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Units will be available February 2008.

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Schools are special. To fulfill their purpose, they need to create an environment for learning and social cooperation for our most treasured possessions - our children, our future leaders, our teachers. Ground source heat pumps (GSHPs) provide a quiet, comfortable environment without on-site fuel combustion or outside equipment accessible to students.

Likewise, GSHPs accommodate schools’ variable class schedules and long unoccupied periods for holidays and summer breaks. With individual classroom thermostats, simple control schemes and the capability to heat and cool different areas at the same time, GSHPs meet school operating schedules easily and flexibly.

There’s nothing built like a school: individual classrooms with high internal loads, wide hallways, cafeterias, auditoriums, athletic facilities.

Balancing all of these unique features is the responsibility of school managers. They are long-term facility owners with unique capital and O&M financial constraints. Low maintenance costs and utility bills resulting from reduced electric demands help administrators stay within operating budgets. The 20-plus year service life of GSHPs and 50-plus year service life of ground heat exchangers is a prudent long-term capital investment.

Schools are special, and they can showcase GSHP green technology to demonstrate that comfort and cost don’t have to be sacrificed to be environmentally progressive.

Why have schools been such a good market for geothermal heat pumps? Everyone who has figured this out is doing extremely well with an ever-increasing market. Every marketing brochure details the obvious benefits well known to those of us who have been associated with the industry with well-founded claims of operating and maintenance costs, long life, etc. The competition with its “business as usual approach” should be hearing some unfriendly foot steps of new ideas and a new generation of thinking - modularization and decentralization.

A major Korean mini-split heat pump manufacturer produced data showing sales numbers of mini-split heat pumps displacing large chillers. A semi-conductor manufacturer in Texas stated that in order to dramatically reduce energy costs in a new manufacturing facility he needed to abandon the thinking of the old guard - again modularization and decentralization! At the IGSHPA annual conference in Oklahoma City in October, in order to reduce system first cost, designers reported using multiple ground heat exchanger fields with small diameter header pipes and load matched circulating pumps to keep first costs comparable with conventional systems. Keeping it simple and having a well-trained work force that understands the idea appears to be the secret.
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Jim Walters
Director of Customer Relations
Rochester Public Utilities

Jim Walters, Ed.D., CEM, has promoted geothermal heat pumps in the utility industry for over 17 years. He is the Director of Customer Relations at Rochester Public Utilities (RPU), the largest municipal utility in the state of Minnesota. With University of Minnesota researchers, he is the co-inventor of patented research that thermally and electrically integrates a geothermal heat pump with a fuel cell. Walters is on the Board of Directors for geothermal heat pump manufacturer Ice Kube Systems in Winnipeg, Manitoba, and is a past director of the Electric Power Research Institute (EPRI) National Geo Heat Pump Information Office and recipient of the EPRI Technology Achievement Award. RPU actively promotes GeoExchange technology through rebates, technical assistance and special electric rates for both residential and business customers. RPU has many unique geothermal heat pump installations including a 14-unit theatre using an adjacent pond, ice rinks, a Habitat for Humanity home, and its own offices.

Don Penn
President
Image Engineering Group, Ltd
Don Penn Consulting Engineer

Don Penn, PE, CGD, is president of Image Engineering Group, Ltd and Don Penn Consulting Engineer located in Grapevine, Texas. He is a professional mechanical and electrical engineer licensed in 49 states and a Certified GeoExchange Designer. Since 1991, he has designed over 150 school projects involving geothermal heat pump systems for school districts in Texas. Penn has been instrumental in the development of the demand pumping concept for these applications as well as numerous measures to insure efficient operation and cost effective installations. Penn recently received the Cornerstone Award from the Council of Educational Facility Planners (CEFPI) for his involvement in a Katrina Task Force aiding in the restoration of numerous school facilities in St. Benards Parish, an area damaged in the 2005 hurricane.
The Geothermal Manufacturing Market is Heating Up

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Paradise
Buddhists Embrace Geothermal Technology

By Trisha Swindle
One of the tenets of Buddhism is to exist in harmony with one’s environment – don’t build an igloo in a desert. The Tibetan Buddhist monks at Deer Park Buddhist Temple have done just that by creating buildings that fit with its surroundings in Oregon, Wis. Although part of the Wisconsin countryside, these buildings were created in the ancient Tibetan architecture style. The new Deer Park Buddhist Temple will have sustainable features, such as a ground source heat pump (GSHP), that will help portray the connection the Buddhists feel with their environment.

A Little History

In 1959, the Dalai Lama and 100,000 Tibetans fled their native country to seek asylum in India, Nepal and Bhutan. Communist China had conquered Tibet and set out to eliminate the native people and their culture. One of the refugees was a monk, Geshe Lhundup Sopa. Sopa was sent to the United States by the Dalai Lama in 1962 to introduce the West to the Tibetan culture and Buddhism. He became professor emeritus of the University of Wisconsin, Madison. He founded the Deer Park Buddhist Temple and Monastery in 1975 to fulfill the request of his Buddhist students who felt the need to further their studies outside the university setting. The temple also served as a place of community for the Tibetan refugees who have made a home in Wisconsin.

At the request of the Tibetan government in exile, the United States Congress passed a bill in 1990 to allow 1,000 Tibetans to immigrate to the U.S. at their own cost conditional on pre-employment. One of the 21 resettlement sites was Oregon, Wis., where Sopa lived. Initially, 82 immigrants were brought to the U.S. and, through family reunification, this number now totals more than 400.

The New Temple

The $6.1 million temple can be found on a 13-acre site. At nearly 20,000 square feet, this temple will be able to accommodate the large attendance of important celebrations, such as Tibetan New Year. After several delays, the temple is set to be completed in the spring of 2008. The Dalai Lama will return to Deer Park in July 2008 to bless the temple.

The Wisconsin Tibetan community has created a haven for Buddhism and Tibetan culture at Deer Park. The new temple will provide them with a place to house their Buddhist education, outreach and inter-religious programs. According to its Web site, “The new temple is designed to be spiritually inspiring and visually striking. With its rich symbolism, the overall space is configured as an outward expression of the inner qualities that students of Buddhism seek to develop.”

Deer Park has become a refuge for not only the monks and Tibetan refugees but also for Tibetan artifacts. An extensive collection of Tibetan art, ritual implements and other artifacts will be housed at the new temple. Space has also been set aside to display their extensive library of sacred literature, including the Buddhist canon. These artifacts are made available to re-
A crew installs radiant floor heating at the Deer Park Buddhist Temple. Thermostats with floor sensors control the temple’s four radiant zones.

searchers and students.

On the lower level, classroom space can be found. These rooms will host classes for the Tibetan children so they can learn their native language and Buddhist cultural traditions. A kitchen is also housed on the lower level. It has the capacity to cook for more than 200 guests at a time. This will allow the Deer Park members to host extended events in the future.

Kalachakra Temple

The first temple built at Deer Park is the Kalachakra Temple. It was constructed in 1981 as a temporary open-air pavilion to host the first Kalachakra ceremony performed by the Dalai Lama in the West. The Kalachakra ceremony is a major Buddhist tantric ceremony dedicated to creating world peace. Near the Kalachakra Temple is the Stupa Monument. It was built in 1982 and blessed by the Dalai Lama. Ani Jampa, a Buddhist nun and Sopa’s personal assistant, wrote that, “this monument represents the state of enlightenment and serves as a meditative focal point for visitors and members alike. Maintaining it is important for the larger community that uses this space, for the integrity of the monastic complex as a whole, and for historic reasons.” Once renovated, Kalachakra Temple will host smaller ceremonies and serve as an important piece of Tibetan history.

