

Bringing Technology to the People: Strategies for Transitioning Emerging Technology to Program Delivery to Consumer Adoption

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ABSTRACT

Emerging technologies are a key driver in the energy efficiency industry. As energy efficient technologies such as CFLs are adopted by consumers, utilities must be able to transition new technologies out of lab and pilot programs, and into regional programs. Working in concert with Bonneville Power Administration (BPA) and Northwest Energy Efficiency Alliance (NEEA), we have identified a critical path in regional introduction of emerging technologies such as ductless heat pumps and second generation heat pump water heaters. We advocate for a conservative approach with emerging technologies to ensure that savings are real and the customer experience with these new technologies is a robustly positive one. The primary objective of this paper is to answer the following question: When emerging technologies or second generation products are identified as potential energy saving measures, how are they successfully phased into the market and adopted by utility programs?

The paper explores the genesis of emerging technologies in the Northwest by identifying key stakeholders such as the BPA, the Regional Technical Forum (RTF), the NEEA, individual utilities, manufacturers, and contractors. Together these institutions, companies and market actors participate in regional programs that have the potential to deliver significant savings. We will trace the parallel tracks for both ductless heat pumps and heat pump water heaters as they move from identification of potential savings to provisionally deemed savings to widespread utility participation in regional programs and positive customer experience. Additionally, the paper will identify real world challenges in pilot phase, contractor education and customer experience with new technologies.

Introduction

In the Pacific Northwest, high energy efficiency goals have pushed utilities and regional stakeholders to work smarter and more collaboratively to meet the demand. In this paper, we will explore the emerging technology collaboration being utilized to successfully shepherd emerging technologies through lab testing to program pilots and into successful program deployment and adoption. This paper will be organized around the elements identified as most critical to moving these technologies to successful consumer adoption. First and foremost has been the partnership of BPA, NEEA, Electric Power Research Institute, Inc. (EPRI), manufacturers, participating utilities and implementation firms. Other key components of success included: use of stakeholder advisory committees, lab and field testing of the technologies, feedback to manufacturers, development of program solutions for addressing application challenges, consumer-directed information and marketing, and documentation of best practices (and what didn't work so well). We believe that for the purposes of this paper, a comparative overview of two emerging technologies—ductless heat pumps (DHP) and heat pump water heaters (HPWH)—will provide an interesting platform for highlighting some of the promising strategies that helped move these

technologies from emerging technology to consumer adoption in the Pacific Northwest. Using experience gained during four years of pilots and program implementation with ductless heat pumps and heat pump water heaters we will outline the road map we used to bring these emerging technologies into energy efficiency programs and use some of the differences and similarities between the projects to illustrate which strategies appear to have the most impact.

With both of these technologies we began our journey several years ago, ductless heat pumps in 2006 and heat pump water heaters in 2008. In both cases our road map began with an investigation of the technology (either through small pilots or lab testing), the recruitment of an advisory committee, more lab or field testing, then careful program development designed to guide each of technologies along a controlled path toward contractor and consumer awareness and adoption. Along the way, we metered and measured and checked on our assumptions of energy savings, application and consumer barriers. To date, it's been an interesting journey with contributions by a diverse cast of characters and organizations. While we have had some missteps, overall working together has produced remarkable success within a fairly short timeline.

Technology Overview

A ductless heat pump is a heating and cooling system capable of functioning without duct work. In use in other places around the world, ductless heat pumps were a new technology to the U.S. market in 2006. The most energy efficient ductless heat pumps are inverter-driven with the ability to scale up and down to meet the heating and/or cooling needs of a home.¹ The outdoor unit (heat pump compressor/condenser) connects to the indoor unit (air handler) by a small bundle of cables and a refrigerant line requiring only a 3-inch hole through the exterior wall. The indoor unit is mounted on a centrally-located wall inside the home. Working with an existing heating system, a single ductless heat pump is enough to heat and cool the average Northwest home. A remote control allows settings to be adjusted for maximum efficiency and comfort.

