



September 20, 2018

REPORT #E18-374

Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7

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1. Executive Summary

The Northwest Energy Efficiency Alliance (NEEA) engaged Cadmus in January 2018 to conduct the seventh market progress evaluation report (MPER 7) for NEEA's Northwest Ductless Heat Pump Initiative. The initiative, which NEEA launched as a pilot in 2008 and at full scale in 2010, encompasses a range of activities to accelerate the adoption of ductless heat pump (DHP) technology by working with upstream and midstream market actors, promoting and supporting effective installation of DHPs in existing homes, supporting initiatives offered by Northwest utilities, and building consumer and market awareness.

Through MPER 7, Cadmus and NEEA sought to build upon several years of prior research (including six previous DHP MPERs) and to focus research activities to fill critical knowledge gaps about consumer awareness and supply-side (installer) and demand-side (consumer) perspectives on DHP pricing. This report presents evaluation findings from several research activities: a web-based survey of homeowners in NEEA's target markets who do not own DHPs, telephone interviews with consumers who have considered but not purchased a DHP, telephone interviews with DHP installers, and a review and analysis of initiative data sources.

The initiative tracks market progress in three target markets (TM)—single-family homes with zonal heating (TM1), single-family homes with electric forced air furnaces (TM2), and manufactured homes with electric forced air furnaces (TM3). Since 2008, an estimated 83,700 DHPs have been installed in NEEA's target markets. Although total annual DHP installations have increased each year since 2008, continued growth will be required to meet NEEA's market saturation goals—currently, market saturation is between 8% and 22% of target 2039 maximum saturation for each of NEEA's three market segments.

The following are Cadmus' key findings, conclusions, and recommendations from this market progress evaluation.

1.1. *Summary of Key Findings, Conclusions, and Recommendations*

The following is a summary of key findings from this market progress evaluation.

1.1.1. DHP Awareness and Information Resources

To quantitatively assess the initiative's progress toward its goal of increased consumer awareness and demand, Cadmus surveyed a representative sample of target market consumers to assess DHP awareness and purchase consideration. To gather deeper insights into consumers' consideration of and decision to purchase a DHP, Cadmus conducted in-depth interviews with consumers in NEEA's target markets who considered purchasing (but did not purchase) a DHP.

Conclusion: DHP awareness has remained consistent over the last three years—more than half of target market consumers have seen or heard of a DHP and around one-third of this population is aware of DHPs by name alone.

There were no significant changes over time (MPER 5 through MPER 7) in unprompted or overall DHP awareness (33% and 57% in MPER 7, respectively). Consistent with MPER 5 and MPER 6, word of mouth is the most common way target market respondents learned about the technology, followed by the internet.

Conclusion: Consumers often conduct online research when considering a DHP purchase, but research findings from in-depth interviews suggest they may be unable to find sufficient information on topics related to climate, home size, pricing, and product and installer reviews.

Of the surveyed consumers who had considered purchasing a DHP (just over one half of those surveyed that were aware of DHPs), more than half reported conducting online research while considering a DHP purchase. Similarly, a majority of interviewed consumers who considered (but did not purchase) a DHP said they conducted online searches for DHPs information prior to contacting installers. However, half of these consumers wanted more product reviews or more information about how DHPs work in their specific climate condition, home size, or price range. Two respondents also wished they knew what questions to ask when interacting with installers.

None of these interviewees were familiar with or remembered visiting NEEA's Ductless Heating & Cooling website,¹ which could indicate that they did not visit the website or that they simply did not recall the name or resource

Recommendation:

To support consumers' online research experience and preparation for installer interactions NEEA could consider providing the following information on its Ductless Heating & Cooling website:

- Product reviews
- DHP cost savings and payback period calculator specific to different Pacific Northwest climate zones and home sizes or number of units
- List of affordable single-head equipment brands and options
- Checklist of questions for respondents to ask installers

NEEA could also consider presenting testimonials written by consumers about how well their DHP is working. These testimonials could contain details of the consumers' home characteristics (including climate condition, home size, home layout, price range) and the consumers' DHP purchase decision and experience with the DHP. These testimonials could serve as a "virtual word-of-mouth" experience, which could help consumers with no direct experience of a DHP and consumers who have questions about whether a DHP suits their needs.

To facilitate consumer access to these resources, NEEA and the region should also explore opportunities to drive customers to NEEA's Ductless Heating & Cooling website (e.g. through search engine

¹ Northwest Energy Efficiency Alliance. "Ductless Heating & Cooling Systems." Accessed July 2018: <https://goingductless.com/>

optimization to ensure that the website appears on the list of top search results for DHPs). These resources could also be made available through other channels where customers are seeking information, such as utility websites.

1.1.2. Supply-Side and Demand-Side Perspectives on Pricing

For MPER 7, Cadmus explored supply-side (installer) and demand-side (consumer) perspectives on pricing, including factors influencing DHP price and the impact of cost on purchase decisions. Interviews with installers provided information on pricing and sales strategies from their perspective. Interviews with consumers further explored customer barriers to purchase and qualitatively assessed hypotheses about installer upselling from the customer perspective.

Consumer Purchase Barriers

Conclusion: Price continues to be a major barrier to purchasing a DHP; however, consumers looking for a new HVAC system and considering DHP technology also encounter a variety of other purchase barriers.

Just as the MPER 6 survey revealed a significant negative relationship between DHP price and purchase intent (i.e., as DHP price decreased, the intent to purchase a DHP increased),² the MPER 7 survey also revealed that price was the primary reason that respondents opted not to purchase the technology. Of the 75 respondents who had previously considered purchasing a DHP, 53% said price was the reason they decided not to make the purchase.

However, of the 14 consumers Cadmus interviewed, only three said price was the primary reason they decided not to purchase a DHP; these three consumers believed DHPs would suit their needs but stated they could not afford the upfront investment. The other 11 interviewed consumers decided not to purchase for these reasons:

- A DHP did not meet aesthetic needs
- A conventional heat pump would better meet their needs for a whole-house system
- They had doubts about DHPs' heating capability
- In one case, the installer could not give a detailed explanation of the functioning of a DHP

Conclusion: Interactions with installers—such as those selling high-cost systems—have deterred some prospective customers from considering purchasing a DHP.

Consumers expected installers to be attentive and knowledgeable and to propose solutions that address their needs. Most consumers reach out to multiple installers for bids. Installers have significant influence over consumers' purchase decision: they can convince consumers to adopt one system type over the other, to replace their entire HVAC system rather than a subset of the system, or to stop the purchase consideration altogether.

² Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6*. 2018.

Several consumers – some looking for single-head systems, and others for whole-home systems – described unsatisfactory interactions with installers, which could discourage respondents from further considering DHPs. Three consumers had experiences in which they believed the installer was more focused on making a sale than on addressing their needs (e.g., pushing them to make a purchase by repeated or unsolicited calls or heavily promoting specific DHP brands instead of offering more affordable options).

Four consumers had experiences in which they did not view the installers as knowledgeable about DHPs and sufficiently capable of answering their questions about DHPs. Of these four, one decided to purchase a different technology, and one was still searching for more information or better installers.

Cadmus and NEEA did not specifically recruit for customers who were seeking single-head systems, and many interviewees indicated they were looking for whole-house solutions when considering a DHP. As a result, this study provides limited insights on whether and to what extent installers are upselling multi-head DHP systems in homes where single-head systems would have been sufficient.

Conclusion: Although installers serve a critical role in customer purchase and decision-making, price is deterring some customers before they even contact an installer.

Of the target market consumer survey respondents who identified cost as a primary reason for not purchasing a DHP (n=39), less than 40% said they had interacted with an installer over the phone or in person or had obtained a formal bid. The remaining respondents said that they had just talked to family, friends, or colleagues or had researched DHPs online. These findings suggest that cost may be coming into play far earlier in the process of considering the purchase of a DHP, prior to the bid consideration stage.

DHP Cost to the Consumer

Conclusion: Diverse factors impact DHP cost to the consumer.

Installers described several factors that could impact the price of DHP installation to the consumer—these factors were related to the location and accessibility of equipment, home characteristics (e.g., home layout, home’s building materials), equipment costs (e.g., brand, product line, system type, capacity, and number of heads), electrical work, customer location, and customer preferences for customized features or aesthetic upgrades. The interviewed installers generally agreed about the ideal scenario for a simple, cost-effective installation to minimize equipment and labor costs: a single-head system with an indoor wall-mounted unit and an outdoor unit installed on opposite sides of the same outer wall in the main living area, with an easily accessible electrical panel nearby.

Conclusion: DHP installers tailor their services to the needs, preferences, and budgets of their customers; although many installers highlight the benefits of multi-head systems in their recommendations, those who serve more cost-conscious customers attempt to be responsive to these customers’ needs.

Across interviews, installers described similar approaches to recommending DHPs and applying sales strategies, indicating that customer needs and preferences and the layout of the specific home are primary factors influencing the services and recommendations they offer to their customers.

Many installers highlight the benefits of multi-head systems in their recommendations—these benefits include bedroom cooling and the potential to individually heat and cool different zones of the home. Installers said customer preferences for equipment location, head configurations, customized features, and aesthetic upgrades could all drive up the cost of a DHP installation. However, several installers who serve more cost-conscious customers seek ways to be responsive to these customers’ needs, for example, by focusing on single-head installations or offering DHP pricing for low-income customers in line with available rebate caps, low-interest financing, and/or seasonal promotions. One installer said he also offered customers the opportunity to assist him in their DHP installation, to reduce labor hours and costs for the job.

Conclusion: Opportunities exist to engage DHP installers in cost containment strategies.

Interviews with installers suggest that DHP cost-containment strategies have been successfully implemented in the region and that some installers are eager to participate in these opportunities. Three interviewed installers indicated they had positive experiences with set-pricing or bulk-purchasing offerings for low-income customers. They were able to make these types of offerings work for their business models and were interested in engaging with these opportunities in the future.

Recommendations:

Although consumers considering DHP technology may encounter a variety of reasons not to purchase, overcoming the cost barrier is still critical for accelerating market adoption. Therefore, Cadmus recommends the following for NEEA and the region’s consideration:

- **Targeted marketing.** NEEA should continue to support targeted marketing efforts to identify and engage the homes that may be most appropriate for DHP installation, including those that meet the home size and layout criteria for a simple less-costly single-head installation.
- **DHP value proposition.** That cost is still the key barrier among potential purchasers suggests that they do not see sufficient value in DHPs to motivate the purchase. Messaging and communication (through the efforts of both NEEA and regional partners) should highlight the most motivating product attributes—DHPs reduce heating costs, provide cooling in addition to heating, and provide more even (i.e., comfortable) heating than baseboard or wall heaters—as identified in MPER 6.³ Continue to disseminate and share consumer research findings with supply chain market actors to assist them in strengthening the value proposition through their own communication and engagement with consumers.
- **Financing.** Even if customers are convinced of the DHP value proposition, research findings suggest that first cost may remain a market barrier to potential purchasers who have less expensive options available to them (e.g., room air conditioner, wall heater replacement, no replacement). To further accelerate the market, NEEA and regional partners should investigate whether there have been successful DHP financing offerings and consider efforts to increase access to convenient financing.

³ Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6*. 2018.

- **Cost containment strategies.** NEEA and the region could work with supply chain market actors and regional partners to identify and implement cost containment strategies. Interviews with installers found that there is appetite from some installers to participate in set-pricing and bulk-purchasing offerings for customers. There are probably opportunities for NEEA to share information or otherwise support these types of programs in the region.

2. Background and Methodology

2.1. Initiative Overview

In 2008, the Northwest Energy Efficiency Alliance (NEEA) launched the Northwest Ductless Heat Pump Project as a pilot to demonstrate the viability of inverter-driven ductless heat pumps (DHPs) to displace electric resistance heat in existing Northwest homes. The DHP Initiative, which NEEA launched at full scale in 2010, encompasses a range of activities to accelerate the adoption of DHP technology by working with upstream and midstream market actors, promoting and supporting effective installation of DHPs in existing homes, supporting initiatives offered by Northwest utilities, and building consumer and market awareness.

2.2. Research Objectives

NEEA has completed six previous market progress evaluation reports (MPERs) for its DHP Initiative. For this seventh MPER, NEEA prioritized four evaluation objectives to augment and expand upon prior research, which this report addresses:

- Assess progress toward initiative goals
- Assess target market consumer awareness
- Improve understanding of factors impeding consumer purchase of DHPs
- Explore both supply-side (installer) and demand-side (consumer) perspectives on pricing, including factors influencing DHP price and impact of cost on purchase

2.3. Research Activities

2.3.1. Assessment of DHP Market Progress

Cadmus used data provided by NEEA and findings from prior MPERs to assess the number of DHP installations over time in the region and the progress toward market saturation goals. In addition, NEEA's DHP initiative team conducted a qualitative review of progress against the initiative's 11 market progress indicators (MPIs).

2.3.2. Target Market Consumer Awareness Survey

Cadmus conducted an online survey of 283 homeowners in Idaho, Montana, Oregon, and Washington using customer email addresses from a consumer panel purchased through Qualtrics. Panel members interested in participating in the survey were screened to ensure they lived in one of the four target states, owned a home in the target state, had an electric heating source in their home, and did not currently own a DHP. This survey assessed consumer awareness of DHPs, awareness channels, and past DHP purchase consideration. For a more detailed description of the survey methodology, see the *Target Market Consumer Awareness Survey* section.

2.3.3. Installer Interviews

In March and April 2018, Cadmus completed 15 interviews with DHP installers. Through prior research and intelligence gathering (including for MPER 6 in 2017), NEEA has found that the cost to the consumer remains a barrier to more widespread adoption of DHPs in the Northwest.⁴ The primary goal of this research was to fill gaps in prior research on the drivers of DHP costs to gain insights that could help shape the DHP Initiative's cost-containment strategies. This research also sought to provide insights on installer sales strategies and perspectives on market trends.