Tibetan Art Projects

Architecture plays an important role in Buddhism as the buildings are designed to embody Buddha’s teachings. The 1,000-year-old Himalayan traditional artwork of Tibet can be found throughout this beautiful structure. Such methods as painting, sculpture, metalwork and woodwork are all used to make the Tibetan Art Projects (TAP). Such Buddhist symbols as the lotus flower, wish-granting jewels and the eight auspicious signs can be found tucked into the TAPs.

To be more cost effective and durable, certain traditional materials were replaced by modern technology. Sculptures have been made not only in wood, clay and hand-hammered copper relief, but also fiber-reinforced
plastic casting for some of the exterior decoration. This will ensure that the artwork can be enjoyed by future generations, as it survives the winters of Wisconsin.

The TAPs were crafted on site at the Temple as well as in Tibet and India. Artist Sonam Mathegonga supervised the creation of the TAPs in South India. There they made the rooftop sculpture, the hand-hammered copper medallions, and the Deer and Wheel sculpture. According to TAPs catalog, the Deer and Wheel sculpture is the “crown ornament of the temple, symbolizing the Buddha’s teachings, its further dissemination, attractive nature, and therefore ability to subdue our minds.” Four artisans from Lhasa have been working on site to complete many of the other TAPs.

**Ground Source Heat Pump**

Creating the masterpieces throughout the Temple took time and deep thought, whether or not to go with a GSHP did not. The horizontal loop fields totaling 31 tons were installed by G.O. Loop LLC. Total equipment tonnage is 28. Three WaterFurnace Synergy3 6-ton water-to-air/water-to-water and two Premier 5-ton water-to-air units were installed. The total cost was $27,600. The mechanical contractor was Jon Koll with
Air Car Inc. The mechanical professional consulting engineer was Bruce Griffin, P.E. The local utility is Alliant Energy. Sustainable technology such as a GSHP is an ideal fit for this temple.

Other Green Features

The GSHP will not be lonely in this building since many other green technologies are present. The entire main level and the upper level and adjoining areas received radiant floor heating. Tekmar radiant floor heating thermostats with floor sensors control a total of four radiant floor zones in the new temple. Honeywell VisionPRO thermostats with touch screen control and eight forced-air heating/air conditioning zones will further increase the energy efficiency of this facility.

Fundraising

According to the Deer Park Web site, the temple was purchased and is maintained through donations, mainly from people in the United States. This allows the temple to stay true to its Buddhist tenets and remain free of any outside influences. The final phase in the temple renovation and construction is the establishment of an endowment base. An endowment will allow the temple community to continue its programs of Buddhist education and outreach.

Volunteers

No non-profit organization could function without committed volunteers and Deer Park Temple is no different. Volunteers have donated time, money and materials to the effort of completing this dream. People from all different faiths and economic levels have offered what they could to help this cause. According to the Deer
Park Web site, the generous include Bob Coughlan of Mankota Kasota Stone and the Coughlan Companies in Minnesota who donated most of the golden buff colored limestone needed for the exterior of the temple. Also listed is the Don Robinson family who offered to clear the trees on site in exchange for the firewood. The Oregon, Wis., community has embraced the Tibetan refugees and Buddhist monks and continues to show their support through such kind acts.

**A Home for All**

Buddhism is a truly peaceful practice with its believers striving for the ultimate goal of enlightenment. Deer Park Buddhist Temple and Monastery offers a home for these followers to come and practice their beliefs, learn more about their path and share it with others. It also provides a much needed community for the Tibetan refugees who now call Wisconsin home. Much like the GSHP tucked in the new temple building, the Deer Park Buddhist Temple’s quiet strength flows through the community and world.

*Photos courtesy of Martín Chávez, Emanation Graphics.*
Profile to Success: Alan Watts

By Megan Wible

Alan Watts has been in the service industry more than 33 years. In 1981, he installed his first geothermal system and has been working in geothermal ever since. He is a Certified GeoExchange Designer and an International Ground Source Heat Pump Association (IGSHPA) accredited installer—two designations that mean a lot to him. “It lets people know that you do have a certain degree of knowledge in the geothermal field,” Watts said. In 1984, Watts established AWEB Supply, where he provides design, installation and technical assistance on residential and commercial geothermal projects, according to the company’s Web site.

Watts was always looking for ways to make geothermal installation easier and less time consuming. That is when his friend Jim Smith showed him a design that would become AWEB Supply’s trademark product: the Slim Jim® plate. Although it needed some work, Watts took on the project, redesigning it and developing it through AWEB Supply.

The Slim Jim® plate is a “pond loop in a package,” according to Watts, who considers it a simplified alternative to polyethylene loops. The plate stands vertical in a body of water, and as water circulates through the plate, heat transfer occurs. The system is labor friendly, easy to flush and very compact, which are major benefits to both the installer and the consumer. The plate is available in a variety of sizes. Stainless steel plates can be used for freshwater and titanium plates can be used for seawater. Plus, there is no limit to job size because single or multiple units can be used.

In the future, Watts hopes to see the Slim Jim® plate used more extensively in the field. One aspect he wants to focus on is capturing the ocean’s heat. “The sun is constantly putting new heat into the ocean everyday and into Earth everyday, so let’s use that heat instead of creating more heat,” Watts said.

AWEB Supply presently has projects in 27 U.S. states, South Korea, Canada, Scotland and more. The future looks promising for the Slim Jim® plate, and Watts is ready for wherever it will take him.
Texas Schools Save BIG with Demand Pumping

By Dara McCoy

Ingenuity is not dead. That trait, never being satisfied with what is, always thinking it can be done better or different, is what fuels advancement. Despite being 60-plus years old and seeing rapid growth and maturity, ingenuity is still alive and well within the ground source heat pump (GSHP) industry. “About the time I think we’ve done just about everything we need to do, somebody else comes along with another idea,” said Jim Bose, executive director of the International Ground Source Heat Pump Association (IGSHPA).

Bose discovered one such idea a few years ago when reading a 2002 Air Conditioning, Heating and Refrigeration News article about a ground-source application at Birdville High School near Ft. Worth, Texas. The idea wasn’t new, but it was new to Bose, who eventually invited Don Penn, owner of Image Engineering Group (IEG), to present his demand pumping GSHP design at the 2006 IGSHPA Technical Conference and Expo in Albany, N.Y. Even though Penn installed his first unorthodox GSHP design in 1992, his idea was still not widely known to the industry.

A Client-Driven Design

Don Penn was first introduced to GSHP in 1981 while doing research at a local utility. In the early ‘90s, Penn was the project engineer for a consulting engineering firm working with Birdville School District, which had requested a GSHP system be installed at one of their schools. Penn’s first position was trying to convince the district to not install GSHP. “It was just new and engineers are pretty conservative by nature,” Penn said. Before the project got very far, Penn left the firm to start Don Penn Consulting Engineering to do work for national retail stores, but his connection with Birdville followed him.

Penn’s previous firm had begrudgingly installed a GSHP system for the school in the time Penn had been gone, but Bill Cypert, Birdville’s director of building and grounds, wasn’t completely satisfied. After a falling out with Penn’s old firm, Birdville sought Penn out. Cypert took Penn to Texas and Oklahoma to look at GSHP designs and demanded something better. In Oklahoma, Penn researched a common GSHP design, a single well field in a checkerboard fashion with a central pump pumping water to all the units. Then, Penn studied a GSHP design in Texas where console units were placed beneath windows around the perimeter of the school and were connected to three well holes for each unit. Each unit had its own pump.

