Integrated Ductless Heat Pump Analysis: Developing an Emerging Technology into a Regional Efficiency Resource

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ABSTRACT

Ductless heat pumps (DHP) represent the potential for large energy savings in the Northwest. The number of eligible homes in this region is more than 500,000, which could translate into about 200 MWa savings. With a potential resource this large, it is important to ensure that performance, market acceptance, and costs are fully understood.

In 2009, the Northwest Energy Efficiency Alliance (NEEA) launched a large-scale and comprehensive impact and process evaluation of the Northwest Ductless Heat Pump Pilot Project. This pilot project targeted single-family, site-built homes using electric resistance zonal heating systems as the primary source of heat. The evaluation used a tiered approach to perform an integrated analysis of the multiple factors that can contribute to performance and customer acceptance of DHPs. The evaluation includes lab testing of two DHPs, field metering of 95 participants, customer surveys of nearly 300 participants, and billing and cost-effectiveness analyses of 3,899 participants. The evaluation focused on DHPs in the Northwest market; however, the potential applicability of this technology spans heating and cooling energy needs throughout the United States and offers higher efficiency than is typically available in central heat pump systems.

This paper summarizes the objectives, methodology, and current findings from this comprehensive assessment of DHPs. The paper emphasizes the integrated nature of the methodology as well as the importance of understanding both the technical and behavioral aspects of DHP performance in order to determine savings potential. The evaluation methodology illustrates an effective interplay between policy objectives, performance evaluation, and program applications.

Introduction

Beginning in October 2008, the Northwest Energy Efficiency Alliance (NEEA)[1] launched a regional project intended to implement, demonstrate and evaluate energy savings and market acceptance of a new generation of ductless mini-split heat pumps in existing residential homes with electric resistance zonal heating systems. The Northwest Ductless Heat Pump Pilot Project (pilot project) included marketing and implementation activities to coordinate installations of Ductless Heat Pumps (DHP) with Northwest utility programs.

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[1] The Northwest Energy Efficiency Alliance (NEEA) is a non-profit organization working to maximize energy efficiency to meet future energy needs in the Northwest. NEEA is supported by, and works in collaboration with, the Bonneville Power Administration, Energy Trust of Oregon and more than 100 Northwest utilities on behalf of more than 12 million energy consumers. See the website at www.neea.org.

This paper outlines the evolution of DHPs as an efficiency resource in the Northwest and summarizes the primary goals, objectives, and evaluation results of the pilot project. This paper focuses primarily on the findings and conclusions of the first three evaluation components: market progress and evaluation, lab testing and field metering. Billing and cost-effectiveness analyses are not summarized in this paper and are scheduled to be completed in the second half of 2012.

Evolution of DHPs as a Northwest Efficiency Resource

A key driver for NEEA's research of the DHP technology was the introduction of variable speed DHP technology with advanced individual controls into the United States market. Manufacturers' stated efficiency values indicated that this technology was a promising energy efficiency measure to displace the use of electric resistance space heaters in the Northwest.

In the summer of 2007, the Regional Technical Forum (RTF)[2], in coordination with NEEA and BPA, began the process of assessing the use of a modernized "mini-split" heat pump technology. These systems had long been used in East Asia and had a limited market in the Northwest in supplying heating, ventilation, and air-conditioning (HVAC) systems to small inconvenient zones in commercial building applications. Until 2006, these systems had been designed to provide spot cooling in individual zones, with very poor potential for any application that required heating.

Beginning in 2006, a new generation of this equipment was introduced. The upgrades were largely the result of the increases in Federal Standards for heat pumps and air conditioning introduced at the beginning of that year. Over the next year, several manufacturers introduced entirely redesigned systems focusing on inverter-driven variable-speed compressor technology and multi-speed fans. Like the previous generation of mini-splits, these systems used small wall-mounted air handlers with direct refrigerant supply from a compressor located outside. The system excelled at providing high-efficiency heating and cooling to a single zone or multiple zones through individual air handlers.

