CADMUS

Memorandum

To: Amy Webb, NEEA

From: Hanna Lee, Trent Hardman, and Karen Horkitz; Cadmus

Subject: Summary of NEEA's DHP Initiative History

Date: May 6, 2019

Introduction

NEEA has completed seven market progress evaluation reports (MPERs) for its ductless heat pump (DHP) initiative. The 2018 MPER (MPER 8) evaluates DHP initiative readiness to exit the market and transition to long-term monitoring and tracking (LTMT).

To assess market readiness for this transition, NEEA contracts a third party to complete a comprehensive retrospective narrative that summarizes the program theory, market interventions, and evaluations of market progress to date. This memo presents the preliminary story of the DHP initiative, including NEEA's role in transforming the market for DHPs and the potential risks of a transition to LTMT, which will serve as a foundation for the MPER 8 to be published during the fall of 2019.

In preparing this preliminary retrospective narrative of the DHP initiative, Cadmus conducted three main research activities:

- **Literature review** of prior NEEA DHP research, including prior MPERs and annual reports of the DHP initiative
- **Logic model review** of current and prior DHP initiative logic models to understand how the initiative and market transformation theory have evolved over time
- **Stakeholder interviews** with 26 individual and group interviews with a total of 38 DHP initiative stakeholders:
  - ***Current and former NEEA staff*** with members of the DHP initiative team (such as the program manager and product manager) and current and former NEEA staff who were influential in developing and deploying the DHP initiative
  - ***Regional utility staff*** with DHP work group members who have served an important role in the initiative
  - ***Supply chain partners*** with manufacturers and distributors with whom NEEA has established strategic partnerships

  Table 1 lists interview sample sizes.

Table 1. Stakeholder and Supply Chain Partner Interview Sample Sizes

Stakeholder Group	Completed Interviews	Total Number of Interviewees*
Current and Former NEEA Staff	7	15
Regional Utility Partners	9	13
Manufacturers	5	5
Distributors	5	5
Total	**26**	**38**

* Completed interview column does not match total number of interviewees due to group interviews.

Through these research activities, Cadmus sought to address several key topics and areas of investigation:

- **History of initiative activities,** including timeline of key milestones and events and intervention strategies
- **Drivers of DHP adoption,** including interventions that were and were not successful and activities and conditions that have had the greatest impact on initiative results
- **Market progress,** including status of MPIs, market progress over time, and remaining barriers
- **Risk assessment,** including the potential risks and impacts to market diffusion and the region resulting from a NEEA transition out of DHP market development

Summary of Findings

Overview of Initiative History and Evolution

This section is an overview of the history and evolution of the DHP initiative.

Pre-Launch

In 2006, several Asian manufacturers began offering "a new generation of inverter-driven mini-split heat pumps into the North American market."[1] NEEA recognized that unique product features of the DHP technology, which promised "high levels of energy efficiency" as well as "increased comfort, low-noise,

[1] Ecotope Inc. *Final Summary Report for the Ductless Heat Pump Impact and Process Evaluation.* Prepared for NEEA. February 19, 2014. https://neea.org/img/uploads/e14-274-dhp-final-summary-report-final.pdf

and ease of installation,"[2] could transform the previously underserved market of approximately one million detached, owner-occupied single-family electrically heated homes in the Northwest.[3] [4]

To test technical viability for DHPs in the Northwest, NEEA spearheaded two demonstration projects consisting of just under 20 homes in the fall of 2006 and summer of 2007. The demonstration project sample size was too small to extrapolate the findings. Consequently, in fall of 2007, the Regional Technical Forum established a provisional deemed savings estimate so that large utility programs could participate in a pilot generating a large enough population to support statistical analysis of savings.

In October 2008, NEEA, Bonneville Power Administration (BPA), and regional utilities launched a large-scale pilot project intended to validate the provisional savings estimate and simultaneously demonstrate market acceptance and delivery of DHPs in residential homes that already used electric resistance zonal heating systems. A total of 3,899 DHPs were installed in 59 utility territories across the Northwest.[5] The pilot sought to remedy residential consumers' unfamiliarity with DHP technology and weak distribution networks of DHPs (at this time, few manufacturers were producing and distributing DHP products for the U.S. market). An assessment of the pilot found that "DHPs have a strong consumer acceptance, a workable integration with existing market actors and supply chains, a reasonable level of agreement between manufacturers' claims and actual performance and, finally, a performance that integrates well with the space conditioning needs of the utility customer."[6]

Early Initiative (2010 – 2013)

Based on pilot results—especially strong customer acceptance and technological performance integrating well with space conditioning needs of Northwest customers—NEEA moved forward with funding and launching a full DHP initiative in 2010. The initiative was publicly promoted as the Northwest Ductless Heat Pump Project.

Product availability was one of the first and most critical market barriers NEEA sought to address. Historically, DHP manufacturers had thought the U.S. was a limited market for residential DHP sales.

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[2] Ibid.

[3] Evergreen Economics. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #3.* Prepared for NEEA. April 24, 2014. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-3.pdf

[4] The initiative first targeted single-family homes that used electric resistance zonal heating systems as the primary home heating source. In MPER 5, this was expanded to three target markets—single-family homes with zonal heating, single-family homes with electric forced air furnaces, and manufactured homes with electric forced air furnaces. NEEA added manufactured homes because DHPs were thought to be particularly suitable for replacing noisy and obtrusive furnaces in primary living areas.

[5] Ecotope Inc. *Final Summary Report for the Ductless Heat Pump Impact and Process Evaluation.* Prepared for NEEA. February 19, 2014. https://neea.org/img/uploads/e14-274-dhp-final-summary-report-final.pdf

[6] Ibid

When NEEA's initiative began, these manufacturers perceived DHPs as a solution only for problem zones, bonus rooms, or add-ons rather than for whole-house heating and cooling systems. In addition, the previous generation of DHPs did not provide heating below 40° F. Therefore, manufacturers did not promote DHPs as an energy efficiency measure or as an alternative to zonal electric heat.[7] At the beginning of the initiative, one particular barrier to DHP adoption, especially in Idaho, Montana, and Eastern Washington, was that there was a question as to whether DHP technology available at the time could provide adequate heat in colder temperatures.[8]

Prior to the pilot, DHPs were "virtually unknown" to the Northwest market,[9] so lack of customer awareness was the second barrier the project sought to address. As of 2008, public awareness of DHPs was only 5% nationwide, and DHPs represented only 1% of the commercial and residential market for HVAC equipment.[10] In addition, NEEA's initiative sought to convince installers, that had been successfully delivering ducted systems to customers, to make a change and adopt ductless technology.

