GeoExchange in Federal Facilities

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GEOEXCHANGE

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ABOUT THE GEOTHERMAL HEAT PUMP CONSORTIUM

The Geothermal Heat Pump Consortium, Inc. (GHPC), is a non-profit organization whose goal is to advance the use of GeoExchange (geothermal) heating and cooling systems, a high comfort, cost-effective, and environmentally sound technology that takes constructive advantage of the Earth’s ability to store renewable energy from the sun. GHPC is a partnership between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), the nation’s electric utilities, and the GeoExchange heat pump industry.

INTRODUCTION

With Executive Orders 12902 of March 1994 and 13123 of June 1999, President Clinton reinforced the 1992 Energy Policy Act by mandating substantial increases in energy efficiency and conservation measures at federal facilities.

One of the primary requirements of EO 12902 is for each agency to develop a program "designed to speed the introduction of cost-effective and energy efficient technologies" that would contribute to "reducing energy consumption by 30 percent by the year 2005." Another requirement is a 25-percent reduction in greenhouse gas emissions by 2005, relative to 1990 levels. The newest mandate, EO 13123, calls for a 35-percent energy-use reduction over 1985 levels, and a decrease in greenhouse gas emissions of 30 percent relative to 1990 levels—both to be accomplished by 2010.

To support the agencies in this process, the Department of Energy's Federal Energy Management Program (FEMP) continues to develop and offer a wide range of information, services, and contracting mechanisms. Three significant outcomes of that effort have been the creation of the energy savings performance contract (ESPC), the super energy savings performance contract (Super ESPC), and strategies for the use of GeoExchange Systems, a highly cost-effective, energy-efficient, and environmentally sound space conditioning technology. (GeoExchange is also known as ground source, water source, and geothermal heating and cooling.)

This brochure and the accompanying videotape tell the story of how several federal agencies are successfully using GeoExchange in their efforts to comply with the mandate to substantially reduce energy consumption and greenhouse gas emissions. GeoExchange technology together with the ESPC and Super ESPC contracting systems, can enable other agencies to do the same.

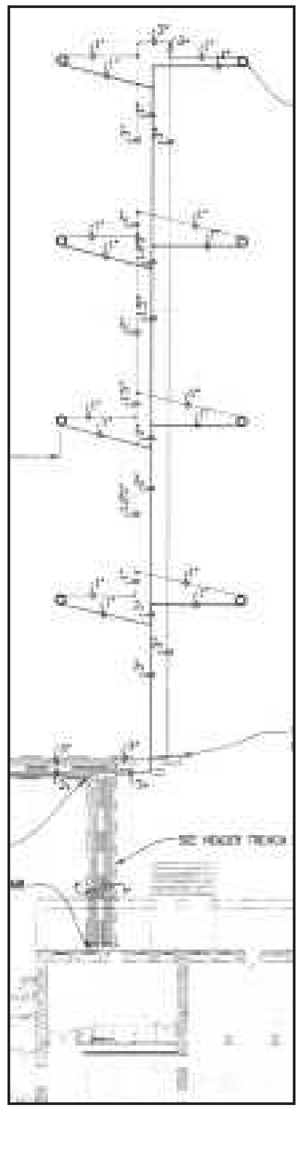
WHAT IS GEOEXCHANGE AND HOW DOES IT WORK?

GeoExchange technology provides space heating and air conditioning that can save energy and slash electric bills, cut greenhouse gas emissions, eliminate the need for outdoor components, drastically reduce the cost of potable hot water, and reduce maintenance costs, even as it improves year-round building comfort. While GeoExchange systems may, at first glance, seem almost too good to be true, their benefits derive from the sound application of technology—what can be regarded as good science.

What They Do

A GeoExchange system is a simple device that uses the earth's renewable energy to provide high efficiency heating and cooling. In winter, the system draws heat from the ground and transfers it into the building space. In summer, it extracts heat from the building's interior and transfers it to the ground. Hardware consists only of heat pumps connected to a series of small-diameter pipes buried underground. A water solution circulating through the pipes carries heat between the ground and the heat pump.

Since GeoExchange systems merely transfer heat to and from ground that remains at a nearly constant temperature year-round, they operate at surprisingly high efficiencies. In fact, they provide nearly four times the energy they consume.



How They Work

GeoExchange systems, like heat pumps and air conditioners, make use of a refrigerant cycle to help transfer (or pump) heat. Refrigerators, air conditioners, and heat pumps all operate by pumping refrigerant through a closed loop in a way that creates a cool zone and a warm zone. In the cool zone, the refrigerant is allowed to evaporate, absorbing energy; in the warm zone, the refrigerant is allowed to condense, releasing energy.

In a refrigerator, for instance, a fan blows the air inside the refrigerator over tubes containing refrigerant that is very cold (typically below 0ºF). Heat is transferred from the interior air to the cooler refrigerant. The refrigerant is then pumped to the high-temperature section, which consists of tubes underneath or outside the back of the refrigerator. Room air flows across these tubes. Because the refrigerant is hot in this zone, it gives up heat to the relatively cooler air in the room, before flowing back to the cold zone to begin the loop again.

An air conditioner or chiller system works in exactly the same way, except that it extracts heat from the air inside a room or building and transfers it the air outside the building.

A traditional heat pump also works similarly, but has a reversing capability, so that it can extract heat from the outside air in the winter and transfer it inside. While being able to extract heat from winter air that is already cold seems counterintuitive, remember that to do so requires only that the refrigerant be made colder than the outside air. And modern heat pumps can do that.

The Efficiency of GeoExchange

Standard heat pumps, while relatively simple to operate, face one major challenge. Their operating efficiency is lowest when demand is highest; that is, heat pumps have to work hardest when we want the most from them.

A regular heat pump extracts heat energy from outside air in winter, and rejects heat to outside air in summer. Unfortunately, the colder the outside air, the more difficult it is to extract heat from it, and the hotter the outside air, the harder it is to transfer heat to it. The temperature difference between the air and the refrigerant is small in both cases, lowering heat transfer rates within the system.

Yet, the colder it gets outside, the higher the rate of heat loss through windows, around doors, and through walls and roofs, and the more heat we need to pump inside to keep indoor temperatures comfortable. In summer, a similar scenario plays out. The hotter it gets outside, the higher the rate of heat infiltration into the building, and the more heat removal we need to maintain comfort.

The GeoExchange Difference

A GeoExchange system eliminates this dilemma by using the relatively constant-temperature ground as a heat source in winter and a heat sink in summer, instead of outside air. Throughout most of the U.S., the temperature of the ground below the frost line (about 3 to 5 feet below the surface) remains at a nearly constant temperature, generally ranging from 45º–50ºF in the north, to 65º–70º in the deep south. So, in the winter, a GeoExchange unit can extract heat from ground that's relatively warm compared to the cold outside air, and in the summer, it can discharge heat to ground that is relatively cool, compared to the hot outside air.

Since the difference between the refrigerant temperature and the ground temperature remains relatively high in both seasons, so do heat transfer rates. Consequently, the GeoExchange system operates at much higher year-round efficiencies than a standard heat pump.

Making The Ground Connection

The unique aspect of the GeoExchange system, and the key to its delivery of such a long list of benefits, is the ground loop. The ground loop provides the means of transferring heat to the earth in summer, and extracting heat from the earth in winter. Physically, the "ground loop" consists of several lengths of tough, resilient, and flexible plastic pipe typically installed either in horizontal trenches or vertical holes that are subsequently filled and covered with landscaping, grass or even parking lots.

Fluid inside the ground loop piping (water or a water/nontoxic antifreeze mixture) is pumped through a heat exchanger in the GeoExchange unit. In the summer, it absorbs heat from the refrigerant hot zone and carries it to the ground through the ground loop piping. In winter, it absorbs heat from the earth through the ground loop, and then transfers that heat to the refrigerant cold zone.

The length of the ground loop will be determined by the heating and cooling loads, which are determined in turn by the building's size, its design, construction, orientation, and the climate. Whether the ground loop is most efficiently installed in horizontal trenches or in vertical bore holes depends on local soil conditions, geology, and the amount of land available.