To ensure geographic representation across the Northwest, Cadmus stratified the interview sample by state and locality type (urban versus rural). To understand any differences in pricing, sales strategies, and business models that might influence recommendations for head configuration, Cadmus also stratified by installer type, which was determined according to the following criteria:

- **≥ 70% single-head.** Single-head applications comprised 70% or more of DHP installations in the past year.
- **≥ 70% multi-head.** Multi-head applications comprised 70% or more of DHP installations in the past year.
- **Large/complex installers.** Installers who had installed at least five systems with four or more heads in the past two years (as identified in CLEAResult's rebate-tracking database).

2.3.4. Consumer Non-Purchaser Interviews

Cadmus completed 14 interviews with consumers who considered purchasing a DHP and received a DHP bid from at least one installer but did not purchase a DHP. The primary goals of this research were to obtain a greater understanding of consumers' decision-making process and to explore barriers to purchasing DHPs. Cadmus also used these interviews to qualitatively test hypotheses about the role of installer upselling in consumer purchasing decisions.

Cadmus contracted with a professional recruitment facility to recruit interviewees through its existing panel of consumer contacts who meet the same screening criteria as described in the *Target Market Consumer Awareness Survey* section.

⁴ Cadmus. 2017. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6*.

3. Detailed Findings

3.1. Market Update

This section provides an overview of market progress for NEEA’s DHP Initiative. The initiative aims to accelerate the adoption of DHPs in three target markets (TM):

- **TM1.** Single-family homes with zonal heating
- **TM2.** Single-family homes with electric forced air furnace
- **TM3.** Manufactured homes with electric forced air furnace

Since 2008, the initiative has tracked the market progress in target markets over time and reported the results by year in each MPER. This MPER presents the market progress up to and including 2017.

3.1.1. DHP Installations in 2017

As shown in Table 1, NEEA estimated 43,000 DHP installations in 2017, of which 15,317 (36%) were within the initiative’s three target markets. The vast majority of DHP installations that received utility incentives in 2017 were in the target markets (94% of 12,179 installations), while only 12% of non-incented 2017 DHP installations were in the initiative’s target markets.

Table 1. DHP Installations in 2017

	Incented*	Non-Incented	Total
Target Market	11,494	3,823 [†]	15,317
Outside Target Market	685	26,998 [‡]	27,683
Total	12,179	30,821	43,000[§]

Source: NEEA DHP ACE Model, July 2018.

* Incented installations came from utility-reported survey data.

† Non-incented target market installations were estimated by applying the 2016 ratio of incented to non-incented target market installations from MPER 6 to the incented target market installations.

§ Total number of installations was estimated using the year-on-year growth trend in available 2017 distributor data, incented installations, and other available market comparison data.

‡ The non-incented non-target market installations was estimated as total installations (§) minus incented installations (*) minus non-incented target market installations (†).

Table 2 shows installations in the initiative’s target markets. The 11,494 installations for which utilities provided incentives accounted for three-quarters of the installations in the initiative’s target markets. The remaining 3,823 installations did not receive utility incentives.

Of the target market installations, 81% displaced zonal heating in single-family homes (TM1). The remaining units displaced electric forced air furnaces—13% in single-family homes (TM2) and 6% in manufactured homes (TM3).

Table 2. Target Market DHP Installations in 2017

Target Market	Incented	Non-Incented	Total	Percent of Total
TM1. Single-Family Zonal	9,411	3,005	12,416	81%
TM2. Single-Family eFAF	1,400	569	1,969	13%
TM3. Manufactured Homes eFAF	683	248	931	6%
Total	11,494	3,823	15,317	100%

Source: NEEA DHP ACE Model, July 2018.

3.1.2. DHP Market Saturation

Table 3 presents the estimated DHP market saturation for each of the initiative’s target markets. An evaluation metric of market progress is to compare the current market saturation estimates with the target maximum saturation sought. As the table shows, TM1’s current market saturation (14%) is about 22% of its 2039 target maximum saturation of 65%, whereas TM3’s market saturation is about 8% of its 2039 target maximum saturation of 14%. These results indicate there is still substantial room for growth in each of the target markets.

Table 3. Target Market DHP Saturations (2008-2017)

Target Market	Market Size*	Target Maximum Saturation	Cumulative Units† (2008-2017)	Market Saturation (2008-2017)	Percent of Target Maximum Saturation
TM1. Single-Family Zonal	505,066	65%	71,970	14%	22%
TM2. Single-Family eFAF	222,981	20%	8,467	4%	19%
TM3. Manufactured Homes eFAF	280,585	14%	3,262	1%	8%
Total			83,700		

Source: NEEA DHP ACE Model, July 2018.

* NEEA estimated the market size as the existing housing stock at the end of 2008 when NEEA began the DHP Initiative, based on the Residential Building Stock Assessment (RBSA) in 2012.

† The cumulative installations include the following updates to the 2016 incented units reported in MPER 6: TM1 incented units increased from 7,613 to 7,821; TM2 incented units decreased from 1,212 to 1,124; and TM3 incented units increased from 833 to 843.

As shown in Table 4 , the market activity for TM1 and TM2 target markets increased from 2016. However, the market activity for TM3 decreased from 2016, with 1,149 installations in 2016 and 931 installations in 2017. The year-over-year unit growth for TM1 was high, at 20%, and TM2 achieved the highest year-over-year unit growth, at 25%.

Table 4. Year-Over-Year Target Market Unit Growth

Target Market	2016*	2017	Year-Over-Year-Growth
TM1. Single-Family Zonal	10,315	12,416	20%
TM2. Single-Family eFAF	1,580	1,969	25%
TM3. Manufactured Homes eFAF	1,149	931	-19%
Total	13,044	15,317	17.4%

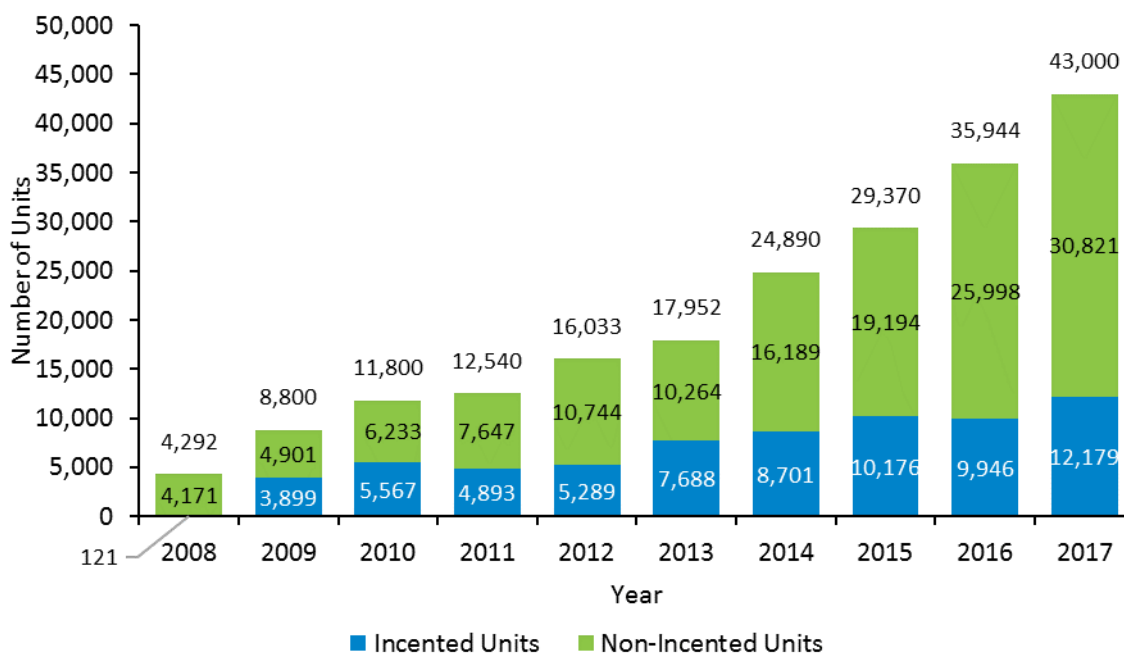
Source: NEEA DHP ACE Model, July 2018.

* The 2016 units shown here include updates to the 2016 incented units reported in MPER 6. Refer to notes in Table 3.

3.1.3. DHP Installations Over Time

NEEA has tracked regional DHP installations since 2008. Figure 1 shows the number of incented and non-incented DHP installations (without differentiating between units inside and outside the target markets) by year. As the figure shows, total DHP installations have increased each year since 2008. As the number of DHP installations increases from year to year, the proportion of incented installations decreases. The proportion of incented installations, 28%, slightly increased between 2016 and 2017.

Figure 1. Incented and Non-Incented Installations by Year



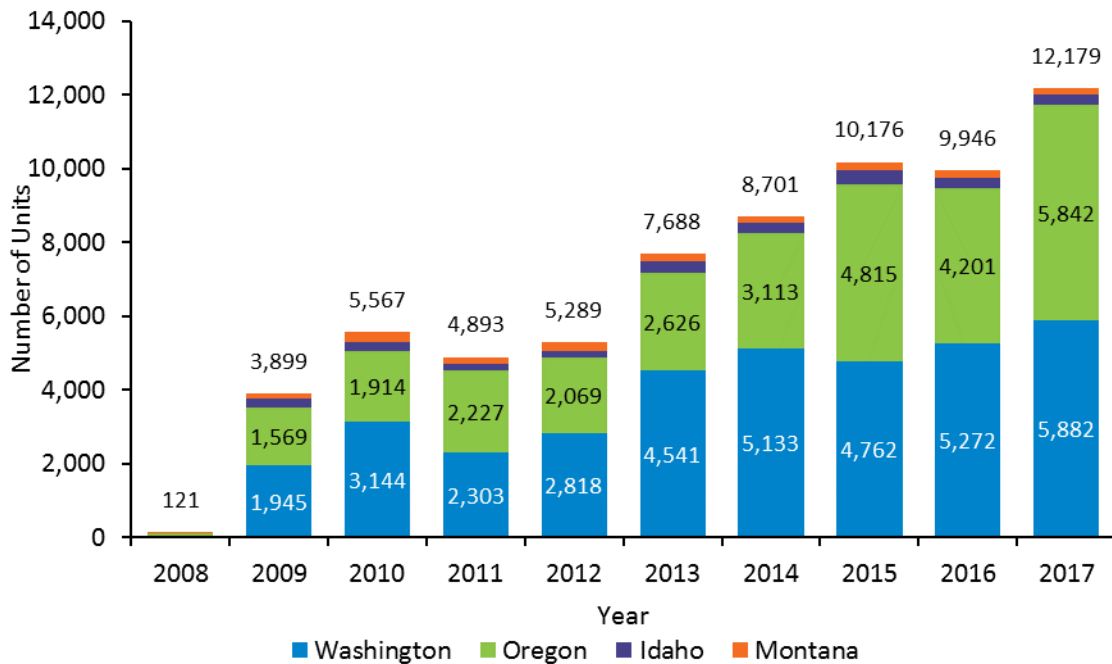
Source: NEEA DHP ACE Model, July 2018.

Note: The 2016 incented units shown here include updates to the 2016 incented units reported in MPER 6. Refer to notes in Table 3.

Figure 2 presents the incented installations by state and year and shows that total incented installations increased from 9,946 in 2016 to 12,179 in 2017. This increase was mainly attributed to increases in

installations in Oregon, followed by Washington and Idaho. Incented installations in Montana decreased slightly in 2017.

Figure 2. Incented Installations by State and by Year



Source: NEEA DHP ACE Model, July 2018.

Note: Idaho's incented installations were 266 and 276 in 2016 and 2017, respectively. Montana's incented installations were 207 and 179 in 2016 and 2017, respectively. Note that the 2016 incented units shown here include updates to the 2016 incented units reported in MPER 6.

3.1.4. DHP Installations by Efficiency Tier

For the period covered by this MPER, NEEA also tracked the distribution of DHP installations by efficiency tiers of heating seasonal performance factor (HSPF). Most recently, NEEA collected data on DHP installations from several distributors in years 2016 and 2017. Then, NEEA used these data to estimate the efficiency tier distribution for all DHP installations (including installations outside target markets and non-incented installations).

Table 5 shows the efficiency tier distribution and their corresponding number of DHP installations in 2016 and 2017. The 2017 distribution did not change significantly from the 2016 distribution, showing that DHP installations of 12.6 HSPF or above represent about 6% of all DHP installations, and the largest share of installations have HSPF between 9.1 and 11.

Table 5. DHP Installations in 2016 and 2017 by Efficiency Tier

Efficiency Tier	2016		2017	
	Distribution	Installations*	Distribution	Installations
HSPF ≥ 12.6	5%	1,890	6%	2,381
HSPF 11.1-12.5	47%	16,882	41%	17,779
HSPF 9.1-11	38%	13,800	45%	19,542
HSPF < 9	9%	3,372	8%	3,297
Total		35,944		43,000

Source: NEEA DHP ACE Model, July 2018.

Note that the 2016 units shown here include updates to the 2016 incented units reported in MPER 6. Refer to notes in Table 3.

3.1.5. DHP Installations by Head Configuration

NEEA also tracked DHP installations by head configuration (e.g., single-head or multi-head). NEEA received head configuration information from a subset of utilities whose incented installations represented about 37.5% of all incented DHP installations. These reported data showed that single-head installations represented about 67% of all single-family incented installations regardless of existing equipment type. For incented installations in manufactured homes, single-head installations represented a higher share, at 83%. Table 6 shows the distribution of head configuration by target market, using the reported data from the subset of utilities, and applies the head configuration distribution to all target market incented installations.

