

Ameren Illinois' Market Effects Pilot – Heat Pump Hot Water Market Characterization Report

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1. Executive Summary

The evaluation team conducted a study to understand the current heat pump water heater (HPWH) residential market size, describe the HPWH supply chains in AIC service territory, and characterize market trends such as the drivers and barriers to HPWH sales.

We used two main data sources to support the market characterization. First, we completed a literature review of HPWH stock assessments, technology briefs, and evaluation reports to augment our understanding of dynamics related to the residential HPWH market. After this review, we completed a supply chain map to illustrate the distribution channels through which HPWH are sold. Second, we conducted 14 in-depth interviews with three types of market actors in AIC territory: HPWH manufacturers (2), distributors (3), and installers¹ (9). These interviews asked about their experiences with HPWH installation and other water heating equipment, their perceptions of customer barriers to HPWH adoption, the influence of utility incentives, and training they have received or need.

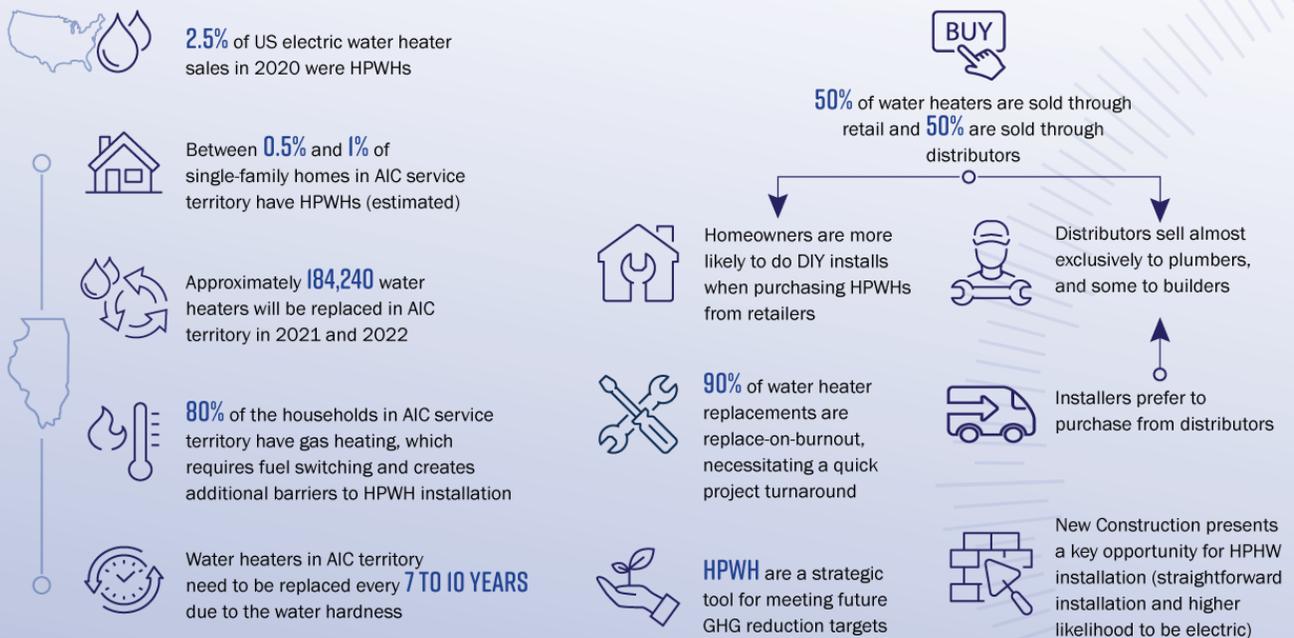
The evaluation team triangulated results from these research efforts to identify several opportunities for AIC to adjust the Midstream HPWH Initiative design to ensure the Initiative optimally captures and generates market effects. We summarize these results in the following infographic.

¹An installer is a term that refers to any professional that installs HPWH equipment, including plumbers, builders, and HVAC technicians.

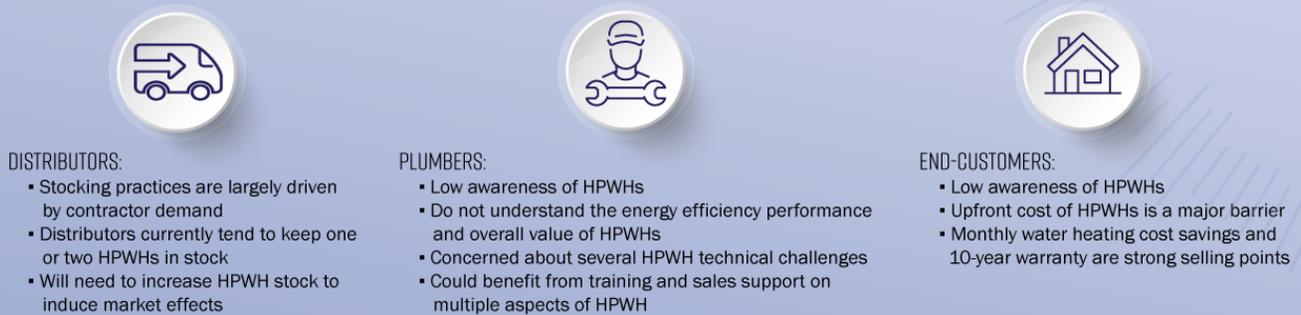
METHODS



KEY FINDINGS AND OPPORTUNITIES (MARKET)



KEY FINDINGS AND OPPORTUNITIES (MARKET ACTORS)



2. Introduction

The evaluation team conducted a study to characterize the residential retrofit and new construction heat pump water heater (HPWH) market in AIC service territory. The evaluation team will also be providing a characterization of the HVAC market in a forthcoming report. This research effort is part of a larger Market Effects Framework Test Pilot Effort that AIC is completing in collaboration with the advisory firm, Brio, Opinion Dynamics, and the AIC portfolio implementer, Leidos. This larger effort is designed to identify the overall needs, risks, and opportunities for capturing market effects savings in AIC's portfolio.

We sought to help AIC and Brio understand the current HPWH residential market size, describe the HPWH supply chains in AIC service territory, characterize market trends, and explore the potential key performance indicators for market change. This work will help AIC and Brio identify the potential for further market effects and inform the Midstream HPWH initiative design. We used the following research questions to guide this research:

- What is the market size for HPWHs in AIC service territory?
- What is the market share by manufacturer for residential water heating product categories?
- What is the HPWH supply chain in AIC's service territory, from manufacturer to installation? What are the distribution channels?
- What are the drivers and barriers to distributors stocking and selling HPWH products?
- What are the drivers and barriers to installers selling HPWH products?
- What are the drivers and barriers to end-customers purchasing HPWH products?
- What are the future opportunities for AIC to capture market effects through the Midstream HPWH offering?

3. Methods

To explore the research questions specified above, we conducted a structured and rigorous secondary data review and in-depth interviews with key HPWH market actors. In tandem with these research efforts, we characterized the supply chain for water heating products in AIC service territory.

3.1 Secondary Data Review

We completed a literature review of existing information available in HPWH market assessments, building stock assessments, emerging technology briefs, and evaluation reports to augment our understanding of key details necessary to execute the HPWH market characterization. We summarized key results from this effort in a memo delivered to AIC in December 2020 (Appendix B) and incorporated key highlights in this report for context.

3.2 Supply Chain Characterization

Understanding the supply chain is essential for identifying and understanding market effects, how those effects will manifest through different market actors and ultimately what data are necessary for measuring the effects. Using the information collected in the secondary data review and recommendations gathered from AIC and Brio, we developed a map of the HPWH supply chain in AIC service territory. We used this map to inform which questions we asked market actors. We then obtained quantitative data from secondary sources and qualitative insights from the market actor interviews to overlay estimates of the flow of HPWH products through the supply chain in AIC service territory.

Using the above-mentioned data sources, we triangulated the size of the residential HPWH market in terms of shipments and sales, characterized the market in terms of efficient vs. less efficient shipments and sales by product category type, and mapped shipments and sales into sectors and across key market actors. We then corroborated and supplemented these findings through in-depth interviews with key market players.

