

September/October 2000

An Ocean Powered by Geoexchange

How do you help a shark keep its cool? Try geoexchange. “The problem with fish is keeping them at the right temperature,” said Joe Petrocelli, co-owner of Atlantis Marine World in Long Island, NY. “Saltwater fish react better to cool water. It’s healthier for them. The key is maintaining a steady temperature and being able to adjust the temperature, if need be, quickly.”



The Atlantis Explorer, one of the attractions at Atlantis Marine World, leads up to 75 passengers on a two hour exploration of life below and above the scenic Peconic River and Flanders Bay.

The Long Island Aquarium

Atlantis Marine World, New York’s first large-scale aquarium and research facility to open in the last 35 years, features a 120,000-gallon shark exhibit. The tank, which also uses geoexchange, includes an array of saltwater fish including ten sharks, moray eels and an array of other fish. “We had never heard of geoexchange before but it really fits with what we are trying to do,” said Petrocelli.

Petrocelli and Bissett were also impressed with the energy savings that geoexchange offers. “We’re able to maintain a good constant temperature in that tank on five heat pumps. With a chiller system, the cost to heat

and cool 120,000 gallons of water would be incredible,” said Petrocelli.

The System

Atlantis’ 150-ton, closed loop geoexchange system relies on 80 285-ft. boreholes and is located underneath a picnic area on the aquarium’s grounds. It uses a total of five 30-ton WaterFurnace International heat pump units and two 7-1/2 horsepower pumps push water through the system.

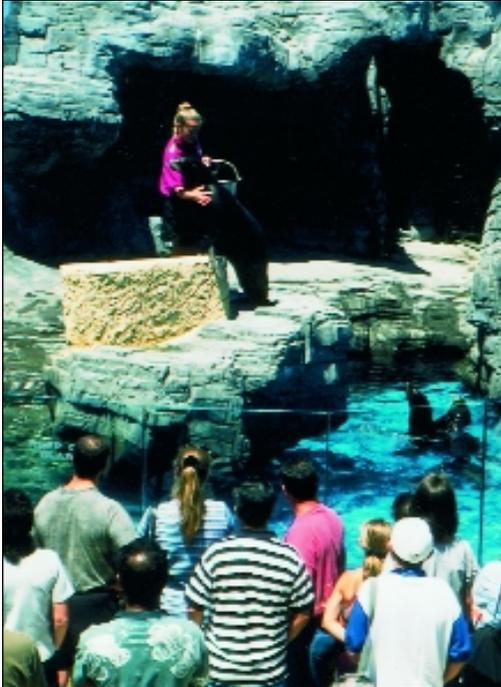
“Obviously the two sides of the system can’t intermingle because it would harm the animals,” said Ken Carrara of the Long Island Power Authority (LIPA). “We use a series of titanium plate and frame heat exchangers to keep the two sides of the system separate and to protect against the saltwater environment.” LIPA offered financial incentives for the project as part of the Clean Energy program and worked with the GHPC to provide design assistance.

“It’s a great application for geoexchange,” said Carrara. “The simplicity of the technology is really one of its greatest strengths. We’re using the passive energy of the earth to heat and cool the saltwater tank through a water source heat pump. It uses much

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Ocean of GeoExchange

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One of the many exhibits at Atlantis Marine World is the Seal and Sea Lion display.

less energy than conventional systems. In fact, the system is so efficient that we can bypass the heat pumps for most of the year and let the natural energy of the earth maintain the tank temperature. This saves additional money because you don't have the cost to run the compressors." Carrara also points out that no above ground equipment is necessary with a geoexchange system, yet another advantage of the technology.

Petrocelli and Bissett built the aquarium and research center in just over 11 months. "It took a lot of hours and many motivated people," said Petrocelli. "We used our own building designers and Riverhead gave us a lot of help because they really wanted to see our facility come to their town."

Attracting Attention

The aquarium opened June 15, 2000 and has been attracting 3,000 visitors a day ever since. The facility houses The Riverhead Foundation for Marine Research and Preservation, a nonprofit organization that rescues, rehabilitates, and releases New York stranded marine life.