Table 6. Target Market Incented DHP Installations in 2017 by Head Configuration

Target Market	Single-Head		Multi-Head		Total Incented
	Distribution	Installations	Distribution	Installations	
TM1. Single-Family Zonal	67%	6,294	33%	3,117	9,411
TM2. Single-Family Electric Forced Air Furnace	65%	915	35%	485	1,400
TM3. Manufactured Homes Electric Forced Air Furnace	83%	566	17%	117	683
Total		7,774		3,720	11,494

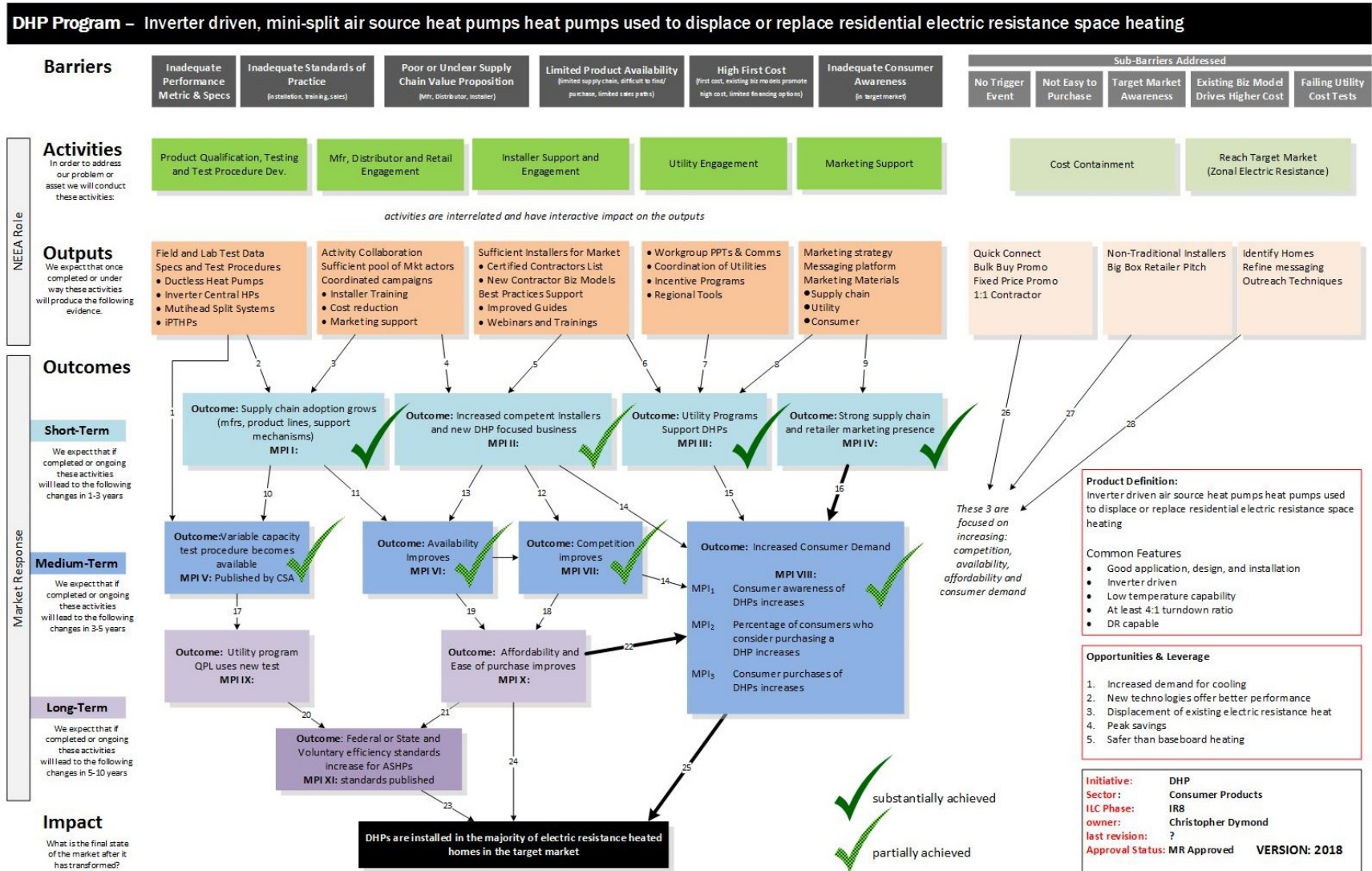
Source: NEEA DHP ACE Model, July 2018.

3.2. Progress Toward Initiative Goals

NEEA anticipates transitioning the DHP initiative from market development to long-term monitoring and tracking (LTMT) in 2020. In preparation for this event, NEEA's DHP initiative team conducted a qualitative review of progress against MPIs. Figure 3 shows the initiative logic model, which includes 11 short, medium, and long-term outcomes. The initiative's theory of market transformation posits that if

these outcomes are achieved, the market for DHPs will be transformed and will persist without NEEA's continued intervention in the market.

Figure 3. NEEA DHP Initiative 2018 Logic Model



The initiative team assessed progress towards these 11 MPIs by providing a simple ranking of one, two, or three for each indicator. A score of one indicated that “little progress has been made” toward achieving the outcome. A score of three indicated “substantial progress has been made” toward achieving the outcome, and connoted that if the initiative were to exit the market, there was sufficient momentum in the market such that the outcome would likely be achieved over time. Table 7 lists the logic model outcomes, their corresponding MPIs, and progress scores for each MPI.

Table 7. DHP Initiative MPI Assessment

Outcome		Market Progress Indicator	Progress Score
I	Strong supply chain adoption	The number of distributors that offer DHPs is increasing.	3
II	Number of competent installers increases and new DHP focused business	The number of installers that are trained to install DHPs and that are delivering quality installations is increasing.	2
III	Utility programs support DHPs	Utilities continue to promote DHPs, as appropriate.	3
IV	Strong supply chain and retailer marketing presence	DHP manufacturers sustain a robust investment of marketing dollars.	2
V	Variable capacity test procedure becomes available	The Canadian Standards Association makes progress toward publishing a test procedure, CSA-EXP-07. (The CSA evaluates the performance of variable capacity heat pumps under their own controls across a range of operating conditions).	2
VI	Availability improves	VIa. An increasing share of regional HVAC companies/installers are offering DHP VIb. An oriented installer is present within 50 miles of any point in the region VIc. More consumers (or purchase intenders) are able to approximate the installed cost of a single head DHP.	3
VII	Market competition improves	VIIa. The net number of distributors that stock/sell DHPs is increasing VIIb. An increasing share of regional HVAC companies/installers are offering DHPs VIIc. A DHP is available (either from a distributor, retailer, or installer) within 50 miles of any point in the region.	2
VIII	Increased consumer demand	VIIIa. The percent of the general population that are aware of DHPs (aided and/or unaided) is increasing. VIIIb. The number of DHPs installed in single-family homes to replace electric zonal heat or electric forced air furnaces is increasing.	2
IX	Utility program QPL uses new test procedure	Utility program QPL uses new test procedure	1
X	DHPs are affordable	Xa. The average price for a single head system remains constant or decreases as compared to multi-head systems. Xb. Consumers have more financing options.	2
XI	Federal or State and voluntary efficiency standards increase for DHPs	Progress is made toward a change to an existing federal, state, or voluntary standard occurs (or toward the development of a new standard) which drives higher average savings compared to pre-standard conditions.	1

The results of the team exercise indicate that the market has made significant progress in achieving outcomes related to the strength of the supply chain. The market for DHPs is strong, or improving, in the areas of supply chain adoption and product availability.

The team identified several outcomes where the market has shown progress, but where more work is needed to ensure that NEEA's future exit from the market will not result in backsliding on performance indicators. These include both supply and demand related outcomes. For example, more work is needed in increasing installer competence (where competence is measured by the share of installers that have received quality training and the quality of the installations installers deliver), supply chain marketing investment, and maintaining competition in the DHP market. A critical challenge and the initiative focus for the past several years is DHP affordability for target market consumers. While analysis of market pricing indicates the price of single-head DHPs is holding steady⁵, MPER 6 found that price is still a barrier to purchase for most consumers when existing heating systems are still functioning⁶. Likewise, the consumer awareness survey conducted in this MPER found that cost limits demand for DHPs.

The MPI assessment is a key input for establishing the research objectives for the next MPER (MPER 8). MPER 8 will be a "transition" MPER, meaning it will lay the groundwork for the initiative's eventual transition to LTMT. Specific objectives of MPER 8 will be to:

- Assess the DHP initiative's readiness for transition complete with respect to the initiative's progress in achieving the market progress indicators (MPIs)
- Identify diffusion indicators to be tracked in annual LTMT efforts
- Establish an LTMT evaluation plan, including the identification of data sources and data collection methods
- Summarize the history of the initiative

The team's qualitative assessment of performance suggests the next MPER should focus on data collection and primary research to assess the following:

- Number and share of competent installers and quality installations.
- DHP pricing
- Supply chain marketing investments
- HVAC supply chain location, dispersion, and DHP offerings
- DHP purchasers' price awareness, available financing options, and the share of purchasers that use financing.

A key risk to the success of the initiative is DHP cost-effectiveness. If DHP prices increase, the technology risks becoming more expensive than the value of the energy savings attributed to it. If DHPs are not cost-effective, utility program support of the technology may be threatened. NEEA's DHP initiative

⁵ Northwest Ductless Heat Pump Project. *DHP Cost Containment*. March 2017.

⁶ Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6*. 2018.

continues to search for interventions that would lower the average price of a single-head DHP. MPER 8 will also include an assessment of progress on this front.

3.3. *Installer Interviews*

Cadmus conducted 15 interviews with installers to address the following research objectives:

- Explore installer sales and marketing strategies for DHPs
- Identify DHP market trends
- Understand factors influencing DHP pricing to the consumer
- Identify potential cost containment strategies

3.3.1. *Installer Marketing and Sales Strategies*

To better understand installer marketing and sales strategies, Cadmus asked respondents how they found most of their DHP customers, what benefits they promoted regarding DHPs, and what factors they considered when recommending DHP head configurations.

Marketing Channels and Lead Generation

Two-thirds of interviewed installers identified referrals or word of mouth—from coworkers, neighbors, family, and friends—as significant sources of leads for DHP customers. Installers also frequently identified the following online sources of leads:

- Installation company’s website and/or Facebook page
- Installer partner lists and “find an installer” tools on the websites for utilities and manufacturers, as well as the NEEA’s GoingDuctless.com website
- Google reviews and review sites such as Angie’s List and Yelp

A few installers also advertised through online (Facebook ads) or traditional advertising channels (newspaper, radio). Two installers said they had done targeted mailings to specific customers. For example, one installer distributed postcard advertisements to residential customers in areas with a high penetration of baseboard or wall heaters.

DHP Benefits Highlighted

Installers identified cost savings, zonal control, and cooling as the key benefits they promoted for DHPs:

- **Cost savings.** Energy bill savings was the most commonly identified benefit that installers promoted to customers. Several installers said they highlighted the lower energy costs associated with DHPs in comparison to traditional heating equipment (e.g., electric furnaces,

baseboard heating). Two installers noted DHPs “sell themselves” because of bill savings and energy efficiency.

- **Zonal control.** The ability to control heating and cooling in specific zones of the house was another benefit promoted by installers. One installer frequently describes zonal control to customers with an analogy from the kitchen: to cook a single egg, “you don’t have to turn all four burners on.”

“AC is huge now...People used to say, ‘I can deal with [the heat] in the Northwest. It doesn’t get that hot here.’ Now [people say], ‘Oh no, I need it. I can’t live without it.’ It’s been a big paradigm shift for us.”

- **Cooling.** According to installers, cooling is increasingly a top driver for customer interest in DHPs. As a result, most installers promote the ability to add a cost-effective cooling option to customers’ homes. One installer described the increasing interest in cooling in the Northwest: *“AC is huge now. It has drastically changed in peoples’ minds. People used to say, ‘I can deal with [the heat] in the Northwest. It doesn’t get that hot here.’ Now [people say], ‘Oh no, I need it. I can’t live without it.’ It’s been a big paradigm shift for us. One thing people say to me now is, ‘I couldn’t sleep last night, and I made the decision in my bed I wasn’t gonna lose another night of sleep.’”*

Single-Head Versus Multi-Head Recommendations

The DHP Initiative focuses on 1:1 (single-head) displacements in homes heated with electric forced air furnaces and zonal heat. Adding additional indoor heads to DHPs increases installation cost and reduces the overall efficiency of the unit. NEEA believes the lack of supply chain acceptance for 1:1 displacement is a critical market barrier to increasing DHP affordability and accelerating consumer adoption of DHPs.

To understand how installers make recommendations for head configurations, Cadmus asked them how they decide whether to recommend a single-head or multi-head DHP installation to the consumer. In general, across installer types (mostly single-head, mostly multi-head, and large/complex), respondents described similar approaches to recommending single-head or multi-head installations. Installers said that the primary factors influencing such decisions were customer needs and preference and the layout of the specific home.

Customer Needs/Preferences

Installers explained that part of their sales process is to understand—and tailor their recommendations to—customers’ needs and their motivations for purchasing a new heating and cooling system. Installers said they typically recommend multi-head systems for customers who want to add cooling to bedrooms or who want to control heating and cooling (and subsequently their comfort) in different parts of the home.

Several installers said that DHP costs and the customer’s budget also factor heavily in their decision. Among the limited number of installers Cadmus interviewed, those who primarily install single-head DHPs more frequently indicated that cost is a primary concern for their customers. A few of these

installers said that low-income and cost-conscious consumers make up a sizable portion of their customer base. As a result, they focus on opportunities to save costs with these customers. Two primarily single-head installers said they often provide quotes for both single-head and multi-head systems so customers can weigh the costs and benefits based on what they are comfortable with or able to spend.

In contrast, one large/complex installer who primarily installs multi-head DHPs and serves customers in urban locations indicated that his more affluent customer base often views the incremental cost of additional indoor heads as insignificant for the added comfort and cooling benefits. Another installer who primarily installs multi-head DHPs and serves a similar market noted that many of his customers are already educated about ductless heat pumps when they contact him and know they want a multi-head system. He also said cost is less important to these more affluent customers than the quality of installation and equipment.

Home Layout/Needs

Installers noted that certain types of homes and layouts are more suited to single-head applications. For example, homes with open floor plans are typically well suited for single-head installations, while installers would be more likely to recommend a multi-head system in split-level or multi-story homes.

3.3.2. Emerging Market Trends

To understand the ever-evolving DHP market, Cadmus asked installers about trends in DHP technologies or the DHP market. The installers identified these emerging trends:

- **Wi-Fi/Bluetooth-enabled controls.** A few installers noted that manufacturers are coming out with more Wi-Fi/Bluetooth-enabled DHP controls, like the Mitsubishi Kumo Cloud controls and mobile app that allows customers to remotely control individual indoor units from their smartphone.
- **Improved indoor unit designs.** A few installers noted that manufacturers were releasing more aesthetically pleasing indoor unit designs, such as Daikin's more streamlined silver-colored indoor units.

