Portland General Electric Company

DIRECT LOAD CONTROL PILOT
FOR
ELECTRIC WATER HEAT

Pilot Evaluation and

Impact Measurement

Revised: October 22, 2004

PGE Direct Load Control Pilot for Electric Water Heat

Pilot Evaluation and Impact Measurement

Forward to Revised Report

In December 2003, Portland General Electric (PGE) filed with the Oregon Public Utility Commission (OPUC) an evaluation report of its direct load control pilot for electric water heat, called "Direct Load Control Pilot for Electric Water Heat: Pilot Evaluation and Impact Measurement, issued December 30, 2003". Since that time, PGE rebuilt its demand side program measurement and evaluation model. The load data collected for the load control pilot was rerun through the new spreadsheet model and the results are reported here in the revised report.

There are three changes incorporated in the evaluation. The fundamental change in the methodology is a close adherence to the California Standard Practice Manual for measuring the Total Resource Cost (TRC) of demand side programs. PGE also revised its capacity values to reflect current market indicators for generating capacity, and also updated the values used for avoided T&D upgrades. Another major change was measuring the effectiveness of the program on a going forward basis that excluded costs for meters and meter installation.

The original analysis reported that the TRC benefit/cost ratio (B/C) was between 0.67 and 0.71, for 2-way communication capability. A benefit/cost ratio of 1.0 or greater is considered cost effective.

Under the revised calculation, the TRC is 0.50. The analysis excluded costs for meters and all meter installations, the costs for the switching equipment was reduced for 1-way communication, the costs for installation labor and permits were reduced for an assumption of bulk installations, costs for reprogramming the billing software were omitted, and there is no factor for free riders.

The analysis assumed that all direct load control customers were on the Time of Use (TOU) rate plan, and that curtailments were called during on-peak periods. Therefore, the TRC reflects price differences for curtailments during on-peak periods. The TRC does not change if there are no customers are on the TOU rate plan. Nor is there any change in TRC under critical peak price scenarios.

Executive Summary

On August 30, 2002, PGE filed Advice No. 02-14 with the OPUC to introduce a research pilot program for remotely controlling residential electric water heat load, under rate Schedule 8. The purposes of this pilot were to measure the load impact of turning off water heaters during peak hours, test customer acceptance of remote control of their water heater, determine the company's capability to control residential electric water heating systems, and estimate the feasibility of operating a full residential load control program in the future.

The water heat direct load control pilot was conducted with 81 participants during January and February 2003. A load control relay with a one-way paging device (receiver) was installed in each participant's home. Water heaters were shut off remotely (curtailed), using the paging system, for two hours each weekday morning over a period of 37 days. Participants could override the curtailment by logging into a secure web site via the Internet. Interval meter data and load control data were collected for analysis.

Key findings from the pilot include:

1. Residential customers, in general, accept and, in some cases welcome, remote control of their water heaters as long as the equipment and water temperature reductions are not noticeable.
    a. Participants generally did not notice any difference in availability of heated water with a two-hour morning curtailment.
    b. Customers did not override any curtailment event.
2. The average kW demand impact for the water heaters evaluated was in the range of 0.65 to 0.69 kW/node[1]. The kW demand impact should be used with caution because the sample group was small; however, the impact is in line with expected reductions from standard electric water heaters.

Table 1 - Demand Impact

	Low	High
Average demand impact/node	0.65 kW	0.69 kW

3. Preliminary benefit/cost analysis for a full program rollout similar to the pilot indicates a negative benefit of 0.50, considerably below the 1.0 breakeven point.

Table 2 - Benefit/Cost Ratio

	@ 0.67 kW
Benefit/Cost ratio	0.50

[1] The term "node" is used here to mean appliance or water heater. Only one water heater per residence was allowed for the pilot.

4. Customer participation requires careful screening and is limited by installation concerns or other at-site issues, such as remote communications limitations.

5. Remote load control equipment selection, installation, and back office support are critical to a successful mass market-level program. For a full program, significant oversight and planning is required.

Recommendations

Based on the results of the pilot and the analysis of potential costs of a full program rollout, there could be potential for a cost-effective residential water heater load control program if avoided costs increase. However, a full-scale pilot would be needed to verify several conditions and hypotheses raised.

If undertaken, a full-scale pilot should be designed to include any of the following:

- Measure kW reduction per node using high confidence methods
- Validate benefit/cost conclusions
- Verify reliability of reductions in both non-controlled and controlled environments
- Test actual marketing methods for recruitment
- Test internal capability to identify participants on CIS records
- Test non-directly controlled timers vs. directly controlled relays
- Test third party, turn key program operations
- Verify lack of requirement for monthly incentive

The report is presented in the following sections:

- Section 1. Pilot Overview
- Section 2. Pilot Process, Analysis, and Results
- Section 3. Measurement / Impact Evaluation and Results
- Section 4. Recommendations