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Gas Tankless Water Heater Combined Research Report

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Table of Contents

1. EXECUTIVE SUMMARY ____ 1

2. RESEARCH BACKGROUND, OBJECTIVES, AND METHODOLOGY ____ 4

3. IN-DEPTH FINDINGS ____ 6

3.1 THE MARKET FOR NEW TECHNOLOGY ____ 6

3.2 INTRODUCTION TO MARKET ACTORS ____ 7

DISTRIBUTORS ____ 7

INSTALLERS ____ 8

CUSTOMERS ____ 10

DEMAND ____ 10

3.3 ONBOARDING PROCESS FOR NEW TECHNOLOGY: DISTRIBUTOR AND INSTALLER PERSPECTIVE ____ 12

INFORMATION GATHERING ____ 13

PRODUCT ASSESSMENT ____ 15

PILOTING ____ 18

ADOPTION ____ 19

3.4 THE CUSTOMER PERSPECTIVE ____ 25

INFORMATION GATHERING ____ 25

CONSIDERATIONS, DRIVERS, AND BARRIERS ____ 26

EXPERIENCE WITH TWH ____ 29

TWH INSTALLATION CASE STUDIES ____ 32

3.5 IMPLICATIONS FOR GHPWH ____ 37

APPENDIX ____ 43

1. Executive Summary

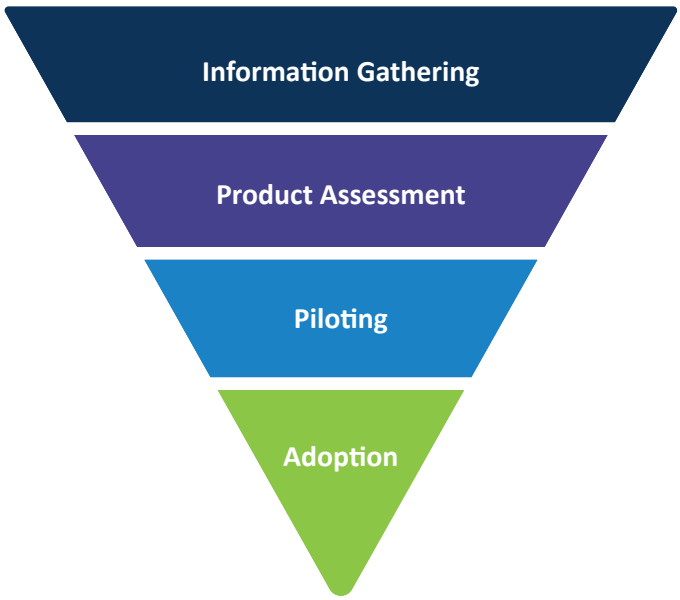
Northwest Energy Efficiency Alliance (NEEA) sought to build on and expand its existing research into and understanding of the successes and failures of gas tankless water heater (TWH) market adoption. The primary objectives of this research were to inform the design of effective interventions for the uptake and installation of **emerging water heater technologies** in general, and in particular, for a near-commercialized gas heat pump water heater (GHPWH) with an expected market entrance in the next two to four years. To gain a broad view of how market actors impact the uptake of new technology, ILLUME Advising, a third-party national research firm (hence forth referred to as "ILLUME" or "we"), conducted qualitative research that included a literature review and interviews with distributors, installers, and customers.

Through our research, we found that, in water heater technology, "new" is a relative term—while distributors and installers no longer view TWH as new technology, customers generally do. Customer awareness of the now decades-old technology is still fairly low, which influences urgency with which other market actors adopt changes and innovations with water heaters. Compared to other home-related technology and appliances, new water heater technologies are "new" longer because innovations have historically been infrequent.

As this research was focused on understanding how new technology (in this case, relatively new technology in the form of TWH) is absorbed, or not, into the market, we sought to understand the process by which market actors learn about products and then move toward their adoption, including the key questions, drivers, and barriers along the way.

The onboarding process for installers and distributors is fluid, dynamic, and deeply intertwined. Once aware of a new product or technology, each actor enters into a decision-making process that includes four main parts:

Figure 1: Onboarding Process for New Technology



1) **Information gathering** -- how and through what channels they learn about new products

2) **Product assessment** – how they go about answering fundamental questions about new products, including whether the product solves a problem for the customer, the implications of incorporating the product into their sales portfolio, and whether the manufacturer will stand behind their product

3) **Piloting** – in-person, hands-on training on, and testing of new products; and

4) **Adoption** – where the decision is made to carry or install a product, which then involves decisions about marketing, applications, and continuing training

While both distributors and installers go through this process in more or less these stages, it is not clean or linear, and drop out can occur at any point. For instance, if a pilot does not go well, an installer may decide not to adopt the product until issues have been resolved. Likewise, an installer or distributor might cease carrying a product after adopting it if too many issues arise – such as, difficulties with installation, or equipment performance issues resulting in customer call backs – and are not addressed by the manufacturer.

For **distributors**, this process revolves around gaining an understanding of whether there is or will be sufficient product demand from their installer customers to warrant product adoption (which they facilitate through on-site demonstrations, trainings, and so on), and their existing manufacturer relationships. For **installers**, much of this process is facilitated through the distributor—an important source of information and, ultimately, the provider of that product and accessory parts. Installers mainly consider the potential for customer demand and how easily they can install the product.

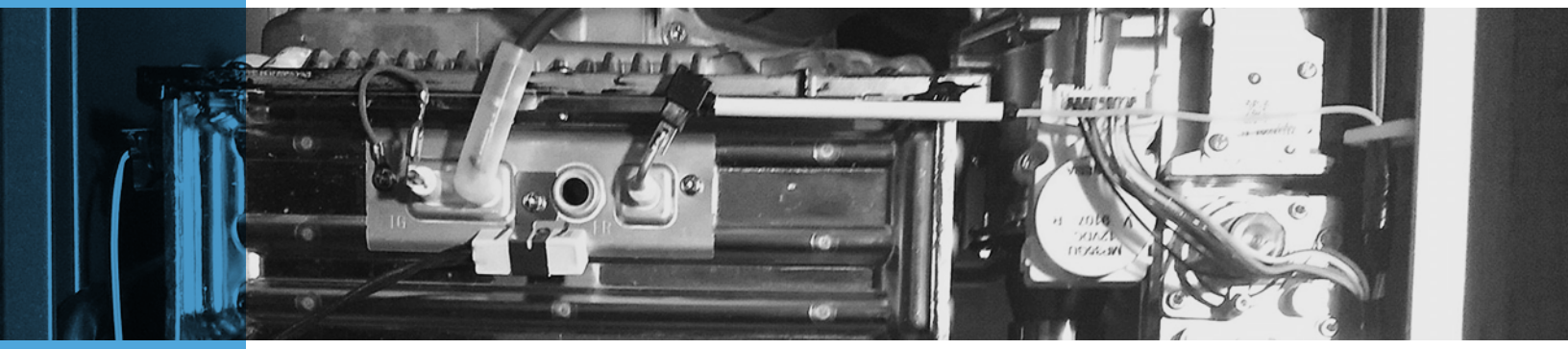
Installers and distributors look for products that will make jobs **easier**, so that less experienced technicians can do jobs with less risk for error and callbacks; and **faster**, so that installers can spend less time on a job and charge customers less for projects. The installer labor shortage is a factor in this consideration because installers feel stretched thin and distributors are looking for ways to support their installers.

When working with a new product, installers and distributors expect some issues to come up, but they also expect the manufacturer to stand by their product when this happens. Installers and distributors need to trust that the manufacturer will provide technical support and help them find a solution if they start having issues in the field. For distributors, this can also mean assurance from the manufacturer that they will buy back the product or cover freight to return product that does not sell or work.

A key focus of this report is the **flow of information amongst market actors**, as this is critical to creating confidence among market actors to adopt new technology and driving demand. Information about new technology tends to be somewhat less certain and more unevenly spread the farther one goes from the source, which in this instance, are the manufacturers who produce water heaters, accessory parts, and supply the information about them.

Although customers are the least knowledgeable about their options, they are also the primary source of demand within the market. While some installers we spoke to described walking customers through a range of options, many reported defaulting to like-for-like replacement in most cases unless a customer specifically asked for a TWH. Even when asked, some installers were hesitant to "upsell" TWH if they did not feel the customer really required one based on household size or space constraints. Therefore, new water heater technology has to overcome the inertia of like-for-like replacements as a default by proving to **have a strong enough value proposition.**

For their part, customers' primary drivers included **endless hot water supply**, a **desire for a high-quality product**, and getting a TWH as part of a **gas conversion**. Secondary drivers, usually mentioned as a benefit but more as a 'nice-to-have' mainly included **energy efficiency** (as a function of lower operating cost of gas), and **space savings**. The customers we spoke with were pleased with their TWH, and very few would consider going back to a traditional tank unit.



The main barriers for customers with regard to TWH were **cost of the unit and installation, lack of familiarity with TWH**, and **competing household replacements**. Installers also felt that emergency replacements were a significant barrier for TWH, or any other non-like-for-like option, owing primarily to people's desire not to be without hot water and the stress from the sudden need to replace their water heater. However, emergency replacements are an important market for new, high-efficiency technology, as most of the distributors and installers we spoke to reported that **the majority of water heaters replacements are emergencies** and result in like-for-like tank installs (we note that most of the customers we spoke with had planned replacements).

Key takeaways from this research include **the need for customer education**, which frequently came up as a tactic to generate customer demand for new technology and to **encourage more planned replacements**. Installers and distributors thought that general customer education as well as encouraging planned replacements were the responsibility of the utilities since they have a direct line to customers through their service. They noted that possible behavioral cues include tapping into the ritual of spring cleaning and taking stock of water heater condition. Others noted that utilities and other organizations could help customers afford more energy efficient and expensive products not only providing rebates but also **financing**. They noted that rebates, while clearly helpful in fostering adoption, are rarely sufficient to get new technology into the households without disposable income, but that financing can help make it more accessible.

2. Research Background, Objectives, and Methodology

Northwest Energy Efficiency Alliance (NEEA) sought to build on and expand its existing research into and understanding of the successes and failures of gas tankless water heater (TWH) market adoption. The primary objectives of this research were to inform the design of effective interventions for the uptake and installation of **emerging water heater technologies** in general, and in particular, for a near-commercialized gas heat pump water heater (GHPWH) with an expected market entrance in the next two to four years. To gain a broad view of how market actors impact the uptake of new technology, ILLUME interviewed distributors, installers, and customers. Our primary research questions by group can be summarized as follows:

Distributors: Understanding what drives stocking practices, particularly with regard to new technology along with the process and information sources used in deciding to onboard new technology

Installers: Understanding the factors involved in customer recommendations for and against TWH, processes and information used to incorporate new technology into their sales and service portfolios, and the associated opportunity cost

Customers: Purchasing considerations around choosing TWH, lived experiences with them, and the extent to which emergency replacements are a barrier to TWH

Market dynamics: How information and demand for new technology move through the supply chain, and the role of local inspectors and contractor licensing rules on the uptake of new technology

COMPLETED WORK ACTIVITIES

This research comprised three parts:

- Part 1 comprised a literature review including both industry reports, market research reports, and a re-analysis of interview and field data from previous NEEA research [link to report] and seven utility program manager interviews with NEEA's gas funders.
- Part 2 comprised two focus groups with installers at a manufacturer's facility following the demonstration of new products.
- Part 3 comprised in-depth interviews—in-person and over the phone—with customers, installers, and distributors.

Table 1. COMPLETED FIELD RESEARCH ACTIVITIES

PARTICIPANT LOCATION	DISTRIBUTOR[1]	INSTALLER	CUSTOMER
Spokane	1 in-store interview		
Tri-Cities	1 in-store interview	1 intercept interview	
Seattle	1 in-store interview	2 intercept interviews	
Vancouver, Portland			14 in-depth interviews
Portland Metro	5 in-store interviews, 1 in-depth interview	8 intercept interviews	2 in-depth interviews
Eugene		1 in-depth interview	
Combined Pacific Northwest, Midwest, and California		2 focus groups (n=14 installers)	
Total	**9 interviews**	**26 interviews**	**16 interviews**

During ILLUME's prior research into HVAC systems and water heaters for NEEA in 2018, ILLUME found that distributors were more receptive to scheduling interviews than installers and that installers were more willing to talk to us face-to-face when we walked into their shops rather than cold calling them to schedule an interview. This information informed our recruitment of installers and distributors for this research.

Distributors: We developed the wholesale distributor recruitment list by web-scraping for distributors who sold TWH throughout Washington and Oregon. We recruited distributors by cold calling branches. We attempted to recruit distributors in different regions—more rural versus urban—and by climate.

Installers: We recruited the installers in Part 2 of the research (n=14) through the host manufacturer's preferred installer list. We recruited the installers in Part 3 of the research from either trade ally lists from Energy Trust of Oregon (Energy Trust) and Northwest Natural (n=2) or with intercept interviews conducted by the research team stopping by installer shops (n=10).

Customers: All customers had installed a TWH in the past two years. We recruited most customers (n=13) from a pool of customers who had taken advantage of an Energy Trust rebate on TWH. Due to changes in the offering, the only eligible customers lived in Washington state. The other three customers were referrals from installers and staff at Northwest Natural Appliance Center.

[1] Distributors includes local retailers, like Northwest Natural's Appliance Center and wholesale distributors.

3. In-Depth Findings

3.1 THE MARKET FOR NEW TECHNOLOGY

Our research indicated that, with water heater technology, "new" is a relative term—while distributors and installers no longer view TWH as new technology, customers generally do. Customer awareness of the now decades-old technology is still fairly low, which influences urgency with which other market actors adopt changes and innovations with water heaters. Compared to other home-related technology and appliances, new water heater technologies are "new" longer because innovations have historically been infrequent.

Electric heat pump water heaters (EHPWH), for instance, have been on the market for several years now but only one customer we spoke with had come across EHPWH during their research. Slow and uneven dispersion of new product awareness and information can impact the customer-generated demand, which causes the product adoption to rely heavily on installers recommending the product—or creating the demand—among customers when there is generally little incentive for them to do so.

This can also give rise to misinformation because, rather than coming from one consistent source that broadly disseminates information, it filters and spreads through word-of-mouth among distributors, installers, and customers. Depending on the perceptions and experiences of the person sharing their views, this can positively or negatively impact product adoption more broadly. For example, a counter worker at a distributor explains to customers who come to their shop that a tank water heater works better than TWH in Oregon because it has a reservoir of hot water that provides more water than a TWH. He learned this—and the rest of his knowledge about water heaters—from ad hoc conversations with installers as they came in to purchase products.

Likewise, a persistent misconception relating to TWH among customers is that they provide instant hot water rather than endless hot water. Installers often try to clarify this point to customers before they install one, but it still came up in conversations with TWH owners as a disappointment, especially when they discover they have longer wait times for hot water at certain fixtures.

> **"We'll talk about how cold Oregon is, because a tankless water heater has to pull water from the ground and then it has to heat it up, all in one little tiny unit, and then it instantly disburses the water, whereas a tank has all that reservoir of water, so it doesn't have to heat it up instantaneously. So, you can get more water or kind of an interesting math ratio...up to a certain point the tank works better."**
>
> – Distributor, Portland, Oregon

In addition to discussing the barriers and drivers of new technology adoption and how it can be enabled, this report will also discuss the role each market actor has in the flow of information, as this is critical to creating confidence among market actors to adopt new technology and driving demand.

Before moving to these critical points, the following section introduces the market actors we spoke to as part of this research.

3.2 INTRODUCTION TO MARKET ACTORS

This section will provide a high-level introduction to the roles of market actors, an overview of their views on TWH/new technology, and their relationship with each other. We note that we have provided detailed analysis of distributors and installers in a previous report. [2]

DISTRIBUTORS

Distributors are a key actor with respect to the flow of both products and information through the water heater supply chain. They serve as a nexus for both; every piece of equipment and related bit of information passes through their doors and is given their consideration. In addition to their main purpose of housing and distributing products, they take the pulse of the market at all levels. They engage with manufacturers and their representatives to stay on top of products and technologies entering the market and communicate this information to their installers. They also engage with installers to understand their needs and those of end-customers, often communicating these needs back to manufacturers. They offer products and equipment, but also training and technical support.

Distributors know that they are only successful if the installers they support are successful, so the driving force behind most of their decisions is what they think is in the best interest of their customers. Overall, distributors are fairly homogeneous, as they serve a broad range of installers (whose businesses vary far more in terms of size and structure). There are niches in terms of the types and sizes of installers that distributors serve and differences in the brands and types of equipment that they offer, but they all use the same basic approach to the market and their installers. The ubiquitous distributor mantra is "service, service, service", and the only thing that truly differentiates one distributor from another is their ability to serve their installers and solve their problems.

With regard to TWH and newer technology in general, distributors consider their installers' needs and preferences, their view on whether a technology will have demand in their area, and their business' manufacturer and brand allegiances. The last point is one that distributors cannot easily change, but that is highly influential over whether they will carry a product. Distributor's relationships and alignment with manufacturers, including distributor proximity in a given area, is a key consideration particularly with new technology, which may be released by manufacturers at different times. If a manufacturer is much later to market, or does not end up manufacturing a product at all, it can have ramifications for distributors they cannot easily maneuver around.

> **"On the distribution side, each market can only have so many distributors with each brand. A lot of them, it's an exclusivity. Once you have one distributor, you can't have another one in the area."**
> **– Distributor, Seattle, Washington**

[2] Natural Gas Water Heater and HVAC Installer Research Report - ILLUME, 2018

> "Well, we got into the tankless game a little bit late. American's tankless is made by Takagi, but some of the other bigger brands were already out by the time we started. So, we were late to the game, which I think hurt us a little bit. It took a long time for us to get traction with ours." – Distributor, Spokane, Washington

Distributors aligned with manufacturers who are first to market with a product can reap the advantage of being the only ones in a given area to offer that product, but also carry the risk of it not selling.

> "I think that we definitely would have explored the possibility of carrying them [if our manufacturer offered tankless from the start]. Boy, I'm sure that we would have made a run at it though. Our owner is real big on the new shiny things. If we were involved at the beginning, well, he would've had us make a run at it." – Distributor, Spokane, Washington

INSTALLERS

Unlike distributors, who serve a broad range of installers, stock a broad range of products, and tend to be similar overall in their market role and emphasis on service, there is a great deal of variation among water heater installers depending on the size of the business and the customers they serve.[3] They vary from single-person operations specializing in a narrow range of products and applications to larger operations with multiple installers, sales and management teams, and administrative staff who 'do it all'.

While TWH are an established technology and no longer 'new', installers had differing experiences with the technology when it came to market. Most described some issues early on that ended up winnowing down the brands they carried to those with the fewest issues, the best manufacturer support, and the best supply of parts and resources around maintenance. Installers were more willing to try new products from brands they trusted and/or had worked with in the past.