Most installers could not speak to trends in the broader DHP market, except to note an overall increase in customer interest and demand for ductless heat pumps. Nevertheless, regarding specific market segments, a few installers said they had seen an increase in DHP installations in the new construction and multifamily markets.

3.3.3. Factors Impacting DHP Cost to the Consumer

Cadmus asked installers to describe the ideal scenario for a simple, cost-effective, single-head installation. In general, they agreed that the best scenario was an indoor wall-mounted unit and an outdoor unit installed on opposite sides of the same outer wall in the main living area, with an easily accessible electrical panel nearby. Installers explained that they could limit the length of refrigerant line by placing the indoor and outdoor units close together. Routing the line from the indoor unit directly outside (instead of through interior walls or attic spaces) also minimizes labor and eliminates the need to install a condensation pump.

Installers then described several factors that could impact the price of DHP installation to the consumer, related to the location and accessibility of equipment, home characteristics, equipment costs, electrical work, customer location, and customer preferences for customized features or aesthetic upgrades.

- **Equipment location/accessibility.** Installers explained that placement and accessibility of the indoor and outdoor DHP units (either because of customer preferences or home layout needs) were primary factors impacting the cost and complexity of a DHP installation. For indoor units, routing refrigerant lines through interior walls, attics, and/or crawl spaces is labor intensive and adds to material costs. Installers also mentioned the costs associated with the placement of the outdoor unit. For instance, mounting the outdoor unit to an exterior wall may be less costly than building a stand or pouring a concrete pad for the outdoor unit.
- **Home characteristics.** According to installers, home layout is a major factor when deciding whether a single-head DHP can adequately heat and cool a home, or whether costlier multi-head solutions are required. For example, several installers said that multistory homes, homes with less open floor plans, or homes with bonus living areas (e.g., a den or family room) might require a multi-head installation. Installers said that a home's building materials also can impact the cost of a DHP installation. For example, drilling through concrete or brick, and mounting equipment on these materials, can be more labor intensive than when working with wood.
- **Equipment costs.** Installers explained that the cost of the equipment represents a significant portion of the total cost to the consumer. DHP brand, product line, system type (e.g., wall-mounted, ceiling cassette), capacity, and number of indoor heads can all impact DHP costs.
- **Electrical Work.** Additional electrical work, such as upgrading electrical systems that are not up to code or cannot provide sufficient electricity for the unit, can also drive up the cost of a DHP installation.
- **Customer location.** Three installers said they add travel time to labor costs when having to travel longer distances (up to 100 miles) to serve a customer.
- **Customization and aesthetic upgrades.** Installers also identified several instances when customers requested customized features or aesthetic upgrades as part of the DHP installation (e.g., custom woodwork to hide line sets or custom-built stands for outdoor units). One installer said customers in higher end homes might request more costly customized features, while his more cost-constrained customers were less concerned about these additional features.

Given all of the factors that can impact DHP costs, Cadmus asked installers how they determine total installation cost to the consumer. Most said they estimate labor hours and cost of equipment needed for the job based on several of the factors described above then add a markup on the equipment costs or factor in profit margin to the total cost of the bid. Some installers acknowledged that they have a typical range for the markup (as a percentage of equipment cost) or profit margin (as a percentage of total job cost), and they might factor in a lower percentage in certain circumstances. For example, one installer with a set markup for most jobs said he occasionally reduces this by 5% to 10% to help make the sale for a customer who is wavering. Another noted that some installers will factor in a slightly lower profit margin if business is slow.

Installers varied in how they calculate costs and invoice customers. A few installers use computer programs that record the installation details and estimate labor hours to individually determine project costs. In contrast to the majority who calculate costs on an individual project basis, one installer charges a flat rate for installations based on equipment size. When providing a bid to customers, some installers said they provide itemized invoices, while others show only a flat fee.

3.3.4. Opportunities to Reduce DHP Cost

Although acknowledging that cost is important to customers who are considering purchasing a DHP and that customers frequently get multiple bids, most installers said they did not feel strong pressure to compete on price against other installers. Beyond incorporating utility rebates, a few installers said that they took steps to reduce costs to the consumer through low-interest financing, seasonal promotions, manufacturer rebates, or recommendations for less-costly options to customers who are cost-constrained. One installer said he also offered customers the opportunity to assist him in their installation, to reduce labor hours and costs for the job.

Installers also suggested a few opportunities for NEEA and the Northwest Ductless Heat Pump Project to help more customers more readily afford a DHP:

- **Set pricing.** One installer had experience with a utility-sponsored set-pricing program that prequalified low-income customers then distributed leads to installers. This installer noted that, although the DHPs installed through the program did not generate as much income per unit because of price-setting, this model worked for his business because the utility prequalified leads and installations were simple, meaning two to three could be installed in one day. Another installer participates in a program for low-income customers that sets a maximum rebate amount to cover the cost of DHP installation. To meet the needs of these customers, this installer offers set pricing for single-head installations that fall within the maximum rebate. He estimated that up to 80% of his company's business last year was tied to serving these customers. Because of the volume of business the program could deliver, he successfully negotiated lower equipment costs with his DHP distributor so these jobs could be profitable while remaining within the program's price limits.
- **Bulk purchasing.** One installer described a positive experience as a DHP installer working on behalf of a bulk-purchasing program offered by a utility outside of the Northwest. In a variation of the set-pricing program, this utility purchases the DHP equipment in bulk at a discount, then subcontracts the labor to installers. Because the program identified suitable leads in advance, he could sustain a high volume of work and quickly and efficiently install DHPs. He viewed this type of program as a highly effective way to contain costs for the consumer and recommended that utilities or other organizations in the Northwest consider offering a similar program.
- **Community action agency (CAA) competitive bidding.** Another installer had participated in a program for which low-income CAAs conducted energy audits, identified customers eligible and appropriate for a DHP, then bid out the work to a pool of installers. Slightly different than the set-pricing model, this program has a maximum DHP cost, but it encourages competitive bids to provide costs below the maximum threshold.

- **Financing.** Two installers suggested that low- or no-interest financing was a powerful incentive that should be made more widely available to customers.

3.4. Target Market Consumer Awareness Survey

Cadmus conducted an online survey of 283 homeowners in Idaho, Montana, Oregon, and Washington to address the following research objectives:

- Assess awareness of DHPs
- Examine sources of DHP awareness
- Understand barriers to DHP purchase

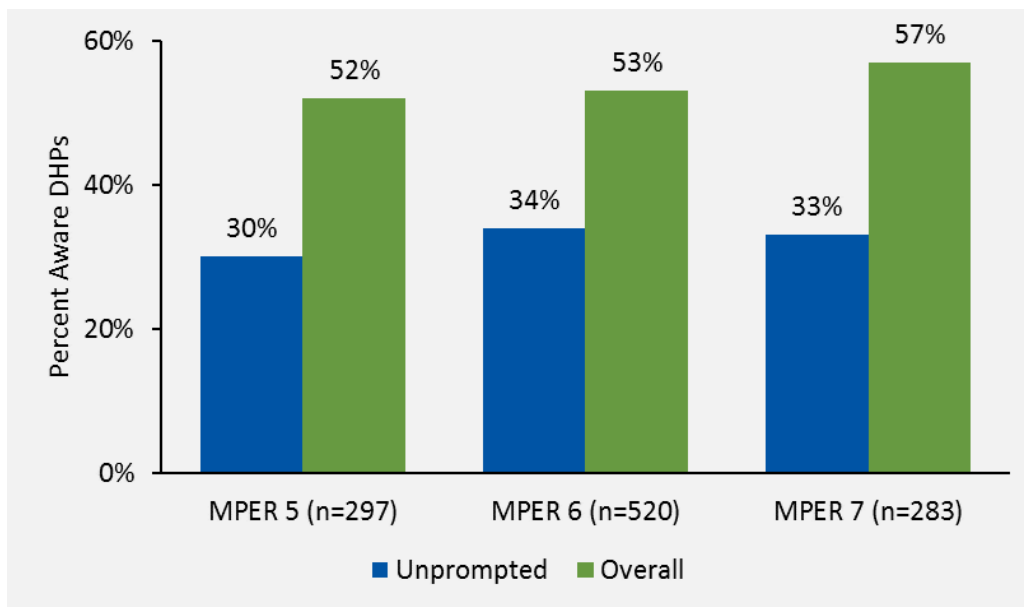
3.4.1. DHP Awareness over Time

A key objective for MPER 7 was to assess trends in DHP awareness over time. Although the MPER surveys have been ongoing since 2010, not all MPER surveys were comparable across years. After reviewing the samples, mode (online versus phone surveys) and measures of awareness in MPERs 1-6, Cadmus determined that MPER 5 and MPER 6 were most appropriate for inclusion in the longitudinal awareness analysis due to their similarity in sample frame, mode, and awareness measurement approach. Cadmus then designed the MPER 7 survey and sampling approach to offer comparison against the MPER 5 and MPER 6 surveys only. The *Target Market Consumer Awareness Survey* Section in Appendix A describes Cadmus' survey approach and analysis methodology in detail.

Cadmus tested for differences in both unprompted DHP awareness (i.e. aware of the technology by name) and overall awareness (i.e., including respondents who were prompted with an image of a DHP after they said they were unaware of the technology) over time. The analysis on unprompted and overall DHP awareness revealed no statistically significant differences between MPER 5, MPER 6, and MPER 7 (Figure 4). In MPER7, unprompted awareness of DHP technology remained similar to the prior years, with 33% of respondents (n=283) aware of the technology by name (compared to 34% in MPER 6 and 30% in MPER 5). Overall awareness in MPER 7 (57%) was also not significantly different from overall awareness in MPER 6 (53%) or MPER 5 (52%).⁷

⁷ The MPER 5 and MPER 6 results presented in the original reports were unweighted. Cadmus therefore weighted the MPER 5 and MPER 6 awareness results using the same method applied to the MPER 7 results.

Figure 4. MPERs 5-7 Unprompted and Overall DHP Awareness

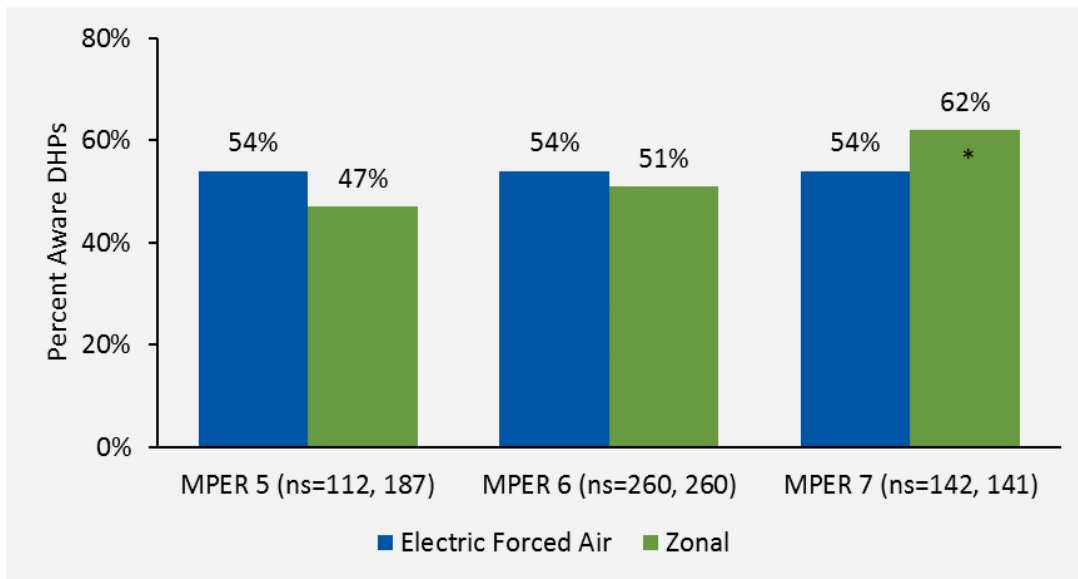


Note: Unprompted: “Prior to this survey, had you heard of a ductless heat pump or mini split?”
Prompted: “[If unaware] This is a ductless heat pump. Have you seen this equipment in person before (MPER 5)/Prior to this survey, had you seen this equipment before (MPERs 6-7)?” * $p < .05$

Cadmus also tested for longitudinal differences in awareness between heating types, states, and urban versus rural areas.⁸ Unprompted awareness did not significantly change over time within heating type, state, or rural versus urban. Overall awareness also did not change over time within rural versus urban areas but did change significantly within heating type and state. Specifically, for respondents with zonal heating, overall awareness did not change between MPER 5 and MPER 6, but it significantly increased from 51% in MPER 6 to 62% in MPER 7. On the other hand, overall awareness did not change for electric forced air respondents (Figure 5). Overall awareness significantly decreased in Washington between MPER 5 and MPER 6 (Figure 6).

