
May 18, 2010

Principal Investigator:
Liz Battocletti
Bob Lawrence & Associates, Inc.

Ground Source Heat Pump Demonstration Projects
• Timeline
  – 29 January 2010 - 31 January 2013

• Budget
  – Total project funding: $1,878,333
  – DOE share: $1,499,601
  – Awardee share: $378,732
  – Funding for FY10: $627,151

• Barriers
  – Ground Source Heat Pumps - Reduce levelized cost of electricity ($/ton) by 30% by 2016

• Partners
  – Bob Lawrence & Associates, Inc. (BL&A)
  – California Geothermal Energy Collaborative (CGEC)
  – Geo-Heat Center, Oregon Institute of Technology (GHC-OIT)
Relevance/Impact of Research

Project objectives:

- To measure the costs and economic, social, and environmental benefits of nationwide geothermal heat pump (GHP) deployment => **Geothermal Heat Pump Cost-Benefit Analysis**

- To survey selected states as to their potential employment, energy use and savings, and environmental impact for direct use applications => **Geothermal Direct Use Analysis and Technical Assistance**
(1) Geothermal Heat Pump Cost-Benefit Analysis (CBA)

- Addresses findings of Oak Ridge National Laboratory 2008 study
  - Need to assemble independent, hard data on costs and benefits of GHPs.
  - Need to independently assess the national benefits of GHP deployment.
- Led by BL&A and CGEC
  - BL&A – lead on overall CBA
  - CGEC – lead on geographic analysis
    - Focus on 30 largest U.S. metropolitan areas
# Scientific/Technical Approach

## 30 largest U.S. metropolitan areas *

<table>
<thead>
<tr>
<th>Group 1 – Year 1</th>
<th>Group 2 – Year 2</th>
<th>Group 3 – Year 3</th>
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<tbody>
<tr>
<td>7. Miami-Fort Lauderdale-Pompano Beach, FL</td>
<td>17. San Diego-Carlsbad-San Marcos, CA</td>
<td>27. Orlando-Kissimmee, FL</td>
</tr>
</tbody>
</table>

* U.S. Census Bureau, Population Division, Release Date: March 19, 2009
(1) Geothermal Heat Pump Cost-Benefit Analysis

- Literature survey
- Data collection and database creation
- Cost-benefit analysis of nationwide geothermal heat pump deployment, using hard data to calculate the real costs and lifetime benefits of GHPs
- Web-accessible portal
- Technical papers and presentations
(2) Geothermal Direct Use Analysis and Technical Assistance

- Survey six (6) states as to their potential employment, energy use and savings, and environmental impact for direct use applications
- Continue to provide technical support to increase the direct use of geothermal resources in the U.S.
- Led by GHC-OIT
Scientific/Technical Approach

(2) Geothermal Direct Use Analysis and Technical Assistance

- Direct use surveys of six (6) states
- Technical assistance on geothermal direct use applications
  - *Quarterly Bulletin* (12 issues)
  - Website ([http://geoheat.oit.edu/](http://geoheat.oit.edu/))
  - Technical papers and presentations
Scientific/Technical Approach

Fiscal Year 2010 Milestones

• ARRA and DOE-GTP quarterly progress reports
• Presentation at CGEC Forum
• Quarterly Bulletin (2)
• Data collection – site visits and surveys
• Initial geographic database with preliminary data
• Draft subset of published maps and datasets
• Sub-report (1) of GHP CBA
• State report (1)
Accomplishments, Expected Outcomes and Progress

Award finalized on 24 February 2010

Progress to date:

• Project start-up, subcontracts finalized, action plan developed

• Training
  – International Ground Source Heat Pump Association (IGSHPA)-accredited training through HeatSpring Learning Institute (February 2010)
  – PI certified as an accredited Ground Source Heat Pump Loop Installer, and received a certificate from ISCO Industries in Butt Fusion and Socket Fusion
Accomplishments, Expected Outcomes and Progress

- Research and literature survey underway
- Data collection underway
- Technology transfer
  - Abstract accepted for presentation at the 2010 Geothermal Resources Council (GRC) Annual Meeting
  - PI joined IGSHPA, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and the National Groundwater Association (NGWA)
  - PI will present project at the California Geothermal Energy Collaborative Forum on 10 May 2010
- Geothermal Contact Database (GCD) updated – currently contains 3,507 people
Accomplishments, Expected Outcomes and Progress

(1) Geothermal Heat Pump Cost-Benefit Analysis

Planned accomplishments/outcomes:

- Database containing the specific costs and benefits of GHP use in 30 major metropolitan areas
- Web-accessible portal for public access
- Biannual sub-reports (5)
- Final CBA report
- Technical papers and presentations
(2) Geothermal Direct Use Analysis and Technical Assistance

Planned accomplishments/outcomes:

- State surveys (6)
- Quarterly Bulletins (12)
- Technical papers and presentations
Project Management/Coordination

- Effort is led by seasoned, successful, and highly experienced Geothermal R&D support project managers with decades of experience:
  - Bob Lawrence is the lead individual for the overall Project Team. Dr. Lawrence has over 35 years of R&D management experience.
  - Liz Battocletti (PI)
  - John Lund and Toni Boyd (GHC-OIT)
  - Bill Glassley (CGEC)
- BL&A, CGEC, and the GHC-OIT will work closely with the National Geothermal Data System to ensure data are provided to the system as requested.
Future Directions

Fiscal Year 2011 Milestones

- ARRA and DOE-GTP quarterly progress reports
- DOE-GTP annual progress report
- Quarterly Bulletin (4)
- Data collection site visits and surveys
- Technical paper for GRC Annual Meeting
- Sub-reports (2) of GHP CBA
- State reports (2)
- Geographic regional compilation
## Estimated economic benefits of increased GHP deployment

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>At 10% of Total HVAC Market</th>
<th>At 33% of Total HVAC Market</th>
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</thead>
<tbody>
<tr>
<td>Employment (person-years)</td>
<td>1,219</td>
<td>7,901</td>
<td>26,074</td>
</tr>
<tr>
<td>Domestic Manufacturers</td>
<td>17</td>
<td>110</td>
<td>364</td>
</tr>
<tr>
<td>Shipments</td>
<td>86,396</td>
<td>560,000</td>
<td>1,848,000</td>
</tr>
<tr>
<td>Revenue ($,000s)</td>
<td>$218,972</td>
<td>$1,419,329</td>
<td>$4,683,785</td>
</tr>
<tr>
<td>Annual North American HVAC Market (2008)</td>
<td>5,600,000</td>
<td>5,600,000</td>
<td>5,600,000</td>
</tr>
<tr>
<td>Percentage of Total HVAC Market</td>
<td>1.54%</td>
<td>10%</td>
<td>33%</td>
</tr>
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If GHPs accounted for 33% of the U.S. market, annual revenues would total $4.68 billion with 26,074 person-hours of employment. This estimate does not factor in increased taxes or decreased GHG emissions reductions, both of which would be substantial.
• Using low- and moderate-temperature geothermal resources for heating, cooling, and direct use applications can significantly help DOE achieve its key Strategic Goals of:
  – diversifying the country’s energy portfolio,
  – reducing the country’s dependence on oil, and
  – ameliorating the environmental impacts of energy production and use.