Ground Source Heat Pump Systems

- What is MNGHPA
- Why choose a Geothermal System
- What is a GSHP System,
- How does a GSHP System Work?
- Brief description of System Components
- System Examples
What is a GSHP System?

• A heat pump does not create heat but moves heat energy from one area to another. This allows for tremendous **Energy Cost Savings** as compared to conventional systems.

• The GSHP system does not require the process of combustion to create heat energy, therefore it does not emit any adverse gases, *Favorable To The Environment.*
Energy Savings & Safe For The Environment
### Cost Per Million BTU's

<table>
<thead>
<tr>
<th></th>
<th>Electricity</th>
<th>Natural Gas</th>
<th>Propane</th>
<th>Fuel Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$/kWh</td>
<td>$/100,000 Btu</td>
<td>$/91.500 Btu</td>
<td>$/138.700 Btu</td>
</tr>
<tr>
<td>C.O.P.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
<td></td>
</tr>
<tr>
<td>65%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
<td></td>
</tr>
<tr>
<td>68%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
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</tr>
<tr>
<td>72%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
<td></td>
</tr>
<tr>
<td>75%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
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<tr>
<td>80%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
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<tr>
<td>85%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
<td></td>
</tr>
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<td>90%</td>
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</tr>
<tr>
<td>92%</td>
<td>4.96</td>
<td>12.63</td>
<td>18.41</td>
<td></td>
</tr>
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</table>

*C.O.P. - Co-efficient of Performance
**AFUE - Annual Fuel Utilization Efficiency
<table>
<thead>
<tr>
<th>System Type</th>
<th>Heating</th>
<th>Cooling</th>
<th>Total</th>
<th>vs. GSHP</th>
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<tbody>
<tr>
<td>Ground Source Heat Pump (GSHP)</td>
<td>$491.78</td>
<td>$0.00</td>
<td>$491.78</td>
<td>—</td>
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<tr>
<td>RH</td>
<td>$1,510.52</td>
<td>$0.00</td>
<td>$1,510.52</td>
<td>$1,018.74</td>
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<tr>
<td>Nat Gas</td>
<td>$611.45</td>
<td>$0.00</td>
<td>$611.45</td>
<td>$119.67</td>
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<td>Propane</td>
<td>$2,180.98</td>
<td>$0.00</td>
<td>$2,180.98</td>
<td>$1,689.20</td>
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</table>
The earth is like a solar battery absorbing nearly half of the sun’s energy. The ground stays a relatively constant temperature through the seasons, providing a warm source in winter & a cool heat sink in summer.
What is a GSHP System?

A GSHP system is a highly efficient electrically run system that when tapped into the earth:

- **draws** heat energy in the winter months to provide heating (loop fluid is cooler than the ground temperature)

- **rejects** heat energy in the summer months to provide cooling. (loop fluid is warmer than the ground temperature)
Earth’s Ground Contains Usable Heat Energy

1. The Earth’s outer crust layer in northern climates remains relatively constant at an average of approx. 52 degF (11 degC) 2.0 to 33 Ft (0-10 meters) below the surface level – soil temperature varies with above ground temperatures and exposure to Solar Radiation.
Earth’s Ground Contains Usable Heat Energy

3. Below 33 ft. (10 meters) – very little temperature change takes place.
4. GSHP systems take advantage of using this “renewable” stored heat energy by absorbing/rejecting the heat to & from the ground & running it through a closed loop refrigeration cycle, which refines the heat energy into usable HVAC temperatures.
Ground Source Heat Pump Technology

Accredited GeoExchang Installer Training
Ground Source Heat Pump Technology

Accredited GeoExchange Installer Training
Components of a Geothermal system

- Ground Loop Heat exchanger
- Heat Pump equipment
- Heat / Cool distribution system;
Ground Loop Systems

- Open Loop (well to well system, pump & dump)
  Ground Water is used as fluid, water quality is important

- Closed Loop (horizontal, vertical, lake/pond, building water loop)
  Water/Antifreeze solution is used as fluid;
Types of Ground Loop Systems

Open Loop Systems:  
*Well to Well (supply & discharge well)*
Types of Ground Loop Systems

Open Loop Systems:

*Pump & Dump System*
Types of Ground Loop Systems

Closed Loop Systems:

*Horizontal Ground Loop*
Types of Ground Loop Systems

Closed Loop Systems:

Vertical Ground Loop
Loop inserted by drillers
Drillers move the rig
Drillers begin drilling next hole
Tremie is inserted after loop
Operational Reasons for Grouting

To provide proper long-term heat transfer capability ..... between the ground loop and the formation.
Horizontal Boring Continued
Boring Out
Pulling Back
Types of Ground Loop Systems

Closed Loop Systems:

Lake/Pond
Types of Ground Loop Systems

Closed Loop Systems:

Closed Building Water Loop System (commercial)