3.3 Interviews with HPWH Market Actors

The evaluation team conducted interviews with three types of HPWH market actors to confirm the accuracy of the supply chain maps and to discuss industry trends affecting the HPWH market in Illinois. In addition, these interviews illuminated the drivers and barriers to market actors selling this equipment and for customers buying this equipment. The objectives of these interviews were to

- Identify market actors' perceptions of the HPWH market in general;
- Characterize HPWH market trends;
- Describe market actors' perceptions of benefits and drawbacks associated with residential HPWHs;
- Understand market actors' perceptions of customer awareness and interest;
- Characterize market actors' perceptions of customer concerns;
- Confirm the accuracy of supply chain maps;
- Understand market actors' perceptions of utility incentive programs; and
- Understand what HPWH training market actors have had and still desire.

We utilized the supply chain maps developed through the Supply Chain Characterization research task to ground our interviews, which enabled us to move from asking broad questions about the market to more nuanced and grounded questions about the details of the market dynamics.

We collaborated with AIC and Leidos to develop a recruiting list that included major manufacturers, distributors, and installers. We contacted these market actors via a combination of email and phone calls, contacting each up to five times. We targeted installers who had familiarity with heat pumps but did not necessarily have experience installing the units. We tailored our interview questions based on each individual market actor’s experience level (see Appendix A for instruments). Four plumbers had installed one or fewer HPWHs and were given the “inexperienced” questions, while five had installed two or more HPWHs and were considered “experienced.”² We conducted a total of 14 interviews with HPWH manufacturers, distributors, and installers (Table 1). These interviews lasted between 45 and 60 minutes and respondents received a \$150 gift card as a token of our appreciation for taking the time to participate in this research. We analyzed the data to uncover themes and patterns in the respondents’ answers.

Table 1. Interviews by Market Actor

Market Actor Type	Number of Interviews
HPWH Manufacturer	2
HPWH Distributor	3
HPWH Installer	9

The nine installers reported having installed a total of 38 HPWHs in their careers. The most any single installer had installed was 12 in their career. Two of the three distributors were actively selling HPWHs while the third had not sold any in the prior year.

² While two installations may seem low, given the nascent nature of this market, we employed this criterion.

4. Overall HPWH Market Detailed Findings

Market actors agreed that the Illinois market for HPWH is nascent and has room to grow. The most common term that market actors used to describe the current HPWH market in Illinois was “nonexistent,” with three respondents describing it that way. Other market actors used the words “virgin territory,” “trivial,” or “sparse” to describe the low customer demand in the HPWH market.

New construction presents a key market opportunity for HPWH installations because new homes can accommodate the HPWH’s physical size, installation requirements, and electric demands according to our interviews and an AIC HVAC initiative trade allies survey.³ These constraints make switching from gas to electric water heating a challenge in the retrofit market. Studies of other midstream HPWH initiatives have found that the new construction market drives a large percentage of HPWH sales.⁴ Though HPWHs may be more viable in the new construction market, residential annual new construction in Illinois has declined significantly since the 1990s and early 2000s.⁵ A few respondents mentioned that new construction builders tend to specify the cheapest water heaters and therefore tanked equipment is the most common type of water heating equipment in residential new construction. Another three respondents mentioned that the new construction they have seen is trending toward all-electric.



AIC is currently developing solutions to confirm customer eligibility for new construction installations to ensure this market segment can be a viable option for the Midstream HPWH Initiative. We encourage AIC to continue to work through these logistical challenges as new construction opportunities do not pose the same installation barriers as retrofit opportunities. As such, this market segment provides an important opportunity to for installers to gain experience installing and maintaining the equipment.

Customers with existing gas water heaters face greater barriers to installing HPWHs. Constraints for HPWHs in a fuel switching situation include:

- **Space Requirements:** Homes with a gas-fired water heater are likely to have their equipment installed in tiny closets without electrical service. If switching to an HPWH in this situation, the closet is unlikely to have enough ambient air space nor electrical service, necessitating more labor, parts, and time for the HPWH install (see Section 0 for more about HPWH installation challenges in existing homes).
- **Possible panel upgrade costs:** Depending upon the existing panel load, switching from gas to electric water heat can require a system upgrade to a 200 AMP electrical panel. The average cost of this panel upgrade is \$3,500, which is a significant barrier for most customers.

³ Opinion Dynamics. 2020. "Memorandum: HVAC Initiative Participant Survey and Trade Ally Survey Process Results." Massachusetts.

⁴ Cadeo. 2018. Northwest Heat Pump Hot Water Heater Initiative Market Process Report #4. Northwest Energy Efficiency Alliance (NEEA). https://neea.org/img/documents/HPWH_MPER4_FINAL.pdf.

⁵ Census, US. 2021. New Privately-Owned Housing Units Authorized by Building Permits in Permit-Issuing Places in the State of: Illinois. <https://www.census.gov/construction/bps/pdf/annualhistorybystate.pdf>.

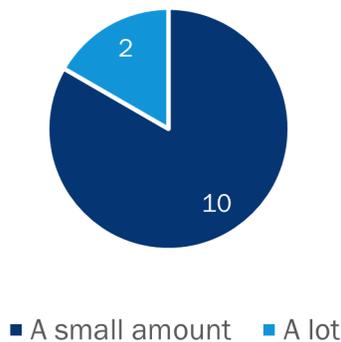
- **Preference for like-for-like replacements:** In the retrofit scenario, about 90% of water heaters are installed in a replace-on-burnout situation. In these cases, customers tend to prioritize the quickest replacement, which is often a like-for-like replacement. If the customer had a gas water heater, the installer is likely swap out their broken water heater with the same type of equipment.



AIC's \$1,000 incentive for HPWHs means that the total A.O. Smith HPWH equipment cost comes in \$50 below the market cost of a gas water heater, which encourages customers with gas water heating and installers serving these customers to adopt HPWHs instead of like-for-like gas replacements. However, AIC plans to drop the incentive to \$800 in Q2 of the 2021 program year. At this point AIC should carefully track HPWH adoption to ensure customers do not begin to default to purchasing like-for-like equipment when the AIC incentive no longer creates a cost advantage.

Market actors expect modest growth in their HPWH sales over the next five to ten years (Figure 1). The market actors we interviewed expect limited residential demand for HPWH due to the higher upfront cost of the equipment and the fact that they are not suitable for some homes due to space and placement constraints. Both respondents who expected large growth cited opportunities for customers to realize operational savings as a key driver.

Figure 1. Expected Growth in HPWH Sales in Next 5-10 Years (n=12)



4.1 Market Size

The Air Conditioning, Heating, and Refrigeration Institute reports roughly eight million residential water heaters are sold in the US each year.⁶ Nationally, about 82,000 HPWHs were sold last year, comprising 2.5% of all electric water heater sales, according to an interviewed manufacturer. Three companies manufacture 90% to 95% of all residential water heaters in the United States: AO Smith, Rheem, and Bradford White. Other smaller manufactures include Nyle Systems, Stiebel Eltro, General Electric, and Midea.⁷

⁶Air Conditioning, Heating, and Refrigeration Institute (AHRI). 2020. "AHRI Releases December 2020 U.S. Heating and Cooling Equipment Shipment Data."

https://www.ahrinet.org/App_Content/ahri/files/Statistics/Monthly%20Shipments/2020/December_2020.pdf

⁷ Butzbaugh, Joshua B., Linda J. Sandahl, and Michael C. Baechler. 2018. "US HPWH Market Transformation: Where We've Been and Where to Go Next." United States.