To increase product availability as well as consumer awareness, to help encourage DHP adoption, the initiative focused on these market interventions:

- Form relationships with supply chain market actors and encourage them to incorporate DHPs into their product offerings by explaining the market growth opportunity in the Northwest
- Establish channels of communication among utilities and between supply chain market actors and utilities
- Train and provide resources to installers, manufacturers, and distributors to help them sell and install DHPs in homes using electric resistance heating
- Perform quality assurance inspections in the field and share findings with installers, distributors, manufacturers and utilities in order to continuously improve quality of installations and build and strengthen knowledge of best practices throughout the region
- Market DHPs through direct consumer marketing (e.g., creation of the website goingductless.com, television and radio public service announcements [PSAs], online marketing) and create marketing tools and sell sheets for market actors and utilities to use when communicating with their customers

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7 Research Into Action. *Northwest Ductless Heat Pump Pilot Project MPER #2*. Prepared for NEEA. March 28, 2010. https://neea.org/img/uploads/northwest-ductless-heat-pump-pilot-project-market-progress-evaluation-report-2.pdf

8 Ibid

9 Ecotope Inc. *Final Summary Report for the Ductless Heat Pump Impact and Process Evaluation.* Prepared for NEEA. February 19, 2014. Page 5. https://neea.org/img/uploads/e14-274-dhp-final-summary-report-final.pdf

10 National Association of Home Builders Research Center. *Ductless Heat Pump Market Research and Analysis*. June 2008.

As a result of NEEA's activities, manufacturers viewed the "Northwest as an important market for DHPs" and reported that availability of DHPs increased in the Northwest (including the most up-to-date cold-temperature products, which manufacturers had previously offered almost exclusively in Scandinavia).[11] The number of contractors installing DHPs in the region also increased. Some utilities began training contractors and developing their own approved installer lists. Furthermore, high consumer satisfaction led to substantial word of mouth promotion for DHPs. According to several utilities, despite a slight reduction in marketing efforts in 2010, consumer demand continued to grow.[12]

Mid-Initiative (2014 – 2016)

The initiative continued influencing DHP installations and by 2014, a total of 36,158 utility incented units had been installed and another 48,152 heating and cooling DHP units were installed without incentives in Northwest homes.[13] By 2014, NEEA had developed strategic relationships with five manufacturers and five distributors. More than 300 installers, participated in the initiative in 2014.[14] Additionally, the initiative had created an infrastructure of supply chain actors supporting participation of over 100 Northwest utilities that implemented local DHP programs and offered incentives to their customers encouraging DHP adoption.[15]

However, despite progress, some barriers to adoption of ductless technology remained, including high installed cost, low installer and consumer awareness, and limited product availability. NEEA aimed to address all three barriers by conducting the following activities:

- Collaborating with utility partners, supply chain actors, and suppliers on lead-generating promotions. NEEA partnered with utilities directly marketing to customers and negotiated temporarily reduced costs from distributors and installers in exchange for greater sales volumes
- Continued to focus on expanding manufacturer and distributor sales by delivering training and sales tools
- Sought to raise the number of engaged installers by rewarding trained installers that completed the Master Installer Program with priority listings on goingductless.com
- Continued to inspect installer installations to ensure quality and homeowner satisfaction,

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[11] Research Into Action. *Northwest Ductless Heat Pump Pilot Project MPER #2.* Prepared for NEEA. March 28, 2010. https://neea.org/img/uploads/northwest-ductless-heat-pump-pilot-project-market-progress-evaluation-report-2.pdf

[12] Ibid.

[13] ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4.* Prepared for NEEA. July 23, 2015. https://neea.org/img/uploads/ductless-heat-pump-market-continues-to-increase-dhp-mper-4.pdf

[14] Ibid.

[15] Ibid

- Continued its support of utility programs by creating new marketing resources and continuing to facilitate strategic partnerships between utilities and supply chain actors

Later Initiative (2017 – Today)

By 2017, an estimated 83,700 DHPs had been installed in NEEA's target markets,[16] and further signs of market transformation were evident. As early as 2012 the market was showing significant changes. Manufacturers were designing new products to the initiative's expectations and adopting NEEA's messaging in their marketing, and market share had increased "in areas where [manufacturers] have worked with NEEA and utilities on coordinated marketing and rebate campaigns."[17] As the initiative continued its support of supply chain actors, they began to exhibit self-sustaining capabilities, and in 2017, reported significant sales growth while the utilities reported flat or declining rebate redemptions. In addition, most promotions took place without the initiative's support—another sign the market was "growing under its own power."[18]

By 2017, several market barriers had been addressed. MPER 7 found that, "the market for DHPs is strong, or improving, in the areas of supply chain adoption and product availability."[19] However, barriers related to cost remained. NEEA has explored and implemented a variety of strategies aimed at cost containment, including exploring opportunities for lower-cost installation pathways and retail sales channel development, working with manufactures to introduce lower-cost products, exploration of unique partnerships supporting and promoting lower cost and single head installations, and a variety of consumer targeting and customer purchase decision support tools. Nevertheless, DHP cost has not decreased in recent years and continues to be a barrier to both consumer uptake and utility cost-effectiveness.

The remainder of this memo provides a detailed accounting of Initiative activities and interventions, drivers of DHP adoption, progress towards initiative MPIs, and potential risks and impacts of LTMT transition.

Initiative Activities and Interventions

Over the past decade, the initiative has fostered demand and created a market for DHPs in the Northwest by encouraging and providing resources to utilities to create DHP programs, influencing manufacturers and distributors to expand distribution to the Northwest, educating and training

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16 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7*. Prepared for NEEA. September 20, 2018. https://neea.org/img/documents/DHP_MPER_7_Report_FINAL_CC.pdf

17 Evergreen Economics. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #3.* Prepared for NEEA. April 24, 2014. Page i. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-3.pdf

18 CLEAResult. 2017 Annual Report. Prepared for NEEA. March 2018.

19 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7.* Prepared for NEEA. September 20, 2018. https://neea.org/img/documents/DHP_MPER_7_Report_FINAL_CC.pdf

installers on how and why to sell DHPs and installation best practices, and supporting supply chain actors with consumer-focused marketing.

Utility Engagement and Support

Northwest Utility Engagement and Support

Utility buy-in was critical to success of the DHP initiative. NEEA supported utility participation in the initiative through the following activities:

- **Encourage utilities to offer DHP incentives and confirm utility buy-in.** NEEA focused on engaging utilities in the region to actively participate by sharing information, offering DHP incentives, and encouraging their installer network to attend training. Early in the initiative, NEEA also processed DHP rebates on behalf of utilities.
- **Establish communication channels with utilities (utility outreach and workgroup).** NEEA convened a utility workgroup and produced utility bulletins, newsletters, and webinars. Through the workgroup, utilities have continued to share their program activities, strategies and lessons learned, information on their installer networks, and any key market developments.
- **Facilitate strategic utility and supply chain actor partnerships.** The initiative facilitated opportunities for utilities to engage with supply chain actors through webinars in which manufacturers and distributors told utilities about their products and facilitated discussion.
- **Provide utility marketing support.** NEEA provides a wide array of marketing materials and research to utilities and in turn utilities can pick and choose what is most useful to them and their customers. The following are examples of marketing support NEEA has provided:
  - **Customizable marketing materials and templates.** The initiative produces a variety of marketing materials aimed at consumers that utilities can easily co-brand or adapt with their own branding and distribute.
  - **Goingductless.com website**. Utilities can point consumers to a website hosted by NEEA explaining DHPs, offers technical resources, and lists trained installers. On the websites partner resource section, utilities can download marketing templates and images for use in their own marketing.
  - **Target audience segmentation.** The initiative provided utilities with support for identifying the characteristics of potential DHP customers (including messaging and value propositions).

