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Sustainable Energy Resources for Consumers (SERC) - Geothermal/Ground-Source Heat Pumps (GHP)

Presenter:

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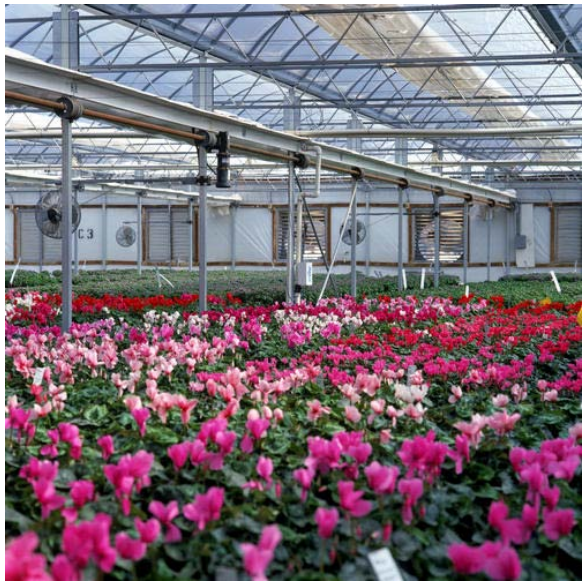
- What is a GHP system?
- How does a GHP system work?
- What are the different types of GHP systems?
- Where do GHP systems work?
- What are GHP system considerations?
- How to evaluate GHP system installers
- Checklist Overview

What is a GHP system? – How it differs from other “geothermal energy” technologies

- **Ground-source Heat Pumps: space heating & cooling, domestic hot water**
- Direct Use: process heat, water heat
- Geothermal Electricity Generation

