Project Overview

• New construction project consisting of 12 residential condominiums in a single 33,270 sq ft multi-story structure; 72-tons heating cooling

• Timeline
  • Project start date: 10 January 2010
  • Project end date: 12 October 2012
  • Less than 5% complete

• Budget
  • $788,956  Total project funding
  • $325,124  DOE share
  • $463,832  Awardee share
  • $0 received in FY09
  • $258,450 projected funding for FY10
Project Overview

• **Barriers**
  - GHP players compete in a fundamentally asymmetric market
  - High ‘first cost’
  - Fragmented market
  - Lack of scale
  - Competes within and against standard HVAC paradigm
  - A ‘one-off’ service model
  - Low probability of extracting additional energetic efficiencies (i.e., beyond incremental)
  - Energy efficiencies alone do not change the NPV analysis for decision makers

• **Partners**
  - Rockwell Automation
Relevance / Impact

- Demonstrate replicable systems, methods, and apparatus that transform the Net Present Value calculations used to determine the HVAC purchasing decisions of property owner developers
- Define a new industry service category in which property owner developers and end-user customers can purchase geothermal space conditioning, secure long-term discounts on the cost of energy services, eliminate maintenance costs, while substantially reducing HVAC-related carbon emissions
- Establish the use of certain special purpose contractual instruments as both a demand aggregator and project cost recovery mechanism
- Establish the use of certain special purpose contractual instruments that provide for the long-term delivery of efficient thermal energy
- Develop distribution and transactional control systems for remote administration, support, and billing
Scientific / Technical Approach

• New construction project consisting of 12 residential condominiums in a single 33,270 sq ft multi-story structure; 72-tons heating cooling
• This effort exploits price discrepancies between commercial energy rates and geothermal space conditioning efficiencies to advantage the creation of a new service category
• Business and financial innovations secure both a revenue and an asset base
• Technology innovations provide the control and cost recovery mechanisms
• The applied technologies serve specific business goals:
  - Provide administrative control over major system components
  - Support variable pricing models;
  - Collect run-time data; compute utilization;
  - Process end-user transactions; provide for granular reporting
  - Facilitate automated end-user support
Accomplishments, Expected Outcomes and Progress

• 2010 Primary Task Schedule

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Start</th>
<th>Complete</th>
<th>Status / Dependencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 Finalize Agreements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Special purpose contractual instruments</td>
<td>02.09</td>
<td>05.31</td>
<td>In progress; subject to legal review</td>
</tr>
<tr>
<td>2.2 Service agreements</td>
<td>02.09</td>
<td>05.31</td>
<td>In progress; subject to legal review</td>
</tr>
<tr>
<td>3.0 Engineering Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Geothermal design</td>
<td>10.01</td>
<td>11.01</td>
<td>Scheduled</td>
</tr>
<tr>
<td>3.2 Mechanical system design</td>
<td>10.01</td>
<td>11.01</td>
<td>Scheduled</td>
</tr>
<tr>
<td>3.3 Prototype thermal energy control hardware, sensor integration</td>
<td>04.02</td>
<td>06.30</td>
<td>In progress; subject to schedule and resources at Rockwell Automation</td>
</tr>
<tr>
<td>3.3.9 Thermal energy control hardware release</td>
<td>06.30</td>
<td>09.30</td>
<td>Planned; subject to unit testing and QA results</td>
</tr>
<tr>
<td>3.4 Prototype admin system</td>
<td>05.22</td>
<td>06.30</td>
<td>In progress; subject to API documentation and support from Rockwell Automation</td>
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<tr>
<td>3.4.9 Admin system release</td>
<td>06.30</td>
<td>10.29</td>
<td>Subject to unit testing and QA results</td>
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Project Management / Coordination

- Q1 efforts for the Lake Elizabeth Micro-Utility project focused on four activities:
  - Recalibrating project plans based on unexpected budget revisions and fewer available resources
  - Draft and review of key agreements
  - Prototype logistics, and
  - Administration

- Q2 and remaining 2010 efforts are directed to:
  - Completing hardware and software prototypes
  - Completing GHP loop and mechanical design
  - Commencing with GHP installation

- National Geothermal Data System
  - Functional specification requirements for admin software prototype include provisions to supply NGDS data in an appropriate format

- Senior management draws from a cross-disciplinary background of seasoned executives with substantial project management experience
Future Directions

- The technical implications of this endeavor are expected to
  - Substantially influence one or more aspects of ground source heat pump manufacturing; and more broadly,
  - Transform the existing price discovery mechanism for geoexchange systems and services,
  - Spur adoption under a new service paradigm

- The business and financial model of the Micro-Utility precludes adopting a goal for reducing levelized cost of electricity
  - Lower energy costs will retard adoption of geoexchange specifically, and ultimately, spur higher consumption
Future Directions

• What’s needed as we move forward
  - Hidden subsidies in the retail energy markets necessitate continued correctives to incent property owner developers (the primary decision makers)
  - Because the Micro-Utility is fully replicable, amending the Production Tax Credit to include the generation of electricity “or BTU equivalent” is suggested
  - Loan guarantees to future Micro-Utilities would no doubt further accelerate market transformation
  - A clean energy bond market as a renewable energy project funding mechanism

• Validation
  - This approach has already generated considerable support in the market
  - Several installations are under discussion or actively being pursued
The Micro-Utility represents a new service category and paradigm shift that overcomes historic market impediments to adopting geoexchange solutions.

The Micro-Utility is a fully replicable solution that can scale.

Continued DOE support in the form of loan guarantees or clean energy bonds is vital to market adoption.

The Micro-Utility is a game-changing approach with the potential for market transformation.