Geothermal Heating and Cooling

Lessons Learned from NM
Geothermal Heat Pump Installations

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GHP Best Practices

Optimize operating cost for cooling
Improve Capital Projects
Improve learning environments
Agenda

- HVAC System Options
- Geothermal Heat Pump Technology
- Installation Options
  - Methods to implement best practices
- Success Stories
- The future
“Do Nothing” is not an option in most cases

**System Options**

- Boiler & Chiller with Fan Coils or other unitary
  - Requires Classroom Ventilation units
- Package Roof top Units (DX or Evaporative)
- Geothermal Heat Pumps (GHP)
  - Requires Classroom Ventilation units

GHP is a trend and offers Value

**Question: How to do it right?**
Main Components of Fan Coil Systems

The Mechanical System

• Boilers, Chillers, Cooling towers use more energy & water. Require specialized service
• Systems require addition mechanical area and must to effectively implemented
• Interior piping is a challenge
• 20 to 25 year equipment life

The Learning Environment

• Less efficient heating and cooling system
• Requires ventilation air for classroom codes
• Cumbersome control process with one thermostat for multiple rooms leads to poor learning environment

Cost Estimates

• Higher first cost due to large equipment
• Higher Operating and Maintenance cost
• Not likely to be approved by State
Main Components of Roof top Systems

The Mechanical System

• Boilers and Cooling towers use more energy & water. Require specialized service
• Systems also require addition mechanical area and must to effectively implemented
• 10 to 15 year equipment life

The Learning Environment

• One unit for two or three classrooms makes for poor learning environment
• Provides ventilation air for classroom codes
• One thermostat for multiple rooms is a comfort problem

Cost Estimates

• Higher first cost due to larger equipment
• Higher Operating and Maintenance cost
• Not likely to be approved by State
## Benefits of the GHP System

### Annual Cost:

<table>
<thead>
<tr>
<th>Energy &amp; Maintenance Cost</th>
<th>Life Cycle Cost</th>
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<tr>
<td>• GHP lower, less volatile energy cost</td>
<td>• GHP 5 to 10 years longer life</td>
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<td>• GHP much lower in maintenance</td>
<td>• Energy and maintenance savings produce cost benefits over time</td>
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<td>• Qualify learning environment</td>
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GHP Installation Process

When the GHP decision is made...

- Owner must decide based on needs & benefits
  - Energy and Environmental Costs
  - Learning Environment
- Consider best practices and enlisting support from GHP expert in design process
- Consider specifying a specialty contractor
  - Single point of accountability
  - Proven performance
  - Long term support
GHP System: Main Components

The Earth Heat Exchanger (outside)
- The EHX design is a fundamental issue.
- Integrated processes critical for efficiency and reliability of installation in long term:
  - Design Engineering Assistance
  - Drilling, Looping, & Grouting
  - Trenching, Headering & Manifolding
  - Test, Meter, Verify and Acceptance
- Life expectancy 20 - 25 years
- Interior piping may still be a challenge

The Learning Environment
- Most efficient heating and cooling system
- Decentralized design: each heat pump is installed close to zone/classroom it serves.
- GHP heat pump is easy to service and does not require specialized training
- Lower Energy & Maintenance cost
- One unit & thermostat for each classroom
- Provides ventilation air for classroom codes

Cost Estimates
- Higher first cost repaid energy/service cost
GHP Best Practices

✓ Turnkey responsibility for full scope of work
✓ New Mexico Proven Performance & Licensed
  ✓ Require bidders to demonstrate experience
✓ Optimize equipment quality
  ✓ All BACnet based controls & other standards throughout
✓ 5 year Performance Guarantee on full system
Quality in every process

1- inch vertical loops, Heat fusion joined, Flanged connections

Multiple Parallel Header Pipes (3 inch)

Main Supply Header (8 inch)

Air Vents

Shut Off Valves

Pressure/Temp. Ports
Success Stories

Alamogordo Public Schools
Phase 1: 400 Wing & Tiger Pit
District-wide Energy & Controls

Yucca Elementary
Phase 1: Balance of High School
Heights Elementary
… this summer

Cobre Consolidated Schools

El Monte Sagrado
Summit At Cottonwood WSHP

Commercial Project too...
The Future

- Smart Systems
- Efficient Systems
- Dashboards
  - Energy performance
  - Carbon footprint
- Optimize Maintenance & Performance
- Demand Response
- GridWise
  - Electric System Price signals & interoperability