Marketing Support beyond the Northwest

Utilities outside of NEEA's territory also leveraged the initiative's marketing resources to increase customer awareness and contractor knowledge. For example, in 2011, NEEA provided Connecticut Light & Power, BC Hydro and LiveSmartBC, an efficiency initiative of Bristish Columbia's government, with resources to bolster DHP programs including content for contractors (e.g. Contractor Orientiation

Webinar and Installation Best Practices Webinar and Guides) and content for homeowners (e.g. "Frequently Asked Questions" and "Homeowner Guide").[20]

Supply Chain Engagement and Support

Supply Chain Marketing and Promotional Support

Early in the initiative, NEEA focused on building relationships with supply chain actors and persuading them to engage with ductless technology. NEEA has engaged in marketing and promotional support of supply chain actors through the following activities:

- **Drive investment in promotions.** Early on, NEEA used lead-development campaigns to build awareness of DHPs in the Northwest. These campaigns brought together manufacturers, distributors, contractors and utilities to co-promote a DHP sale. After the success of small-scale DHP promotions, NEEA began coordinating regional market-driven promotions with manufacturers and distributors. The initiative provided both labor support and direct funding to market the promotions. Recently, NEEA found that installers and distributors are busy selling ductless systems and no longer need the same level of interaction.[21]
- **Marketing support, trade pitches, and media outreach.** NEEA has provided copywriting, design, coordination, and distribution of supply chain marketing materials as well as trade pitches and media outreach to trade publications. Some manufacturers and distributors have worked closely with NEEA to develop marketing resources while others have just used imagery or information produced by NEEA.[22] Over the course of the initiative, NEEA was able to influence supply chain marketing activities; for example, manufacturers began emphasizing heating capabilities of DHPs to appeal to northern climates. [23,24]
- **Attendance at live events and presentations**. To foster regional support for ductless systems, the initiative provided marketing support for distributors that involved coordinating display units for internal training and home shows. NEEA has also encouraged contractor participation in the initiative at distributor-hosted contractor trainings and events.

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[20] Northwest Energy Efficiency Alliance. *2011 Annual Report NW Ductless Heat Pump Project.*

[21] Northwest Energy Efficiency Alliance. *2017 Annual Report.* March 2018. Prepared by CleaResult.

[22] ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #5.* Prepared for NEEA. July 28, 2016. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-5.pdf

[23] Evergreen Economics*. Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #3.* Prepared for NEEA. April 24, 2014. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-3.pdf

[24] Research Into Action. Northwest Ductless Heat Pump Pilot Project MPER #2. Prepared for NEEA. March 28, 2010. https://neea.org/img/uploads/northwest-ductless-heat-pump-pilot-project-market-progress-evaluation-report-2.pdf

Strengthen Supply Chain

NEEA has sought to increase Northwest availability of DHPs by strengthening the supply chain through identifying and building upon strategic market partnerships with manufacturers and distributors through numerous activities including these:

- **Facilitate market collaboration.** Early in the initiative, NEEA hosted two workshops to increase market collaboration of manufacturers, distributors, contractors, and energy efficiency organizations, and utilities. More than 236 people attended the first workshop in 2008.[25] These partnerships endure today as NEEA continues identifying market barriers to growth in the Northwest and working with supply chain actors to mitigate these barriers.
- **Training to distributors.** The initiative has engaged new distributors by conducting training on opportunities for DHP sales and how to work with utility programs.
- **Collaboration with distributors and manufacturers to train regional installers.** NEEA increased awareness of displacement theory (that is, displacing heating load rather than replacing a customer's entire heating system) by lending information and materials to distributor and manufacturer training.

Develop Regional Installer Network

Over the past decade, initiative activities first focused on convincing installers of the market opportunity presented by DHPs then on installer training ensuring that homeowners in all locations have access to qualified installers. NEEA sought to develop and strengthen a regional installer network through the following activities:

- **Gain installer buy-in.** NEEA's early installer outreach focused on presenting the market opportunity of DHPs because an initial barrier was that HVAC installers lacked motivation to install something less expensive and profitable than a ducted system.
- **Installer pitch and messaging support.** Installers were taught how to sell DHPs and how to identify appropriate target homes. In addition, the initiative produced consumer-facing marketing materials for installers to use when introducing DHP technology to their customers. In 2010, NEEA delivered 104,000 sales sheets to installers designed to assist sales efforts.[26]
- **Ensure regional coverage of trained installers.** To jumpstart markets, NEEA identified areas such as the Tri-Cities, Spokane, and Idaho that had less DHP activity than the rest of the region and offered training that installers in these areas could easily access.
- **Displacement theory education, best practices training, and contractor sales training.** NEEA designed the Master Installer Program to increase installers' knowledge and promotion of DHPs to displace zonal electric heat equipment.
- **Promote high-quality installers to consumers.** NEEA showcased and rewarded installers who completed training and employed best practices in many installations through "installer of the

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[25] Northwest Energy Efficiency Alliance. *Final Implementation Report Ductless Heat Pump Project 2008-2009*.

[26] Northwest Energy Efficiency Alliance. *Annual Report Northwest Ductless Heat Pump Project.* 2010.

year" awards and by giving these installers priority listings on goingductless.com as well as access to marketing collateral and an image library. NEEA maintains this certified installer list to ensure promoted installers continue to be actively engaged with the initiative.

Retail Channel Development

Through retail channel development activities, NEEA worked to increase awareness of DHPs, generate demand, and provide additional purchase options for customers, with the goal of reducing costs and increasing access to equipment:

- **Retail partnership.** The initiative was instrumental in creating a Northwest retail channel for customers. NEEA partnered with a major manufacturer to display DHPs in The Home Depot retail stores in the Northwest so potential customers could learn about the technology. The initiative assisted with the development and deployment of in-store signage to alert customers of utility rebate information. NEEA collaborated with the manufacturer and the retailer to prepare a new television advertising campaign, improve customer in-store education, and train staff on sales closing.
- **DHP marketing material provided to manufactured home retailers.** NEEA provided manufactured home retailers with consumer-facing DHP advertising materials that retailers said were essential to getting information about DHPs to the public.
- **Do-it-yourself (DIY) channel and contractor-assisted installations.** Throughout the initiative, NEEA has explored the pathways through which customers can acquire and install a DHP, including the possibility for customers to purchase a DHP and then either install it themselves (DIY channel) or partially install it themselves (contractor-assisted installations). To support development of these channels, NEEA has conducted market research with utilities and the supply chain, tested off-the-shelf DHPs, tested and documented the DIY installation process, and have offered utility support and quality control for contractor assisted- rebated installations.