Cypert challenged Penn to come up with a better
design, and Penn accepted. His demand pumping design was inspired not only by the GSHP designs he visited, but also by his past. “Part of it came from my father,” Penn said. “He was an engineer with Shell, and he designed gathering systems in the oil field. A lot of times they would have parallel pumps, which is what we do with this demand pumping. It boils down to multiple parallel pumps.” Penn’s own experience working in the oil fields in the summers during high school also helped. “I spent one summer working with a technician on the pumps, and I started asking a bunch of questions about how that worked,” he said.

What is Demand Pumping?

Seeing the Texas GSHP design with individualized heat pumps for each unit immediately sparked his memory of his dad’s work and his days on the oil fields. With that and the knowledge of more common GSHP well field designs, Penn proceeded to take components of each and combine them into the improved design Birdville was demanding. “I came up with a more central well field with a dedicated pump,” said Penn. “We put approximately 15 to 20 units on a single well field and each unit has its own dedicated pump, but they are on a common loop.” Instead of needing more wells on a common field and a central pump to deal with a building or zone’s heating or cooling extremes at all times, Penn’s design, which zones the ground loops, reduced the number of wells and lowered costs.

With a common well field for a group of units and a dedicated pump per unit, the pump cycles with the unit when there is a demand for heat or cool in each space. “The best energy management strategy is turn off something when you don’t need it, but here, a pump only runs when it needs to run,” said Penn. “You do not have to run some central pump for just one part of the building.” This aspect of Penn’s design is extremely useful for the schools he installs them in. Teachers can come in their classroom after hours to work or events can be held in one area of the school without firing up an entire GSHP field and central pump to heat or cool the space.

Bose found Penn’s method similar to how GSHP residential designs are approached. “My heat pump has a circulator, and every one of his heat pumps has a circulator, and they’re tied together to one loop,” Bose said. “It’s a modular approach. Almost every residence that we’ve done for the last 25 years has that same concept, but nobody ever figured it out. He’s doing a small thing many, many times on the same job, which is unusual because most engineers want to come in with a big field and a big pump.”

New Design, New Level of Savings Means Big Success

Penn’s demand pumping design based on a run-when-you-need-it strategy means big things in energy savings. Based on the results from schools he has in-
installed demand pumping in, his method saves an extra 10 percent in energy savings over central pumping designs, Penn said. Adding 10 percent to the normally substantial energy savings from using GSHP versus conventional heating and cooling methods was icing on the cake for his education clients. Penn installed his first demand pumping GSHP in 1992 and hasn’t looked back. He estimates he’s installed systems at 140 schools across Texas.

“We don’t do marketing,” Penn said. “We’ve never marketed this. We’ve never done any advertising. We’ve never gone out and talked to school districts.” Word of mouth was a powerful enough promoter that Penn spun off IEG from Don Penn Consulting Engineer, his original company, to focus on educational facilities. Though Penn’s design tacks on extra energy savings, there are plenty of other reasons Penn has found success with GSHP installations in schools.

“The pros include competitive construction costs, approximately 30 percent savings in utilities, simple technology to maintain and tighter control of after-hour HVAC use,” said Blake Vaughn, director of maintenance for Frisco Independent School District. “We plan to continue to spec the geothermal systems for our facilities.” In fact, Frisco is so excited about the technology they’ve done 20 to 30 schools with GSHP. “We’re going to start taking areas of the building off the central plant and converting it to geothermal,” Penn said of one building that was having humidity problems. “That’s how sold they are on it.” Penn said Frisco’s current strategy is to retrofit any buildings that need an HVAC change to ground source.

Penn’s GSHP work with Grand Prairie Independent School District earned the district an “excellent” rating from TXU Electric’s energy performance benchmarking analysis, SCORE. According to their report, only 7 percent of Texas schools use less energy per square foot than Grand Prairie. Penn said about 75 percent of the district’s schools have some or all geothermal.

One of Penn’s more impressive benchmarking results comes from Richland Middle School. In 1995, Penn was called upon to retrofit the school’s HVAC sys-
The closing gap between geothermal construction costs and more conventional systems is a major factor to public schools. Figure 3 on page 20 shows the difference in first cost of GSHP versus central plants as mere pennies in a dollar per square foot comparison. “If you’re doing central plant, we can do geothermal and the payback is basically negative years,” Penn said. “The sooner you turn it on, the faster you can save money.” The payback for GSHP versus rooftops is in a five to six-year payback range, which is still very feasible for schools.

Penn’s design also has the benefit of not having all its eggs in one basket or not having all its boreholes in one well field (see photo on page 17). “The number one issue for failure of the system has been a guy with a backhoe,” Penn said. With Penn’s design, a “guy with a backhoe” might breach one well field and cause part of the building to go offline, but it’s extremely unlikely that multiple well fields would be breached at the same time.

Just because an errant backhoe may be a downside to having the major component of your HVAC system buried underground doesn’t offset the benefits of that
Figure 3. The four geothermal schools had mechanical system installation costs comparable to those with central plants.

very same feature for school districts. Penn remembers one school that burned down, but its well field was still operational saving them significant dollars in rebuilding the school. With everything on a GSHP system being inside the building or underground, schools don’t have to worry about vandalism, damage from hail or storms, or the wear and tear units receive just by being outside, Penn said.

The Impact of One Man’s Idea

Client or customer demands drive changes and improvements in most industries, and it is no less true with Penn’s demand pumping and Birdville’s Bill Cypert expecting more from GSHP design. It’s not to say other designs were lacking. They still provide excellent savings over conventional HVAC systems, but improvement will never hurt an industry still trying to grow their share of the pie in the HVAC marketplace. In Texas, 140 schools have benefited from Penn’s work, and Penn is finding out everyday how far reaching a good idea can be. In early 2007, Penn’s experience with GSHP earned him a call from Harvard University in Boston, Mass., who hired Penn as the GSHP consultant for a new research facility the university is planning.
Penn hasn’t been worried about keeping his idea secret. “Looking back a lot of people said ‘you should have patented this’,” Penn said. “Of course, I’ve been doing it so long it wouldn’t do any good at this point because I’ve been doing it 15 years, and I think a patent’s only good for 17.” He’s presented demand pumping to the Council of Educational Facilities Planners and Interior Designers in San Antonio, the U.S. Green Building Council, the Dallas and Ft. Worth chapters of the American Society of Heating, Refrigerating and Air Conditioning Engineers and to IGSHA members at the 2006 conference in Albany. “I’ve been very open with the engineering community and shared with them what we’re doing because I don’t want somebody to have a bad job,” Penn said. “One bad job will undo 10 good ones.”

So, what do people like Don Penn and ideas like demand pumping really mean to the GSHP industry? For Bose, who has his own sizable share in growing the industry, it means a lot. “They created it (the industry),” Bose said. “People that just – as Dan Ellis says – ‘you’ve got the bug.’ You just can’t seem to let go of it. It’s the people who are engaged in it, look close enough and listen to what’s really needed.” Bose doesn’t think the industry has reached its peak even though it has grown and matured a lot from decades past. “The improvements are getting smaller and smaller, but there’ll always be somebody there who will advance the applications in new areas, and that’s where the biggest growth will be,” he said. Maybe the next big idea or improvement is hiding in the next question a client will ask you.

Photos courtesy of Don Penn.
Neptune Township Schools Pass the Sustainability Test

By Kelly Green

Poor indoor air quality, bad lighting, and inefficient heating and cooling can all be contributors to a sub-standard learning environment. But what happens when these and other environmental concerns are addressed? If you ask David Mooij, superintendent of the Neptune Township school district in Neptune, N.J., the results are better attendance, better test scores, happier students and an overall healthier atmosphere.