Among installers, there is a sentiment that newer storage tank heaters are pretty efficient, especially compared to years ago. They express that 60% may not be 93% efficiency, but it is pretty good, and that the difference in energy savings between the two is not enough to justify the price difference.

In past ILLUME research, we found the sentiment that plumbers were more resistant to new technology, specifically TWH because "plumbers aren't computer chip [people]." However, both plumbers and HVAC installers for this research reported installing TWH frequently and without concern, and that barriers were not necessarily an inherent aversion to new technology, but based on specific factors related to installation requirements and customer needs (discussed further below in the Installer Perspective on Barrier/Impeding Factors section).

[3] Installers have been characterized in detail in a previous report: Natural Gas Water Heater and HVAC Installer Research Report - ILLUME, 2018

The old fashioned, stubborn plumber trope—expressed by both plumbers and other trades—may be more a cultural identity for plumbers than a testament to their abilities and product offerings. Our conversations with plumbers in this round of research revealed a willingness and familiarity among plumbers to install new technologies, including TWH. Despite this, plumbers, more so than HVAC installers, tended to demonstrate a higher bar for 'trying out' a new technology—a process we will discuss in the section on the Onboarding Process.

Regardless of which trade they were part of, installers emphasized that recommending products that suit their customers' needs was among their highest priority. This leads to a more conservative outlook on technology overall—if a simple tank heater is all they have needed in the past, there is little incentive for installers to recommend something more complicated.

> **"Everybody's pushing modulating furnaces, it's like a hundred furnaces in one. Those are a nightmare. You got five computer control boards in a lot of them...But technology keeps going. I'm lucky in four years I'm leaving the business with my son and I don't care."** – HVAC Installer, Portland, Oregon

Because of the installers' role in making recommendations to customers, their desire to complete jobs quickly and without call-backs, and their preference for known and tested products and solutions, it is critical to gain their buy-in and overcome their skepticism of new technology. The installers we spoke to following a demonstration of a new product were impressed and pleased at being included in the manufacturer's design process. As a result, the installers expressed confidence in how the product would turn out since "we're the ones putting them in."

Our research also found that, while plumbers and HVAC tradespeople are generally regarded as different and independent, the practice of subcontracting to one another on projects that require work outside of their preferred tasks and/or beyond their licensed capabilities was quite common. For example, an HVAC installer selling and installing a TWH and subcontracting to a plumber to hook up the potable water lines is common. Or, according to some installers and distributors we spoke with, installers will do the project without the proper licensing or permits, which can lead not only to illegal but to improper installations and issues for end-customers.

One HVAC company, with a water heater installer license but not a plumbing license, explained that they can only hang a TWH on a wall in tank-to-tankless retrofits and new construction. They can only do like-for-like replacements "as long as the plumbing does not exceed three feet." For situations when they are changing water heater technologies, they subcontract an area plumber, which they pay between $800 – 1,500 for connecting the potable water lines. However, it is apparently common in their area for HVAC installers to "just do it illegally," because they fear the extra expense of hiring a plumber raises the risk of getting undercut on a bid. While there is a fine if they get caught and they are pulling permits for the gas piping, the installers know that "some of the local inspectors turn a blind eye to it."

> **"What's common in our area is a lot of contractors, like heating contractors, just do it illegally. That's what we see the most of. It's a pattern that's existed here for a very long time. So, there is a lot of illegally-installed tankless water heaters in our area... Because they won't take the extra expense to hire a plumber and have the plumber come in and do the hookup and set the tankless water heater."**
> – HVAC Installer, Eugene, Oregon

For this reason, bringing new water heater technology to market must consider the licensed abilities and practical interdependencies amongst installers.

CUSTOMERS

There was a substantial variation among the customers we interviewed, including life stage, household composition, previous awareness of tankless, their decision-making processes, and individual journeys. We spoke with empty nesters, young families, people who sought and attained financing, DIY-ers, and people who had previously owned a TWH. That said, this was a self-selecting group of customers and they are likely unique to the broader customer population in that they are planners, they like to research products, and are willing to pay more for higher-quality products.

Most customers we spoke with had a planned replacement, meaning their water heater was still working, in some capacity, at the time of replacement. In these instances, customers typically caught an issue with their water heater and replaced their unit before it fully failed. Some customers knew their unit was old, and others noticed performance issues (e.g., small leaks, rust, sediment in tubs/sinks) and decided to research their options to either replace at that time or prepare for a replacement in the future.

Research was an important and varied process in customers' decision to install a TWH—and one that characterizes TWH owners. According to installers, many of their customers skip research and simply look at the price on the bid and go with the installers' recommendation. Unlike installers and distributors who view TWH as established technology, these units still have a sense of "newness" for most customers. As a result, customers wanted to understand TWH better before committing.

DEMAND

Although customers are the least knowledgeable about their options, they are also the primary source of demand within the market. While some installers we spoke to described walking customers through a range of options, many reported defaulting to like-for-like replacement in most cases unless a customer specifically asked for a TWH. Even when asked, some installers were hesitant to "upsell" TWH if they did not feel the customer really required one based on household size or space constraints. Therefore, new water heater technology has to overcome the inertia of like-for-like replacements as a default by proving to **have a strong enough value proposition**.

> **"And so, I was pretty insistent on getting the tankless one. My daughter and her husband had really not even heard of them. So, I insisted that we get that this time. And it has been fantastic. We've never run out of hot water. It doesn't take up all this space. It's just, I swear by it. I truly do."** – Customer

Installers who sold TWH frequently often specialized in energy efficient products or businesses, worked with builders who did, or worked in markets where square footage was at a premium, justifying the expense. We encountered a unique case where an installer decided early on that TWH would be their 'niche' in the market, and chose to specialize as a means of differentiation.

Whether demand originates with end-customers, as it appears to most of the time, or installers, it is notable that it moves in the opposite direction as information. Information generally begins with manufacturers and trickles down from there (see Figure 2 – Information Gathering). This indicates that efforts to inform and create demand in the market for new technology should not leave out those who are more numerous and harder to reach—i.e., customers and installers.

3.3 ONBOARDING PROCESS FOR NEW TECHNOLOGY: DISTRIBUTOR AND INSTALLER PERSPECTIVE

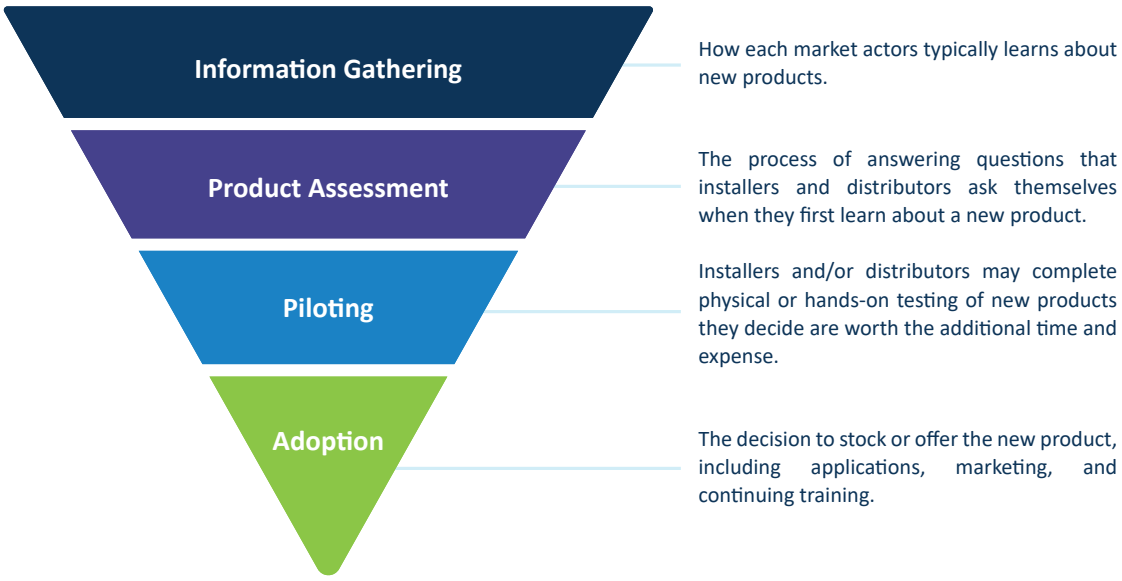
This section (and Figure 1) outlines and then describes the four main stages in the process that distributors and installers follow when considering new products. We organized the information this way to highlight the overlap between installers and distributors in this process, as well as their interconnectedness throughout. Following this section, we provide an analysis of customers and their decision-making process.

The onboarding process for installers and distributors is fluid, dynamic, and deeply intertwined. Once aware of a new product or technology, each actor enters into a decision-making process that includes multiple iterations of information gathering and product assessment and piloting before adoption.

The following section delves into the specifics for both distributors and installers at each stage of their process to onboard technology. We note that **while this is a staged process in general, it is not clean or linear, and drop out can happen at any point**. For instance, if a pilot does not go well, an installer may decide not to adopt the product until issues have been resolved.

For **distributors**, this process is largely predicated on sufficient product demand from their installer customers to warrant product adoption, and their existing manufacturer relationships. For **installers**, much of this process is facilitated through the distributor—an important source of information and, ultimately, the provider of that product and accessory parts. Installers mainly consider the potential for customer demand and how easily they can install the product.

Figure 1: Onboarding Process for New Technology



INFORMATION GATHERING

This section covers common sources of information for installers and distributors and describes how information moves among these actors (see Figure 2).

When it comes to new technology, **manufacturer representatives** (reps) are a common source of information for both distributors and installers. Manufacturer reps sometimes work for product manufacturers directly but more often work for third-party organizations that represent multiple lines of products and manufacturers. Reps serve as the "boots on the ground" for the manufacturer to reach more areas. Accordingly, manufacturer reps primarily promote products and provide technical support—sometimes for multiple manufacturers—to distributors and installers in a particular region.

Manufacturer reps are in contact with both distributors and installers and interact with them in a variety of ways: in-person at distributor or installers businesses, over the phone, and through email. The regularity and mediums for these interactions can vary based on company purchasing power, the installer and distributors' relationship with the rep, and the brands the installer and distributor typically installs/stocks. The most common interactions we heard about, related to the adoption of new products, include:

Annual meetings: Some distributors hold an annual meeting with branch personnel and their manufacturer reps. At these meetings, reps typically introduce new products and equipment that they plan to bring to market that year.

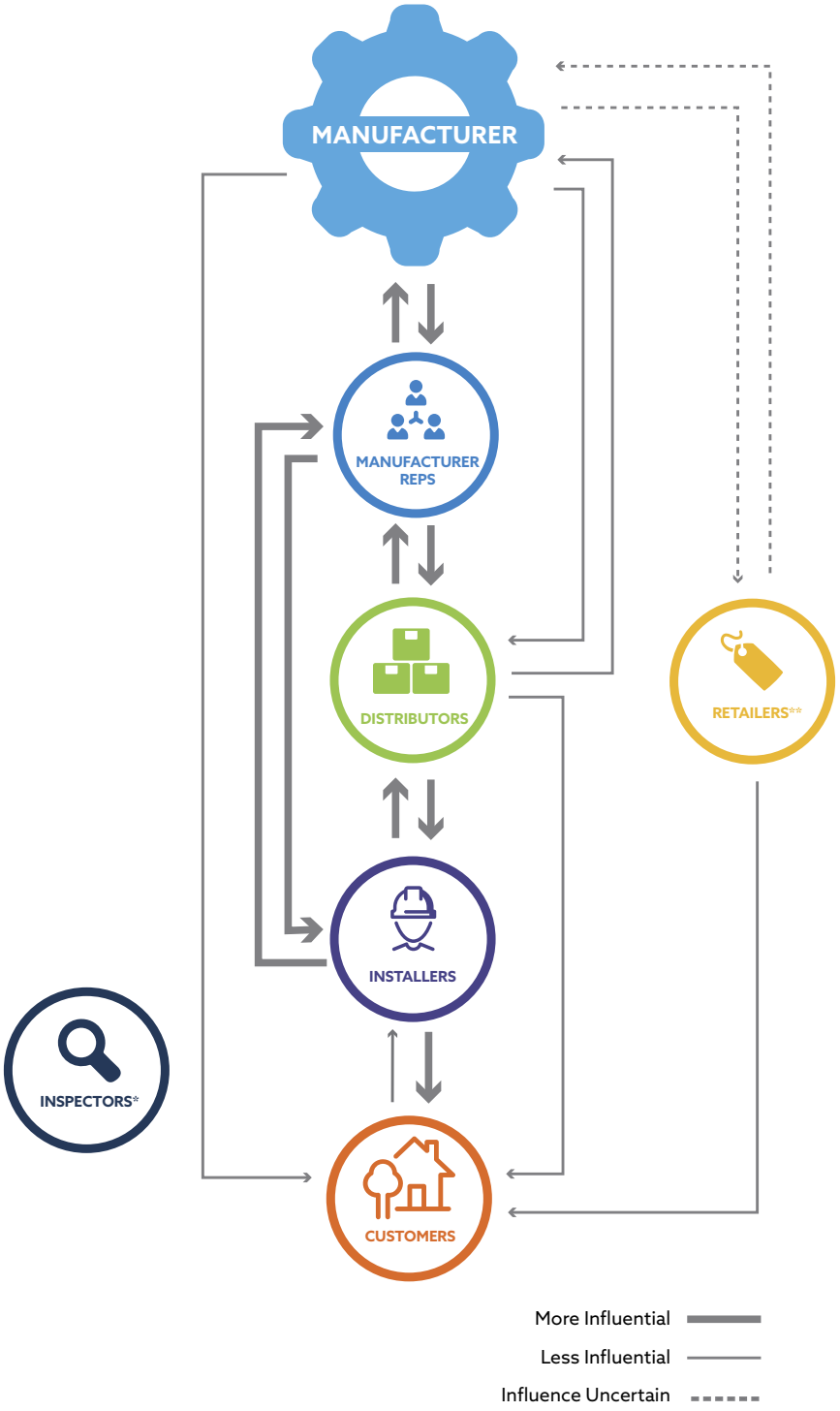
Ad-hoc check-ins: Manufacturer reps will call, email, or show up at installer and distributor shops to inform them of new product offerings or changes to existing offerings. The regularity of these check-ins can vary based on the manufacturer rep and/or size of the distributor/installer, generally increasing with business size (and purchasing power).

Distributor table days: Manufacturer reps coordinate with distributors to schedule days for the rep to host a table at the distributor's shop. These events are intended to share new/featured product information with installers, as well as answer their product questions. Table days usually include BBQ or coffee and donuts to draw in the installers as they come and go. These activities are good opportunities to reach smaller installation companies and technicians.

> **"We typically have a counter day one to three times a month. So, local representatives, they'll showcase products just to get the word out and try to get more sales."** – Distributor, Portland, Oregon

Trainings: Manufacturer reps coordinate trainings between both distributors and installers, which are critical for installers to learn new products, and generally cover product installation and servicing. Larger installers often host their own trainings because it is easier for the rep to come to them versus sending staff to a distributor's shop. It also allows them to customize the trainings to meet their company's needs. Distributor-hosted trainings are usually open to any interested installers.

Figure 2: The spread of information among market actors



* Inspectors are another market actor whose awareness of new technology can impact adoption by other market actors. That said, how inspectors are informed and how they inform other market actors was beyond the scope of this research.

** Retailers includes big box retailers, like Home Depot and Lowe's, as well as local retailers, like Northwest Natural's Appliance Center.

Distributors and installers: They are a common information source for one another. Distributors and installers share information from manufacturer reps and other sources with one another. For example, installers may see a new product or setup in the field—during visits to other distributors, service calls to homes, or while working on a new construction site—and bring it to their distributor's attention to find out more information. Many distributors also staff outside sales teams that call on installer customers and gather information related to customer demand. Depending on the perceived viability of the product for their business (based on factors described in detail below), the distributor may then start discussing the product with other installers early on as a way to gauge potential interest, then as a way to sell a product once stocked.

> **"We learn as much from our contractors about what we should be stocking as they learn from us on what they should be using. They'll see things at other wholesalers or when they're on the job and bring it up to us – 'Hey, is this available, because it would be way easier.' That kind of stuff. Our customers are a huge base of knowledge for what we carry."** – Distributor, Spokane, Washington

Distributors and installers noted that professional publications, industry organizations, and membership groups are additional sources of information. We list and briefly describe these sources below.

Journeymen trainings – licensed journeymen installers (e.g., electricians and plumbers) are required to take continuing education courses to maintain their license. These trainings cover a variety of topics, including codes and standards, new products, and best practices for installation and servicing.

Service Roundtable – a paid, online membership group, with a similar feel to social media, for installers. It is a source of information for installers on new products, price books, installation workarounds, and warehouse management.

Trade Organizations – both distributors and installers look to trade organizations to keep up with industry information. Some receive magazines and attend industry trade shows. Commonly cited trade organizations, include:

- ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
- ASPE – American Society of Plumbing Engineers
- PHCC – Plumbing Heating Cooling Contractors Association
- IAPMO – International Association of Plumbing and Mechanical Officials
- ORACA – Ontario Refrigeration & Air Conditioning Contractors Association
- NATE – North American Technician Excellence

PRODUCT ASSESSMENT

Once market actors learn about a new product, they assess the product and its suitability for their business and customers to determine whether they will move on to the next step. This process generally focuses on installers and distributors answering three main questions:

- Does the product solve a problem for the customer?
- What are the implications of incorporating the product into their sales portfolio?
- Will the manufacturer back-up their product?

Distributor and installer backgrounds and preferences play a role in how they answer these questions and the weight they apply to each. **Ultimately, the distributors and installers are trying to determine whether the product's value proposition is worth the opportunity cost to offer it.** If the distributor or installer decides the cost to adopt the product is too great, they will not consider it further.

Distributors and installers are closely linked at this stage largely because distributors stock what they know will sell; and therefore, look for products based on criteria that installers are considering. As every distributor says, service is the only differentiator between them and their competitors, making them highly tuned in to installer needs. While distributors might focus on finding products that are reliable and reduce installation time, they also pay attention to products that will have value for the end-customer because they understand that is important to installers.

> "I think [installers] have a huge influence. I think that they install what they're comfortable with and what they know. It's a lot harder for me to change their mind unless it helps them or benefits them. We really truly stock what they want. We'll try and convince them of something new; we'll teach them about it, but usually what they want is what they want." – Distributor, Pasco, Washington

As noted earlier, the onboarding process is not necessarily linear, and product assessment and reassessment can result in different outcomes, for instance if a manufacturer overcomes an issue that resulted in installers and/or distributors deciding against offering it.

> "Once [the manufacturer] came out with the TWH that was PVC vented, that was huge, that's what we put into this area faster than anything." – Distributor, Spokane, Washington

MARKET FEASIBILITY: DOES THE PRODUCT SOLVE A PROBLEM FOR THE CUSTOMER?

