Shaking up the HVAC industry …

IGSHPA Annual Meeting
Mark Faulkenberry
Western Farmers Electric Cooperative
October 16, 2014
WFEC Family ...
Geo Validation Project Overview

- Co-Sponsors
  - Bosch
  - ClimateMaster
  - Cooperative Research Network (CRN)
- 22 retrofits in two different states (17 in OK & 5 in NM)
  - These consumers are our Poster Children
- Sub-metering installed Jun 2013 to “baseline”
- All 22 retrofitted week of July 29 – Aug 2
- Sub-metering to continue through Oct 2014
- Lots of information and data to Validate …
So what is being Validated?

- Consumer Perspective – Energy savings
- Customer Satisfaction – (immediate, end of year & final)
- Co-op Perspective – Demand Savings
- Average Loop Cost
- Average Retrofit Cost
- Loop temperatures – Validate adequate sizing
- Loop BTU Transfer – RPS requirements
- Carbon Reduction Potential
- Manufacture Software Projections
CRN’s Role

CRN article to be published in Q4

This is the third and final article in the series validating our results!

Prepared for Brian Sloboda at CRN by:

Peter May-Ostendrop (Xergy Consulting)
Laura Moorefield (Moorefield Research & Consulting)

1. Introduction to the program and scope of the project
2. Focused on the results for the Summer 2013
3. Focused on Winter Results 2014 and Customer Satisfaction & Economics
### Summer Results verified by CRN

#### Consumer Perspective
41.2 % Energy Savings

#### Co-op Perspective

<table>
<thead>
<tr>
<th></th>
<th>All Homes</th>
<th>Fault Free</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Reduction (kW)</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Percentage of Demand Reduction</td>
<td>39%</td>
<td>41%</td>
</tr>
<tr>
<td>Reduction per installed ton (kW/T)</td>
<td>0.55</td>
<td>0.59</td>
</tr>
</tbody>
</table>
The Big Picture … a little can be a lot!

1.4 million residential consumers in Oklahoma
1,400,000 * 25% = 350,000 Homes
350,000 homes @ 3 Tons/home = 1,050,000 Tons
1,050,000 Tons @ 0.55 kW/Ton = 577,500 kW

Potential reduction of 578 MW of peaking capacity
At $1850/kW to build … this reduction could offset

$1.068 Billion in future capacity costs
Winter Results – Consumers Perspective

Still in the process of evaluation

CRN
• Plan to normalize for weather difference

WFEC
• Neighbor to Neighbor Comparison
<table>
<thead>
<tr>
<th>Winter 12-13</th>
<th>Winter 13-14</th>
<th>% diff</th>
<th>Winter 12-12</th>
<th>Winter 13-14</th>
<th>$ diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total kWh</td>
<td>Total kWh</td>
<td></td>
<td>Total $</td>
<td>Total $</td>
<td></td>
</tr>
<tr>
<td>7942</td>
<td>5838</td>
<td>-26.5%</td>
<td>$775.84</td>
<td>$544.35</td>
<td>-$231.49</td>
</tr>
<tr>
<td>8560</td>
<td>9861</td>
<td>15.20%</td>
<td>$695.10</td>
<td>$892.39</td>
<td>$197.29</td>
</tr>
<tr>
<td>4583</td>
<td>5536</td>
<td>20.8%</td>
<td>$420.01</td>
<td>$518.96</td>
<td>$98.95</td>
</tr>
<tr>
<td>4617</td>
<td>5867</td>
<td>27.1%</td>
<td>$453.43</td>
<td>$567.99</td>
<td>$114.56</td>
</tr>
<tr>
<td>4042</td>
<td>7789</td>
<td>92.7%</td>
<td>$459.93</td>
<td>$732.16</td>
<td>$272.23</td>
</tr>
<tr>
<td>5098</td>
<td>6695</td>
<td>31.3%</td>
<td>$496.26</td>
<td>$704.20</td>
<td>$207.94</td>
</tr>
<tr>
<td>7099</td>
<td>10533</td>
<td>48.4%</td>
<td>$617.25</td>
<td>$951.07</td>
<td>$333.82</td>
</tr>
<tr>
<td>5441</td>
<td>7180</td>
<td>31.9%</td>
<td>$486.25</td>
<td>$661.67</td>
<td>$175.42</td>
</tr>
<tr>
<td>7062</td>
<td>6769</td>
<td>-4.1%</td>
<td>$684.81</td>
<td>$629.92</td>
<td>-$54.89</td>
</tr>
<tr>
<td>1323</td>
<td>1425</td>
<td>7.71%</td>
<td>$157.16</td>
<td>$184.69</td>
<td>$27.53</td>
</tr>
<tr>
<td>1953</td>
<td>1974</td>
<td>1.1%</td>
<td>$196.73</td>
<td>$232.87</td>
<td>$36.14</td>
</tr>
<tr>
<td>Group Avg.</td>
<td></td>
<td>27.2%</td>
<td></td>
<td></td>
<td>$140.90</td>
</tr>
<tr>
<td>Elect Heat</td>
<td></td>
<td>38.2%</td>
<td></td>
<td></td>
<td>$200.03</td>
</tr>
</tbody>
</table>
## Neighbor Comparison – Electric Retrofits

