

THE NORTHWEST DUCTLESS HEAT PUMP DEMONSTRATION PROJECT

Project Implementation Document

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APPENDICIES:

Project Timeline – Delivered 8/19/08

Installation Flow Chart – Delivered 8/19/08

Section 1. Project Purpose and Overview

OVERALL PROJECT GOALS:

- To demonstrate the use of inverter-driven ductless heat pumps (“DHPs”) to displace electric resistance space heat in existing Northwest homes;
- To support evaluation efforts to document project implementation and determine the costs and potential energy savings of DHPs in this application. Market research elements of the evaluation will examine other non-energy benefits and potential barriers to large scale implementation of DHPs; and,
- To define the future of the DHP market and build an infrastructure to sustain and accelerate growth in the market.

IMPLEMENTATION:

1. **Administration.** The Northwest Energy Efficiency Alliance (“NEEA”) will administer the Northwest DHP Demonstration Project (“project”) on behalf of funding sponsors.
2. **Implementation.** Fluid Market Strategies, Inc. (“Fluid”) has been selected to provide implementation services including project design, development, marketing, installation verification, market and stakeholder coordination, and project reporting.
3. **Implementation Scope.** Bonneville Power Administration (“BPA”) has committed to a pilot project for up to 1,500 homes through September of 2009. Parallel efforts by the regional utilities are expected to supplement the commitment and grow the project scale by 1,000 units. It is anticipated that this portion of the Project will continue through December of 2009.
4. **Evaluation.** NEEA, on behalf of project sponsors will administer evaluation efforts intended to document and examine project implementation, and to help guide future ductless heat pump program design, implementation, energy savings estimation, and cost estimation efforts.

Section 2. Project Implementation Strategy

OBJECTIVES:

- To accomplish up to 2,500 quality installations of inverter-driven ductless heat pumps (“DHPs”) in existing homes with electric resistance space heat in the Northwest;
- To pave the way for future ductless heat pump programs by testing program designs and marketing messages, and by building an effective contractor and utility infrastructure to serve the market; and,
- To test and learn from high volume efforts in specific geographic areas.

IMPLEMENTATION:

1. **Regional Project.** The project will begin with a regional launch and roll-out. The regional roll-out will include core project implementation elements (project design, specifications, guidelines, administration, marketing, etc.) available to all sponsors. **Sponsors/utilities may access these core elements and pursue DHP installations at whatever level they choose.** The project will support active sponsors within the constraints of the project implementation budget and competing project needs.
2. **Project Forums.** The project will designate six locations across the region to host “face-to-face” project forums to support the initial implementation of the regional project. The six locations were selected based on geography, interest by sponsors, and accessibility. All sponsors/utilities can attend the forums to: inform the design and development of the project design; communicate initial interest and coordinate roll-out activities; and, communicate local market nuances to be addressed by the project. In addition to the six initial project forums, the project will work with BPA’s EERs and individual utilities to provide a “virtual” project forum with the more rural areas of the region. If useful, these project forums may be used to help guide the implementation of the project over time.
3. **High Volume Areas** After the regional project roll-out is underway, it is expected that several local markets will emerge as potential opportunities to demonstrate high volume implementation. High volume implementation areas will require: a commitment to promote and install a large number of DHPs; access to the distribution channel and a supportive contractor base sufficient to accomplish the high installation volume; and, program support such as local staff, advanced data and target marketing capabilities, and robust incentives.

Section 3. Project Evaluation Strategy

OBJECTIVES:

- Estimate potential energy savings of DHPs in existing single family homes with electric resistance zonal heating systems; and
- Examine measure costs, non-energy benefits, and cost-effectiveness of DHP units
- Understand customer satisfaction and develop recommendations for future program implementation strategies.