Alternatively, if the building is near a lake or pond, closed loop piping can be installed at the bottom of the body of water, transferring heat to and from the water. Where water is especially clean and plentiful, an open loop system can even be used, where wells are drilled and water is pumped from supply wells, through the GeoExchange heat exchanger, and back to the acquifer through return wells.

Any one of these installation schemes, though, results in the same high efficiency, when properly sized.

POST OFFICES IN MARYLAND: "GEOEXCHANGE IS THE ANSWER"

Since early 1997, ten U.S. Postal Service facilities in Maryland have replaced a variety of failed or failing conventional heating and cooling systems with GeoExchange technology, in one case removing a brand new air-to-air system that was already showing signs of trouble. All ten facilities have been realizing between 34 and 42 percent energy savings from the new systems, supplemented with energy conservation measures (ECMs) such as upgraded insulation, lighting and windows. And all expect even greater energy and cost savings in the future.

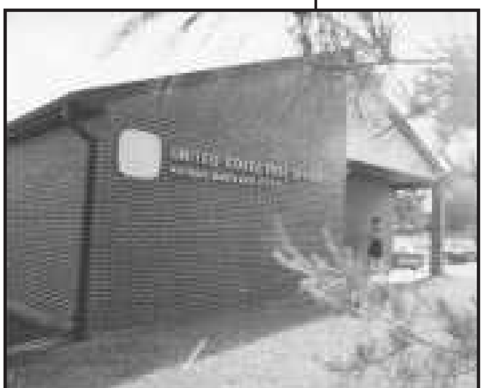
USPS Manager of Field Maintenance Operations, Gary Dunaway, says of the technology, "It's the way to go, there's nothing else like it." Like other facility managers who have GeoExchange experience, he cites the systems' unparalleled energy- and life-cycle-cost savings, environmental soundness, total elimination of above-ground equipment (with its tendency to trap dirt and tempt vandals), near elimination of service calls, and ease of operation and maintenance. As someone both personally and professionally committed to lowering fossil fuel emissions, he especially appreciates the uniquely low environmental impact of GeoExchange technology, one of the "credits" he uses in evaluating costs and benefits.

The facilities' postmasters have additional reasons for liking the systems: consistently high comfort levels, unlike the extremes of hot and cold, and the poor-to-mediocre air quality with which they'd contended before. And administrators are impressed by greater than expected savings due to lower energy consumption, improved energy use patterns, elimination of the need for special operators or service contracts, and improved morale, health, and productivity among personnel.

System Financing and Design/Installation

As a quasi-governmental agency, the U.S. Postal Service normally funds projects from its own revenues on an area wide basis, with the General Services Administration providing the funding mechanism. To date all of the Maryland post office GeoExchange projects have been financed this way. (For the Postal Service, as for other agencies, a mechanism for private-sector funding opened up with the advent of energy savings performance contracts (ESPCs) and energy service companies (ESCOs), and more recently, Super ESPCs and Super ESCOs, described on page 14 of this booklet. Future projects will be funded either conventionally or under the Super-ESPC option, depending on the size of the project and the availability of revenues for up-front funding of total costs.)

Constellation Energy Source (CE Source), one of five ESCOs that the U.S. Department of Energy recently awarded a nationwide Technology-Specific Super ESPC for GeoExchange projects, has installed nine out of ten of the Maryland post offices' GeoExchange projects, located in small communities in Western Maryland and on the Eastern Shore.



Both the Postal Service's Gary Dunaway and CE Source's Bob Sweitzer, Senior Account Representative, consider these installations to be ideal applications of GeoExchange technology. The retrofits replaced the full range of conventional heating, ventilation, and cooling technologies including oil, propane, oil with air-to-air conditioning, oil with water-to-water air conditioning, gas-fired with chiller, and all-electric.

Besides the need for drastic energy savings and consistent comfort and air quality, the new systems have resolved many longstanding issues. Among them were degrading and leaking underground fuel storage tanks, high fossil fuel combustion emissions, repeated compressor or compressor-component breakdowns (contributing to high use of exorbitant resistance heating), and slow and costly system response to high volumes of air brought into the buildings by customers and mail handlers coming and going through front and back doors.

The facilities' GeoExchange equipment, typically either one lead unit and one back-up or a single unit with two speeds, fit into mechanical rooms no larger than a standard utility closet. The only maintenance they require is changing the filters twice a year, and an annual maintenance check-up, in contrast to the once-a-month visits many of the old systems required.

The well field for each system is located under either grassy areas or asphalt parking lots flanking the buildings, or both. Business has gone on as usual during installation, which lasts between four and eight days causing minimal inconvenience to patrons and occupants. The number of boreholes drilled for the underground heat exchanger piping has averaged between eight and ten. All of the systems already installed have been vertical closed loop designs, though CE Source is looking into the possibility of installing an open loop system for a facility on Maryland's Eastern Shore.

Overall Appraisal—and Advice to Potential Users

"I see GeoExchange right now being where internal combustion was this time last century," says Bob Sweitzer. "It's there, it has unlimited potential, but most people are still riding the horse. It's gonna save between 30 and 40 percent on energy bills, there's no doubt about it. What we've got to do is educate the public that . . . at the end of that 20-year life cycle, the only thing you're replacing is the internal [indoor] components. The GeoExchange field [the heart of the technology] will go on and on and on." When asked if he thinks GeoExchange could be a wide-ranging solution to the energy and emissions challenges facing federal agencies in 2005 and 2010, Sweitzer responds positively, "Absolutely, it's the answer . . .These systems are so simple and so reliable and effective compared to the others. It's not rocket science."

But both Sweitzer and Dunaway as well as CE Source's Director of Engineering David Dash, do temper their enthusiasm for GeoExchange with some advice to potential users of the technology: It's important to have an experienced project manager on every project, preferably one certified by the International Ground Source Heat Pump Association (IGSHPA) or with a minimum of 2 years' work on GeoExchange systems, including at least one with 250-ton capacity, or greater. They also stress the importance of selecting only qualified bidders, meaning those with proven, certifiable or customer-testified GeoExchange installation experience. In fact, they believe it's best to seek bids only from qualified bidders in the first place. (For information on how to locate assistance and guidance in ensuring a successful GeoExchange project, refer to the GeoExchange Resource Guide on page 16 of this booklet.) ◆

. . ."These systems are so simple and so reliable and effective compared to the others. It's not rocket science."

says Bob Sweitzer of CE Source

Agencies Sign On With GeoExchange Technology

The U.S. Postal Service is one of three federal entities that has entered into a technology transfer program with the Geothermal Heat Pump Consortium (GHPC) in an effort to reduce air pollution and energy consumption in its facilities nationally.

In a 'Memo of Understanding' signed earlier this year, officials at the U.S. Postal Service noted that reducing energy consumption while protecting the environment is a high federal priority. "The U.S. Postal Service builds 4 to 5 hundred new facilities each year, and seeks to lower expenses while minimizing harmful emissions," said Dennis Baca, Manager of Environmental Management Policy for the Postal Service. "GeoExchange limits environmental liabilities, reduces service calls, and remains protected from vandalism and the elements. Moreover, because it uses a renewable energy source, the systems decrease our dependency on foreign energy."

Under the Program, the U.S. Postal Service will evaluate the feasibility of installing GeoExchange technology in its facilities wherever it is cost-effective. For its part, GHPC will help the government perform feasibility and life-cycle-cost analyses, then assist in the design of appropriate GeoExchange systems. In addition, to the Postal Service, the U.S. Department of State and the General Services Administration have signed MOU's with GHPC.