A rendering of the aerial view of the Neptune Community School. The facility will employ an energy-efficient ground source heat pump system.
“They (the New Jersey School Development Authority (SDA)) did a very smart thing solving our building problems,” Mooij said. “Now, there are really only two things that need to be done here: make sure we have the right curriculum for our kids and make sure that curriculum is being delivered. That’s the real business of education.”

Neptune is one of 31 districts in the state of New Jersey classified as an Abbott or special needs district. This classification results from a 1990 state Supreme Court ruling that found children in these districts received an inadequate and unconstitutional education. The state was required to provide more than $6 billion to help these schools implement a comprehensive set of programs and reforms, including standards-based education, supplemental programs, preschool education and school facilities improvement.

When it came to facility improvements, Mooij wanted to not only meet the needs of his district but also make a statement to his students about the importance of renewable technologies and sustainability. “As the superintendent, I was very interested in getting ideas across to our students of the need to protect our dwindling resources,” Mooij said. “We had this real concern that our dependence on foreign oil was really going to hamstring the United States in the future and we needed to make that case in a very visible way to our students.”

Guided by these concerns, Neptune along with SDA, designed its two new facilities, Summerfield Elementary and Neptune Community School, to meet standards outlined in the United States Green Building Council’s Leadership in Energy and Environmental Design (LEED) program. The schools were constructed with features such as daylighting, raised floor displacement ventilation, waterless urinals, metering faucets, and geothermal heating and cooling. While neither school has officially received its LEED award, Mooij and the design team are confident both facilities will earn a Gold rating.

Summerfield Elementary opened in spring 2006 to an excited community of students, parents, teachers and administrators. Neptune Community School is set to open in fall 2008. “The community is just enthralled with it,” Mooij said. “Honestly, we’re an urban district, and if this was something that was asked of the voters it probably never would have happened, but as a result of (state) Supreme Court rulings and this legislation, the students now have the best facilities that anybody could buy or build them.”

Geothermal’s Sustainable Advantage

Geothermal was selected for the schools’ heating and cooling systems for one main reason: low lifecycle costs. “With geothermal there is a higher upfront expense, but the lifecycle analysis with increasing costs for utilities really was the selling point as to why the district went in that direction,” Mooij said.

continued on page 27
It’s a geothermal industry legend: the fateful day in 1974 when James Bose, professor at Oklahoma State University, pulled an old textbook from his shelf and came across the heat pump concept. Just days later, Bose used the concept to help a homeowner circulate hot water from his heat pump through pipes instead of allowing it to dump into his pool. Soon, Bose was working with a local contractor to convert an air source heat pump to a ground source one. The rest is geothermal history.

Bose calls the incident an accident. “The technology was better than anything we were doing here or around the world as far as that goes,” Bose said. “I didn’t find out until later that they knew that back in 1862. It wasn’t like I discovered anything. I ran upon something.”

Development of the recycled idea was rapid, and the concept really took him places. When Bose sent his paper on ground source heat pumps (GSHPs) to the Nordic Symposium on Earth Heat Pump Systems in Sweden, they flew him in, expenses paid, to present. Since his trip to Sweden in 1979, Bose has traveled to Germany, Austria, Korea and China to promote the technology and has spoken to a variety of audiences from the Kiwanis Club in Glencoe, Okla., to the Department of Homeland Security.

Although his audiences differ, the message is mostly the same. “I enjoy being able to walk into audiences and say, ‘There is nothing that will ever beat this technology. The physics is on our side. We cannot do better than this. I don’t care what you do with a gas furnace or an oil burner. You hit a limit and you just can’t move beyond it.’”

Interested in energy-efficient solar technology in the 1970s, Bose understood costs for implementing solar were too high without significant government assistance. “I just couldn’t make the economics work out with solar panels,” Bose said. “I just couldn’t make it work out, and I could see it was going to be a long row to hoe.” For Bose, making GSHPs affordable seemed more feasible, but there was more work to be done. It was time to further develop the idea and build an industry.
The National Rural Electric Cooperative Association (NRECA) was the first to recognize how the technology would benefit its members: people living in rural areas with big yards for horizontal installations. Thus, the NRECA supported research and the first design manuals. The Electric Power Research Institute and the Department of Energy also made major contributions to the geothermal research efforts of Bose and Oklahoma State University. Overall, the technology has received more than $10 million in funding for research and development at Oklahoma State University.

If Bose is asked how a heat pump works, he might just say magic. “I’ve done that before,” Bose said. “It’s just magic. Don’t worry about it. It’s just like your heart pumping.” However, Bose and other leaders in the young industry saw the need for further research, training and education, and in 1987, the International Ground Source Heat Pump Association (IGSHPA) was formed. Today, Bose serves as executive director.

In Bose’s opinion, other than the formation of the association, two of the industry’s biggest milestones have been the implementation of technology to measure the thermal properties of the earth and the utilization of high density polyethylene pipe. Being able to measure the thermal properties of the earth has taken the guess work out of calculations. “If you reduce the uncertainty, you reduce the cost,” Bose said. The advancement of plastic pipe has also played such a significant role because it lengthens the life of ground loops. “Plastic is really important because that pipe is just unbelievably good as far as its life, better than arteries,” he said.

Bose credits former Oklahoma Governor Henry Bellmon as one of the biggest supporters of the industry. Bellmon was instrumental in the decision to install GSHPs at the Oklahoma State Capitol. He was also key in securing grant funding from the Oklahoma Department of Commerce to spread the word about GSHPs to a national audience via the OSU Educational Television Service.

For the future, Bose expects the development of a variety of integrated systems. These community systems may be as simple as combining loads from an apartment complex to networking an entire city. Another thing he hopes to see is the technology recognized for what it’s worth during his lifetime, he said. “I like to be around people who have these things and absolutely just brag more about their geothermal heat pump system than their grandchildren,” Bose said. “It just seems like to me, it’s so much better than what they expected because everyone is promising so much.”

When Bose selected the engineering text from his office shelf in 1974, he had no idea that his find would become geothermal history. “I couldn’t understand why people weren’t doing this. For some odd reason, there was something about this that really caught my eye.” Bose is thankful that the ideas and concepts developed by those that came before him still hold true today.
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### Summerfield Elementary School
- Mechanical contractor: Epic Mechanical
- GHPs manufactured by WaterFurnace
- Raised floor displacement ventilation
- Closed-loop vertical bore geothermal heat pumps
- Classroom heat pumps—horizontal, ceiling corridor
- Heat recovery of ventilation air—heat wheels
- Supplemental hot water boilers
- Daylighting in manual switches
- Light shelves
- Waterless urinals, metering faucets
- Rain water collection

### Neptune Community School
- General contractor: Binsky & Synder
- GHPs manufactured by Florida Heat Pump
- Raised floor displacement ventilation
- Closed-loop vertical bore geothermal heat pumps
- Classroom heat pumps—vertical closets, corridor access
- Humidity control—hot gas reheat coil in heat pumps
- Heat recovery of ventilation air in heat wheels and geothermal hot water preheat coils
- Daylighting—dimmable ballasts
- Light shelves
- Waterless urinals, metering faucets
- Green roof
- Green power photovoltaics

*continued from page 23*

Michael Fischette, principle at Concord Engineering Group and engineer of record for the Neptune Community School project, is also a big believer in geothermal. He believes the systems are an ideal fit for schools, especially those looking for LEED certification. “Geothermal heating and cooling and LEED sustainable design are really perfect together,” Fischette said. “It (geothermal) is inherently sustainable because it’s renewable and it provides the savings we need over conventional systems to get those (LEED) points.”

At the Neptune Community School, Fischette designed custom, sound-proof closets for each classroom that house the heat pump units. The units sit at waist level in the closet making filter changes and other routine maintenance a cinch for the school’s maintenance staff. At Summerfield, the heat pumps are located outside the classrooms in a corridor in the ceiling. While the maintenance staff does have to use a ladder to access these units, they can be inspected without interrupting the classrooms.