IMPLEMENTATION:

1. **Participant and Market Actor Surveys.** Through carefully designed and administered surveys, the Project plans to quantify customer and contractor satisfaction, perceptions, and behavior as well as participating utility satisfaction and recommendations for future offerings;
2. **Billing Analysis.** A billing analysis of each participant home's pre-installation and post-installation annual electricity consumption will be conducted to provide weather normalized estimates of the change in energy use due to installation of the DHPs;
3. **Field Study.** Electronic metering will be installed in about 120 homes to gather data on the energy use of the house, the DHP, the resistance heat, and the water heater, along with indoor and outdoor temperatures. Data will be collected for over a year and analyzed to take a quantitative approach to determining occupant interaction between the existing resistance heating system and the new DHP. Heating and cooling energy use will be assessed for the various housing types and climates; and,
4. **Laboratory Testing.** Lab testing will be conducted to provide detailed operating characteristics of DHPs. Comparison to manufacturer ratings will be made. Testing will consist of detailed monitoring of two ductless heat pumps (one single indoor type unit and one multi-indoor type unit) at multiple operating conditions.

Section 4. Target Homes and Participation Requirements

OBJECTIVES:

- To identify appropriate and potentially cost-effective DHP applications;
- To provide streamlined and effective project procedures that allow the project, utility-sponsors, and contractors in the field to verify consumer eligibility; and,
- To provide data and/or access to data to support project evaluation.

IMPLEMENTATION:

1. **Target home type.** Existing single-family homes using electric resistance zonal heating systems as their primary source of space heat will be the target market segment.¹
2. **Participation requirements.** To be eligible for participation, the home and/or the consumers must meet basic criteria as follows:²
 - Electric resistance zonal heating³ must be permanently installed and serve as the primary heating system for the home
 - The consumer must have occupied the home for at least the past year. (In addition, the consumer should expect to occupy the home for the next year.);
 - The consumer must allow their local utility to make their billing histories available;
 - The consumer must agree to participate in the project, project activities, and project evaluation;
 - Although the following may ultimately be good applications for DHPs, for the project, **participating homes cannot:**
 - be new construction or manufactured housing of any type nor;
 - have a fossil fuel heating central forced-air ducted or hydronic heating system nor
 - have natural gas service to the home; ,

¹ Program elements will not be developed to target multi-family housing. The program will support a multifamily project in the Puget Sound Area in order to gain qualitative evaluation information on activities in the multi-family market.

² Consumers will be required to sign to acknowledge their understanding of, acceptance of, and meeting of the eligibility requirements of the project under penalty implications. Contractors will be informed of penalties for misrepresenting consumer eligibility to the project.

³ such as baseboards, wall units, or ceiling cable heat

- If the home has a freestanding stove or a fireplace insert , the consumer will sign a paper participation form that the freestanding stove or fireplace insert is not used as a primary heat source.

Section 5. Incentives

OBJECTIVES:

- To address potential first cost barriers associated with DHPs;
- To provide a strong, easy-to-communicate stimulus to compel consumers to take action; and,
- To promote and provide access to a streamlined incentive that allows the project to launch quickly.

IMPLEMENTATION:

1. **Proposed (initial) project incentive.** A \$1,500 consumer rebate is proposed initially to provide a strong incentive and allow a quick project launch.
2. **Multi-zone DHP systems.** Multi-zone DHP systems are allowed in the project. However, the project incentive is per consumer/home and only one (e.g., \$1,500) incentive payment will be made regardless of how many indoor units are installed or how many zones are served.
3. **Incentive Processing.** The implementation team is not responsible for the processing of payments on incentives for utilities.
4. **Future incentive options.** Although there is interest in applying incentives “upstream” (e.g., buy-downs and other cooperative promotions), the development of such incentive strategies is likely to take more time than the project can afford given the delayed start and the implementation timeframe. Once the project and relationships with the manufacturers, distributors and contractors are solidified, creative incentive strategies and aggressive cooperative promotions will be pursued.
5. **Ancillary incentive strategies.** Utility financing programs and perhaps other forms of financing may be integrated in the incentive offer. Where applicable, energy tax credits will be integrated in the incentive offer.