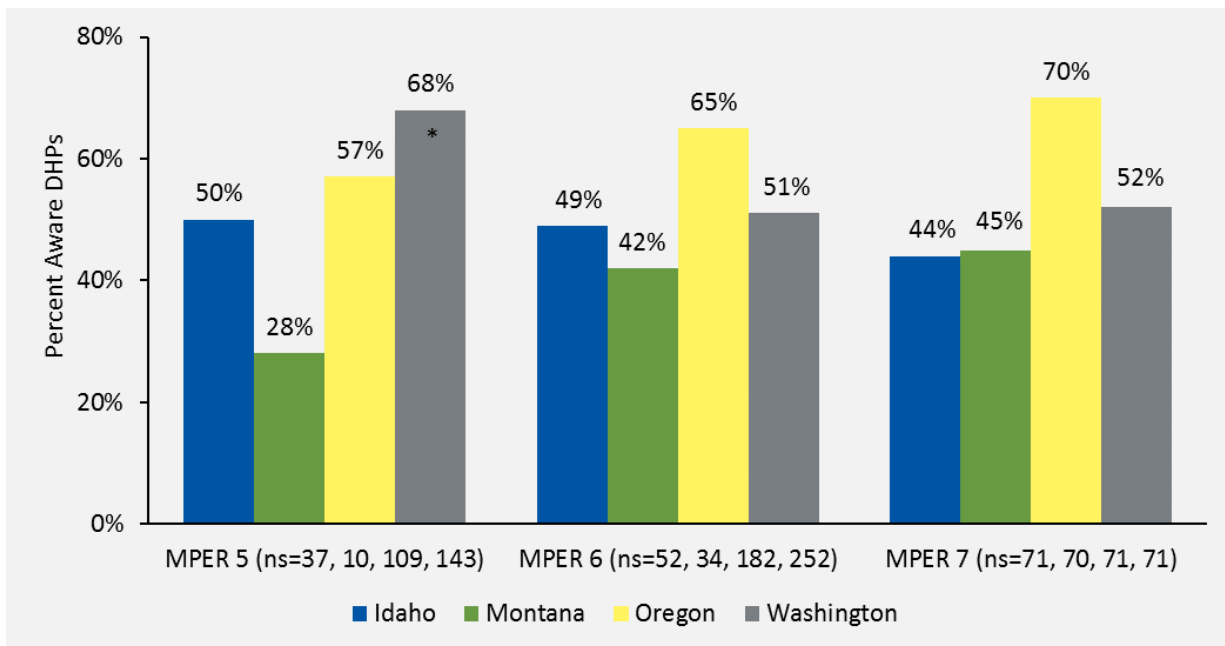
⁸ The MPER 5 sample size in Montana was small (n=10). Thus, any difference or lack thereof should be interpreted with caution.

Figure 5. MPERs 5-7 Overall DHP Awareness by Heating Type



Note: Unprompted: “Prior to this survey, had you heard of a ductless heat pump or mini split?”
 Prompted: “[If unaware] This is a ductless heat pump. Have you seen this equipment in person before (MPER 5)/Prior to this survey, had you seen this equipment before (MPERs 6-7)?” * $p \leq .05$

Figure 6. MPERs 5-7 Overall DHP Awareness by State

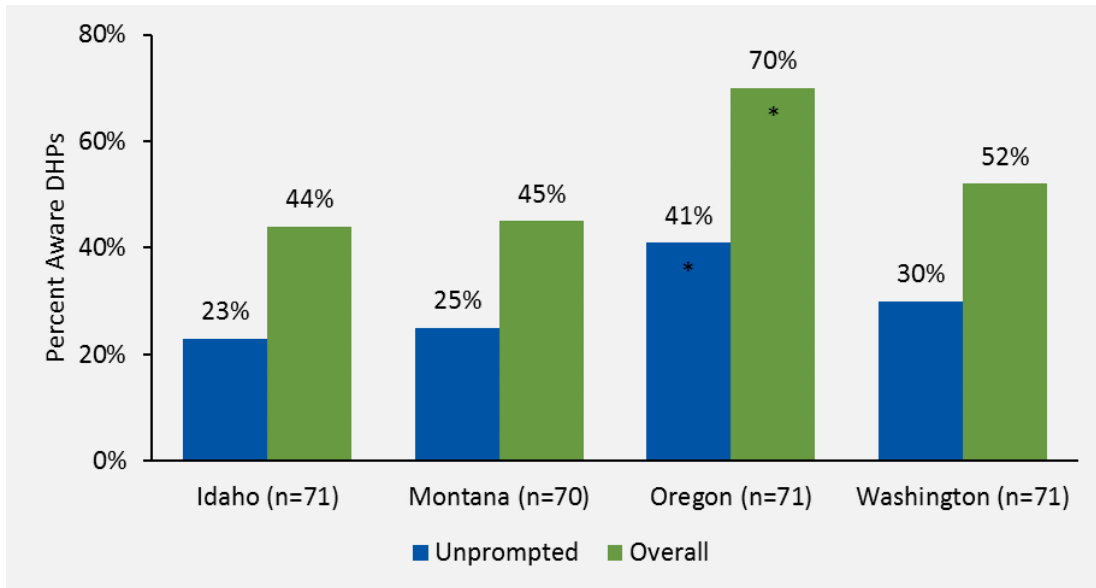


Note: Unprompted: “Prior to this survey, had you heard of a ductless heat pump or mini split?”
 Prompted: “[If unaware] This is a ductless heat pump. Have you seen this equipment in person before (MPER 5)/Prior to this survey, had you seen this equipment before (MPERs 6-7)?” * $p \leq .05$

3.4.2. MPER 7 DHP Awareness by State

In MPER 7, there were no statistically significant differences in awareness of the technology among home heating types or between rural and urban areas. However, unprompted and overall awareness of DHP technology differed among states: Oregon respondents had significantly higher awareness of DHPs compared to Idaho, Montana, and Washington respondents. Figure 7 depicts unprompted and overall DHP awareness by state.

Figure 7. MPER 7 Unprompted and Overall DHP Awareness by State



Note: General DHP Awareness Survey question B1 and B5, Unprompted: “Prior to this survey, had you heard of a ductless heat pump or mini split?” Prompted: “[If unaware] Prior to this survey, had you seen this equipment before? [DHP image presented]” * $p \leq 0.05$

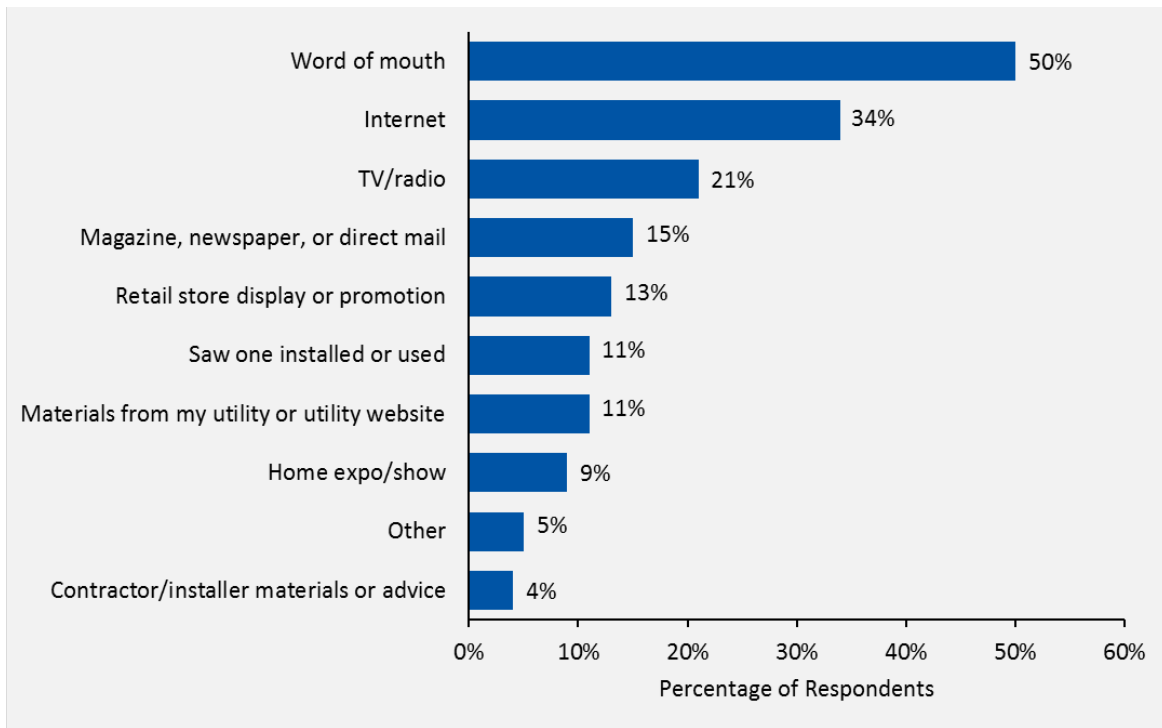
3.4.3. How Customers Learned about DHPs

Cadmus evaluated awareness channels in MPER 7.⁹ Word of mouth continues to be the most common channel through which respondents learn about DHPs, followed by internet and TV/radio (Figure 8). Among respondents who learned about DHPs via the internet in MPER 7 (n=28), they most frequently reported learning about DHPs on utility websites, retail store websites, and in a general web search

⁹ Cadmus did not compare sources of awareness between MPERs. The MPER 7 results were not weighted because of concerns about the accuracy of weighted findings, which precluded these comparisons.

(32% each).¹⁰ How respondents learned about DHPs did not differ significantly by heating type, state, or urban and rural areas.

Figure 8. Awareness Channels



Note: General DHP Awareness Survey question B2, “How did you learn about ductless heat pumps (also known as mini splits)?” Multiple responses were allowed.

3.4.4. Customer Purchase Considerations

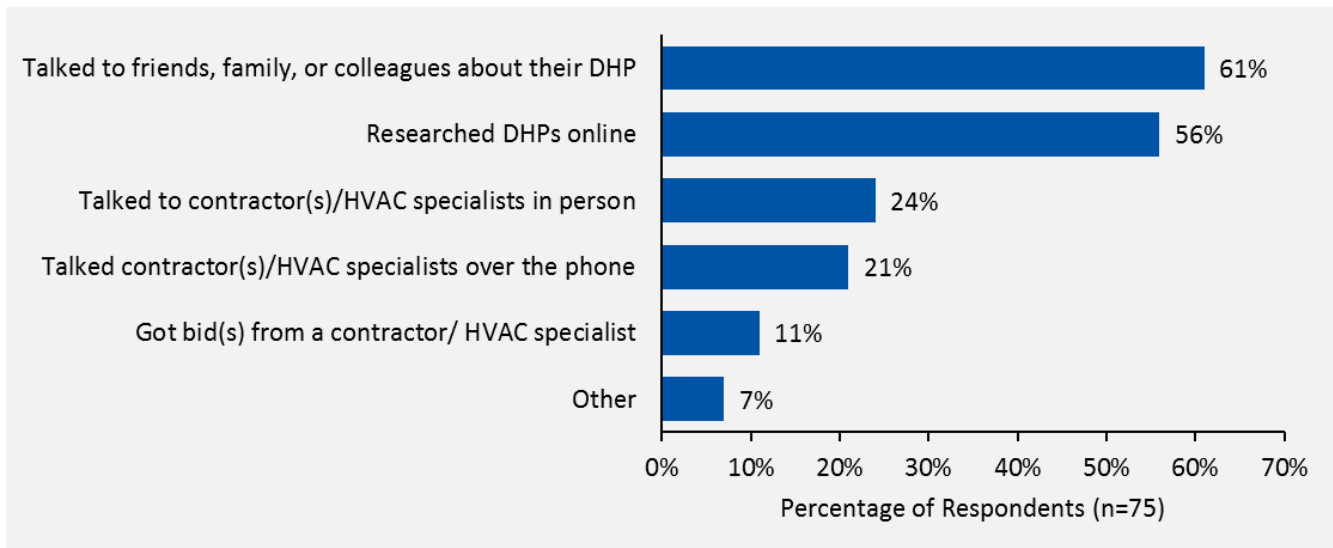
Cadmus also assessed if and how respondents may have previously considered purchasing a DHP for their current home. Of the surveyed respondents who had previously heard of the technology (n=161), 47% reported that they had considered purchasing a DHP. When these respondents (n=75) were asked what action(s) they had then taken (Figure 9), they most frequently reported talking to friends, family, or colleagues about their DHPs (61%), followed by researching DHPs online (56%).

Consideration of a DHP did not differ significantly by heating type, state, or urban versus rural. Actions taken while considering a DHP purchase generally did not differ by heating type, state, or urban versus

¹⁰ Most of the 28 respondents who reported learning about DHPs via the internet reported searching for ductless heating/cooling equipment (n=4), general heating/cooling information (n=3), air conditioning units (n=2), and money-saving heating/cooling options (n=2). Some respondents reported that they were not searching for DHPs specifically, and they learned about this technology while performing other tasks on the internet (n=3).

rural areas, although respondents with zonal heat (16%) were slightly more likely to talk with a contractor over the phone compared to electric forced air respondents (5%).

Figure 9. Actions Taken When Considering DHP Purchase



Note: General DHP Awareness Survey question C2, “In considering purchasing a ductless heat pump, which of the following actions did you take?” Multiple responses were allowed.

The respondents who reported considering purchasing a DHP were also asked why they ultimately decided not to purchase a DHP for their current home. Respondents described several reasons for not making the purchase (Table 8), and cost was the most frequently cited. For example, one respondent said, “The initial cost is more than I can afford, and I already have a heating system. However, my friend was very pleased with his, and he could control the climate in several rooms of the house to meet everyone's needs. I may choose to install one in the future, but my debt to income ratio is not conducive to installing a new system.”

Table 8. Reasons for Not Purchasing DHP

Reason	Proportion of Respondents (n=75)
Price	53%
Still deciding what to do	5%
Lack of knowledge of DHPs	4%
DHPs take up too much space	3%
Aesthetics	3%
DHPs only heat/cool one area of the home	3%
Did not feel like it was a necessary purchase	1%
Did not want to try a new type of equipment	1%
Contractor did not provide a bid	1%
Other/did not provide a response	26%

Of the survey respondents who identified cost as a primary reason for not purchasing a DHP, only about one-third said they had interacted with an installer over the phone or in person or had obtained a formal bid. The remaining two-thirds said that they had just talked to family, friends, or colleagues or had researched DHPs online.

3.5. *Consumer Non-Purchaser Interviews*

Cadmus completed 14 interviews with consumers who considered purchasing, but ultimately did not purchase, a DHP to address the following research objectives:

- Identify motivations for considering HVAC equipment purchase
- Understand sources of awareness about and perceptions of DHPs
- Explore consumer interactions with installers
- Identify consumer barriers to DHP purchase
- Assess role of installer upselling in consumer purchase decision

3.5.1. *Motivations for Considering HVAC Equipment Purchase*

To better understand consumer motivations for considering purchasing HVAC equipment, Cadmus asked respondents why they were considering a new HVAC system, what they were looking for in a new system, what types of HVAC equipment they had considered, and what type of system they ended up purchasing, if any.

Respondents reported a variety of reasons for considering a new HVAC system. A third of the respondents said they wanted to upgrade their existing HVAC system because it provided insufficient heating or was too old. Others wanted a new HVAC system because their current system did not have cooling capability, was not functional, or was inefficient.