At both facilities, classrooms are equipped with their own heat pump unit and an individual thermostat. This allows teachers the freedom to adjust the temperature in their classrooms. The building automation system sets the midpoint temperature at 71 degrees fahrenheit. Teachers can adjust the temperature 3 degrees up or down to meet their needs.

The heat pumps in each school are served by a closed-loop, vertical ground heat exchanger, which Mooij said is buried under parking lots. The schools are comparable in size, about 150,000 square feet, and required about 100 holes each drilled to a depth of 470 feet.

### Breathing Easier

To increase comfort, improve air quality and achieve more LEED points, the district also decided to install a raised floor displacement ventilation system at both schools. This ventilation system requires a raised floor...
into which tempered air is directed replacing ductwork typically found in the ceiling. The floor registers discharge the air at a very low velocity, so low that it cannot even be felt at times, Fischette said. This creates a layer of heated or cooled air right where the students sit, in the zero to three foot elevation region. It also eliminates the need for high-powered fans to distribute the air and the blasts of air accompanied by those fans.

“If you have a duct coming out of the ceiling, there’s a lot of horsepower and a lot of air volume that’s required to push the temperate air down to where the students are,” Mooij said. “If you have it coming out of the floor, the first things it’s going to impact are the students and the staff.”

Fischette said in addition to comfort, the raised floor displacement ventilation system also improves indoor air quality. “That type of system gets an extra LEED point for ventilation effectiveness because pollutants such as carbon dioxide, which is lighter than air, rise to the top of the ceiling and are exhausted,” Fischette explained. “The new fresh air coming in from the floor is what you breathe.”

The system is also equipped with sensors that open dampers to let in more fresh air if carbon dioxide levels get too high. Mooij said the teachers have even reported an increase in the alertness of their students, which they attribute to greater amounts of clean, fresh air. “I honestly think it makes a difference,” Mooij said.

Success with a Design Build School

On top of containing some of the latest and greatest green building features, the Summerfield School possesses another impressive attribute – it was a design build project. “It (Summerfield) was the only one in the $6 billion that the state has spent that was design build, and it was a real success,” Mooij said. The school was completed in 19 months with a final cost of about $198 per square foot, including land acquisition and its typically higher priced green features. “Schools were coming in New Jersey in excess of $250 (per square foot) and some upwards of $330 to $340 per square foot,” Mooij continued. “In essence this contractor was able to put a more expensive upfront system into the building and build it for less.”
The design build process differs from the typical construction process in the sense that it is qualitative instead of quantitative, Fischette explained. Contractors are awarded the project based on their overall design, not just their price. The school district used Concord Engineering’s plan for the Neptune Community School as a model and developed a request for proposals (RFP) for the Summerfield project. The RFP outlined a design concept and a wish list of features that included LEED certification, geothermal, raised floor displacement ventilation and others.

“What’s unique about this is even though it was design build, they were able to make sustainability and efficiency a very high rank in the evaluation process, which is why we got geothermal in both,” Fischette said.

**Live Event Learning**

With Summerfield complete, the administration wasted no time incorporating the school’s green technologies into the curriculum. They coined the phrase “live event learning,” which refers to the times the students actually use their building as a textbook, Mooij said. When it comes to understanding the geothermal technology heating and cooling their facility, the students see video of the boreholes being drilled, they see the temperature of the water in the ground loops, and they see the heat pumps themselves.

“The students have an opportunity to understand what geothermal is, and hopefully, when they become the decision makers of tomorrow, they will choose to look for renewable resources,” Mooij said.

The success of these projects and the ways Neptune has used the state funds available to them as an Abbott district has not gone unnoticed by the community. Mooij said ten years ago at least 25 percent of the children in his district attended private school. Now, that number is down to about 10 percent. “I think that’s a public endorsement,” Mooij said. “What it says to me is the people in town that can afford private school are taking a look at the public schools and saying, ‘I like what’s here.’”

Fischette said he works frequently with schools in New Jersey and believes the environmental leadership shown by the Neptune administration is also important to note. “Some districts are very conservative and not willing to take a chance on new technologies even if they recognize there is a benefit to them,” Fischette said. “This district just has good leadership and just has ultimate confidence in the technology and in the professionals they have, so they were able to really find a much better solution.”

Mooij believes when all is said and done these improvements truly empower the staff to focus on learning, which is what is really important. “When all the issues of comfort in a building – clean air, fresh air, good lighting – are resolved we felt it had an impact on education,” Mooij said. Only time will tell if he is right, but so far the signs point to a positive outcome for the students at Summerfield Elementary and Neptune Community School.

*Photos courtesy of EI Associates.*
Whitmore Lake High School Goes GREEN

By Mary Jones

The sign in the Whitmore Lake High School gymnasium says “The Home of the Trojans.” Just like the Trojans of Homer’s Iliad, these Trojans of Michigan have built a structure worthy of envy. The new 150,000-square-foot high school, which opened in August 2006, is one of the first high schools in Michigan to achieve a Silver rating from the Leadership in Energy and Environmental Design (LEED) program. Among its many sustainable features, a geothermal exchange system provides heating, ventilating and air conditioning (HVAC). The 67 McQuay water source heat pumps, totaling 430 tons, deliver conditioned air to classrooms and other spaces, helping to reduce energy costs by an estimated 35 percent compared to a conventional system.

A Need to Distinguish

Whitmore Lake High School, located near Ann Arbor, serves about 420 students in grades nine through 12. One of the project goals was to build an exceptional school that would stand out in the community. “There are several private schools in the area that local students could choose to attend,” said Tom Dekeyser, principal of Whitmore Lake High School. “Plus, Ann Arbor public school students can choose to attend Whitmore Lake because we’re so close. So we wanted to put our best foot forward and show that Whitmore Lake can make a difference. Achieving LEED certification was one way to distinguish ourselves, and we
decided we wouldn’t settle for anything less than LEED Silver. In fact, it was non-negotiable.”

Going Green to Save Green

In addition to being a community icon, school officials wanted to minimize operating costs—especially as the cost of natural gas began to rise during the planning stages. The school board recognized that any additional first costs for the geoexchange system would be offset by the savings in energy costs. As a result of their foresight, the school anticipates saving about $80,000 per year. In the first year alone, that’s more than double the added cost to construct the geoexchange system versus a conventional HVAC system.

Geoexchange systems can reduce energy consumption—and corresponding emissions—by as much as 40 percent compared to electric resistance heating and standard air-conditioning equipment. Their simplicity further reduces costs. Geoexchange systems do not require chillers, cooling towers, or boilers, and the closed loop water circulating system requires very little maintenance. During cold months, heat is transferred from the ground via the closed loop circulating system to individual water source heat pumps. During warm months, heat is transferred out of the school and rejected into the ground.

Combination Pond and Horizontal Loop System Improve Heat Transfer

Although geoexchange systems reduce energy costs compared to traditional systems, Whitmore Lake’s geoexchange system goes even further by combining a horizontal loop and pond system. Approximately 47 miles of pipe are laid in a horizontal field and a 15-acre pond. The system has two horizontal layers of piping trenches dug eight feet deep. The top pipe is six feet below the surface and loops back with the second pipe two feet below that.

“We could have put the whole pipe system in one horizontal field, and still had an efficient system,” said Bob Roop, mechanical engineer with Peter Basso & Associates. “We had plenty of real estate. But we had to create the pond to provide storm water retention and a fire protection water supply. The water in the ponds is a better heat transfer media than the soil, so we took advantage of what we had to construct anyway to further improve the efficiency of the geoexchange system.”