Heat pump water heaters feature established heat pump technology used to heat and cool homes for years. A heat pump water heater is like a refrigerator working in reverse. While a refrigerator *removes* heat from its interior and expels that heat to the surrounding air (the kitchen), a heat pump water heater does just the opposite. It *takes* heat from the surrounding air and *transfers* it to the water in the enclosed tank. Typically, the compressor, evaporator and fan are at the top of the unit with conventional heating elements included to boost the temperature and production of hot water in the event of additional demand.²

Partnership Roles and Contributions

The Northwest Power and Conservation Council (the Council) released the 6th Northwest Power Plan in 2008, including ductless heat pumps and heat pump water heaters as opportunities

¹ “If the savings and cost estimates adopted by the Regional Technical Forum are confirmed . . . this technology(DHP) has the potential to reduce regional space-heating use by approximately 200 average megawatts at a cost of less than \$60 per megawatt hour.” —Sixth Power Plan

² “By 2030 heat pump water heaters could reduce regional electric water heating use by over 490 average megawatts at a cost less than \$30 per megawatt hour.” —Sixth Power Plan

for northwest utilities to use to reach 6th Plan energy efficiency goals (NW Council 2012). Towards these goals BPA leveraged coordinated efforts of several key stakeholders including: the Council's Regional Technical Forum (RTF), EPRI, NEEA, manufacturers of these technologies, northwest utilities and implementation firms. The collaboration of all of these players has been one of the key components in our success for transitioning these emerging technologies into market adoption in the Northwest. Below are brief overviews of each of the partners. A timeline summarizing lab tests and pilot programs referenced in this paper can be found in the Appendix.

The Bonneville Power Administration (BPA) is a federal nonprofit agency that transmits and sells wholesale electricity across an eight state service territory covering Oregon, Washington, Idaho, Montana, Nevada, Utah, Wyoming, and parts of California. BPA initiated early pilot testing and was instrumental in forming advisory committees for both technologies, as well being a lead funder for regional program development (BPA 2010).

The Northwest Power and Conservation Council (the Council) was created by Congress to give the citizens of Idaho, Montana, Oregon and Washington a stronger voice in determining the future of key resources common to all four states — namely, the electricity generated by Columbia River Basin hydropower dams and the fish and wildlife affected by the same. The Council's Regional Technical Forum (RTF), is an advisory committee that develops standards for verifying and evaluating conservation savings.

The Northwest Energy Efficiency Alliance (NEEA) is a nonprofit organization working to maximize energy efficiency to meet the Northwest's future energy needs through collaboration with Bonneville Power Administration, Energy Trust of Oregon and more than 100 Northwest utilities. NEEA works in collaboration with its funders and other strategic market partners to accelerate the innovation and adoption of energy-efficient products, services and practices. NEEA has played a key role providing regional coordination of the Northwest Ductless Heat Pump Project and developing the Northern Climate Specification for heat pump water heaters.

The Electric Power Research Institute, Inc. (EPRI) is an independent, nonprofit organization that brings together scientists and engineers to conduct research and development relating to the generation, delivery and use of electricity for the benefit of the public. Because EPRI works nationally and internationally, BPA's membership with EPRI leverages opportunities to connect pilot activities in the Northwest with larger national data sets providing comparative regions for analysis. Data collected for the NW Ductless Heat Pump pilot's 2500 installations became part of a larger national pilot through our collaboration with EPRI. Similarly, BPA's 40 unit HPWH field pilot became more relevant when pooled with data from a national field pilot with other EPRI partners.

Manufacturers of ductless heat pumps and heat pump water heaters are key partners in our process. We worked closely with Daikin, Fujitsu, LG, Mitsubishi and others to deliver comprehensive contractor trainings for ductless heat pumps and regional consumer marketing. Manufacturers of heat pump water heaters, including General Electric, Rheem-Ruud, A.O. Smith and Air Generate, have been similarly engaged on everything from product improvements to collaboration on contractor training.

