing to engage distributors and manufacturers. If successful, Energy Trust can acquire significant residential savings through the water heating channel.

5.1 KEY FINDINGS AND RECOMMENDATIONS

There is large potential for savings. While energy savings benefits to the individual end user are relatively low, the gas water heater replacement market represents one of the largest cost-effective residential measures available in the region. If all the water heaters in Energy Trust territory were replaced with a 0.67+ energy factor (EF) rather than a 0.62 EF, it would represent first-year savings of up to 910,000 therms per year.²⁵ Additionally, missing a significant portion of the replacement market represents a true lost opportunity as water heaters are only replaced periodically, unlike other measures, like insulation, that can be accomplished at any point. The savings potential for heat pump water heaters (HPWHs) in the replacement market is large as well, at around 50 million kWh annually.²⁶

- Recommendation: Given the market potential, Energy Trust programs should continue to pursue this resource.

Upstream incentives alone may not lead to success. Distributors respond to contractor demand for products and contractors demonstrate loyalty to preferred distributors. Because of this market dynamic, distributor and manufacturer incentives alone may not be the most effective avenue to increase the installations of 0.67+ EF water heaters²⁷.

- Recommendation: Manufacturers and distributors are well positioned to help educate their installers about 0.67+ EF water heaters and program offers. Focus manufacturer and distributor efforts on opportunities to help these market actors educate their installers.

Contractors are the key players in the supply chain. In the majority of bids, 0.67+ EF water heaters are not offered as an option. While distributors play a role in educating contractors about product capabilities and benefits, it is up to the contractor to complete the sale. And, as noted above, contractors drive distributors' stocking practices.

- Recommendation: Identify ways to generate leads for contractors through marketing activities. Successful contractors value qualified leads and marketing that rewards them for installing qualifying water heaters. Finding methods that promote an individual contractor with Energy Trust's endorsement in some manner is critical, particularly large volume contractors.
- Recommendation: Develop a marketing strategy that contractors can use to address the real and perceived barriers to purchase and installation of 0.67+ EF water heaters. Develop educational materials around the different technology options and considerations for various types of installation.
- Recommendation: Combine marketing efforts for gas and electric water heaters.

²⁵ We have calculated an approximate annual market size of 30,000 gas water heaters replaced per year; see the *Market Size and Savings Potential* section for details. Annual unit savings are 29 therms/year.

²⁶ We have calculated an approximate annual market size of 33,000 electric water heaters replaced per year; see the *Heat Pump Water Heaters* section for details. Annual unit savings are 1512 kWh/year.

²⁷ This approach is in use today with one local retailer, where the program makes it extremely easy for the retailer to claim the incentive and pass it on to the installer. While this approach has increased the number of 0.67+ EF water heaters being claimed in the program, it has failed to make a significant increase in the market share of the more efficient water heaters.

Contractors are not familiar with high efficiency technology. There are a number of common misperceptions about 0.67+ EF water heaters, such as the need to be power vented or that the tanks are larger, that discourage contractors from promoting these products. This education gap is further exacerbated by the recent standards change.

- Recommendation: Educate contractors on the best applications for various 0.67+ EF water heater products.

Many 0.67+ EF water heaters have a low incremental cost. The current incentive levels are not influencing contractors to upsell to 0.67+ EF water heaters, but they may be enough to offset the incremental cost in many cases. If combined with a simplified incentive redemption process and marketing leads, an incentive could be an important part of the program design.

- Recommendation: Maintain \$100 instant incentive payable to contractor.

Paperwork inhibits participation. For sales of the 0.67+ EF water heaters and HPWHs to increase, the process of capturing the required information in order for an incentive to be issued has to be extremely fast and easy. All installers and distributors cited paperwork as a barrier for their participation in energy efficiency programs; this included all parts of the process, not just a specific part (such as getting the customer signature). It is the overall time investment and impact on their relationship with their customer that is perceived as onerous.

- Recommendation: Eliminate the requirement for the homeowner's signature in order to receive an incentive. Consider only requiring a geo-stamped picture of an installed water heater or only an invoice as proof of install. This documentation must contain the model number and verify the installation is in the service territory.

Non-energy programs are potential stakeholders. The Northwest and the Portland area specifically are stressing the need for earthquake preparedness and resilience planning; entities include City of Portland, Red Cross, PREP, neighborhood associations and more. Installing new water heaters with electronic ignition could easily be coupled with the message of proper seismic strapping. Energy efficiency programs could partner with these entities to align messaging and leverage marketing efforts.

- Recommendation: Explore potential partners for this approach with local governments, organizations and gas companies.

Drivers of HPWH sales exist that don't transfer to 0.67+ EF water heater sales. HPWHs have large energy savings; multiple NEEA reports mentioned that the primary and most effective sales message to homeowners is "save money on your bills". The incentive is also significantly larger – large enough to move the market and large enough to counteract the perceived hassle on the part of the contractor to participating with energy efficiency programs. Neither of these factors applies to 0.67+ EF water heaters.

- Recommendation: Enhance 0.67+ EF water heater installer engagement by incorporating HPWH offers into unified participation pathway for contractors who install both technologies.

Condensing gas tank water heaters are uncommon. None of the contractors interviewed install condensing gas tank water heaters on a regular basis. Contractors reported that they are quite expensive. Condensing gas tank water heaters are effectively mandated in the 55 gallon + range by the National Appliance Energy Conservation Act (NAECA) efficiency standards; in the face of these standards, most interview respondents stated that they expected contractors to install two smaller water heaters, tankless water heaters, or HPWHs for households with high water use requirements.

- Recommendation: Do not incorporate condensing gas tank water heaters in program strategies due to lack of contractor experience with and high cost of these products.