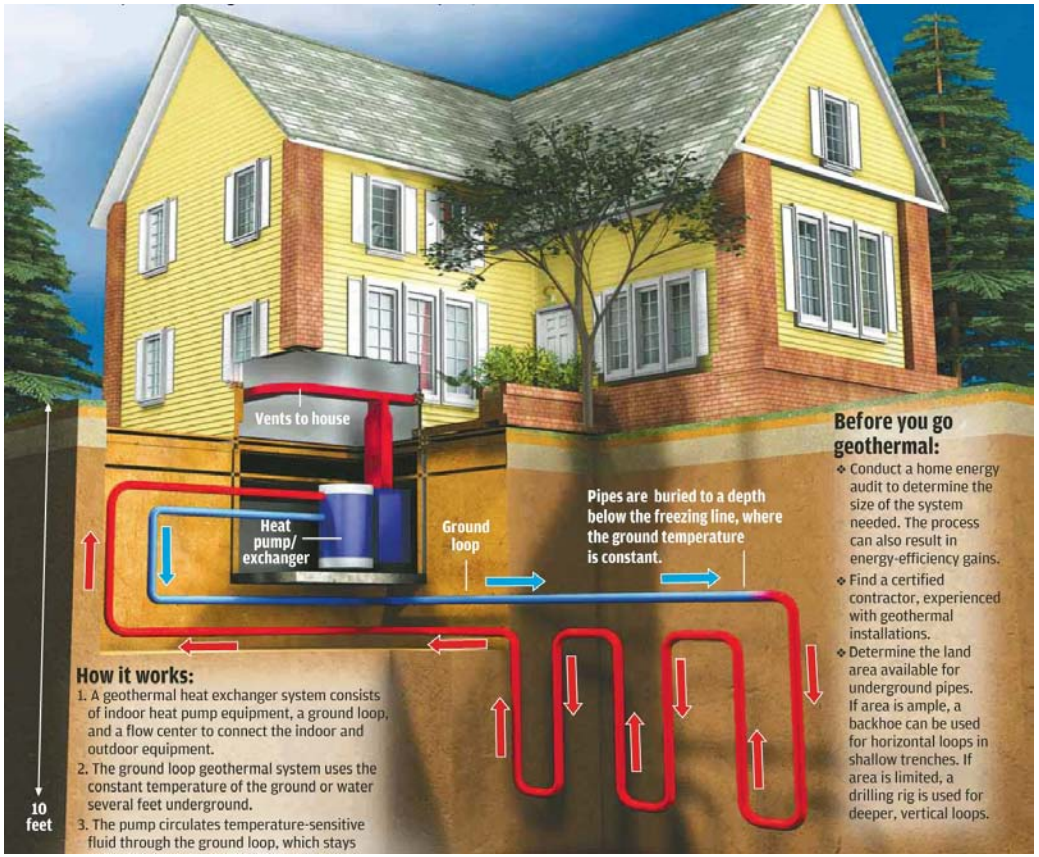


What is a GHP system? – General description

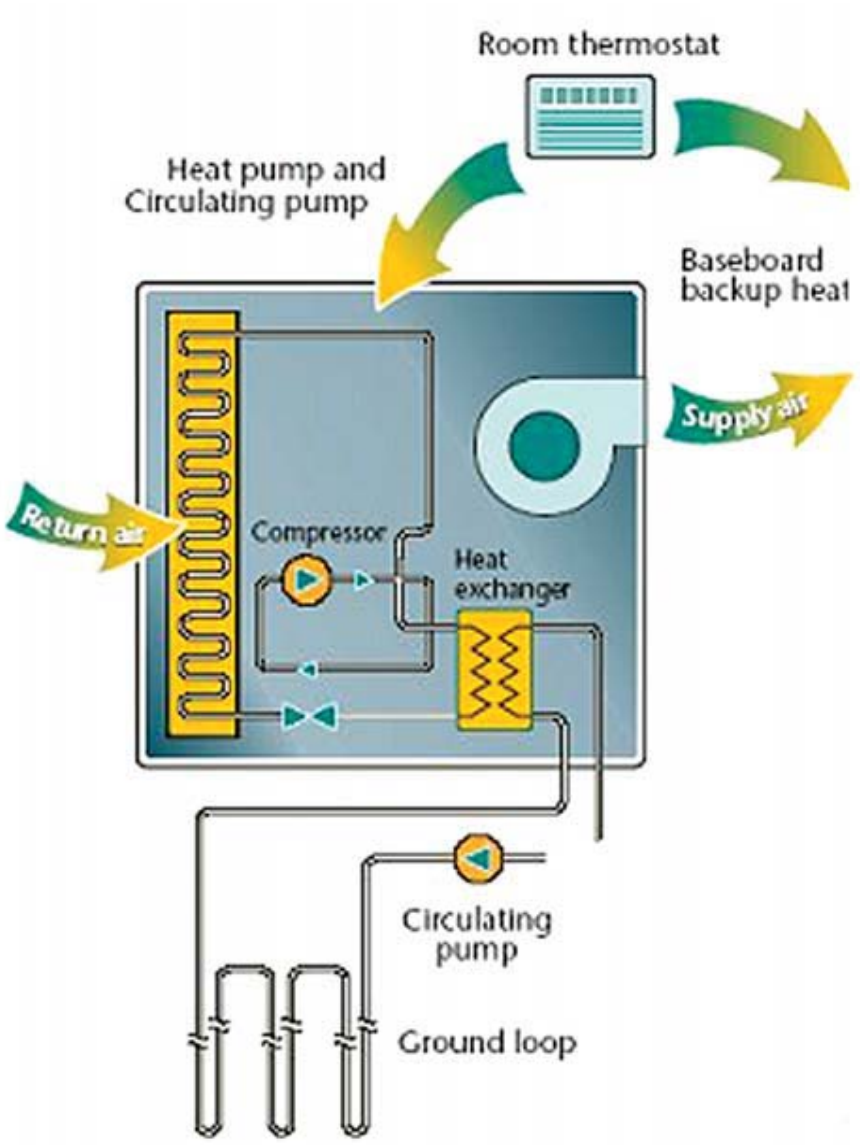
- An electrical-powered, heating and cooling system that uses relatively constant ground or groundwater temperature to transfer energy for space heating/cooling and water heating
- **Heating mode**: transfers heat from the ground or groundwater into the building
- **Cooling mode**: transfers heat from the building and rejects it into the ground or groundwater.

How does a GHP work? – Basic components

1. The external loop field (tubing, circulation pumps)
2. The heat pump (evaporator and condenser, compressor, expansion value, refrigerant)
3. The interior HVAC distribution system - ductwork or radiant.