Section 6. Project Marketing and Promotion

OBJECTIVES:

- To quickly establish and implement an effective project identity and marketing platform to:

- Provide a significant degree of regional consistency while allowing various local market nuances to be addressed; and,
 - Foster the development of simple and effective messages and promotions that communicate the benefits of this somewhat complex technology and application to consumers.
- To implement various marketing and outreach strategies and assess their relative effectiveness and potential for future large scale implementation; and,
 - To enlist a sufficient number of consumers with appropriate DHP applications to meet project goals and objectives.

IMPLEMENTATION:

1. **Project identity and marketing platform.** The program team will develop or integrate an existing identity and marketing platform to ease regional consistency of messaging and adoption of DHPs.
2. **Identifying and targeting customers with electric resistance heat.** The project will rely on utility-sponsors to assist with the identification of targeted customers. This assistance could be in the form of analyses of their customer base and billing histories and/or records for participation in weatherization and efficiency programs such as Super GOOD CENTS. High bill complaints may be another source of project leads. The utility-sponsors may also be aware of “Gold Medallion” neighborhoods (i.e., known concentrations of single family electric resistance heat homes).
3. **Customer outreach and enlistment.** Multiple strategies will be used depending on the interests of the local utility-sponsors. Public relations campaigns and advertising will be used in high volume areas. Bill stuffers and direct mail pieces will be developed for use by utility-sponsors. Follow-up telemarketing resources may also be developed by the project. Neighborhood canvassing/blitzes and various types of open house/information/sign-up events may also be developed and employed. Marketing strategies and materials will also be developed for contractors along with contractor-driven consumer enlistment mechanisms. Materials developed for High Volume Areas will be available to everyone in the region.
4. **Project website.** A project website will be established. Initially, the website will serve to provide utility-sponsors and industry partners access to project information and materials that could include access to FAQ, additional participant screening tools, product and application information, testimonials and other promotion oriented pieces. The project does not currently have the funding to launch and support a consumer-facing website.

Section 7. Eligible Technology

OBJECTIVES:

- To ensure DHP products installed through the project are among the best available and are well supported by the distribution channel in the Northwest; and,
- To provide a simple, easy to maintain mechanism for determining the eligibility of products.

IMPLEMENTATION:

1. **Qualifying DHP equipment.** To be eligible for incentives, DHP systems installed through the project must:
 - be a 208-230V powered split system heat pump employing inverter-driven, variable speed compressors, variable speed outdoor fans, and multi-speed or variable speed indoor blowers;
 - use R410a refrigerant;
 - not employ integrated electric resistance back up; and,
 - be listed (or submitted for listing) in the ARI directory.

To facilitate the equipment selection process by contractors and consumers, the project will maintain a list of preferred equipment (brands and models) for use by utilities, industry and consumers. Preferred is defined as meeting the above requirements as well as having local distribution channel support. The most up-to-date list will be available on the project website.

Section 8. DHP Application Guidelines

OBJECTIVES:

- To facilitate installation of DHPs in a manner that achieves cost-effective energy savings; and,
- To foster DHP applications that lead to consumer satisfaction with DHPs.

IMPLEMENTATION:

1. **System configuration.** Qualifying DHP equipment for the project will include both single-zone systems and multi-zone systems. However, in the interest of cost-effectiveness, the project will actively promote the installation of single-zone systems.

2. **Location of indoor unit(s).** For the project, the DHP system must be installed with the indoor unit in the main living area of the house (i.e., the “primary zone”⁴). Within the primary zone, the unit should be located to maximize the displacement of electric resistance heat through the primary zone and any “secondary zones”⁵. Home owners may have additional indoor units installed throughout the house, but will not receive additional incentives for doing so (please refer to Section 5: Incentives).
3. **System sizing.** The DHP inverter technology provides significant system sizing flexibility. Therefore, the project is not making absolute sizing recommendations. Sizing considerations will be discussed during manufacturer trainings and contractor orientation.