Tankless water heaters continue to be popular. After 0.62 EF (code minimum) tank water heaters, tankless water heaters are the biggest seller for the two manufacturers interviewed; for one of them, condensing tankless models are the most popular. Not all contractors install tankless models, but those that do prefer to sell them over 0.67+ EF water heaters. They have benefits that the 0.67+ EF water heaters do not, such as space savings, infinite hot water, and larger energy savings.

- Recommendation: Acknowledge the popularity of tankless water heaters when designing contractor education and outreach.

Drivers of cost are complex. In this report, costs were broken out by water heater type and whether a contractor was a plumber or a home performance contractor; it is possible that more detailed analysis of invoices would yield additional information on the drivers of water heater installation costs.

- Recommendation: Analyze differences in cost by model number, manufacturer, contractor, and other variables to identify any important trends.

5.2 ADDITIONAL CONSIDERATIONS

In addition to the key findings and recommendations identified in this report, CLEARResult identified a number of additional research and planning opportunities that came up through this research, yet were outside of the scope. Energy Trust and Program Management Contractors may want to address these in future research and program designs. The following considerations address gaps and opportunities identified throughout the research and review process. Many of these will be addressed by CLEARResult as the program(s) redesign water heater offerings in 2016.

- Future research and planning should address the following gaps in the current understanding of the water heating market:
 - Identify the potential for promotion of 0.67+ EF water heaters at retail. Much of this will be determined by whether or not Energy Trust considers a self-install measure for gas appliances.
 - Determine which retail strategies used for HPWHs can be applied to 0.67+ EF water heaters.
 - Determine the market shares of the different market channels to better identify the focus for new Energy Trust water heating strategies.
 - Continue to evaluate the market baseline and incremental costs for gas efficient tank water heaters and potentially incorporate into measure analysis.
- Future stakeholder outreach should consider engagement with:
 - ENERGY STAR to understand their perspectives on the market supply chain and technology adaptations to meet their requirements.
 - NEEA to identify if there are opportunities for NEEA's gas initiative to support for gas water heating.
- Additional data analysis should be planned to better understand:
 - If there is a relationship between market channel and emergency versus planned replacement.
 - Differences and trends in cost by model, manufacturer, contractor, or other variables to identify the most cost effective applications of 0.67+ EF gas tank water heaters.

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7 Appendix I: 0.67+ EF Gas Water Heater Specifications

(This section has been removed for confidentiality reasons.)

CLEAResult

8 Appendix II: Summary of Existing Research

This summary provides key findings and lessons learned from four DHW studies and tests in the region. These were all performed at the behest of NEEA. Three focus on the HPWH market and one focuses on the DHW market overall. The studies are:

- NEEA Market Test Summary Report (CLEAResult)
- 2011 Water Heater Market Characterization (Verinnovation)
- Northwest Heat Pump Water Heater Market Test Assessment (Evergreen Economics)
- Consumer Messaging for DHPs and HPWHs (Illume Advising)

8.1 NEEA MARKET TEST SUMMARY REPORT²⁸

NEEA tested market interventions for HPWHs at three points: consumer (direct), retailer/wholesaler (midstream) and manufacturer (upstream). NEEA also invested significant time working with one major retailer to move specific Tier 1 units. The results show that the manufacturer incentives were by far the most effective and cheapest. The manufacturer incentives were delivered to distributors, and paired with contributions from the manufacturer. Part of the reason this was more successful than other promotions was because it had much greater reach – over 500 locations in the Pacific Northwest. The manufacturer also engaged in some marketing and media buys. Table 10 shows the results of each initiative.

Table 10. Results of NEEA Initiatives

Incentive Type	Product Tier	Promotion Period	Offering Duration	NEEA Markdown	Unit Sales
Direct	Tier 2	2012 and 2013	14 mo.	\$1,000	466
Midstream ²⁹	Tier 1	Fall 2012	32 days	\$400 - \$600	245
Midstream	Tier 1	Winter 2012	32 days	\$400 - \$600	344
Midstream	Tier 1	Winter 2013	19 days	\$400 - \$600	53
Midstream	Tier 1	Spring 2013	15 days	\$500 - \$600	12
Upstream	Tier 1	Spring 2013	56 days	\$200	1,033

The conclusion of this report was that the upstream incentive was the most effective. However, this conclusion should be balanced against the difficulty of working with manufacturers who frequently have a national focus.

8.2 2011 WATER HEAT MARKET CHARACTERIZATION³⁰

NEEA – Verinnovation

NEEA contracted with Verinnovation to conduct a water heater manufacturing research study in 2011 to better understand the overall water heater market (not just the market for HPWHs). The report looked at trends in the water heater market and messaging that resonated with consumers.

²⁸ Internal NEEA document, written by CLEAResult

²⁹ Midstream promotions were through 35 stores of one major retailer.

³⁰ <http://neea.org/docs/reports/2011waterheatermarketupdatea273dbb87ca3.pdf>

Three firms — AO Smith, Rheem/Ruud, and Bradford White — dominate the U.S. water heater manufacturing sector. This report estimates 2010 sales of 94,000 units in Oregon, with 92% of those going to existing homes.

Table 11 shows the reasons water heaters were purchased in the United States in 2005 and 2010. With the drop in housing starts driven by the 2009 recession, the percentage of water heaters going into new construction dropped significantly; the percentage of planned replacements increased slightly; and the percentage of water heaters being replaced because of poor performance or outright failure went up significantly.