Qualities of New HVAC System

Eight of 14 respondents said they were looking for a whole-house solution to replace their existing HVAC system. The remaining respondents said they were primarily interested in replacing or supplementing the heating unit in a subset of rooms such as their main living area, the basement, or the bedrooms. One said she wanted to replace the HVAC system in all but two rooms because the two rooms were more isolated from the rest of the house and not frequently used.

The three most frequently mentioned qualities respondents were looking for in new HVAC systems were higher efficiency (lower electricity costs), cooling capability, and ease of control or maintenance. For example, some respondents were looking for HVAC systems that required minimal control adjustments. A couple of respondents said they found it difficult to change filters for the new HVAC systems they purchased (neither of which were DHPs). Other highlighted qualities included quiet operation, easy installation, and zonal thermostat control.

Even though many respondents said price was a factor when they were considering a new HVAC system, only three said price was the primary factor in their decision not to purchase a DHP. These three respondents believed DHPs could suit their heating or cooling needs, but they could not afford the

upfront investment. Several respondents explained that price considerations came into play when choosing an installer or equipment brand after they had determined the type of system they wanted. A few respondents also said they did not focus on specific brands when considering purchasing a new HVAC system. Two of these respondents said they did not want to spend more on name brand equipment if they could find lesser-known brands that provided good quality and suited their needs.

3.5.2. Source of Awareness about and Perceptions of DHP

To better understand sources of awareness about and perceptions of DHPs among consumers who considered purchasing one, Cadmus asked respondents how they learned about DHPs and what their perceptions were of DHPs prior to interacting with installers.

Sources of Information about DHPs

Respondents most commonly identified direct personal experience or word of mouth when asked how they first learned about DHPs. Respondents who had direct personal experience with DHPs mostly encountered DHPs when staying in hotel rooms with DHPs; two saw DHPs in houses they were considering purchasing. Other respondents recalled first hearing about DHPs from neighbors, family, or friends describing their experiences with DHPs. After hearing about DHPs, respondents said additional sources of DHP knowledge were online research and salespeople at home improvement stores.

Most consumers said they conducted online research to learn more about DHPs; but none could recall the goingductless.com website. These respondents recalled using the following phrases for online searches:

- “Best heating and air for 2,000 sq. ft. house”
- “Most efficient ductless” or “most economical ductless”
- “Average cost of ductless system for 2,000 sq. ft. home”
- “Mini split AC” or “Portland AC special”
- “Tiny house heat pump”
- “Efficiency levels of DHP in cold weather”

Almost half the respondents who conducted online research said they wanted more product or installer reviews or more information about how DHPs work in their specific climate condition or home size.

“I wish I could find the annual operational cost of running a DHP in Seattle for a home of a given size.”

According to one respondent, user reviews were useful in providing her information about DHP systems that companies selling DHP systems may not provide. Another wished installers in rural or smaller towns had more online credentials. Two respondents wanted more information, such as climate conditions, home size, and pricing, specifically tailored to their specific situation. For example, one respondent wished he did

not have to search through many web pages to find a more affordable brand option.

Some respondents who conducted online searches found the experience overwhelming and preferred talking to other people about DHPs to online research.

DHP Perceptions

When asked about what they had heard about DHPs prior to reaching out to installers, respondents listed the following top benefits of DHPs:

- **Efficiency or cost savings.** A majority of respondents said they knew DHPs are efficient and could save money in electricity bills in the long run.
- **Zonal control.** Half of respondents noted the zonal feature of DHPs as an advantage. Some of them described DHPs as a “nice add-on” to an existing furnace system for added rooms or a repurposed garage. One respondent noted that DHPs provide a “personalizable heating environment” where one could turn off units in unoccupied rooms.
- **Cooling.** Several respondents highlighted that DHPs can provide cooling in addition to heating as a key benefit of DHPs.
- **No ductwork.** Several respondents said a benefit of DHPs is they do not require ductwork, which suits homes that do not have or cannot accommodate ductwork. One of them added that a family member’s DHP produced less dust in the house compared with the previous heating system, resulting in better air quality.

Respondents also mentioned a few doubts about DHPs:

- **Heating capability.** Several respondents said they were unsure about the heating capability of DHPs. Some of these said they had experienced only the cooling capability of DHPs and did not know how effective DHPs were in providing heating.
- **Aesthetics issues.** A few respondents said they had concerns about the visual impact of the equipment. One mentioned wanting a cover for the outdoor unit, another found the indoor unit too “conspicuous.” One respondent disliked the look of the indoor units as well as the conduits and pipes that would be installed on the exterior of the house.
- **Noisy operation.** A couple of respondents who had direct personal experience with DHPs found the units noisy.

“DHPs would exhale mildly warm air as opposed to a gas fireplace system that can heat up the bones of the house.”

3.5.3. Interactions with Installers

To explore consumer interactions with installers, Cadmus asked respondents who had engaged with an installer when considering a DHP purchase why they reached out to installers, how they searched for installers, and how helpful or challenging they found their interactions with installers.

Search for Installers

All but one respondent had interacted with an installer. Most said they reached out to installers to get bids for new HVAC systems to replace their existing systems. Respondents found installers mostly through referrals and online research. Several respondents also said they contacted friends or family members who were installers. When searching online, respondents said they generally used generic terms such as “heating or cooling company,” “ductless heat pump electrician,” and “heating system,” coupled with the name of the city or town in which they lived.

Impressions of Installers

Eleven respondents had interacted with an installer who left a negative impression or did not fully meet expectations. Half of these respondents said they then looked for other installers whom they could trust more. Respondents described several negative impressions of installers:

- **Installer was more focused on making a sale than addressing my needs.** A few respondents thought some installers were pushing them to make a purchase by making repeated and unsolicited calls or emphasizing the expiration date for DHP tax rebates. For two respondents, the installer heavily promoted certain DHP equipment brands instead of offering more-affordable options or options better suited to their needs.
- **Installer was not knowledgeable.** Several respondents said they spoke to installers who did not seem knowledgeable about DHPs and could not answer their questions in detail. One respondent wished his installer had provided credible sources to back up the information on DHP operating cost, and another wished the installer had provided more information on DHP brands and cost savings.
- **Installer choice or commitment was limited.** Two respondents living in rural or smaller towns said the installers they interacted with were the only ones available. Both wished their installers provided more detailed information on DHPs. One of these respondents spoke with installers who said they would set up an appointment but never called him back to schedule one. Similarly, another respondent said installers would “disappear” after they learned of his unique customization needs to minimize the visual impact of the equipment.

Two respondents also mentioned it was challenging to interact with an installer because they did not know what questions to ask. One said she did research before meeting installers to come up with questions, which was a time-consuming process. Another respondent said because he had not seen a DHP system in action, it was difficult for him to know what questions to ask installers.

3.5.4. Barriers to DHP Purchase

The consumers Cadmus interviewed were at various stages of the purchasing process: some were still exploring different types of systems, some had decided on the system type but had not chosen an installer, and some had already purchased a new (non-DHP) system. Regardless of the stage, nine out of 14 respondents had decided not to purchase a DHP. Four primary barriers emerged from these respondents’ reasons against purchasing a DHP.

Upfront investment for a DHP was too high. A respondent with a 500-square-foot condo believed the installer’s soft quote of \$5,000 was double what he considered a justifiable investment. Another respondent wanted to replace the existing system in her basement but believed she could not afford a single-head DHP that cost about \$1,500. This price barrier may also exist among consumers looking for multi-head DHPs. One respondent researched a DHP system with four indoor units; she compared her estimate of \$2,500 to \$3,500 against an installer’s soft quote of \$7,000 for equipment and installation and decided the \$3,500 to \$4,500 for installation was too high.

“The DHP was a lot more expensive than I thought for not being able to take care of all zones.”

DHPs did not meet aesthetic expectations. One

respondent who lived in a condo decided against a DHP because the homeowners’ association did not allow owners to make exterior modifications and he was not willing to ask for an exception. Aside from

“The only wall where it makes sense to put a DHP was so focal that the DHP would look too glaring and conspicuous.”

the homeowners’ association’s rules, the respondent said that a DHP would have served his heating and cooling needs. Two other respondents found DHPs aesthetically displeasing. One of these respondents described his house as an “architectural gem,” so his main concern with a DHP was the negative visual impact of indoor units and ancillary parts such as tubes and wires on the exterior. He had not met any installers who provided a customized solution that met his needs.

Conventional heat pump was better for a whole-house system. One respondent looking for a whole-house HVAC system encountered a salesperson at Home Depot who did not explain how a DHP was sufficient for a whole-house HVAC system. He then spoke with another installer who recommended a conventional heat pump to replace his existing electric forced air furnace. Another respondent looking to replace part of his existing zonal system talked with an installer who recommended replacing the entire zonal system because the rest of the system would eventually fail. The installer said that the DHP option would require more indoor units and more labor-intensive electrical work compared to a conventional heat pump.

Installer did not recommend a DHP. One respondent looking to replace part of the existing zonal system said the only available installer recommended a baseboard heater and did not describe DHPs in a way the respondent could easily understand.

3.5.5. Role of Installer Upselling in Consumer Purchase Decision

To assess the role of installer upselling in consumers’ purchase decisions, Cadmus compared respondents’ descriptions of their needs for a new HVAC system with what systems installers recommended and how installers described the systems.

Cadmus and NEEA did not specifically recruit for customers who were seeking single-head systems, and many interviewees indicated they were looking for whole-house solutions when considering a DHP. As a

result, this study provides limited insights on whether and to what extent installers are upselling multi-head DHP systems in homes where single-head systems would have been sufficient. Nevertheless, there was some evidence of possible installer upselling that then deterred some prospective customers from considering purchasing a DHP. Table 9 presents the four respondent anecdotes that may reflect installers upselling high-cost systems.

Table 9. Respondent Anecdotes of Possible Installer Upselling

Anecdote	Existing System Type	Primary Quality Sought in New System	Purchase Decision	Customer Experience/Installer Recommendation
1	Electric forced air furnace	Whole-house HVAC system	Leaning toward conventional heat pump	Respondent perceived upselling from the Home Depot salesperson who was selling “name brand” DHP equipment, which contributed to his decision to not purchase a DHP.
2	Zonal radiant panels	Replacement of single zone	Leaning toward conventional heat pump	Installer recommended replacing entire HVAC system (rather than subset), which favored conventional heat pump.
3	Electric forced air furnace	Whole-house HVAC system	Leaning toward DHP	Installer recommended a DHP system that would provide zonal controls for 11 rooms, at \$16,000, but did not explain in detail how the system would work. The respondent said she preferred the DHP over a conventional heat pump of similar price based on the installer’s recommendation, even though she did not understand how the DHP system would work in her house.
4	Zonal wall heaters	Single-head whole-house HVAC system	Decided not to purchase DHP	Installer gave a soft quote of \$5,000 for a 500 sq. ft. condo and did not respond when the respondent asked for more-affordable options. The respondent had the impression that the installer was selling “top of the line” equipment and pressuring him to schedule a visit before prices increase.

Appendix A. Detailed Methodology

Target Market Consumer Awareness Survey

Cadmus conducted an online survey of 283 homeowners in Idaho, Montana, Oregon, and Washington using customer email addresses from a consumer panel purchased through Qualtrics, a survey platform and panel provider. Panel members interested in participating in the survey were screened to ensure they met the following criteria:

- Lived in one of the four target states: Idaho, Montana, Oregon, and Washington
- Owned a home in the above state
- Had an electric heating source in their home (respondents who used a non-electric fuel source for a secondary heating system were still eligible to participate)
- Did not currently own a ductless heat pumps (DHP)

The survey contained questions about consumer awareness of DHPs, which were adapted from the sixth market progress evaluation report (MPER 6) awareness survey. Specifically, the survey assessed respondent awareness of DHPs, where respondents learned about DHPs (if applicable), and if respondents previously considered purchasing a DHP.

The NEEA DHP Initiative sets goals for market penetration in two main target markets: single-family homes with electric forced air furnaces and single-family homes with zonal heat. Therefore, Cadmus stratified the sample to obtain an equal number of the two heating system types. Cadmus also stratified the sample by state to obtain an equal number of responses from the four target states.

Table A-1 shows the number of completed surveys by heating type and location.

Table A-1. Sample Sizes by Heating System and State

Year	Sample Size	Sample Size by Primary Heating System		Sample Size by State			
		eFAF	Zonal	ID	MT	OR	WA
2018	283	142	141	71	70	71	71

Sample and Weighting

Cadmus obtained population estimates from the American Community Survey (ACS) five-year estimates for single-family (SF) and manufactured homes (MH). Based on the results in the NEEA residential building stock assessment (RBSA), Cadmus estimated the population of electrically heated (EH) SF and MH homes in the population by state then applied the proportion of observed homes with electric forced air furnace (eFAF) and zonal systems and applied these proportions to break down the population estimates by system type, reported in Table A-2.

Sample weights were used to correct for over- or under-representation of states and/or system types in our sample compared to the distributions in the population. The sample weights in Table A-2 are

calculated as the estimated population size (N_h) within state and system type divided by the sample size (n_h) for the same sub-groups (here ‘h’ identifies the unique state/system type combinations). This ratio of population size to sample size provides the user with an estimated number of homes that each sampled home represents in the population within each stratum. For example, each sampled home in Idaho with an eFAF system represents 2,583 homes in the population.

Table A-2. Sample Weights by State and System Type

State	Estimated Population* (NEEA RBSA)				Survey Respondents				Sample Weights	
	eFAF	Zonal	eFAF %	Zonal %	eFAF	Zonal	eFAF %	Zonal %	eFAF	Zonal
Idaho	93,003	38,764	13%	11%	36	35	25.4%	24.6%	2,583	1,108
Montana	18,171	19,868	3%	6%	35	36	24.6%	25.4%	519	552
Oregon	184,556	175,244	26%	49%	36	35	25.4%	24.6%	5,127	5,007
Washington	425,974	121,547	59%	34%	35	36	24.6%	25.4%	12,171	3,376

* This is the estimated population of single-family and manufactured homes that are primarily electrically heated.