Northwest utilities and implementation firms are some of our most hardworking and productive partners, The six investor-owned utilities and 140 public utilities (public utility districts, municipals, and cooperatives) in the Northwest are our front-line partners, testing and implementing strategies as they are developed. While not all utilities participate in emerging technology pilots, a surprising number do. More than 90% of the 2500 ductless heat pump pilot

installations occurred in small and mid-size public power utilities territories. Two investor-owned utilities, Portland General Electric and Puget Sound Energy, led the region with early HPWH installations and shared their experiences (both good and bad) for the benefit of others. Regional implementation and engineering firms including Fluid Market Strategies, Ecotope, Hadley Engineering, and Jeff Pratt of the Heat Pump Store all provided critical support in either engineering analysis or program development strategies that led to the region's success.

Regional Advisory Teams, Technology Testing and Manufacturer Feedback

Early in the road-map for both technologies, BPA facilitated the creation of regional advisory teams to guide the development of lab and field testing criteria and program evaluation design. BPA, NEEA and other key regional stakeholders helped ensure that engineering analysis and the process for capturing metered data were thorough and that pilots were designed with consideration for what data would be important for later evaluation. Advisory group members were recruited based on their expertise and ability to bring diverse ideas or positions to the group. Differences of opinion were common, encouraged and openly discussed, resulting in what we believe to be a beneficial advisory process in the case of both technologies.

Manufacturers of energy efficient technologies have perhaps as much to gain or to lose from laboratory testing, field testing and feedback. Manufacturers are highly valued partners in the DHP and HPWH pilots. Throughout these pilots we have included them in opportunities to review data collected, customer feedback (both good and bad) and to collaborate with us on addressing technology challenges. They have been instrumental in recommending best practices on installations, supporting contractor installations and trainings, and sponsoring earned media marketing opportunities. This strong connection between program implementers and the manufacturers led to support for installation training, accelerated efficiency gains and increased product availability in the region. In the case of ductless heat pump manufacturers, good communication was supported through quarterly newsletters and regularly scheduled webinars on installation best practices. Overall, providing constructive feedback to manufacturers has been instrumental in addressing application challenges and improving performance. Below are some specific examples of how that feedback was used to improve either the pilot or the technology design.

Ductless Heat Pumps: Lab Testing and Evaluations

Two ductless heat pump models from different manufacturers were selected and tested using a wide range of operating conditions representative of conditions found in the Pacific Northwest. Data collected in the lab helped develop a predictive energy-use model that was used with the Simple Energy and Enthalpy (SEEM) simulation to predict annual energy consumption and savings for ductless heat pumps. The field data compared well with the lab measurements, which will help manufacturers validate their current product strategies and project how future ductless heat pumps might perform in residential applications.

The United States is relatively late in market adoption of ductless heat pump technology that has been readily available in other countries around the world for some time. The Northwest Ductless Heat Pump pilot was part of a larger, comprehensive research project on ductless heat pump technical performance and market acceptance. One of NEEA's deliverables for the region was a market progress evaluation report on the NW Ductless Heat Pump pilot. Manufacturers

cited the efforts of the pilot as a key driver for growth of ductless heat pumps in the residential market and helped bring the most up-to-date cold-climate products to the Northwest. Manufacturers used the growth in the region as justification to support specialized training and resources to contractors – a “win-win” for the manufacturers and the Northwest region.

Residential Heat Pump Water Heater Evaluation: Lab Testing & Energy Use Report

Three heat pump water heater models from different U.S. manufacturers were selected and tested at the National Renewable Energy Laboratory (NREL) in Golden, Colorado using a wide range of water and ambient air conditions. Data collected allowed project analysts to map compressor performance curves across various operating ranges and determine under what draw conditions units switch to resistance heating mode. The major success of this effort was that the NREL lab measurements combined with EPRI field pilot data were used with residential building simulation modeling to predict annual energy consumption and savings for heat pump water heaters. Manufacturer-specific feedback reports were well received by each participating manufacturer with the intent that the lab results may be used by manufacturers to develop future products, control strategies and gain greater customer adoption.