Table 2 shows the weighted percent breakdown of water equipment sales for the interviewed installers and distributors; this table also includes the 2014 figures from the most recently available AIC Potential Study.⁸ Notably, 11% of installers’ water heater installations were electric and of all their electrical water heater sales, 9% were HPWHs. The 9% for HPWHs is high based on our understanding of the market and there are two possible explanations for this bias related to our sample sources:

- The sample included some installers whose primary job was not water heating, but instead HVAC or home performance work. This situation reduces the denominator of water heater jobs and magnifies the effect of any HPWH installations. For example, one interviewed installer reported that 8 of the 9 water heaters they installed last year were HPWH. Removing the two installers that reported the highest number of HPWH brings the weighted average of HPWH installations down to 4.1%.
- Two-thirds of installers and distributors (8 of 12) participated in AIC Initiatives, causing the number of HPWH sales to be greater than it would otherwise be in the overall market. Our interviewees may be responsible for most, if not all, of AIC’s 21 incented HPWHs in 2020.

Table 2. Breakdown of Water Heater Sales

Equipment Type	Sales Percent in AIC Territory		AIC Potential Study 2014
	Installers (n=9)	Distributors (n=3)	
Liquid Propane	3%	0%	0%
Natural Gas	86%	55%	79%
Tankless	12%	4%	0%
Tanked	88%	96%	100%
Below 55 gallons	84%	99%	–%
Above 55 gallons	16%	1%	–%
Electric	11%	45%	19%
Tankless	0%	1%	0%
HPWH	9%	3%	0%
Other Tanked	91%	96%	100%
Below 55 gallons	95%	99%	–%
Above 55 gallons	5%	1%	–%

Note: The percentages for installers and distributors have been weighted by the percent of sales they represent. The answers of those representing more sales are weighted proportionally to reflect that. We summed the total number of water heater sales in the last year and then calculated the proportion of those sales for each respondent. Then, we weighted each person’s answers per that proportion.

Given the non-representative interview sample, it is important to consider other data sources. According to the Environmental Protection Agency (EPA), in 2019, national HPWH penetration was 2%.⁹ An interviewed manufacturer corroborated this figure, citing that 2.5% of national electric water heater sales in 2020 were HPWHs. Two areas of the country—the Pacific Northwest and the Northeast—have higher penetration of HPWH, comprising up to 10% of total water heating sales due to their longstanding HPWH incentive programs. The Northeast and Northwest are contributing to the national HPWH sales figures, which means the penetration of HPWH outside of those areas will be below the national average of 2%. According to AIC program tracking data, AIC incented 22 HPWHs in their territory in 2019 and 2020. Given the strong influence of utility programs

⁸ AEG. 2016. "Ameren Illinois Demand Side Management Market Potential Study: Volume 3 – Energy Efficiency Potential Analysis." https://ilsag.s3.amazonaws.com/Ameren-IL-Potential_Final-Report_Vol-3-Analysis_2016-04-18.pdf.

⁹ EPA. 2019. ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2019 Summary. <https://www.energystar.gov/sites/default/files/asset/document/2019%20USD%20Summary%20Report.pdf>.

on HPWH sales and AIC's relatively young HPWH incentive, we estimate that the actual market penetration of HPWH in AIC territory is likely to be less than 0.1% of homes.

ENERGY STAR reports that 8% of water heaters are replaced each year.¹⁰ Applying that replacement rate to the 1,151,503 households in AIC territory results in an average of 92,120 water heaters being replaced each year that AIC's programs could potentially influence.¹¹ We expect a total of 184,240 water heaters to be replaced over 2021 and 2022.

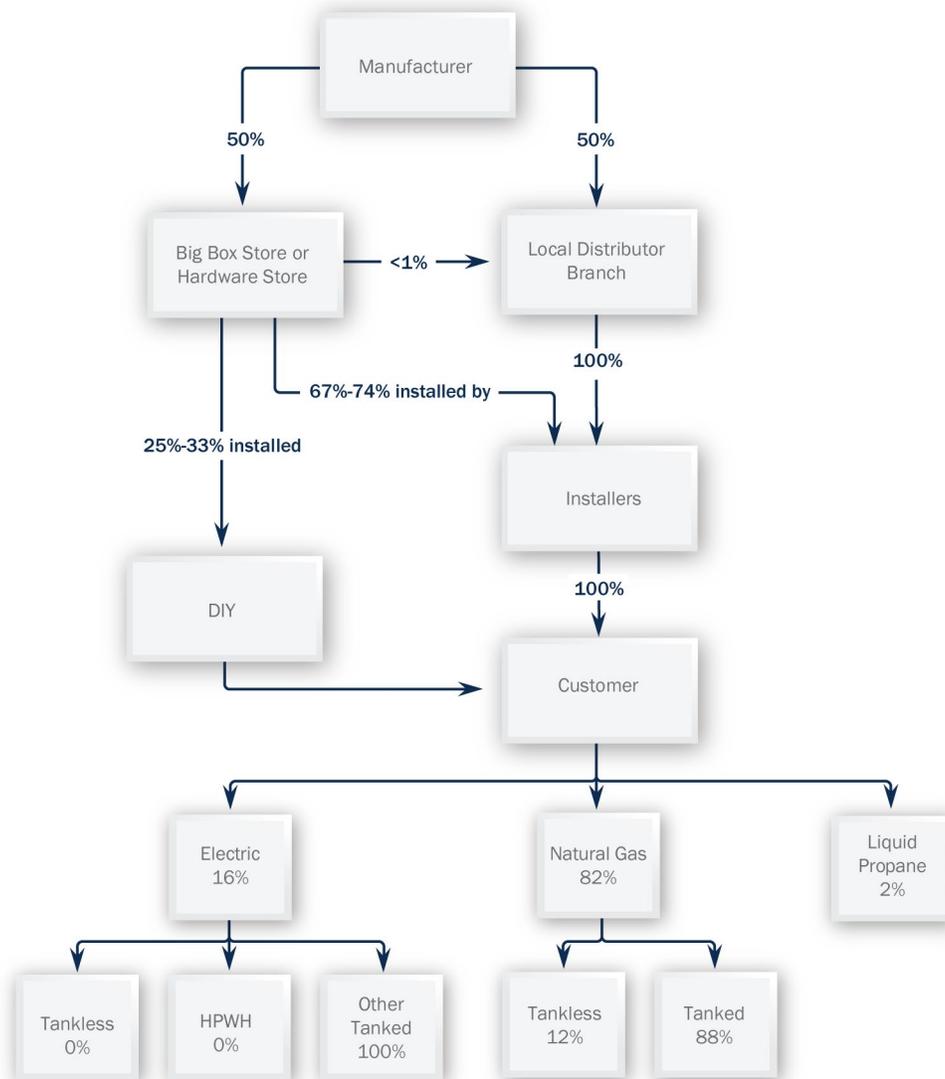
4.2 Market Structure

Manufacturers sell half of their equipment to retailers and half to distributors (Figure 2). The distributors sell exclusively to the trades, and about one-quarter to one-third of sales from retailers are installed by the homeowners themselves. Water heating equipment in Illinois is mostly natural gas (82%), some electric (16%), and a small percentage of liquid propane (LP; 2%). Rural areas are less likely to have natural gas service, and the penetration of electric and LP fuels will be higher. Tanked equipment predominates, as 100% of electric water heaters are tanked and about 88% of natural gas-fired equipment is tanked. Taken together, gas-fired tanked water heaters are most common in Illinois. These percentages derive from the data in Table 2 and account for the six-year age of the Potential Study. For example, the potential study reported 0% tankless equipment, so we relied on the more up-to-date installer data to account for market changes.

¹⁰ ENERGY STAR. 2009. "New Technologies New Savings. Water Heater Market Profile 2009." U.S. Department of Energy.

¹¹ Number of households number from AEG. 2016. "Ameren Illinois Demand Side Management Market Potential Study: Volume 3 – Energy Efficiency Potential Analysis." https://ilsag.s3.amazonaws.com/Ameren-IL-Potential_Final-Report_Vol-3-Analysis_2016-04-18.pdf.

