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Charting a Course to Energy Independence

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Reviewing Real World Federal Geothermal Heat Pump Applications

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This Program Will Address:

- **Why Use Geothermal Heat Pump Systems**
- **New Building Project Considerations**
- **Existing Building Project Considerations**
- **Historic Building Project Considerations**

Geothermal Heat Pump Systems are: Simply The Best….

Per the EPA 1993 report titled Space Conditioning, The Next Frontier (Report 430-R-93-004), Geothermal Heat Pumps are:

"The most energy efficient, environmentally clean and cost effective space conditioning system available today."

Geothermal Heat Pump Systems Are: Simple and Flexible

- **Able to serve from the smallest house up to massive commercial facilities.**
- **Can provide heating, cooling, hot water, ventilation, etc.**
- **Available in forced air or hydronic models**
- **Have multiple options for ground heat exchange**

Environmental Operational Considerations

- No point of use combustion of fossil fuels, so no greenhouse gases discharged to the environment.
- Reduced electricity consumption, so reduced power plant emissions
- As stated at the beginning, per the EPA, "The most energy efficient, environmentally clean and cost effective space conditioning system available today."

Geothermal Heat Pump Systems are: A RENEWABLE Resource

- **Earth energy is available:**
  - **Day or night**
  - **Rain or Shine**
  - **Windy or calm**
  - **Not high temperature geothermal (50° C+)**
  - **Renewed by heat from the earth's core and/or the sun**

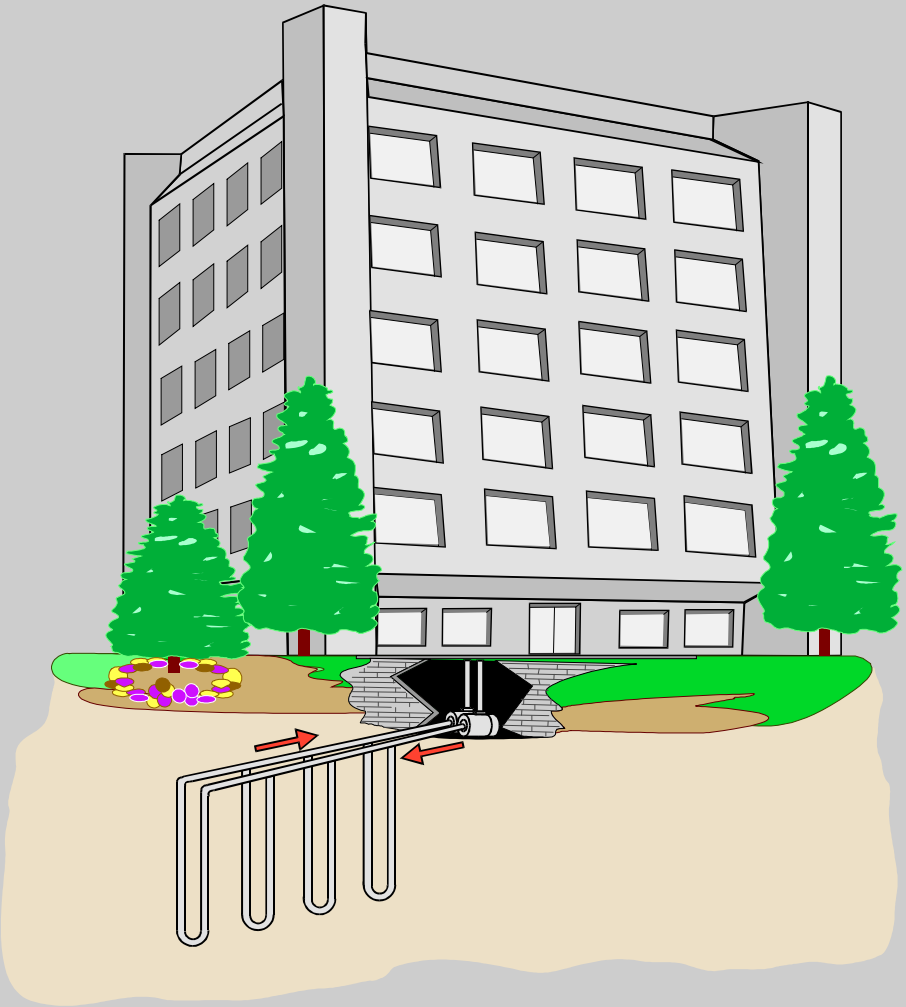
Typical Commercial GSHP System Requirements