When considering a new product, installers and distributors carefully consider whether the product solves a problem for the customer. Installers do not want to sell customers equipment that they do not need or is not suitable for their household.

TWH's specific features that checked this box for distributors and installers are the endless hot water, small footprint, energy efficiency, and no tank. The endless hot water solved the customer problem of running out of hot water faced by many large households; the equipment's small footprint solved a problem of optimizing square footage in a small apartment or accessory dwelling unit; and no tank

meant higher efficiency and that customers would not have to worry about flooding.

> **"To have this super high-efficiency heating device was very desirable, as well the smaller footprint. The customers found out about tankless, and they really were the driving force behind the demand."**
> **– Installer, Eugene, Oregon**

ADOPTION IMPLICATIONS: WHAT ARE THE PRODUCT IMPLICATIONS FOR INSTALLERS?

Installers and distributors look for products that will make jobs easier, so that less experienced technicians can do jobs with less risk for error and callbacks; and faster, so that installers can spend less time on a job and charge customers less for projects. The installer labor shortage is a factor in this consideration because installers feel stretched thin and distributors are looking for ways to support their installers.

> **"There is a massive shortage of labor right now…what we really look for are things that save our contractors time and labor so that they can get more jobs done…We try not to promote products that are going to zap them of a lot of time…Anything that we're promoting should be efficient – meaning, have the least amount of impact on their labor pool and it should make life easier for them."**
> **– Distributor, Seattle, Washington**

MANUFACTURER REPUTATION: WILL THE MANUFACTURER BACK-UP THEIR PRODUCT?

When working with a new product, installers and distributors expect some issues and problems to come up, but they also expect the manufacturer to stand by their product when this happens. Installers and distributors need to trust that the manufacturer will provide technical support and help them find a solution if they start having issues in the field. For distributors, this can also mean assurance from the manufacturer that they will buy back the product or cover freight to return product that does not sell or work.

One HVAC installer described an instance where they stopped considering a product because the installation did not seem easy or straightforward to them. Plus, they were not familiar with the manufacturer and were concerned they would "ghost" them once they installed the product and started having issues.

> **"This one was a European water heater technology…so, in these units we have refrigeration. We have a license to handle all that refrigeration, but this unit has CO2. CO2 works at much higher pressures, we're hitting 10,000 PSI with these things, and we have no technicians that know how to work on it. So, I don't want to take a product and start putting it in, and then have a problem and who do we call? Ghostbusters…"**
> **– HVAC Installer, Portland, Oregon**

PILOTING

Product piloting is the physical or hands-on testing of new products that installers and distributors have decided are worth additional time and expense, after assessment. For a product to reach this stage, it needs to prove its value for installers, customers, or both. To move beyond this stage, the product needs to prove it works in the field. The piloting stage is when installers get their hands on a product, attend trainings, experiment with the product, and decide whether it is something they will want to fully incorporate into their business.

While distributors play a role in piloting, this part of the process is primarily focused on installers and their acceptance of the product; distributors' role is primarily to facilitate and support installer adoption.

PRODUCT TRAINING

Prior to piloting a new piece of equipment, installers attend product trainings to learn how to sell and install the product. These trainings are often conducted by the manufacturer rep and facilitated/hosted by distributors.

> **"I tend to gravitate towards manufacturers that offer some kind of training for their product. Today's products are extremely convoluted...They're basically are computers now that make hot water."** – Installer, Portland, Oregon

FIELD TESTING

Installers field test a product by installing it in their own home or finding a willing customer who is interested in the technology and prepared for the installer to come back and fix an issue.

Several installers and distributors mentioned installing TWH in their own homes to gain a better understanding of how it works, the best way to install it, and an idea of what customers might experience. Besides helping them vet TWH, this also turned into a sales tactic for installers because they would tell customers they had one in their home and about their experience with it—the good and the bad.

> **"It takes some adjusting to get used to it, going from a tank heater to a tankless. But I had to do that because I didn't believe in a tankless heater and I knew that was a market coming up. So, I paid to have one put in my house so I could experience it and I could sell it. And then once I lived it, I'm a very big believer in it.** – Distributor, Seattle, Washington

One installer described an instance where a customer wanted a new type of equipment. In this situation, they cautioned the customer to "expect [them] to be back" to work on the equipment because it is new. Given this information, the customer was still interested and did not mind follow-ups. The installer noted that it was important to manage customer expectations about equipment performance—something that we heard in Phase 1 with HPWHs and more generally from installers when informing customers

about their different technology options. In this case, the customer ended up "selling" the equipment to the installer and their team of technicians by telling them about the product's features.

> **"That's what customers want, if they're going to try a newer product, they want that peace of mind that you're not going to just, move on. It doesn't work that way, it's a long-term relationship."**
> **– Installer, Portland, Oregon**

During field tests, distributors provide installers with technical support to resolve any issues. Distributors also gather feedback and insights from installers that they can then share with other installers.

ADOPTION: CONSIDERATIONS, DRIVERS, AND BARRIERS

As previously noted, there are several considerations that can impact the way that market actors evaluate and prioritize products, which tend to come down to the two key questions of (1) 'What is the feasibility of a product in the market?' and (2) 'What are the implications of incorporating the equipment for my business?'

The answers to these questions relate primarily to **installer experience**, **business structure**, **attitude toward new technology**, and **the market in which they operate**. The process outlined above is the primary structure for the equipment onboarding process; here, we present the various factors that market actors consider as they move through each stage in the process.

DISTRIBUTOR STOCKING CONSIDERATIONS

There is some variation in the autonomy of individual branches to make stocking decisions, with an apparent correlation to size (branches of smaller distributors have greater autonomy over their stocking decisions). While most distributors will accommodate installer requests for any piece of equipment on a case by case basis, decisions concerning stocking practices and equipment promotion are usually made at the corporate-level and involve negotiations with each distributors' respective buying group. Branch-level distributors described the need to present a sufficient business case to their corporate team to drive more widespread corporate adoption.

> **"In order for us to bring product in, usually we have to come up with some business case. I'm not talking just like one little part or piece. If we're saying, 'Hey, we want to support this one product line that we're not currently supporting', we have to put together a business case. Usually that means some customer following or market intel to show that we are going to be able to sell it."** – Distributor, Seattle, Washington

As previously reported, buying groups[4] appear to have more influence on price negotiations of water heating equipment than HVAC equipment, and represent a potentially important actor in the uptake of new technology that has yet to be fully explored. In these situations, distributors may look to get a

[4] Buying groups leverage the purchasing power of a large number of independent distributors and provide distributors with an opportunity to discuss business strategies and share ideas with non-competing businesses.

guaranteed buy back from whomever the manufacturer is, "Just to make sure that, if in six months or 12 months it doesn't sell, will they take it back?"

As noted earlier, the relationships between distributors and manufacturers are extremely important and highly influential over whether a distributor will stock a new technology.

> **"Well, actually, for a wholesaler to switch brands is not easy… It takes an act of Congress to get picked up by another and want to drop one. You end up building long-term relations, and it's not easy… Because they don't like one another, manufacturers don't, and there's basically three manufacturers that make tank water heaters anymore. They don't want to have competitors next door to one another."** – Distributor, Portland, Oregon

MARKET CHALLENGES: LICENSING, LABOR, AND SUBCONTRACTING

When we asked installers about the licensing and permitting requirements to install water heaters, we heard many different, sometimes conflicting, responses. License and permitting enforcement also seem varied in the industry, according to both installers and distributors. This, in conjunction with the labor shortage, has allowed unlicensed/unqualified installers to fill space in the market.

Labor shortage. Although most installers and distributors thought the labor shortage was impacting all trades, we heard that it may be impacting plumbers and electricians more than HVAC installers. Part of this difference may be connected to variations in licensing requirements for plumbers compared to HVAC installers. Becoming a journeyman plumber requires between four and five years of school and continuing education to maintain the license. Whereas, HVAC installers joked that anyone with a business license and an 9th grade reading level (to pass the refrigerant test) could become an HVAC installer within a week.

> **"HVAC, in Oregon, is essentially an unlicensed, unregulated industry…you could go to the supply house, take your Universal refrigerant test, which…any ninth-grader could read the book, take the test, and pass… And then you go get a CCB with the State of Oregon, a bond, and open an account at a distributor, and then you're a residential HVAC contractor…any service technician that essentially has no licenses can go start a HVAC [company] in a week. So, therefore, it's way easier to get saturation of our market on the HVAC side." – Installer, Eugene, Oregon**

Regional differences. Installers we spoke with indicated that Washington state may be more stringent when it comes to gas and venting licensing than Oregon. In Washington, installers noted that plumbers can usually handle those systems, but it might depend on the municipality they are working in since some require gas licenses. We did not hear of similar licensing requirements in Oregon. If the municipality requires a separate license for handling gas, then it could be a barrier for plumbers to convert a customer to a TWH because they would need to subcontract to someone with a gas license or get the license for themselves.

Permitting and inspections. While permits and inspections do not rise to the level of being a true barrier, and are technically required for all water heater replacements, most installers do not pull permits on like-for-like replacements (and say that this goes unenforced), but do pull them for TWH installation given that there are more household modifications and that this leads to greater enforcement. The main implication is that this requirement, which appears to be more likely enforced for new technology or anything requiring household modifications, adds cost for the customer and two steps for the installers (1) pulling the permit and (2) having the inspector come out.

Whether inspectors are fully knowledgeable about a given issue or technology was another potential variable installers cited as a hassle or impediment, if not a barrier. Installers often referenced their "old school" knowledge about technology and installation practices, and that this could make new applications or technology challenging to get through the process. This came up in particular in discussions about the NFPA 54 code – "[Inspectors] have to understand it to adopt it. A lot of the city inspectors are old school. The old methods they learned, and they're stuck. That's how they know it." – HVAC Installer, Portland, Oregon.

Subcontracting. While installers did not explicitly state that subcontracting can serve as a barrier for TWH, or other efficient, new technologies, it can increase the overall project cost and require more coordination on the part of the prime installer. Accordingly, this could serve as a barrier for some companies and push them to stick with jobs that do not require subcontracting. One HVAC company noted that they "[don't] try to get [themselves] involved in" jobs that require them to subcontract because it keeps their prices more competitive and streamlines the bidding process (sometimes bids require the subcontractor to assess the job on-site).

Plumbers subcontracting to HVAC companies for gas line and/or venting work is another example of a potential subcontracting barrier. Although the consensus is plumbers are legally allowed to handle venting and gas piping, we heard from HVAC companies that some plumbers do not want/like/know how to do it, and will subcontract that part of a job to HVAC installers. One HVAC installer recalled a recent project where a plumber subcontracted them to run the gas line for a TWH he installed, "[the plumber] could have done it…he would have saved himself a thousand dollars. I don't know, plumbers don't like gas pipes."

INSTALLERS PERSPECTIVE ON KEY BARRIERS/IMPEDING FACTORS

Perceived value for customer. Salespeople and installers often consider TWH as 'upselling' and not typically justifiable in terms of return on investment. It is still common for installers to recommend a tank water heater, especially in emergency replacements, to meet the customer's needs and budget.

Similarly, although to a greater degree than TWH, almost all installers—both HVAC installers and plumbers—perceive little value in electric HPWHs, especially in situations where the EHPWH is in a conditioned space. Installers often commented that the main "downside is you put a heat pump in someone's basement, it's going to suck all the heat out of the basement." Some installers thought that this was a feature that customers did not like, and others felt like the EHPWH was misleading to customers who care about energy efficiency "because it's taking heat from the house that the furnace then has to heat."

An HVAC installer noted that they have had a difficult time fitting the EHPWH into their business and see it as a "niche" product. The installer specifically highlighted that the bad reputation EHPWH earned when they first came to market has been difficult to overcome; in addition to being a hard sell to customers with the slow recovery time.

> **"[EHPWH] is a niche business…they got a bad rap right out of the gate because there were some manufacturers that jumped in the bandwagon, and they just didn't have a robust enough piece of equipment to meet the customers' needs. And another thing is that they're really low Btu, and, it's really hard to sell a customer on a really low Btu appliance when they're used to an abundance of hot water."**
> – Installer, Eugene, Oregon

Installation time owing to household modifications and subcontracting. Installers primarily highlighted increased installation time and cost owing to household modifications (e.g., upsizing gas lines and venting) as main barriers to TWH uptake. Upsizing gas lines or running PVC venting is not particularly difficult, but it is an extra step that, according to most installers, requires an inspection. The inspection adds another step and these factors together increase project cost. As noted above, though customers do not seem to notice or mind the practice of subcontracting, it can also add to the total cost, which might put some customers off tankless.

Despite this, installers did identify suitable applications for TWH to include planned replacements where efficiency is a project-wide or home-wide priority, large households with heavy water use, and in accessory dwelling units where space considerations are important.

While some installers also think that a TWH is "more than they need," most will sell it at the customer's request. This supports one distributor's theory that most installers do not mind installing a product that takes longer to install, but they do mind taking the time to "convince the end user to switch…to something new" because "they are too busy and they just want to get to the next job."

When customers are interested in TWH, installers do their best to manage customer expectations about performance. For example, the cold-water sandwich, the myth that it provides instant hot water, and the fact that it may take a while for the hot water to reach certain fixtures.

Emergency replacements. Although emergency replacements are certainly possible, they are more time-consuming and expensive. As one installer explained, "you can't just switch" to a TWH because there are more steps involved and customers are not willing to wait longer. The turnaround on TWH can be a couple of days versus like-for-like replacements are either same day or next day.

> **"You can't just go, 'Oh, hey, your tank is leaking now, let's put a tankless.' It doesn't work that way because there are days involved with rerunning gas lines and venting and so it's just not an easy, quick turnaround."**
> – Installer, Portland, Oregon

Tankless installations require an in-person consultation, whereas for like-for-like tank replacements, some installers do the consultation over the phone. As one installer commented, **"there's no cookie cutter installation for tankless, especially when you are retrofitting."** Installers are supposed to pull permits for TWH installations -- one installer said it takes three -- whereas tank water heaters installs typically do not require permits. One installer noted that you should pull a permit but that inspectors do not enforce it. Most TWH installations also still need a gas line upgrade. Despite the NFPA 54, market actors commented that inspectors will not pass a job where the gas line has not been changed. Once the gas line and venting are installed, the inspectors come out, typically either the same day or the next day. Then, the installer has to come back and install/hook up the TWH.

We learned in Part 1 of this research that a utility offers a loaner water heater program for circumstances where customers want a TWH but do not want to be without hot water. One installer we spoke to in Eugene mentioned a similar offering but noted that it was rarely used because they have not had the chance to plan for it. For example, a customer may want to install a gas fireplace or furnace at the same time as a TWH. The barrier becomes the unexpected aspect of the emergency replacement situation. The customer may want the TWH, but they are not "ready" to make that decision yet. This is consistent with the findings from customer interviews, where most did a good amount of research and planning prior to getting their TWH installed.

NFPA 54: Gas pipe sizing methods. A point of interest for this research was how code changes, that were intended to alleviate adoption barriers for newer technologies, fare in the real world. To that end, we spoke to installers about the new NFPA 54 code provision which allows gas appliances with higher firing rates to use smaller gas lines in certain applications.[5] Installer awareness and acceptance of the NFPA 54 provision was of interest for this research because increasing the size of the gas line is considered one of the barriers for TWH adoption, especially in emergency replacements.

Among the installers we spoke with, about half asked demonstrated awareness of the NFPA 54 code (an even split of plumbers and installers). There were two plumbers who had not heard of the code but were able guess how it worked—using negative gas pressure to supply the TWH. Several installers mentioned learning about the code from manufacturer's training classes and the installation manual for newer TWH. Most installers thought it needed to be adopted by the local jurisdictions, which is something they would learn about through notices about updates to the uniform mechanical code.

Generally, installers were skeptical of it in practice due to concerns that it would impact other gas appliances on the same line by "sucking fuel" from them. Plumbers and HVAC installers share this perception and most noted that they would stick with the longest-length method because they think it will avoid customer call-backs and give the customer greater flexibility if they want to add gas appliances in the future. One installer also noted that it is the easiest method to train staff to use.

[5] As of 2012, NFPA 54 (National Fuel Gas Code) added new provisions to its gas pipe sizing methods that permit appliances, with up to 200 MBH firing rates, to use ½" gas lines up to 40 ft-equivalent. This allows TWH to operate on ½" gas lines, in certain situations. The new provision also outlines alternative procedures for adequately sizing a gas pipe system for a building—the branch length method versus the longest length method in the previous code iteration—to better account for energy use under realistic hot water draw patterns.

> **"A lot of the states, they adopted it. Because it's actually sucking gas through the line but it's gotta be the first appliance off the line...That's the only way. If Oregon adopts it, it'll have to be the first appliance and 99.9% of water heaters aren't the first appliance so you'd still have to re-pipe anyway."**
> – Installer, Portland, Oregon

Two HVAC installers claimed that local inspectors are a barrier to implementing the code because they do not understand how it works. These installers observed that inspectors will only approve jobs that are based on the longest length sizing method. This signals that educating inspectors may be an important aspect for new product and code adoption.

> **"Inspectors have to understand it to adopt it. So, a lot of the city inspectors are old school. They used the old methods they learned, and they're stuck. That's how they know it."** – Installer, Portland, Oregon

UTILITY REBATE PROGRAMS

Distributors we spoke with described that utility rebates can spark an increase in sales for a new product but, once the rebate ends, the sales drop-off. This is, in part, because installers are driven by cost and are often drawn to the lowest cost option. As a result, when rebates for a specific product dry up, installers may not push the new product as an option because they do not think the value is worth the cost of the product, especially if the previously rebated equipment does not provide advantages with respect to time and ease of installation. Most distributors discussed this pattern in terms of the recent EHPWH rebate offered at the distributor-level.

> **"Well, I would say that the time that we actually sold the most heat pump water heaters was when we got the rebate directly at the branch, and we could take it right off the sale price before it even left the door. That was huge. I mean we probably sold 50 heat pump water heaters in three months. We probably haven't sold two a month after that rebate went away."** – Distributor, Portland, Oregon

Distributor-level rebates helped boost sales for a period, but most distributors expressed frustration with the extra work required to track and process the rebate information. Some remarked that the "cleanest" or "easiest" rebate comes from the manufacturer. Others also suggested rebates at the customer-level because it puts the "onus on the homeowner, who may really want that product."

> **"Wholesalers are in the business to inventory product and to sell the product. We're not in the business to run reports, keep track of addresses, where things are going, if it's a new install, not a new install."**
> – Distributor, Portland, Oregon

There was no consensus among installers about where in the supply-chain rebates are best placed. Most said that customers often asked them whether rebates were available. Installers want to include rebates in their bids but are not always aware of all of the available rebates and incentives. One installer wished that there was a single, up-to-date source that listed all the available rebates including, manufacturer, state, federal, and utility rebates. Similar to distributors, some installers—typically smaller companies with less office staff—lamented the administrative aspects of offering rebates.