As the new generation of equipment was introduced, it was apparent that this equipment would be substantially more efficient than conventional split-system heat pumps with central air handlers and a central ducting system. Moreover, such systems were low enough in cost and were flexible enough to be considered as a measure to offset electric resistance zonal heating systems, which are not easily retrofitted with ducting systems.

The RTF reviewed a provisional measure using these new technologies. At that point, the measure was renamed DHP. The RTF used several assumptions to make preliminary savings estimates:

- The equipment would be installed in main living zones without actually replacing the existing electric heating. This approach became known as the "displacement" heating model.

[2] The Regional Technical Forum (RTF) is an advisory committee established in 1999 to develop standards to verify and evaluate energy conservation savings in the Northwest. See http://www.nwcouncil.org/energy/rtf/about.htm for more information on the RTF.

- Occupants would usually select this heating source over their existing system because of its efficiency and convenience.
- The DHP would provide up to 60% of the space heat and result in a 30–40% reduction in space heating energy requirements.
- Interaction with wood and other supplemental heating would be minimized by restricting the measure to homes that do not use substantial amounts of wood heat.
- Mechanical cooling usage, especially in the region's western climates, would not be large enough to offset the heating benefits in these climates and may provide added cooling benefits in the eastern climates with larger cooling loads.
- The systems could be delivered in any climate in the Northwest, although there was some concern that the DHP technology might not perform in the coldest climate zones. The displacement model was thought to mitigate the risk associated with this scenario.

In addition, to deliver a cost-effective DHP measure, the systems were thought to be optimized with a single outdoor compressor and one or two indoor air handlers. This configuration represents a relatively low-cost approach to supply the needs of a major portion of the heating load without actually requiring the introduction of a full distribution system that serves several zones.

In November 2007, based on these assumptions, the RTF approved a provisional savings and cost/benefit analysis that suggested that a system could be designed to provide cost-effective regional efficiency resources. The RTF provisional savings was estimated at approximately 3,500 kWh per year with an incremental cost of about $4,000 (RTF 2010).

A major focus of the pilot project and evaluation is to validate the RTF provisional savings estimate by understanding the impact of the DHP technology as a retrofit in existing single-family residences using electric resistance zonal heaters as their primary heat source. The goals of this research were designed to serve as both a framework for the evaluation of an emerging technology and as a basis for defining the impact of this technology on the energy efficiency resource goals of the Northwest utilities. To accomplish these diverse objectives NEEA has conducted a simultaneous pilot market acceptance and performance evaluation of a one-year implementation of a DHP installation program. Both efforts are essential for the development of an emerging technology into a cost-effective efficiency resource.

Pilot Project and Evaluation Goals

The primary target market for the pilot project consisted of single-family, site-built homes using electric resistance zonal heating systems as the primary source of heat. NEEA program staff estimate there are approximately 535,000 homes in the Northwest in the target market. The secondary target market for the pilot project includes single-family, site-built homes using central forced-air electric furnaces (593,000) and manufactured homes using central forced-air electric systems (385,000). Altogether, NEEA program staff estimate there are approximately 1.5 million single-family homes potentially eligible for the DHP measure. Only the first group was targeted in this pilot project and evaluation.

The vision for the pilot project included electric resistance heaters remaining in place for the occupant to use as needed. The DHP was also to be installed in the main living areas of the home and would "displace" the need for heat from the existing electric resistance heat in those zones. The energy savings theory assumed that, on average, occupants keep the main living area warmer than bedrooms, so the main living area requires the most heating energy throughout the season. On mild winter days, bedrooms and other cooler rooms are likely to receive most or all of their heating needs via heat transferred from the warmer main living area. As a result, the heating system in the main living area acts as the primary heat source throughout most of the heating season. The pilot project estimated that if the occupants use the more efficient heat pump to provide this heat, rather than the electric resistance heaters, energy savings will occur.

