

ORNL's Unsurpassed Expertise with Geothermal Heat Pumps

If designed properly, GHPs save energy and cost less to maintain.



The small white box left of the porch is the only outdoor evidence of the new GHP system that provides heating, cooling, and hot water in this military family residence.

A growing number of federal agency sites are turning to geothermal heat pumps (GHPs, or ground-source heat pumps) to improve their facilities, reduce energy and maintenance costs, and meet energy goals. The Department of Defense alone has invested more than \$400 million to install an estimated 21,000 GHP units in their facilities, the majority in military family housing.

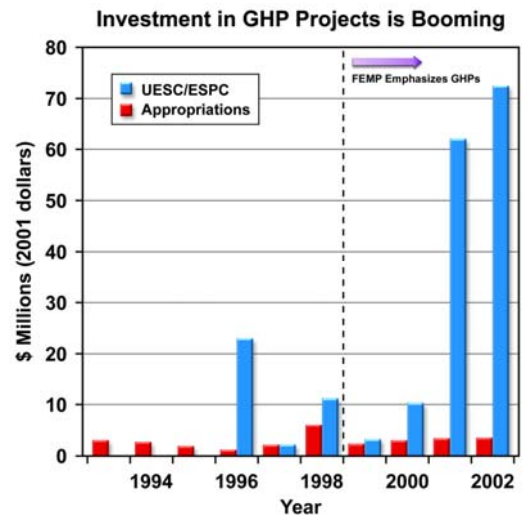
Replacing conventional heating and cooling equipment with GHPs typically saves up to 25% of total building energy use in nonresidential buildings and up to 40% in residential buildings. GHPs can significantly reduce peak electrical demand as well. Low maintenance cost, owing to their simpler technology and indoor placement, is another important advantage of GHPs.

Bringing GHPs into the mainstream

GHPs were a proven technology for some time before they were used widely in the federal sector, because to justify an investment in GHPs and move forward with confidence, federal managers needed hard data to document the performance and benefits of GHPs in real installations in facilities like their own. These managers needed:

- adequate models of GHP systems for use in building energy analysis software programs,
- guides for estimating GHP construction or maintenance costs,
- useful and reliable design tools,
- engineers qualified and willing to consider GHPs in their designs, and
- quality contractors for GHP installation, commissioning, and service.

These tools and capabilities for GHPs could not always be found locally in the private sector, so the U.S. Department of Energy's Federal Energy Management Program (FEMP) supported several ORNL engineers to serve as its GHP core team to fill the gaps in the GHP infrastructure. Then, the core team and private sector overcame all of the technical barriers for particular GHP projects, agencies often lacked sufficient capital appropriations to implement them. This last barrier was overcome when FEMP established the GHP Super Energy Savings Performance Contracts (ESPCs) to give federal sites access to quality sources for developing, financing, and implementing GHP



projects. ORNL's GHP core team provided technical support to the DOE procurement officials who competitively awarded the GHP Super ESPC contracts, and then provided direct assistance as needed to agency customers or the energy service companies or utilities and their subcontractors who were implementing GHP projects. As a result of these activities, the cumulative federal investment in GHPs has grown from \$6 million in 1995 to \$300 million in 2007, more than doubling the GHP growth rates achieved in the non-federal markets.

The hard data that triggered this success came from ORNL's independent, unbiased, and statistically robust evaluation that detailed the energy and cost savings and maintenance benefits from a 4000-home GHP retrofit at Fort Polk, Louisiana (ORNL/CON-460, April 1998). In this federal city of 12,000 people, reductions in electricity consumption of 33% and summer peak demand of 43% were achieved. Industry worked diligently for years to make the Fort Polk project happen, but it was ORNL's independent and unbiased evaluation that mattered most to skeptical federal facility managers.

Engage ORNL to guarantee a successful GHP project

ORNL's unsurpassed expertise has helped many agencies develop and implement GHP projects that are delivering maximum value and long-term savings to their facilities. The ORNL GHP team provides authoritative, objective technical assistance at any level — from initial feasibility screenings, to ensuring that contractor-designed GHP systems are priced right and perform as expected.

ORNL provides the following kinds of technical assistance for GHP retrofits or new construction:

- Feasibility studies
- Life-cycle-cost studies
- Review of technical and price proposals
- Review of system design
- Interpretation of thermal properties tests
- Review of bore field sizing
- Baseline and energy savings estimates/calculations
- Review of pricing
- Development of building simulation models
- Development of measurement and verification plans



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ORNL's timely independent design review and simulation modeling for residential GHP systems for Marine Corps Air Station Beaufort, South Carolina ("Fightertown") contributed to the success of the project.