Energy Recovery Systems are Key to Supplying Heat on Cold Winter Days

The Whitmore Lake project is the first school project Roop and his firm have designed utilizing a geoexchange system. “We have quite a bit of experience with heat pumps on closed-loop boiler tower systems, and we’ve been using them successfully in schools for more than 10 years,” he said. “When Whitmore Lake told us they wanted LEED certification, we did some comparative cost information and came back with some favorable numbers for a geoexchange system. Our boiler tower systems consume about 28 percent less energy than traditional systems; we expect that Whitmore Lake, with its geoexchange system, to be about 33 percent less in energy consumption compared to a conventional building. Those numbers, combined with the ample real estate available, convinced school officials to go ahead with the system.”

All of the McQuay heat pumps, located throughout the school, are fed a pre-treated, measured amount of outside air from one of two pre-packaged energy recovery units. “All of the relief air from the building goes through the energy recovery unit,” said Roop. “It has a plate-type heat exchanger and pre-treats all the outside air. It maintains a discharge air temperature in winter of 60 degrees, so all of the outside air is pre-treated to 60 degrees.”

The plate-type energy recovery device is 70 percent efficient. For example, if the outside temperature is 0 degrees Fahrenheit, and the inside temperature is 70 degrees, the recovery units capture 70 percent of that 70 degree air. “That’s about 54 degrees just by going through the energy recovery device without spending any more energy,” said Roop. “The water source heat pump then brings the air temperature from that temperature up to 60 degrees.

“That means that the 67 individual water source heat pumps are basically responsible for space tempering, and don’t have to deal with the outside air load. We’ve
found this to be very successful for supplying heat in a northern climate in the dead of winter. This is integral to all of our designs for the past 10 years; it’s a keystone for making these systems more energy efficient.”

**Water Source Heat Pumps Help Meet LEED Requirements**

Working with Thermal-Netics, Roop and his team chose McQuay Enfinity water source heat pumps to help meet the requirements for efficient, reliable operation. Each unit responds only to the heating or cooling load of the individual zone it serves, whether it’s a classroom or the indoor swimming pool. This provides excellent comfort levels for occupants, better control of energy use and lower seasonal operating costs. To help meet heating loads in the winter, a coaxial heat exchanger is designed for maximum heat transfer with minimum pressure drop. A high-efficiency motor and low-speed blower further reduce energy consumption. High energy-efficiency ratios (EER) and non-ozone-depleting R-410A refrigerant also helped to meet LEED requirements.

**A More Comfortable Learning Environment**

The geoxchange HVAC system also uses demand control ventilation to further increase energy efficiency. “The ventilation rate, calculated through ASHRAE Standard 62, is based on a rise in CO₂ levels in the space using CO₂ as a predictor of occupancy. When people aren’t in the building, we bring in a minimum amount of outside air. When the building is occupied, the air becomes concentrated with CO₂; we bring in more outside air.”

While the main job of a school is to provide a safe and comfortable learning environment for students, Whitmore Lake sets a new standard. “We wanted to bring the outside in, while providing the best learning environment we could,” said Dekeyser. Other amenities include a commons area with a large skylight for natural lighting. “One of the most interesting innovations of the school is the adjustable auditorium,” said Dekeyser. “The auditorium features a full stage and 200 permanent seats. Removable bleachers provide seating for another 450 spectators. When the bleachers are not in use, they are collapsed and stored in the cafeteria. The adjustable seating decreased the footprint required and reduces the heating and cooling costs.” The school includes two levels of academic spaces, a large gymnasium, an auxiliary gym, and a six-lane competition pool (which includes an energy-recovery-based dehumidification unit). In addition, waterless urinals and touchless faucets reduce water consumption by 20 percent; biodegradable materials are used throughout the building and locally-produced products and green cleaning all contributed to the LEED Silver certification.

With a specific goal in mind, the backing of the community, and an efficient HVAC system, Whitmore Lake has built its dream school. The school serves as a flagship for a growing community and a testament to their environmental mindset. Much like the Trojans of Homer’s Iliad, the Trojans of Whitmore Lake have built a structure worthy of an epic.

“Now that we’ve earned our LEED certification, the new school has created a buzz in the community; it has people excited,” said Dekeyser. “Everyone from members of the community to prospective students and visiting sports teams are witnessing what Whitmore Lake has to offer. We’re very pleased with the result.”

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A record number of industry professionals gathered at the Cox Convention Center in Oklahoma City to celebrate the 20th anniversary of the International Ground Source Heat Pump Association (IGSHPA) at the association’s technical conference and expo. More than 440 attended the annual conference Oct. 29 and 30, and nearly 100 students enrolled in pre-conference training, which began Oct. 27 and continued through the conference.

Tours, speakers and sessions offered attendees a chance to network with professionals as well as an opportunity to learn about advances in the geothermal industry.

Federal Environmental Executive Edwin Piñero spoke about one such advancement: Executive Order 13423, “Strengthening Federal Environmental, Energy, and Transportation Management,” which set goals for the federal government in the areas of energy efficiency, renewable energy and more. Piñero believes ground source heat pumps (GSHPs) could help the federal community accomplish its goals, he said. Piñero said

More than 440 industry professionals helped IGSHPA celebrate its 20th anniversary at its annual conference and expo in Oklahoma City, Okla. in October.
that while most people attending the conference know a vast amount of information about GSHPs, the general public doesn’t. However, he foresees changes on the horizon.

James Bose, executive director of IGSHA, took the stage after Piñero and responded by saying, “For 20 years I’ve told people that the breakthrough in this technology was just around the corner. Well, this might just be the corner I was talking about.”

As for IGSHA’s 20-year presence in the growing industry, Richard Henn of Hydron Module said the association has come a long way since he became a member seven years ago.

“They (the association) have gotten friendlier,” Henn said. “They’ve made education easier.”

In addition to the strides IGSHA has made, individuals were recognized for their accomplishments over the years. Awards were given at the conference to those who have made an impact in the geothermal industry. Ann Felton, Dan Ellis and Xin Fan were honored for their hard work and dedication.

Felton received the IGSHA Leadership Award for her involvement in the affordable housing Hope Crossing Subdivision, a Habitat for Humanity project. Felton is currently serving in her 17th year as chairman and CEO for Central Oklahoma Habitat for Humanity.

Ellis received the IGSHA Industry Leadership Award for his support of eQuest software and the Hope Crossing project. He was also acknowledged for his federal government legislative initiatives concerning GSHPs. As the president of ClimateMaster, Ellis has advanced geothermal heat pump (GHP) technology and improved design procedures for commercial GHPs. He was also a pioneer of GSHP applications in northern climates and co-founded WaterFurnace International.

Shawn Xu accepted the International Industry Leadership Award on behalf of Fan. Fan is the chief executive officer of Tsinghua Tongfang Environmental Co., which is a leading GSHP company in China. Under Fan’s guidance, the company has completed GSHP projects using ground soil, ground water and wastewater. Tsinghua Tongfang Environmental Co. is currently working on a residential community with 4 million square meters of floor space—the largest project in the country.

Attendees at the conference opening session saw the recognition of IGSHA’s international members. Alex Aposteanu, of the Romanian GeoExchange Society (inset), was one of those recognized.
IGSHPA welcomed many international attendees from Canada, China, the United Kingdom, South Korea, Spain, Israel, Romania and Australia. Andrew Radford, general manager of Global Energy Solutions, said he hopes the Accredited Installer course and the Certified GeoExchange Designer training he received will allow him to help jump start the geothermal industry in Australia.