The principal goal of the pilot project was to show that DHPs could interact with the homes of individual owners and provide savings that justify the relatively significant cost of adding a split system to an individual, zonal electrically heated house. The objectives of the pilot project included:

- Demonstrating the use of inverter-driven ductless heat pumps (DHPs) to displace electric resistance space heat in existing Northwest homes
- Supporting evaluation efforts to document pilot project implementation and determine the costs and potential energy savings of ductless heat pumps in this application
- Examining non-energy benefits and potential barriers to large scale implementation of DHPs
- Building a regional infrastructure to sustain and accelerate market growth

The pilot project implementation ran from October 2008 to December 2009. Ecotope, supported by Research Into Action, Inc. and Stellar Processes, is conducting the DHP Pilot Project Impact and Process Evaluation from February 2009 to December 2012. Five research tiers were specified in this evaluation:

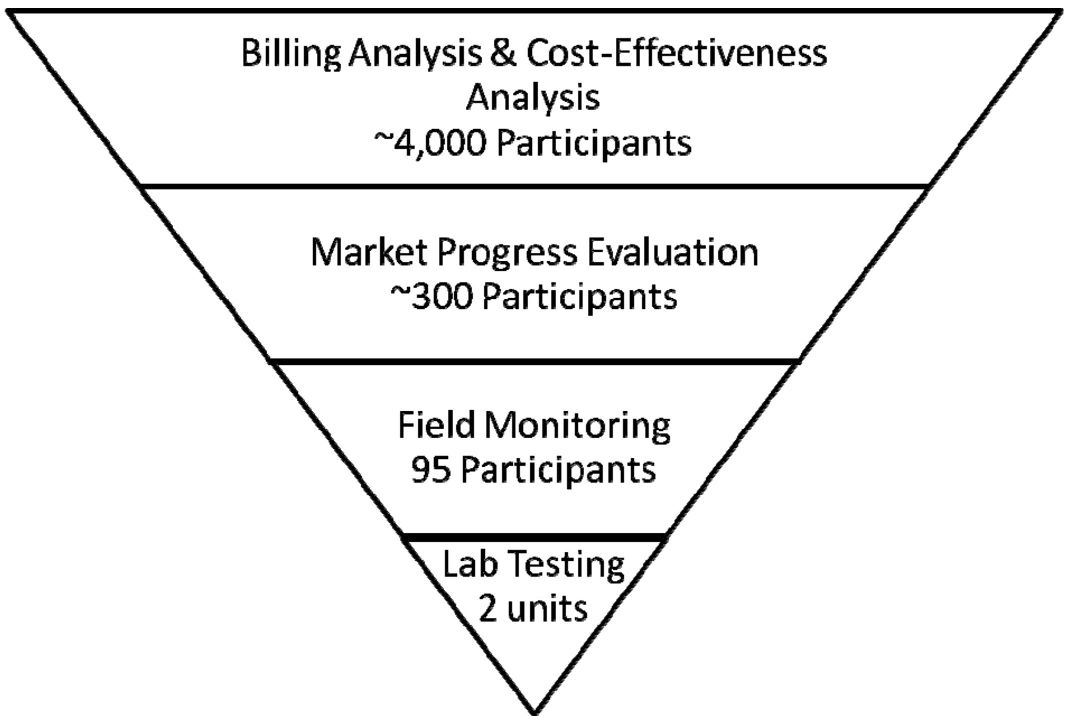
- **Market Progress Evaluation.** Assessment of pilot project participants' use of DHPs, their use of other heating and cooling equipment, and their satisfaction with the DHPs. The market progress evaluation also reported on the evolving experiences and perspectives of manufacturers, utilities, and NEEA, as well as those of program implementation staff and their opinions about the suitability of DHPs as an efficiency measure in markets other than those targeted by the pilot. The evaluation explored responses to the technology and pilot, and intentions to install DHPs among participating and nonparticipating installers (McRae et al. 2011).
- **Lab Testing and Analysis.** Detailed laboratory testing to establish the efficiency of the DHP technology. The lab testing sought to establish the efficiency and performance of the equipment at various outside temperatures (Larson et al. 2011). DHP lab performance was compared to *in-situ* metered performance.
- **Field Metering and Analysis.** Detailed metering of the equipment installed in 95 single-family homes throughout the Northwest. This effort was meant to establish the determinants of consumption and energy savings as these systems operate across a variety of climates (Ecotope, Inc. 2012). Performance curves developed in the lab testing phase were used to calibrate simulation models used for the field data analysis.
- **Billing Analysis.** An impact analysis using the results of the billing changes in the customers using the DHP. This analysis will be conducted on the total population of pilot project participants (3,899) across the region and is meant to capture the overall impacts of DHP use. The billing analysis will be conducted in 2012. Key program design insights

attained during the field data analysis will inform the development of refined billing analysis research questions.