Table 11. Reasons for Water Heater Purchase in the US

Reason for purchase	2005	2010
New construction	21%	7%
Planned	28%	30%
Poor performance	20%	25%
Failure	31%	37%

Key findings from this report include:

- **Resellers' priorities can conflict with installers' priorities.** Resellers, including retailers, distributors, and wholesalers, want to sell high-margin products. Installers, however, prefer to find the best fit for their customers.
- **Inventory affects sales recommendations.** Resellers recommend the products they have in stock, either on the sales floor or in the back of the truck.
- **Some installers wish for more product testing before roll-out.** In Verinnovation's in-depth interviews and mystery shops, they saw concern and skepticism about the rate at which new products were being rolled into market. Installers stated that they pay attention to factors that cause customer complaints and new technologies that don't work cause customer complaints.

8.3 NORTHWEST HEAT PUMP WATER HEATER MARKET TEST ASSESSMENT³¹

NEEA – Evergreen Economics

NEEA contracted with Evergreen Economics in 2013 to better understand the market for HPWHs in the Northwest. They wanted to know how it stands at all points along the supply chain – homeowners, manufacturers, distributors and installers. They also had Evergreen interview utility representatives to assess their perceptions of the state of the market.

From the report:

Key findings from this assessment are:

1. *Key drivers for HPWH purchases are saving energy, lower monthly operating cost, and rebate availability. The main marketing messages to end-users include energy savings and return on investment.*
2. *Barriers to HPWH adoption are typical of new energy efficiency products (first cost, low awareness).*
3. *Market actors have a wide range of views regarding future HPWH sales, HPWH price, and installation price.*
4. *Nearly all Tier 2 HPWHs were installed by contractors, while more than half of Tier 1 units were DIY installations.*
5. *Emergency replacements only accounted for 13 percent of HPWH installations.*
6. *Households that installed Tier 1 and Tier 2 HPWHs report high levels of satisfaction.*
7. *Northwest utility representatives believe HPWHs are well suited for new construction, particularly the Tier 2 models.*

³¹ <https://neea.org/docs/default-source/reports/northwest-heat-pump-water-heater-market-test-assessment.pdf?sfvrsn=6>

8. *The three (out of eight) distributors that do not stock HPWHs believe they are currently too risky to stock (in terms of the barriers preventing installations). Less than half actively market HPWHs.*
9. *At the time of the research, the Market Test had limited engagement with small retail stores. The large retailer that worked with NEEA reported that the partnership was very successful – Tier 1 sales seem to corroborate this finding.*
10. *Installers source HPWHs from distributors. Installers do not stock HPWHs, but indicate that this does not hamper their use as an emergency replacement option.*

8.4 CONSUMER MESSAGING FOR DHPS AND HPWHs³²

NEEA – Illume Advising

NEEA contracted with Illume Advising to complete this study to better understand how to reach consumers to promote HPWHs and DHPs.

For HPWHs, upfront cost, lack of familiarity and ease of self-install were the primary barriers noted by respondents. While a lesser concern, respondents were also apprehensive that HPWHs may not be offered by all contractors.

Saving money on energy bills was the most important message identified by participants. This was followed by saving energy. Participants in the HPWH focus groups had the greatest concerns with their lack of familiarity with HPWH technologies. In many instances, participants associated a new (or unfamiliar) technology with risk as a sign that the technology had either not been proven or that the technology was unpopular. Participants clearly indicated that they would depend most on online ratings and reviews and their utility company for unbiased information about a new technology; they would also listen to contractors, salespeople and family and friends, but those were considered secondary sources of information.

Another finding of this research is that people only think about their water heater when it breaks, and their primary concern is to get hot water running again. Thus, reliability is the most important characteristic in a water heater, and cutting edge or smart technology has little inherent appeal.

³² <http://neea.org/docs/default-source/reports/consumer-messaging-for-ductless-heat-pumps-and-heat-pump-water-heaters.pdf?sfvrsn=10>

9 Appendix III: Interview Guides

9.1 MANUFACTURERS AND MANUFACTURERS' REPRESENTATIVES

9.1.1 INTRODUCTION

My name is [NAME], and I work for CLEAResult, a company contracted to research the water heater market on behalf of Energy Trust of Oregon. I'd like to talk to you about your experience with the **EFFICIENT GAS** water heater market. Our conversation should take between 30 and 45 minutes. Again, we really appreciate your willingness to provide feedback. Your responses will help Energy Trust improve its energy efficiency programs so that customers can save money on energy costs in the future.

Throughout this interview, I will refer to "0.67 and better storage gas water heaters." By this I mean non-condensing gas tank water heaters with an energy factor, or EF, of 0.67 or greater.

[Record name, position, phone number, and set up time to talk]

9.1.2 SECTION A: DEMOGRAPHICS

First I'd like to get some general information about you and your company.

1. Please describe your position at [COMPANY].
 - a. CONFIRM STATUS AS MANUFACTURER
2. How long has your company manufactured water heaters?
3. About what percent of your 2015 water heater sales (gas and electric) comes from:

Type	Percent
Less than 0.62 EF storage tank gas water heaters	
0.67 or better storage tank gas water heaters	
Tankless gas water heaters	
Condensing gas water heaters	
Storage electric water heaters	
Heat pump water heaters	
Tankless electric water heaters	

4. What are the highest selling efficient gas water heater products in 2014 and 2015 combined?
5. Who makes the recommendations to distributors on what to stock?

9.1.3 SECTION C: WATER HEATER PRICING

6. Do you have insight into what the average installation price charged by installers might be for:
 - a. 0.67 or better storage tank water heaters?
 - b. Tankless gas water heaters?
 - c. Condensing gas water heaters?

7. What do you think will happen to the price for efficient water heater installations in the next two years (2016-2017)? And how about five years (2016-2020)? [PROBE FOR: percent increase/decrease]
 - a. Decrease
 - b. Stay the same
 - c. Increase by 0-10%
 - d. Increase by 11-25%
 - e. Increase by over 25%
8. Do you have any concerns about installation prices and practices of contractors selling efficient water heaters? [PROBE FOR: prices that are too high or too variable; utility rebates /tax credits are being “captured” by installers; too few installers; earthquake strapping; venting; gas pipe sizing; other issues]

9.1.4 SECTION D: MARKETING

Now let's discuss your marketing activities. Think about how you market in the Northwest specifically.