Northern Climate Specification for Heat Pump Water Heaters

By developing strong relationships with heat pump water heater manufacturers through shared lab and field testing, we have been able to partner with them in collaborating on a modification of specifications to achieve increased efficiency in Northern climate heating zones. The result of this collaboration was the development of a Northern Climate Specification for heat pump water heaters. NEEA developed this specification, using laboratory and field testing data, to help manufacturers understand critical performance and comfort issues not addressed by the ENERGY STAR program. The Northern Climate Specification uses three tiers to address two key categories: 1) Performance – energy savings, efficiency, condensate control, freeze protection, end-user controls, and reliability of the units; and 2) Comfort/satisfaction – hot water delivery rates, sound levels, cool exhaust air, installation ease and servicing of the units. The goal of the specification is to ensure greater consumer satisfaction and improved energy performance in cooler northern latitudes (NEEA 2011).

Ongoing Laboratory, Field Testing, and Pilots

BPA initiated early pilot testing on ductless heat pumps in 2006 and brought the initial presentation of provisional savings to the RTF in 2007 (BPA 2009 - 2010). In 2008, BPA and other northwest utilities asked NEEA to provide regional coordination of the Northwest Ductless Heat Pump Project, a large scale pilot to test applications of ductless heat pumps across multiple climate zones. BPA joined the national pilot sponsored by EPRI and provided program funding to connect DHP pilot installations in the Pacific Northwest to EPRI’s national pilot.

With heat pump water heaters, BPA administered initial laboratory testing from 2009-2011 of three U.S. manufactured units while NEEA focused on the development of a Northern Climate Specification for heat pump water heaters (NEEA 2011). During that same time period, BPA also rolled out a 40-unit field test in collaboration with EPRI’s national HPWH demonstration project (BPA 2010 – 2011). Analysis of data collected through these two project

provided evidence of cost effective energy saving paving the way for BPA to begin supporting installations of integrated HPWH units in the Northwest market in early 2012

Laboratory and field testing continues, with data collection of over 70 heat pump water heaters (40 units from the EPRI/BPA field pilot and 30 units from the NEEA field pilot). The data and observations collected through these efforts will be communicated to manufacturers and will include detailed reports, installation feedback from the contractors and end-user feedback from the consumer.

The information gathered from the laboratory and field testing has been valuable to the region and throughout the US. The data from both projects, combined with "lessons learned" and customer surveys helped to formulate the best way to bring successful heat pump water heater programs to consumers for a positive experience in energy savings for their homes. The information was provided to the Regional Technical Forum, and a "provisionally deemed," measure was approved in October 2011 (NW Council 2011).

Strong partnerships with manufacturers are proving to be valuable with these emerging technology lab tests and pilots. Northwest regional stakeholders have invested years building strong relationships with both ductless heat pump and heat pump water heater manufacturers. Without these robust relationships, it is not likely the region would have been able to move as quickly as we have with these promising technologies. Our manufacturing partners have contributed to our shared success in many ways, from the development of specifications, collaboration on technology improvements, installation best practices guides and by providing access to unique trainings and financial support in market-based activities.

Program Development: Solutions for Addressing Application Challenges

As the old adage goes, “An ounce of prevention is worth a pound of cure.”³ Getting out ahead of potential problems through early, collaborative engagement with a variety of partners can create powerful solutions. Successfully transitioning both the ductless heat pump and the heat pump water heater emerging technologies to the market place required specific focus on three key challenges. Those challenges included *developing an engaged contractor base*, *addressing installation issues* and *educating consumers on the benefits of these technologies*. Contractor engagement for ductless heat pumps over a four year period has guided the contractor engagement strategy for heat pump water heaters. Lessons learned during initial technology pilots, as well as feedback provided by contractors, helped us identify and address installation issues as we encountered them. In 2008 few consumers in the Northwest knew much about ductless heat pumps or heat pump water heaters. A variety of consumer outreach strategies were deployed and tested to educate consumers in the Northwest on how these technologies worked and their benefits. The following section outlines our results to date in contractor engagement, strategies we used to address installation issues, and consumer engagement tactics, as well as recommendations for the future.