Figure 2. Market Distribution Channels



The two largest HPWH manufacturers sell in retail stores and to distributors and the third largest sells only via distributors. The retail stores are all chains and include big box stores such as Lowe’s, Home Depot, and Menards, as well as smaller hardware stores, such as Do It Best and ACE Hardware.¹²

Half of water heaters sold in the United States go through retailers and half go through distributors, according to one manufacturer. One installer mentioned that they have seen a growing number of end customers purchasing water heaters from big box store retailers. These stores tend to have contracts with plumbers who

¹² All product or company names that may be mentioned in this publication are tradenames, trademarks, or registered trademarks of their respective owners.

will install the equipment for the homeowner. This installer says that they do service work for one big box store and that their work with them is increasing each year.

Big box stores will sometimes stock HPWHs, but their clientele is reportedly looking primarily for a low-cost solution and is unlikely to be interested in an HPWH. A manufacturer explained that smaller hardware stores are less likely to stock HPWHs than big box stores. One big box store chain stocks HPWHs in 50% of their nationwide stores; however, the stores in primarily gas water heating markets will not carry HPWHs. Distributors may purchase water heaters from big box stores, but that is rare. One interviewed distributor shared an example of a time they were in a big box store and noticed the store had discounted all its HPWHs and so the distributor ordered them “by the truckload.”

The distributors primarily sell to plumbers: On average the three distributors sell 89% of water heaters to plumbers. One sells exclusively to plumbers, another distributor estimated 98% of water heater sales go to plumbers with the other 2% going to HVAC installers, and the last distributor estimated their customers were 70% plumbers and 30% builders. These distributors do not sell online because they do not ship water heaters and they do not sell to homeowners because they want the equipment installed properly by a licensed plumber, particularly for cases where the plumbing and electrical work will need to be inspected.



AIC has successfully engaged a large network of HVAC contractors, who play a key role in delivering AIC-incentivized equipment to AIC customers. Historically, AIC has not had the same level of engagement with plumbers. The state of Illinois requires water heater changeouts to be completed by a licensed plumber and many HPWHs require the expertise of both electricians and plumbers. As such, AIC should ensure installer training efforts are designed to engage and support plumbers. In addition, AIC should work to facilitate relationship-building between these trade groups to ensure an efficient installation process for the customer to help further encourage HPWH adoption.

All nine interviewed installers preferred to buy water heating equipment from distributors and only one reported also purchasing from big box stores. The reasons interviewees gave to support their preference for purchasing from distributors included their supplier having product in stock, prompt delivery, better warranty support, and providing a 100% pass-through on the AIC incentive. They avoided big box stores because HPWHs are not always in stock, there are lines, and they believe big box store staff are not as knowledgeable about water heating equipment as distributor staff. A distributor mentioned that plumbers come to them to seek their advice because the distributors are seen as knowledgeable professionals.



AIC is not currently incentivizing HPWH equipment sold through retail channels. Given that 50% of HPWHs are sold through big box and hardware stores, this is a missed opportunity for capturing both resource acquisition savings and market effects. Once AIC feels confident with level of market response from distributors from the Midstream HPWH Initiative, AIC should consider expanding the Initiative to offer point of sale rebates for HPWH equipment for end-customers at hardware stores and big box stores.

Interviewed installers estimated that 26% of water heaters are installed directly by end customers but expected that percentage to be smaller for HPWHs. The seven installers' estimates ranged from as little as

3% to as high as 50%. Previous research found estimates, however, that 26% of all water heaters are installed “do-it-yourself” (DIY) by customers, while up to 50% of HPWHs purchased at retailers were installed DIY by end customers.¹³ Of all the water heaters sold at retail, one manufacturer estimated that one-third are purchased and installed by plumbers, one-third are purchased and installed DIY by the homeowner, and one-third are purchased by the homeowner but installed by an installer.

4.3 Distributor Stocking and Promotions

Distributors order their equipment in batches and pick what type of equipment to order based on what installers are demanding. One distributor, who did not stock HPWHs explained, “I’m not against adding to our product line, but if I am, I have to make sure it’ll be marketable and move from one point to another in a reasonable amount of time.” Distributors take cues from plumbers and if plumbers ask the distributor to keep HPWHs in stock, they are likely to do so.

Table 3 shows the breakdown of what types of equipment the distributors had in stock at the time of the interview. Their equipment stock was about evenly split between gas and electric equipment, with tanked equipment below 55 gallons predominating their stock.

Table 3. Distributors’ Equipment Stock (n=3)

Equipment Type	Average In Stock
Natural Gas	52%
Tankless	14%
Tanked	86%
Electric	48%
Tankless	3%
HPWH	12%
Other Tanked	85%
All tanked equipment	
Below 55 gallons	96%
Above 55 gallons	4%

Note: These data are weighted based on the proportion of stock the respondent represents out of those interviewed. The first interviewed distributor’s stock represented 54% of the stock reported, the second represented 39%, and the third represented 7%. Their breakdowns of stock were weighted per the portion they represent.

Only one of the interviewed distributors promotes HPWHs. The promotion is done in-store via the sales staff who seek to influence plumbers’ choices. This distributor also promotes equipment by sending emails that explain the technical benefits of HPWHs or inviting the plumbers to webinars that explain more about HPWHs. The distributor explained their reasoning for why their store promotes HPWHs, “We push them because there’s more financial opportunity for us, for our customers, and savings for the end-user. So, it works out that everyone wins. And it is a better product, which makes a world of difference.”

4.4 Barriers

End customers’ and installers’ low awareness of and familiarity with HPWHs is a primary barrier to market expansion because it is hard for these groups to justify the upfront cost of the equipment without

¹³ See note 6 above.

understanding the benefits. Installers prefer like-for-like replacements and recognize that HPWHs have a more complicated installation process than other water heater types.

4.4.1 Availability

Suppliers in AIC territory are generally stocking enough HPWHs to meet current demand but will need to increase stock as demand grows. All eight installers reported that they have had no trouble ordering an HPWH from their plumbing distributor and that their distributor usually has one or two in stock.¹⁴ One respondent, who installed eight HPWH in one week, reported exhausting their distributor’s inventory and then needing to go to three big box stores to obtain the remaining four HPWHs. If an installer does not have an HPWH, respondents reported it takes on average of three days to get one (Table 4), with most (4 of 5 experienced installers) reporting it takes between one and two days. COVID-19 lengthened the amount of time it takes for distributors who need to wait on freight to get HPWHs and it can now take about a month and a half. Before the pandemic, distributors could receive an HPWH between 7 to 30 days after they placed an order. Notably, distributors said it takes the same amount of time to order an HPWH as other residential water heating equipment.

Table 4. Wait Time for an HPWH Not in Stock

Group	Average Time to Order an HPWH
Installers ordering from distributor (n=5)	3 days
Distributor waiting on freight (n=3)	49 days



AIC should continue to focus efforts on encouraging distributors to stock high efficiency equipment. As current distributor rebates are based on sales, AIC may want to consider exploring the possibility of offering distributors a bonus for stocking HPWHs.

Manufacturers noted that the cost of raw materials has increased lately but did not expect that to affect supply. All manufacturers noted that the cost of cold-rolled steel has increased since the introduction of tariffs in 2018. The price of steel is up about 15%. Due to this the price of all water heaters has increased slightly. Even without this price increase, manufacturers do not expect the price of HPWHs to come

down over the next five years because demand is still low enough in the United States that they cannot achieve economies of scale to drive down production costs. They reported experiencing no other challenges to the production of their equipment and one added that they are “totally ready” to handle increases in HPWH demand.