In addition, Atlantis Marine World partnered with Cornell Cooperative Extension Marine Division, a nonprofit educational organization. Cornell develops marine educational programs for school age children based on aquarium exhibits like the shark tank.

"We hope to expand the facility and its programs within the next year," said Petrocelli. "Although we've only been open a few months, we've really been impressed with the geoexchange system. We're very pleased." •



Another one of the tanks featured at Atlantis Marine World.

Thoughts from Conn Abnee

Just about anywhere you turn these days, you can not help but notice reports on the winter fuel crisis that lurks around the corner for many in the U.S. The U.S. Energy Information Administration predicts that natural gas prices will increase by as much as 40-50 percent for consumers this winter over last winter, or an average of \$240 per home. Home heating oil prices are also expected to rise by \$190 per home from last year's already high prices in the Northeast. Keep in mind that these predictions are based on *normal* winter weather. Prices could escalate even further if the weather proves to be particularly harsh this season.

Conn Abnee is the Executive Director of the Geothermal Heat Pump Consortium.

There are several reasons for the high energy costs anticipated this winter. For starters, last winter was the warmest on record so prices will naturally increase over these levels. Secondly, the inventories of key heating fuels are significantly below normal and substantially below the reserves we had for the winter of 1999-2000. Finally, as many of you know, crude-oil prices have remained at rather high levels.

Now more than ever consumers need to realize the advantages of geexchange, which can cut the average home energy consumption by 25 to 50 percent. As winter approaches, help us remind home and business owners, facility managers and others that geexchange can be the answer to high energy costs in any weather. •



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Due to a print production problem in the July/August issue of ECU, we are re-running this ClimateMaster ad.

A Know-Your-Neighbor Approach to Urban Living

Welcome to the nation's first urban cohousing community south of Boston. Located in northwest Washington, DC, Takoma Village Cohousing (TVC) offers a blend of personal privacy with a supportive community. "Most of the cohousing developments in the U.S. are more rural. Takoma Village is one of just a handful of urban cohousing developments. It's a great concept where the design of the building and the members contribute toward a sense of community," said Cynthia Gardstein of Steven Winter Associates (SWA), which provides technical support on the project.



Construction on Takoma Village is expected to be completed this fall. Floor plans range from single-story one-bedroom flats to three-story townhouses with four bedrooms and basements.

The Homes

Members of the cohousing community can choose from single-story one-bedroom flats to three-story townhouses with four bedrooms and basements. The total complex consists of 43 units with one common house — all heated and cooled with geexchange. The common house will be used for group functions like potluck dinners or movie nights.

Where Everyone Gets a Say

A design team, which consists of seven future residents, serves as the interface between the members and the developer. In this way, the membership really had a voice in the selection of many different building elements, including geexchange.

"We have a strong interest in energy efficiency," said Eric Mendelson, a member of Takoma Village. "It really fits with what we're trying to do. Cohousing appeals to many people because we believe it enhances the quality of life. We can have a strong sense of community where we actually know our neighbors and still live near an urban area. One of the main reasons we chose geexchange was because of this quality of life issue. We didn't want the excess noise that often comes from a condenser sitting in our backyards."

Using GeoExchange

The developer, Don Tucker of ECO Housing in Bethesda, MD, had not used geexchange before but was willing to consider the technology for the project. "Natural gas was available at the site but Takoma Village's future residents strongly endorsed the technology and wanted to use it. I looked into it and it really sounds like the optimal way to heat and cool the units," said Tucker.

"The nice thing about geexchange is that it eliminates the dilemma of where to put the condenser," continued Tucker, who is also the architect. "I think architecture in

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Urban Living

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general is going to have to move toward a green focus as our resources become increasingly limited.”

Takoma Village's 35-ton geothermal system is just one 'green' element of the cohousing development's design. Members also opted for a desuperheater for domestic hot water, blown cellulose insulation, low VOC paints and adhesives, and siding that is, in part, comprised of recycled materials.