Ductless Heat Pumps: Developing an Engaged Contractor Base

Building an engaged contractor base was a critical element to the overall success of bringing ductless heat pumps to the market place in the Pacific Northwest. As a trusted advisory

³ Quote attributed to Benjamin Franklin (1706-1790), U.S. author, diplomat, inventor, physicist, politician and printer.

to consumers, contractors play a valuable role in helping to inform consumers about the benefits of ductless heat pumps. For ductless heat pumps, NEEA and Fluid Market Strategies developed a partner website (GoingDuctless.com/partners) to engage and inform contractors and utilities about ductless heat pump technology. Through the partner website, contractors have access to webinars, training opportunities, a best practices guide with installation tips, homeowner education and marketing tools. Contractor newsletters are posted quarterly, covering pertinent topics such as marketing resources, consumer loan programs, regional marketing campaigns, updated utility incentives and trainings. In 2009, the NW Ductless Heat Pump project had 321 active contractors across the northwest, with 444 participating by 2011

The key benefit of a real time website is the access to critical product information and program updates. GoingDuctless.com is a powerful tool with “front of the house” information for consumers and “back of the house” information for contractors, manufacturers, and participating utilities. To further engage contractors and provide education opportunities, NEEA organized a Ductless Heat Pump Workshop in 2009 and 2011, providing a forum for manufacturers, contractors and utilities to network, gain valuable knowledge and improve market adoption. Without these partnerships, we would not be meeting our regional goals. In 2011 the DHP Workshop attracted 307 registrants, a 30% increase in attendance over the 2009 workshop.

Ductless Heat Pumps: Addressing Installation Issues

Since the Northwest Ductless Heat Pump pilot was initiated in late 2008, NEEA has provided regional coordination on contractor training and quality assurance. As with most contractor-based programs, an inherent challenge is to ensure contractors are committed to installing equipment correctly. Participating contractors were required to attend a manufacturers training and an orientation to learn more about the regional pilot and its goals. To reward and encourage best practices in ductless heat pump installations, NEEA developed a Master Installer Program offering a competitive advantage for champion installers across the region to be highlighted on GoingDuctless.com. As of 2012, Master Installers represent 17% of the active contractor base and account for 60% of all project installations.

In a few cases, contractors with installations that failed to meet quality assurance standards were removed from the program. Contractors are removed from participation in the case of multiple unresolved installation deviations or other significant issues. However, these contractors are also provided with a path to be re-listed by repeating attendance at an orientation or performing a qualified installation.

Ductless Heat Pumps: Educating Consumers

A consumer-oriented website (GoingDuctless.com) was developed to help consumers learn about ductless heat pump technology and connect them with resources for utility incentives, customer testimonials, and how to find an installer. In addition to GoingDuctless.com, NEEA and Fluid Market Strategies developed homeowner education resources and a ductless heat pump display unit that literally “travelled around the region” visiting utility lobbies and community events. The following consumer-facing marketing initiatives were implemented by NEEA to educate and engage with consumers regionally.

Online Engagement

- Facilitated an online campaign across ten news websites from September-December 2011, delivering 1.4 million online impressions and 4,532 visitors to the site.
- Facebook ads had the highest number of impressions of all online advertising, delivering 4,986,828 impressions and generating 1,598 visitors to site. This method is the least expensive, proving to be a cost-effective way to spread awareness with large audiences.
- A web-based interactive social media sweepstakes, “Discover Ductless”, with a \$10,000 prize played on outdated 1970s baseboard electric heat. The campaign leveraged print and radio advertisements to drive consumers to the program’s website and Facebook page where they could learn about the technology and enter the sweepstakes.

Television and Radio

- In March 2011, NEEA tested TV as a medium to increase consumer awareness for ductless systems across the Northwest, resulting in increased Web traffic.
- August-December 2011, NEEA coordinated a regional PSA (Public Service Announcement) campaign with 158 radio stations participating at a value of \$235,532.