9. Who do you consider your primary target markets for high efficiency gas water heaters? For instance, do you focus on distributors, contractors, homeowners, multifamily property owners or other groups?
10. How does your company currently market high efficiency gas water heaters for the residential market? [IF NO MARKETING, SKIP TO Q12]
11. And what are your key marketing messages? [PROBE FOR: energy savings, more control over settings, desire for improved technology, bill savings, rebates, more hot water etc.]
12. Why do you choose not to market high efficiency water heaters for households?
13. Do you ever give discounts? If so, to whom?
 - a. How large a discount is generally required to move product?
 - b. How effective are discounts compared to other forms of marketing?
 - c. If you give discounts to the distributor, do you give them to the company or to the individual making the sale?
 - d. If you give discounts to the retailer, do you give them to the company or to the individual making the sale?
 - e. If you give discounts to installers, do you give them to the company or to the individual making the sale?
14. Do you have any recommendations for Energy Trust or other Northwest utilities regarding how best to promote high efficiency gas water heaters to homeowners?

9.1.5 SECTION E: INTERACTION BETWEEN MARKET ACTORS

Next, I would like to talk about the contractors that install efficient gas water heaters.

15. Do you have any concerns about how your high efficiency gas water heaters are being installed?
 - a. [IF YES, PROBE FOR: details on known or potential issues, prevalence of issues, and whether or not issues are related to plumbers and/or HVAC contractors] What concerns do you have?
16. Are there any technical challenges that hold back installations of efficient gas water heaters?
 - a. [IF YES] What technical challenges?
17. When efficient or inefficient gas water heaters are replaced do you think the average contractor does the following:
 - a. Installs seismic strapping to code
 - b. Makes code required venting and combustion air improvements
 - c. Makes any code required gas piping requirements

18. Do you also rely on contractors to promote your efficient gas water heaters?
 - a. [IF YES] How do you work with contractors to ensure that they use effective messaging to households?
19. How do you work with Northwest distributors to promote your high efficiency gas water heaters? [PROBE FOR: co-funding advertising, teaming on technical training to installers, just sending them product literature to distribute, other]
20. How many distributors are you working with? Which ones?
21. Are you trying to get additional distributors to carry your products?
22. Have you had any challenges working with specific distributors?
 - a. [IF YES] What challenges have you experienced and why?
23. Do you work with any Northwest retailers to promote 0.67 or better storage tank gas water heaters?

[IF Q23 = "Yes"]

24. Which retailers do you work with?
25. How do you work with these retailers? [PROBE FOR: whether or not they are coordinating discounts/rebates, co-funding advertising, giving them technical sales training, etc.]
26. Have you had any challenges working with specific retailers to promote your 0.67 or better EF units?
 - a. [IF YES] What challenges have you experienced and why?
 - b. [IF YES] What has worked well and why?

[IF Q23 = "No"]

27. Is there any particular reason why your company doesn't work with retailers on:
 - a. 0.67 or better storage tank water heater
 - b. Tankless gas water heaters
 - c. Condensing gas water heaters

9.1.6 SECTION F: EXPERIENCE WITH ENERGY TRUST

28. What interactions have you had with Energy Trust in the past year?
29. What impact have Energy Trust's efforts had on your sales of residential high efficiency gas water heaters in 2015?
30. Thinking of 2014 and 2015 only, did you have any challenges working with Energy Trust? [PROBE FOR: rebates eligibility, Energy Trust /CLEARResult delivery, training or marketing issues]
31. On a scale of 1 to 5, with 1 meaning "not at all satisfied " and 5 meaning "very satisfied," how satisfied would you say you are working with Energy Trust?
 - a. Why do you say that?

9.1.7 SECTION G: BARRIERS AND CHALLENGES

We're almost done and I'd like to get your feedback on challenges for efficient gas water heaters...

32. What are the key barriers to offering Energy Trust incentives to your contractors' customers? [PROBE FOR: contractor awareness, homeowner awareness, size of rebate, eligibility requirements]
33. What are the most common consumer barriers to purchasing highefficiency gas water heaters? [PROBE FOR: new technology concerns, lack of familiar brands, local codes, capital costs, install time/costs, availability for emergency replacement]
34. What impacts do these barriers to equipment purchase have, both in terms of demand and ease of installation and use?
35. Are there any consumer segments that are most amenable to purchasing 0.67 or better storage gas water heaters?

36. Are there any segments that are particularly resistant?
37. What are the main manufacturing challenges associated with producing high efficiency gas water heaters? What impacts do these challenges have? [PROBE FOR: price, availability, quality assurance, etc.]
38. Have any of your 0.67 or better tank water heaters been returned due to technical failures?
 - a. [IF YES] Can you provide details about how many, which models, and the reasons for the failures?
39. Are there any ways that Energy Trust could increase the rate at which high efficiency water heaters are selected by consumers, especially in emergency replacement situations? How?
40. What technological trends are you seeing with high efficiency gas water heaters?
41. What do you think will be the impact of the new federal standards? The new federal water heater standard requires that electric tanks larger than 55 gallons be more efficient than smaller tanks. How will you address this?
42. Will the federal standards have any effect on the smaller volume (<55gal) gas water heater market? What effect?
43. How do you think the market will respond when replacing these > 55 gallon electric water heaters?
[DO NOT READ THESE OPTIONS, BUT CODE THE ANSWER INTO ONE OF THEM.]
 - a. Install a heat pump water heater
 - b. Talk the homeowner into a smaller tank
 - c. Install two smaller electric tanks
 - d. Switch to gas tankless water heaters
 - e. Other
44. What do you feel are the largest barriers that heat pump water heaters face?
[DO NOT READ THESE OPTIONS, BUT CODE THE ANSWER INTO ONE OF THEM.]
 - a. Cost
 - b. They won't fit in many cases
 - c. Noise
 - d. The required maintenance won't be done
 - e. The extra weight requires a second installer or specialized equipment
 - f. Other
45. What are some successful strategies for increasing the number of efficient gas water heaters that are stocked and installed? [PROBE FOR: SPIFs, marketing blitzes, incentives for any sales above baseline (market lift), promotions to distributors/retailers/contractors, and any variation among different types of water heaters]
46. What are some unsuccessful strategies for increasing the number of efficient gas water heaters that are stocked and installed? [PROBE FOR: SPIFs, marketing blitzes, incentives for any sales above baseline (market lift), promotions to distributors/retailers/contractors, and any variation among different types of water heaters]