Downstream Marketing and Consumer Resources

Early in the initiative, NEEA dedicated substantial resources toward direct-to-consumer marketing, with the goal of increasing consumer awareness and demand. At pilot launch, 5% of consumers were aware of DHP technology.[27] As the initiative has matured, NEEA has shifted its marketing activities to supporting utilities and the supply chain (as described in the Supply Chain Marketing and Promotional Support section above).

NEEA's downstream marketing efforts and consumer-facing resource and tool development has focused on the following:

- **Customer awareness campaigns and marketing.** Early in the initiative, NEEA deployed a number of marketing campaigns and activities including television and radio PSAs and advertisements (some co-funded by manufacturers) in markets with low DHP uptake, online marketing that

[27] National Association of Home Builders Research Center. *Ductless Heat Pump Market Research and Analysis*. June 2008.

included online banner ads (for example, on weather websites on particularly hot or cold days) to attract a younger market, and social media campaigns.

- **Develop, host, and maintain the goingductless.com website.** NEEA launched the website with the goal of fostering a better understanding of DHPs and their benefits and ultimately greater sales. The website presents a wide variety of resources for both consumers (e.g., information on DHPs, why to install them, and a list of qualified installers), utilities (e.g., market data, customer segmentation data, image library, marketing templates), and supply chain actors (e.g., marketing resources, utility rebate forms, installation best practices).
- **Consumer confidence and purchase decision support tools.** In 2019, NEEA launched its "Buyer's Guide" on the goingductless.com website. To support price transparency, consumer confidence in DHP technology, and purchasing decisions, the guide offers several tools such as pricing factor checklist, questions to ask an installer, and a bid and analysis guide.
- **Operational resources for consumers to maximize energy savings.** NEEA has also developed resources to educate homeowners and help them optimize DHP efficiency, including NEEA's homeowner's guide, which provides heating and cooling operation and maintenance recommendations.

DHP Market and Technical Research

NEEA generates, commissions and disseminates DHP market and technical research to track market progress, promote best practices, and answer questions unique to the Northwest through the following types of market and technical research:

- **Sales data tracking, analysis and trends.** NEEA produces Northwest market data for use by utilities and supply chain actors. The initiative acts as a conduit of information and data from utilities and installers to manufacturers and distributors and vice versa.
- **DHP technology recommended practices and use cases**. NEEA develops guides for recommended practices such as for cold climate DHPs, use cases for specific technology such as variable speed heat pumps, and guidance on how to select the correct DHP technology for various applications such as ducted mini-split selection.[28]
- **Technical resource development and research**. NEEA commissions a number of technical reports to better understand the context of the Northwest market and answer questions unique to the Northwest:
  - **Lab and field-testing of DHPs to improve the technology for Northwest.** Examples are field-testing energy savings generated by DHPs across a range of temperature conditions and comparing these savings to manufacturer ratings, performing lab and field-tests in

[28] CLEAResult. 2017 Annual Report. Prepared for NEEA. March 2018.

Northwest homes of DHP prototypes to provide manufacturers with feedback on how to improve the DHP product prior to final design and full-scale manufacturing.[29,30]

- **Research to support increasing the energy savings potential of DHPs.** NEEA initiated and organized an effort conducted by the Pacific Northwest National Lab (PNNL) with financial contributions from BPA, Silicon Valley Power, America Public Power Association, and NEEA to determine how controls and homeowner operation could be used to maximize the energy savings of a DHP system when operated in concert with pre-existing electric resistance heating systems.
- **Technical and market assessments used to track and forecast the likely total displacement of electric resistance heating by DHPs under different market adoption scenarios**. An example is the Residential Inverter-Driven Heat Pump Technical and Market Assessment,[31] which quantified maximum technical potential for displacing electric resistance heating in relevant Northwest market segments, identified current market barriers, and forecast likely total displacement of electric resistance heating by standard and specialized DHPs over the next 20 years.
- **Cost containment research to find areas to decrease costs**. Examples of NEEA's cost containment research include:
  - The Residential Inverter-Driven Heat Pump International Market Characterization Report, which NEEA commissioned to assess how international DHP market experience can be leveraged in the NW and to assess market cost drivers.[32]
  - An assessment of regional cost and invoice data to assess variables that drive costs and determine potential intervention points
  - DIY system investigation that included: review of all DIY products, installation of several in a field trial, and evaluation of the technical risks of DIY products for reliability, performance and safety.

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[29] Ecotope Inc*. Final Summary Report for the Ductless Heat Pump Impact and Process Evaluation*. Prepared for NEEA. February 19, 2014.

[30] Energy 350. *Combination Ductless Heat Pump and Heat Pump Water Heater Lab and Field Tests.* Prepared for NEEA. August 26, 2015.

[31] Navigant Consulting, Inc*. Residential Inverter-Driven Heat Pump Technical and Market Assessment.* Prepared for NEEA. June 2, 2015. https://neea.org/img/uploads/residential-inverter-driven-heat-pump-technical-and-market-assessment.pdf

[32] Navigant Consulting, Inc. *Residential Inverter-Driven Heat Pump International Market Characterization Report.* Prepared for NEEA. June 2, 2015. https://neea.org/img/uploads/residential-inverter-driven-heat-pump-international-market-characterization.pdf

- MPER research designed around cost reduction.[33, 34]

Quality Assurance

To influence regional installation quality and uniformity, NEEA conducted installation quality control, provided utilities with support through on-site inspections, and communicated its findings with the supply chain. Over the past decade, NEEA conducted these quality assurance activities:

- **On-site inspections.** NEEA performed a significant number of on-site inspections (e.g. in 2010, the initiative inspected 4% of the initiative's installations or 189 installations).[35] The project refined their on-site inspection trigger system annually to ensure the best use of resources by targeting new installers while lowering inspections rates for proven, high performing installers.[36,37,38] Findings from these inspections influenced technical updates to initiative marketing materials and installer training.
- **Foster and promote quality installations.** By identifying and addressing common installation issues, NEEA promoted best practices among contractors and ensured the high quality of project installations. In addition to installers, supply chain actors also benefited from NEEA's inspection findings. Feedback directly from NEEA's on-site inspections helped manufacturers identify inaccurate installation guidance and laid the groundwork for successful cold-climate technology installations.[39] In addition, NEEA worked with distributors to ensure the region had adequate supplies of tools needed for quality installations.[40]
- **QA inspection support.** NEEA supported utility-driven QA efforts by developing and delivering utility QA webinars to help unify regional efforts and provide utilities with resources to refine, improve, and increase their QA activities. NEEA also shared inspection and recordkeeping templates with utilities to facilitate their inspections.