COURTHOUSE AND JAIL, FORT SMITH, ARKANSAS:

PRESERVING THE PAST WITH TECHNOLOGY OF THE PRESENT AND FUTURE

A National Historic Site of the National Park Service since 1961, Fort Smith has housed military, civilian federal, state, and city agencies, as well as private businesses during its colorful 182-year history. In its heyday, the Fort served as protector, peace-keeper, and law enforcer for the tumultuous frontier territories. The largest and most significant onsite structure is the Courthouse/Jail, best known as the place where "Hanging Judge" Isaac Parker presided over the U.S. Court for the Western District of Arkansas between 1872 and 1893. Judge Parker dispensed justice to the frontier outlaws he found guilty of everything from petty larceny to murder to harassment of Cherokee Indians traversing the site's portion of the Trail of Tears.

The current restoration project, which centers on rehabilitation of the Courthouse and Jail, responds to longstanding community cultural needs and legal requirements including federal laws that safeguard cultural and natural resources. The first phase of the project calls for replacement of the structure's obsolete and hazardous open-flame gas-fired stoves with a GeoExchange system. Installation began recently with clearing of the well field and the drilling of the first boreholes.

The decision to use GeoExchange followed an in-depth cost analysis comparing the technology with three other systems: air-cooled heat pumps, gas boiler and chiller, and electric resistance and chiller. The study's outcome was a recommendation for either a GeoExchange system or a gas-fired boiler/chiller system. Both had been found to be far more economical than the other two alternatives, and would satisfy all of the site's HVAC requirements.

But several other considerations weighed heavily in favor of GeoExchange: The estimated annual energy costs of the gas-fired boiler/chiller were more than twice those of GeoExchange ($17,248 vs.

$7,948); the gas-fired system would require an exterior location for the chiller, with associated visual and noise impacts incompatible with the requirements for a historic site; and it would mean having to use exhaust-and-combustion vents equally incompatible with the building's period style.

While the initial costs of the GeoExchange system are higher than for the gas-fired system, its energy-efficiency savings and lower environmental impact, both indoors and out, will more than compensate for the cost difference when looking over the two systems' expected lifetimes.

The estimated annual energy costs of the gas-fired boiler/chiller were more than twice those of GeoExchange ($17,248 vs. $7,948).

The GeoExchange System

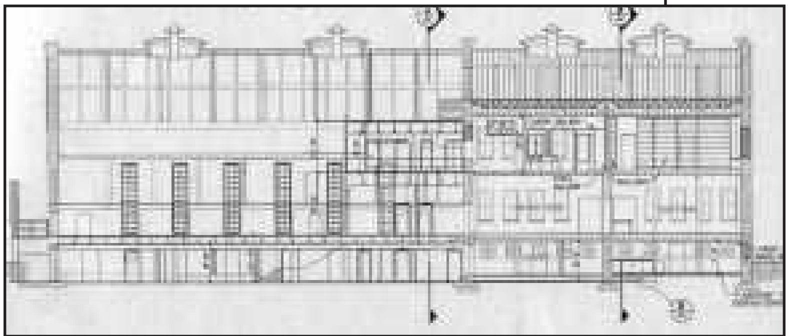
Fort Smith's Courthouse and Jail GeoExchange system is the heart of the building's overall energy-savings and air quality/climate control plan. Other energy efficient features being added are insulating the building's two roofs and replacing all windows with double-pane insulated glass. Additionally, the structure will be maintained under positive interior air pressure to minimize pollutant infiltration from outside. All new and existing wall, floor, and roof penetrations will be sealed and insulated.

Indoor components of the GeoExchange system will include all-new duct work and twelve water-to-air heat pumps for various zones individually controlled by programmable thermostats (an optional feature of a GeoExchange system that users especially value). Outside air will be provided per ASHRAE standard 62-89 for acceptable indoor air quality based upon required CFM and continuous fan operation during occupied periods.

The well field will be monitored for archeological finds during trenching and ultimately landscaped in accordance with cultural landscape planning. It will contain a vertical loop system comprised of high density polyethylene pipe, 1 inch in diameter in 32 bore holes spaced 40 feet apart to a depth of 400 feet.

System Financing

As part of the Fort Smith restoration project, the system will be paid for by a congressional appropriation. Because the National Park Service will own the system outright, it will immediately begin to realize all of its energy and maintenance savings.



NATIONAL PARK SERVICE
VANDERBILT NATIONAL HISTORIC SITE ALSO SLATED FOR GEOEXCHANGE

"We're off on an adventure. I can't wait to get [the system] built and 'test drive' it. No more worrying about when the boiler's going to give me problems again. . . We feel like it's the way to go. It's the future."

Henry Van Brookhoven,
Chief of Area Services,
Roosevelt-Vanderbilt National
Historic Sites

By the middle of the year 2000, the nationally famous Vanderbilt Mansion overlooking the Hudson River in Hyde Park, New York, expects to replace its oil-fired boiler system and non-existent air conditioning with GeoExchange heating and cooling. The system's four 1500-foot-deep wells will minimize disruption of the historic landscape, while the temperature and humidity control, and freedom from combustion, (and its environmental and structural effects) will optimally protect the site's irreplaceable materials and holdings. Other deciding factors in choosing a GeoExchange system were its total elimination of visual and noise degradation and its tremendously lower projected life-cycle costs: $32,000 to $35,000 annually, compared with more than $80,000 for the boiler/chiller system.

FORT POLK, LOUISIANA, BASE HOUSING:

33 PERCENT REDUCTION IN WHOLE HOUSE ELECTRICAL CONSUMPTION

The Army's Fort Polk Joint Readiness Training Center in west central Louisiana prepares military and civilian personnel for airlift, close-air support, resupply, and battlefield combat missions. Altogether some 23,000 military personnel and family members live in base housing, which consists of 4,003 units in 1,296 buildings.

The units are mostly apartments, two-story townhouses, and duplexes, ranging in size between 900 and 1,400 square feet. About 80 percent of the units originally had air-source heat pumps and electric water heaters. The remainder were heated by natural gas forced-air furnaces and had central air conditioning. Cooling and humidity control are the main requirements in this area.

Fort Polk energy managers needed a way to reduce energy and maintenance costs while avoiding cuts in services and salaries. The housing HVAC equipment was "a hodgepodge of minimum-efficiency units selected on the basis of low bids" and suffer from mistakes in sizing and poor installation. In July of the last year before the retrofit, the number of service calls averaged 90 per day and sometimes reached 100.

In addition acute and worsening maintenance headaches were the primary motivation for seeking a package arrangement that would allow the Army to shed maintenance responsibilities and renew the heating and cooling systems. In evaluating and attempting to reconcile budget constraints and the energy-savings mandates of EO 12902, it became apparent that a GeoExchange retrofit acquired by way of an energy savings performance contract (ESPC), could offer the best solution: It would allow the needed construction to be paid for out of energy cost savings without adding to the operating budget, or perpetuating the maintenance problems.

At that time, the advantages of GeoExchange technology to both contractor and customer were "a well-kept secret," and only one ESCO, Co-Energy Group—now a primary consultant to the Super ESCO Enron Energy Services—bid for the project. (Another ESCO, Exelon Energy Services, Inc., later bid for and won a contract to install 25 percent of the GeoExchange systems put in since the original installations.) The project was carried out under the largest ESPC that had ever been drawn up, and remains one of the largest GeoExchange installations.

Fort Polk's ESPC and GeoExchange System

The GeoExchange ESPC

The energy savings performance contract (ESPC) funded the equipment, installation, and maintenance funds for Fort Polk's GeoExchange systems.

The $18-million contract, completed in 1996, was financed and managed by the Huntsville Engineering and Support Center of the Army Corps of Engineers and administered by Fort Polk. Under its terms, the energy service company (Co-Energy Group) financed the project with virtually no up-front cost to Fort Polk, on the understanding that DOD would return 77.5 percent of the first 20 years' savings to the ESCO. Because the equipment is owned and maintained by Co-Energy, the Army will save all baseline maintenance costs, estimated at about $1.3 million annually. Fort Polk will keep 22.5 percent, or an estimated $744,800, of the expected annual energy and maintenance savings for 20 years, after which they will own the equipment and all profits (savings) for the remaining life of the system. The savings realized by the base will be put back into environmental and energy conservation projects.