The following equation uses analysis methods for stratified proportions to calculate overall results across strata including results by system type across states,¹¹ results by state across system types, or results across states and system types.

$$\hat{p}_{all}^{(w)} = \frac{\sum_{h=1}^H N_h \times \hat{p}_h}{\sum_{h=1}^H N_h}$$

Where:

- $\hat{p}_{all}^{(w)}$ = Weighted estimated population proportion across all strata.
- h = Indicator of strata, where ‘H’ is the total number of strata.
- N_h = Total number of individuals in the population in stratum ‘h’
- \hat{p}_h = Estimated population proportion in stratum ‘h’

\hat{p}_h is the proportion of individuals within a stratum with a certain characteristic, and is calculated as $\frac{n_h^*}{n_h}$ where n_h^* is the number of homes with said characteristic in stratum ‘h’ and n_h is the total number of homes in stratum ‘h’.

Testing Differences in Awareness over Time

In addition to assessing consumer awareness of DHPs in 2018, Cadmus tested for differences in DHP unprompted and overall awareness over time. Although the MPER surveys have been ongoing since 2010, not all MPER surveys were comparable to MPER 7. For an awareness measure to be included in the analysis testing for differences over time, Cadmus determined that the following criteria should be met:

¹¹ Khawaja, M. Sami, Josh Rushton, and Josh Keeling. “Section 8.3 Stratified Proportions” In *The Uniform Methods Project (UMP): Methods for Determining Energy Efficiency Savings for Specific Measures*.

- Populations of interest should be similar
- Sample size (number of respondents who completed the question) should be greater than 30
- Screening criteria should be similar
- Methods used to assess awareness should be similar

After reviewing the samples and measures of awareness in MPERs 1-7, Cadmus determined that MPER 5, MPER 6, and MPER 7 were most appropriate for inclusion in the longitudinal awareness analysis. These surveys were deemed comparable due to their similarity in sample frame and awareness measurement approach. In addition to comparing overall DHP awareness, MPERs 5-7 provided the opportunity to segment the sample by heating type and state. Table A-3 summarizes prior MPER approaches for evaluating DHP awareness and provides an assessment of comparability.

Table A-3. Summary of MPER Research

Study	Year(s)	Method	Sample Size	Sample Frame	Awareness Question	Risk to Results**
MPER 1	2010	N/A*	N/A	N/A	Not assessed*	N/A
MPER 2	2012	Telephone*	199	<ul style="list-style-type: none"> • Single-family homeowners • Homes heated by electricity, wood, kerosene, or oil* • Stratified by cooling zones and urban/rural locations 	Before this call, had you ever seen or heard about ductless heat pumps? (description of DHP provided if response = “not sure”)	High
MPER 3	2014	Telephone*	203	<ul style="list-style-type: none"> • Single-family homeowners • Homes heated by electricity, wood, kerosene, or oil* • Resident ≥ two months per year • Stratified by cooling zones and urban/rural locations 	Before this call, had you ever seen or heard about ductless heat pumps? (description of DHP provided if response = “not sure”)	High
Consumer Messaging Study for DHPs and HPWHs	2015	Online	282	<ul style="list-style-type: none"> • Single-family homeowners • Electric heating* • Heating system ≥ 10 years old* • Lived in home ≥ two years 	Have you heard of a ductless heat pump or mini split?	Moderate

Study	Year(s)	Method	Sample Size	Sample Frame	Awareness Question	Risk to Results**
MPER 5	2016	Online	297	<ul style="list-style-type: none"> • Single-family homeowners in Idaho, Montana, Oregon, and Washington • Electric heating only (primary heat source) • Includes zonal and forced-air furnace households • Lived in home ≥ one year 	Have you heard of a ductless heat pump or mini split?	Low
MPER 6	2017	Online	520	<ul style="list-style-type: none"> • Single-family homeowners in 	Prior to this survey, had	Low

				Idaho, Montana, Oregon, and Washington <ul style="list-style-type: none"> • Electric heating only (primary heat source) • Stratified to include equal number of zonal and forced-air furnace homes 	you heard of a ductless heat pump or mini split?	
MPER 7	2018	Online	283	<ul style="list-style-type: none"> • Single-family homeowners in Idaho, Montana, Oregon, and Washington • Electric heating only (primary heat source) • Stratified to include equal number of zonal and forced-air furnace homes 	Prior to this survey, had you heard of a ductless heat pump or mini split?	Low

*Indicates that the feature(s) precludes the survey from being included in the awareness analysis.

** Denotes the impact that that the survey would have on the accuracy of the awareness analysis. High risk means including the survey would likely produce inaccurate and misleading insights

Demographics

Cadmus stratified the sample by heating type, with respondents equally divided between homes with electric forced air furnaces (n=142) and zonal heating (n=141) as their primary heating equipment. For zonal heating equipment, electric radiant heaters were the most common type (31%), followed by wall (Cadet) heaters (30%), baseboard heaters (23%), and space heaters (16%). Table A-4 summarizes respondent demographics by home heating type.

Table A-4. MPER 7 Demographics

Heating Type	Percent with Homes Built in Year 2000 or later	Percent in Single-Family Detached Homes	Average Square Footage	Percent of ≥ 45 years old	Percent with ≥ \$100,000 Household Income	Percent with Bachelors Degree of Higher
Electric Forced Air (n=142)	24%	70%	1,587	65%	15%	36%
Zonal Heating (n=141)	19%	80%	1,553	55%	18%	43%

Installer Interviews

Sampling Methodology

Cadmus compiled a list of installers from two NEEA-provided data sources:

- An existing list of 1,081 installer companies that have completed the Northwest Ductless Heat Pump Project’s installer orientation.
- CLEAResult’s rebate-tracking database for DHP installations rebated through a subset of NEEA’s regional partner utilities.¹²

To ensure geographic representation across the Northwest, Cadmus stratified the interview sample by state and locality type (urban versus rural). To understand any differences in pricing, sales strategies, and business models that might influence head configuration recommendations, Cadmus also stratified by installer type, which was determined according to the following criteria:

- **≥ 70% single-head.** Single-head applications comprised 70% or more of DHP installations in the past year
- **≥ 70% multi-head.** Multi-head applications comprised 70% or more of DHP installations in the past year
- **Large/complex installers.** Installed at least five systems with four or more heads in the past two years (as identified in CLEAResult’s rebate-tracking database)

Table A-5 shows completed interviews by state, locality, and installer type.

Table A-5. Completed Installer Interviews

State	Installer Type			Total
	≥ 70% Single-Head	≥ 70% Multi-Head	Large/Complex	
WA/OR	5	2	3*	10
Urban	3	2	3	8
Rural	2	-	-	2
ID/MT	3	2	-	5
Urban	2	-	-	2
Rural	1	2	-	3
Total	8	4	3	15

* Multi-head applications also comprised 70% or more of DHP installations for one large/complex installer, however this installer is recorded only once in the table as a large/complex installer.

¹² CLEAResult’s DHP Initiative tracking database captures detailed rebate processing data for the units that got incentives from utilities for which CLEAResult is the program implementer. NEEA uses these data to determine characteristics of such DHP units, including displaced heating equipment, head configurations, heating seasonal performance factor (HSPF) levels, and capacity levels.

Consumer Non-Purchaser Interviews

Cadmus conducted 14 phone interviews with consumers who considered purchasing but did not purchase a DHP. Cadmus contracted with a professional recruitment facility to recruit interviewees through its existing panel of consumer contacts. Recruiters screened for consumers according to the criteria in Table A-6.

Table A-6. Consumer Non-Purchaser Screening Criteria

Criteria	Attribute
Homeownership Status	Homeowners
State of Residence	Primary residence in OR, WA, ID, or MT
Primary Heating Fuel Type	Electric
Primary Heating Equipment Type	Electric forced air furnace or zonal heating such as baseboard heaters or wall heaters (e.g., Cadet heaters)
DHP Purchase Consideration	Considered purchasing, but ultimately did not purchase, a DHP in the past year
DHP Bid	Received a DHP bid from at least one installer*

* Because of the scarcity of consumers who fit all screening criteria, NEEA qualified five consumers for interviews who did not receive a DHP bid from an installer but had talked to friends, conducted online research, and—except for one—had spoken to an installer about DHPs.

To ensure geographic representation across the Northwest, Cadmus attempted to stratify the interview sample by state. However, we were unable to recruit consumers in Montana and Idaho even after making accommodations such as removing the DHP bid criterion. The 14 consumers who completed an interview did, however, represent a mix of existing heating equipment types. Table A-7. shows completed interviews by state and existing heating equipment type.

Table A-7. Completed Consumer Non-Purchaser Interviews

State	Existing Heating Equipment Type		Total Number of Interviews
	Zonal	eFAF	
WA	3	2	5
OR	6	3	9
Total	9	5	14

Appendix B. Interview Guides and Survey Instruments

Target Market Consumer Awareness Survey Instrument

Welcome. Thank you for participating in this study about home heating in the Northwest. This survey should take you approximately 5 to 7 minutes. If you'd like to pause your survey and come back to it at any time, please simply close out of the survey, re-click on the link in your email, and pick up where you left off.

A. Screeners

A1. What best describes your living situation?

1. Homeowner
2. Renter **[THANK AND TERMINATE]**
3. Other **[THANK AND TERMINATE]**

A2. In what state do you currently reside? **[Show dropdown list of states]**

1. If response=OR, WA, MT, ID **[CONTINUE]**
2. If response ≠OR, WA, MT, ID **[THANK AND TERMINATE]**

A3. What type of heating fuel does your home use?

1. Electric only
2. Gas only **[THANK AND TERMINATE]**
3. Oil only **[THANK AND TERMINATE]**
4. Wood heat only **[THANK AND TERMINATE]**
5. A combination of electric heat and something else
6. A combination of non-electric heating sources **[THANK AND TERMINATE]**

A4. How many years have you lived in your current home?

1. Less than 1 year
2. 1 year to less than 5 years
3. 5 years to less than 10 years
4. 10 years or more

A5. What type of equipment do you currently use for your home's primary heating system? **[SINGLE RESPONSE]**

1. Electric forced air furnace
2. Baseboards
3. Wall heaters (sometimes called Cadet heaters)
4. Electric radiant heat (radiant heat can be floor heat, or panels on the wall or ceiling)
5. Space heaters
6. None **[THANK AND TERMINATE]**
7. Other (heat pump, wood stove, fireplace, or something else) **[THANK AND TERMINATE]**

For Quota Tracking:

Equipment Bin	Response Options
Electric Forced Air Furnace (n=120)	1
Zonal heat (n=120)	2, 3, 4, 5

A6. How old is your primary heating equipment?

1. Less than 10 years old
2. At least ten years old
3. I don't know

Terminate Script: Based on your response we do not need you to complete this survey at this time. Thank you for your time and consideration.

B. General Awareness & Perceptions of DHP Technology

B1. Prior to this survey, had you heard of a ductless heat pump or mini split?

1. Yes
2. No **[SKIP TO B5]**

B2. How did you learn about ductless heat pumps (also known as mini splits)? (Please check all that apply)

1. From a friend, family member or colleague
2. Internet
3. TV/Radio
4. Retail Store display or promotion (for example Home Depot or the Heat Pump Store)
5. Saw one installed or used in another home or business
6. Home Expo/Show
7. Contractor/Installer materials or advice
8. Materials from my utility or utility website
9. Advertisement in magazine, newspaper, or direct mail
10. There is one in my home **[THANK AND TERMINATE]**
11. Other (Please specify: _____)
12. Don't know

[ASK IF B2=2]

B3. You indicated that you learned about ductless heat pumps on the internet. Where on the internet did you learn about ductless heat pumps? (Please check all that apply)

1. Contractor/installer/HVAC specialist website
2. Utility website
3. Goingductless.com
4. Retail store website (e.g. The Home Depot, Appliance Store, Sears)
5. Web search (e.g. via google or Bing)
6. Other (Please Specify: _____)

[ASK IF B2=2]

B4. What information were you searching online for when you learned about ductless heat pumps?

1. **[RECORD]**

[ASK B5 IF B1=2]

B5. This is a ductless heat pump. Prior to this survey, had you seen this equipment before?

1. Yes
2. No **[SKIP TO D1]**

GO HERE FOR JPEG (SURVEY LINK FOR CADMUS):

[HTTPS://PROJECTS.CADMUSGROUP.COM/SITES/6663-P01/SHARED%20DOCUMENTS/MPER%206/TASK%205%20CUSTOMER%20SURVEY/PHOTOS/GOINGDUCTLESS.COM-DUCTLESS%20HEATING%20AND%20COOLING%20SYSTEM%20SIDE%20VIEW%20-%20HORIZONTAL_1488238723.ZIP](https://projects.cadmusgroup.com/sites/6663-P01/SHARED%20DOCUMENTS/MPER%206/TASK%205%20CUSTOMER%20SURVEY/PHOTOS/GOINGDUCTLESS.COM-DUCTLESS%20HEATING%20AND%20COOLING%20SYSTEM%20SIDE%20VIEW%20-%20HORIZONTAL_1488238723.ZIP)



C. Customer Purchase Considerations

C1. Have you ever considered having a ductless heat pump installed in your current home?

1. Yes
2. No **[SKIP TO D1]**

C2. In considering purchasing a ductless heat pump, which of the following actions did you take?

(Please check all that apply)

1. Talked to friends, family, or colleagues about their ductless heat pump system
2. Researched ductless heat pumps online
3. Talked to one or more contractors or HVAC specialists **over the phone** about ductless heat pumps
4. Talked to one or more contractors or HVAC specialists **in person** about ductless heat pumps
5. Got one or more bids from a contractor or HVAC specialist for ductless heat pump installation
6. Something else (Please specify: _____)

C3. **[ASK C3 IF C2.2 IS SELECTED]** You indicated that you researched ductless heat pumps online. What search terms did you use when researching ductless heat pumps online?

1. **[RECORD]**

C4. What were the reasons you chose not to install a ductless heat pump?

1. **[RECORD]**

D. Demographics

D1. Please enter your zip code.

1. **[RECORD ZIP CODE]**

D2. What year was your home built?