Section 9. Contractor Expectations and Support

OBJECTIVES:

- To identify contractors that possess the technical and business characteristics to contribute to the success of the project;
- To provide HVAC contractors with an understanding of the basis of the project, these applications, and what is in it for them (new market and increased profits); and,
- To ensure HVAC contractors are trained in the technical nuances of installing DHPs correctly and install accordingly.

IMPLEMENTATION:

1. **Contractor participation requirements.** In addition to meeting jurisdictional regulations and any local utility program requirements, contractors must also attend a NW DHP Demonstration Project orientation. Orientation will cover the purpose and key elements of the project, and will discuss the short-term and longer-term opportunities for contractors. Project implementation procedures and expectations regarding eligible products, installer performance, quality assurance, and incentive payments will be outlined.
2. **Additional Contractor requirements.** Contractors must have successfully completed manufacturer sponsored installation and service training for the specific equipment being installed. Installers are expected to ensure that project DHP installations are completed consistent with manufacturer installation instructions and best practice industry standards including:

⁴ Primary Zone is defined as some combination of living/family room, dining room, and kitchen. A house’s primary zone is determined by its floorplan.

⁵ Secondary Zones are defined as areas of the house connected to the primary zone by open hallways and/or open doorways. Secondary zones are determined by both floorplan and homeowner behavior.

- using gauges, hoses, fittings and oils specifically designed for (and only used for) R410a refrigerant based systems;
 - constructing flare connections suitable for use with R410a according to the manufacturer's specification and instructions including flare sizing and tightening torque;
 - performing nitrogen pressure testing and/or other approved method for determining the reliability of the refrigeration lines to hold refrigerant without leaking;
 - evacuating/dehydrating the refrigerant lines to below 500 microns or as specified by the manufacturer;
 - supplementing the refrigerant charge by electronic weigh-in for refrigerant line length beyond that prescribed for factory charge; and,
 - performing start up, testing and commissioning procedures as specified by the manufacturer.
3. **Contractor support.** The project will coordinate with the technical support and warranty functions provided by manufacturers and use project leverage to advocate for contractors when appropriate. The project will also provide mid-project technical updates to share best practice sales and installation information.

Section 10. Manufacturer/Distributor Expectations and Support

OBJECTIVES:

- To engage the DHP industry (manufacturers, distributors, and contractors) and to create cooperative relationships and leverage resources to support the project.

IMPLEMENTATION:

1. **Pre-launch roundtables.** Project implementation staff will schedule a meeting with manufacture/distributor teams to discuss the project, seek project design input, and begin to explore cooperative relationships and promotions.
2. **Qualifying DHP models.** Manufacturers may be asked to provide product specifications, performance documentation, and other information as requested by the project.
3. **Distribution channel support.** The project will review each manufacturer's Northwest distribution channel structure. For qualifying DHP models, it is expected that distribution channel will ensure that:

- qualifying DHP models will be inventoried and available without interruption through stocking distributors in the Northwest; and,
 - order and delivery timeframes of qualifying DHP models and replacement parts are within industry norms.
4. **Installation and service training and support.** Manufacturers and their representative distributors are expected to provide:
- a high quality installation and service training program that is available and accessible by HVAC contractors in the Northwest; and,
 - a responsive technical service mechanism to assist project contractors and installers with DHP troubleshooting, service and warranty claim support.

Section 11. Installation Verification and Quality Assurance

OBJECTIVES:

- To verify appropriate DHP applications and installations according to the expectations and requirements of the project;
- To provide near term feedback to contractors regarding poor quality and best practices; and,
- To supplement the collection of routine project data to support evaluation efforts.