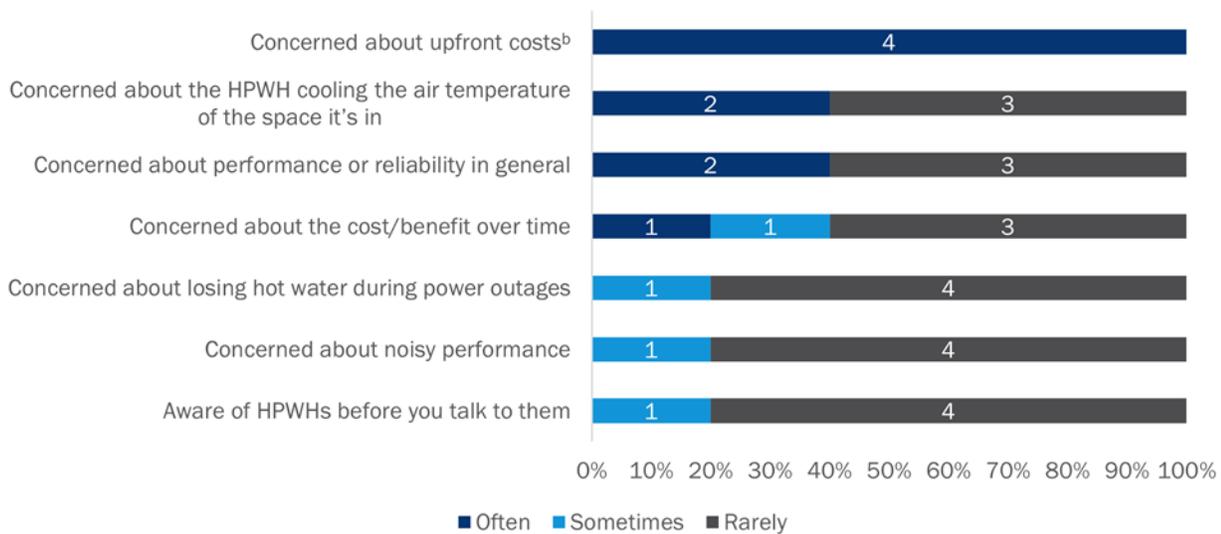
4.4.2 Upfront Cost and Overall Awareness

Our interview findings corroborated literature review findings that the higher upfront cost of HPWH is the main reason customers choose not to install an HPWH (Figure 3). Customers’ knowledge about the technology can influence the magnitude of the upfront cost barrier. The evaluation team conducted an earlier study with AIC customers and found that customers who were not educated about HPWH technology by their installer indicated that cost (41%) was a more common concern than those who were educated by their installer

¹⁴ The ninth installer reported they had never tried to purchase an HPWH and could not comment on their availability.

(20%).¹⁵ Installers also believe that customers will have concerns about the HPWH cooling the space that it is in, but those concerns usually arise after the HPWH has been installed. This is mostly a concern when the HPWH is installed in a living space, such as a finished basement, which leads to comfort issues. Other concerns included the HPWH’s performance or reliability and whether it will be worth the upfront cost if the customer can save money over time.

Figure 3. Experienced Installers’ Perceptions of Customer Concerns (n=5)^a



^a The survey question asked experienced installers: “Using the terms often, sometimes, or rarely, how often are customers...”

^b One installer reported that all the HPWHs they had installed were covered at no cost to the customer, and therefore did not have concerns about upfront costs. We have excluded his response from the figure because the situation is not representative of most customers’ considerations.

Low customer awareness of HPWHs is another significant challenge. Installers report that customers almost never inquire about an HPWH. The five experienced installers estimated that a customer asks about an HPWH 2% of the time. Nine market actors across the supply chain reported that AIC should promote HPWH to the general public more and that this would help drive sales.



According to the 2021 AIC Energy Efficiency Programs Marketing Implementation Plan, AIC does not currently have plans to conduct outreach to end-customers for the Midstream HPWH Initiative. Marketing and promoting HPWH to homeowners can result in increased market demand for HPWH, as such AIC should consider expanding marketing plans to include promoting HPWH equipment to end-customers, including on the AIC website. Highlighting key benefits of HPWH equipment including the incentive, ten-year warranty, and potential operational savings are likely to influence homeowners.

4.4.3 Installers

¹⁵ See note 2 above.

Installers were open to installing HPWHs, but most said it would have to be the right application for them to recommend an HPWH. Installers report that on average, 90% of their water heater jobs are replacing a non-functioning water heater. In these situations, the customer wants to get their water heater replaced as quickly as possible. For installers, the quickest way to install a new water heater is to do a like-for-like replacement and install a new version of what the customer had before. Installers are often reluctant to offer a customer costly and unfamiliar options and prefer to install equipment they know and trust. A few installers we spoke to reported they offer the customer “good, better, and best” options, with the HPWH representing the “best” option.

Installers did not perceive HPWHs as highly efficient and instead preferred gas equipment for its perceived efficiency. One-third of installers (3 of 9) said their most commonly recommended water heater is a “power vented” natural gas water heater because of the efficiencies they believe it offers. One installer said the power vented water heaters offer “the most bang for your buck” and are 73% to 85% efficient. In fact, when asked their opinion of an HPWHs’ energy efficiency compared to other equipment, not one installer said that an HPWH was the most efficient option. About half (4 of 9) said that a gas tankless water heater has the most economical performance. When HPWHs are in a conditioned space and use the heat being produced to heat the home to heat the water, it creates a system inefficiency called parasitic heat loss.¹⁶ One-third (3 of 9) said that the parasitic heat loss means that a HPWH’s energy savings performance does not live up to manufacturer claims. The final two installers had no opinion on the HPWH’s efficiency because of their lack of experience with them.



Ensure marketing and training efforts targeting installers cover the demonstrated efficiency performance of HPWHs to debunk the installer misperception that HPWHs are not the most efficient type of water heating equipment on the market.

Illinois requires water heater changeouts to be completed by a licensed plumber, which makes HPWH installations difficult for two respondents whose business largely focuses on HVAC work. Both of these installers reported needing to hire a licensed plumber as a sub-contractor to complete the water heater installations on their projects, which they said was not cost-effective. They contrasted Illinois to Missouri, which does not have such a requirement, and noted that they do more water heater installations in Missouri.

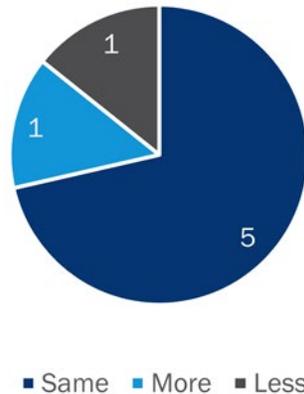
A majority of installers reported concerns about the recovery rate of HPWHs (7 of 9), noting that it is slower than natural gas-powered water heaters. The lower recovery rate causes them to be reluctant to offer HPWHs to larger households and homes with jacuzzi-style tubs. Additionally, two-thirds of installers questioned HPWH reliability (6 of 9). This was largely due to the fact that HPWHs they have worked with have not been installed for long. Their limited experience with HPWHs results in a lack of confidence in the long-term reliability of the equipment and an associated reluctance to suggest it to customers. A distributor who has an HPWH in their home noted that on “bath day” for his three children, he switches the HPWH’s mode to electric resistance so that there is enough hot water for everyone because the recovery rate is slower in heat pump mode.

Most installers said that the profitability of installing an HPWH was about the same as other equipment, but that the HPWH installation takes longer (Figure 4). These respondents reported that the markup on equipment and the labor rates are the same for HPWH as other equipment. Four of these added that a customer would pay more to have an HPWH installed because it takes longer, equating to more labor costs. The one installer

¹⁶ Shapiro, Carl, and Srikanth Puttagunta. 2016. Field Performance of Heat Pump Water Heaters in the Northeast. U.S Department of Energy.

who said HPWHs can be more profitable to install said that the markup percentage is the same but because HPWHs are more expensive, the markup percentage equates to more money on the more expensive HPWH equipment. Finally, the installer who said HPWHs are less profitable reported that they could install only one HPWH in a day whereas they could install up to three other water heaters in one day because of the more straightforward installation.

Figure 4. Profitability of an HPWH Install Compared to Alternatives (n=7)



Installation challenges for HPWHs was a common theme among the market actors. All the installers and distributors we talked with mentioned how the installation of an HPWH is more complicated than other equipment options (Table 5). We explain each of the issues following the Table.