“Although we haven't moved in yet, we're very pleased with how the project is coming together,” said Mendelsonn. “It really shows how effective cohousing can be.” Construction on Takoma Village is expected to be completed this fall. •



The Common House featured at the center of Takoma Village.

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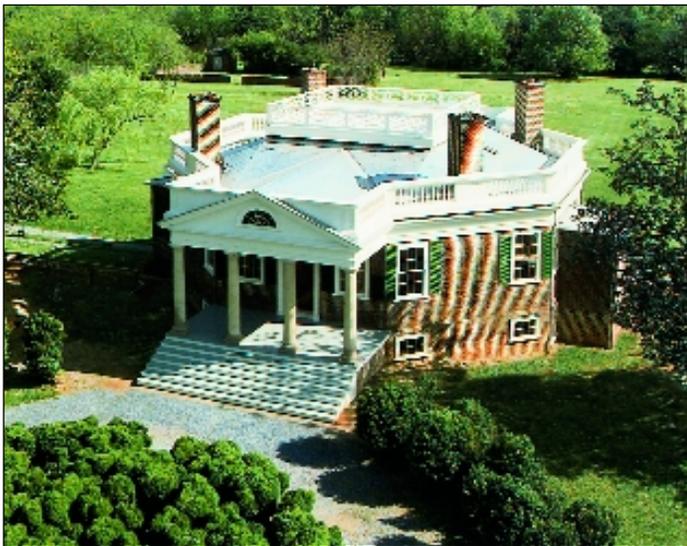
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Jefferson's Most Valuable Possession & Geoexchange

Poplar Forest, Thomas Jefferson's retreat near Lynchburg, VA, was built in 1806 as an escape from the hustle and bustle of life at Monticello. At Poplar Forest, Jefferson pursued his passion for reading, writing, studying, and gardening, enjoying "the solitude of a hermit" the plantation afforded him. In a letter dated September 20, 1810, Jefferson wrote, "I am just returned from a place I possess in Bedford County near Lynchburg, and where I pass certain portions of the year. It is the most valuable of my possessions..."

The octagonal house was meticulously designed by Jefferson in an Italian villa style incorporating architectural ideas from his years of travel and study abroad. The house is set within an elaborate landscape also designed by Jefferson. He was involved in



Located near Lynchburg, VA, Poplar Forest was Thomas Jefferson's retreat, often used to escape the hustle and bustle of life at Monticello.

every aspect of building the house, writing numerous, detailed letters of his designs to his workers, even from the White House. The house came to embody the spirit of the personal, private Thomas Jefferson, a man of nature and science.

After Jefferson's death, his grandson, Francis Eppes, who had inherited the property, sold Poplar Forest to a neighbor in 1828. Poplar Forest remained a private residence until 1984 when the nonprofit Corporation for Jefferson's Poplar Forest purchased the property and set about preserving the architectural masterpiece for future generations.

Using the documents and letters written by Jefferson has allowed restorers to follow a "neorealistic model" for the restoration. Poplar Forest is being returned to its authentic state. Through his written legacy of specific building instructions, the ghost of Jefferson is supervising the restoration himself.

"We've tried to use traditional materials wherever possible and modern scientific techniques when necessary — because that's what Jefferson would have done," said Travis McDonald, director of restoration. In particular, the ventilation and cooling of the house posed a dilemma for the Corporation for Jefferson's Poplar Forest. The restoration team was looking for an innovative, invisible, efficient, quiet, low maintenance system that would not distract from the house or require tearing up the walls and ceilings. One of the board members had read an article about geoexchange and its merits. Upon investigation, the team found that geoexchange met all of their criteria, plus provided the added benefit of cutting cooling cost.

McDonald said, "Our geoexchange system is a single, flexible system that will allow us a wide range of options while shielding the Jeffersonian brick structure from damage due to modern grilles, ducts, and large equipment in the house."