- **Cost-Effectiveness Analysis.** An analysis that integrates the impact evaluations with costs collected from installation intake forms, the process interviews and the program reviews. The cost-effectiveness analysis will be conducted in 2012.

The following figure illustrates the tiered nature of the DHP evaluation:

Figure 1. Research Tiers in the DHP Impact and Process Evaluation



Market Progress and Evaluation

This portion of the research focused on customer acceptance and market acceptance of the DHP technology. The market progress and evaluation of the pilot project was implemented by Research Into Action, Inc. The evaluation consisted of two market progress and evaluation reports (MPER) broken up into two "waves" of interviews. This section summarizes the pilot project's accomplishments both during and one year after the pilot project implementation period.

The Wave 1 interviews were conducted for the first-year MPER (McCrae et al. 2010) and reported on participants' reasons for installing a DHP, satisfaction with the DHP and program processes, use of heating and cooling equipment prior to installation of the DHP, and intended use of the DHP. It also reported on: the activities of manufacturers in support of the pilot, DHP installers' experiences with the pilot project and the technology, and activities and experiences of utilities participating in the pilot project, as well as those of the NEEA and program implementation staff.

The Wave 2 interviews were conducted for second-year MPER (McCrae et al. 2011) and reported on participants' use of DHPs over the prior year, use of other heating and cooling equipment, and their longer-term satisfaction with the DHP. It reports on the evolving experiences and perspectives of manufacturers, utilities, and NEEA, as well as those of program implementation staff and their opinions about the suitability of DHPs as an efficiency measure in markets other than those targeted by the pilot. The MPER also explores responses to the technology and the pilot, and intentions to install DHPs among nonparticipating installers.

For the second-year MPER, Research Into Action conducted follow-up surveys with 223 consumers who had installed DHPs during the pilot, 192 of whom were surveyed for the first MPER. They also surveyed 15 nonparticipating installers, and conducted follow-up in-depth interviews with three NEEA staff, three staff of the pilot project implementation contractor, and 20 staff of utilities and energy agencies that offered their customers incentives for DHPs through the pilot project.

The two waves of market progress research showed that NEEA has made substantial progress in attaining its goals and objectives for the pilot project. By directly intervening with market actors, the pilot appears to be effective in strengthening DHP marketing, training, and distribution networks, and in increasing consumer awareness of DHPs. By offering an incentive on DHP installations, utilities overcame many participants' first-cost hurdle for DHP installation – persuading them to participate in the pilot project.

Key MPER findings:

- **The pilot project has been very successful creating consumer interest in and demand for a previously unknown technology.** Consumer satisfaction is very high. Throughout all stages of the project, participants have embraced the DHP technology. Participants reported high levels of satisfaction with the performance, effectiveness, and operating costs of the DHP. Participants spoke enthusiastically about the increased comfort that the DHP has brought to their homes. While most of the participants had never heard of DHPs before the onset of the pilot, they have since become strong advocates for DHP technology. Word-of-mouth has proven to be a powerful method of disseminating information and promoting the DHP. The performance of the technology speaks for itself and participants continue to recommend the technology to others.
- **NEEA is attaining its goals and objectives for the Northwest Ductless Heat Pump Pilot Project.** By directly interacting with the supply-side of the market, the pilot project appears have strengthened DHP training, marketing, and distribution networks, and increasing consumer awareness of DHPs. By offering incentives for qualifying DHP installations, utilities overcame many participants' first-cost hurdle for DHP installation.
- **Many supply-side actors evidence some lack of understanding of or appreciation for the intended DHP target market and role of displacement theory.** Many installers and distributors report promoting multi-zone systems because they are more profitable or sought to use DHPs to provide heating throughout the house. These comments implicitly convey a belief that the single-zone market is smaller or less attractive. Nonparticipating installers are interested in installing DHPs through the program, but do not understand how to turn the pilot project requirements into selling points. In contrast, the most successful installers, interviewed MPER #1, reported that the pilot project opened up new markets to them. They perceived that the pilot project gave them new customers who they could now target with the intention of displacing the heating source in the customers' primary zone of occupancy.