Table 5. Issues that Complicate HPWH Installation

Issue	Number of Respondents (n=12)
Inadequate electricity service	6
Inadequate installation space	5
Cools ambient space	4
Ducting need	4
Piping needs	4
Condensate line need	2
Inadequate temperature in installation space	2
Heavier	1
Controls complicated	1
Noisy	1

Installers and distributors noted the following factors that make an HPWH installation more complicated than other equipment:

- Inadequate electricity service:** While often not a problem if replacing an existing electric water heater or in a home with central air conditioning, installers need to be sure that there is adequate electricity service in the panel, that there is an outlet for the HPWH, and that the wires and the utility service drop to the house have adequate capacity. HPWHs generally require 240V electrical capacity and gas or dual fuel homes are less likely to have an electrical panel that can accommodate the capacity required for HPWH installation. Manufacturers are currently in the process of developing a 110V HPWH unit,

however this technology is not yet available on the market. If the installation requires a new wire to be run from the panel, the plumber will need to hire an electrician and it could be a week before the electrician can get to the site. The added labor, materials, and time to ensure adequate electricity service add to an HPWH's project costs. When confronted with a choice, customers "will pick the easy, faster, less intrusive option" according to one interviewee. The installers we spoke with had never needed to upgrade the electrical panel to accommodate an HPWH, and a few asserted that if a panel upgrade was needed, the added cost would be reason enough to not go with an HPWH.

- **Inadequate installation space:** Installers noted that existing water heaters are often in closets, which may not provide enough air flow for the HPWH to function properly. HPWH are also about one foot taller than other tanked equipment, which prevents installation in about 15% of basements, according to one installer.
- **Cools ambient space:** The four interviewees who mentioned this as a complicating factor had strong feelings about it. They said the manufacturer specifications that claim HPWHs cool the space by two or three degrees were incorrect and that the HPWHs actually cool the space by about 10 degrees. This aspect also affected perceptions of energy efficiency. One installer made the following illustrative comment, "When you factor in that it cools their house down, and you've got to rely on central heating to heat the house up, I don't know that the savings are what they advertised." One installer said they would never install an HPWH in areas the customer uses for living space, such as finished basements, bathrooms, or laundry rooms. Another said the fact that the equipment cools the ambient space was the main reason they do not install HPWHs. This installer further reported they have received call-backs from customers in the winter complaining about comfort issues. All four of these installers reported they explain this facet of HPWHs to the customer and one added that they show the customer the HPWH's modes so they can switch it to electric resistance in case the space is getting too cold.
- **Ducting needs:** Those who were concerned about the HPWH cooling its surrounding space mentioned that they could vent out the cold air via a duct, but the extra materials and labor required to complete the ducting could add \$600 to the installation costs.
- **Piping needs:** An HPWH's pipes come out of the side of the unit instead of the top, like other equipment. The piping position can mean a plumber needs an extra 20 feet of piping to install the unit. When fuel switching from gas to electric, the plumber must disconnect the water and gas lines, remove the water heater and a portion of the gas piping, and cap the gas line.
- **Inadequate temperature in installation space:** HPWHs in unconditioned spaces work less efficiently in cold weather because there is less heat in the surrounding air. One respondent mentioned that garages are too cold in their area for HPWHs and another mentioned that they often run into issues where the temperature in the installation space is too cold, citing a mechanical closet that was 43 degrees.
- **Condensate line needs:** Installers need to be aware that HPWHs produce condensate. As such, they will either need to install a condensate drain line or a pump to move the condensate elsewhere. A distributor also mentioned that a lot of installers ask questions about the condensate drain line, whether an auxiliary pump is needed, and how much condensate to expect. Offering training on this aspect of HPWH installation would be beneficial.

- **Perceptions that HPWH are heavier, noisier, and come with more complicated controls than traditional water heaters:** Mentioned by one person each, a distributor noted that HPWHs are top-heavy and somewhat more difficult to manage. The controls are more complicated than other types of water heating equipment because there are multiple modes on a keypad, compared to an on-off switch with other water heaters. According to the literature review, some installers report associating increased complexity of energy efficient equipment with a lack of reliability and increased maintenance needs.¹⁷ One interviewed installer noted that they are sure to put HPWHs away from living spaces due to the noise. The literature review found that noisy performance was a concern for 18% of customers in one DOE study, as they can make about as much noise as a refrigerator.¹⁸



AIC Midstream HPWH Initiative training for plumbers should cover how an HPWH works, its installation requirements, its efficiencies, its modes, its warranty, and available incentives. Sales training will be important so plumbers can effectively educate a customer about the advantages of HPWHs. In addition, AIC can also consider facilitating ongoing feedback loops with manufacturers to ensure they continue to develop new HPWH iterations that address these current product limitations.

4.5 Motivations

Customer decision-making is primarily driven by costs while installer and distributor decision-making is most commonly driven by sales. Market actors agreed that the most effective way to encourage widespread HPWH adoption is to convince homeowners of the advantages offered by HPWHs. Once they start demanding HPWHs, installers and distributors will want to meet the demand and will start stocking and selling more HPWHs.¹⁹

End Customers

Illinois customers are cost conscious and consider the upfront cost, the operating cost, and the equipment warranty when deciding on water heating equipment.

The main reason end-customers might be interested in an HPWH is due to the potential to save on monthly water heating costs, according to three-quarters (9 of 12) of installers and distributors and corroborated by the literature review results. The ability to save on operating costs is the most common reason that cost-conscious consumers would be willing to pay a higher upfront cost.

Four respondents added that the longer warranty that accompanies HPWH equipment is a positive selling point. Illinois has hard water, which can degrade the tanks, necessitating that water heaters be replaced every seven to ten years. Installers reported that customers commonly ask about warranties and are pleased to learn that HPWHs come with a ten-year warranty, longer than that of tankless or other tanked equipment. A distributor noted that an advantage for installers offering HPWHs is that the ten-year warranty gives their customers “peace of mind.”

¹⁷ Apex Analytics. 2020. HVAC Market Actor Profile Report. NEEA.

¹⁸ See note 14 above.

¹⁹ Although not cited directly, the following source was included in the secondary data review and informed the evaluation team's thinking and approach to customer and contractor motivations: Steiner, Ellen, Samantha Lamos, and Dan Hudgins. 2020. “Successes and Challenges of Residential Heat Pump Water Heater Programs Through the Lens of Customers and Contractors.” 2020 ACEEE Summer Study.

Environmental benefits and dehumidification benefits were not strong drivers for customer purchases of HPWHs, according to interviewees. Only one installer reported that customer concern about the environmental impacts of energy use is a driver of demand for HPWH. An HVAC initiative study conducted in AIC territory found that less than half of respondents (47%) were interested in HPWHs because of their “green” environmental benefits.²⁰ The literature review found that pairing solar PV systems with HPWHs can be a motivator for customer adoption because the solar energy can offset the water heating load and lower operating costs.²¹ A few interviewees agreed that rooftop solar could be a motivator, but they asserted that almost none of the end-customers had rooftop solar.



Ensure that the 10-year warranty selling point is prominently featured in installer trainings and promotional materials. Given the prevalence of hard water in Illinois, this HPWH benefit is likely to motivate installers and end-customers alike.

Utility incentives are influential in homeowner decision making, according to all but one interviewee. Incentives reduce the upfront cost of efficient equipment and signal to customers that the technology is supported by trusted energy partners. Respondents agreed that AIC’s utility rebates have been a strong driver of HPWH demand, and the absence of rebates would make it nearly impossible to convince a homeowner to install an HPWH. In fact, for one

interviewed installer, their only HPWH customer was a homeowner who saw the AIC rebate and wanted to try the HPWH. The manufacturers corroborated this sentiment and explained that the areas of the country with the greatest HPWH penetration are those with longstanding rebate programs.

Three-quarters of the surveyed installers and distributors (8 of 12) had participated in AIC’s incentive programs.²² All four who had not yet participated, said they may be interested in participating after learning more about the program. For one of them, the promotional benefits of becoming listed as a certified installer with AIC would be reason enough to participate.