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Jefferson

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The geexchange system was installed in an underground vault 330 feet from the main house, using 6 bore holes, each 250 feet deep, in a closed loop system. The restoration team noted that ventilation is achieved by activating underground air tubes, similar to what Jefferson used for venting two privies inside Monticello. At Poplar Forest, the tubes will draw heated or cooled air from the pump house to the main house. That air will then be discharged under the stairways. A quiet attic fan will pull the air up and eventually out of the house.

Restoration of the outside of Poplar Forest has been completed but interior restoration is ongoing. The geexchange system, installed over the summer, will be fully operational beginning this fall.

McDonald noted that Jefferson, a man who loved nature and technology, would have appreciated the innovation and environmental friendliness of geexchange. In his lifetime, Jefferson was constantly striving to incorporate the two in his work. •

New FEMP Publications Available

Several new publications are now available from the Federal Energy Management Program's Geothermal Heat Pump Core Team at the Department of Energy's Oak Ridge National Laboratory (ORNL). The new publications include:

- *Generic Guide Specification for GHP Installation*. These specifications were developed to assist federal agency sites and engineers with construction specifications.
- *Geothermal Heat Pumps in K-12 Schools: A Case Study of the Lincoln, Nebraska, Schools*. This study reviews utility billing data, site-monitored data, maintenance costs to determine the effectiveness of geexchange in schools.
- *New Method to Determine the Thermal Properties of Soil/Rock Formations from In Situ Field Tests*. This report offers a new analysis method for determining thermal properties from short-term in situ test data using a parameter estimation technique.
- *The Geothermal Properties Measurement Model*. A tutorial program that allows users to determine thermal properties from short-term in situ field tests.
- *The Geothermal Heat Pump Technology-Specific Program*. A brochure describing initiatives to promote geexchange as a mainstream energy-cost saving measure.

All of these publications and software tools are available for download from the FEMP web site at: www.eren.doe.gov/femp/financing/ghpresources.html. •

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Sole Mates: Chaco and Geoexchange

As a company, we are keenly aware of environmental concerns and try to make decisions accordingly," said Margaret Nies of Chaco Incorporated, a Paonia, Colorado-based manufacturer of high-end sports sandals. So when it came to choosing a heating and cooling system for its new 22,500-sq. ft. facility, Chaco owner and founder Mark Paigen made another "green" decision, turning to geoexchange."It just fits in great with who we are and what we are doing," Nies said.

Familiar with the basic concepts of geoexchange, Chaco leadership directed its general contractor, G & R Builders, to look into the feasibility of geoexchange for the new building. G & R contacted a local mechanical contractor, Snipps Heat and Air, and Snipps turned to Terry Proffer of Sound Geothermal to generate a range of cost and installation requirements.



The new 22,500-sq. ft. facility for Chaco Incorporated, a Colorado-based manufacturer of high-end sports sandals.

In March, Chaco gave Snipps and Sound Geothermal the approval to move forward with a system design. "One of our first steps was to meet with the client and identify priority issues," Proffer recalled. "Margaret outlined them clearly — comfort, indoor air quality, aesthetics, sound levels, and sufficient independent zone climate control." Sound Geothermal recommended an all-geoexchange system for heating and cooling, radiant in-floor heating in upstairs offices and energy recovery ventilators (ERVs) for maintaining air quality.

The upstairs office area is divided into five forced air cooling zones, allowing multiple thermostat control points. The same zones are used for heating by way of in-floor radiant transmission. The lower floor warehouse and manufacturing space uses two 10-ton forced air units; peripheral ground floor offices use smaller one- and three-ton units, for a total of 52.5 tons. Chaco's geoexchange system uses a vertical loop design with 24 boreholes, 250-foot deep, which was installed by Bergerson-Caswell Drilling.

While green considerations were important to Chaco, projected cost savings with geoexchange were another hard-to-resist factor. Annual operating costs are estimated at \$4,800, versus \$12,100 with a conventional furnace/air-conditioner/boiler system. "And our estimates are conservative, because they don't take into account the performance-enhancing features of the system, degradation of conventional equipment performance due to altitude, life-cycle costs or maintenance savings," Proffer said.