1. 2010 or later
2. 2000 - 2009
3. 1990 - 1999
4. 1980 - 1989
5. 1970 – 1979
6. 1960 – 1969
7. 1950 - 1959
8. 1940 - 1949
9. Earlier than 1939
10. Don't know

D3. Which of the following best describes your home?

1. Single-family detached home
2. Manufactured home
3. Townhome
4. Apartment or condominium
5. Other (Specify: _____)

D4. What is the approximate square footage of your home? Include the basement, attic or garage only if they are regularly heated or cooled.

1. **[RECORD NUMBER]**

D5. Which of the following best describes your age range?

1. Under 18
2. 18 to 24
3. 25 to 44
4. 45 to 64
5. 65 and over
6. Prefer not to answer

D6. Which of the following categories best represents your approximate annual household income from all sources in 2017, before taxes?

1. < \$40,000
2. Between \$40,000 and \$49,999
3. Between \$50,000 and \$59,999
4. Between \$60,000 and \$79,999
5. Between \$80,000 and \$99,999
6. Between \$100,000 and \$119,999
7. \$120,000 or more
8. Don't know
9. Prefer not to say

D7. What is the highest level of education you've completed so far?

1. Some high school, no diploma
2. High school diploma or GED
3. Associates degree
4. Bachelors degree
5. Graduate or professional degree
6. Prefer not to say

This survey is now complete. Thank you for your time.

Installer Interview Guide

Key Research Objectives	Question
Explore installer sales and marketing strategies for DHPs	B2-B3; C1-C3
Identify DHP market trends	C5
Understand factors influencing DHP pricing to the consumer	C3; D1-D6

Cadmus will conduct fifteen half-hour interviews with DHP installers. Cadmus developed the sample from a NEEA provided list of installers, and worked with NEEA to develop the appropriate strata for installer interviewees. This in-depth interview guide is designed to achieve the research objectives and address the topics outlined above. Installers who complete interviews will receive a \$100 VISA gift card.

A. Screener

Hello, I'm **[NAME]** from Cadmus calling on behalf of the NW Ductless Heat Pump Project. May I please speak to **[NAME]**?

Cadmus is conducting the annual evaluation of the NW Ductless Heat Pump Project for NEEA. As part of this project, we are inviting qualifying DHP installers to participate in a 30-minute interview to discuss trends in the DHP market and explore factors influencing the costs associated with DHPs. To thank those who participate in an interview with us for their time, we are offering a \$100 VISA gift card. Your responses will be kept confidential and used for research purposes only. Would you be interested in participating if you qualify?

[IF RESPONDENT AGREES TO PARTICIPATE] Thank you! First, I need to ask you a few questions to ensure you qualify for the study.

A1. Do you install ductless heat pumps, also known as DHPs or mini-splits?

1. Yes, I install DHPs
2. No, I do not install DHPs **[THANK AND TERMINATE]**
3. Don't know **[THANK AND TERMINATE]**

A2. In what types of buildings do you install DHPs? (Select all that apply)

1. Manufactured homes
2. Single-family homes (site built)
3. Multifamily buildings such as apartment buildings or condos, or senior or assisted living
4. Commercial facilities
5. Other

[THANK AND TERMINATE IF A2≠ 1, 2, OR 3]

A3. Of the residential DHP installations you performed in the past year, approximately what proportion **were one-to-one or "single zone" systems** (i.e. a unit with one outdoor compressor and one indoor unit) versus multi-head or "multi-zone" systems?

1. **[RECORD PERCENTAGE]**
 - a. **If ≥ 75% single-zone, PLACE IN SINGLE-ZONE QUOTA**
 - b. **If ≥ 75% multi-zone, PLACE IN MULTI-ZONE QUOTA**

- c. If neither a nor b (and not identified as a large/complex installer in AAID),
THANK AND TERMINATE

B. Introduction/Background

Thank you so much for agreeing to talk with me today.

Is now still a good time to talk?

Your answers will be kept confidential and will be grouped with other respondents for reporting in aggregate form only. Neither your name nor your company will be mentioned in any reports or documents.

- B1. What services or equipment does your company primarily specialize in?
 - 1. What are the main types of residential HVAC equipment you sell?
 - 2. From a revenue standpoint, about what proportion of your sales do DHPs represent?

- B2. What DHP brands do you sell?
 - 1. Do you present customers with different brand options, or are you primarily recommending one brand?

- B3. Who are your typical DHP customers? *[Probe for housing type (single family, multifamily, manufactured homes, commercial, new construction); retrofits vs additions; existing heating equipment type]*

C. DHP Sales and Marketing Strategy

- C1. How do you find most of your residential DHP customers? *[Probe for advertising, lead generation, utility program participation, etc.]*

- C2. How do you typically promote and sell DHPs? *[Probe: any other ways/activities?]*
 - 7. Under what circumstances do you recommend a DHP to the customer instead of other HVAC technologies? What are the primary benefits you sell on the DHP system?
 - 8. How often are customers coming to you specifically requesting a DHP?

- C3. Earlier you said that approximately **[INSERT PERCENTAGE FROM A3]** of your residential DHP sales were one-to-one or “single-zone” systems (i.e. a unit with one outdoor compressor and one indoor unit) versus multi-head or multi-zone systems. What factors influence your decision about whether or not to recommend installation of multi-head DHP systems (versus single-zone systems)?
 - 1. Under what circumstances do you typically recommend a single zone system?
 - 2. Under what circumstances do you typically recommend a multi-zone system?

- a. What do you look for to consider recommending that a customer purchase a multi-head system?
 - b. What are some common reasons homeowners want a multi-head systems? (e.g. bedroom cooling, other reasons?)
 3. What influences your recommendation for size and configuration (i.e. number of heads)? *[Probe for tools/methods used to size the system]*
- C4. How many DHP installations do you typically do in a day? How often do you do two single head systems in a day?
9. Under what circumstances do you install multiple systems in a day?
 10. What challenges, if any, do you experience in installing multiple systems in a day?
- C5. What emerging trends in DHP technologies or in the DHP market are you seeing/do you anticipate? *[Probe for trends in specific market segments (e.g. new construction)]*
1. How, if at all, have market changes (e.g., customer demand/values, emerging technologies) influenced how you promote DHPs to customers?

D. DHP Pricing to the Consumer

Next I have some questions for you about the factors that impact DHP cost to the consumer. We understand that every installation is unique, and are hoping to get a better understanding from your perspective as an installer about how these factors impact the cost of a DHP.

- D1. To provide some context for our discussion, could you give me an estimate of the price range to install a **one-to-one or “single zone”** DHP system for your residential customers, including all equipment and labor costs, before any rebates or tax credits are applied? *[IF NEEDED: Your best estimate is fine; Let me assure you that we will not publish anything in our report that reports on these costs individually. We’re just looking for a price range estimate to give us some context for our discussion today].*
11. What is the price range to install a **multi-head system** for your residential customers, including all equipment and labor costs?

As we understand it, the price of DHP installation includes equipment (box and unit) costs, and labor hours for installation, permitting/paperwork, inspection, staffing and overhead. What other costs are associated with a DHP installation?

We know that there are significant differences in the complexity and cost of an installation based on whether it’s a single-zone or multi-zone system. My next few questions are specifically about single-zone systems, and then I’ll ask you a few questions about multi-zone systems.

D2. Thinking about your **single-zone** systems, under what circumstances is the cost of an installation on the lower end? *[Probe: when is an installation the least expensive?]*

12. Could you walk me through a typical single-zone system installation?
13. What types of factors can drive up the cost of a single-zone system? *[Probe for specific details, including: Home characteristics, equipment type/costs, sizing/capacity, placement of the outdoor unit]*
 - a. How many hours are spent on a typical installation like this (sales, HVAC work, electrical work)?
 - b. How many visits are done to the jobsite per project?
 - c. What impact do those factors have on cost? *[Probe for impact of each factor on cost to the consumer and/or labor hours]*
14. Under what circumstances is the cost of a single-zone DHP installation on the higher end? *[Probe: when is an installation the most expensive?]*
 - a. Could you walk me through a more costly single-head system you've installed? What made this installation so complex? *[Probe for number of hours spent, visits to the jobsite required]*

D3. Thinking about your **multi-zone** systems, under what circumstances is the cost of an installation on the lower end? *[Probe: when is an installation the least expensive?]*

15. Could you walk me through a typical multi-head system installation?
16. What types of factors can drive up the cost of a multi-zone system installation? *[Probe for specific details, including: Home characteristics, equipment type/costs, number of heads, sizing/capacity, placement of the outdoor unit]*
 - a. How many hours are spent on a typical installation like this (sales, HVAC work, electrical work)?
 - b. How many visits are done to the jobsite per project?
 - c. What impact do those factors have on cost? *[Probe for impact of each factor on cost to the consumer and/or labor hours]*
 - d. Do you expect to get more call backs on a multi-head install? If so, do you factor that into your project costs? *How?*
17. Under what circumstances is the cost of a multi-zone DHP installation on the higher end? *[Probe: when is an installation the most expensive?]*
 - a. Could you walk me through a more costly multi-head system you've installed? What made this installation so complex? *[Probe for number of hours spent, visits to the jobsite required]*

D4. Thank you so much for sharing your insights on the factors that impact DHP cost. I'm wondering, given all of these different factors that impact costs, how do you determine/calculate total cost to the customer?

D5. In your experience, how important is cost to customers that are considering purchasing a DHP?

18. How often is cost a primary factor in a customer's decision to not purchase a DHP?
19. To what extent do you find you need to compete on the price of DHP systems?
20. What change, if any, do you anticipate in future costs of DHP systems (probe for single vs. multi-head) [*Probe: what makes you anticipate that change?*]

D6. What steps, if any, does your company take to lower the price for the consumer?

21. What % of your installs receive a utility rebate. If they do, do you add price.
22. Beyond rebates, is there anything NEEA could do to help more consumers afford a DHP?

E. Closing

Thank you for sharing your perspective and taking the time to participate. Your input is greatly appreciated.

E1. Is there anything else you'd like to share before we go?

E2. Can you provide me with the name and address that you would like the \$100 VISA gift card sent to?

23. **Name:** _____
24. **Address:** _____

Consumer Non-Purchaser Interview Guide

Key Research Objectives	Question
Identify motivations for considering HVAC equipment purchase	B1-B4
Understand sources of awareness and perceptions of DHP technology	C1-C2
Explore consumer interactions with installers	D1-D7
Identify consumer barriers to DHP purchase	E1-E4
Assess role of installer upselling in customer purchase decision	D5; E2-E3

Cadmus will conduct 15 half-hour interviews with non-purchasers. Cadmus will work with a professional recruitment facility to recruit interviewees through their existing consumer contacts.

This in-depth interview guide is designed to achieve the research objectives and address the topics outlined above. Respondents who complete interviews will receive a \$50 VISA gift card.

A. Introduction

Thank you so much for agreeing to talk with me today.

As you might remember from the invitation call, I have some questions for you about your recent experience with considering purchasing a new heating or cooling system. We'll talk mostly about the ductless heat pump (or mini-split) system you considered purchasing, but ultimately chose not to, and your experiences talking to contractors or HVAC specialists about heating or cooling equipment options.

Your answers will be kept confidential and will be grouped with other respondents for reporting in aggregate form only.

Is now still a good time to talk?

B. Motivations for Equipment Purchase Consideration

- B1. To start, can you tell me about the reasons you were considering a new heating or cooling system?
25. Were you seeking to replace or to supplement your existing heating or cooling system?
 26. Were you exploring options for heating and cooling your whole house or just a single or set of rooms?
- B2. What were the key attributes or characteristics you were looking for in a heating or cooling system for your home?
- B3. What types of heating or cooling systems did you consider? *[Probe for equipment in addition to ductless heat pumps]*
- B4. What type of heating or cooling system did you end up purchasing, if any? *Why?*

C. Awareness & Perceptions of DHP Technology

C1. How did you first learn about ductless heat pumps?

1. Where else have you heard about ductless heat pumps?
2. Did you visit the website goingductless.com for any information?
 - a. If yes, how useful was the information on that website?

C2. Prior to reaching out to an installer or HVAC specialist, what, if anything had you heard about ductless heat pumps?

D. Installer Interactions

During the invitation survey, you mentioned that you had consulted with a contractor or HVAC specialist when considering the new heating or cooling equipment.

D1. Why did you initially reach out to the contractor(s) or HVAC specialist(s)? *[Probe for: general consultation to address heating and cooling needs, tune-up for existing equipment, looking for bids on specific equipment types (ask to specify equipment types), something else]*

D2. How many contractors or HVAC specialists did you reach out to for consultations/bids on heating and cooling equipment?

1. Where did you find these contractors or HVAC specialists? *[Probe for marketing channel: e.g. referral/WOM, online search, utility website, goingductless.com, radio, tv, mailing]*

D3. What types of equipment did the contractor(s) or HVAC specialist(s) recommend?

1. What type of ductless heat pump system did the contractor(s) recommend? *[Probe for head configuration]*

D4. How many bids did you receive for ductless heat pumps? For other HVAC equipment?

D5. What did this/these contractor(s) or HVAC specialist(s) tell you about ductless heat pumps?

1. What benefits did they highlight about ductless heat pumps? What drawbacks, if any, did they highlight?
2. How did the contractor(s) talk to you about your existing heating system?

D6. How helpful did you find this professional guidance? *Why?*

D7. What challenges, if any, did you face in working with contractors to get heating and cooling consultations and bids?

3. What was the most difficult element about this process?

E. Barriers to DHP Purchase

E1. To what extent did you feel that a ductless heat pump would be able to meet your system needs? *[Probe for strengths and weaknesses/shortcomings]*

E2. Ultimately, what were the reasons you chose not to purchase a ductless heat pump for your home?

E3. Do you recall how much the contractor(s) quoted you for the ductless heat pump systems?

4. How, if at all, did price factor into your decision not to purchase a ductless heat pump for your home?

E4. **[If respondent purchased an alternative system]** You mentioned that you ended up purchasing **[equipment type]**. How did this equipment compare to a DHP?

1. Why did you choose to purchase **[equipment type]** over a DHP?

F. Closing

Thank you for sharing your perspective and taking the time to participate. Your input is greatly appreciated.

F1. Is there anything else you'd like to share before we go?