(3) Residential Heat Pump and Air Conditioner Research, Demonstration and Deployment; Improving Pacific Northwest Utility and State HVAC Programs.
The project is focused on discovering the simplest means to diagnose and optimize the new generation of high performance heat pumps and air conditioners and to integrate these diagnostic and optimization tools into the energy efficiency programs operated by the SEOs and utilities of the Pacific Northwest.

Total project cost: $1,420,000
Funding request: $630,000
Project Lead: Idaho Department of Water Resources, Energy Division
Project Participants: Northwest Power and Conservation Cuncil, Bonneville Power Administration, Energy Trust of Oregon, Oregon Department of Energy, Washington State University Extension Service, Ecotope Inc., Stellar Processes, NEEA, NW Power and Conservation Council, Plus representative utilities

Start Date: March 23, 2006
End Date: March 23, 2008

Presentations/Publications
No publications based on or about the project were created or published during the quarter.

Patents
None.

Progress in Past Quarter and Current Status
During the time period beginning October 1, 2006 and ending December 31, 2006, the Energy Division accomplished the following.

Task 1. Develop and Implement Technical Advisory Group
Bob Davis, Dave Robison, and Ken Eklund presented the STAC field study results at the February 20, 2007 meeting of the Regional Technical Forum in Portland, Oregon. The primary findings presented were (1) that 2/3 of the systems initially had substantial installation problems that reduced performance 50 to 80%, and 2) field technicians failed to diagnose improperly installed or malfunctioning TXV in at least two of the six systems studied to date.

Ken Eklund presented the program design and preliminary findings at the ACI NW Conference in Portland, Oregon on February 21st.

In addition, Mike Lubliner is organizing a project presentation to the ASHRAE Technical Committee 6.3 on Small Forced Air Heating and Cooling Systems at the ASHRAE Summer Meeting in Long Beach, California, June 23 through 27th. Mike Lubliner, Working Group member from WSU Energy is chairman of TC 6.3's Research Subcommittee. The following papers are being planned:

1. Evaluation of Utility Heat Pump Programs and Research in the PNW (Baylon, Ecotope)
2. Case study evaluation of heat pump in-situ performance (Dave Robison, Stellar Processes)
3. Performance of air-source heat pumps in New England (John Proctor, Proctor Engineering)
4. Lab tests of charge and air-flow impacts on performance (Larry Palmiter, Ecotope)
5. Evaluation of energy use modeling associated with heat pump defrost (Danny Parker, FSEC)
6. Modeling issues associated with heat pump system heating

performance (Palmiter, Ecotope)

Task 2. Conduct Lab Testing of HP Systems

A new graduate student has been selected to conduct testing. Preliminary results show that training in the protocol is necessary. Unfortunately, Larry Palmiter is unable to travel to perform the training himself due to ill health.

Task 3. Develop and utilize enhanced modeling tools

A new front end for the SEEM model is now being developed by Tom Eckman at the Northwest Power and Conservation Council. It will use a user-friendly Excel spreadsheet to load information into the software. Programming of the latent load algorithms continues.

The SEEM model was used by WSU Energy in its comparison analysis of crawlspace modeling by Energy Gauge and Remrate. This work was performed by Larry Palmiter under a Building America grant for crawlspace study, but demonstrates the leveraging that this project is able to marshal in support of its goals. Larry Palmiter presented the findings of this study at the Building America expert meeting in Vancouver, Washington on February 22, 2007.

Task 4. Develop and Test Field Commissioning Protocol Tool

The Oregon Department of Energy presented the status of short-term monitoring rig to Oregon tax credit certified HVAC contractors at annual update training, got feedback on possible applications for tool.

Task 5. Perform Long Term Monitoring and use it to Verify/Beta Test Short Term Monitoring (STM)

1) Five monitoring sites were up and running during the quarter.
2) Monitoring results are posted at: http://www.ezsim.com/STAC/
3) As noted in the last report, the owner of the monitoring site in Bend, Oregon died in October. This site has been withdrawn and the monitoring equipment removed. The Oregon Department of Energy has found a replacement site and we are shifting funds to cover the cost. Monitoring equipment was installed at the site in March. The system is the same as at the Bend site, and is the only system in the study manufactured by this particular manufacturer, which is one of the three largest heat pump manufacturers.
4) Oregon Department of Energy staff visited Deer Island monitoring site, performed duct system testing with utility and HVAC contractor, found mouse nest in branch duct that blocked airflow and caused initial bad duct leakage test/lack of air flow to one register.
5) Of the 6 original systems, two are now performing very well, one performs very well in cooling but moderately well in heating due to excessive defrost energy use, two are performing below specifications despite complete reinstallation of one of them, and one is performing very poorly—this last system has been withdrawn from the study. The new site is performing quite well.

Status of Field Research to Date:

- Four of the seven sites had installation or commissioning errors that significantly decremented performance. This is consistent with the previous study done in Oregon and Washington on complicated heat pump systems. In other words, over half of systems have installation or commissioning errors that reduce performance 50 to 80%.

- Thermal expansion valve problems in the systems were undetected by the technicians, although they had a significant performance impact. We are considering adding temperature split measurement to the commissioning process in order to diagnose this problem.

NOTE: It would be very helpful if an extension could be granted to allow another full season of heating data to be gathered for all sites. This is particularly important for the Oregon site that will was brought online in March 2007.

Task 6. Develop HVAC Technician Training, Recruit Contractors, Train and Provide Technical Assistance, and Monitor Results

1) Idaho Energy Division staff began reviewing the current training used in the region for commissioning plus R410A training materials.
2) Oregon Department of Energy Staff presented project findings to date to Oregon tax credit certified HVAC contractors at annual update training sessions, solicited their help with developing potential changes to program that might help eliminate common installation problems, make good use of monitoring equip.

Task 7. Conduct Data on Cost of HVAC equipment and commissioning

The Oregon Department of Energy sorted its tax credit database for heat pump tax credit job cost and system information and shared it with WSU.

Task 8. Develop Final Report

No work was done on this task.

Task 9. Manage Project

All subcontracts are in place.

Plans for Next Quarter:

A meeting of the Project Group and Technical Advisory Group will be held in Portland, Oregon on May 23rd for project coordination. The Technical Advisory Group will also begin training curriculum review and develop the schedule for testing the training and short term monitoring. The Final Report outline will also be discussed and work outlined on its development.