3.4 THE CUSTOMER PERSPECTIVE

This section of the report will echo the previous sections in discussing the process by which customers make decisions about water heaters, and, for this research, select a TWH.

Despite a common source for many of the customer participants, there remained substantial variation among them (life stage, household composition, previous awareness of TWH), their decision-making processes, and journeys. We spoke with empty nesters, young families, people who sought and attained financing, DIY-ers, and people who had previously owned a TWH.

Most customers we spoke with had a planned replacement— their water heater was still working, in some capacity, at the time of replacement. This aligns with installer feedback that the majority of TWH installations are planned because changing to a TWH from a tank water heater requires more steps than a like-for-like replacement. In these instances, customers typically caught an issue with their water heater and replaced their unit before it fully failed. Some customers knew it was old and others noticed performance issues (e.g., small leaks, rust, sediment in tubs/sinks) and decided to research their options to either replace at that time or prepare for a replacement in the future.

INFORMATION GATHERING

Research was an important and varied process in customers' decision to install a TWH. Broadly speaking, most customers began their research on the internet, accessing various sources (listed below), before moving on to speaking to installers, usually by requesting bids.

We note that this level of research and information gathering is not typical among the majority of people having a water heater replacement. Installers were in general agreement that customers tend to be more educated now than in the past, but they noted many still require guidance and education from installers or salespeople.

Most customers learned about TWH while researching water heater options and were considering one before speaking to an installer. Several customers had heard of TWH over the years but could not recall where they had learned about them. Three customers heard about TWH because someone they know had one, and two others learned about them from staff at a big box retail store while trying to purchase a tank water heater.

Sources that customers reported using most, and often in combination, include:

Comparison tools. Some customers found "calculator" type resources that allowed them to compare options and figure out what type of water heater/TWH system they should get based on cost and payback period, household usage, energy type, and other attributes.

Review websites. Reviews, both professional and general, were important sources of information, including Consumer Reports, Amazon, and retailer websites such as Home Depot and Lowe's.

Utility websites. Customers also reported searching information on utility web sites, mostly to look for available rebates.

Manufacturer websites. A few customers noted finding information on manufacturer sites during their general web search.

Installer consults. While most of the customers we spoke to had conducted research before seeking bids, this was still an informative part of the process, as installers were able to provide customers information relevant to their particular home and needs.

> "Well, I mean a starting place was Google. Tankless versus tank water heaters...electric versus natural gas...And then I actually dove into, I think it was Energy Trust of Oregon, I looked at the rebate program. And I even went on to Lowe's and Home Depot to compare their customer ratings...I did a calculation through [an online] calculator, so when [the installer came] out, I already had some frame of reference as to what would be a reasonable range of water flow." – Customer, Vancouver, Washington

CONSIDERATIONS, DRIVERS, AND BARRIERS

TWH PURCHASE CONSIDERATIONS

Most customers knew that their water heater was getting old and would need to be replaced soon, or they noticed it was not working quite right and started looking for replacement options. These customers tended to have TWH on their radar prior to searching, they would research their options, including, in some cases, looking at tank versus TWH options.

PRIMARY DRIVERS

Endless hot water supply was most frequently mentioned across the customers we spoke to, and it was one of the strongest drivers for adoption. Several had larger households (or many visitors) or issues running multiple hot water appliances/fixtures prior to installing a TWH. Customers did not set out to find a water heater with endless hot water supply but once they learned about that feature it turned into a main driver because it solved a problem they had.

> "The biggest issue is when you have multiple people in the home, and you're doing laundry, and running a dishwasher, and taking a shower, you kind of have to figure out what is going to happen first, because you only have so much hot water to go around. So, it's nice, with this tankless system, because again, you can have the laundry going and shower at the same time, instead of having to go, 'Okay, well, I'm doing laundry, right now. Wait until this load is done, then you can have a shower.'"
> – Customer, Vancouver, Washington

Desire for a high-quality product was important to customers who tended to see TWH as a premium or high-quality product that would last them a long time, and therefore worth a higher cost. Some customers commented that their previous water heater lasted 20 – 30 years—which they thought was a fluke—and that pushed them toward TWH because they wanted a product that they could forget about for another two or three decades.

> "Something that is clearly more efficient, more compact. Something that states right in the sales brochures and stuff that it's going to last you 25 years or more...I want something that I can say to myself, "I'm never going to have to do this again." And I will invest the money, if I can, to do that."
> – Customer, Vancouver, Washington

Gas conversions comprised another main consideration for customers who favored gas appliances, generally because they thought gas costs less to operate. In these cases, TWH were sometimes an add-on installation in order to bring down the overall cost of running new gas lines to their house.

SECONDARY DRIVERS

Energy efficiency was a factor in customer decisions but tended to be associated with operating costs rather than solely with a reduction in energy consumption. Energy efficiency/operating cost was often a factor in customers' decision to switch from electric to gas.

> "It was really more because...I would say the efficiency and the heating capabilities of natural gas, and also for resale...we felt that you'd be getting much better [equipment] by using natural gas instead of electric...so basically efficiency." – Customer, Vancouver, WA

Space savings was frequently cited as an added benefit rather than the sole motivator to switch to a TWH. Space savings was also cited as a reason they would not be keen to revert back to a tank water heater, especially an 80-gallon tank.

> "I really liked the fact that we no longer have that big, huge tank. It's an eyesore and it takes up so much space." – Customer, Vancouver, WA

BARRIERS

Although the customers we spoke with ultimately chose a TWH, they described issues and drawbacks that might comprise barriers for others. This list also incorporated feedback on customer barriers from installers and program managers.

Cost of unit and install. Customers, installers, distributors, and program managers all noted the high cost of TWH units and installation (due to required household modifications, such as venting and adding an outlet) as a potential barrier for many, particularly those without readily available financing (see Financing and HVAC Bundle Case Study: Melissa). Installers observed that any model that costs more than a typical tank water heater has to have strong, distinguishing value propositions, like endless hot water, to justify the cost.

Lack of familiarity with TWH. Because market penetration of TWH is low overall, awareness is fairly limited among the general population. A lack of knowledge of options beyond what they have always seen or had (something generally left undisturbed and out of sight for years on end) makes many customers unlikely to even question what kind of water heater to choose.

Competing household requirements. Several customers reported that they had made the decision to attend to other household needs and expenses before installing their TWH. While this did not ultimately prevent these homeowners from choosing a TWH, it is likely that, combined with the cost, other priorities might make a TWH seem unnecessary or out of reach.

EMERGENCY REPLACEMENTS AND TWH

Installers tend to view emergency replacements as a significant barrier for TWH or any other non-like-for-like option owing primarily to people's desire not to be without hot water. However, emergency replacements are an important market for new, high-efficiency technology, as most of the distributors and installers we spoke to reported that **the majority of water heaters replacements are emergencies** and result in like-for-like tank installs.

While we did not examine the decision-making process in emergency replacements (in particular for customers who considered and decided against TWH), we can explore potential obstacles and opportunities for new technologies to enter the emergency replacement market based on our extensive research across market actors over the course of this project.

We have often heard that TWH are primarily going into planned replacement situations, like remodels, gas conversions, or cases where people knew their TWH was old. While we did speak to several customers who fit that situation, there were also seven customers who were having issues with their water heater and one with a full-blown emergency. These instances highlight the importance of customers being aware of the technology and having time to research their options, something we have heard from various market actors.

The customer with a true emergency replacement situation already had a TWH so it was a like-for-like replacement. From this customer, we learned that a customer's process of researching their options may be compromised by the sense of urgency they experience from an unexpected failure. **She explained that she and her husband typically research their big purchases but, because she did not want to be**

without hot water for a long period of time, they did no research, only called one installer (someone they used in the past) and went with the installer's product suggestion (see Emergency Replacement Case Study: Patricia)**.** This is typical of installer descriptions of tank water heater emergency replacements.

In contrast, the customers who noticed issues with their water heater (e.g., leaks, reduced hot water, sediment) **were able to research their options and plan the replacement, and could choose a TWH without being without hot water for an extended period.** Sometimes they did not replace their failing water heater right away and allowed it to 'limp along' until it became more serious or other projects had been completed. Having already done the research, they were prepared with the decision and installer for when they did want to go ahead with the replacement.

This signals an opportunity for more research to understand when and why customers decided not to install TWH in a planned install situation. This suggests a potential intervention or opportunity to increase customer awareness of new technology and promote replacements before they turn into an emergency so that customer have time to devise a plan. For example, an intervention could encourage customers to monitor/check their water heater for leaks and rust to catch/prevent issues before the situation turns into an emergency. This could help customers find the middle ground of postponing a replacement until they have to while allowing enough time for them to research their options and plan financially before being in a situation with a flooded basement and/or no hot water.

Encouraging non-emergency replacement more broadly involves both installers and customers: customers need to express interest in options besides a tank water heater, and installers need to inform customers of other options. For example, installers do not want customers to think they are trying to upsell them or sell them something they do not need. This stems from the customer concern that installers might try to swindle them—something that did emerge as a decision factor for customers when selecting an installer. However, the installer or sales team member role in informing and educating customers is critical.

EXPERIENCE WITH TWH

INSTALLATION EXPERIENCE

While research and needs varied widely, customers tended to follow a similar path through installation.

Information gathering and planning period – The replacement planning period varied between customers, some made a decision within a couple days of the original consultation, others several weeks, and a few waited several months.

Installer selection – Most customers got bids from multiple installers, several mentioned using Northwest Naturals' or Energy Trusts' trade ally list as a starting point. While installer prices were important in customers' selection process (and the driver to get multiple bids), customer's comfort with the installer seemed to be the deciding factor. This included whether the customer felt that the installer was being honest, whether they were being upsold on the project, and willingness/ability to answer their questions.

Cost – The average installation cost was about $3,000 (range of $2,000 to $4,700) and typically included the equipment/materials, labor, and permits. Most did not seek financing.

Installation – The actual time to install the TWH ranged between one and five days, during which time most customers had hot water because the work was staged so that gas lines and venting were installed and inspected prior to removing the old water heater.

Overall experience – Generally, customers had a positive installation experience. The typical installation involved two main stages: (1) installing the gas line, venting, and electrical, as needed and (2) removing the old unit and installing the TWH. Some customers also had a third stage where an inspector would come at some point in the installation—typically between stage 1 and 2—to inspect the gas lines and/or venting.

Customers did talk about upgrading their gas line but did not indicate that it was a big issue. Some customers were having gas installed so the larger gas line was not an issue for them.

One customer had the installer come back out to make an adjustment/fix something, but this was a minor callback.

We spoke with some DIY-ers. Two people initially intended to install the TWH themselves but ultimately decided it was too complicated. One ended up installing it himself with a friend who was a general contractor and did not have any issues.

> **"I just decided to bite the bullet after looking at the complication of [installing]...he had to do the gas, and then he had to do the exhaust. And he had to cut a hole, two holes in the west wall to put the venting out there and run the plumbing and all that. I said, "You know what? If I mess this up, it's going to be a waste of money." So that prompted me to go back and bring him in."** – Customer, Vancouver, Washington

TANKLESS CONCERNS AND DISLIKES

Although almost all of the customers we spoke to were happy with their decision to switch to a TWH, several downsides came up in the interviews.

Uncertain efficiency and cost savings. The most common complaint from customer was the **time it takes for the hot water to reach their fixtures**, some felt more strongly about this than others. This was often tied to the misconception that TWH meant "instant" hot water, rather than "endless" hot water. Several people had a recirculation pump and were happy with the functionality. With the hot water delay, some people mentioned that they felt they were wasting water.

A few customers voiced concerns that the endless hot water feature caused them or their families to use more water than previously, as there was no indication for having showered too long. This was a particular concern for households with children and teenagers, though customers voiced appreciation that they could still count on a hot shower even if their children showered first. One customer recalled that all the installers they consulted "said it's cheaper to go with [a tank]." These installers explained

that, although newer energy efficient tanks are not as efficient as TWH, the latter encouraged longer showers.

Some customers were also disappointed in **the savings amount they noticed on their utility bills**. Customer expectations around bill savings seemed to vary greatly with some thinking they would save $40 per year and others thinking they would save up to $250 per month. Of the people who quantified the savings they expected, two people mentioned talking about the savings with their installers (these two were on the lower end of the range). And one seemed to build-up high expectations of savings from his research ($100 – 250 per month). One customer wished that there was some tool online that would estimate household savings with a TWH based on custom customer inputs, including switching from electric to gas, number of people in the home, and typical water use.

> **"If there was an actual calculator, if the utilities could give you that accurate information that would be helpful. The tankless water heaters have been around for a number of years…they should have an ability to give you a very accurate estimation. Give or take 5% maybe 10%. I was thinking, based on the information I was getting, we were going to save at least on average $100 to $250 a month. But it's actually averaging maybe $30 a month. That doesn't take into consideration the additional water use and or the water taxes that we have to pay."** – Customer, Vancouver, Washington

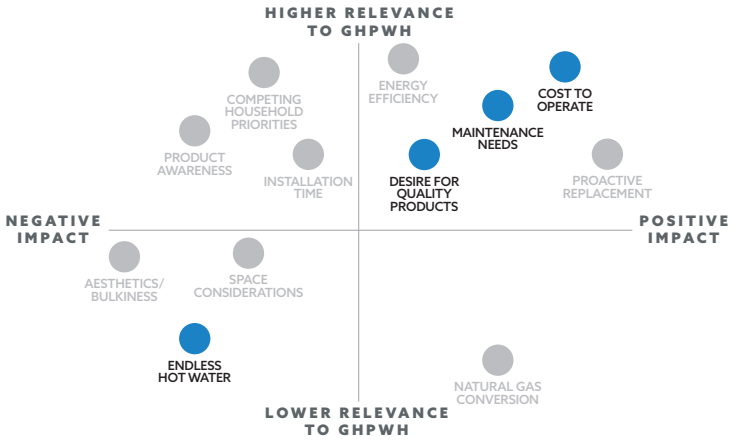
TWH INSTALLATION CASE STUDIES

While planned replacements were most common, customers' replacement journeys and key drivers varied. We selected the following case studies to demonstrate the range of experiences we heard—both more and less typical.

Each case study features the key drivers that led to replacement, as well as any considerations or barriers weighing against the decision.

ALAN

KEY DRIVERS:
Endless hot water, desire for quality products, cost to operate, maintenance needs



Alan and his wife are happily retired with an empty nest in Vancouver, Washington. They have been careful with their finances throughout their lives and now enjoy getting to spend more freely—traveling and hosting friends and family in their home. Alan and his wife generally make decisions together, each bringing a balancing perspective to one another. He is typically drawn to new products with all the bells and whistles while she asks, "is it something we really need?"

> "We're retired and we have some excess money that we can pretty much feel comfortable. We've saved it all our lives, now's the time to spend it... [my wife] still looks at the price more so than I do. I think that's probably number one on her list and then again it comes back to the item itself. Is it something we really need? And is it going to do the job you want it to do?"

Alan first learned about and became interested in TWH 15 years ago while visiting his family in Australia who recently installed one. A couple years later, they moved into their current home and decided to replace the old water heater before they started having issues with it. Alan thought about installing a TWH then but ultimately did not since he did not have the bandwidth to research it at the time.

Over the next 13 years, he looked more into the TWH and, convinced he wanted one, he debated waiting until the current heater needed replacing. Rather than wait, they decided to replace their water heater as it was getting old and their need for endless hot water grew as they began hosting more visitors.

> "Off and on over the last dozen years or so, I've looked at the [tankless] online. So, I felt more comfortable than I did with it when we first moved into this house... I mean, I would have taken a little bit of time to look at pricing and rebates and comparisons and things...But yes, I probably would have still gone with the [tankless], even in [an emergency replacement] situation."

Even though he has not noticed much of an impact on their gas bill, they are pleased with their TWH and would not consider going back to a tank water heater. They like that it has freed up space for them in the garage to put an extra freezer and, now when they have guests, they do not have to worry about running out of hot water.

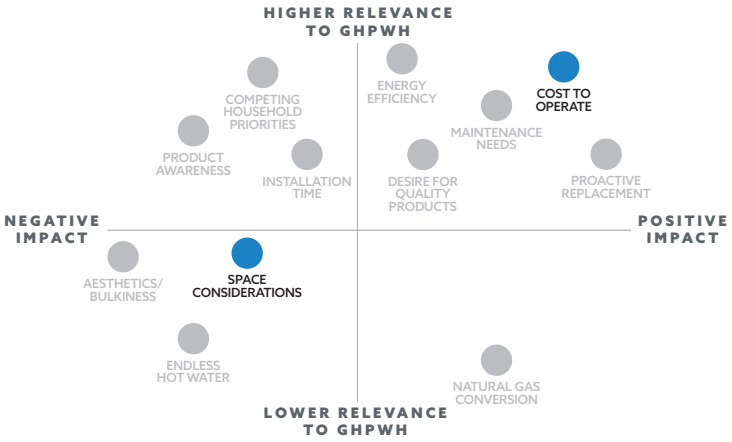
> "We wanted something that would provide a never-ending supply basically so that whenever you took a shower or washed clothes or washed the dishes, you'd always have hot water...there's no reason to go back [to a tank] and I wouldn't. I like the convenience of having the endless hot water. [And] in the space where the water tank used to be, we now bought a chest freezer."

TAKEAWAY

Planned replacements were the most common situations we heard about for TWH installations and often people had already heard about them, so they knew it was something they would consider when the time came to replace their water heater. Knowledge of and exposure to new technology is often iterative: People learned about TWH a while ago and are now getting to install it.

PATRICIA

KEY DRIVERS:
Space considerations, cost to operate



Patricia and her family—a husband and two high-school-aged boys—moved to Vancouver from Montana 16 years ago. Their new home was all-electric, but since "electric is way more expensive" than gas, they decided to take advantage of a Northwest Natural gas conversion incentive—part of which incentivized them to install a TWH because the more gas appliances they installed, the lower the gas line installation cost.

Patricia's husband loves to research products extensively in the pursuit of finding "the best" one. Accordingly, before they purchased their first TWH, he spent hours researching water heaters until he "thought he found the best one." Despite his extensive research, they quickly started having issues with their new TWH, specifically an issue with build-up on the heat exchanger from the hard-water which required a special cleaning process every few months.

> "Yeah, so it's very time-consuming trying to research all of them, to try to figure out what's best. And then, we ended up getting it here, and that one that he thought he found the best one, and it wasn't. There were just all kinds of problems with it."

Then, one Saturday, her husband was cleaning the heat exchanger and melted an essential, irreplaceable part with his flashlight, which left them without hot water. However, this time around, Patricia was in no mood to let her husband spend hours researching their options—she just wanted her hot water back as soon as possible.