How does a GHP work? – mechanical diagram



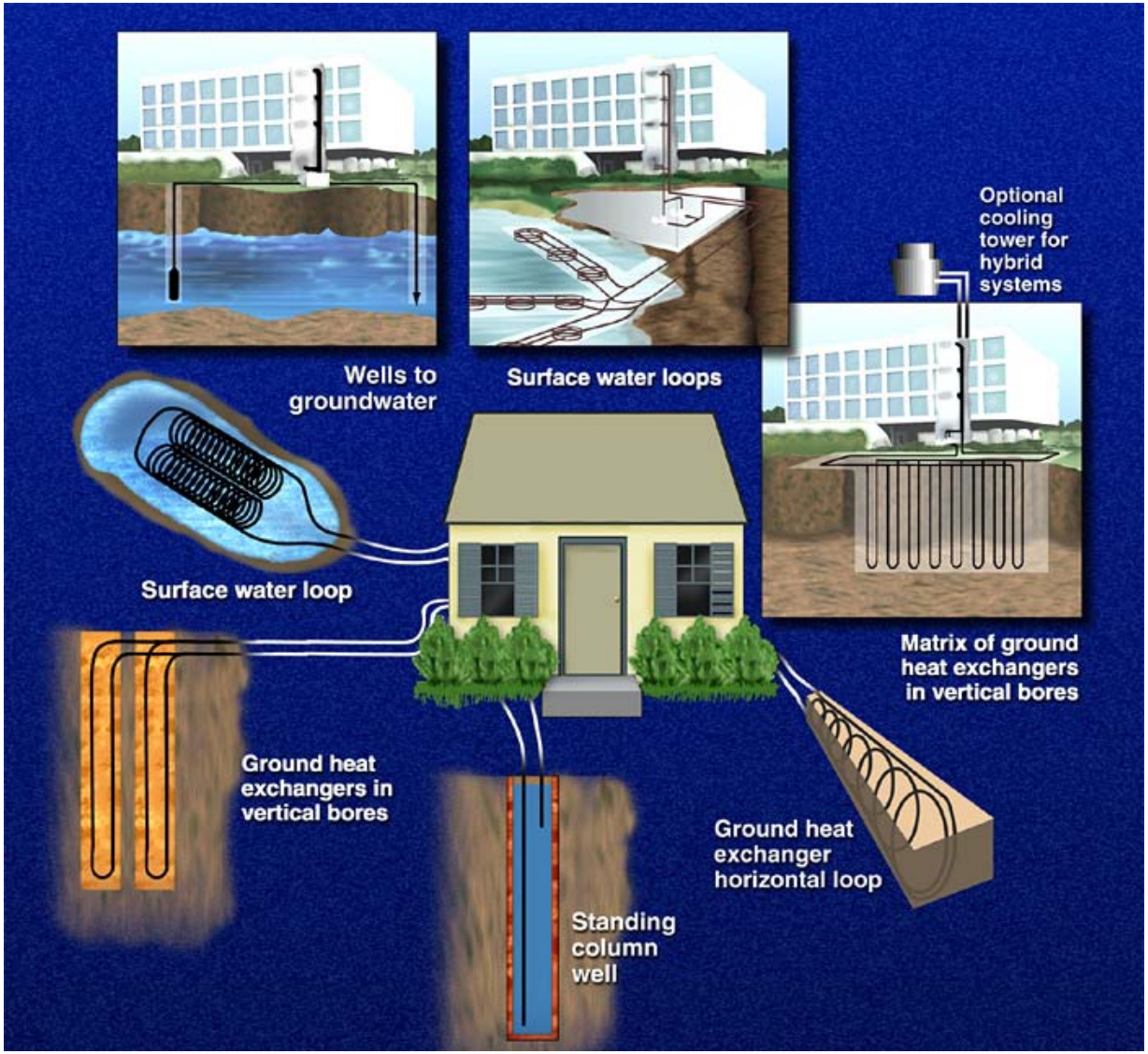
What are different types of GHP systems? - Dependent on ground-loop used

Closed Loop

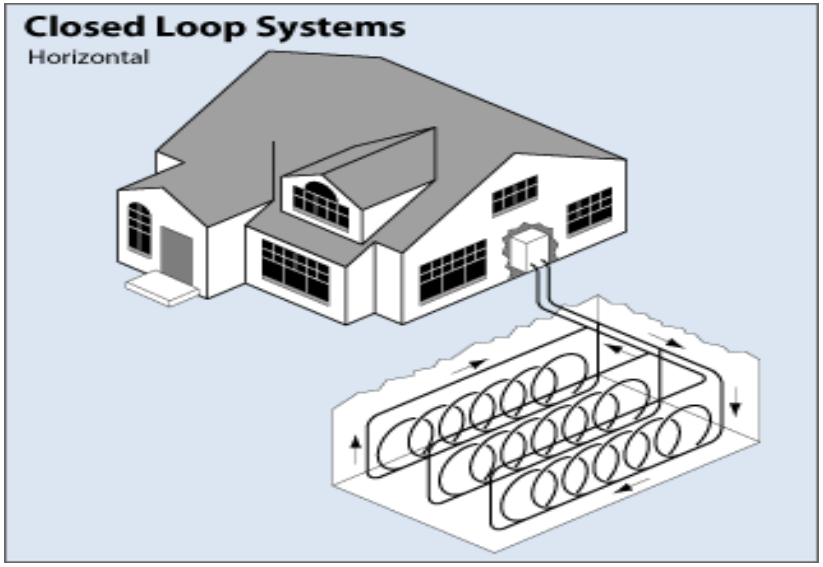
- Utilizes a sealed tube buried underground or underwater that circulates a heat transfer fluid

Open Loop

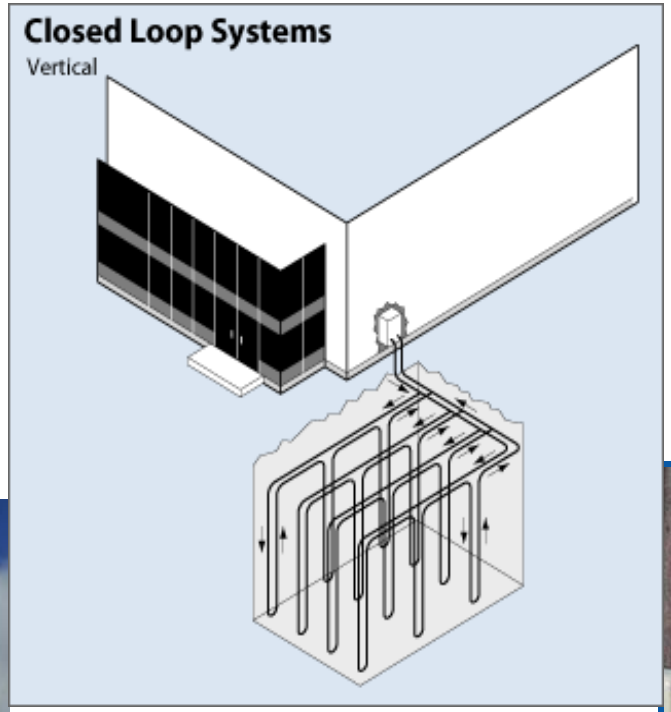
- Utilizes groundwater directly as heat transfer fluid