“Geothermal is nonexistent in Australia,” Radford said. “We’ll be one of the first companies set up to do it over there.” Radford, who first learned about IGSHPA on the Internet, said the conference was a very good experience.

“Until now I’ve only seen these companies on their websites,” Radford said. “It’s good to come here and meet these people in person.”

Paul Vaillancourt of ECCO Heating Products agreed. “It’s not a big conference, but certainly the quality of the conference is good,” Vaillancourt said. “You meet a lot of good contacts.”

Dick Burhans, of ReBearth Products, pictured with his drill rig. For the first time rigs were displayed in the exhibit hall.

An IGSHPA conference first and a popular attraction were tours hosted by ClimateMaster and WaterFurnace. WaterFurnace offered a tour to The Brownstones at Maywood Park construction site in Bricktown, just blocks from the Cox Convention Center. Horse-drawn carriages took attendees to the site, a neighborhood of townhouses featuring WaterFurnace units.

“Geo on five acres is easy,” Mark Sullivan, of WaterFurnace International, said. “Geo in an urban setting is much harder.” Four boreholes, drilled 350 feet deep, supply heating, cooling, and hot water assist for each townhouse. The townhouses, ranging from 2,300 to 3,600 square feet, consist of three or four stories and are all equipped with GSHPs, elevators and a two-car garage. In addition to energy-efficient GSHPs, the homes are built with insulated concrete forms.

ClimateMaster offered a three-hour tour starting with their corporate headquarters, a facility that houses corporate functions such as human resources and marketing, as well as water source heat pump final assem-
employ geothermal technology. An extensive project, the capital’s geothermal heat exchange field includes 370 boreholes that are 12 feet apart and approximately 255 feet deep.

Overall, the conference was a good place to learn and meet people with experience, Carlo Vissani, of Pontmax Inc., said. Fred Schoen of Geo Enterprises said he was pleased to see so many new faces at the conference this year. “IGSHA grows with the people in the industry because IGSHPA is the people in the industry,” Schoen said.

This year’s expo featured 50 exhibitors, and more than half have already signed up to be a part of next year’s conference. The 2008 IGSHPA Conference and Expo is set for Oct. 1-2, 2008, in Nashville, Tenn. For more information, visit www.igshpa.okstate.edu.

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product to be used as a boiler replace-
ment in many cases, resulting in sig-
nificant operating cost savings. Inte-
grated controls simplify unit installa-
tion and decrease installation costs.
Factory-installed internal pumps and
expansion tanks are optional.

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CPTerm™ Heat Transfer
Fluids
CPI Engineering Services
www.cpterm.com

CPTerm™ is an aqueous-
based, non-flammable and non-toxic
fluid that is formulated to prevent
corrosion. The product is an attrac-
tive alternative to glycol due to its
improvements in thermal conduc-
tivity and low viscosity at low operat-
ing temperatures. CPTerm™ can
be used as both a direct heat and sec-
ondary loop heat transfer fluid due
to its improved performance and heat
transfer capacity over glycols.

Dean Hamil / Peter Hayes
Email: sales@cpieng.com
Phone: 989-496-3780
GeoSource Vara 2 Plus
ECONAR Energy Systems, Corp.
www.econar.com

What do you do to make a great ECONAR GeoSource heat pump based on ColdClimate™ technology better? You make it variable with a two-step compressor driving R-410a refrigerant, a chlorine-free HFC refrigerant that does not harm the earth’s protective layer, and use an energy efficient variable speed Electronically Commutated blower Motor (ECM). This could be the best GeoSource heat pump ever!

Check out ECONAR’s new 78 series GeoSource Vara 2 Plus and view the highest heating capacity per nominal cooling ton in the industry.

Bob Donley
Email: bdonley@econar.com
Phone: 763-241-3110

BET Pump Module Kit
Earth Energy Technology
& Supply, Inc.
www.earthenenergytech-supply.com

Standard Earth Energy pump module kit components include Grundfos UP26-116F circulating pumps. Also 1” purge assembly with handle style isolation valves, two 1” mpt x 1” barbed brass 90° ells with 1/4” PT plugs, eight 1” stainless steel clamps, twelve feet of 1” pressure hose, and compact, 14 gauge metal, heavy duty pump brackets. Pump modules are available in single pump or double pump. They can also be modified to fit your specific needs.

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Email: eets@cableone.net
Phone: 580-276-9455

FHP Aquarius II-AP Series
FHP Manufacturing Company
http://www.fhp-mfg.com

FHP’s second generation Aquarius II Series brings you the highest efficiency series of geothermal units available on the market today. It features a state of the art two stage unloading scroll compressor which, when controlled by a multi-stage thermostat, stages the unit to match the demand for heating and cooling. The result, up to 70% lower energy bills, increased comfort and better humidity control. All FHP Aquarius II Series units come ready for operation in a geothermal application. Using the earth’s energy to heat and cool your home not only makes economic sense but is good for the environment.

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Serenity Series Geothermal Heat Pumps
GeoComfort, Inc
www.geocomfort.com

The new GeoComfort or Paradise brands Serenity Series of Geothermal Heat Pumps from GeoComfort, Inc. are state-of-the-art technology. Available for residential and commercial use at 2 tons through 6 tons, in vertical and horizontal packaged style, and split systems. The refrigerant is R-410A. Available in single and dual stage operation using Copeland scroll compressors. ECM blower motors are standard, with a PSC option on the single stage packaged units. EER’s up to 28 with COP’s to 4.8. Microprocessor controls with LED status lights. These products are available nationwide in the USA from GeoComfort, Inc.

Shawn Melton
Email: s.melton@geocomfort.com
Phone: 618-664-9010 or toll free 888-436-3783

Atlantis Vault
Geothermal Supply Company
www.geothermalSupply.com

The Atlantis Vault is a one of a kind geothermal vault designed for simple installation and trouble-free operation. The Atlantis Vault is a self contained, prefabricated vault constructed of high density polyethylene. Basic components include: custom sized supply and return headers, butterfly valves, p/t ports, sump pump, ladder, catwalk, and manhole. Each vault is custom built to meet the customers’ specific needs for each job. Main pipe sizes are available in 3” - 12”, with circuit pipe sizes available in 2” - 4”. Additional pipe sizes may be custom designed based on project specifications.

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GSC Commercial Pump Station
Geothermal Supply Company
www.geothermalSupply.com

Geothermal Supply Company’s commercial pump station is a completely prefabricated, self-contained geothermal pumping system. This pump station is uniquely designed for geothermal applications and simplifies installation, purging, and antifreeze addition. This inclusive pumping package includes dual pumps, isolation and control valves, air removal device, and optional controls. The commercial pump station is available in 3” - 8” pipe sizes, with a wide range of pump sizes and motor horse power.

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Purge Pro
Geothermal Supply Company
www.geothermalsupply.com

The Purge Pro is a geothermal purging system designed specifically for residential applications. The Purge Pro provides the installer the ability to flush and purge debris and air from geothermal systems to ensure optimal operation. It can be easily mounted to a two wheel cart for ultimate maneuverability. The two horse power motor provides all the pumping power needed to purge most residential and small commercial systems - and conveniently operates from 120V. A cone shaped screen filter provides water filtration and air dispersion. Quick connect hoses promote simple set up and operation.

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Phone: 270-786-3010

Purge Pro Max
Geothermal Supply Company
www.geothermalsupply.com

The Purge Pro Max is a commercial flushing and purging system custom designed for geothermal applications. “Max” provides geothermal installers the capabilities to flush and filter debris from the system, purge trapped air bubbles, reverse flow, hydrostatically pressure test, and flow test - all from one convenient unit. The trailer-mounted, all-in-one design makes “Max” the most productive and convenient commercial purging system available to geothermal installers.

