Technology Innovation Project *Project Brief*

TIP 326: Combined Space and Water CO_2 Heat Pump System Performance Research

Context

Combined space and water heating systems using CO_2 refrigerant are an emerging technology that is farther back on the development curve than CO_2 HPWHs. Based on the lab and field performance research done on CO_2 refrigerant HPWHs, combined systems using the split system technology appear to be a good fit for highly energy efficient homes that are the policy goal in Washington State and a popular voluntary standard throughout the Pacific Northwest.

Description

This research project will conduct lab and field tests on a prototype combined space and water heat pump system using carbon dioxide (CO_2) refrigerant. Six of the units will be installed in energy efficient homes built under NEEA's b.

The lab tests will determine the Coefficient of Performance (COP) of each function, the overall system performance and the interaction of the loads at various simulated outside air temperatures ranging from 0°F to 95°F. Results will be compared to previous lab tests of dedicated equipment.

The project partners have committed over $553,000 of match to support this research and will be directly engaged as part of an Advisory Task Force.

The overall tasks involved in this project are:

- Install prototype systems, develop field monitoring plan, and install monitoring equipment.
- Develop protocol for lab test.
- Conduct field study, analyze data, and report.
- Interview installers, builders and home occupants, analyze data, and report.
- Conduct lab tests, analyze data, and report.

Why It Matters

This project marries two cutting-edge applied research projects. The first is the exploration of the performance and demand response potential of split system, CO_2 refrigerant heat pump water heaters that the WSU Energy Program and its partners are doing under BPA sponsorship. The second is NEEA's Next Step Homes project to develop, implement and monitor a practical high performance standard with heating energy loads in the one kWh per square foot per year range.

Bringing prototypes of this technology to the region for lab and field testing provides crucial information supporting development of a commercially viable product. It will also give visibility to the concept that will encourage future development.

Goals and Objectives

The main goal of the project is to determine the performance of the prototype for both space and water heating through a wide range of temperatures and use patterns.

Secondary goals include exploring the interaction between space and water loads and the impact on system performance, as well as logistical findings such as HVAC installer, builder and home occupant response to the systems.

Deliverables

Project deliverables include:

- Lab test report, field test report and final project report;
- Presentations to BPA and NEEA about the project, its goals and findings;
- A peer-reviewed paper by the researchers.

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Project Start Date: October 1, 2014

Project End Date: September 30, 2016

Reports & References

Links

Funding

Total Project Cost:	$915,000
BPA Share:	$362,000
BPA FY2016 Budget:	$135,000

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Participating Organizations

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Puget Sound Energy
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Sanden International U.S.A. Inc.
Tacoma Power