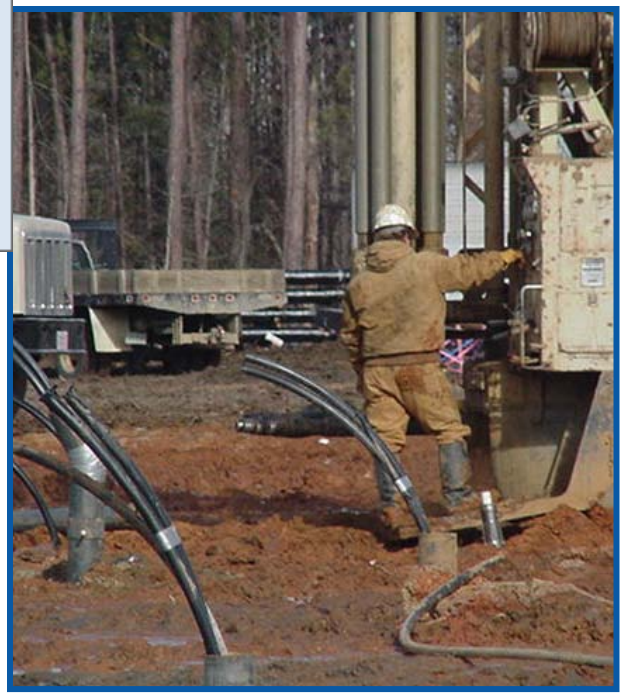


What are different types of GHP systems? - Horizontal closed loop design

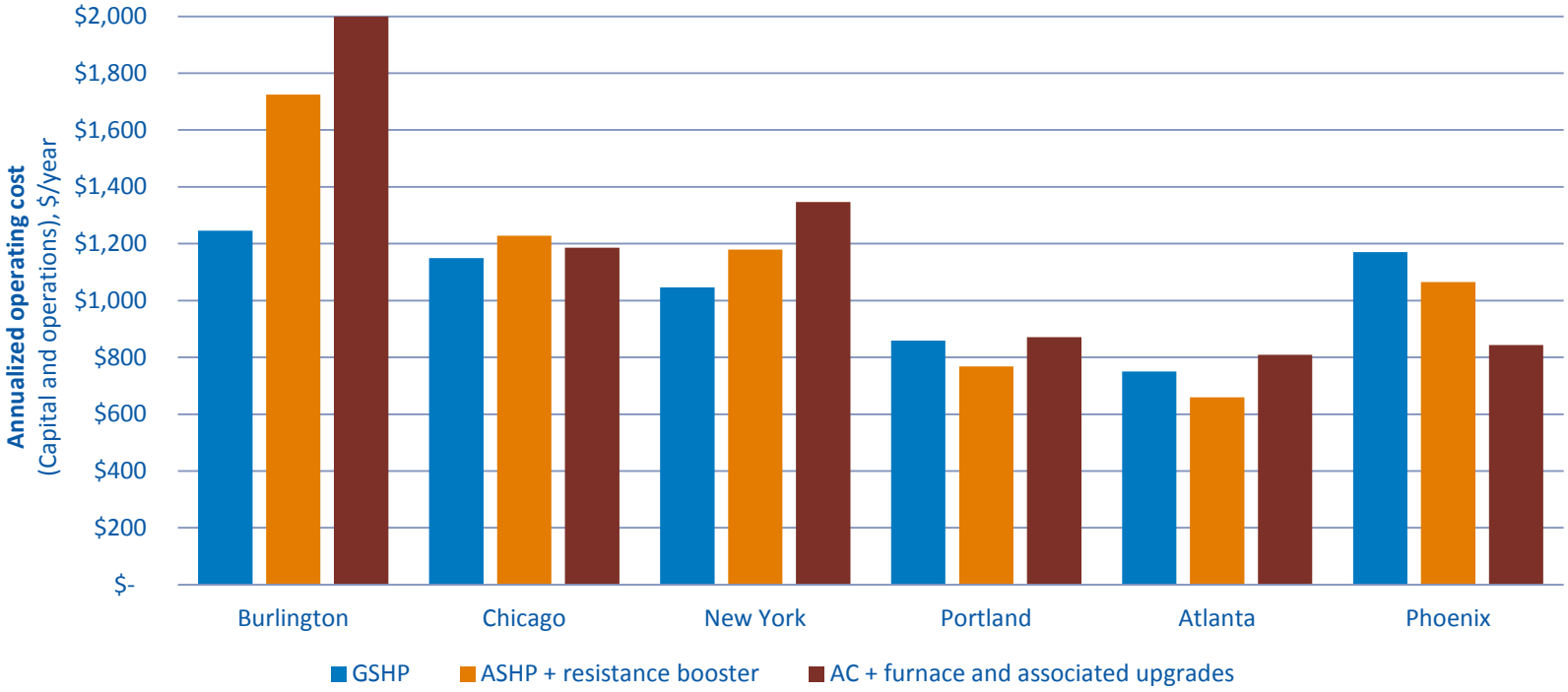


What are different types of GHP systems? - Vertical closed loop design