The GeoExchange System

The GeoExchange system at Fort Polk is a closed-loop, vertical-borehole ground heat exchanger system. The heat exchanger, the heat pumps (4,003 GeoExchange heat pumps ranging between 1.5 and 2.5 tons), and the other components of the system were designed for easy installation, compact size, maximum efficiency, long life, and low maintenance demand and cost. In addition to those benefits the GeoExchange System will also provide a more comfortable environment for the residents.

The well fields are located in the front, back, or side yard of each residential building. Collectively, the loop systems' high-density polyethylene pipe is sunk in more than 8,000 boreholes, 4 inches in diameter, at depths of 130 to 325 feet.

Dramatic Energy Savings

According to Oak Ridge National Laboratory's evaluation, annual electricity consumption in Fort Polk's family housing has dropped by about 26 million kWh since retrofit—a 33 percent reduction that has already put the base within easy reach of the overall 30 percent savings it must achieve by 2005. Natural gas consumption of 260,000 therms per year for space and water heating has been completely eliminated. Together these savings represent an estimated reduction in CO_2 emissions of 22,400 tons annually. Summer peak electrical demand has diminished by 7.5 MW, a 43 percent reduction equivalent to a decrease of nearly 2 kWh per residence. The electrical energy and demand savings correspond to a 10 percent improvement in annual electric load factor.

The overall 33 percent reduction in electricity use was achieved in spite of the fact that electric-powered GeoExchange heat pumps replaced natural-gas-fueled furnaces and water heaters in 20 percent of the apartments. As expected, the average electricity savings in the originally all-electric housing units were substantially higher (35 vs.14 percent) than the savings in units that had used natural gas. In apartments that were all-electric before the retrofit, the geothermal heat pumps were found to save about 42 percent of the pre-retrofit electrical consumption for heating, cooling, and water heating. The proportion of total energy savings attributable to the new system—through the heat pumps as well as through the desuperheaters installed for water heating—was 66 percent in 200 apartments that were all-electric before the retrofit.

The GeoExchange ESPC has also allowed the Army to shift maintenance functions to a vendor and to cap future expenditures for family housing HVAC maintenance at about $0.18 per square foot per year and $262 per housing unit per year. This represents about 78 percent of the Army's previously estimated 20-year-average baseline maintenance costs of about $336 per housing unit per year—cost savings even greater than those originally estimated.

National Recognition for Success of Project

In July of 1997, Fort Polk's energy-saving GeoExchange installation was recognized by the presentation of Vice President Gore's Hammer Award, which honors teams that contribute to making government "work better and cost less by significantly reducing unnecessary bureaucracy and costly inefficiency." The award was presented jointly to Fort Polk, Louisiana State University, the U.S. Army Corps of Engineers Cold Regions, the U.S. Army Engineering and Support Center in Huntsville, and the Co-Energy Group, who together comprised the team responsible for the successful project. ◆

ESPCs, SUPER ESPCs, AND GEOEXCHANGE-CENTERED PROJECTS

Two innovative funding mechanisms now make it simpler and easier for federal agencies to undertake energy-saving GeoExchange projects.

Two innovative funding mechanisms now make it simpler and easier for federal agencies to undertake energy-saving GeoExchange projects.

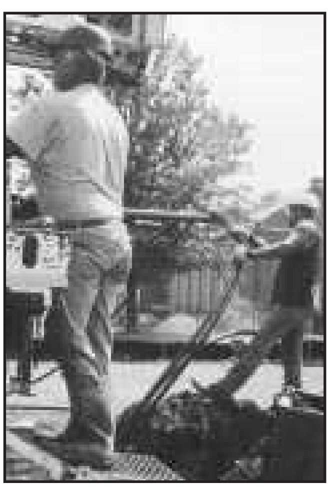
Energy Savings Performance Contracts (ESPCs)

Public Law 105-388 (the Energy Conservation Reauthorization Act) extended through September 2003 the authority of federal agencies to enter into ESPCs, or energy savings performance contracts. Under an ESPC, an energy services company (ESCO) assumes purchase, installation financing, and maintenance costs of energy-saving equipment, or purchase and financing costs of energy-saving services, in return for a share of the resulting savings—which the ESCO guarantees the agency.

ESPCs were specifically designed to reduce the cost of energy consumption in federal buildings without requiring capital investment by the building owner. They also eliminate the cost to the agency of maintenance and repair of aging or obsolete equipment, place operation and maintenance responsibilities on the contractor, and help stimulate the economy by allowing the ESCOs to profit from up-front investments in federally-owned buildings.

Super Energy Savings Performance Contracts (Super ESPCs)

Developed by the Department of Energy's Federal Energy Management Program (FEMP), Super ESPCs are similar to the traditional ESPCs, but streamline the ESPC contracting process, making it simpler, faster, and easier for the agency. By using the indefinite delivery/indefinite quantity (IDIQ) provision of the Federal Acquisition Regulation (FAR), they allow agencies to negotiate site-specific delivery orders with a Super ESCO (a company that has been awarded a Super ESPC) without having to start the contracting process from scratch. Agencies can effectively "piggy-back" their ESPC projects onto the broader Super ESPC, saving both time and money.



Super ESPCs use the same general contract terms and provisions as conventional ESPCs, and can be used to purchase equipment, products, and services that increase energy- and cost-efficiency. Like conventional ESPCs, they provide a congressionally approved mechanism for funding capital improvements with private sector monies rather than through federal appropriations—at no cost to the taxpayer.

But they're different from conventional ESPCs in two important ways: First a Super ESPC blankets a large geographic area, rather than a specific site. And second, Super ESPCs substantially reduce the lead-time necessary to contract with an ESCO for energy services. Using delivery orders under a Super ESPC, an agency can contract within 4 to 8 months (vs. 3 to 4 years under a traditional ESPC) to acquire equipment retrofits and private sector capital.

There are two types of Super ESPCs: (1) Regional, which blanket a broad regional area, and (2) Technology-specific, which blanket the nation and commit at least 33 percent of their funds to a particular energy-efficient or renewable energy technology. GeoExchange-centered ESPC projects are technology-specific.

Under the terms of this type of Super ESPC, an agency requiring energy services, equipment, or products (or some combination of the three), develops site-specific requirements and a delivery order using DOE's Technology-Specific Super ESPC Guidelines. The agency may select one Super ESCO, or request multiple proposals, without advertising the procurement. This system greatly reduces both lead-times and demands on agency resources to develop and award contracts, and allows energy savings to be realized more quickly. Because profits to the Super ESCO depend on realization of substantial energy savings by the agency, and because the contract was awarded to the Super ESCO on the basis of its experience and expertise with the particular technology, the risk of misapplication is minimized.

A GeoExchange-centered Super ESPC can be used solely for the purpose of retrofitting with GeoExchange technology or it can cover a more comprehensive project that includes multiple energy conservation measures—on the condition that at least 33 percent of the total cost of the hardware and services are applied to procuring and installing GeoExchange technology.

Project Support and Guidance

The FEMP Services Network (FSN) stands ready to assist agencies in achieving their cost- and energy-savings goals. Project facilitators from the network will lead agencies' acquisition teams through the GeoExchange Super-ESPC process for a modest fee, which can be paid either incrementally over 5 years or at the beginning of the project. The FSN partnership consists of DOE's Office of Energy Efficiency and Renewable Energy, Golden Field Office, and Regional Support Offices, and the Lawrence Livermore, Oak Ridge, Pacific Northwest National, and National Renewable Energy Laboratories. Technical and advisory services are also available from private sector contractors.