On line with the new system since early September, the company, located about 75 miles west of Aspen, is pleased with its decision to choose geoexchange. "Clean industry is important in this part of the country," Nies noted. "We're proud to be one of the largest companies in the area with a geoexchange system." •

Geoexchange Teleconference November 15, 2000

Make plans to participate in the next geoexchange industry teleconference, which will feature state and local governmental facilities that meet budget demands with the help of geoexchange. Learn about the energy efficiency, reliability, low maintenance and operating costs they have achieved.

The teleconference, "Geoexchange — Bringing Efficiency to State, County and Municipal Buildings," will be broadcast live via satellite on Wednesday, November 15, 2000 from 12:30 p.m. – 2:30 p.m. EST at sites throughout the United States, Canada and Mexico. At the same time, the teleconference can also be viewed on the Internet through live audio-video streaming of the event at the GHPC web site, www.geoexchange.org. Profiled sites include:

- Museum of Civilization, Ottawa, Quebec, Canada. With over 3.5 million artifacts, 500 staff members, and nearly 3,000 visitors a day, this renowned museum receives the compliment from many that they are "more comfortable at the museum than at home," in spite of artifact environmental requirements.
- Sacramento Housing and Redevelopment Agency, Sacramento, CA. Homeowners living in Dos Rios and River Oaks Village have seen utility bills 30-40 percent below other developments and sometimes ask if there's a mistake.
- Quincy Community Services District, Quincy, CA. A wastewater treatment plant for the city of Quincy.
- The Discovery Center, Kansas City, MO. An interactive environmental center, part of a state/private partnership to develop the nation's first urban conservation campus.
- Jackson County Marina, Kansas City, MO. This boat rental/concession facility located on Lake JACOMO uses the lake to heat and cool the office and sales area and to also provide refrigeration for the walk-in cooler.
- Overland Park Arboretum, Overland Park, KS. This Kansas City suburb is home to an environmental education center whose estimated operating costs for the geoexchange system show a 47 percent annual savings over a more conventional system.

In addition, several educational facilities from across the country will be profiled.

Host Richard Trethewey of Public Television's *This Old House*, will be joined by a panel of state and local officials and system designers to discuss the many applications of the technology and answer live, call-in questions from viewers across North America.

For more information or to learn more about hosting a downsite, contact Larry Ott at Casals & Associates, Inc., (703) 920-1234, or via email at lott@casals.com. •

Co-sponsors of the teleconference are the Geothermal Heat Pump Consortium, Inc., the International Ground Source Heat Pump Association, and the U.S. Environmental Protection Agency.

Schools Unearth Cost-conscious Geexchange

With student enrollment figures climbing through the roof this back-to-school season, school administrators nationwide are unearthing a way to build smarter schools, literally, from the ground up.

Citing the U.S. Department of Education's recently-published Baby Boom Echo Report which projects a record enrollment of 53 million students this fall, GHPC urges school officials to consider heating and cooling system costs as a determining economic factor in upgrading old schools and building new ones.

"According to Department of Education statistics, half of the nation's 80,000 public schools have at least one building feature — such as the roof, electrical system or heating and cooling system — that is inadequate," said Conn Abnee, GHPC executive director. "For administrators faced with correcting these inadequacies, the life cycle cost of heating and cooling buildings has become a crucial economic consideration."

Cost-conscious administrators should find geexchange especially appealing in light of the Department of Education's back-to-school statistics. Aptly titled "Growing Pains," this year's report also projects a record 15.1 million college students in fall 2000 and forecasts no end to the tremendous enrollment growth in the coming decade. In fact, between 1989 and 2009, public and private elementary school enrollment is expected to have risen by 4.2 million, secondary school by 2.4 million and college enrollment by 1.3 million.

"As children of baby-boomers crowd the nation's classroom, many communities struggle with issues of school modernization, renovation and repair to keep up with the rising enrollments," Abnee said. "The GHPC's goal of bringing the efficiency, low annual operating costs and environmental stewardship of geexchange technology to schools across the country dovetails with the Department of Education's priorities and our communities' needs," Abnee said.