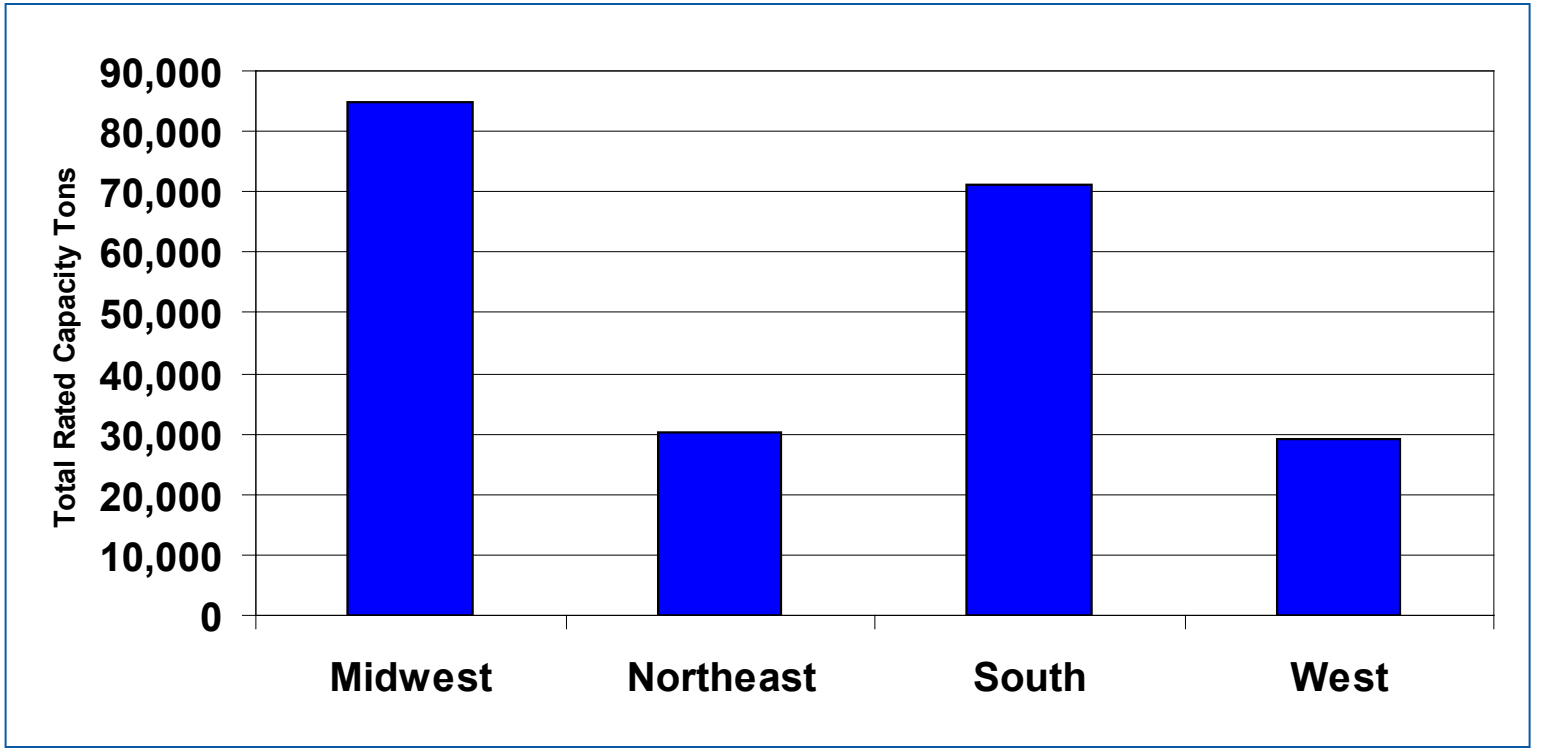


Where do GHP systems work?



- GHP systems can operate in any climate with a heating-only or heating and cooling load.
- Soil conditions are a very important aspect to GHP system performance and must be considered