- **Although the pilot project has effectively engaged DHP manufacturers and distributors, their objectives are not fully in line with those of the project.** Manufacturers and distributors are happy to have new and expanded markets for DHPs, yet they have no particular interest in displacing electrical load in the target market. The manufacturers and distributors are interested in pushing higher end and multi-headed units, and entering markets not relevant to NEEA's goals.
- **Rural nonparticipating installers indicated difficulty getting attention from distributors** who are more interested in working with installers the distributors characterized as installing higher volumes of systems and the more profitable multi-zone systems. Interview findings suggest a willing HVAC installation force exists that can be mobilized to install DHPs.

Note that these MPER findings relate to the initial DHP pilot project and may not reflect the current effort. The results of the first-year and second-year MPERs were released in March 2010 and July 2011 respectively. The pilot phase of the project ended in December 2009 and the pilot project transitioned to a regional program (Northwest Ductless Heat Pump Initiative). The program implementation team was able to apply key MPER findings to the ongoing refinement of the regional initiative.

Lab Testing and Analysis

As an integral part of the DHP evaluation, Ecotope carried out an extensive laboratory analysis of performance of two manufactures. The equipment to test was selected in conjunction with NEEA and other regional stakeholders. The priorities in selecting the equipment models included: frequency of occurrence of the specific model in the field, number of similar models installed in the field, range of HSPF/SEER ratings, age of model, and the number of field sites installed with the detailed instrumentation (*in situ* COP testing) package.

The lab evaluation was designed to develop a detailed understanding of DHP performance for use in simulation tools and to support the field metering and subsequent data analysis of DHPs installed in homes. The work described here was used to inform metering results from the field installations.

Like all heat pumps, single point ratings of performance are published following guidelines specified by the Department of Energy (DOE) and Air-Conditioning Heating and Refrigeration Institute (AHRI). The rating points, such as the heating seasonal performance factor (HSPF) and seasonal energy efficiency ratio (SEER) depend on a single curve describing the performance of the equipment over a temperature range which is essentially continuous and predictable. For conventional split system heat pumps the single rating point is marginal, at best, for determining energy use (Francisco et al. 2004). Likewise, although the AHRI standard (AHRI 210/240-2008) has specific tests for variable speed equipment, early observations indicated that the ratings do not measure well the equipment response to changing control signals (Davis 2009). Moreover, existing field tests indicate DHP technologies often perform better than the ratings suggest by optimizing the outputs and inputs to the current environmental conditions (Geraghty et al. 2009).

The efficiency and flexibility of the DHP systems stem from their ability to change thermal outputs and indoor fan flow in response to control signals from changing ambient conditions or the occupant. Therefore, a single rating point for variable speed DHPs can only represent a small fraction of the capable operational range. The lab testing and performance modeling of this pilot project seeks to better understand DHP operation and energy use with an eye toward characterizing its savings energy saving potential. In conjunction with NEEA, Ecotope established the following goals for the lab evaluation:

- Develop a performance map of the equipment at all temperature bins and operating modes while providing special focus to low temperature heating performance.
- Review standard ratings (AHRI 210/240) published by the manufactures and establish the relationship between the ratings at controlled test conditions and other tests at conditions more likely in the Northwest applications.
- Assess performance variation with various control strategies and operating modes.
- Conduct measurements to review and verify the data collected in the field metering, especially *in situ* coefficient of performance (COP) measurements. Ecotope installed a detailed metering package in more than 30 houses to directly measure equipment output capacity and input power to observe COP.
- Establish empirical performance curves to predict the efficiency and output of the equipment in energy simulations and other engineering calculations. The modeling capability will directly support regional energy planning efforts and conservation program design.