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33 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6.* Prepared for NEEA. January 17, 2018. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-6.pdf

34 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7*. Prepared for NEEA. September 20, 2018. https://neea.org/img/documents/DHP_MPER_7_Report_FINAL_CC.pdf

35 Northwest Energy Efficiency Alliance. *Annual Report Northwest Ductless Heat Pump Project.* 2010.

36 Northwest Energy Efficiency Alliance. *Final Implementation Report Ductless Heat Pump Project 2008-2009*.

37 Northwest Energy Efficiency Alliance. *Annual Report Northwest Ductless Heat Pump Project.* 2010.

38 Northwest Energy Efficiency Alliance. *2011 Annual Report Northwest Ductless Heat Pump Project.*

39 Northwest Energy Efficiency Alliance. *Annual Report Northwest Ductless Heat Pump Project.* 2010.

40 Ibid.

Codes and Standards

Over the course of the initiative, NEEA's Codes and Standards program helped utilities as well as DHP supply chain actors by making beneficial changes to existing codes and informing them of upcoming changes to regulations through the following activities:

- **Identify and change inefficient state and local codes**. NEEA contributed to changing codes to make the installation of DHPs in the Northwest as efficient as possible.
  - **Internal disconnect switch requirements.** Washington and Oregon codes required installation of internal disconnect switches which contributed to installation cost and created an aesthetic barrier for homeowners. NEEA collaborated with utilities, trade associations, and supply chain actors to draft a document stipulating that internal disconnect switches should no longer be required. This change was approved by the State of Oregon in 2009.[41] In 2010, Washington State Labor and Industries subsequently released an interpretation that mirrored the initiative's request.[42]
  - **Programmable thermostats.** NEEA identified an installation barrier in a Washington State code interpretation requiring programmable thermostats for DHP installations. The initiative overcame this barrier by providing testimony which led the Washington State Building Code Council alleviating this requirement.
- **Disseminate code and regulation changes.** Ahead of impactful code and regulation changes, such as the U.S. Environmental Protection Agency's January 1, 2018, changes to refrigeration regulations, NEEA informed utility partners, changed distributor presentations, and revised the installer orientation and best practices webinar to ensure that installers accurately implemented changes.
- **Influence ENERGY STAR® rating systems.** NEEA influenced ENERGY STAR®'s "Most Efficient" product category approach by advising that the rating system used to illustrate ductless system efficiency were not an appropriate fit for ductless technology.[43]

Drivers of DHP Adoption

Many factors have contributed Northwest DHP adoption, including compelling product features unique to DHPs, market forces and conditions, and regional activities and interventions implemented by utilities, NEEA, and the supply chain.

DHP Product Features

DHP's unique product features make them well suited for achieving energy savings and high customer satisfaction and has contributed to increased adoption in the Northwest market. In assessments of the

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41 Northwest Energy Efficiency Alliance. *Final Implementation Report Ductless Heat Pump Project 2008-2009.*

42 Northwest Energy Efficiency Alliance. *Annual Report Northwest Ductless Heat Pump Project.* 2010.

43 Northwest Energy Efficiency Alliance. *2011 Annual Report Northwest Ductless Heat Pump Project.*

initiative, customers have shown extremely high satisfaction with DHP technology.[44] A former NEEA initiative staff member said, "something we saw really early was how much customers love this technology…[customers] found me at NEEA to tell me how much they loved their DHP." Word of mouth has been well documented in prior MPERs as the main driver of customer awareness of DHPs,[45,46,47,48,49] Some stakeholders have identified word of mouth as a particularly effective accelerator of market adoption. In MPER 2, a utility representative said the rapid expansion of DHP installations through word-of-mouth advertising was "like someone throwing gasoline on a dry field."[50]

Previous MPERs and research with DHP program stakeholders, consumers, and the supply chain have highlighted these product features as significant drivers of adoption:

- Substantial energy and cost savings
- Cooling capability
- Quiet operation
- Potential to provide greater comfort (e.g., more even heating) than baseboard heating
- Limited maintenance requirements
- Less complex/costly installation than ducted central heating systems
- Ability to displace existing heating system

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44 ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #5.* Prepared for NEEA. July 28, 2016. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-5.pdf

45 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7*. Prepared for NEEA. September 20, 2018. https://neea.org/img/documents/DHP_MPER_7_Report_FINAL_CC.pdf

46 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6.* Prepared for NEEA. January 17, 2018. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-6.pdf

47 ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #5.* Prepared for NEEA. July 28, 2016. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-5.pdf

48 ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4.* Prepared for NEEA. July 23, 2015. https://neea.org/img/uploads/ductless-heat-pump-market-continues-to-increase-dhp-mper-4.pdf

49 Evergreen Economics. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #3.* Prepared for NEEA. April 24, 2014. Page i. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-3.pdf

50 Research Into Action. Northwest Ductless Heat Pump Pilot Project MPER #2. Prepared for NEEA. March 28, 2010. https://neea.org/img/uploads/northwest-ductless-heat-pump-pilot-project-market-progress-evaluation-report-2.pdf

- Zonal control of heating and cooling

Of these DHP product features, prior research has found the ability to reduce monthly heating costs (by some estimates up to 50%) and cooling capability are the most compelling product attributes to consumers.[51] In MPER 7, two installers who were interviewed said DHPs sell themselves because of bill savings and energy efficiency. Cooling is increasingly a driver of customer interest in DHPs, as the region overall has seen an increase in residential homes with cooling.[52]

Market Conditions/Forces

Market conditions and forces have also contributed considerably to DHP adoption. For this MPER, interviewees elaborated on the following:

- Steadily increasing electricity rates that have caused customers to look for more efficient heating options to save on bills
- An aging population in need of a more effective heating and cooling option to increase home comfort
- Increasing urban density driving a need for small space heating and cooling solution
- Increasing demand for air-conditioning due to customers closing windows during summer forest fire season in an effort to reduce smoke intake

Although some interviewees identified the economic recession of 2007–2009 as a reason for market stagnation, they noted that economic recovery has resulted in a renovation and construction rebound, which has supported an increase in installations of both ducted and ductless systems.

NEEA staff, manufacturers, and one distributor noted that the recession had contributed to the current shortage of skilled labor to support DHP installations, exacerbated by an aging HVAC workforce with fewer new installers joining the trade, which two NEEA staff noted may have exerted upward pressure on installations costs. Some DHP installers who left the trade during the economic recession did not rejoin the HVAC installer workforce following the recession.