Between 1989 and 2009, public and private elementary school enrollment is expected to have risen by 4.2 million, secondary school by 2.4 million and college enrollment by 1.3 million.

In August, the Department of Education drew national attention to the issue with its Building Better Schools initiative and is calling upon parents, teachers, administrators and community leaders to be actively involved in planning and designing school facilities to make them strong.

"Helping to bring the benefits of geexchange to our schools has always been a priority for us," Abnee said. "Our young people need a comfortable learning environment, and our taxpayers and school administrators need access to technology that puts more education dollars into learning activities. Geexchange can provide both."

The Department of Education identifies geexchange (geothermal heating and cooling) as an energy saving consideration to building better schools. For more information on the Baby Boom Echo Report, access www.ed.gov/inits/construction. •

Spreading the Good News about GeoExchange

At Johnson Bible College in Knoxville, Tennessee, faithfulness is a way of life. In its 108 years of history, the college has had only five presidents, the first being Ashley S. Johnson, the second his wife, Emma.

It's little surprise, then, that current president David L. Eubanks wanted to consider geoexchange to heat and cool the school's two new dormitories. "We were looking for a system that would be practically maintenance-free, with system component longevity and good payback," said John Linsenbigler, director of plant services at Johnson Bible College. "We took our time, did our research and decided on geothermal."

Situated in the foothills of the Smoky Mountains, the college wanted students in each of its new 53,873-square-foot dormitories to have access to individual climate control for maximum comfort. "Dr. Eubanks first heard about this concept during a visit to a church in Memphis, Tennessee," Linsenbigler said. "He asked us to check into the process, and for more than two years the college looked into using the earth as a source of energy."



The college considered four different types of heating and cooling systems, including a conventional four-pipe system, steam boilers, hot water boilers and a standard water source heat pump, before investing in the geothermal system. "We already had three of the four types of HVAC systems on campus and were familiar with the problems of costly equipment repair and replacement," Linsenbigler said.

After seeking advice from experts at the Tennessee Valley Authority (TVA) and the Knoxville Utility Board (KUB), and making smart quality-engineering moves, including the drilling of two test wells and conductivity testing, administrators decided on geoexchange. "This is the best long-term direction to use," Linsenbigler said.

To accomplish the installation, the college assembled a team of players, which — in addition to the TVA and KUB — included Community Tectonics; West, Welch & Reed, WWR; and Loop Master Geothermal Loop Contractors. The college also acknowledges the contribution of the GHPC. "The consortium has been very helpful," Linsenbigler noted. "They supplied us with plenty of up-front and useful information, and we appreciated the personal contact from [executive director] Conn Abnee."

Online since early August, each of the two identical buildings features a 144-ton geoexchange system containing 96 console units for the individual dorm rooms, and seven consoles, seven horizontal and seven vertical units for the common areas. Each

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Ben Lutz Jr., Johnson Bible College's mechanical/building controls system manager and John Linsenbigler, director of plant services, are in the mechanical room at the men's dorm.

The Good News

(continued from page 11)

Linsenbigler encourages interested parties to visit the college's web site at www.jbc.edu to learn more about geexchange installations. "Once you've found the geexchange system that is right for you, go for it," he said. "As you can tell, I am very pro geo."

building has its own vertical loop system comprised of 72 boreholes and 43,200 feet of pipe. Each of the multiple units serves small zones. In the event of a service call, only one zone or small portion of the building is affected. The system also provides potable hot water.

"There are several benefits in choosing geexchange, including projected energy savings," Linsenbigler said. "But for us the biggest advantage is the maintenance-free aspect." The elimination of outdoor units also saves maintenance costs and extends the life expectancy of the system. Aesthetics, too, win with geexchange. "There are no noisy condensers, nothing to see or hear," Linsenbigler noted. "And because we are cutting down on the use of fossil fuels, the environment benefits as well."

Johnson Bible College is so pleased with the new system that administrators are planning to install a 90-ton geexchange system in its planned 33,000-sq. ft. Global Education and Technology Center, which will be used to house the teacher education department, two computer labs, high-tech classrooms and standard classrooms. •



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