Geothermal Energy Demonstration at Fort Indiantown Gap

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### Geothermal Energy Demonstration at Fort Indiantown Gap

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<table>
<thead>
<tr>
<th>a. REPORT</th>
<th>b. ABSTRACT</th>
<th>c. THIS PAGE</th>
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<tbody>
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Prescribed by ANSI Std Z39-18
Pennsylvania National Guard (PANG) is seeking to:
   - Reduce energy consumption
   - Reduce use of fossil fuels
   - Become energy independent
   - Increase use of sustainable energy technology

Challenges faced by PANG include:
   - Higher energy costs as a result of price rate increases
   - Outdated facilities, 50+ years
   - Lack of funding for repairs and renovations.
Demonstration Site

- Fort Indiantown Gap (FTIG) was chosen as the location for an alternative energy technology demonstration.
  - Largest PANG installation
  - 17,000 acres and 140 training areas and facilities
  - Provides year-round training for military forces, law enforcement agents, and civilians
Demonstration Site (continued)

- Selected buildings 4-201 & 4-202 for demonstration
  - 4-201 selected for geothermal installation
  - 4-202 selected for energy consumption baseline comparison

- Identical design/construction – provides good energy comparison
- Open floor plan – each is approximately 4,890 square feet in size
- Recently constructed – May 2008
- Features updated energy-efficient fixtures – programmable thermostats
- Used for Soldier Readiness Processing (SRP) by units departing and returning from military deployments
Technology Assessment

- Conducted technology assessment in October 2008.
- Identified alternative technology options.

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Lowest Payback for Rate  | Highest NPV for Rate
Calculations do not include cost of natural gas. Full calculations were not conducted due to 5-yr life expectancy of equipment.
Geothermal Heat Pump System

- Recommended geothermal heat pump system as the most economically viable system
  - Selected closed loop vertical well system
  - Takes advantage of seasonal temperature differences between air and ground temperature
  - Moves heat from ground to building in winter and from building to ground in summer

Diagram courtesy of EERE.
Demonstration Goals

• Evaluate life-cycle cost of ground-source heat pump heating/cooling systems
  – Determine savings from reduced propane usage

• Evaluate environmental benefits of ground-source heat pump system compared to propane gas heating and electric air cooling system
Well Drilling

- Installed 8-ton geothermal system outside of building 4-201 in April 2009

- Installation included the drilling of 6 wells at an average depth of 220 ft and piping connected to building 4-201.
Heat Pump Installation

- Heat pump system replaced the conventional HVAC system.
- Propane backup heater was kept in building 4-201 for use during geothermal startup.
System Commissioning

- Entire system was commissioned in July 2009.
  - Duct work was evaluated for proper air flow.
  - Electrical panels were configured for metering/monitoring.
Data Collection

- Data collecting software was installed on laptops placed at each location.
  - Laptops are collecting electrical information from the electrical panels in each building.
Data Collection (continued)

• Electrical data will record:
  – Voltage
  – Current
  – Kilowatt.

• Additional collected information includes:
  – Occupancy schedules of buildings
  – Weather/temperature information of FTIG.
Current Results

Average monthly temperatures at FTIG:

Average occupancy of Buildings 4-201 and 4-202:
As of December 2009, PANG saved over 600 gallons of propane by using the geothermal heat pump system.

- The propane savings is even greater considering the extensive use of building 4-201 compared to 4-202.

- A more accurate volume of propane usage will be calculated at the end of the technology demonstration.
Conclusions

• Electrical data is being collected monthly through August 2010.

• Period of performance was extended so that one full year of data could be gathered.
  – A full year of monitoring provides both summer and winter data – seasons when the geothermal heat pump will be heavily utilized.

• Upon completion of demonstration:
  – Collected data will be analyzed
  – Cost benefit analysis will be developed.

• Demonstration findings will be used by PANG and other National Guard entities to determine the feasibility of implementing the technology regionally.
Path Forward

- Follow-on geothermal project has started at FTIG
- Include design of 3rd building similar in design to buildings 4-201 and 4-202
  - LEED Silver Certified
  - Energy efficient features
  - Installation of geothermal heat pump system
- Will use 4-201 and 4-202 as baseline comparisons
  - 4-201 – baseline
  - 4-202 – with geothermal
  - 3rd building – LEED with geothermal

Image courtesy of USGBC.
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