Utility DHP Programs

Utility buy-in was critical to early and continuing success of the initiative. NEEA staff who were interviewed for this MPER explained that ongoing utility involvement, support for DHPs, and deployment of DHP programs has been critical to accelerating adoption of DHPs in the region. Utility programs offer customers incentives to help reduce the initial cost of a DHP, track DHP installations,

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[51] Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6.* Prepared for NEEA. January 17, 2018. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-6.pdf

[52] Cadmus. *Residential Regional Building Stock Assessment.* Prepared for NEEA. https://neea.org/img/uploads/Single-Family-Web-Version.pdf

engage contractors in their DHP programs, cultivate their own DHP Trade Ally networks, ensure quality installations, and provide ongoing training and support. Several manufacturer and distributor interviewees agreed that utility incentives have served an essential role in driving customer demand. As of 2017, 114 utilities in the Northwest offered DHP rebates. Since 2008, 68,459 DHPs installed in the region have received a utility rebate.[53]

Most and Least Impactful NEEA Interventions

Most Impactful NEEA Interventions

NEEA and utility interviewees identified several NEEA interventions and activities that were critical for accelerating DHP adoption in the Northwest, including the following.

Building consumer awareness. Several NEEA staff, manufacturers, distributors, and utility representatives noted the importance, particularly early in the initiative, of NEEA's direct-to-consumer marketing activities to help build consumer awareness of DHP technology. One manufacturer characterized NEEA's early customer messaging as the "catalyst" that sparked the market. Manufacturers and distributors interviewed mentioned that NEEA's messaging carries weight with both utilities and customers given NEEA is a trusted, third-party source. Most utilities interviewed said they benefited from NEEA's centralized marketing efforts to introduce the public to the new technology and increase market adoption throughout the region. Utilities said important aspects of NEEA's marketing activities included devoting staff to creating radio, print, and web marketing tools and maintaining the initiative's website, goingductless.com. Three utilities, two of which are small and rural, said that being provided with marketing material they could co-brand or rebrand along with the ability to direct consumers to resources on the goingductless.com website has been invaluable because they do not have the staff resources to create or maintain these marketing products themselves.

NEEA said its early work in building awareness helped prove the business case to manufacturers and distributors for greater investment in the Northwest DHP market. Supply chain actors have also acknowledged that raising consumer awareness improved their sales—for example, in MPER 3, when asked about the impact of NEEA's Initiative on their sales, a manufacturer and a retailer said NEEA was essential in informing the public about DHPs and that they could attribute their recent sales increases to NEEA's work in the market.

Influencing the supply chain. Both NEEA and the utilities acknowledged that NEEA is uniquely suited to influencing manufacturers and distributors in developing the technology and bringing new products to the Northwest market. Utilities said they value the initiative's ability to prod supply chain actors, and as one interview noted, "we need [NEEA] to gracefully push the supply chain toward solutions."

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[53] Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7.* Prepared for NEEA. September 20, 2018. https://neea.org/img/documents/DHP_MPER_7_Report_FINAL_CC.pdf *(Note: this number will be updated with MPER 8 market update values in final report)*

Past MPERs have documented the substantial impact NEEA has had on manufacturers and distributors in the following areas:

- **Expanding distribution throughout the Northwest.** Given historical demand for DHPs was low in the Northwest prior to the initiative, NEEA focused efforts on encouraging manufacturers and distributors to expand their distribution throughout the Northwest. For example, NEEA's shared market research to help demonstrate the business case and customer preference to supply chain actors. One interviewee said that NEEA's information sharing with supply chain actors was invaluable as it helped them to stock the right equipment in the right areas. According to one manufacturer interviewed early in the initiative, Oregon and Washington ranked eighth and ninth, respectively, in 2010 national data in total DHP units sold, compared with rankings of nineteenth and twentieth in 2008.[54]
- **Expanded awareness and perspective of potential DHP applications.** In MPER 1, manufacturers reported that "the initiative had expanded their perspective and awareness of potential DHP applications and value, including displacement applications for DHPs."[55] When the initiative began, the leading manufacturers of DHPs sold in the U.S. perceived them as a solution for problem zones, bonus rooms, or add-ons rather than whole-house heating and cooling systems, and manufacturers did not promote DHPs as an energy efficiency measure or as an alternative to zonal electric heat.[56]
- **Supply chain adoption of NEEA's messaging.** MPER 2 and MPER 3 noted that suppliers had adopted the initiative's messaging (emphasizing multiple benefits such as energy efficiency, ease of installation, and bill savings) in their marketing strategies as well as had begun to market regional rebates.[57,58] This adoption continued and by MPER 5 supply chain actors were still using imagery or information produced by NEEA in their marketing efforts.[59]

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54 Research Into Action. *Northwest Ductless Heat Pump Pilot Project MPER #2*. Prepared for NEEA. March 28, 2010. https://neea.org/img/uploads/northwest-ductless-heat-pump-pilot-project-market-progress-evaluation-report-2.pdf

55 Research Into Action. *Northwest Ductless Heat Pump Initiative 2010 Market Progress Evaluation Report* #1. October 27, 2011. https://neea.org/img/uploads/NorthwestDuctlessHeatPump15116CF434BC7.pdf

56 Research Into Action. *Northwest Ductless Heat Pump Pilot Project MPER #2*. Prepared for NEEA. March 28, 2010. https://neea.org/img/uploads/northwest-ductless-heat-pump-pilot-project-market-progress-evaluation-report-2.pdf

57 Ibid

58 Evergreen Economics. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #3.* Prepared for NEEA. April 24, 2014. Page i. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-3.pdf

59 ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #5.* Prepared for NEEA. July 28, 2016. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-5.pdf

Developing regional installer network. Utilities, manufacturers, distributors, and NEEA acknowledged the importance and value of NEEA's development of a regional installer network. NEEA's early outreach focused on securing contractor buy-in by promoting the market opportunity of DHPs in the Northwest. NEEA interviewees noted that the early quality assurance programs were also important for making installers comfortable and confident with DHP technology.

According to some utility interviewees, NEEA's role as an educator and resource for installers in the region grew when the initiative designed the Master Installer Program. A few utilities noted that this distinction and training course was a driving force in the professionalization of DHP installation in the region. Although utilities and NEEA acknowledged the importance and value of NEEA's development of the regional installer network, one utility and a few NEEA staff members who were interviewed said NEEA's importance may be diminishing, as utilities are cultivating their own DHP trade ally networks.

Facilitating market collaboration. Throughout the initiative, NEEA has served an important role in facilitating market collaboration among utilities, manufacturers, distributors, and installers. For example, NEEA interviewees noted, and prior MPERs have documented, that the workshops NEEA hosted and facilitated early in the initiative history—bringing together these diverse market actors—helped educate the supply chain on the market opportunity for DHPs in the Northwest and build partnerships that continue to the present. Utility interviewees also noted that it has been useful to have NEEA facilitate conversations among utilities to share insights and lessons learned from their DHP programs and for NEEA to facilitate conversations with contractors. Manufacturer and distributor interviewees agreed that NEEA has been incredibly valuable in facilitating their collaboration with utilities.