> "Without my husband checking everything and taking forever to decide, it was just … We asked the hot water guy which one he would recommend. He said they have their best luck with this one, so we said, 'Okay.'"

Although Patricia decided their situation was too urgent for research, she still wanted to wait until Monday to call an installer to avoid any emergency charges. First thing on Monday, she called an installer they had used in the past for some work. They confirmed it was irreparable and also noted the venting had been installed incorrectly. The installer offered to come back the next morning to install the new TWH, but Patricia opted to wait an extra day until they could do the installation in the afternoon.

During this process, the thought of switching back to a tank water heater did not cross her mind because she does not like all the space they take up in the home or that they "constantly need to be heating up the storage tank."

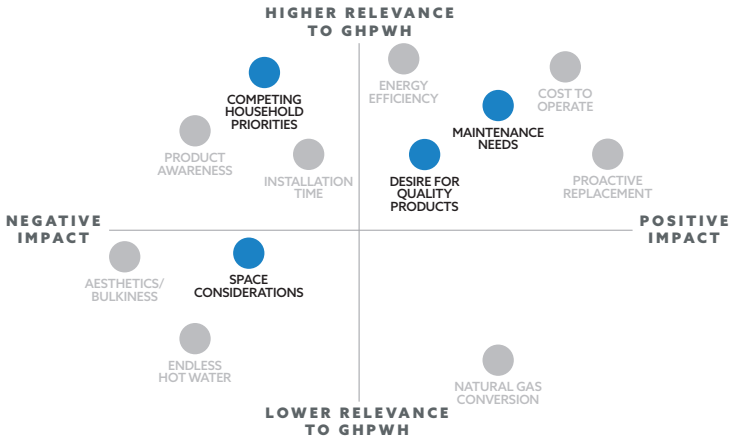
> "No, because we had [a tank] when we first moved in. And it took up a lot of room, so that's why we went with [tankless]. It just attaches to the outside wall, and it's out of the way…we don't ever want [a tank] back again."

TAKEAWAY

The urgency people feel during emergency replacements can give them tunnel vision. Even if they end up having a few days to research or plan their replacement, they do not because they just want it fixed. Installers noted that customer tunnel vision is common in emergency situations, it catches them off guard and they are not prepared to think through it as logically as they might in a planned scenario. This signals an opportunity for NEEA to work with manufacturers and utilities to encourage more preventative replacements or at least get a quote/consultation so that when their unit does finally fail, they have a plan.

CALVIN

KEY DRIVERS:
Space considerations, competing household priorities, desire for quality products, maintenance needs



Calvin lives with his wife and 18-year-old daughter in Northeast Portland. They bought a recently remodeled home in 2005 with a TWH. He typically does some amount of research before a purchase, specifically looking at sources like Consumer Reports. Ultimately, what they buy is a family decision that comes down to price, availability, and how urgently they need the product.

> **"If you find something that gets good reviews online and it has a great price but it's not available for whatever reason in our neighborhood or, then we start looking for alternatives. So, I think that's it, I mean how urgent is the need?"**

Calvin is a handy person who likes to look into the problems and try to fix them. Over the years, he got well acquainted with the ins and outs of his first TWH—and the manufacturer's technical support team—while trying to figure out why it kept having issues. Ultimately, he determined that the wrong venting was installed and figured out a band aid fix so that they could get organized and schedule an installer to replace the unit rather than paying to fix it.

In the meantime, Calvin wanted to understand how he bought a home with an improperly installed water heater that was leaking lows levels of carbon monoxide into his basement, especially since he had seen the permits for the remodel job. This led him to call the City of Portland's Development Services Department to complain that an inspector approved the job despite it being done incorrectly, to which the person he spoke with explained they were not liable and that approval had been given before inspectors were knowledgeable about TWH.

> **"When we bought the house, they had permits for all the remodeling work they did, including the tankless water heater... the guy came out and inspected it and checked it off...I called Portland... and [they] said 'oh, well, that went in before we really knew much about tankless water heaters'... And I asked them, 'how can you go out and, I mean, we're paying for you guys to come and make sure that we meet code.'"**

Over the next few months, he prioritized other projects around the house while his old TWH hobbled along, until he saw a notice from Northwest Natural about a deal on TWH. At this point he started calling installers to bid on the project and ultimately picked one with a competitive bid and a salesperson who came across as detail oriented. This installer also told him that, in addition to improperly installed venting, the gas line was also the wrong size—he needed a ¾ inch line instead of a ½ inch.

Calvin generally had a positive experience with the installation process and thinks that the new unit is "reliable and simple to maintain, so far," but is still skeptical of TWH because of his bad experience with the first one. Had he not been constrained by space in his basement, he would have considered going back to a tank water heater.

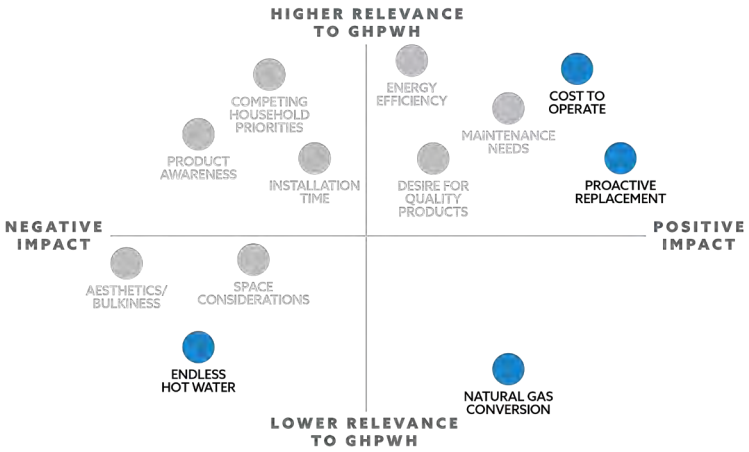
> **"I would be fine going to a water heater with just a traditional tank but where it was located, there's just no way I could get a tank to sit there with the remodeling."**

TAKEAWAY

Past improper installation can impact customer perceptions of equipment, therefore it is important to ensure that installers and local inspectors understand the installation needs/process for new equipment. This is relevant and important for new technology to safeguard it from getting a bad reputation.

MELISSA

KEY DRIVERS:
Endless hot water, cost to operate, natural gas conversion, proactive replacement



Melissa runs a busy household of six people in Vancouver; she is the main decision-maker and does all of the product research. After spotting a slow leak from her old tank water heater, she started applying for financing and researching her options online, including whether to go electric or gas, or tank or tankless. She ultimately landed on a gas TWH—gas because it was more affordable and tankless because "it was a no-brainer" since there are six people in the home.

> "I mean, I did a lot of research as to whether or not to get a tanked or tankless...and whether or not to get gas or electric on it...and, well, gas is more affordable, costs less to heat our home and so on. I think it was a no brainer as far as having six people."

Melissa also decided she wanted to replace her furnace at the same time because they had baseboard heaters that were expensive to run. The financing program she used, Craft3, largely influenced the installer she selected because the company had to be approved by the program and able to install both water heaters and HVAC equipment. Despite the slow leak, Melissa had to wait a couple of months until the financing went through to start the replacement process.

> "There's only a few [companies] to pick from. So, it's A) whoever is approved through the state of Washington to do the financing, and B) who was able to fund those multiple things together. Like a water heater and a furnace at the same time."

Melissa has been happy with her TWH, especially the fact that they never run out of hot water. She "absolutely [would] not" ever go back to a tank water heater because of her large family, plus she likes having the extra space.

> "Multiple people showering at the same time is fine and it doesn't steal the water so everybody should have hot water. And I also looked up how many things that would run at the same time. Like if I run my dishwasher, my washing machine and both of us take a shower at the same time. Those kinds of things were important to me."

TAKEAWAY

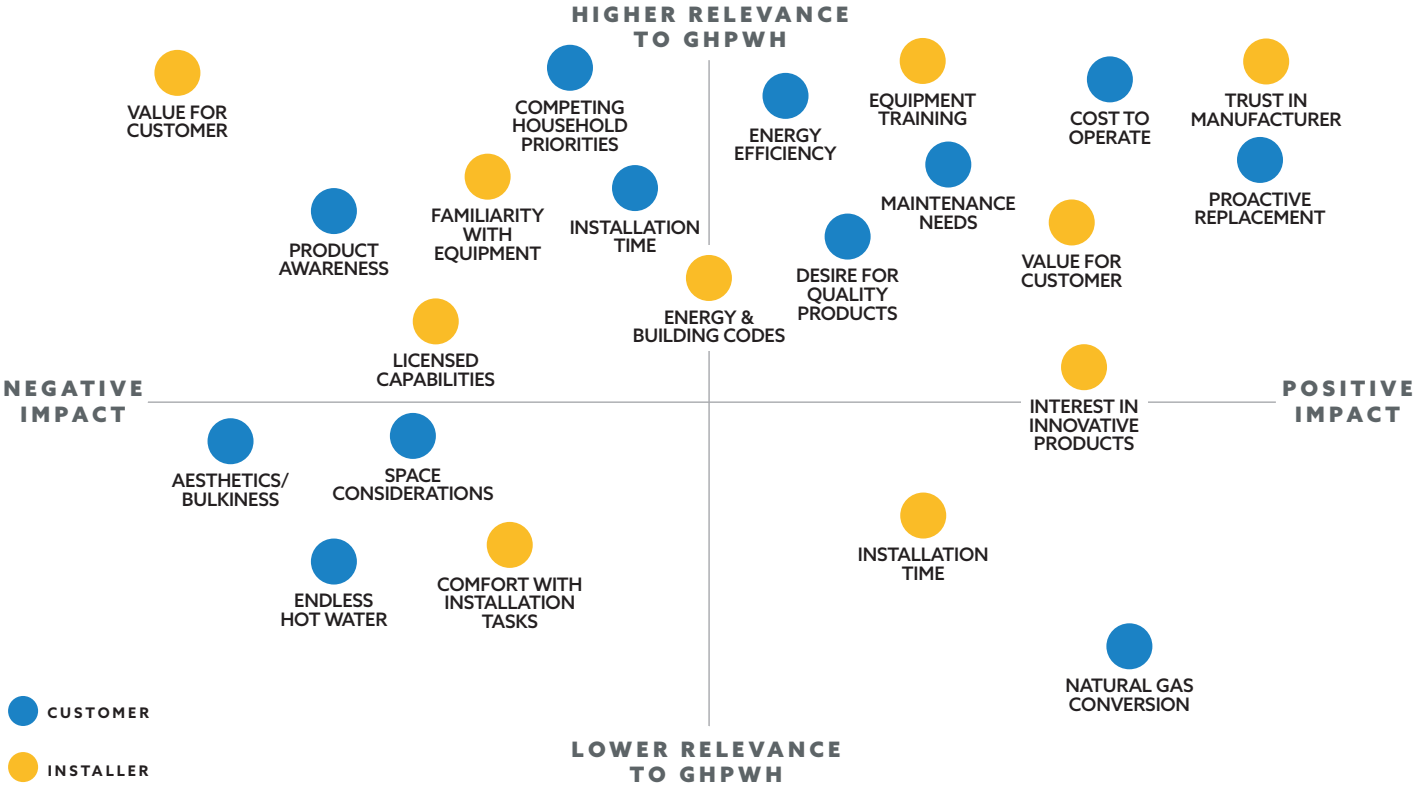
Financing came up as a difference between HVAC companies and plumbers. One distributor noted that if there were more financing options through TWH manufacturers, they would be more accessible to customers. An HVAC installer also noted that it is advantageous for them to notice an old water heater while on a furnace consultation because if the customer wants to replace it at the same time it is easier for them to bundle it into the financing for the entire project.

3.5 IMPLICATIONS FOR GHPWH

As noted, a key aspect of this research was to understand the successes and failures of TWH market adoption as a means to inform interventions that will support the uptake and installation of emerging water heater technologies in general, and in particular, for a near-commercialized GHPWH. This section highlights findings from this research that are most relevant to the market adoption of a GHPWH.

Figure 3 illustrates drivers/enabling factors and barriers to TWH adoption as discussed in previous sections. This figure was adopted from Part 1 of this research based on our findings in Part 2 and 3. Each has been situated on the graph below in terms of its potential relevance to GHPWH (along the y axis) and whether it had a positive or negative impact on TWH adoption (along the x axis). Barriers in the upper left-hand quadrant are likely to be the strongest and mitigating for these barriers should be a focal point in program development. Topics in the upper right-hand quadrant can be strong motivators or enablers and program designers and implementers should leverage them where possible.

Figure 3: Drivers and Barriers to TWH Adoption



In addition to the drivers and barriers identified in Figure 3, the process that installers and distributors follow to adopt a new product is important to consider when developing an intervention to support new product adoption. In particular, the main questions installers and distributors ask themselves about a product:

- Does the product solve a problem for the customer?
- What are the implications of incorporating the product into their sales portfolio?
- Will the manufacturer back-up their product?

For the GHPWH, or any new water heater technology, identifying the problem it solves for customers is key, given that in Part 2 of this research, both installers and sales reps were unclear about the value proposition to customers, besides the energy efficiency rating – which was considered more a secondary driver for TWH adoption. Furthermore, given some of installers' negative perceptions about the EHPWH, the problem solved by the GHPWH needs to be clear.

KEY BARRIERS TO GHPWH

Experience with EHPWH. Installers' negative perceptions and lack of perceived value of the EHPWH could impact the adoption of the GHPWH because they may associate the GHPWH with their negative experiences with the EHPWH. In addition, many of the concerns installers cited about the EHPWH will presumably still be an issue for GHPWH, like the air transfer into conditioned spaces and slow recovery time.

> "I was just having a conversation with a rep that came in recently. We were talking about heat pump water heaters. I'm not a fan. It's going to be very difficult for me to overcome that and be sold that it's a good investment for a homeowner." – Installer, Portland, Oregon

Reversion to tanks. Generally, customers with TWH were not interested in switching back to a tank water heater. They might consider switching back to a tank system if the cost difference was so great that it became the clear choice; one customer did specifically say that he would consider it if the tank's efficiency was "so efficient that it made sense." However, most customers also brought up that they would not want to give up the endless hot water supply or the space savings.

When asked whether they would consider a product like the GHPWH, customers indicated that they are always open to considering new options but, again, it would have to be the clear choice financially.

> "It's really just cost. Let's say the cost of a water heater tank, that would work with our house, was $500 and the tankless is $2,000. Well, so, maybe. But at this point, all the piping and everything is there. It's all set up for a tankless water heater. I think it's just easiest to keep going that route than to try to change it." – Customer, Vancouver, Washington

That being said, most homes still have tank water heaters, which GHPWH would more closely resemble as like-for-like, though it would still necessitate some household modifications.

INTERVENTION CONSIDERATIONS

The following are possible opportunities for NEEA to consider as they develop interventions for the GHPWH:

Customer education frequently came up as a tactic to generate customer demand for new technology, like TWH or the GHPWH, and to encourage more planned replacements. Installers, distributors, and a TWH manufacturer thought that it was the responsibility of the utilities to educate customers about new products since they have a direct line to customers through their service. They noted that possible behavioral cues include tapping into the ritual of spring cleaning and taking stock of water heater condition. Likewise, utilities could try to reframe water heaters as an appliance that people think/care about through home improvement networks.

Encourage planned replacements. Planned replacements have been the primary market for TWH because customers have time to research their options and plan financially, which could also be important for a new product that costs more than a standard tank water heater. One opportunity to encourage more planned replacements is through HVAC installers while they visit homes for furnace consultations and annual maintenance. If they can catch a water heater before it breaks, it might help avoid the emergency replacement barrier for newer technologies. According to one HVAC installer, customers who are planning to stay in their home for a long time are generally open to this suggestion/sales approach. But these opportunities can sometimes be missed since it is not the focus of the visit, which could be addressed through more sales training for installers.

> "When we're in the house, we're looking at the furnace and sometimes we'll notice if a water heater is old or something like that. Personally, I miss it, I literally have my clipboard sitting on top of it and don't even look at [the water heater]." – Installer, Portland, Oregon

Financing. Others noted that utilities and other organizations could help customers afford more energy efficient and expensive products not only providing rebates but also financing. They noted that rebates, while clearly helpful in fostering adoption (as discussed earlier in The Customer Perspective section), are rarely sufficient to get new technology into the households without disposable income, but that financing can help make it more accessible. One installer wished that there were more financing options for customers because that would make higher-efficiency and higher-priced products, like the future GHPWH, easier to sell.

> "If some of the major manufacturers had financing options for somebody that just wants a water heater and we have interest free options for long term. That would make them a little easier to sell."
> – Installer, Portland, Oregon

Other considerations include continuing to work with manufacturers to mitigate the perceived risk by installers and distributors to test out new products; and develop job creation and training programs (such as sales and new product trainings) to help ameliorate the industry labor shortage – these program could also serve to educate the next generation of trades-people with an eye towards energy efficiency.

As noted in Part 1 of this research, future interventions should not focus on just one market actor or intervention point but aim to increase general awareness and buy-in among market actors throughout the supply chain, and, in particular, among customers and installers.

Appendix A. Part 1 Memo – Literature Review & Program Manager Interviews Findings

PREPARED FOR: ANU TEJA, NEEA
PREPARED BY: ILLUME ADVISING
DATE: June 21, 2019

Primary objectives of this research are to understand motivations for and barriers to installers recommending and customers choosing tankless water heaters (TWH) and electric heat pump water heaters (EHPWH), and how utility program structure and market forces influence these barriers and motivations. Findings from this research can be used to provide insight into current TWH programs and inform design of appropriate and effective programs promoting gas heat pump water heater (GHPWH) uptake.

This document combines findings from literature and research reviews and in-depth interviews conducted with utility program managers. It includes an overview of research activities we have completed to-date, and high-level findings and emerging themes from this work followed by more detailed analysis and points for consideration in subsequent research phases. In these later phases, we will gain additional and direct insight into the customer experience, as well as that of distributors and installers. We have endeavored to flag topics and questions raised in this Phase that we will examine further in the next.

Research Overview

We collected and reviewed relevant literature to understand the TWH market and identify drivers and barriers to increased market adoption. Literature reviewed included industry reports on recent regional studies, early feasibility studies, market transformation efforts related to TWHs, and NEEA's recent water heater market characterization research documentation. We provide a list of sources in the Reference section at the end of the document.

We also reviewed interview and field data we collected for the gas HVAC and water heating study conducted for NEEA in 2018 to pull out and synthesize relevant findings. In that study, we conducted installer ride-alongs, distributor observations, and interviews with both market actors. During those interviews, we explored replacement drivers and considerations for water heater installations, including TWHs.

In addition to the secondary research described above, we conducted primary research interviews with seven program managers from NEEA's gas funders. During these in-depth interviews, we discussed the utilities' current and past TWH programs, barriers to market adoption of TWHs, and program attributes and interventions that had been most effective in addressing those barriers. We also discussed how lessons from these programs and others may apply to the adoption of GHPWHs.