- Vertical or horizontal package units with:
- Green refrigerant (R-410A)
- Single or two-stage compressors
- PFC or ECM fan motors
- Remote or internal loop pumping
- Desuperheaters (Optional – may use dedicated)
- Controls per project requirements
- Appropriate ductwork and return air design

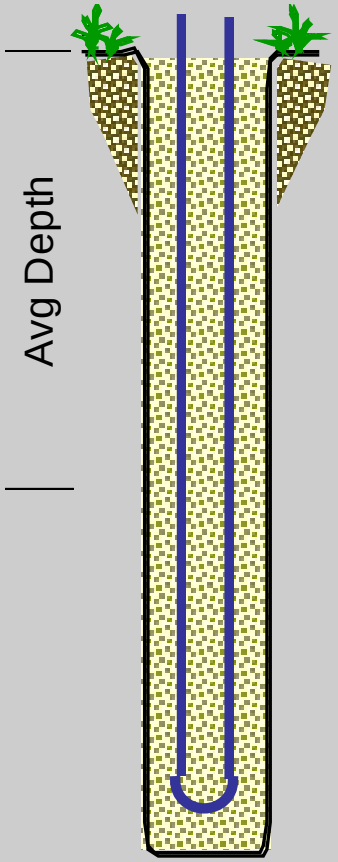
Typical Ground Heat Exchanger Requirements

- Vertical ground heat exchangers are by far the most common method of ground coupling.
- Loop field designed to accommodate building peak load heat loss/heat gain considering diversity (if applicable)
- Typically one loop field per building
- Multi-building condensed campus type projects sometime served by single loop field

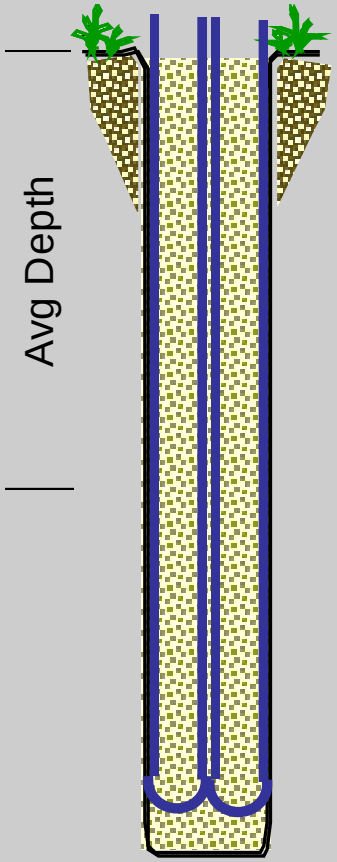
Vertical Loop System



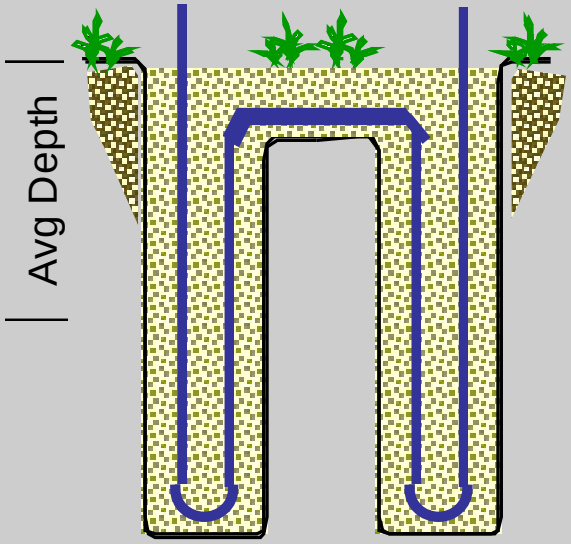
Verticals



One Pair



Two Pair



When Loops are shallower than one ton per loop

Series/Parallel One Pair

Typical Ground Heat Exchanger Requirements

- Drilling the borehole, inserting the U-bend, and grouting the hole
- Trenching to install headers
- Installing header piping using heat fusion technologies
- As-builts, locator wire and warning tape
- Testing the ground heat exchanger

Drilling the Boreholes

Inserting the U-bend

Grouting the Borehole

Trenching and Headering

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Locator Wire and Testing

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Optional Desuperheater Requirements

GSHP New Construction Applications

On new construction applications, GSHP systems are installed as a part of the regular construction process from site pad prep through final completion. Site work such as ground cover and/or landscaping is by others.