Where do GHP systems work? – U.S. Domestic GHP Market



Source: EIA, 2006

What are GHP system considerations? – General

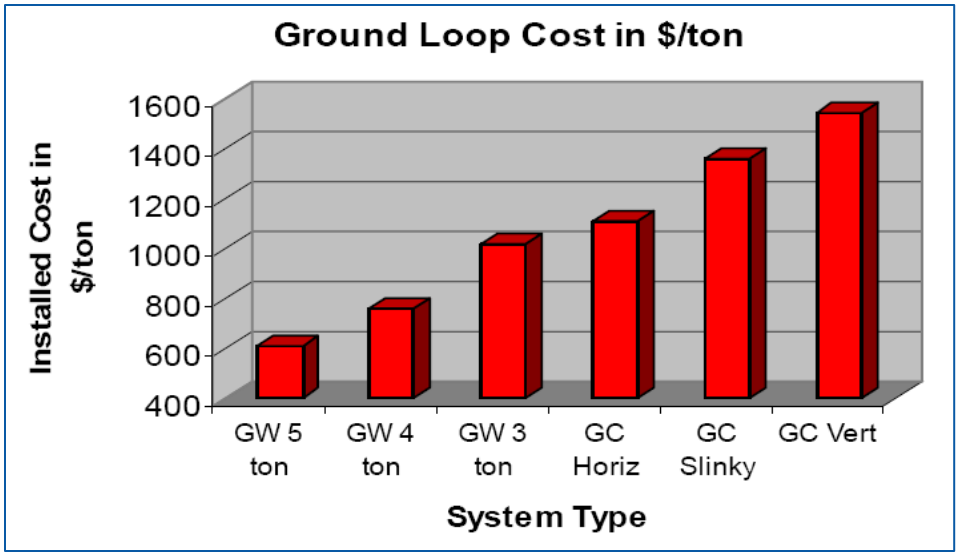
- Know the processes and what to look for in regards to residential systems

Geothermal Surviver Kit - Rafferty

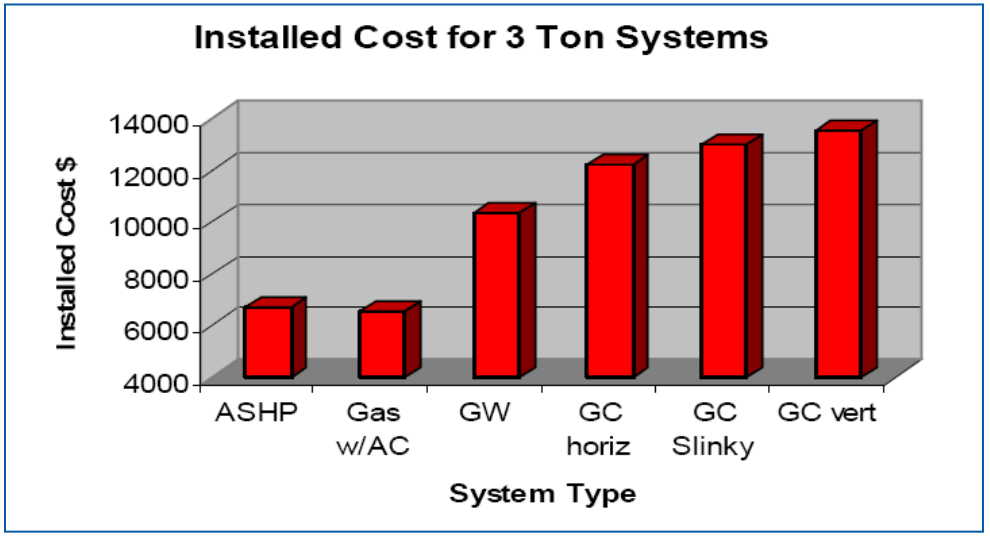
http://solarthermal.heatspring.com/geothermal-survival-kit/

- Require site inspection prior to installation
- Require *minimum* **system** warranty
- Reference *minimum* installation standards (i.e., use IGSHPA certified installers and designers)
- Require system design drawing prior to installation
- Request unit pricing

What are key GHP system considerations? – Cost



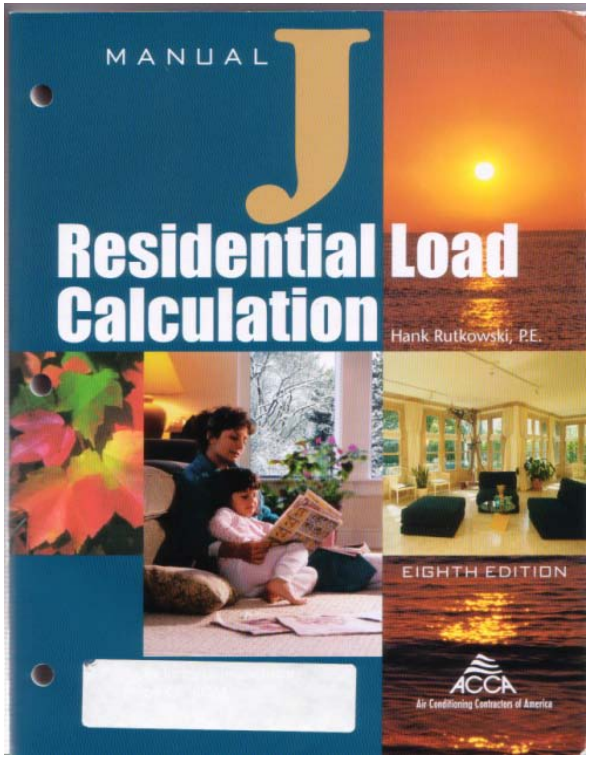
Source: An Information Survival Kit: For the Prospective Geothermal Heat Pump Owner, Rafferty, for Heat Spring Energy, 2008



What are key GHP system considerations? – Sizing the system

Critical - the design of the GHP system needs to fit the building use and loads

- ❑ Determine the heating/cooling loads using ACCA Manual J
- ❑ Properly size and design ground loop according to annual loads
- ❑ Properly size ground loop circulation pumps
- ❑ Select proper heat pump size



How to evaluate installers of GHP systems

- ❑ Contractor should follow the installation procedures established by IGSHPA (only available for closed loop systems)
- ❑ Installers should be accredited by IGSHPA or another recognized institution that trains and certifies contractors (such as a manufacturer).
- ❑ Ask for and check references
- ❑ Get several estimates in writing
- ❑ Get a warranty that guarantees performance that covers the installed system—not just the heat pump itself.
- ❑ Insist on a written contract that includes all terms, including costs and start-stop dates.