Key Lab Testing Findings

- **Measured Performance.** Both models exhibited highly efficient operation that was consistent with the manufacturer's specifications. Since these performance tests focused on a wide range of temperatures, the testing confirmed that the exceptionally high HSPF ratings were consistent with the observed performance in the laboratory setting.
- **Low Temperature Performance.** Both models continued to operate well in cold temperatures. COPs observed in temperature regimes below 0°F remained near 2.0. The equipment adjusts capacity to ensure that the delivery air temperature remains comfortable. Installers and home-owners should be made aware that the equipment will continue to run and provide benefits at cold temperatures so that energy savings can be maximized.
- **Laboratory and Field Measurement Comparison.** Comparison of the laboratory results and *in situ* field measurements of COP show excellent agreement with field performance. Both measurements provide a useful cross reference for each other. The two approaches are complementary. The lab data is collected in a stable, repeatable, and highly controllable situation; the field metering of COP shows which equipment operating modes are most common and therefore the most important parameters to be measured in the lab.
- **Performance Rating.** The testing standard and calculation procedure do not always produce ratings which characterize the overall performance of the equipment. Occupant interactions and the influence of other heating sources (e.g., electric zonal heaters, supplemental wood fuel, etc.) are largely responsible for the observed field savings. Performance curves (including capacity and input power over a range of compressor loadings) and descriptions of operational strategies will be useful but an updated testing procedure should include evaluation of changes in compressor speeds in response to

heating load. This would make these ratings more predictive of DHPs performance in actual operation.

Field Metering and Analysis

This section summarizes the DHP field metering effort (Ecotope, Inc. 2012). The overall DHP pilot project was built on a "displacement" model in which the DHP equipment was designed to supplement an existing zonal electric heating system. This model for the DHP pilot project leaves more of the occupant interaction to chance; i.e., the occupant is able to reset the equipment, adjust the thermostat remotely, and change the load on the equipment through the use of the electric resistance heating or a supplemental heating system. Detailed field metering was necessary to distinguish performance impacts related to occupant actions (e.g., thermostat adjustments) from those resulting from the efficiency and performance of the DHP equipment as installed by contractors under the pilot program.

Ecotope installed metering equipment on 95 homes selected from the participants in the DHP pilot project. The metered sites were analyzed to develop the determinants of energy savings of the DHP systems as they operated across a variety of climates and occupants. The results of the metering report will contribute to a more comprehensive understanding of DHP performance and applicability as an energy efficiency measure in the Northwest. The objectives of the DHP field metering were to:

- Describe the total energy use of the DHP as it operates in each home, including the effective heat output and the total heating energy required.
- Determine the total equipment cooling use across cooling climates throughout the region.
- Establish the offset to space heating brought on by this equipment and the energy cost-savings impact of the incremental cooling from the equipment.
- Develop the climate and occupancy parameters needed to explain the observed savings.
- Summarize the non-space heating energy uses across the monitored houses.

The DHP field metering site selection required that a sufficient number of homes be metered in most Northwest climates to allow a reliable assessment of the performance of the DHP equipment in the climates tested. The 95 metered sites were recruited from five climate "clusters." The savings identified in the metering analysis are characterized by these clusters, and are meant to characterize the distinctly separate climates that are represented by these geographic clusters.

To minimize the extent to which the analysis would be compromised by supplemental (non-electric) heating fuels that could not be directly measured, all potential metered sites were screened. The screening took the form of a variable base degree day (VBDD) assessment of the bills collected for the period before the installation of the DHP. This methodology allowed an assessment of the electric heating use of the home based on month-to-month changes in consumption predicted by outdoor temperature. The screening process had the effect of increasing the potential electric savings from the sample. The results from the metering should be generalized with care given the potential bias in the composition of the metered sample.