GSHP New Construction Requirements:

- Loop piping building entry
- Ground heat exchanger installation (as previously described)
- Ductwork rough-in and control wire installed (technology blind)
- Equipment set and desuperheater connected (if used – as previously described)
- Ductwork final trim out (technology blind)
- Check, start-up, and test

Chase Type Building Entry

New Construction Drilling

Headering to Building

Setting GSHP Equipment

Finished Product

GSHP Retrofit Applications

On retrofit applications, GSHP systems are installed as all or a part of renovation to one or more existing buildings. After installation, exterior restoration is required.

GSHP Retrofit Requirements

- Ground heat exchanger installation (as previously described but typically with drilling spoils control)
- Loop piping building entry
- Ductwork inspected and used as is or modified
- Equipment set and desuperheater connected (if used – as previously described)
- Check, start-up, and test
- Site Restoration (sod or mulched, fertilized, and seeded)

Retrofit Drilling

Drilling Spoils Control

Building Entry

Setting GSHP Equipment

Site Restorations

GSHP Historical Retrofit Applications

On historical retrofit applications, GSHP systems are installed as all or a part of renovation to one or more historical buildings. After installation, very controlled exterior restoration is required.

GSHP Historical Retrofit Requirements

- Historical site evaluation
- Ground heat exchanger installation (as previously described but typically with drilling spoils control) and trenching caution/notification requirement
- Ductwork inspected and used as is or modified
- Equipment set and desuperheater connected (if used – as previously described)
- Check, start-up, and test
- Site Restoration (sod or mulched, fertilized, and seeded)

Historical Site Evaluation

Setting GSHP Equipment

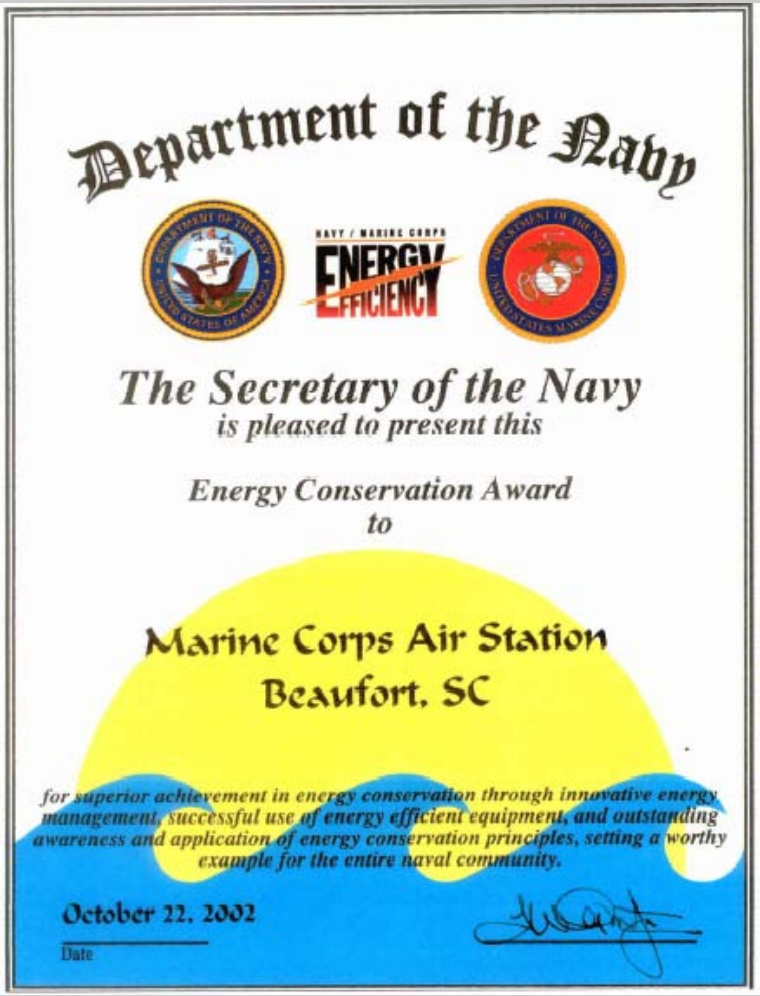
Finished Product

The Rewards

- Utilizing a renewable technology
- Helping meet energy consumption targets
- Eliminating greenhouse gas discharge
- Reduced maintenance costs
- Reduced capital expenditures
- Eliminate outside equipment and related
- Peace and quite
- No targets of opportunity,
- And you just might get recognized….