Print Media

- Full-page ads were placed in Seattle Magazine and Portland Monthly in November and December 2011, resulting in 874,200 impressions.
- BPA focused marketing dollars on small, rural markets by providing co-op advertising opportunities with public utilities and ductless heat pump contractors. These hometown newspaper ads provided opportunities for utilities to promote their energy efficiency incentives and the services of a local contractor at the same time.

The value of utilities directly engaging with their consumers should not be understated. To date, there are 88 northwest utilities offering ductless heat pumps as part of their energy efficiency programs. By offering incentives and program support, utilities in the Northwest have leveraged their local contractor base to ensure quality ductless heat pump installation. From 2008 to 2010 utility incentives played a significant role in consumer adoption, especially when linked with Federal Tax Credits (available through 2010). The loss of the Federal Tax Credits, reduced utility incentives, and the continued challenges of the U.S. Economy all predict a decrease in installation rates. To offset reduced incentives, regional stakeholders are working to identify potential loan programs for ductless heat pumps.

Heat Pump Water Heaters: Developing an Engaged Contractor Base

In early 2011 a handful of Northwest utilities began offering utility incentives on heat pump water heaters. In October 2011, the Regional Technical Forum “provisionally deemed” Tier 1 integrated heat pump water heaters, providing cost effective energy savings based on early results from BPA’s NREL laboratory HPWH performance data and field data from the 40-unit EPRI/BPA pilot. As heat pump water heaters continue to improve efficiency gains, we anticipate that utilities will engage in a more diverse set of contractors, support local trainings and provide

consumer messaging through a variety of marketing platforms in much the same way that they are supporting consumer outreach on ductless heat pumps. To assist in this effort, BPA is collaborating with manufacturers of Tier 1 integrated HPWHs to support contractor training on installation practices and program requirements. These trainings will help to pave the way for increased market adoption and ensure an improved level of end-user satisfaction.

To support utilities and contractors across the region, NEEA developed a partner Web site (SmartWaterHeat.org/partners) to engage and inform contractors about heat pump water heater technology including information on efficiency, noise reduction, and condensation management. Through the partner website, contractors have access to a best practices guide with tips on optimizing performance, increasing customer satisfaction and ensuring that each installation is successful. Additional information is provided to assist contractors in communicating about the technology to consumers.

NEEA and BPA are also collaborating on the ongoing development of heat pump water heaters that meet Tier II of the Northern Climate Specification. We expect that as our efforts around the heat pump water heaters expand over time, the contractor base will grow. Forecasting a similar trajectory to the ductless heat pump, we can anticipate a significant increase in our contractor base and the development of a master installer protocol sometime in 2013-2014.

Heat Pump Water Heaters: Addressing Installation Issues

Northwest utilities provided valuable support for field testing of heat pump water heaters by being willing to take a risk on participating. Each of the 17 utilities who participated in BPA and NEEA's fielding testing of heat pump water heaters had to be ready for the possibility of unhappy utility customers if the technology failed to perform well. Utilities who volunteered to participate in the heat pump water heater pilot identified either employees or customers who were willing to have heat pump water heaters installed with data loggers and wireless communication, providing metered data to EPRI as part of the national pilot.

In addition to valuable data on energy use, these pilots also provided the opportunity to observe and capture issues that occurred during the initial installations. Six different plumbing contractors were used for installations in the field pilots including contractors from Greenwood Plumbing (WA), Custom Plumbing (MT), Pioneer Plumbing (MT), Endeavor Plumbing (OR), RotoRooter (OR), and Riverside Plumbing (ID). As with any new technology, there will always be installation challenges as contractors become familiar with new technology and unique installation requirements. Some of the installation challenges encountered included issues with noise from vibrating fan shrouds, vibration noise transferring through adjacent walls from the unit while in heat pump mode, and challenges with accommodating earthquake strapping. Rubber washers and a screwdriver were an easy solution to the noisy fan cover and a small foam pad or rigid rubber gasket anchored between the water heater tank and the wall was found to be very effective in reducing the transfer of vibration noise through common walls. By providing feedback to manufacturers, the earthquake strapping challenge was quickly resolved.