9.1.8 SECTION H: CLOSING

Those are all of the questions I have for you at this time. Is there anything else that you think would be important for us to know regarding high efficiency gas water heaters, Energy Trust, or anything else?

Thank you for answering all of my questions. I truly appreciate your willingness take time out of your day to provide feedback on your experience with the gas water heating market. You can expect your incentive within the next 2-3 weeks. Your responses will be compiled with those of other participants and be used to inform future programs.

Thank you VERY MUCH for your time!

9.2 RETAILERS AND DISTRIBUTORS

9.2.1 INTRODUCTION

My name is [NAME], and I work for CLEAResult, a company contracted to research the water heater market on behalf of Energy Trust of Oregon. I'd like to talk to you about your experience with the **EFFICIENT GAS** water heater market. Our conversation should take between 30 and 45 minutes. To show our appreciation of your valuable time, we will send you a \$150 Visa card. Again, we really appreciate your willingness to provide feedback. Your responses will help Energy Trust improve its energy efficiency programs so that customers can save money on energy costs in the future.

Throughout this interview, I will refer to "0.67 and better storage gas water heaters." By this I mean non-condensing gas tank water heaters with an energy factor, or EF, of 0.67 or greater.

[Record name, position, phone number, and set up time to talk]

9.2.2 SECTION A: DEMOGRAPHICS

First I'd like to get some general information about you and your company.

47. Please describe your position at [COMPANY].
 - a. CONFIRM STATUS AS [DISTRIBUTOR/RETAILER]
48. How long has your company sold water heaters?
49. Which types of high efficiency gas water heaters do you stock?
 - a. 0.67 or better storage gas water heaters
 - b. Tankless water heaters
 - c. Condensing gas water heaters
50. About what percent of your 2015 water heater sales (**gas and electric**) come from:

Type	Percent
Less than 0.62 EF storage tank gas water heaters	
0.67 or better storage tank gas water heaters	
Tankless gas water heaters	
Condensing gas water heaters	
Storage electric water heaters	
Heat pump water heaters	
Tankless electric water heaters	

51. What were the highest selling efficient gas water heater products in 2014 and 2015 together? What do you think drives high sales of [HIGHEST SELLING PRODUCTS]? [Ask for each product mentioned. Probe for rebate amount, brand recognition, physical characteristics including volume, etc.]

9.2.3 SECTION B: MARKET SUPPLY [RETAILERS ONLY; DISTRIBUTORS, SKIP TO Q19]

Now I would like to ask you a few questions about your supply of high efficiency gas water heaters.

52. From what company or companies do you source your 0.67 or better storage tank water heaters?
53. From what company or companies do you source your tankless water heaters?
54. From what company or companies do you source your condensing water heaters?
55. Do you have any problems getting high efficiency gas water heaters you need from the companies you work with in the time you need them? [IF YES , PROBE FOR DETAILS]
56. Does your company maintain a stock of high efficiency gas water heaters or do you always purchase them upon receiving an order?
 - f. Yes, we maintain stock.
 - g. No, we do not maintain stock. [SKIP TO Q17]
57. What brands and models of 0.67 or better storage tank water heaters do you keep in stock?
58. What brands and models of tankless water heaters do you keep in stock?
59. What brands and models of condensing water heaters do you keep in stock? How long does it take for orders to come? Is it a difficult process?
60. What motivated you to stock 0.67 or better storage tank water heaters? [PROBE for demand, rebates, utilities, etc.]
61. What motivated you to stock tankless water heaters? [PROBE for demand, rebates, utilities, etc.]
62. What motivated you to stock condensing water heaters? [PROBE for demand, rebates, utilities, etc.]
63. [SKIP IF Q10 = "Yes"] Why don't you stock 0.67 or better storage tank water heaters?
64. [SKIP IF Q10 = "Yes"] Why don't you stock tankless water heaters?
65. [SKIP IF Q10 = "Yes"] Why don't you stock condensing water heaters?
66. What percentage of your residential high efficiency gas water heater sales in 2014 were installed in new residential homes, versus retrofits in existing homes?
 - a. New single family ____
 - b. Existing single family ____
 - c. New multifamily ____
 - d. Existing multifamily ____
 - e. Don't know ____
67. [ASK IF ANY WATER HEATERS GO INTO MULTIFAMILY] What kind of residential-grade water heaters go into multifamily?
68. Please estimate the % of efficient gas water heater installations in the market that have a permit pulled for the job in 2014.
69. What do you expect to happen to the demand for high efficiency gas heaters in the next five years (2016-2020)?
 - a. Decrease
 - b. Stay the same
 - c. Increase by 0-10%
 - d. Increase by 11-25%
 - e. Increase by over 25%
70. Who makes the recommendations to contractors on what efficient gas water heaters to stock?
71. What changes, if any, do you foresee for your high efficiency gas water heater stocking practices in the next 5 years (2016-2020)?