Providing research and sharing information. Interviewees mentioned NEEA's important role as a leader of DHP research in the region and as a conduit for sharing information among all supply chain actors and utilities. Utility interviewees said NEEA has done a good job of informing utilities about the benefits of DHPs to the region and that this has had a snowball effect. As one said, "if you can get the utilities fired up on it then you've got a good portion of the battle done."

DHP Cost Containment Interventions and Ongoing Challenges

A critical challenge and ongoing focus of the initiative has been the affordability of DHPs for target market consumers. NEEA has explored and implemented a variety of strategies aimed at cost containment. NEEA has had some success in partnering with manufacturers and distributors, for example, on limited time promotions to reduce product cost, which the supply chain now regularly offers without program support and sometimes directly in partnership with utilities. Despite these efforts, however, overall installed DHP cost to the consumer has not decreased in recent years. NEEA

and the utilities have identified the cost of a DHP as an ongoing barrier to consumer uptake and, for some utilities, to cost-effectiveness.[60,61]

This section describes NEEA's interventions and activities that have been aimed at reducing cost, the outcome of these activities, and the ongoing challenges in addressing the cost barrier.

Lower-cost installation pathways. A key element of NEEA's market transformation logic since the initiative's inception has been to expand the pathways through which customers can acquire and install a DHP. NEEA conducted market activities in 2016 and 2017 to determine the viability of supporting two options targeting homeowners and shared these results with the region.

- **DIY installation channel development.** NEEA explored opportunities for a DIY installation channel, where customers purchase and install a DHP themselves. NEEA conducted market research with the supply chain and utilities. Ultimately, NEEA's funders expressed concern about the efficacy of DIY installations, and supply chain partners expressed concerns about lack of warranty and equipment performance and reliability. NEEA also evaluated and tested off-the-shelf DHPs and conducted and documented the DIY installation process but determined that the tested DIY models were not ready for reliable, easy self-installation with dependable savings.
- **Contractor-assisted installation (CAI) channel development.** NEEA explored opportunities for developing a CAI channel by conducting market activities to determine its viability, researching the market with supply chain and utilities, conducting a limited number of quality control post-installation visits, observing a CAI class, and offering utility support and quality control for CAI-rebated installations. As with the DIY option, the CAI channel has received low support from the supply chain. According to NEEA, this approach has received mixed support among utilities. NEEA has identified a few utilities that are currently accepting CAI installations for rebates; however, given that some utilities directed NEEA not to present this option or support it through consumer-facing messaging, NEEA is not actively pursuing this option any further.

Retail sales channel development. Although NEEA was successful in partnering with a key manufacturer to offer DHPs in The Home Depot retail stores in the Northwest and has supported manufacturer partnerships with other retail chains, NEEA believes the retail channel has not yet proved it can lower DHP cost. According to NEEA, consumers typically see the product in retail stores but are then directed back through the supply chain to a partner installer. Furthermore, NEEA has noted that manufacturers have guarded their relationships with retail chains and have not been willing to accept NEEA's offer for greater support or access to their contacts.

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[60] Cadmus. Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6. Prepared for NEEA. January 17, 2018. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-6.pdf

[61] Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation #7*. Prepared for NEEA. September 20, 2018. https://neea.org/img/documents/DHP_MPER_7_Report_FINAL_CC.pdf

Support for direct-to-dealer distribution model. In 2017 and 2018, seeking to further drive down the cost of DHPs, NEEA explored opportunities to introduce competition for the single-head system market. NEEA worked with a manufacturer of lower-cost DHPs on a direct-to-installer distribution and sales model (aiming to reduce cost by removing the distributor and associated distributor overhead). NEEA encountered challenges identifying willing participant contractors but ultimately chose to halt the pilot project because of concerns that the manufacturer had not set aside sufficient resources to support the contractors directly. This concept was still viewed favorably but placed on hold until a suitable manufacturer could be identified to pilot this potentially market disruptive approach to cost reduction.

Focus on single-head displacement approach. The initiative has remained focused on a single-head or one-to-one displacement over the past 10 years because these smaller, more targeted systems are less costly than multi-head systems, produce the desired energy savings impact and, from the standpoint of utilities, are more likely to be a cost-effective measure than a larger multi-head system. Even so, as DHPs have been introduced in the Northwest, multi-head systems have increased partly because of customer preference for a multizone heating and cooling solution and partly because supply chain actors prefer the more lucrative opportunities of installing multi-zone DHPs in a home. In 2016 and 2017, installers and suppliers reported that most of their sales were one-to-one configurations; however, they also expected the portion of multi-head installations to increase in upcoming years.[62,63] In addition, utility rebate data show that the share of multi-head installations is increasing.[64]

Unique partnerships to support and promote lower-cost and single-head installations. In 2018 and 2019, NEEA explored two options for new partnerships to support and promote single-head and lower-cost DHP installations.

- **Community-based organization (CBO).** NEEA explored opportunities to partner with CBOs that serve clients who may benefit from DHPs to increase customer awareness, drive leads, and reduce cost through bulk purchasing and aggregating installations.
- **Nontraditional installers.** NEEA explored the viability of recruiting installers in other trades (e.g., electricians, solar installers) who may be more likely to have customers with zonal heat and/or may be more receptive to focus on single-head installations in addition to their primary business model. Research with nontraditional installers found that recruiting and training adjacent trades

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62 ILLUME Advising, LLC. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #5.* Prepared for NEEA. July 28, 2016. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-5.pdf

63 Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6.* Prepared for NEEA. January 17, 2018. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-6.pdf

64 CLEAResult. *2016 Annual Report*. Prepared for NEEA. March 2017.

to expand services to offer DHP installation was not likely to be a highly effective way for the DHP initiative to engage more contractors and accelerate market adoption.

Ultimately, NEEA's funders did not recommend actively pursuing either of these partnerships. Instead, NEEA has shared findings from this effort and developed guidance for utilities that may be interested in cultivating CBO partnerships or recruiting new trade partners.

Consumer targeting support. NEEA has encouraged the region to focus marketing on reaching target-market homes right for single-head systems and educate these consumers on the benefit of displacement. NEEA created marketing materials, developed a targeted address list of areas with concentration of homes most likely to be appropriate for a single-head DHP installation, and proposed a consumer awareness campaign through direct mail and digital media, and it shared these with utilities to use in their own marketing. However, there is no evidence currently available to indicate whether utilities are using these resources to target homeowners.

Consumer financing. In 2016, NEEA researched financing opportunities for DHPs; however, NEEA determined that although financing could make DHPs more accessible for some consumers, the fees associated with financing often increase the overall total cost to the consumer. In addition, NEEA's funders have recommended that NEEA should not take on a role in advancing financing.