For further information on the Super ESPCs please contact: Doug Culbreth of FEMP's GeoExchange Technology Specific Program at 1-919-782-5238 or e-mail: carson.culbreth@hq.doe.gov

Delivery order process support services offered by the FSN include assistance with performance requirements and specifications for the development of RFPs, including measurement and verification (M&V) requirements and proposal submission and evaluation criteria. The FSN will also assist agencies in understanding Super ESPC requirements, site-specific operational considerations and range and appropriateness of the technology. Agencies can use the network as a "one-stop shop" for all of the technical and procurement expertise and services their personnel may need to implement energy-saving projects and achieve EO 12902 and EO 13123 compliance. ◆

Cost analysis studies and information provided by FEMP and the Oak Ridge National Laboratory convinced decision-makers at DOD/Navy's Naval Air Station Oceana and Little Creek Naval Amphibious Base in Virginia Beach, Virginia, to undertake the country's first Super-ESPC-financed GeoExchange installations. Oceana already has three conventionally funded GeoExchange installations under way at two barracks and a day care center, and engineers, administrators, and residents at both bases are looking forward to having Super-ESPC GeoExchange systems up and running and bringing in needed energy savings at 16 buildings by the end of year 2000. Sites will include offices, shops, classrooms, hangars, labs, communications and transportation centers, a Post Office, laboratories, and clubhouses.

Organizations

The following guide lists names, addresses, and telephone numbers of organizations you can contact for more information on GeoExchange heating and cooling. Design manuals, technical papers, installation guides, and software design tools also are listed. Available training courses are highlighted, as well as other useful information on GeoExchange systems.

1. **Geothermal Heat Pump Consortium, Inc. (GHPC)**
   701 Pennsylvania Avenue, NW
   Washington, DC 20004-2696
   Phone: (202) 508-5500
   Toll Free: (888) ALL-4-GEO (255-4436)
   Fax: (202) 508-5222
   Web: http://www.geoexchange.org
   E-mail: info@ghpc.org

2. **International Ground Source Heat Pump Association (IGSHPA)**
   Oklahoma State University
   490 Cordell South
   Stillwater, OK 74078-8018
   Phone: (405) 744-5175
   Toll Free: (800) 626-4747
   Fax: (405) 744-5283
   Web: http://www.igshpa.okstate.edu

3. **The American Institute of Architects (AIA)**
   1735 New York Avenue, NW
   Washington, DC 20006-5292
   Phone: (800) AIA-3837
   Fax: (202) 626-7364
   Web: http://www.aia.org

4. **American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)**
   1791 Tullie Circle, NE
   Atlanta, GA 30329-2305
   Phone: (404) 636-8400
   Fax: (404) 321-5478
   E-mail: ashrae@ashrae.org
   Web: http://www.ashrae.org

5. **Electric Power Research Institute (EPRI)**
   3412 Hillview Avenue
   P.O. Box 10412
   Palo Alto, CA 94303
   Phone: (415) 855-2411
   Toll Free: (800) 766-EPRI
   Web: http://www.epri.com

6. **National Rural Electric Cooperative Association (NRECA)**
   4301 Wilson Boulevard
   Alexandria, VA 22203-1860
   Phone: (703) 907-5500
   Fax: (703) 907-5521
   Web: http://www.nreca.org

7. **American Society of Mechanical Engineers (ASME)**
   8996 Burke Lake Road
   Burke, VA 22015
   Phone: (703) 978-5000
   Fax: (703) 978-1157
   E-mail: 76330.1335@compuserve.com
   Web: http://www.millkern.com/ero

8. **Air Conditioning Contractors of America (ACCA)**
   1712 New Hampshire Avenue, NW
   Washington, DC 20009
   Phone: (202) 483-9370
   Fax: (202) 232-8545
   E-mail: plupson@acca.org
   Web: http://www.acca.org

9. **Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)**
   4201 Lafayette Center Drive
   Chantilly, VA 20151
   Phone: (703) 803-2980
   Fax: (703) 803-3732
   Email: smacna@erols.com
   Web: http://www.smacna.org

10. **Environmental Protection Agency (EPA)**
    Manager GHP Program
    Mail Code 6202J
    401 M Street, SW
    Washington, DC 20460
    Phone: (888) STAR-YES
    Fax: (703) 803-3732
    Web:
    http://www.epa.gov/energystar.html

11. **U.S. Department of Energy (DOE)**
    Energy Efficiency and Renewable Energy Clearinghouse
    P.O. Box 3048
    Merrifield, VA 22116
    Phone: (800) 363-3732
    Fax: (703) 893-0400
    Web: http://www.eren.doe.gov

12. **Federal Energy Management Program**
    1000 Independence Avenue, SW
    Washington, DC 20585
    Phone: (202) 586-5772
    Help Desk: (800) DOE-EREC
    Fax: (202) 586-3000
    Web: http://www.eren.doe.gov/femp

13. **National Ground Water Association (NGWA)**
    601 Dempsey Road
    Westerville, OH 43081-8978
    Phone: (614) 898-7791
    Toll Free: (800) 551-7379
    Fax: (614) 898-7786
    E-mail: ngwa@ngwa.org
    Web: http://www.ngwa.org

14. **Canadian Earth Energy Association**
    130 Slater Street, Suite 1050
    Ottawa, ON Canada K1P6E2
    Phone: (613) 230-2332
    Fax: (613) 237-1480
    E-mail: ceea@earthenergy.org

TRAINING CENTERS

1. **International Ground Source Heat Pump Association (IGSHPA)**
   Phone: (800) 626-4747
   Fax: (405) 774-5283

   A. ***Architects and Engineers Workshop***
   Training Course #61020
   B. ***Installer Accreditation Workshop***
   Training Course, IGSHPA Catalog #63010
   C. ***Train-the-Trainer Workshop***
   Training Course, IGSHPA Catalog #64010
   D. ***Annual Three-Day Technical Workshop***
   Technical Workshop held each May at IGSHPA in Stillwater, OK
   E. ***On-Site Training Workshops***
   Traveling Training Course

2. **Learning Unit Program for American Institute of Architects Members**
   For more information contact GHPC at 888-ALL-4-GEO (255-4436)

3. **Design Short Courses for Architects and Engineers**
   For more information contact GHPC at 888-ALL-4-GEO (255-4436)

4. **Alabama Heat Pump Training Center,**
   Verbena, AL
   Phone: (205) 257-1681

GHPC PUBLICATIONS

Brochures

GeoExchange for Architects	GB-017
The Bottom Line on Commercial GeoExchange Applications	GB-002
HVAC Contractor Success Stories	GB-008
Opportunities for Drillers with GeoExchange	GB-021
Geothermal Heating and Cooling Systems: Fascinating Facts	GB-003
Overview of the Geothermal Heat Pump Consortium	GB-007
Comparing Heating Systems	GB-010
Design Assistance Program	GB-011
Equipment Manufacturers with Customer Contacts	GB-012
Industrial Sector Improves Quality Through Temperature Control	GB-014
GeoExchange Systems: Renewable and Ready	GB-019
Member Services, Programs, Materials, and Publications	GB-024
Application for Membership	GB-024a
Connections to the Earth	GB-025
Spread The Word	GB-909
Utility Executive Briefing	GB-910
GeoExchange for Lenders	GB-022
GeoExchange for Lodgings	GB-016
GeoExchange Meets Tough Military Housing Standards	GB-023
GeoExchange for Office	GB-018
GeoExchange for Realtors® and Appraisers	GB-020
The Residential GeoExchange Heating and Cooling Story	GB-001
Tenant Comfort and Owner Savings	GB-026
GeoExchange: The Best Course to Energy Savings for Schools and Universities	GB-028