- a. Decrease
- b. Stay the same
- c. Increase by 0-10%
- d. Increase by 11-25%
- e. Increase by over 25%

72. What is driving these changes?

73. Are there any efficient gas water heaters that you specifically favor or promote? What makes them better?

9.2.4 SECTION C: WATER HEATER PRICING

74. What do you think will happen to the price for efficient gas water heater installations in the next two years (2016-2017)? And how about five years (2016-2020)? [PROBE FOR: percent increase/decrease]

- a. Decrease
- b. Stay the same
- c. Increase by 0-10%
- d. Increase by 11-25%
- e. Increase by over 25%

75. Do you have any concerns about installation prices and practices of contractors selling efficient water heaters? [PROBE FOR: prices that are too high or too variable; utility rebates /tax credits are being "captured" by installers; too few installers; earthquake strapping; venting; gas pipe sizing; other issues]

9.2.5 SECTION D: MARKETING

Now let's discuss your marketing activities. Think about how you market in the Northwest specifically.

[ASK OF RETAILERS]

76. Who do you consider your primary target markets for high efficiency gas water heaters? For instance, do you focus on general households or specific demographics, new homebuilders, home remodelers, plumbers, multifamily property owners or other groups? Are there differences between, 0.67, tankless, and condensing?

[ASK OF DISTRIBUTORS]

77. Who do you consider your primary target markets for high efficiency gas water heaters? For instance, do you focus on homeowners, contractors, multifamily property owners or other groups?

78. How does your company currently market high efficiency gas water heaters for the residential market? [IF NO MARKETING, SKIP TO Q33]

79. And what are your key marketing messages? [PROBE FOR: energy savings, more control over settings, desire for improved technology, bill savings, rebates, more hot water etc.]

80. Why do you choose not to market high efficiency water heaters for households?

81. Do you ever give discounts? If so, to whom?

- f. How large a discount is generally required to move product?
- g. How effective are discounts compared to other forms of marketing?
- h. If you give discounts to the contractor, do you give them to the company or to the individual making the sale?

9.2.6 SECTION E: INTERACTION BETWEEN MARKET ACTORS

Next, I would like to talk about the contractors that install efficient gas water heaters.

82. Do you have any concerns about how your high efficiency gas water heaters are being installed?

- b. [IF YES, PROBE FOR: details on known or potential issues, prevalence of issues, and whether or not issues are related to plumbers and/or HVAC contractors] What concerns do you have?
83. Are there any technical challenges that hold back installations of efficient gas water heaters?
- b. [IF YES] What technical challenges?
84. When efficient or inefficient gas water heaters are replaced do you think the average contractor does the following:
- d. Installs seismic strapping to code
 - e. Makes code required venting and combustion air improvements
 - f. Makes any code required gas piping requirements

[ASK OF DISTRIBUTORS]

85. Do you also rely on contractors to promote your efficient gas water heaters?
- c. [IF YES] How do you work with contractors, to ensure that they use effective messaging to households?
86. How is it going working with the manufacturers that sell high efficiency gas water heaters to you?
- a. What is working well?
 - b. What could be improved?
87. Have you had any challenges working with specific manufacturers?
- a. [IF YES] What challenges have you experienced and why?

[ASK OF DISTRIBUTORS]

88. Do you work with any Northwest retailers to promote 0.67 or better storage tank gas water heaters?
89. [IF Q41 = "Yes"] Which retailers do you work with?
90. [IF Q41 = "Yes"] How do you work with these retailers? [PROBE FOR: whether or not they are coordinating discounts/rebates, co-funding advertising, giving them technical sales training, etc.]
91. [IF Q41 = "Yes"] Have you had any challenges working with specific retailers to promote your 0.67 or better EF units?
- a. [IF YES] What challenges have you experienced and why?
 - b. [IF YES] What has worked well and why?
92. [IF Q41 = "No"] Is there any particular reason why your company doesn't work with retailers on:
- a. 0.67 or better storage tank water heater
 - b. Tankless gas water heaters
 - c. Condensing gas water heaters
93. Do you think any manufacturer has done a better job than the others at designing a 0.67 or better water heater that is overall better fit for the replacement market?
94. Do you know of any 0.67 or better tanks that don't need to be plugged in?

9.2.7 SECTION F: EXPERIENCE WITH ENERGY TRUST

95. What interactions have you had with Energy Trust in the past year?
96. What impact have Energy Trust's efforts had on your sales of residential high efficiency gas water heaters in 2015?
97. Thinking of 2014 and 2015 only, did you have any challenges working with Energy Trust? [PROBE FOR: rebates eligibility, Energy Trust /CLEARResult delivery, training or marketing issues]
98. On a scale of 1 to 5, with 1 meaning "not at all satisfied" and 5 meaning "very satisfied," how satisfied would you say you are working with Energy Trust?

- b. Why do you say that?

9.2.8 SECTION G: BARRIERS AND CHALLENGES

We're almost done and I'd like to get your feedback on challenges for efficient gas water heaters...