<table>
<thead>
<tr>
<th>Geo Installs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average kWh Usage</td>
<td>- 21%</td>
</tr>
<tr>
<td>Average $ decrease</td>
<td>- $120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neighbor Group</th>
<th>GEO Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average kWh Usage</td>
<td>+ 29.5%</td>
</tr>
<tr>
<td>Average $ Increase</td>
<td>+ $253</td>
</tr>
<tr>
<td></td>
<td>50.5%</td>
</tr>
<tr>
<td></td>
<td>$373</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Electric Neighbors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average kWh Usage</td>
<td>+ 41.5%</td>
</tr>
<tr>
<td>Average $ Increase</td>
<td>+ $332</td>
</tr>
<tr>
<td></td>
<td>62.5%</td>
</tr>
<tr>
<td></td>
<td>$452</td>
</tr>
</tbody>
</table>
Winter Analysis – Propane conversions

Originally propane heated home – now total electric GEO  
Below is two month comparison Dec & Jan usage

<table>
<thead>
<tr>
<th></th>
<th>Winter 2012-13</th>
<th>Winter 2013-14</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kwh usage</td>
<td>2666</td>
<td>3090</td>
<td>424 (16% increase)</td>
</tr>
<tr>
<td>Cost</td>
<td>$311.74</td>
<td>$337.66</td>
<td>$25.92 (increase)</td>
</tr>
</tbody>
</table>

By taking actual sub-metered kWh usage for geo heating system we can calculate the actual BTU of heat provided by the geo system. (1KW = 3412 BTU/hr.) *Below represents all three winter months*

- BTU for Heating 25,704,746 BTU
- BTU for Hot Water 2,469,947 BTU

Converting to Propane (92,000 BTU/Gal. of Propane @ 80% Eff.)

- Heating 349.2 gallons
- Hot Water 48.8 gallons

398 Gallons of Propane @ $2.50/gal = $1344.41
Winter Results – Utility Perspective

Only 3 of the 22 installations showed any auxiliary heat strip usage during the Monthly CP for Dec - Jan – Feb

Note that none of the three locations had usage for more than one (1) five minute interval in any given peak hour

Thus in effect no peak contribution for the Geo installations for the largest winter peaks ever established by WFEC
Participant Survey Highlights

How satisfied have you been with the overall operation of your geothermal system?

- 68% Extremely Satisfied
- 27% Pleased
- 5% neutral

Have you contacted the installer or manufacturer with any issues? If so, were you pleased with outcome/response?

- 59% Yes, problem fixed
- 32% No Contact Necessary
- 9% Yes, problem not fixed

Have you seen any difference in your electric bills over the past year? How have they varied since the installation of the new equipment?

- 45% Bills Lower
- 45% maybe a little difference
- 10% Bills are higher
Participant Survey Highlights

Would you recommend geothermal technology to others?
90% Yes  5% Depends on cost  5% No, not savings justifiable

How satisfied are you with the overall program your cooperative provided?
100% - Very satisfied (all 22)

Did this program change your level of satisfaction with your co-op?
90% Yes  10% No, the same

Should your co-op continue to offer this program to other members?
95% Yes  5% No
1 kWh of energy from the grid

Plus: 3-5 kWh of energy from the earth

Yields: 4-6 kWh of energy for the building

Why not own the system and bill the customer for the “earth energy” the system produces?

Thermal Energy Services

Another form of utility “plant” for delivering Renewable Energy to the load
Co-op partners to become a premiere

“Thermal Energy Services Provider”

• Co-op installs, owns, and maintains loop for fixed monthly service fee added to electric bill

• Co-op contracts with 3rd party for construction and maintenance of the loop

• Co-op provides low interest financing for equipment, installation, & basic energy efficiency improvements (insulation & seal)

Note: the financing will be limited to positive cash flow applications and only offered through pre-approved installers.
Thermal Service Provider

Customer

HVAC Contractor

Electric Cooperative

Loop Contractor
Thermal Energy Service Charge

Cost for System

3 Ton System
200ft/ton + 100 ft. = 700 ft.
700 ft. x $7/ft. = $4900

4 Ton System
200ft/ton + 150 ft. = 950 ft.
950 ft. x $7/ft. = $6650

Standard Co-op ROR

3 Ton     $18-$22/month

Tariff Rate

4 Ton     $25-$28/month

Tariff Rate
Everybody Wins!

- Home Owner – wise investment with rising energy costs
- Distribution Cooperative
  - lowers wholesale cost of power
  - potential new revenue stream
- Co-op Members
  - lower wholesale $ equates into lower kWh $ (PCA)
- WFEC
  - Lower capacity needs in the future
  - Potential carbon benefits
- Environment
GHG … EPA Rule 111.d could be game changer!
Concerns moving forward!

Currently only have 4 co-ops offering Thermal Energy Services with several taking the “wait and see” approach

*We need many more to achieve our goals.*

If the research and results are so good …

*Why the hesitation to offer Thermal Services” … Utilities are very hesitant to tie their reputation to an industry that could have a negative impact on their creditability!* ？  *The Problem Children*
Barriers to “Active Co-op Participation”

• Dealer Issues
• Manufacture Issues
• Driller Issues
• Industry Issues
A step in the right direction …

www.gogogogeochallenge.com
Grand Prizes

THE GRAND PRIZES

Courtesy of House of Kawasaki
Talking Points

• Huge savings potential
  Especially if system is over 10 yrs old and propane heat

• Array of utility incentives
  Ask your local utility – Ranging from $1000/T, Thermal Energy Services, Low Interest Loans

• Huge Tax Credits – Going Geo is Going Green!
  30 % Federal – NM additional 30% State

• Hedge against rising utility costs
  Preparing for the storm that lies ahead
Questions