Case Studies

Hillside Oaks, East Dallas, Texas	CS-038
Cost Meets Energy Efficiency in Wamego, Kansas	CS-039
Park Chase Apartments – A HUD Project	CS-045
Norfolk Redevelopment and Housing Authority, Virginia	CS-069
Green Valley Estates, Fort Payne, Alabama	CS-088
Habitat for Humanity Turns to GeoExchange for Savings	CS-091
Horticultural Uses of Geothermal Heat Pumps	CS-030
Agricultural Applications of Geothermal Heat Pumps	CS-034
GeoExchange and Aquaculture, Mountain Home, Tennessee	CS-087
Beaumont at Bryn Mawr, Bryn Mawr, Pennsylvania	CS-005
Church of Christ, Medina, Ohio	CS-077
Phillips 66 Service Station, Prairie Village, Kansas	CS-002
Fox Chase Golf Club, Lancaster, Pennsylvania	CS-004
Martin & Kroencke Implement Inc., Quincy, Illinois	CS-024
Conoco's "Skunk Creek" Service Station, Minnesota	CS-043
The Middleton Corporation, Akron, Ohio	CS-078
FarmTek Supply, Dyersville, Iowa	CS-081
Northwest Louisiana Juvenile Detention Center	CS-036
Cambria County Prison, British Columbia	CS-053
Yakima County Jail, Yakima, Washington	CS-061
Federally Sentanced Women's Facility, Turo, Nova Scotia	CS-067
Oklahoma Developer Wins with GeoExchange	CS-031
Schalmo Builders, Canal Fulton, Ohio	CS-042
Hudson Valley Builder Features GeoExchange, Cold Springs, NY	CS-082
Stone Ledge Development, Leawood, Kansas	CS-090
Kopernick Space Education Center, Vestal, New York	CS-066
Galt House East, Kentucky	CS-001
Comfort Inn, Missouri	CS-008
Holiday Inn Express, Albany, New York	CS-012
Sagamore Resort, Lake George, New York	CS-016
Tower Building, Yakima, Washington	CS-060
Blue River Resort, British Columbia	CS-086
Du Pont Medical Center, Fort Wayne, Indiana	CS-011
Hazelton St. Joseph Medical Center, Freeland, Pennsylvania	CS-021
Wildlife Center of Virginia	CS-047
Iowa Medical Center Chooses GeoExchange	CS-092
Patuxent River Naval Air Station, Maryland	CS-051
GeoExchange Saving Millions at Fort Polk, Louisiana	CS-052
Lighthouse Terrace Base Housing, Pensacola NAS, Florida	CS-062
Bachelor Enlisted Quarters, MCAS, New River, North Carolina	CS-063
York County Health and Human Services, Virginia	CS-003
North Bonneville City Hall, North Bonneville, Washington	CS-056
Municipal Building, Park Hills, Missouri	CS-064
Nags Head Municipal Building, North Carolina	CS-068
Tacoma City Light Building, Tacoma, Washington	CS-072
Waterfront Office Building, Kentucky	CS-010
Water Tower Square Office Building, Williamsport, Pennsylvania	CS-013
Paragon Center Office Condominiums, Allentown, Pennsylvania	CS-015
West Philadelphia Enterprise Center	CS-046
Prairie Electric, Vancouver, Washington	CS-059
Home Builders Association of Greater Akron, Ohio	CS-079
Customer Service Center, Akron, Ohio	CS-080
Energy Crafted Homes in Connecticut	CS-037
A New Paradigm for GeoExchange Retrofits	CS-040
Scenic St. George, Utah, Enjoys Low Energy Bills	CS-041
Florida Home Wins with GeoExchange, Panama City, Florida	CS-083
Garden East Apartments, South Australia	CS-084
Beachfront Condominiums, Maryland	CS-085
Energy Star Home, Sandusky, Ohio	CS-089
Great Bridge Middle School South, Virginia	CS-025
Lake City High School, Coeur d'Alene, Idaho	CS-026
Salem Elementary School, Arkansas	CS-027
Austin Independent School District (AISD), Texas	CS-028
Schuyler Elementary School, Queen City, Missouri	CS-029
Neff Elementary School, Lancaster County, Pennsylvania	CS-035
Paint Lick Elementary School, Kentucky	CS-048
Bob McMath School, British Columbia	CS-054
Onamia Elementary School, Onamia, Minnesota	CS-065
Fuqua School, Farmville, Virginia	CS-070
Father Michael McGivney Senior High School, Markham, Ontario	CS-071
Choptank Elementary School, Cambridge, Maryland	CS-074
Daniel Boone High School, Washington Co., Tennessee	CS-075
Taylor Elementary School, Arlington, Virginia	CS-076
Daily Family YMCA, Bixby, Oklahoma	CS-007
Clark County PUD Headquarters, Vancouver, Washington	CS-057

Reports

Summary: Alternative Financing Programs & Options	RS-001
Summary: Customer Space Conditioning Choice Research	RS-002
Design Tools Benchmarking Study	RP-003

Reports (Cont.)

Summary: Design Tools Benchmarking Study	RS-003
Summary: Technician Training & Curriculum Benchmarkin	RS-004
Summary: Utility Program Benchmarking	RS-005
Geothermal Heat Pump Marketing Strategy Utility Survey	RP-007
Assessment of Antifreeze Solutions for Ground Source Heat Pumps Study	RP-010
Summary: Assessment of Antifreeze Solutions for Ground Source Heat Pumps Study	RS-010
Fort Polk Energy Savings	RP-013
Geothermal Heat Pump Benchmarking Report	RP-014
R & D Project Profiles: A Series of Reviews of Early Projects	RP-016
Development of Head Loss Data & Design Tools for Geothermal Heat Pump Piping (Includes: 2 Program Disks)	RP-017 S-002
Analysis and Development of a Design Method for Hybrid GeoExchange Systems	RP-018
Maintenance and Service Costs in Commercial Building Geothermal Systems	RP-024
Analysis of Existing GeoExchange Installation Data Sets	RP-026
Geothermal Heat Pump Systems in Two Pennsylvania Office Buildings	RP-027
Geothermal Heat Pump Profitability in Energy Services	RP-028
Summary: GeoExchange Profitability in Energy Services	RS-028
Icemakers, Coolers and Freezers, and GX	RP-030
A Survey of Methods to Provide Ventilation for Acceptable Indoor Air Quality	RP-032
Brentwood, NH Variable Speed Drive Geothermal Heat Pump Installation	RP-033

Segment Kits

SchoolsIncludes: VT-901, GB-015, CS-048, CS-074, RP-011a	SK-01
Office Buildings Includes: VT-902, GB-002, RS-024, CS-046, CS-013	SK-02
Convenience Stores Includes: VT-903, GB-002, CS-002, CS-043, RS-024	SK-03
Affordable Housing Includes: VT-906, GB-001, CS-038, CS-039, CS-045, CS-091	SK-04
Military Housing Includes: VT-907, GB-023, CS-052, CS-062, CS-063	SK-05
Healthcare Facilities Includes: VT-908, GB-002, CS-005, CS-092	SK-06
Hotels Includes: VT-909, GB-016, CS-001, CS-008	SK-07
GeoExchange in Federal Facilities: VT-911, GB-031	SK-08

Videos

The Neff School Project Video	VT-901
GeoExchange in Commercial Buildings	VT-902
GeoExchange in Convenience Stores	VT-903
GeoExchange in Affordable Housing	VT-906
GeoExchange Systems in Military Housing	VT-907
GeoExchange for Healthcare Facilities	VT-908
GeoExchange for Hotels	VT-909
GeoExchange at the Mohonk Visitors Center	VT-910
GeoExchange in Federal Facilities	VT-911

Miscellaneous

Residential Poster (20"x30") Sample	GB-901
GeoExchange Folder	GB-902

EPA Publications

Schools + GHPs = Savings & Efficiency	430-K-97-001
The ABCs of GHPs (Geothermal Heat Pump Technology In Schools)	430-F-97-008
Geothermal Heat Pump Installation Without Utility Rebates	430-F-97-009
Geothermal Heat Pumps in Frigid Climates	430-F-97-010
Geothermal Heat Pumps in Metropolitan Schools	430-F-97-012
Open Loop Geothermal Heat Pump Systems in Schools	430-F-97-013
Installing GHPs in Schools Using Innovative Financing Options	430-F-97-014
Evaluation of Consequences of Antifreeze Spills from Geothermal Heat Pumps	
Space Conditioning: The Next Frontier	430-R-93-004

Department of Energy Publications

Geothermal Heat Pumps for Medium and Large Buildings	DOE/GO-10098-648
Geothermal Heat Pumps Score High Marks in Schools	DOE/GO-10098-650
Geothermal Heat Pumps Make Sense for Homeowners	DOE/GO-10098-651
Geothermal Heat Pumps	DOE/GO-10098-652
Environmental and Energy Benefits of Geothermal Heat Pumps	DOE/GO-10098-653