- 99. What are the most common consumer barriers to purchasing high efficiency gas water heaters? [PROBE FOR: new technology concerns, lack of familiar brands, local codes, capital costs, install time/costs, availability for emergency replacement]
- 100. What impacts do these barriers to equipment purchase have, both in terms of demand and ease of installation and use?
- 101. What technological trends are you seeing with high efficiency gas water heaters?
- 102. What do you think will be the impact of the new federal standards? The new federal water heater standard requires that electric tanks larger than 55 gallons be more efficient than smaller tanks. How will you address this?
- 103. Will the federal standards have any effect on the smaller volume (<55gal) gas water heater market? What effect?
- 104. How do you think the market will respond when replacing these > 55 gallon electric water heaters?
[DO NOT READ THESE OPTIONS, BUT CODE THE ANSWER INTO ONE OF THEM.]
 - a. Install a heat pump water heater
 - b. Talk the homeowner into a smaller tank
 - c. Install two smaller electric tanks
 - d. Switch to gas tankless water heaters
 - e. Other
- 105. What do you feel are the largest barriers that heat pump water heaters face?
[DO NOT READ THESE OPTIONS, BUT CODE THE ANSWER INTO ONE OF THEM.]
 - a. Cost
 - b. They won't fit in many cases
 - c. Noise
 - d. The required maintenance won't be done
 - e. The extra weight requires a second installer or specialized equipment
 - f. Other
- 106. What are some successful strategies for increasing the number of efficient gas water heaters that are stocked and installed? [PROBE FOR: SPIFs, marketing blitzes, incentives for any sales above baseline (market lift), promotions to distributors/retailers/contractors, and any variation among different types of water heaters]
- 107. What are some unsuccessful strategies for increasing the number of efficient gas water heaters that are stocked and installed? [PROBE FOR: SPIFs, marketing blitzes, incentives for any sales above baseline (market lift), promotions to distributors/retailers/contractors, and any variation among different types of water heaters]

9.2.9 SECTION H: CLOSING

Those are all of the questions I have for you at this time. Is there anything else that you think would be important for us to know regarding high efficiency gas water heaters, Energy Trust, or anything else?

Thank you for answering all of my questions. I truly appreciate your willingness take time out of your day to provide feedback on your experience with the gas water heating market. Your responses will be compiled with those of other participants and be used to inform future programs.

Thank you VERY MUCH for your time!

9.3 CONTRACTORS

9.3.1 INTRODUCTION

My name is [NAME], and I work for CLEAResult, a company contracted to research the water heater market on behalf of Energy Trust of Oregon. I'd like to talk to you about your experience with the **EFFICIENT GAS** water heater market. Our conversation should take between 30 and 45 minutes. To show our appreciation of your valuable time, we will send you a \$150 Visa card. Again, we really appreciate your willingness to provide feedback. Your responses will help Energy Trust improve its energy efficiency programs so that customers can save money on energy costs in the future.

Throughout this interview, I will refer to "0.67 and better storage gas water heaters." By this I mean non-condensing gas tank water heaters with an energy factor, or EF, of 0.67 or greater.

[Record name, position, phone number, and set up time to talk]

9.3.2 SECTION A: DEMOGRAPHICS

First I'd like to get some general information about you and your company.

- 108. Please describe your position at [COMPANY].
 - a. CONFIRM STATUS AS CONTRACTOR
- 109. How long has your company sold water heaters?

9.3.3 SECTION B: MARKET SUPPLY

Now I would like to ask you a few questions about your supply of high efficiency gas water heaters.

- 110. From what company or companies do you source your 0.67 or better storage gas tank water heaters?
- 111. From what company or companies do you source your tankless water heaters?
- 112. From what company or companies do you source your condensing gas tank water heaters?
- 113. Do you have any problems getting high efficiency gas water heaters you need from the companies you work with in the time you need them? [IF YES , PROBE FOR DETAILS]
- 114. Does your company maintain a stock of high efficiency gas water heaters or do you always purchase them upon receiving an order?
 - a. Yes, we maintain stock.
 - b. No, we do not maintain stock. [SKIP TO Q12]
- 115. What brands and models of 0.67 or better storage tank water heaters do you keep in stock?
- 116. What brands and models of tankless water heaters do you keep in stock?
- 117. What brands and models of condensing water heaters do you keep in stock?
- 118. What motivated you to stock high efficiency gas water heaters? Are there different reasons for 0.67 or better storage gas tank water heaters, tankless gas water heaters, or condensing gas tank water heaters? [PROBE for demand, rebates, utilities, etc.]
- 119. [SKIP IF Q7 = "Yes"] Why don't you stock 0.67 or better storage tank water heaters?
- 120. [SKIP IF Q7 = "Yes"] Why don't you stock tankless water heaters?
- 121. [SKIP IF Q7 = "Yes"] Why don't you stock condensing water heaters?

122. How long does it take for orders to come?
123. Is it a difficult process?
124. What percentage of your residential-grade high efficiency gas water heater sales in 2014 are installed in new residential homes, versus retrofits in existing homes?
- New single family ____
 - Existing single family ____
 - New multifamily ____
 - Existing multifamily ____
 - Don't know ____
125. [ASK IF ANY WATER HEATERS GO INTO MULTIFAMILY] What kind of residential-grade water heaters go into multifamily?
126. [ASK IF Q7="YES"] Do your plumbers usually carry gas water heaters on their trucks as a part of daily routine?
- If so, which kind? Select all that apply.
 - Non-ENERGY STAR gas storage tanks
 - 0.67 or better storage tank water heater
 - Tankless gas water heaters
 - Condensing gas water heaters
127. Please estimate the % of all gas water heater installations in the market that have a permit pulled for the job in 2014.
128. What do you expect to happen to the demand for high efficiency gas heaters in the next five years (2016-2020)?
- Decrease
 - Stay the same
 - Increase by 0-10%
 - Increase by 11-25%
 - Increase by over 25%
129. What factors do you consider when selecting, selling, and installing efficient gas hot water heaters?
130. Are there any efficient gas water heaters that you specifically favor or promote? What makes them better?

9.3.4 SECTION C: WATER HEATER PRICING

131. What is the average installation price (parts and labor) charged by installers for:
- 0.67 or better storage tank water heaters?
 - Tankless gas water heaters?
 - Condensing gas water heaters?
132. How many hours per job do you typically bid for:
- 0.67 or better storage tank water heaters
 - Tankless gas water heaters
 - Condensing gas water heaters
 - A standard basic water heater
133. [IF PRICES VARY IN Q23, ASK]: Do the prices reflect higher product costs or higher labor costs? What are the key variables that impact pricing (equipment and labor)?

