Summary of 60-Day Notice: Ground Source Heat Pumps

Public Service Company of Colorado posts this 60-Day Notice in follow up to an item in Appendix A of the 2014 DSM Plan Stipulation and Settlement Agreement (Proceeding No. 13A-0773EG). Specifically, Appendix A of the Settlement Agreement requests that Public Service consider the following in preparation for the 2015/2016 DSM Plan:

Evaluate Ground-Source Heat Pumps as a potentially cost-effective measure for a commercial and industrial prescriptive program.

Ground-source heat pumps (GSHPs) use the constant temperature of the earth as the exchange medium instead of the outside air temperature to heat, cool, and, if so equipped, supply the building with hot water. There are horizontal, vertical, and pond/lake closed-loop GSHP system options, and open-loop GSHP options which can be used for residential or commercial and industrial (C&I) applications.¹

On May 8, 2014, the Company provided a presentation to the DSM Roundtable on: (1) the ground-source heat pump (GSHP) measure within Xcel Energy’s Residential Cooling Program in Minnesota, (2) the GSHP measure within Xcel Energy’s High Efficiency Air Conditioning (HEAC) product in Colorado, and (3) high level results of the Company’s analysis of GSHPs for the commercial market in Colorado. The content presented is located on slides 29-34: http://www.xcelenergy.com/staticfiles/xe/Marketing/Files/CO-DSM-05-08-2014-Meeting-Q1-2014-Presentation.pdf. During the Roundtable presentation, attendees from the Energy Efficiency Business Coalition (EEBC) committed to providing the Company additional cost information—critical to the cost-benefit analysis of GSHPs. This information was subsequently provided by EEBC, and this Notice serves to convey the results of the completed analysis, utilizing the information provided, and other resources. The Company also evaluated the potential for a prescriptive offering for residential GSHPs. While the approach to the analysis is largely the same for each market sector, the inputs to the analysis differ in that residential applications of the technology are more consistent from customer to customer because the use of the buildings, and heating and cooling loads, are similar. In contrast (C&I) applications can vary significantly from customer to customer based on building occupancy, building design, and the operation of the building or industrial process. In addition, C&I projects tend to be much larger than residential projects, increasing the consequences if the projects don’t match the forecasted average project. The results of these evaluations are described below.

1. Analysis of GSHP for C&I Applications in Colorado
The Company utilized the results of GSHP measures that have been reviewed through existing DSM product applications for C&I customers, and data from EEBC, to evaluate the potential for a separate GSHP prescriptive business product.

¹ More information on GSHPs can be found on the U.S. Department of Energy’s website, here: http://energy.gov/energysaver/articles/geothermal-heat-pumps.
a. Existing Commercial GSHP Measure Rebates
The Company currently has two pathways for commercial and industrial GSHPs to receive rebates, via our Custom Efficiency and New Construction DSM products. Few GSHP measures have been proposed by customers through these existing pathways during the past six years.

b. Analysis of Proposed Prescriptive GSHP Product for C&I
The request within the Settlement Agreement was to evaluate whether a separate prescriptive product for GSHPs would be cost-effective on its own.

Only one of the GSHP projects evaluated through the Custom Efficiency product over the past six years was found to be cost-effective. If 2015 avoided cost assumptions are applied to that project’s technical assumptions, and zero Administrative costs are assumed, the project would yield a Modified Total Resource Cost (MTRC) test ratio of 1.03. The addition of any Administrative cost (to market and promote a GSHP product) would make this one cost-effective measure fail the MTRC. Furthermore, the project was not implemented within the PSCo business customer market; it was proposed for a Minnesota customer, where electric resistance heat is used as the baseline condition. There are very few, if any, business customers in the PSCo service territory that use electric resistance heat.

A small number of GSHP projects evaluated through the New Construction product were found to be cost-effective when bundled as a package with non-GSHP measures, and where a standard efficiency GSHP was used as the baseline condition. The majority of projects using GSHP were non-cost-effective given baseline conditions of a standard efficiency GSHP or a natural gas-heated unit.

The Company has not evaluated GSHP displacement of commercial electric heating units because commercial customers using electric heating are an insignificant portion of the PSCo customer base.

Summary of primary variables impacting GSHP cost-effectiveness:
- **Baseline Unit /Fuel:** The baseline fuel and unit affects not only the baseline capital cost to the customer; it also impacts the operating cost savings to the customer and the avoided cost savings to the overall system. The effect of the a low baseline fuel cost, such as today’s cost of natural gas, reduces the economic savings available to pay for the increased cost of the efficient equipment, both for the customer and for the system overall.

- **Incremental Capital Cost:** The incremental capital cost is the cost difference between the proposed efficient equipment and the baseline equipment. The higher the cost of the efficient equipment and the lower the cost of the baseline equipment the higher the incremental capital cost. Higher incremental capital costs require higher energy savings to cover that cost differential. When the incremental cost is high and the baseline fuel cost—also known as an “avoided cost”—is low it can be mathematically impossible to create a cost-effective offering.
2. **Analysis of GSHPs for Residential Applications in Colorado**

The Company continues to offer residential rebates for GSHP measures under the HEAC product. Using data from completed residential GSHP projects, coupled with data from EEBC, the Company evaluated the potential for a separate GSHP prescriptive residential product.