Following these core research activities, we had the opportunity to interview a TWH manufacturer's senior program manager about his experience with TWH programs and adoption. We also discussed barriers and opportunities that he foresees with market adoption of GHPWHs, which, in addition to being a new technology, will enter the market with a low volume of product given there is only one manufacturer. Utilities will need to take these factors into account when designing their programs, as they present a unique go-to-market challenge. Though this memo primarily focuses on findings from the utility interviews and literature review, we have also

highlighted areas for close attention (and future research), particularly where overall findings may not entirely align with the manufacturer's perspective and unique circumstances.

Overview of Findings and Opportunities

Engage the entire supply chain to create buy-in and identify early adopters

Several program managers reported that they have achieved the best outcomes by engaging market actors across all levels of the supply chain. This best practice was shared with us more consistently than any single program design or implementation strategy. Program managers explained that engaging the supply chain at each level serves both as a means of educating the market as well as identifying actors within the market who may be most receptive to adoption of the new technology.

An essential aspect to supply chain engagement is ensuring that installers are properly trained to install and service the new technology—a point of agreement among program managers that the TWH manufacturer also emphasized. This can help avoid installation issues and callbacks, which can lead to negative perceptions of the technology among installers as well as end users.

> **Questions for future research***:* What are the best means and timing for engagement of various actors in the lead up to a new product coming to market? What are the past experiences of installers and distributors with integrating new technologies, and what can be learned from them? Understanding these directly will be important in a proactive communications strategy.

Educate and be transparent about the technology's capabilities and limitations

Several program managers and sources noted that TWHs—like most technology, including EHPWHs—are not appropriate for all installation situations and have certain limitations. For instance, the cost-effectiveness of TWHs can vary based on household make up and usage.

Based on our conversations and literature review, it is a best practice to educate those who are engaging with emerging water heating technology about its capabilities, limitations, and installation requirements. This can help ensure that installers and customers do not develop misconceptions about and aversions to the technology as a result of equipment or installation issues.

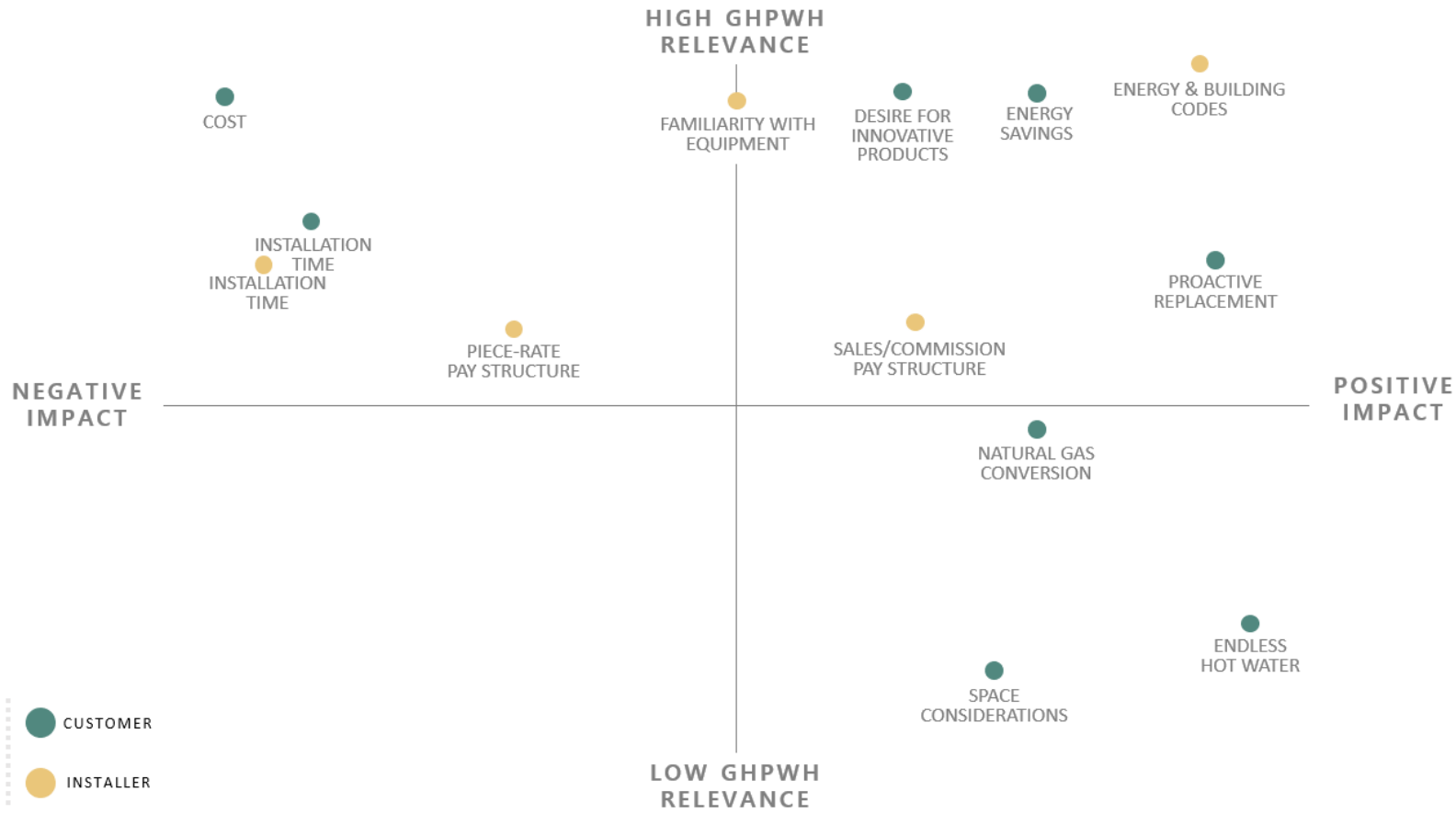
Transparency and education can also improve market actor familiarity with new technology, which is key in mitigating the perceived risks of new equipment. Familiarity with the ancillary equipment components may also be a contributing factor in equipment adoption by market actors, especially installers.

> **Questions for future research***:* When and how do various supply chain actors seek information and where do they go to find out about new technologies? What processes and factors are involved in deciding whether to adopt a new technology into a sales and service portfolio? How can NEEA contribute to these forums/mediums of information and education?

Considerations for GHPWHs

Figure 1 illustrates drivers and barriers to TWH adoption as discussed in the literature and indicated in interviews by program managers. Each has been situated on the graph below in terms of its **potential relevance** to GHPWH (along the y axis) and whether it had a **positive or negative impact** on TWH adoption (along the x axis). Barriers in the upper left-hand quadrant are likely to be the strongest and mitigating for these barriers should be a focal point in program development. Topics in the upper right-hand quadrant can be strong motivators or enablers and program designers and implementers should leverage them where possible. We summarize relevant points below and address them in greater in the following sections.

FIGURE 1. DRIVERS AND BARRIERS TO TWH ADOPTION



Relevant Customer Barriers for GHPWHs

Cost – If equipment and installation costs for GHPWHs are considerably higher than existing equipment (as TWHs were when launched), this upfront cost could be a significant barrier to adoption, even with high energy savings.

Emergency Replacement – Early reports indicate that GHPWHs will be designed like standard tank units with similar installation requirements. If this is the case, emergency replacement may be less of a barrier for GHPWHs than it has been with TWHs. However, there are still GHPWH installation considerations (e.g., location and venting) that could be a barrier for some customers.

Space Considerations – While the small footprint of TWH helped their adoption, the size and room requirements for GHPWH may be a barrier.

Relevant Customer Drivers for GHPWHs

Energy Savings – Customers who are attracted to TWHs primarily due to their energy savings and lower environmental impact may be equally attracted to GHPWHs for the same reasons. Research conducted by Energy Trust of Oregon emphasized that the energy savings from EHPWH are substantial and that message may be highly significant in creating customer buy-in (CLEAResult 2016).

Desire for Innovative Products – Some customers have a tendency toward early adoption of technology in their homes in general, and particularly when it allows them to lower their bills or live in a more efficient home.

Natural Gas Conversion – Fuel-switching to natural gas could be a driver for customers to convert to a GHPWH, as it has been for TWHs. However, this is contingent on policies and attitudes around fuel-switching in the future, especially as the push towards electrification continues. One program manager we spoke with noted that their fuel-switching incentives in Washington will be ending in the coming year.

Relevant Installer Barriers for GHPWHs

Equipment Familiarity – Although equipment unfamiliarity may be a barrier, it likely will not be as steep for GHPWHs as with TWHs because market actors are more familiar with HPWHs due to the introduction of EHPWHs in the market and because the incremental change between a storage WH and a GHPWH is smaller than the change from a storage unit to TWH. That said, installers still need to be properly trained on how to install and service equipment to help mitigate the potential for job callbacks.

Installer Labor Shortage – A surplus of work for installers reinforces a tendency to follow the path of least resistance with like-for-like replacements. If GHPWHs are perceived as more difficult transactions—due to installation time/complexity or the need to upsell—market actors may be less likely to recommend them to customers.

Relevant Installer Drivers for GHPWHs

Installer business models – Both utility program managers and the TWH manufacturer identified installer business models as an indicator for whether installers would promote a new technology. Possible business characteristics of these installers include, among other attributes, those who have sales acumen, commission-based sales models, and customer financing. When GHPWHs first enter the market, it may be helpful to target installers with these types of business models.

Local building and energy codes – Some local codes require builders to meet a certain number of energy credits for new construction and major remodeling projects. In some instances, TWHs have been a cost-effective way for builders to meet those requirements. Additionally, TWH installation requirements that pose barriers for retrofit situations can be more easily incorporated into construction plans and any additional costs can be amortized into the overall home price. These benefits may also translate to GHPWHs in new construction or renovation projects.

Emerging Technology Barriers and Opportunities

The following section discusses the primary drivers and barriers our team identified for customers and installers when considering new technology derived from the interviews with TWH program managers and literature exploring the adoption of both TWHs and EHPWHs. Where relevant, we include drivers and barriers discussed during our conversation with the TWH manufacturer.

We asked program managers what they believed the key considerations would be for a program promoting the uptake of GHPWHs based on their experiences with TWH program. They consistently identified a set of barriers and drivers for customers and installers, including cost, equipment familiarity, and perceived risk involved in early adoption of equipment that would need to be addressed.

Customer Barriers

All seven program managers we interviewed cited the **total cost of equipment and installation** as the key barrier to adoption of TWHs. Several of the papers we reviewed also discussed cost as a barrier for customers. While cost is a hurdle for many emerging technologies, with water heaters this barrier is especially high since many replacements happen in emergency situations, where customers have little time to financially plan for the equipment and installation costs. Program managers reported an average total cost of a retrofit installation for TWHs of around $3,000, though one utility reported seeing installation costs as high as $8,000.

While TWHs are still more expensive than a storage WH, equipment costs have fallen in recent years and cost concerns for TWHs are now primarily driven by installation cost. Installation costs are an even stronger barrier to customer adoption in retrofit applications because of the **household modifications** required for TWH installations, such as larger gas lines, new venting, and electrical near the unit. One program manager also attributed the installer labor shortage as a factor driving up the installation costs.

> *"I've literally heard contractors bragging that they're charging a ridiculous amount for change orders. It caused a lot of problems for low-income programs. 2018 was a tough year for contractor pricing."*
> *– Program Manager*

Potentially adding to this, Cadeo's report on EHPWH market progress found that some installers present quotes as a "lump sum estimate" for the job rather than showing installation costs and equipment costs as separate line items, which may give the customer sticker shock when reviewing the quote (Cadeo 2018). The study also found, through mystery shopper calls, that some installers may be using high costs to dissuade customers from selecting EHPWH and newer technology in general because of low installer buy-in. This tactic may also be related to installers' interest in pursuing the easiest transaction (discussed in more depth in the Installer Barriers

section).

Emergency replacements represent another considerable barrier to uptake of newer WH options as they compress the replacement timeline for customers, who generally (and understandably) want to maintain hot water in the home. This often results in customers choosing equipment that is readily available with the quickest installation time, reinforcing installer preferences for **like-for-like replacements**. To address the emergency replacement issue for TWHs, one utility is considering a short-term stopgap WH 'rental' program for customers in

an emergency replacement situation. The program would offer customers a 'loaner' tank while the installer made household accommodations (gas lines, etc.) for a gas TWH.

The tendency for installers to turn to like-for-like replacements is reportedly not related to equipment availability. A CLEAResult report from 2016 noted that HPWH are not often sold in emergency replacement situations despite the fact that they are available from distributors, "stocking is not what keeps them from being deployed in emergency replacement situations" (CLEAResult 2016). This indicates other barriers impact the likelihood of installers selling HPWH in these contexts that should be investigated further.

The literature and interviews with both program managers and the TWH manufacturer identified **customer awareness** as key for new technology adoption and a frequent barrier. However, it is important that marketing and education materials are clear and transparent to avoid creating confusion and misinformation. The Cadeo report highlighted the need for clear materials and communications to manage customer expectations —for example, some EHPWH owners were dissatisfied with their bill savings (Cadeo 2018). The same report found that while EHPWH owners are overall satisfied with their EHPWHs, some equipment-specific areas of dissatisfaction, including equipment noise, lower than expected bill savings, and hot water recovery time, may be relevant barriers for GHPWHs depending on their design, highlighting the need for clear customer communications (Cadeo 2018).

On a separate topic, program managers from gas-only utilities also noted that **the push towards electrification** could pose another barrier for emerging gas technologies. The policy landscape for natural gas equipment is in flux—especially in Washington—as electrification gains traction. This brings the future of fuel-switching programs into question, which often work in tandem with equipment rebates to promote the adoption of new gas technologies, as seen with TWH programs.

Customer Drivers

The program manager interviews and literature identified several drivers of customers TWH adoption, including energy savings, interest in new technology or a 'premium' product, interest in fuel-switching—sometimes driven by utility incentives, and equipment specific features like 'endless' hot water and the smaller footprint (PHCPPROS 2018).

Among these TWH drivers, **energy savings** and **interest in new technology** may be the most relevant to GHPWHs since the future of fuel-switching incentives are in question with the push towards electrification. Additionally, GHPWHs do not have the same equipment-specific benefits as TWHs, like endless hot water and small footprints.

Financial savings were cited in the literature and mentioned by two of the program managers interviewed as drivers for customer adoption of new, higher-efficiency technology, and given that there may be fewer structural changes to retrofit a home for a GHPWH than a TWH, this may amplify the impact of the cost savings over time.

Interest in new technology or a 'premium' product was mentioned by multiple program managers and could be effective in promoting GHPWHs when they come to market. That said, program managers mostly described this interest in new technology in the context of new construction. However, while certain consumers want the latest product, "newness of the technology" was cited by both contractors and homeowners as barriers for HPWH adoption (CLEAResult 2016). Furthermore, NEEA's most recent HPWH MPER found installers do not describe TWHs as "emerging technology" when they are selling it (Cadeo 2018).

Installer Barriers

As detailed in ILLUME's prior research into HVAC systems and water heaters for NEEA in 2018, installers are **motivated to avoid callbacks** to a job because these return visits cost money and can impact their reputation. As such, installers often **work with equipment and brands they are familiar with** because they are confident that they can install the system properly and have minimal performances issues. This can act as a barrier for new WH technologies to proliferate in the market until customer demand, utility incentives, or regulations push adoption.

Although **equipment unfamiliarity** may be a barrier, it likely will not be as steep for GHPWHs as with TWHs due to the introduction of EHPWHs in the market. In this context, GHPWHs are an incremental change relative to the change from storage WHs to TWHs.

> *"A successful program is built around the contractors accepting the technology and selling it when they're in the home…With EHPWHs there's a perception that you give up some of that comfort [of TWHs] to get efficiency—that worries them, and the thing contractors worry about most are comfort callbacks because they take a lot of time."*
> *– Program Manager*

In addition to training installers, **the equipment should not be rushed into the market before it is properly tested** and demonstrated. One program manager expressed the opinion that EHPWHs were brought to market before they had been properly vetted and undergone enough testing. They felt that, despite the organization's efforts to promote and incentivize the technology, train contractors, and collaborate with distributors, the program was not successful because the technology still had mechanical issues that needed to be resolved. As a result of the equipment issues, installers received a lot of customer callbacks, souring them on the technology. This interview participant also expressed a concern that this poor experience with EHPWHs may increase the risk that installers associate with GHPWHs. This hypothesis should be further research, and it is worth noting that NEEA's WH market characterization report states that distributors in Oregon and Washington hold more favorable opinions of heat pump technology then do those in Idaho and Montana (Russel Research 2018).

During ILLUME's 2018 NEEA research, we noted that the **installer labor shortage may be impacting the adoption of high-efficiency equipment** because installers did not receive the necessary training. The TWH manufacturer also identified the installer labor shortage as a barrier to new technology because installers have abundant work and can be profitable doing like-for-like replacements. The manufacturer explained that many installers follow the path of least resistance with like-for-like replacements because they do not need to spend extra time upselling higher efficiency equipment to a customer or "puzzling" on how they will run the venting for a TWH (ILLUME 2018).

Cadeo's evaluation for NEEA on EHPWHs' market progress echoes the idea that installers are drawn to "easier transactions." Through interviews with installers, they confirmed that "most installers recommend a 'like-for-like" exchange when heading to an emergency replacement job because "they generally consider [EHPWHs] too expensive to risk an upsell or too difficult to install when a traditional water heater is a much easier transaction" (Cadeo 2018). Since customers tend to rely more on installer recommendations in emergency situations, the report suggests that interventions should consider opportunities to encourage installers to quote HPWHs in emergency replacement scenarios.

Installer Drivers

Both the program managers and the TWH manufacturer identified installer business models as an indicator for whether they would promote a new technology. The TWH manufacturer described installers likely to adopt new technology as "sophisticated installers" characterized by sales acumen, commission-based sales models, and customer financing, among other attributes.

The program managers we interviewed consistently reported that HVAC installers and builders were the most engaged installer-type in their TWH programs. HVAC installers and builders may be receptive to TWHs, and other new WH technology, because it fits within their business models. Many HVAC installers use a commission-based system which incentivizes HVAC companies to offer customers the more expensive, higher-efficiency equipment like TWHs.

Program managers believed some installers, plumbers in particular, were less involved in utility TWH programs. They often have a sales model known as "piece-rate pay," where installers are paid based on the number of units they install rather than the dollar value of those units. This structure eliminates the incentives for these installers to upsell more expensive equipment, like TWHs, that may take longer to install.

The participation difference between HVAC installers and plumbers noted by program managers could be a byproduct of utilities offering more HVAC related programs (e.g., HVAC tune-up programs and rebates for high-efficiency HVAC systems). As a result, HVAC installers may generally be more engaged with utilities than plumbers. Furthermore, the TWH manufacturer noted that the "sophisticated installers" who are involved in their trade ally network are equally split between HVAC installers and specialized plumbers.