Heat Pump Water Heaters: Educating Consumers

As with ductless heat pumps, NEEA provided regional coordination on developing a consumer website (SmartWaterHeat.org) as an informational resource for end-users to learn about heat pump water heater technology. Contractors are encouraged to provide this website URL to their prospective customers.

The two heat pump water heater pilots underway in the northwest include 70 units installed in individual homes. Each unit is provided to the homeowner at no cost as a condition of participating. The year-long metering program monitors various data points including air and water temperature, space heating interactions and water usage. With both pilots, multiple homeowner surveys are taken throughout the study period to capture end-user satisfaction and opinions on heat pump water heater technology. These surveys are providing valuable consumer feedback to test our assumptions around potential barriers, concerns and benefits.

Conclusion: Strategies for Successful Emerging Technology

Throughout the transition from emerging technology through pilot testing and into successful program implementation, our key components of success, use of stakeholder advisory committees, lab and field testing of the technologies, feedback to manufacturers, development of program solutions for addressing application challenges, consumer-directed information and marketing, and documentation of best practices, consistently delivered value.

The partnerships that have been developed through these emerging technology transitions, from 2007 through today, while challenging to maintain, have been the cornerstone of our success. By leveraging the unique and individual strengths of all of the partners – BPA, the Council, NEEA, EPRI, manufacturers, utilities and contractors, we⁴ created a strategy that exemplifies how much can be accomplished in a few years to rapidly launch a technology relatively unknown to consumers. Our initial stakeholder advisory committee members continue to provide feedback and guidance. Various organizations are uniquely qualified to fulfill critical responsibilities including funding, lab testing, field testing, evaluation, training and marketing. Maintaining regular communication channels with each of the key stakeholders helped maintain focus on the goals throughout our work for the region.

By taking a somewhat conservative approach, we elected to move cautiously at first – testing each technology in the lab or through smaller, controlled pilots before taking them out to test in the wider region. We balanced field testing with lab tests to provide a feedback loop that could corroborate lab results with actual implementation of the technology. These early technology tests provided us with valuable learning opportunities that we were able to use to avoid major mishaps during larger pilot deployment. For example, Portland General Electric and Puget Sound Energy led the region with early HPWH installations and shared their experiences (both good and bad) for the benefit of others. The BPA Heat Pump Water Heater field pilot used this guidance to create a “best practices guide” for reducing errors on pilot installations. While

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miss-steps still occurred, participating contractors commented that the pilot was well orchestrated and their experience participating was generally free of the level of frustration that usually accompanies the first round of installations with a new product.

We engaged both ductless heat pump and heat pump water heater manufacturers to refine product specifications and maximize savings opportunities. Without a collegial relationship with manufacturers and the opportunity to discuss product modifications, technology might fail to fully maximize energy savings potential, or achieve strong consumer satisfaction and adoption. Manufacturers were also a key link with contractors. Training contractors on best practices also helps ensure maximum savings and customer satisfaction. Expect that there will be challenges for contractors as they learn the new technologies. Training and access to technical information in real time is absolutely critical.

We identified three key successes in the delivery of ductless heat pumps and heat pump water heaters. Developing the Master Installer program was instrumental in supporting the contractors who were installing the highest number of ductless heat pumps. Hosting a ductless heat pump conference for the entire region was a driver for advanced education on this relatively new technology. Having over 80 utilities throughout the region willing to offer ductless heat pump incentives has helped sustain market adoption of that technology. We anticipate leveraging the successes identified in our experiences with ductless heat pumps in a maturing heat pump water heater program throughout 2012 and 2013. In the short term, we will build the heat pump water heater program through utility participation and support and when critical mass with installers has been achieved, we expect to roll out a master installer path to encourage quality installations.