IGSHPA Directory

http://www.igshpa.okstate.edu/directory/directory.asp

Geoexchange Directory

http://www.geoexchange.org/find-a-pro/geothermal-heat-pump-directory.html

What are key GHP system considerations? – General annual maintenance

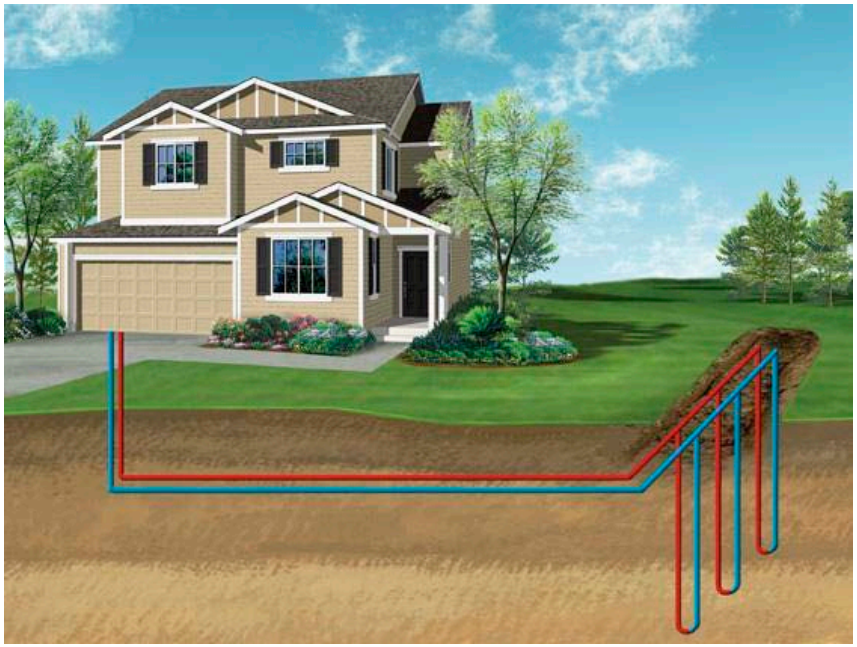
- ✓Filter and coil maintenance has a dramatic impact on system performance and service life. A dirty filter, coil, or fan can reduce airflow through the system.
- ✓Fan should be cleaned and checked to ensure that it provides the airflow required for proper operation.
- ✓Ductwork should be inspected and cleaned as required to ensure that airflow is not restricted.
- ✓Be sure that vents and registers are not blocked by furniture, carpets or other items that would impede airflow.

Checklist overview – General

- ❑ Project Information
- ❑ Inspection Checklist
  - ✓ Pre-installation
  - ✓ Installation
  - ✓ Post-installation

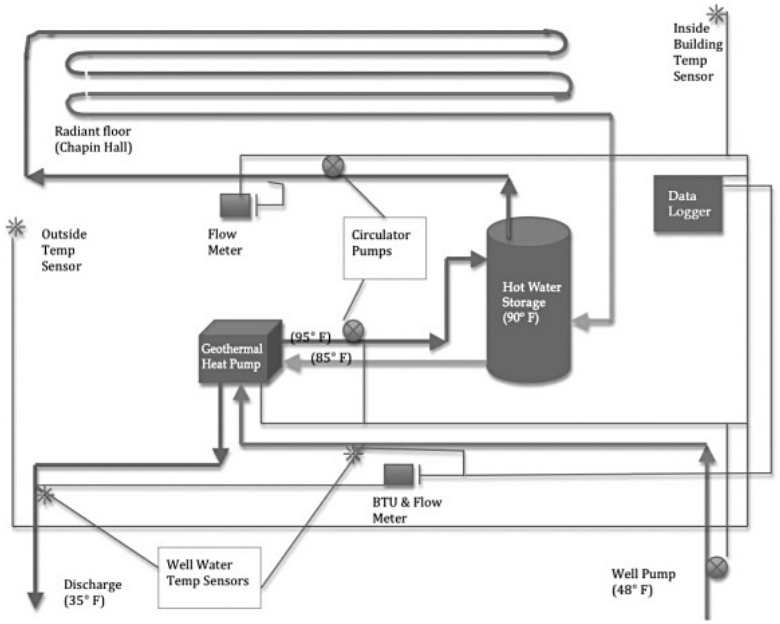
Checklist overview – Project information

- ✓System description
- ✓Size of the system (in tons)
- ✓Type of ground loop
- ✓Name of designer and installer
- ✓Inspector
- ✓Performance test and date.