*a. Existing Residential GSHP Measure Rebates*

The Company currently offers GSHP rebates for residential applications in new and existing homes within the Company’s HEAC product, using a baseline condition of either a standard-efficiency Air Source Heat Pump (ASHP) or an electric resistance heating system compared to an energy-efficient GSHP. The GSHP measure rebate offering, as shown below, is continued within the Company’s filed 2015/2016 DSM Plan:

<table>
<thead>
<tr>
<th>GSHP Measures</th>
<th>Baseline Product &amp; Rating</th>
<th>Rebate Amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of new GSHP 6 T, 14.1 EER in a NEW HOME (3220 Sq.Ft) for COOLING</td>
<td>6 T, 13 SEER ASHP with 2.5 Ton load</td>
<td>$750</td>
</tr>
<tr>
<td>Installation of new GSHP 3.4 T, 14.1 EER in an EXISTING HOME (1440 Sq. Ft.) for COOLING</td>
<td>2.16 T, 13 SEER AC with 2.0 Ton load</td>
<td>$600</td>
</tr>
<tr>
<td>Installation of new GSHP 6 T, 3.3 COP in a NEW HOME (3220 Sq.Ft) for HEATING</td>
<td>6 T, 13 SEER ASHP</td>
<td>$1,800</td>
</tr>
<tr>
<td>Installation of new GSHP 3.4 T, 3.3 COP in an EXISTING HOME (1440 Sq. Ft.) for HEATING</td>
<td>Installation of ducted electric resistance heating</td>
<td>$1,020</td>
</tr>
</tbody>
</table>

*b. Analysis of Proposed Prescriptive Residential GSHP Product*

The Company used cost and energy savings inputs provided by EEBC members to conduct this analysis. For purposes of the analysis, in cases where the energy savings assumptions provided by EEBC differed from the assumptions used in the Company’s existing GSHP measure offering, the Company utilized the assumptions that were most advantageous to the measure in terms of supporting cost-effectiveness. For example, the operating hours used by Public Service for the existing GSHP measure are lower in the heating mode than the operating hours provided by the EEBC, so Public Service used the higher heating hours provided by the EEBC. In cooling mode the situation is reversed, the hours used by the EEBC are lower that the hours used by Public Service in the existing GSHP measure, so the higher Public Service cooling hours were used. Applying the higher operating hours for both heating and cooling maximizes the kWh savings used in the cost-effectiveness evaluation. **Public Service used this method in order to give GSHPs the full benefit of accounting of any variability in approach to the proposed technology.** Furthermore, no Administrative costs, which would be needed to market and promote a GSHP product, were applied.

Yet, even with these benefits, a high-efficiency GSHP measure that uses a code compliant GSHP for the baseline is not cost-effective, yielding an MTRC test ratio of 0.63 in 2015 and 0.64 in 2016. The full cost-effectiveness results are shown in the tables below:

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2 Additional detail on the HEAC technical assumptions and forecast for GSHP measures can be found on pages 455-460 and page 506 of the [2015/2016 DSM Plan](#).
GSHP Analysis: Budget and Impact

<table>
<thead>
<tr>
<th>Year</th>
<th>Rebate Budget</th>
<th>Admin Budget</th>
<th>kW Savings</th>
<th>kWh Savings</th>
<th>Rebate per kW</th>
<th>Rebate per kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>$2,024.00</td>
<td>$-</td>
<td>3.00</td>
<td>$3,059.00</td>
<td>$674.67</td>
<td>$0.66</td>
</tr>
<tr>
<td>2016</td>
<td>$2,024.00</td>
<td>$-</td>
<td>3.00</td>
<td>$3,059.00</td>
<td>$674.67</td>
<td>$0.66</td>
</tr>
</tbody>
</table>

Cost-Effectiveness Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Simple Payback before Rebate</th>
<th>Simple Payback after Rebate</th>
<th>MTRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>19.75</td>
<td>14.15</td>
<td>0.63</td>
</tr>
<tr>
<td>2016</td>
<td>19.75</td>
<td>14.15</td>
<td>0.64</td>
</tr>
</tbody>
</table>

The measure does not pass the MTRC test on its own, and the added cost of a budget for promotion and marketing would simply further reduce the cost-effectiveness of such a product.

Additionally, the high incremental capital cost and long payback period make it unlikely for such a product to attract participants. The Company is forecasting very few units participating in the current measure rebate offerings.

In conclusion, the Company will continue offering GSHPs as a measure for electric heating customers within the existing HEAC product, and within the Custom Efficiency and New Construction products for business customers, rather than creating a stand-alone product.

Included with this Notice, are the following documents that display the results of the analysis for the proposed GSHP product (no change to the 2014 DSM Plan or the 2015/2016 DSM Plan is being proposed):
- Electric Forecast Summary; and
- Cost-benefit Analysis.

These documents can be found on our website at the following link:
http://www.xcelenergy.com/About_Us/Rates_&_Regulations/Regulatory_Filings/CO_DSM