Key Field Metering Findings

Ecotope implemented two approaches to develop final savings estimates for the DHP metered sample:

1. **Total savings** indicated by overall net heat output of the DHP as measured by the metering (Table 1). This approach relies on the metered heating output of the DHP regardless of the other heating systems in the house. Ecotope used a COP estimate as well as the runtime and power draw of the equipment throughout the year to generate these savings estimates. In this calculation, the cooling impacts of the DHP are not taken into account.

Table 1. Total Savings, Metered

Cluster	Savings from COP (kWh/yr)		N
	Mean	SD	
Willamette	4148	2061	18
Puget Sound	3812	1981	19
Inland Empire	3264	1470	11
Boise/Twin	4184	1871	8
Eastern Idaho	3924	1767	9
Total	**3887**	**1844**	**65**

2. **Adjusted savings** are calculated from the change in space heat consumption between the pre-installation period and the metered space heat after the DHP is installed (Table 2). This approach is complicated by the uncertainty in the base case but includes occupant "take-backs" such as increased indoor temperature and reduced supplemental fuel use.

Table 2. Adjusted Heating Savings, Metered

Cluster	DHP Savings (kWh/yr)		N
	Mean	SD	
Willamette	3316	2121	26
Puget Sound	3043	2357	25
Inland Empire	1882	1580	16
Boise/Twin	3628	2985	16
Eastern Idaho	3307	3230	10
Average/Total	**3049**	**2424**	**93**

The ratio between the two saving calculations is about 80%. This suggests that almost 20% of the heat produced by the DHP is used to provide other benefits (beyond energy savings) to the occupant. The overall results provide a basis for estimating regional savings and for future program design.

The field metering tier of the evaluation also identified a number of important program implications. The analysis of the performance of the DHPs across the entire sample and the entire range of climates suggested several important components of a utility program that would support this technology:

- Pre-existing supplemental non-electric heat has little or no impact on DHP savings if the initial electric heat usage is strong.
- Occupants tended to increase their thermostat settings in the DHP zones which had a small but consistent impact on overall savings (10% of measures savings).
- The DHP offsets a fairly uniform amount of electric resistance heat regardless of the heat loss characteristics or size of the home.
- In colder climates the addition of a second indoor air handler (head) improves the savings from the system. The effect is much smaller in warmer regions.
- In no climate did the overall cooling use from the DHP approach the levels of heating savings. In general, the cooling effects in all Northwest climates were negligible and probably offset by pre-existing cooling usage.
- Consistent with the findings of the MPER interviews, the occupant acceptance of this equipment within the group of metered sites is quite good. Most occupants are enthusiastic about the improvement in comfort and space heat efficiency.

Evaluation Conclusions and Next Steps

The results of the research conducted in these three evaluation tiers are that the DHP is a very successful technology when applied to homes heated with zonal electric heating systems. The implications for utility programs are that this technology can provide a significant energy conservation resource using a "displacement model." While occupants should have the option of installing larger systems, the smaller more targeted system produced desirable savings numbers

The overall program implications suggest that this is an important and transformational technology which can appreciably offset electric space heating requirements in simple electric resistance systems without disrupting the existing heating system or underlying home structure. Within the specifications of the DHP products used for this pilot evaluation, the performance rating of this equipment is not as significant as the acceptance and use of the product by the customer. As a result, the technology is potentially very adaptable to a utility program with the goal of providing improved heating efficiency and savings resources. The one caveat is that the savings are strongly determined by the amount of pre-existing electric heating. Average savings of 33% were observed across the Northwest climates. Higher savings fractions were observed in the warmer milder climates and lower savings percentages were observed in the more severe heating climates.

The pilot project emphasis on installers as a delivery mechanism has been successful. The DHP pilot project provides an excellent model for the implementation and marketing of an emerging efficiency technology in the residential sector.

Upcoming DHP Impact and Process Evaluation research includes billing and cost-effectiveness analyses of the overall pilot project population (3,899 participants). The results of the first three evaluation tiers will inform the billing and cost-effectiveness analyses. The final savings estimates and cost inputs will be presented to the RTF in order to transition the provisional DHP measure[3] to an active Northwest efficiency measure.

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[3] For single-family, site-built homes using electric resistance zonal heating systems as the primary source of heat.

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