General Accounting Office Publications

Geothermal Energy (Outlook Limited for Some Uses but Promising for Geothermal Heat Pumps)	GAO/RCED-94-84

The Following Publications Are for GHPC Members Only

Advertisements – Available in CD-ROM
(Samples While Supplies Last)

Residential Radio Ad (Retrofit)	AD-901
Residential Radio Ad (New Construction)	AD-902
Commercial Print Ad	AD-903
Residential Print Ad (Summer)	AD-904
Residential Print Ad (Winter)	AD-905
Residential HVAC Dealer Print Ad	AD-906
Residential Radio Spots (cassette)	AD-907

Brochures – Available in CD-ROM
(Samples While Supplies Last)

Residential Brochure	GB-900
Coop/HVAC Dealer Direct Mail	GB-903
Realtor/Appraiser Direct Mail	GB-904
Architect/Engineer Direct Mail	GB-905
Builder/Developer Direct Mail	GB-906
Commercial Direct Mail	GB-907
Coop/Builder Residential Direct Mail	GB-908

Reports

Alternative Financing Programs and Options Study (Summary is available (RS-001))	RP-001
Alternative Financing Programs and Options Study-Appendices	RP-001a
Customer Space Conditioning Choice Research (Summary is available (RS-002))	RP-002
Customer Space Conditioning Choice Research – Qualitative Research ReviewStrategic	RP-002a
Technician Training & Curriculum Benchmarking Study (Summary is available (RS-004))	RP-004
Technician Training & Curriculum Benchmarking Study – Appendices C & D	RP-004a
Utility Program Benchmarking Study (Summary is available (RS-005))	RP-005
Keys To Successful Utility Programs	RP-006
Potential for Geothermal Heat Pumps in the Federal Civilian Buildings Market	RP-008
Geothermal Marketing Expertise Resource Information Team (GeoMERIT)	RP-009
GeoExchange Sites	RP-011
GeoExchange Schools Sites	RP-011a
GeoExchange Materials and Publications Reference Guide and Catalog	RP-015
An Accurate Estimate of 1995 and 1996 Geothermal Heating and Cooling Installations	RP-019
The Climate Master "Spider" Loop Evaluation Project	RP-020
Measuring Thermal Properties of Soil and Rock:	
Bibliography and Abstracts	RP-021
Analysis Procedures and Software	RP-022
Hardware Specifications and Description	RP-023
Investigation of Multiple Callback Situations with Residential GeoExchange Systems	RP-025
An Accurate Estimate of 1995 to 1997 Geothermal Heating and Cooling Installations	RP-029
Counting GeoExchange Systems: Issues and Estimates	RP-031

Technical Papers, Reports, Studies

1. ***Bentonite-based Backfill Mixtures for GSHPs***, Project Report 90-18, National Rural Electric Cooperative Association, Washington, DC, April 1993, 178 pages.

2. ***Conductivity and Cost of Backfill Materials for In-Ground Heat Exchangers,*** Project Report 90-17, National Rural Electric Cooperative Association, Washington, DC, August 1993, 52 pages.

3. ***Demonstration of the Direct Earth-Coupled Heat Pump***, Project Report 88-15, National Rural Electric Cooperative Association, Washington, DC, November 1992, 58 pages.

4. ***Geothermal Heat Pump Training Support for Architects and Engineers,*** Oklahoma State University, Available IGSHPA, 1996.

5. ***HVAC Contractor Case Study Report,*** Report by TODAY Associates, Available from GHPC, Washington, DC.

6. ***Soil and Rock Classification According to Thermal Conductivity,*** Report #CU-6482, Electric Power Research Institute, August 1989.

Software for GeoExchange System Applications

1. ***CLGS-Ground Heat Exchanger Design Program,*** Design Software, IGSHPA Catalog #31010 (Demonstration Diskette) #31020, Oklahoma State University.

2. ***GEOCALC,*** Design Software, Developed by Ferris State University, Released by Thermal Works Software, Grand Rapids, Michigan, Phone: (616) 243-0212.

3. A useful range of geothermal heat pump software is available from ***Wright Soft***, 394 Lowell Street, Lexington, MA 02173, Phone: (800) 225-8697, Fax: 617-861-2058.

4. ***GL/GW-Source,*** Design Software, Kansas Electric Utilities Research Program.

5. ***Earth Energy Designer,*** Design Software.

6. ***GchpCalc*** Design Software for Commercial and Institutional Buildings, Version 3.1, a vertical ground coupled heat pump systems design software. Available from Energy Information Services, P.O. Box 861462, Tuscaloosa, AL 35486-0013. E-mail: skavanaugh@coe.eng.ua.edu

7. ***Geothermal Heat Pump Pipe and Fitting Program,*** 2 disks, GHPC S-002

8. **Energy- Smart Choice for Schools,** (an HVAC Comparison Tool) Contact GHPC at (888) ALL-4-GEO, and ask for SW-001

Building Energy Simulation Models

1. ***BuilderGuide,*** National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80403, Doug Balcomb, Phone: (303)384-7507, Fax: (303) 384-7540, OR Passive Solar Industries Council, 1511 K Street, N.W., Suite 600, Washington, DC 20005, Phone: (202) 628-7400, Fax: (202) 393-5043

2. ***ELITE***, Trane Company, P.O. Box 7916, Waco, TX 76714, Shaun Blue, (817) 840-5381.

3. ***Energy-10,*** National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80403, Doug Balcomb, Phone: (303)384-7507, Fax: (303) 384-7540, OR Passive Solar Industries Council, 1511 K Street, N.W., Suite 600, Washington, DC 20005, Blaine Collison, Phone: (202) 628-7400, Fax: (202) 393-5043

4. ***Energy Scheming,*** Energy Studies in Buildings Laboratory, Department of Architecture, University of OR, Eugene, Oregon 97403, G.Z. Brown, Phone: (503) 346-5647, Fax: (503) 346-3626, E-mail: GXBrown@aaa.uoregon.edu.

5. ***PEAR***, Lawrence Berkeley National Laboratory, Mail Stop 90-4000, 1 Cyclotron Road, Berkeley, CA 94720, Joe Huang, Phone: (510) 486-7082, Fax: (510) 486-6996, OR National Technical Information Service, Springfield, VA, Phone: (703) 487-4807, Fax: (703) 321-8547.

6. ***PowerDOE***, Lawrence Berkeley National Laboratory, Mail Stop 90-3147, 1 Cyclotron Road, Berkeley, CA 94720, Dr. Fred Winkelmann, Phone: (510) 486-5711, Fax: (510) 486-4089, E-mail: FCW@gundog.lbl.gov, OR James J. Hirsch, Hirsch & Associates, 12185 Prescilla Road, Camarillo, CA 93012, Phone: (805) 532-1045, Fax: (805) 532-2401, email: hirsch@gundog.lbl.gov.

7. ***SERIRES***, National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80403, Ron Judkoff, Phone: (303)384-7520, Fax: (303) 384-7411, e-mail, JudkoffR@tcplink.nrel.gov, OR SUNCODE-PC 5.7 (a private-sector PC version pf SERIRES), Ecotope, Inc., 2812 East Madison Street, Seattle, WA 98112, Kaija Berleman, Phone: (206) 322-3753, Fax: (206) 325-7270.

8. ***SUNDAY***, Ecotope, Inc., 2812 East Madison Street, Seattle, WA 98112, Kaija Berleman, Phone: (206) 322-3753, Fax: (206) 325-7270.

Directories

1. ***Directory of Certified Applied Air--Conditioning Products,*** Air-Conditioning & Refrigeration Institute, December 1995.

2. ***Directory of Heat Pump Water Heater Manufacturers and Equipment,*** Electric Power Research Institute Water Heating Information Office, May 1995.

3. ***Directory of Multifunction, Full-Condensing Heat Pump Manufacturers and Equipment,*** Electric Power Research Institute Water Heating Information Office, June 1995.