Fort Polk - Hammer Award

Beaufort MCAS Awards



Department of the Navy

NAVY / MARINE CORPS ENERGY EFFICIENCY

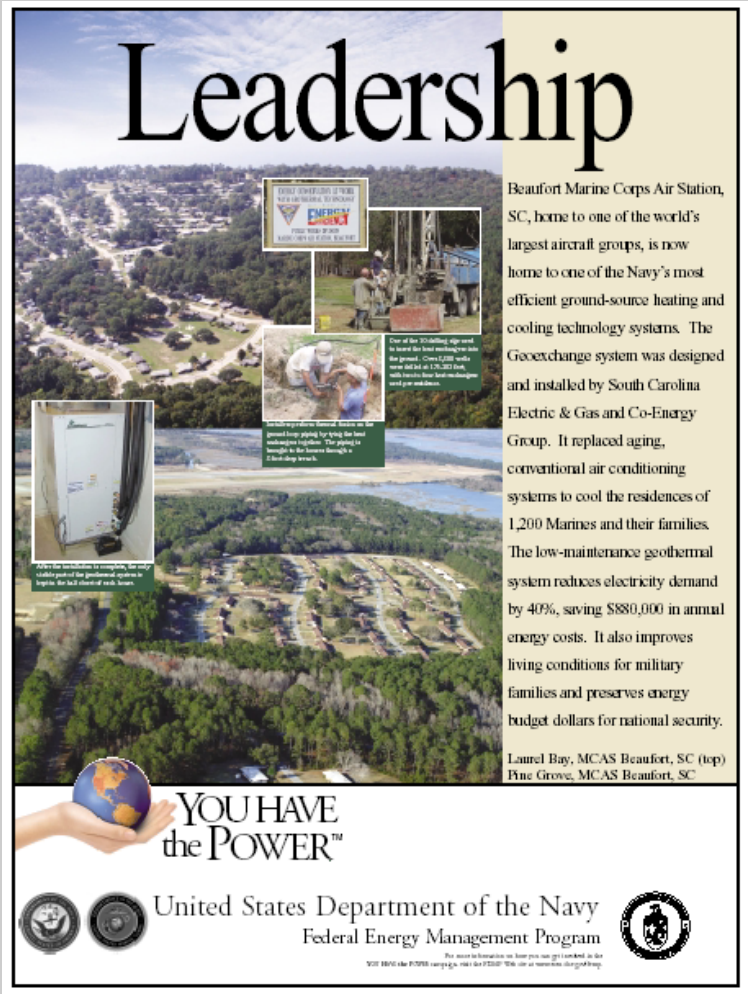
The Secretary of the Navy
is pleased to present this

Energy Conservation Award
to

Marine Corps Air Station
Beaufort, SC

for superior achievement in energy conservation through innovative energy management, successful use of energy efficient equipment, and outstanding awareness and application of energy conservation principles, setting a worthy example for the entire naval community.

October 22, 2002
Date



Leadership

Beaufort Marine Corps Air Station, SC, home to one of the world's largest aircraft groups, is now home to one of the Navy's most efficient ground-source heating and cooling technology systems. The Geoexchange system was designed and installed by South Carolina Electric & Gas and Co-Energy Group. It replaced aging, conventional air conditioning systems to cool the residences of 1,200 Marines and their families. The low-maintenance geothermal system reduces electricity demand by 40%, saving $880,000 in annual energy costs. It also improves living conditions for military families and preserves energy budget dollars for national security.

Laurel Bay, MCAS Beaufort, SC (top)
Pine Grove, MCAS Beaufort, SC

YOU HAVE the POWER™

United States Department of the Navy
Federal Energy Management Program

Any Questions??