Utility program participation between HVAC installers and plumbers should be explored further in Phase 2 of this research since, according to NEEA's 2018 WH Market Characterization Report, a plumbing company typically installs between 50 and 1,000 WHs per year and an HVAC company installs anywhere between 3 to 30 WHs per year (Russell Research 2018). This suggests that, even if HVAC companies are more inclined to participate in utility programs that incentivize efficient WHs, plumbers' concerns should not be ignored because they install a high number of units. Outreach to plumbers that addresses any concerns they have about installing GHPWH is likely to be important to a successful program.

Builders have also been active participants in TWHs programs because of stricter local code requirements and because installation barriers are minimized with new construction. Some local codes require builders to meet a certain number of energy credits, and TWHs are one of the most cost-effective ways for builders to achieve that requirement. In addition, TWH installation requirements that pose barriers for retrofit situations can be more easily incorporated into construction plans and any additional costs can be amortized into the overall home price.

New construction is likely to be an opportunity for GHPWHs because many of the additional considerations that increase installation costs and timelines for retrofit applications are much easier to plan for and address in new construction. Any infrastructural requirements for the equipment can also be planned into the home design.

Program Design Considerations

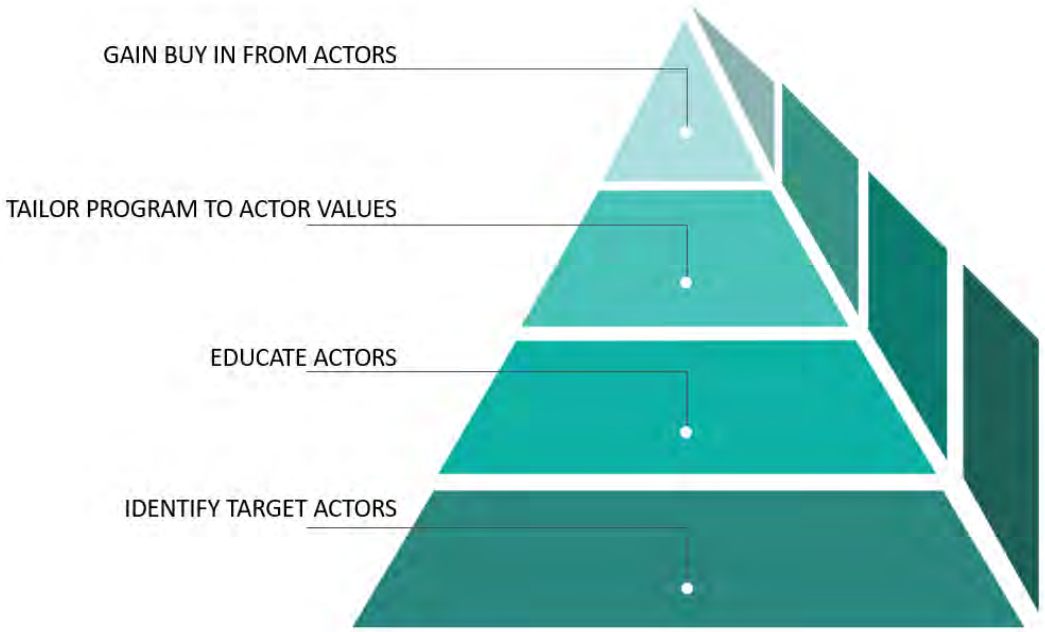
Program managers consistently emphasized the need to engage supply chain actors at all levels prior to implementing any program. This is especially important for new technologies to ensure that the supply chain is prepared and bought-in. We have included summaries of the program designs provided by the program managers in the Appendix.

In addition to education and transparency about technological capabilities and limitations, the program managers we interviewed offered several supply-chain-centric strategies for the successful implementation of a GHPWH program:

- **Prove the technology in real-world application –** Prior to adoption, distributors, installers, and home builders need to be assured that the technology is market-ready to quell any concerns about callbacks.
- **Mitigate the risk for potential partners –** New programs may need to bear some of the initial costs to get equipment into the market to alleviate market actors' perception of risk with the new technology.
- **Leverage supply-chain partnerships –** Partnerships with manufacturers, distributors, and trade allies are helpful for a successful program launch. These partnerships can support marketing efforts through co-branding and product promotion, supplementing rebates, consolidating the program's touchpoints, training installers, and identifying target markets. Figure 2 shows our understanding of the relative importance of various interventions and activities to a successful program based on the research.

> *"The key piece is to have an existing manufacturer, a good one, with an existing trade ally network, so you're not coming in the market with a product no one is familiar with and no one can service "*
> *– Program Manager*

FIGURE 2. MARKET INTERVENTIONS BY IMPORTANCE



Downstream versus Midstream

Interviews with program managers and the literature review highlighted the benefits and challenges of both upstream and downstream programs. In order to shift the market, these sources suggest that a two-pronged approach may be more effective than either a single downstream or midstream program.

> *"Come to the market with the entire supply chain ready…If a utility comes with one or a few people missing they'll spend all their time getting them on board…So, taking something and proving it in real-world applications, or getting it out there some other way. Bringing it to the market without folks bought in will be a challenge."*
> *– Program Manager*

Downstream programs have the ***benefit of being direct-to-customer****, but the necessary* ***paperwork for installers and customers can be prohibitive****.* From program manager interviews and the literature reviewed, we found that the downstream model is the most common program structure for WH programs (Talbot 2012). The advantages of downstream programs, cited during the interviews, included positive customer recognition of the utility and easier data collection for evaluations (e.g., end user and installation details.)

A disadvantage of downstream programs is that they may require paperwork for both the utility and installers, which may limit installer participation (CLEAResult 2016). As detailed in ILLUME's previous research for NEEA, WH installers are stretched thin and are limited in what they can participate in. Installers seek opportunities that easily fit into their business model.

Midstream models can a create ***streamlined experience for installers, but where supply is not a barrier, may not increase sales substantially****.* Some program managers preferred midstream models for implementation ease because they reduce program costs and paperwork for the utility and market actors. Although paperwork is still a barrier for distributors, the overall process is simplified because there are fewer market actors involved and they often have dedicated staff to administer programs.

In 2017, Energy Trust of Oregon moved their TWH and EHPWH programs to a midstream model where both the distributors and installers receive a financial incentive. Since moving to a midstream model, the program has reportedly grown, and implementation is now simpler because the program only has to coordinate with a few distributors rather than many installers completing rebates for customers. Installers involved in the downstream model reportedly found it easy to find the analogous rebates at their distributor.

However, an Energy Trust of Oregon report notes that "upstream incentives alone may not lead to success. Distributors respond to contractor demand for products and contractors demonstrate loyalty to preferred distributors" (CLEAResult 2016). The same report suggested that distributors often have more efficient units stocked, but installers may not be selling them in emergency replacement contexts. This suggests that there are other barriers than merely access to efficient equipment that are impacting installer behavior.

During our conversation with the TWH manufacturer, he identified two key intervention points that, in his opinion, are essential to the adoption of GHPWHs in the market: (1) customer awareness through utility marketing and education, and (2) manufacturer training and education for installers. From his perspective, utilities are the best placed to market and educate customers about GHPWHs because of the access they have to customers via a range of touchpoints. In addition, he noted that utility rebates are essential to overcoming the higher price point often tied to new technology.

The manufacturer explained that educating and training installers about proper installation of and servicing for the GHPWHs will mitigate callbacks. From his perspective, the manufacturer is best suited to provide installers that education and training directly as opposed to distributors because they will be the only manufacturer and have an existing installer network that they can leverage.

Incentives

During the program manager interviews, we heard differing opinions about how to structure incentives. Two program managers thought that the total dollar amount of the incentive was the most important feature and that incentives over $1,000 are key. One program manager, and a 2011 ACEEE paper, report that the ratio between the incentive and the cost of the installed measure was most important and needed to be around 30% of incremental cost.

In general, identifying the "appropriately sized" incentive can be a challenge. Programs need to balance their goals and financial constraints with a value proposition that is most salient to market actors. When designing program incentives, it is important to understand the target market's barriers for adopting the new technology and how end-users perceive the product's value. Otherwise, market actors supporting program implementation may not promote the program or product since it would not be in their customers' best interest.

For example, one program manager explained that initially their TWH rebate was too low to bridge the gap between the equipment cost and the value to the customer. As a result, installers guided most customers away from TWHs since it would not be in their best financial interest.

> *"Installers knew that the [TWH] cost was more than the savings were worth, so they were acting in the customer's best interest by not directing them towards a tankless unit…many of those who were doing it, did it for the energy savings and because it's the 'greener choice'."*
> *– Program Manager*

In Phase 2 of this research, we intend to explore the factors that influence customers' perceived value of a product and how installers determine the "best interest" for customers. For example, how do installers prioritize cost-effectiveness with other factors, such as expected time in the home?

Overview of Considerations for Phase 2

The following section provides a high-level overview of the research objectives for Phase 2 of this research, as well as relevant questions that emerged during Phase 1 and will be explored further in the next phase, which includes research with installers, distributors, and customers.

Overarching questions we will continue to explore in Phase 2, include:

- What can NEEA borrow from successful components of the outreach and education strategies around analogous equipment/technology?
- How might NEEA engage market actors who routinely work with this equipment as well as overcome the barriers faced by those who may be less familiar?

Distributor and Installer Research

We will conduct 4 – 6 field visits at WH distributor sites in the Northwest and interview up to 10 water heater installers. During these interviews and site visits, we will explore the following research objectives:

- When and or why do installers recommend TWHs? What considerations do they take into account in these recommendations? Do they use utility rebates in their sales efforts?
- How do plumbers, if at all, talk to customers about high-efficiency water heating equipment? Are plumbers less engaged in utility programs for water heating equipment? If so, why?
- What is distributor's relationship with their installers and manufacturer contacts? What is the typical interaction between them?
- What are the best means and timing for engagement of various actors in the lead up to a new product coming to market?
- What are the past experiences of installers and distributors with integrating new technologies? Understanding these directly will be important in a proactive communications strategy.
- When and how do various supply chain actors seek information and where do they go to find out about new technologies?
- What processes and factors are involved in making stocking decisions, and in particular whether to adopt a new technology into a sales and service portfolio? How can NEEA contribute to these forums/mediums of information and education?
- What are the primary barriers to installers selling/installing HPWHs in emergency replacement situations?
- How might utility programs or interventions support installers so that they are more inclined to present higher efficiency equipment to customers in emergency replacement situations? How might interventions make high efficiency equipment installations "easier transactions" for installers?

Customer Research

We will conduct up to 4 focus groups (about 16 to 24 total participants) in Northwest with customers who have installed TWHs. During these focus groups, we will explore the following research objectives:

- What factors influence customers' perceived value of a product and how do installers determine the "best interest" for customers; e.g., how do installers prioritize cost-effectiveness with other factors, like expected time in the home?
- How do customers define "emergency replacements?" How does their definition impact their response and decision-making?
- What factors did customers' purchase consideration include and how did they land on a tankless unit?
- What do customers like most or like least about their unit (what did they think they would like the most vs. what are they actually like)?
- What was the installation experience like (did they need a larger gas line to be installed, etc.)?
- Have they had to perform maintenance work on their TWH and, if so, what issues have they had to deal with? Do installers use maintenance programs for TWHs?

Overview of Utility Programs

Below is a summary of TWH programs as described by the utility program managers during the in-depth interviews and from details available online. All five had residential programs, while only two utilities had a commercial program. Our discussions focused primarily on residential programs as this was the primary focus of their experience.

Avista

Eligible customers can receive a $215 rebate for a TWH with an energy factor (EF) rating of 0.82 or greater. Customers are also eligible for a fuel conversion rebate of $1,700 if they convert both their furnace and WH from electric to gas (though this rebate is ending in Washington). Rebates are available for both new construction projects and retrofit applications. Either the contractor or the customer can complete the rebate paperwork, and Avista sends the rebate to either the customer or contractor depending on whether the customer selected the "payment release to vendor" option. The installing contractor must be licensed and bonded but does not have to be a trade ally.

Cascade Natural Gas Company

Residential – Eligible customers can receive a $250 rebate for a 0.87 EF TWH or a $350 rebate for a 0.93 EF TWH. Rebates are available for both new construction projects and retrofit applications. The installing contractor must be licensed and bonded but does not have to be a trade ally. Cascade Natural Gas Company partnered with a manufacturer to help promote the program and identify the appropriate incentive levels for specific markets.

Commercial – Eligible customers can receive $120/gpm for a 0.87 EF TWH or $150/gpm for a 0.93 EF TWH (e.g., 0.93 EF at 6 gpm*$150 = $900 incentive).

NW Natural Gas

Partnered with Rinnai, trade allies, and Energy Trust of Oregon to provide fuel-switching customers with a package of rebates towards Rinnai's Sensei TWH with an EF of 0.82 or greater. Washington fuel-switching customers are eligible for a $1,000 rebate—$100 from Rinnai, $200 from trade ally, $200 from Energy Trust of Oregon, $500 from NW Natural for fuel-switching. Oregon customers are eligible for an $800 rebate—$100 from Rinnai, $200 from trade ally, $500 from NW Natural for fuel-switching. Existing gas customers can also participate but do not receive the fuel-switching portion of the rebate package. Customer must have the equipment installed by a NWN trade ally.

Puget Sound Energy

Residential – Eligible customers can receive a $250 rebate for an ENERGY STAR qualified TWH. Rebates are available for retrofit applications only. Customer can receive an instant rebate if they go through a Puget Sound Energy trade ally or fill out a traditional application.

Commercial – The program is midstream with an incentive paid directly to distributors to stock and sell qualifying equipment.

Energy Trust of Oregon

Provides TWH incentives in both Washington and Oregon, including Cascade's programs in Oregon, and the $200 rebate for NW Natural Gas customers (Washington-only). There are two new construction programs for TWHs: (1) Energy Performance Score (EPS) that incentivizes builders, on a sliding scale, to build at least 10% above the

baseline code; and (2) a standalone rebate for TWHs with an EF of 0.81 or greater—the stand-alone program is still being developed.

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Appendix B. Customer Focus Group / Phone In-Depth Interview Guide

PREPARED FOR: NEEA
PREPARED BY: ILLUME
DATE: SEPTEMBER 13, 2019

Focus Group Guide

1.1.1 INTRODUCTION (~7 MIN)

I'd like to start by thanking you for coming in tonight. My name is _____ and I work for ILLUME Advising, an independent, national research firm.

Tonight, we're going to be discussing water heaters, and specifically tankless water heaters.

With that, let's get started and introduce ourselves.

[Skip for IDI] Please share:

- Your first name
- Where you live and how long you've lived there
- Your job and if you're retired, what you used to do, and
- A hobby or activity you enjoy

1.1.2 CONTEXT (~8 MIN)

1. For context, can you tell me about the make up of your household (e.g. how many people live there)?
    a. How many people live in your home?
    b. How many bathrooms does your home have?
    c. Are there any other water-intensive features (e.g. large bathtubs)?

2. When it comes to 'big ticket' purchases like appliances, how does that process generally go in your home? Eg, who is involved, what research do you do, how do you finally decide

3. Before your most recent water heater replacement, what was your experience with water heaters?
    a. What kind of heaters have you had in the past?

4. **Have you ever had to replace your water heater unexpectedly? If so, what happened?**
    a. Did you know it needed to be replaced? If yes, how did you know? Were you planning to replace it?
    b. How did you find the installer who replaced it? What was that interaction like? What options did they provide you? Did you seek out any other bids?

c. How long did it take to get the new water heater installed? How did you manage without hot water?
d. What were the main factors you were considering when deciding on a water heater? Installer? [**Listen/probe:** cost, installation speed, system efficiency]
e. Would you have installed a TWH in that situation? Why or why not?

5. **How would you describe your TWH to a friend?** What are the first adjectives that come to mind?

1.1.3 1.1.3 CUSTOMER JOURNEY/EXPERIENCE (~45 MIN)

Now I'd like to discuss your perceptions and experiences with tankless water heaters.

Let's talk about your decision-making process. I'd like to have you grab your pen and paper again and draw a horizontal line across it. What I'd like you to do is write a rough timeline of when you first started considering a TWH and then all the steps through installation. On the left side will be when you **started** considering TWH, and the on the right will be installation. It doesn't need to have a lot of detail, it's just meant to jog your memory. If you could take a few minutes to do this, we'll talk about it after.

[Moderator to ask each participant to briefly narrate their journey, probe the following points as they go through.]

1. **Initial interest.** Do you remember what first sparked your interest in TWH? *Probe how many were emergency replacements.*
    a. When was this?
    b. Did you know people that already had one?
    c. Were you considering other options for water heaters?
    d. What features were you interested in?
    e. What was it that interested you in TWH? *Probe on features.*
    f. How important was energy efficiency, if at all?
2. **Sources of information.** Did you do any research on water heaters, and/or TWH in particular?
    a. Where did you get your information? Who did you speak with? *Probe online, personal, utility, HVAC/plumbing companies, etc.*
    b. Were any sources particularly helpful? Trustworthy?
    c. How long did you spend doing this kind of research?
3. **Getting bid/sales consultation.** What prompted you to get a bid?
    a. How did you find the contractor who came to do the sales visit? What did you think of the consultation?
    b. What information did they provide?
    c. Did you discuss other water heater options? Tell me about this conversation.
4. **Decision process.** Now I'd like you briefly to walk me through your decision process.
    a. Who was involved?
    b. What factors did you consider? What were the pros and cons? *Probe decisive benefit/cost/limitation.*
    c. How important were space considerations? Would a tanked heater have worked in your home?
5. **Decision to install TWH.** Next can you tell me about your decision to go ahead with installation?

1.1.4 1.1.4 INSTALLATION AND LIVED EXPERIENCE (~15 MIN)

Next, I'd like to talk about your experience with installation.

1. Can you tell me about your installation experience?
   Prompt if needed:
   a. How many of you had an existing gas line that needed to be increased in size?
   b. How many of you got a TWH and gas line at the same time?
   c. How long did it take? Were there any delays?
   d. Were there any unexpected challenges with the installation itself?
   e. **Did you have to get the installer back to address anything in another visit?**

2. What has the experience of living with your TWH been?
   Prompt if needed
   a. Has it lived up to your expectations? What benefits have you noticed most—is this what you expected?
   b. Have there been any disappointments?
   c. Would you make the same decision again?

3. **Would you consider going back to a water heater with a storage tank?**
   a. In your current home or a future home?

1.1.5 WRAP-UP (~5 MIN)

1. My last question is about your **main sources** for **1) ideas for home improvement** and **2) information and news generally**. Can you tell me the top three sources that you go to find out about things or stay informed? *Moderator to prompt to a helpful level of detail (e.g. not just 'radio' but what channels).*

Thank and close.