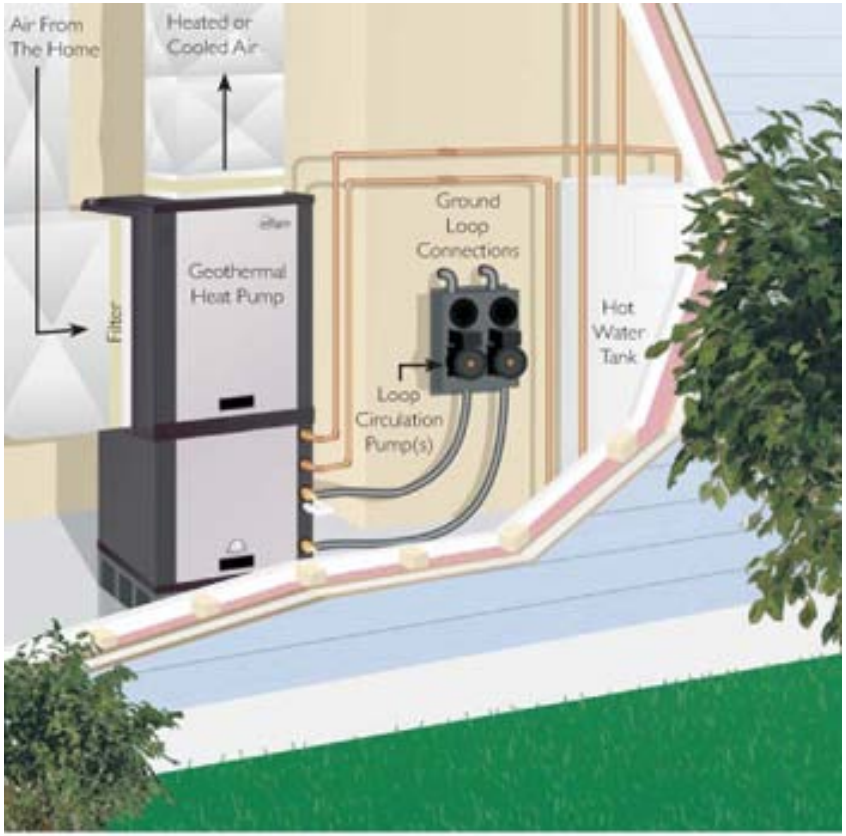
Checklist Overview – Pre-installation checklist

- ✓Design and Installation completed by IGSHPA certified contractor
- ✓System design drawings are complete
- ✓System is compliant with applicable codes
- ✓Proper permits
- ✓Sufficient warranties



Checklist Overview – Installation checklist

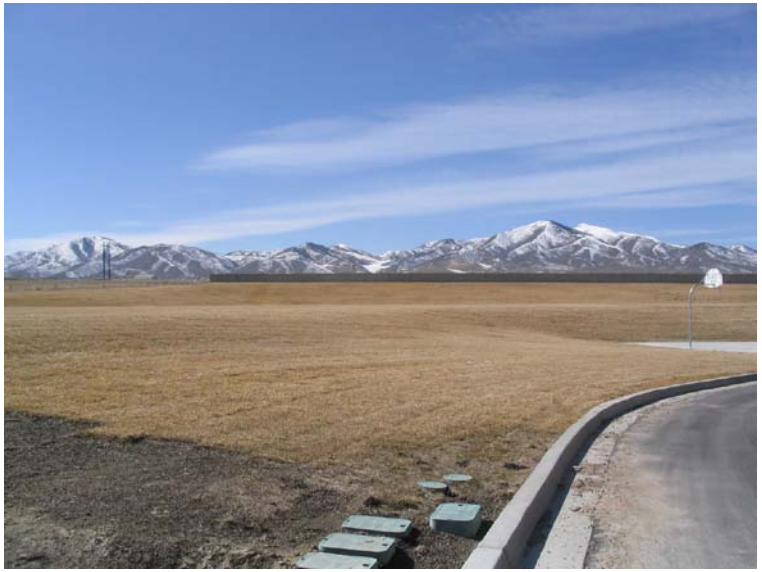
- ✓General
- ✓Ground Loop
- ✓Heat Pump/Mechanical
- ✓Electrical



An example of a vertical upflow unit installation

Checklist Overview – Post-installation checklist

- ✓Visual Inspection Prior to Burial of Ground Loop
- ✓Visual Inspection After Burial of Ground Loop
- ✓Performance Testing
- ✓System Documentation
- ✓Owner Education



Checklist Overview – System documentation and owner education

✓System Documentation

- All equipment and parts are labeled
- All as-built equipment is properly documented
- Customer Manual

✓Owner Education

- Understands basic system operation
- Can verify if system is performing correctly
- Understands required maintenance and schedule

Key Points to Remember

- ❑Verification of installation is important
- ❑Monitoring assists with the success of installations
- ❑If you don't know what to look for, just ask
- ❑A picture is worth 1,000 words
- ❑Document as much as possible
- ❑Does client understand maintenance?

Contact

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