Consumer confidence and purchase decision support tools. In 2019, NEEA launched its "Buyer's Guide" on the goingductless.com website. To support price transparency, consumer confidence in DHP technology, and purchasing decisions, the guide offers several tools such as a pricing factor checklist, questions to ask an installer, and a bid and analysis guide. Because these tools have only been deployed recently, NEEA does not yet have a measure of the impact of these resources.

Potential Risks and Impacts of LTMT Transition

As with NEEA's other initiatives, once the market is sufficiently transformed NEEA will move the initiative from active market development into long-term monitoring and tracking (LTMT) to measure ongoing energy savings and market impact.

As NEEA has begun to evaluate what a transition should look like, utilities interviewed expressed anxiety about what it will mean, including worry over loss of NEEA's pressure on supply chain actors to keep costs low, training for installers, ensuring quality installation standards, and sharing information through utility workgroup meetings and the goingductless.com website. One consistent theme was the continued reliance of smaller utilities on NEEA's information and marketing support and concern over what would happen if this was diminished. Cadmus gathered feedback from utilities, manufacturers, and distributors on the potential risks and impacts of an initiative transition to long-term monitoring and tracking including slowed or stalled market growth outside the I-5 corridor and rising DHP costs.

Slowed or stalled market growth outside the I-5 corridor

Utilities, distributors, and manufacturers generally agreed that the market had been transformed west of the Cascades, however several utilities and a few supply chain actors said that more work may need

to be done to prevent backsliding outside of the I-5 corridor. Reasons for anticipating slowed or stalled growth east of the Cascades include the following:

- **High DHP cost.** Utility interviewees noted that high DHP costs continued to impact customer willingness to purchase as well as the potential to impact a utility's ability to offer DHP programs.
- **Diminished savings.** In 2014, the Regional Technical Forum added a supplemental fuel screen to the calculation of savings from DHPs in single-family homes used for zonal heat.[65] One utility said that for its service area, where there is a large proportion of wood heat, this additional screening has meant that currently single-head installations are not cost-effective.[66]
- **Insufficient installer workforce.** Three utilities said they thought there was an insufficient supply of installers trained through the initiative and/or of contractors installing DHPs in their service territory. One manufacturer and two distributors also mentioned barriers to installer training specific to the rural areas east of the cascades. One distributor said rural contractors cannot get to training due to "windshield time." While this distributor has tried to remedy this by providing mobile training, some contractors cannot spare any of their workforce to attend.
- **Insufficient focus by initiative on cold-climate heat pumps.** Two utilities noted that cold climate heat pump technology was not available or as widespread early in the initiative when NEEA was most actively working with the supply chain. As a result, they believed installers (as well as customers) were not as aware or familiar with cold climate DHP applications and therefore installers were not promoting the technology for heating in colder climates. As further evidence of the lack of focus on cold climate heat pumps, one of the utility representatives also noted that NEEA had not provided sufficient resources specific to cold climate heat pumps (e.g., materials suggest using backup heat below freezing temperatures even though cold climate heat pumps are effective at these temperatures and most customers in the service territory would experience these temperatures for most of the year).

In general, manufacturers and distributors said that cold climate heat pumps are available for purchase throughout the Northwest, However, two utilities, two manufacturers, and one distributor said that additional intervention may be needed from NEEA to support cold climate heat pump technology and transform the market for DHPs east of the Cascades. These interviewees suggested that NEEA implement lessons learned from accelerating DHP adoption in the I-5 corridor and apply them east of

[65] "Ductless Heat Pumps for Zonal Heat SF. Version 2.0" Regional Technical Forum, NWCouncil.org, April 30, 2014 https://rtf.nwcouncil.org/measure/ductless-heat-pumps-zonal-heat-sf

[66] RTF workbook version 4.2 ("Ductless Heat Pumps for Zonal Heat SF. Version 4.2" Regional Technical Forum, NWCouncil.org, December 5, 2017) has revised the DHP impact calculations to not include the supplemental fuel screen, rather incorporated the supplemental fuel costs as deferred annual costs (e.g. a benefit to the customer) therby improving cost-effectiveness for the measures, however, it may still not be cost-effective for this utility to incent DHPs.

the Cascades with a focus on cold climate heat pumps. In addition, manufacturers and distributors said that it would be helpful for a third-party, such as NEEA, to validate manufacturer's claims as to the performance of their technology in cold climates to help inspire confidence and diminish the perception they see amongst some installers that ductless technology does not perform in cold climates.

DHP cost may continue to rise (or will not decrease)

Several utility interviewees indicated there was still more work to be done to contain DHP costs, and that without NEEA exerting pressure on the supply chain to contain costs, these costs were likely to increase. One utility indicated there was significant risk that the DHP market will fail across the Northwest without NEEA's continued work on cost-containment strategies. Rising DHP costs have the potential to threaten both consumer adoption of DHPs as well as the utility's ability to offer DHPs:

- **Consumer purchase barriers.** Interviewees noted that DHP cost continues to be barrier to customer purchase of DHPs and that increasing costs could hinder DHP adoption. Although a NEEA analysis of market pricing in 2017 indicates the price of single-head DHPs is holding steady, prior research has shown price is still a barrier to purchase for most consumers when existing heating systems are still functioning.[67]
- **Cost-effectiveness.** Utilities interviewed said they plan to continue their programs if DHPs remain cost-effective. Higher DHP costs and diminished savings result in DHPs not being cost-effective, and therefore utilities may discontinue their DHP programs, further exacerbating the first cost purchase barrier to DHP adoption. One utility said that for its service area single-head installations are not currently cost-effective due to a large proportion of wood heat; however, it has kept offering incentives for the measure with the hope that NEEA's cost-containment strategies would be successful. Without NEEA's continued work, this utility may no longer be justified in offering incentives for DHPs in its service territory. Another utility noted that cost-effectiveness was the primary reason it was unable to offer a DHP program.

Utilities generally said that NEEA needs to continue work to further bring down costs, while some utilities said they did not know what else could be done, two utilities gave the following suggestions:

- One utility said NEEA should encourage a "rogue" manufacturer or one that hasn't worked previously in the Northwest to sell a cheaper unit in the region.
- One utility said NEEA can go to Northwest Power and Conservation Council and suggest that they revise their methodology for assessing cost-effectiveness.

Future of Utility Programs

Most utilities plan to continue their programs as long as DHPs remain cost-effective. One rural utility east of the Cascades that has not seen much uptake in DHPs remains optimistic that the technology will catch on and the utility will continue its program as long as the BPA offers incentives. Another rural

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[67] Cadmus. *Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #6.* Prepared for NEEA. January 17, 2018. https://neea.org/img/uploads/northwest-ductless-heat-pump-initiative-market-progress-evaluation-report-6.pdf

utility east of the Cascades has seen a high demand for DHPs just in the last two years and recently halved its incentive to allow more customers to participate. In response to market interest, a large utility west of the Cascades plans to expand its program, by offering an additional rebate for multi-head systems. However, this rebate will only be available for a year as BPA has announced they will reverse their multi-head measure.