Appendix C. Water Heater Installer Interview Guide

PREPARED FOR: Northwest Energy Efficiency Alliance (NEEA)
PREPARED BY: ILLUME
DATE: September 4, 2019

Installer Interview Guide

Hi, thank you so much for speaking with us today. This research is being conducted on behalf of NEEA (Northwest Energy Efficiency Alliance) – a regional non-profit organization that supports the adoption of energy efficient products and services in the Northwest.

We are interested in learning more about the decisions that installers make when selling and installing water heaters and how various market actors – like distributors and customers – influence those decisions. More specifically, we are interested in learning about how and when you recommend new products – like tankless water heaters or electric heat pump water heaters – and your experiences working with newer technologies.

To be clear, we are not trying to sell anything, or make any assessment or judgement of how well you do your job. We are simply interested in how things work.

We would like to record our conversation for note-taking purposes. Everything you say will be kept confidential and we will report our findings in aggregate only. We will not attach your name or any other identifying information to any of our results or findings. Is it ok if we record this conversation?

Do you have any questions before we begin?

Introduction

1. To get started, please tell me a little bit about yourself and the company.
    a. How long have you been in the water heater industry?
    b. How long has the company been in operation?
    c. How many employees work for the company?
    d. What areas do the company serve?

2. **What type of license do you need to install water heaters?**
    a. What is the process for getting that license?
        i. How often do you have to renew it? What is the renewal process?
    b. Do you need any permits? If so, in what situations?
    c. [**IF HVAC company**] How many technicians at your company are licensed to install water heaters?
    d. [**IF HVAC company**] What licenses do you need to install HVAC systems? How many technicians at your company have these licenses?

3. Approximately how many water heaters does the company typically install in a year?
    a. Of those water heaters, how many are standard storage tanks versus tankless water heaters or electric heat pump water heaters?
        i. Are tankless water heaters or electric heat pump water heaters more common? Why?

4. **What water heater equipment does your company install?**
    a. **Do you personally install some types more than others? Why?**
    b. What is the overall proportion of equipment types you install? *Moderator to focus on equipment types that installer has the most experience and ask about others (TWH/EHPWH) where appropriate if these are not their focus.*

5. What portion of the company's business are retrofits versus new construction and service work?
    a. Of the retrofit work, how many jobs are emergency replacements versus planned replacements?
        i. What drives customers to replace their water heaters before it fails? [**PROBE**: attitudes/beliefs towards efficiency, the environment, demographics, cost, rebates]

6. Which brands of water heater does the company typically install?
    a. Why do you typically work with these brands? [**PROBE:** equipment reliability; ease of installation; product support (distributors or manufacturer); price; efficiency; customer demand; familiarity]

7. **In general, where do you go to for industry information?**
    a. What resources do you rely on for information?
    b. Where do you learn about installation best practices? Codes and standards? Customer trends? Utility rebates?

New Technology

1. **How you do you learn about new trends and technologies in the industry?**
    a. What resources do you rely on for information?
    b. Where do you learn about installation best practices? Codes and standards? Customer trends?

2. **What has been your experience integrating new technologies into your business offerings, specifically tankless water heaters or electric heat pump water heaters?** [**PROBE**: specific examples of integrating new technologies; whether fuel type affects the decision to integrate technologies]
    a. How did the company learn about the new product?
    b. Who was involved internally in deciding to offer the product?
    c. What trainings did you or someone at the company receive about the new product?
    d. How did the company decide which product manufacturer/brand to offer?

3. **What are the primary barriers to integrating new technologies or products into your business offerings?** [**PROBE**: risk of callbacks, equipment failures, unfamiliarity, cost]
    a. How did your company overcome these barriers?
    b. How did the benefits of integrating the new product balance with these barriers?
    c. Can you think of any external support that would have been helpful in overcoming these barriers? [**PROBE:** utility or manufacturer incentives; marketing materials; trainings]
    d. How do the barriers change (if at all) when thinking of retrofit vs. new construction scenarios?

4. **What are the primary drivers for integrating new technologies or products into your business offerings?** [**PROBE**: specific product features; customer demand; incentives]

5. **What supply chain relationship(s) influence your decisions to offer new technologies or products?** [**PROBE**: distributors; buying groups; manufacturers; third-party agencies]

Tankless Water Heater Installations

Next, we would like to talk a bit more specifically about your installation experience with tankless water heaters (and if relevant, electric heat pump water heaters).

1. How would you characterize your experience, generally, with installing tankless water heaters (or electric heat pump water heaters)?

2. **How different is the gas tankless water heater (or electric heat pump water heater) installation process compared to standard storage water heaters?** [**PROBE:** time to install; number of installers; types of tools; modifications to the home]
    a. What type of barriers, if any, do you encounter with installing a tankless water heater (or electric heat pump water heater) into an existing home? [**PROBE**: gas line size, condensate management, local code requirements, controls interface, etc.]
    b. Have these changed over time as these technologies have been around longer?

3. **Are you aware of the recent changes to the National Fuel Gas Code (NFPA 54) that permit larger gas appliances to use ½" gas lines in certain situations?** *(As of 2012, NFPA 54 has added new provisions to its gas pipe sizing methods that permit appliances with up to 200 MBH firing rates to use ½" Schedule-40 gas lines up to 40 ft-equivalent.)*
    a. **Are you also aware NFPA 54 outlines alternative procedures for adequately sizing a gas pipe system for a building (specifically the branch length method), revised to better account for energy use under realistic hot water draw patterns?** (*This includes the Branch Length Method vs. the Longest Length Method from the previous code iteration).*
        i. If yes, where did you learn about it?
        ii. If no, where do you typically learn about this type of information?
    b. How, if at all, would you use this calculation in your day to day work?
        i. If you would not use it, why not?
    c. How, if at all, would this new calculation approach impact your installation practices and/or recommendations for customers?
        i. If the sizing calculation required you to change the gas supply pressure at the meter (to 8 inches of water column (inWC)) - is this something you would do/commonly do?
    d. Would you trust this alternative sizing method?
        i. From whom would you need to learn about this alternative sizing method to trust/use it?
        ii. What would you need (e.g. resources, training, tools) to use the alternative calculation?
            1. Would better tools for determining gas distribution system capacity enable more frequent reuse of existing gas lines?
        iii. What are possible barriers for installers to use the new provisions of the National Fuel Gas Code with respect to ½" gas lines?

4. **What are common maintenance issues that you have encountered with tankless water heaters (or electric heat pump water heaters)?**
    a. How have you addressed these maintenance issues?
    b. How long after the unit is installed do these maintenance issues typically occur?
    c. Does your company offer any specific maintenance programs for tankless water heaters (or electric heat pump water heaters)?

5. **What are common performance issues that you have encountered with tankless water heaters (or electric heat pump water heaters)?**
    a. How have you addressed these performance issues?
    b. How long after the unit is installed do these performance issues typically occur?

Installer Sales Approach

Next, we would like to discuss how you talk to customers about a potential sale and make equipment recommendations.

1. **How do you make decisions about your recommendations to customers?**
    a. What is your current sales approach with customers? [**PROBE**: variations by water heater technology; variations by customer situation, especially planned and emergency replacement situations]
        i. **How does the consideration of energy efficiency come into play? Who initiates the discussion?**
    b. How do you communicate the different equipment options with customers?
        i. How do customers typically respond to these options?
        ii. What questions or concerns do they have?
    c. How does this vary, if at all, between a planned replacement versus an emergency replacement situation?

2. **How does your sales approach differ, if at all, when recommending new technology, like tankless water heaters (or electric heat pump water heaters)?**
    a. **Are tankless water heaters (or electric heat pump water heaters) products that you upsell to customers? Or do customers ask you about tankless water heaters?**
        i. If so, in what scenarios do you decide to upsell these products to customers? [**PROBE:** customer type; household make-up; customer concerns or interests]
    b. When you mention these options, how familiar, if at all, are customers with these types of water heaters?

3. **When do you recommend newer water heater technologies, like tankless water heaters (or electric heat pump water heaters), to customers?** [**PROBE:** emergency versus planned replacements; customer type; household configuration]
    a. How often do customers proceed directly with the equipment you recommend?
    b. How often do customers make decisions on site? How often do they request time to conduct research or consider other options?

4. Do you use utility rebates or programs in your sales efforts?
    a. If yes, how do you learn about the rebates and programs?
    b. How do you integrate them into your sales pitch/discussions with customers?

Customer Perceptions & Decision-Making

Next, we would like to ask you a few questions about any insights you may have related to how customers make decisions and their perceptions of tankless water heaters (or electric heat pump water heaters).

1. **What types of customers are more likely to install a tankless water heater (or an electric heat pump water heater) than a standard storage water heater?** [**PROBE:** demographics, affinity for new technology]

2. **What factors do customers consider when purchasing a tankless water heater (or an electric heat pump water heater)?**
    a. How do customers ultimately decide to purchase a tankless water heater (or an electric heat pump water heater)?
    b. How important do you think familiarity is in equipment replacement?
    c. How often do customers seek to replace their current equipment with something different?

3. **What types of feedback have you heard from customers about their tankless water heater (or an electric heat pump water heater)?**
    a. Did it meet their expectations? How was it different from their expectations?
    b. What features do you think customers prefer most? Are there any features customers do not like?

4. What are the primary concerns you hear from customers when consulting them on a water heater replacement? How do you address to those concerns?
    a. How do these concerns vary, if at all, from customers considering newer technologies, like tankless water heaters (or electric heat pump water heaters)?
    b. How do these concerns vary, if at all, between a planned replacement versus an emergency replacement situation?

5. What trends have you noticed over time in terms of customer education or awareness of certain water heater technologies? [PROBE: how their sales approach has adopted in response to these changes]
    a. What types of research do customers usually do before you arrive on site?
    b. If they already know they are replacing equipment, do they typically have specific equipment in mind?

Water Heater Market & Support

Finally, we want to ask you a few questions about the water heater market and the best ways to support installers.

1. **What, if any, concerns do you have about the water heating market?** [PROBE: competition; labor shortage; equipment costs; regulation changes; electrification]

a. How do you see the labor shortage being overcome?
    i. Are you hiring and training new recruits?
b. How else does your company typically find qualified labor?
c. Do you have trouble retaining or hiring qualified employees?
    i. If yes, why? How does that, if at all, impact your business and decisions to offer new technologies or products?

2. **What type of support might be helpful to your business model?** [**PROBE**: more training; support establishing business processes; support establishing service offerings; information sheets for customers; marketing materials; rebates]
    a. Why?

3. **Who within the supply chain would be best to provide that support?** [**PROBE**: distributors; buying groups; manufacturers; third-party agencies, utilities]
    a. Why?

Thank you so much for your time. Those are all the questions we have for you today.

Is there anything else you would like to share with us about tankless water heaters (or an electric heat pump water heaters) that we have not discussed?

Appendix D. Water Heater Distributor Interview Guide

PREPARED FOR: Northwest Energy Efficiency Alliance (NEEA)
PREPARED BY: ILLUME
DATE: August 7, 2019

Distributor In-Depth Interviews

1.1.5 INTRODUCTION

Hi, thank you so much for speaking with us today. As a reminder, this research is being conducted on behalf of NEEA, who is interested in learning more about the many decisions distributors make when purchasing and selling tankless water heaters and heat-pump water heaters, and how manufacturers, installers, and end-users affect these decisions. We'll be speaking with up to 6 distributors in the Northwest. To be clear, we are not attempting to make any assessment or judgement of how well you do your job. We're interested in how things work.

In our time together, we will ask you questions about what you do and how the water heater market works from your perspective, including your perspective on installer and customer behavior and choices based on your experience in the area. We will also explore your considerations when making stocking decisions for advanced units like tankless and electric heat pump water heaters. We're also interested to learn about typical interactions between you and your installers, as well as your manufacturer contacts. We encourage you to be as open as possible so that we have a full picture of the market in general, and the distributor's role within it. All information gathered will be reported anonymously.

Do you have any questions before we begin?

1.1.6 INTERVIEW GUIDE (45 MIN)

Please note that these are the topics that we expect to cover over the course of the interview. This is intended as a topical guide and not a script. We will not necessarily ask questions in these exact words or in this exact order or ask each distributor every question. The researchers will use their discretion to determine how and when to address each topic.

Business Characteristics AND INTRODUCTIONS (7 min)

8. Can you start by telling us more about yourself and your role?
    a. Service area?
    b. Types of businesses you serve?

9. And the business?
    a. How long has the business existed?
    b. Supply or equipment distributor?
    c. Independent or manufacturer owned?
    d. Franchise, single-locations, chain?

Stocking and Assortment Practices (25 min)

10. How does your company select its product assortment?

a. What are the main factors taken into consideration? [**PROBE for**: energy efficiency.]
b. Who do you engage with in the process of making these decisions? At what level are these decisions made internally?
c. What starts the process of considering new products or technology (e.g. installers asking because customers have asked, manufacturers approaching them, etc.)?
d. What manufacturers do you work with?
    i. Why have you chosen to work with those manufacturers? **[PROBE for:** influences**]**
    ii. How do you communicate with manufacturers? How do they communicate with you? Does this vary depending upon relationship/sales volume?
    iii. What services do manufacturers provide for your business? **[PROBE for:** training, product information, etc.**]**

11. We'd like to get a better understanding of efficiency water heaters and how sales and distribution might differ from standard water heaters.
    a. Does your firm sell higher efficiency water heaters? **[PROBE FOR:** Standard Tank ENERGY STAR, tankless, HPWH**]**
        i. [If Yes]: Approximately what percentage of your water heater sales are higher efficiency?
    b. How long are lead times for high efficiency water heaters? How does this differ from standard efficiency water heaters?
    c. Is there anything else you think we should know about water heater distribution that we haven't covered?

12. **[If not mentioned yet]** Next I'd like to talk about how your company goes about adopting new technologies or products. [**If nothing new, prompt gas tankless water heater]?**
    a. What was the goal or motivation for doing this? What was the business case?
    b. How did you first learn about the new technology?
    c. How successful have they been?
    d. How important were end customer motivations in driving adoption?
    e. What else has driven the success of this equipment among installers?
    f. End customer motivations aside, what has prevented this technology gaining market acceptance?
    g. Could manufacturers have done more to promote this technology and/or mitigate challenges for you?

13. **[If not mentioned yet]** Can you tell me about your companies' decision to bring in **tankless water heater/heat-pump water heaters**?
    a. What was the goal or motivation for doing this? What was the business case?
    b. How did you first learn about the new technology?
    c. How successful have they been?
    d. How important were end customer motivations in driving adoption?
    e. What else has driven the success of this equipment among installers?
    f. End customer motivations aside, what has prevented this technology gaining market acceptance?
    g. Could manufacturers have done more to promote TWH/HPWHs and/or mitigate challenges for you?

14. How do you inform your customers about a new piece of equipment or type of technology? **[PROBE FOR: Marketing, training, workshops]**
    a. What have you found works best to get installers to engage with a new product you're offering?
    b. How receptive are your customers to engaging with new types of technology?
    c. How does your relationship with the installer impact this?
    d. Are you aware of any other channels your customers seek out to learn about new equipment and/or technologies?
    e. How does this vary, if at all, between HVAC companies and plumbing companies?

15. Now that we've established how you select your product assortment - can you briefly describe your stocking practices?
    a. What influences these?
    b. What is the current market like for efficient equipment?
    c. Who is currently driving the demand for more efficient equipment?
    d. What influence do installers have on the supply chain as a whole? What about you?
    e. What are your most popular types of water heaters?
        iv. Who is asking for them? **[PROBE for:** customers VS installers; HVAC companies VS plumbing companies**]**
    f. What can you tell us about the current market for gas tankless water heaters? **[PROBE FOR:** Percentage of sales, brands, who buys them, any insights**]**
    g. What can you tell us about the current market for electric heat pump water heaters? **[PROBE FOR:** Percentage of sales, brands, who buys them, any insights**]**

16. We'd also like to understand how relationships between distributors and installers work. Can you tell me about some of the installers you commonly work with? **[Probe for**: installer business type (independent/franchise/something else), size, location, volume, etc.**]**
    a. How would you describe your relationship with installers?
    b. How do you normally communicate?
    c. How often do you communicate with installers? In-person? Through phone or email?
    d. Can you describe a typical interaction with an installer?
    e. Do they purchase equipment as needed, or do some maintain stock?
        ii. What is a typical turn-around for an order? How quickly is an average order filled?
        iii. Are there ever delays in providing any types of equipment? **[PROBE for:** energy efficient equipment**]**
    f. How do installers' businesses impact **your** stocking practices or other business decisions? **[PROBE for:** Independent/franchise/something else, urban/rural, small/large, customer types, sales volume, etc.**]**
    g. What influence do installers have on the supply chain overall?
    h. Are there any key differences between your relationships with HVAC companies and plumbing companies?
        i. If yes, what are those differences? Why are they different?

17. Can you briefly describe your promotion & marketing practices?

d. What influences these? **[PROBE FOR:** special promotions on equipment, manufacturer driven promotions, seasonal timing, advertising and marketing, web presence, marketing coops, utility rebates**]**

Energy Efficiency (5 min)

18. How, if at all, do you think energy efficient equipment provides value to customers (end users)? To installers?
19. Has energy efficiency had an impact on the market for water heaters? **[PROBE FOR:** impact of programs like Energy Star; relevance to the market; changes over time.**]**
20. In your opinion, where does the demand for energy efficient equipment come from? In other words, which party is most influential in the sales of efficient equipment? **[PROBE FOR:** impact of customer requests, installer recommendations, manufacturer promotions, utility rebates, distributor promotions, other factors**]**

Customer Decision Making (7 min)

If time permits and it is relevant based on the previous conversation, the interviewer will also gather distributor opinions about customer decision-making.

We'd like to get a sense of what you think customers consider when deciding to purchase new equipment.

21. Generally speaking, why do you think end customers choose to install a new system? **[Probe for:** failure, repair costs too high, remodeling, looking to save money, looking to save energy, etc.**]**
   a. **[IF SELLS BOTH]** Does this vary between water heaters and HVAC equipment?

22. What factors do you think customers consider when making purchase and installation decisions?
   b. How important do you think familiarity is in equipment replacement? How often do customers seek to replace their current equipment with something different? **[IF NEEDED:** For example, replacing a standard storage water heater with a tankless water heater or replacing a ducted heating system with a ductless heat pump, brand loyalty**]**
   c. What influences installer product recommendations? **[Probe for:** stock on hand, distributor stocking practices or promotions, utility rebates or tax credits, customer requests**]**
   d. Does the consideration of energy efficiency come into play? Who initiates the discussion?
   e. Do you find that certain types of customers are more likely to install energy efficient equipment?
      i. Are customers who replace their equipment while it is still working reasonably or those whose equipment is not functioning or barely functioning more likely to install higher efficiency equipment?
   f. Do any of these customer considerations influence your decision making? If so, how?