Those who were aware of AIC’s HPWH rebate program agreed that the \$1,000 incentive should be adequate to generate interest in HPWH and that a \$500 rebate would not be enough. Two respondents (one installer and one distributor) reported that AIC’s incentive influenced their company’s decision to increase its stock and promotion of HPWHs. One manufacturer praised AIC for incentivizing 65- and 80-gallon HPWHs, a size that is needed for customers switching from gas water heaters due to HPWHs’ lower recovery rates. In the 2010 update to the National Appliance Energy Conservation Act (NAECA), the Department of Energy (DOE) mandated new higher energy factor (EF) ratings on virtually all residential water heating products, including gas-fired, oil-fired, electric, tabletop, instantaneous gas-fired and instantaneous electric. These new standards went into effect on April 16, 2015. For larger capacity models, the only technologies that meet these EF requirements are heat pump water heaters and high efficiency condensing gas water heaters. We have heard that installers in other utility territories have circumvented this requirement by installing two 40-gallon water heaters instead of installing a unit above 55 gallons.²³ If AIC wants to avoid installers putting in two storage units below 55

²⁰ See note 2 above.

²¹ Hopkins, Asa, Kenji Takahashi, Devi Glick, and Melissa Whited. 2018. Decarbonization of Heating Energy Use in California Buildings. NRDC.

²² Three of these eight participated in the AIC income-qualified program; two participated in AIC’s HVAC program, two were distributors using AIC’s midstream HPWH program, and the last installer said it used AIC’s water heating incentive.

²³ Almost half of 70 installers (48%) commonly use workarounds to avoid installation HPWHs in place of large electric resistance tanks. Source: Nevius, Monica, Powell, Jared, and Lauren Abraham. Northwest Heat Pump Water Heater Initiative Market Progress Evaluation Report #5. NEEA.

gallons, then incenting HPWHs above 55 gallons may motivate HPWH installations for homes with high water demand.

Interviewees were commonly confused about the AIC Midstream HPWH incentive structure, and often stated the incentive pass-through requirements incorrectly. In addition, six interviewees also suggested that installers should receive a portion of the rebate to incentivize them to sell HPWHs.



AIC should clearly specify the incentive pass-through requirements for end-customers in marketing and outreach materials designed for distributors and installers. Furthermore, AIC could encourage distributors to create HPWH in-store displays with signage that clearly states the incentive amounts and cost savings for contractors and end-customers to alleviate confusion about the incentive design.

A manufacturer cautioned that distributors may be reluctant to participate if the paperwork is too onerous and requires a lot of customer information. If the distributor and installer miss documenting one of several customer details and do not receive the incentive due to that, they may perceive the program as too risky to participate. According to literature review findings, midstream incentives have been shown to motivate distributors, if they are not required to pass through 100% of the incentive.

The same manufacturer had a couple other suggestions for AIC:

- The emphasis on distributor incentives means that homeowners and multifamily property owners visiting the AIC website to learn more are missing educational information about HPWHs. They suggested AIC leverage its website to provide more marketing and education about the availability of a rebate, that it should be about \$800, and tell the story of how an HPWH pays for itself.
- AIC should require that participating distributors have an HPWH on display with the after-rebate pricing on it, so that more installers see it and start asking about HPWHs.

Another manufacturer recommended that AIC offer its \$1,000 via retailers to stimulate market competition. According to this interviewee, if homeowners see that they can get an affordable HPWH via a big box store, then installers are more likely to feel like they are “missing out” on sales and will be more likely to offer HPWHs.

Installers

One of installers’ key goals is maintaining relationships with customers. They are driven to sell technologies that will satisfy the customer, make economic sense, and are unlikely to lead to call-backs. As such, installers will take into account what the customer wants and needs when deciding what equipment to recommend. Table 6 shows that most installers consider the home’s need for hot water and then consider economic factors such as the existing fuel supply and upfront cost before considering space and location constraints.

Table 6. Factors Installers Consider When Deciding What Equipment to Recommend (n=9)

Factor	Number of Installers
Daily water demand	6

Factor	Number of Installers
Fuel of existing water heater	5
Upfront cost	4
Space constraints	3
Customer preference	3
Location for sound issues	1
Ease of installation	1
Energy efficiency	1

Note: Multiple responses allowed

Installers would be more likely to stock HPWH equipment if there was greater customer demand and if they knew more about them, but a portion do not stock any water heaters (Table 7). A handful of installers reported they do not keep any water heaters in stock and acquire them the day of the job. Others would stock more HPWHs if there was greater customer demand and guaranteed installs. Two wanted to learn more about the benefits of HPWHs before deciding to stock them. Furthermore, one respondent, whose primary business was HVAC work, said that if the state of Illinois could offer an expedited permit for water heater changeouts, that would result in more water heater work and allow him to stock HPWHs.

Table 7. What Would Cause Them to Stock HPWH (n=11)

Factor	Number of Installers or Distributors
None - Do not stock any water heaters	4
More customer demand	4
If they knew more about HPWH	2
Licensing requirements change	1

Note: One distributor was not asked this question as they already stocked a lot of HPWHs. They reported having 20 in stock at the time of the interview and had just ordered 76 more.

4.6 Training

Excluding the manufacturers, half of the market actors (6 of 12) we talked to had received training on HPWH specifications: Four of the nine installers and two of the three distributors. Two of the installers said their training was sponsored by AIC, while the remainder described manufacturer-sponsored trainings. These included a mix of in-person classes and webinar-format classes. These trainings reviewed how the product works, its efficiencies, how to install it, and any rebates available. The manufacturers’ manuals and an online portal were also mentioned as additional information resources the respondents used.

Training Needed:²⁴ The training installers reported needing most is troubleshooting for when something goes wrong (n=4). Other training needs include a basic overview of how a heat pump works, its modes, its efficiencies, and its installation requirements including any venting needs. A distributor reported that one of the more common questions he receives is about which HPWH mode is recommended. This same distributor also said that, after the installation, the plumber will follow-up to ask why it is so cold in the area the HPWH was installed. An HVAC technician noted that he did not need much training on heat pumps because he was familiar with them for space heating and cooling. He added that, plumbers in his area will install HPWHs but will not service them, whereas HVAC installers are more willing to service HPWHs. He stated “The plumbing license is a barrier for sure. I think if you could get more HVAC installers in the program, I think heat pump

²⁴ This data came from trainings installers wanted to have or from questions that distributors reported receiving from installers.

water heaters would have a lot more likelihood of taking off. Most plumbers are just pipe fitters and don't embrace new technology.”

Training Offered: Only one of the three distributors reported doing any training or promotion of their HPWHs. The one distributor said they have an HPWH on display at their store and have done “lunch and learn” presentations. They proactively educate their installer customers about an HPWH’s potential energy savings and the potential earnings opportunities for installers. They also pass out pamphlets provided by the manufacturer.

All three of the manufacturers reported offering training on their HPWHs, including participating in an AIC-sponsored showcase. One reported their training is primarily self-guided online, but they recently began training counter sales staff at distributors. Another offers literature and does webinars that cover technical aspects along with sales training. This manufacturer determines where to offer webinars based on the markets that have utility incentives. They reported that in markets without an incentive, there is no training need because the HPWH market is non-existent.