134. What do you think will happen to the price for efficient gas water heater installations in the next two years (2016-2017)? And how about five years (2016-2020)? [PROBE FOR: percent increase/decrease]
- Decrease
 - Stay the same
 - Increase by 0-10%
 - Increase by 11-25%
 - Increase by over 25%

9.3.5 SECTION D: MARKETING

Now let's discuss your marketing activities. Think about how you market in the Northwest specifically.

135. Who do you consider your primary target markets for high efficiency gas water heaters? For instance, do you focus on general households or specific demographics, new homebuilders, home remodelers, plumbers, or other groups? Are there differences between, 0.67, tankless, and condensing?
136. How does your company currently market high efficiency gas water heaters for the residential market? [IF NOT MARKETING, SKIP TO Q30]
137. And what are your key marketing messages? [PROBE FOR: energy savings, more control over settings, desire for improved technology, bill savings, rebates, more hot water etc.]
138. Why do you choose not to market high efficiency gas water heaters for households?
139. Can you describe your sales process, starting from when you get a phone call?
- Do you provide a quote over the phone or do you go out to the site?
 - Do you provide multiple water heater options or just one?
140. Do you ever give discounts?
- How large a discount is generally required to move product?
 - How effective are discounts compared to other forms of marketing?
141. Do you have any recommendations for Energy Trust or other Northwest utilities regarding how best to promote high efficiency gas water heaters to homeowners?

9.3.6 SECTION E: INTERACTION BETWEEN MARKET ACTORS

Next, I would like to talk about the process of installing efficient gas water heaters.

142. Are there any technical challenges that hold back installations of efficient gas water heaters?
- [IF YES] What technical challenges?
143. When efficient or inefficient gas water heaters are replaced do you think the average contractor does the following:
- Installs seismic strapping to code
 - Makes code required venting and combustion air improvements
 - Makes any code required gas piping requirements
144. Do you think any manufacturer has done a better job than the others at designing a 0.67 or better water heater that is overall a better fit for the replacement market?
145. Do you know of any 0.67 or better tanks that don't need to be plugged in?

9.3.7 SECTION F: EXPERIENCE WITH ENERGY TRUST

146. What interactions have you had with Energy Trust in the past year?

- 147. What impact have Energy Trust's efforts had on your sales of residential high efficiency gas water heaters in the past year?
- 148. Thinking of 2014 and 2015 only, did you have any challenges working with Energy Trust? [PROBE FOR: rebates eligibility, Energy Trust /CLEARResult delivery, training or marketing issues]
- 149. On a scale of 1 to 5, with 1 meaning "not at all satisfied " and 5 meaning "very satisfied," how satisfied would you say you are working with Energy Trust?
 - c. Why do you say that?

9.3.8 SECTION G: BARRIERS AND CHALLENGES

We're almost done and I'd like to get your feedback on challenges for efficient gas water heaters...

- 150. What are the key barriers to offering Energy Trust incentives to your customers? [PROBE FOR: contractor awareness, homeowner awareness, size of rebate, eligibility requirements]
- 151. What are the most common consumer barriers to purchasing high efficiency gas water heaters? [PROBE FOR: new technology concerns, lack of familiar brands, local codes, capital costs, install time/costs, availability for emergency replacement]
- 152. What impacts do these barriers to equipment purchase have, both in terms of demand and ease of installation and use?
- 153. Is cost more or less important in an emergency situation than in a nonemergency situation?
- 154. Can you tell from talking with a customer on the phone if a high efficiency gas water heater will actually fit where the old water heater was?
- 155. What do you think will be the impact of the new federal standards? The new federal water heater standard requires that electric tanks larger than 55 gallons be more efficient than smaller tanks. How will you address this?
- 156. Will the federal standards have any effect on the smaller volume (<55gal) gas water heater market? What effect?
- 157. How do you think the market will respond when replacing these > 55 gallon electric water heaters?
[DO NOT READ THESE OPTIONS, BUT CODE THE ANSWER INTO ONE OF THEM.]
 - a. Install a heat pump water heater
 - b. Talk the homeowner into a smaller tank
 - c. Install two smaller electric tanks
 - d. Switch to gas tankless water heaters
 - e. Other
- 158. What do you feel are the largest barriers that heat pump water heaters face?
[DO NOT READ THESE OPTIONS, BUT CODE THE ANSWER INTO ONE OF THEM.]
 - a. Cost
 - b. They won't fit in many cases
 - c. Noise
 - d. The required maintenance won't be done
 - e. The extra weight requires a second installer or specialized equipment
 - f. Other
- 159. What are some successful strategies for increasing the number of efficient gas water heaters that are stocked and installed? [(PROBE FOR: SPIFs, marketing blitzes, incentives for any sales above baseline (market lift), promotions to distributors/retailers/contractors, and any variation among different types of water heaters)]
- 160. What are some unsuccessful strategies for increasing the number of efficient gas water heaters that are stocked and installed? [PROBE FOR: SPIFs, marketing blitzes, incentives for any sales above baseline (market lift), promotions to distributors/retailers/contractors, and any variation among different types of water heaters]

9.3.9 SECTION H: CLOSING

Those are all of the questions I have for you at this time. Is there anything else that you think would be important for us to know regarding high efficiency gas water heaters, Energy Trust, or anything else?

Thank you for answering all of my questions. I truly appreciate your willingness take time out of your day to provide feedback on your experience with the gas water heating market. Your responses will be compiled with those of other participants and be used to inform future programs.

Thank you VERY MUCH for your time!