IMPLEMENTATION:

1. **Basic job file and contractor documentation review.** All job files and submitted paper work will be reviewed for completeness and correctness. The focus will be on home/customer eligibility and contractor/installation documentation. Specifically, the project staff will review the following documentation to identify issues or patterns of concern:
 - Installation Documentation
 - System manufacturer, model number
 - Outdoor unit(s) location
 - Indoor unit(s) location
 - Lineset size(s) and approximate length(s)
 - Quantity of supplemental refrigerant charge
 - House Characteristics Documentation
 - Square footage
 - Number of Bedrooms
 - Existing heating system type
 - Supplemental heating system, if any

- Existing cooling system type, if any
- Receipt of signed homeowner agreement
 - Agree to release electric utility bills information to project
 - Certify they have lived in house for at least 1 year prior
 - Certify that they plan to live in the house for at least 2 more years

The project will not clear incentive payment until documentation is complete and correct. Concerns related to contractor performance will be submitted to the field verification staff to examine on-site.

2. **Onsite installation verification plan.** Onsite inspections will verify the system meets project standards, including installation quality, DHP model, indoor unit location, and that the home has electric resistance heat and meets project eligibility guidelines. Systems will be chosen for onsite inspection based on the number of completed installations by contractor. Inspection frequency will be high with the contractor’s first installations and the frequency will diminish as the contractor successfully completes more installations. Upon completion of a “trigger” DHP⁶, the project will review a “randomly” chosen installation from the most recent batch of installations for onsite inspection. The project may inspect more often without notice to contractors. This increased inspection may be the result of a utility concern or other factor. Contractors with an unsuccessful onsite inspection, as defined by the project⁷, will receive an additional inspection upon completion of the next three installations. Subject to homeowner availability, inspections will take place within 30 days⁸ of completion of the “trigger” DHP. The project anticipates some local utilities and contractors will be interested in participating in the onsite inspections in one way or another; the project plans to accommodate these wishes.

Section 12. Installation and Consumer Data Requirements

OBJECTIVES:

- To document DHP installations and project activities, and support project management, reporting, and verification; and,
- To support regional evaluation efforts.

⁶ The “trigger” DHP’s are defined as a contractor’s 3rd, 7th, 15th, 25th, 40th, and so on (in increments of 15). For active contractors, this amounts to a sliding scale inspection rate of 33% to approximately 7% of installations, depending on the contractor’s number of installations. Contractors who do not install more than 2 systems will likely not receive onsite inspections. The project inspection rate is subject to change.

⁷ The project will take into consideration the performance of all contractors in determining the definition of an unsuccessful onsite inspection.

⁸ In rural areas, to maximize cost-efficiency, the project may take longer than thirty days to perform a due onsite inspection.

IMPLEMENTATION:

1. **Develop and maintain project tracking system.** The project will maintain a project tracking system. For each home, the database will include fields for the following information:
 - *consumer name, phone numbers, email, and unique project ID;*
 - *electric utility name, and account number;*
 - *home address, number of stories, foundation type, vintage, square footage, and number of bedrooms;*
 - *number of occupants age 18 and younger, 19 to 64, and 65 and older;*
 - *existing heating system type;*
 - *type of secondary heating system, if any;*
 - *type of air-conditioning system(s), if any and number of window air-conditioners;*
 - *comment on whether the home is/should be eligible;*
 - *date of installation;*
 - *name of contractor and HVAC technician/installer;*
 - *sizes/model numbers of DHP(s) installed;*
 - *location of indoor unit(s) and approximate square footage of zone(s) served;*
 - *lineset size, length, refrigerant added, and any documentation of refrigerant trim;*
 - *date of onsite inspection and inspection notes;*
 - *system installed cost, equipment cost, labor cost, and other cost; and,*
 - *date of inspection and inspection notes.*

Missing data in key implementation-related or evaluation-related fields will result in a trigger to follow up with the source of the data (noted in *italics*).

2. **Reporting.** The project will provide a monthly summary to NEEA showing the number of units installed through the program by local utility service territory. These reports will also address progress toward the objectives, opportunities and achievements. Other reports will be made available as necessary, at the request of NEEA or project sponsors.
3. **Evaluation.** The project database will be made available to NEEA for use in its evaluation effort.