5. Key Findings and Recommended Opportunities for AIC

The evaluation team analyzed key findings from the secondary data review and discussions with market actors to identify several opportunities for AIC to adjust the Midstream HPWH Initiative design to ensure the Initiative optimally captures and generates market effects. We highlighted these key findings and opportunities throughout the report and we also summarize them below:

- **The HPWH market in AIC service territory is very young and has room to grow.** Given the strong influence of utility programs on HPWH sales and Ameren’s relatively young HPWH incentive, we estimate that the actual market penetration of HPWH in AIC territory is likely to be between 0.5% and 1% of single-family homes. Furthermore, market actors described AIC’s HPWH market as “nonexistent,” “virgin territory,” “trivial,” and “sparse.”
- **Opportunity: The current nascent state of the market reflects opportunity for AIC to claim both resource acquisition and market effects savings.** Installers report that upfront cost of the equipment is a substantial barrier to end-user acceptance of HPWHs and growth in HPWHs is currently highly dependent upon incentives offsetting the up-front costs. In the short run, the AIC incentive amount for HPWHs is likely to successfully offset this price differential enough to provide for increased sales. In the longer run, there are significant opportunities for AIC to create market effects through growing product acceptance, recommendations, and installations outside the program.
- **Opportunity: To produce market effects, the program must reduce transaction costs in the supply chain, increasing product availability.** Stocking practices for HPWHs are indicative of the immature market with inconsistent and delayed product availability resulting from limited demand. While all distributors report being able to meet the limited demand for HPWHs, installers report waiting days and even weeks for a product to be in stock. As demand grows, and distributor’s confidence that inventory will move improves, increased product availability will provide another potential source of market effects.
- **New construction presents a key market opportunity for HPWH installations** because new homes can accommodate the HPWH’s physical size, installation requirements, and electric demands according to our interviews and an AIC HVAC initiative trade allies survey.²⁵

²⁵ See note 2 above.

- **Opportunity: Continue to explore opportunities to work with new construction.** AIC is currently developing solutions to confirm customer eligibility for new construction installations to ensure this market segment can be a viable option for the Midstream HPWH Initiative. We encourage AIC to continue to work through these logistics as new construction opportunities do not pose the same installation barriers as retrofit opportunities. As such, this market segment provides an important opportunity for installers to gain experience installing and maintaining the equipment.
- **The high prevalence of gas water heating in AIC service territory presents a barrier to adoption:** The study identified 80% of homes in Ameren territory have gas water heat. Conversion from gas to electric present a number of challenges that may require additional education, training, or other program support. Notably, about 90% of all water heaters are installed in a replace-on-burnout situation and installers strongly prefer like-for-like equipment replacements in these situations, which creates challenges for encouraging for both gas and water heating customers to switch to HPWH. In addition, policy challenges in encouraging fuel switching from gas water heaters to HPWH may exist. These factors could restrict the market for HPWHs that are sold without AIC incentives, and corresponding market effects. The more directly addressable market for HPWHs are existing electric water heaters as they do not require fuel conversion and the electric panel is likely sized for the added load of the water heater. Single family homes with air conditioning also likely have electrical panels that can accommodate HPWHs.
- **Opportunity: Ensure incentives are high enough to encourage customers to overcome the tendency to make like-for-like equipment purchases.** AIC's \$1000 incentive for HPWHs means that the total HPWH equipment cost comes in \$50 below the market cost of a gas water heater (for A.O. Smith units), which should help encourage customers with gas water heating and installers serving these customers to adopt HPWHs instead of like-for-like gas replacements. However, AIC plans to drop the incentive to \$800 later in the program year. At this point, AIC should carefully track HPWH adoption to ensure customers do not begin to default to purchasing like-for-like equipment when the AIC incentive no longer creates a cost advantage.
- **HPWH distributors primarily sell to plumbers.** These distributors do not sell online because they do not ship water heaters. They do not sell to homeowners because they want the equipment installed properly by a licensed plumber, particularly for cases where the plumbing and electrical work will need to be inspected. Furthermore, Illinois requires water heater changeouts to be completed by a licensed plumber, which necessitates that HVAC installers that install HPWHs must engage plumbers as subcontractors or have installers that are dual-licensed.
- **Opportunity: Focus installer training support on plumbers and support relationship-building between plumbers and electricians.** AIC has successfully engaged a large network of HVAC installers, which play a key role in delivering AIC-incentivized equipment to AIC customers. Historically, AIC has not had the same level of engagement with plumbers. The state of Illinois requires water heater changeouts to be completed by a licensed plumber and many HPWHs require the expertise of both electricians and plumbers. As such, AIC should ensure installer training efforts are designed to engage and support plumbers. In addition, AIC should work to facilitate relationship-building between these trade groups to ensure an efficient installation process for the customer to help further encourage HPWH adoption.
- **Retail stores are a key HPWH distribution channel.** AIC's distributor incentive of \$1000 should generate interest in HPWHs. Though, not offering an incentive for HPWHs purchased at big box stores and hardware stores misses potentially half of water heaters sold, reducing opportunities to capture resource acquisition savings and market effects.

- **Opportunity: Consider introducing a point-of-sale rebate for HPWH at retailers.** AIC is not currently incentivizing HPWH equipment sold through retail channels. Given that 50% of HPWHs are sold through big box and hardware stores, this is a missed opportunity for capturing both resource acquisition savings and market effects. Once AIC feels confident with level of market response from distributors from the Midstream HPWH Initiative, AIC should consider expanding the Initiative to offer point of sale rebates for HPWH equipment for end-customers at hardware stores and big box stores.
- **Illinois end-customers are cost-conscious and may be interested in an HPWH for its potential operational savings and ten-year warranty.** Currently, Utility incentives are influential in homeowner decision-making, but customers' low awareness of HPWHs limits their demand. As upfront cost is another key barrier to customer adoption. The price and installed cost of HPWHs need to come down considerably for them to result in market effects—non-program sales. Increasing customer demand for HPWHs will reverberate up the supply chain.
 - **Opportunity: Consider expanding HPWH marketing efforts to include homeowners.** AIC does not currently have plans to conduct outreach to end-customers for the Midstream HPWH Initiative. Marketing and promoting HPWHs to homeowners can result in increased market demand for HPWHs. As such, AIC should consider expanding marketing plans to include promoting HPWH equipment to end-customers, including on the AIC website. Highlighting key benefits of HPWH equipment including the incentive, ten-year warranty, and potential operational savings are likely to influence homeowners.
- **Distributors in AIC territory are generally stocking enough HPWHs to meet current demand but will need to increase their stock induce market effects.** Distributors generally stock one or two HPWHs, which meets current demand but when installers complete larger projects they must order the equipment or purchase it from big box stores. Moreover, distributors report that they stock what the market is demanding and are willing to change their inventory if they know they can sell it.
 - **Opportunity: AIC should continue to focus efforts on encouraging distributors to stock high efficiency equipment.** As current distributor rebates are based on sales, AIC may want to consider exploring the possibility of offering distributors a bonus for stocking HPWHs.
- **Installers in AIC territory are not convinced of an HPWH's energy efficiency and overall value.** Due to their limited experience with the HPWH technology, some installers questioned its reliability. Many had concerns about their recovery rate compared to gas water heaters and some feared the parasitic heat loss would result in customer call-backs about comfort. Half of the interviewed installers had not received training on HPWHs.
 - **Opportunity: Training for plumbers should include how an HPWH works, as well as its installation requirements, efficiencies, modes, warranty, and available incentives.** Sales training will be important so that plumbers can effectively educate customers about the advantages of an HPWH.
 - **Opportunity: Ensure marketing and training efforts targeted to installers cover the demonstrated efficiency performance of HPWHs** to debunk installer misperceptions that HPWH's are not the most efficient type of water heating equipment on the market.
- **There is confusion among market actors about the Midstream HPWH Initiative incentive structure, particularly the pass-through requirements.** Six interviewees also suggested that installers should receive a portion of the rebate to incentivize them to sell HPWHs.
 - **Opportunity: AIC should clearly specify the incentive pass-through requirements for end-customers in marketing and outreach materials designed for distributors and installers.** Furthermore, AIC could encourage distributors to create HPWH in-store displays with signage that clearly states the

incentive amounts and cost savings for end-customers to alleviate confusion about the incentive design.

- **Our literature review demonstrated that HPWH can be a strategic tool for achieving greenhouse gas emission reductions.**
- **Opportunity: AIC should continue to evaluate how to optimally leverage this technology as the Illinois policy landscape evolves.**

Appendix A. Instruments



HPWH Installer
Guide.docx



HPWH Distributor
Guide.docx



HPWH Manufacturer
Guide.docx

Appendix B. Secondary Data Review Memo



Secondary Data
Review Memo.pdf

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