Communication strategies are in significantly different stages today for ductless heat pumps and heat pump water heaters. Northwest stakeholders have been driving ductless heat pump market adoption for the past four years as opposed to only two active years of market introduction for heat pump water heaters. Our primary communication objective for ductless heat pumps in 2011 was to launch a campaign to increase consumer adoption of ductless heat pump technology in the Northwest. We can leverage our experience launching an effective marketing campaign that includes technology-specific websites to educate consumers on the new technology and connect them with trained contractors. As technologies move out of field testing phase of pilot programs, we can identify key consumer messages and the effective mechanisms for distributing those messages to consumers.

The final key strategy to market adoption eventually falls to the product availability and pricing. Utility incentives are not designed to support an energy efficiency product forever. Once a technology has been successfully introduced, program strategy begins honing in on increasing market adoption and eventually market transformation. Toward that end, solid strategies include coordinating with retailers and distributors on product availability and pricing and coordinating with utilities on product incentives and proper distribution of incentives. When implementing regional programs with multiple utilities, it is essential to leverage their in-house expertise, local contractor base and customer outreach channels.

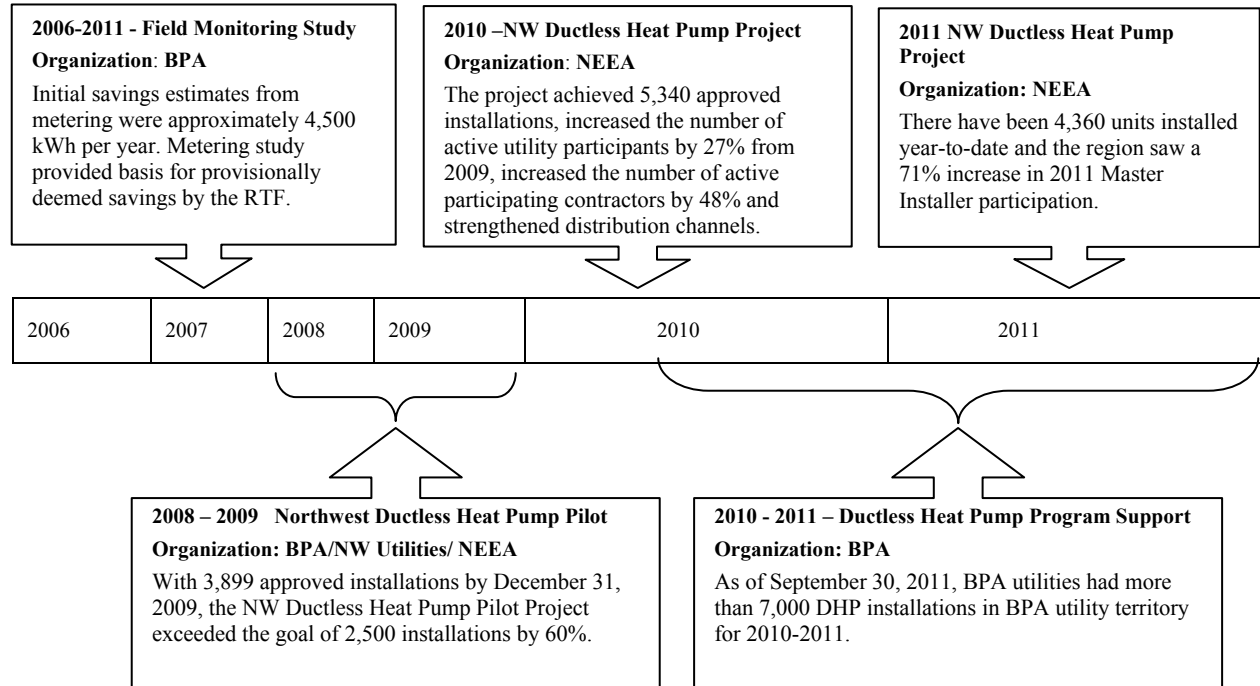
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Appendix

Ductless Heat Pump: Northwest Technology Timeline



Heat Pump Water Heaters: Northwest Technology Timeline