4. ***Directory of Pool Heating and Dehumidification Heat Pump Manufacturers and Equipment***, Electric Power Research Institute Water Heating Information Office, June 1995.

Standards

1. ***Energy-Efficient Design of New Low-Rise Residential Building***, ASHRAE Standard 90.2- 1993, ASHRAE Code 86234, American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc., Atlanta, Georgia, 1993.

Case Studies and Fact Sheets

1. ***GHPC*** has a wide range of commercial, residential, institutional, and government GeoExchange case studies available in print. (See GHPC PUBLICATIONS) Phone: (888) ALL-4-GEO, Fax: (202) 508-5222 or on-line through the GHPC's National Information Resource Center at www.geoexchange.org.

2. ***IGSHPA*** has many one-page case studies and fact sheets on a variety of topics Phone: (800) 626-4747, Fax: (405) 744-5283.

3. Several ***GeoExchange heat pump manufacturers*** offer printed case studies. A complete list of GeoExchange heat pump manufacturers is available from GHPC.

4. The ***EPA*** has available several case studies Phone: (888) STAR-YES.

5. The Department of Energy has available several case studies on renewable energy. Phone (800) 363-3732.

Newsletters, Brochures, and Posters

Newsletters

1. ***Earth Comfort Update, GHPC,*** bi-monthly publication.

2. ***The Source: IGSHPA's Newsletter,*** IGSHPA Catalog #13040.

3. ***IEA Heat Pump Newsletter,*** Available from the Oak Ridge National Laboratory, Contact Sandy Smith, Phone: (423) 574-9339, Fax: (423) 574-9338.

Brochures

1. ***A Complete Question and Answer Guide to GS-Systems,*** Brochure, IGSHPA Catalog #05160.

2. ***Building a Future — Geothermal Heat Pump in Residential Applications,*** Brochure, IGSHPA Catalog #12030.

3. ***Ground Source Heat Pumps,*** EPRI CU.3029.3.94, Electric Power Research Institute, March 1994.

4. ***GS-Systems: An Introduction,*** Brochure, IGSHPA Catalog #14010.

5. ***GS-Systems Folder,*** Folder to Hold Brochures, IGSHPA Catalog #14020.

Posters

1. ***GS-Systems Technical Poster,*** IGSHPA Catalog #71020.

2. ***Matched Set of GS-System Drawing (Color Posters of Artist Renderings),*** IGSHPA Catalog #71030.

3. ***Residential Poster (20" x 30"),*** GHPC #GB-901.

Videos

GHPC

1. **The Neff School Project**, VT-901.
2. **GeoExchange in Commercial Buildings**, VT-902.
3. **GeoExchange in Convenience Stores**, VT-903.
4. **GeoExchange in Affordable Housing**, VT-906.
5. **GeoExchange Systems in Military Housing**, VT-907.
6. **GeoExchange for Healthcare Facilities**, VT-908
7. **GeoExchange for Hotels**, VT-909
8. **GeoExchange at the Mohonk Visitors Center**, VT-910
9. **GeoExchange in Federal Facilities,** VT-911

Teleconference Videos

1. ***Geothermal Issues for State Energy Officials and Utility Executives,*** IGSHPA Catalog #45010, 1992.

2. ***Geothermal Issues for Contractors and Dealers*** IGSHPA Catalog #45015S, March 1993.

3. ***Geothermal Issues for Architects and Engineers*** IGSHPA Catalog #45020S, April 1993.

4. ***Geothermal Heat Pumps in Schools,*** IGSHPA Catalog #45025S, April 1994.

5. ***Geothermal Heat Pumps: The State of the Art*** IGSHPA Catalog #45030S, June 1995.

6. ***Geothermal Heat Pumps in Commercial Buildings*** IGSHPA Catalog #45035S, September 1995.

7. ***Geothermal Heat Pumps for Residential Customers*** IGSHPA Catalog #45040S, April 1994.

8. ***Geothermal Heating and Cooling Teleconference for Architects and Engineers,*** I GSHPA Catalog #45050 November 1996.

9. ***GeoExchange Heating and Cooling Teleconference for the Residential Building Industry,*** IGSHPA Catalog, April 1997.

10. ***Contractors and GeoExchange Heating and Cooling— A Profitable Combination,*** March 1998. Contact GHPC at 888-ALL-4-GEO (255-4436).

11. ***GeoExchange Heating and Cooling—An Educational Experience,*** February 1999. Contact GHPC at 888-ALL-4-GEO (255-4436).

IGSHPA

1. ***GHP Systems: Flushing, Purging, and Pressurizing,*** IGSHPA Catalog #40010.

2. ***GS-Systems: An Introduction,*** IGSHPA Catalog #40015.

3. ***Inside GS-Systems,*** IGSHPA Catalog #40020.

4. ***Examples of GS-Systems,*** IGSHPA Catalog #40025.

5. ***Soil Identification for GS-System Installation,*** IGSHPA Catalog #40030.

6. ***Rock Identification for GS-System Installation,*** IGSHPA Catalog #40035.

7. ***GS-Systems: Installation Overview,*** IGSHPA Catalog #40040.

8. ***Proper Drilling and Trenching Procedures for GS-System Installations,*** IGSHPA Catalog #40045.

Manuals, Guides, Handbooks, and Procedures

1. Chapter 29, "Geothermal Energy", ***1995 ASHRAE Handbook***, Heating Ventilating, and Air-Conditioning Applications.

2. ***Ground-Source Heat Pumps, Design of Geothermal Systems for Commercial and Institutional Buildings***, ASHRAE, 1997.

3. ***Commercial/Institutional Ground-Source Heat Pump Engineering Manual***, ASHRAE, 1995.

4. ***Closed-Loop/Geothermal Heat Pump Systems—Design and Installation Standards,*** IGSHPA Catalog #21030.

5. ***Closed-Loop/Ground-Source Heat Pumps — Installation Guide,*** NRECA Research Project 86-1, IGSHPA Catalog #21010.

6. ***Grouting Procedures for Ground-Source Heat Pump Systems,*** IGSHPA Catalog #04130

7. ***Layout, Fabrication, and Installation of SLINKYTM Ground Heat Exchangers,*** IGSHPA Catalog #04140

8. ***Soil and Rock Classification for the Design of Ground-Coupled Heat Pump Systems—Field Manual,*** IGSHPA Catalog #04120 (November 1989).

9. ***Water-Loop Heat Pump Systems: Engineering Guide***, EPRI TR-101134, Electric Power Research Institute, June 1994.

10. ***Environmental Guidance Document, EPA, Phone:*** (1-888-STAR-YES).

11. ***Manual on Environmental Issues Related to Geothermal Heat Pumps, EPA.***

12. ***Well logs and Quadrant Maps, U.S. Geological Survey and State Geological Surveys (soil reports and water tables, some with temperatures) (USGS).***

13. ***Guidelines for the Construction of Vertical Boreholes for Closed Loop Heat Pump Systems,*** NGWA.

14. ***Ground Water Source Heat Pumps,*** a manual for the design of residential and small commercial ground source heat pump systems.
    Available from Energy Information Services,
    P.O. Box 861462, Tuscaloosa, AL 35486-0013.
    E-mail: skavanaugh@coe.eng.ua.edu

The GeoExchange Super ESCOs

On February 11, 1999, United States Secretary of Energy Bill Richardson announced the selection of five energy service companies (ESCOs) to undertake performance based GeoExchange projects worth as much as $500 million at federal facilities throughout the nation. "These contracts alone can save each site up to 40 percent on their energy bills," said Secretary Richardson. The five ESCOs selected by the United States Department of Energy to perform the GeoExchange Super Energy Savings Performance Contracts are:

Constellation Energy Source, Inc.
111 Market Place, Suite 530
Baltimore, Maryland 21202
Mr. Gregory Jarosinski
(410) 468-3850, Fax (410) 468-3829
E-mail: greg.jarosinski@cesource.com

Duke Solutions, Inc.
230 South Tryon Street, Suite 400
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