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Mesurrometer Hose Kit-Manual Balancing
Hays Fluid Controls
www.haysfluidcontrols.com

Mesurrometer Hose Kits are a convenient method of combining the advantages of flow control and a flexible connection. The Mesurrometer kits are supplied with a venturi balancing valve, ball valve, ball valve with memory stop and two stainless steel flexible hoses. The Mesurrometer has low impact on system pressure due to higher recovered Cv values than typical Venturi valves. The Cv range is 0.16 to 112 gpm with a simple robust design. The wide range of Cv values allows better tailoring of product to the application.

All hose kits are 100% leak tested before shipping.

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Phone: 704-915-3311
ISCO HDPE Circuit-Maker
Geothermal Vault
ISCO Industries, LLC
www.isco-pipe.com/applications/geothermal.asp

ISCO Industries, LLC fabricates custom HDPE Circuit-Maker Geothermal Vaults. ISCO Circuit-Maker vaults are strong, leak-free structures to insure your valving and components are clean and safe for years to come.

- 100% Leak-Free HDPE Structure
- Factory Tested to Insure Leak-Free Status
- Custom Design/Fabrication Capabilities
- Butt-Fused Circuitry
- Extrusion Welded Outlets
- H20 Load Rating Available
- OSHA Approved Ladder
- Easy Installation and Purging

Tom Titus
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Phone: 615-425-8255

Geothermal Pipe
Lamson Vylon Pipe
www.vylonpipe.com

Lamson Vylon Pipe manufactures Geothermal High-Density Polyethylene Pipe. The pipe is made from PE 3408 high-density polyethylene resin that is resistant to most chemical compounds and aggressive soils. It is designed for use in a variety of markets such as commercial, institutional, residential and industrial.

Our pipe loop assembly is manufactured with an attached narrow angle U-bend and can be ordered in custom lengths. These loop assemblies are available in 3/4", 1" and 1 3/4" diameter and include footage markers. Straight length pipe sticks are also available up to forty-feet. Custom length coils are also offered in diameters of 3/4" to 4".

Debra Kolasinski
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Phone: 800-382-0862

Coiled Steel Tubing Drill Rig
Coiled Steel Tubing Drilling Systems
www.CSTDrillingSystems.com

Designed specifically for residential geothermal retrofit market, CST 150 is 4/6" wide track-mounted unit complete with remote mud pump and mud cleaning system. Remote controlled during moving/set-up and easily adapted for use with hydraulic lines for down hole tool and communication functions. CST 150 has connections compatible with AmKin CT drilling orienters used in conjunction with DTH hammers. CST 150 comes equipped with an elite 15,000-pound capacity injector head, fluid swivels, levelwind system, and CT stripper. It has hole – depth capacity of 400 feet with a 5.5 inch bit, and 10,000-pound push and 20,000-pound re-wind capability.

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Email: Dick@CSTDrillingSystems.com
Phone: 800.251.4664
Mud Puppy Recycling Systems  
Coiled Steel Tubing Drilling Systems  
www.CSTDrillingSystems.com

Mud Puppy Recycling Systems allow you to skip the settling pit and save money by using clean mud. No more over-drilling, over-mixing or dumping the mud pan. Mud Puppy has a double screen shaker and desander system, includes a Sand Guzzler Pick-Up Pump, and has the capacity to clean up to 500 gallons per minute. After a fast and easy setup, Mud Puppy “Recycles the Mud and Dumps the Crud.”

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Sonic Drill Rig SDC550-18  
Sonic Drill Corporation  
www.sonic-drill.com

When it comes to geothermal installations or environmental investigations, the Sonic drill is the fastest method on earth. It’s also the only drilling method that can “buzz” through challenging conditions where layers of silt, clay, sand and boulders are combined in one hole.

Because of its superb drilling performance in cobbles, the Sonic drill rig makes an ideal tool for fast, cost-effective geothermal drilling. And, with its unique ability to drill, case, loop and grout in one easy step, a Sonic drill rig can significantly reduce on-site time and per-foot costs.

Tom Savage  
Email: tom.savage@sonic-drill.com  
Phone: 604-854-1383

HEATzO Water Heater  
Terra Thermal Technologies, INC  
www.terranthermaltech.com

The HEATzO by Terra Thermal Technologies is today’s solution to ever increasing hot water heating costs, both residential and commercial.

Using a geothermal loop or open well “pump and dump” system, we can achieve savings of 50-80% over conventional hot water heaters and recovery rates twice that of an electric hot water heater.

In addition, our small but powerful water heater can provide hot water to a radiant floor heating system, a water coil in a forced air heat pump or fossil fuel system, and room unit heaters.

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Phone: 301-204-2434
Envision Commercial Line
WaterFurnace International, Inc.
www.waterfurnace.com

The 3/4 through 25 ton WaterFurnace Envision Commercial Line boasts two-speed compressor units that reach 5.0 COP in heating and an impressive 30 EER in cooling in ground loop applications giving it the title of the most efficient commercial line ever rated by the Air Conditioning & Refrigeration Institute in category 13256-1 GLHP. Envision systems utilize scroll compressors to provide whisper-quiet operation. With an optional FX10 DDC control platform, field-adjustable filter racks, status lights on the front of the unit for easy field service, and onboard diagnostics, its clear the Envision line was designed with the technician in mind.

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Envision Residential Line
WaterFurnace International, Inc.
www.waterfurnace.com

The WaterFurnace Envision Residential Line sets the bar in the HVAC industry with efficiency ratings of 5 COP in heating and 30 EER in cooling in ground loop applications. In fact, the Envision Line is the most efficient residential line ever rated by the Air Conditioning and Refrigeration Institute in category 13256-1 GLHP. It uses two-speed scroll compressors to achieve optimal operating efficiencies and whisper-quiet operation. In addition, the Envision is extremely versatile with top-flow and bottom-flow airflow configurations available, and its field-adjustable filter racks, on-board diagnostics, and status board LED lights provide valuable assistance to technicians in the field.

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Envision Split
WaterFurnace International, Inc.
www.waterfurnace.com

With efficiency ratings of 4.4 COP in heating and an impressive cooling rating of 26.2 EER in ground loop applications, WaterFurnace’s Envision Split holds the distinction of having the highest heating and cooling efficiency ratings of any split product ever certified by the Air Conditioning & Refrigeration Institute in category 13256-1 GLHP. The Envision Split offers extreme flexibility by utilizing a remote air handler that can be installed some distance away from the compressor section. This allows for easier installation and service as well as enables the system to work in conjunction with a fossil fuel furnace for dual-fuel applications.

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Selling GSHP Systems to Schools and Universities

Schools and universities are perhaps the perfect candidate for GSHP systems. Today’s educators are painfully aware of their shrinking budgets and increasing costs. Ground source heat pump (GSHP) systems can immediately impact a facility’s operating costs by reducing energy costs, maintenance costs, and costs associated with theft or vandalism of outdoor HVAC equipment.

Environmentally friendly features include “green” refrigerants instead of refrigerants detrimental to the environment and no fossil fuel consumption with the resulting “point of use” generation of “greenhouse” gases which are discharged to the environment. Within existing schools, installation of GSHP systems can eliminate ventilation and/or indoor air quality issues that may exist because of or in spite of older/antiquated HVAC systems. Working/learning environment features such as individual classroom control can allow teachers to control (within a prespecified range) the temperature of their classroom.

Loop field installation space on school and university facilities is rarely a problem. “Green” areas are typically the first choice – open ground areas such as lawns, playgrounds, athletic fields, etc. that are intended to remain the same for the life of the facility. The second choice is under parking lots, which utilizes an otherwise unusable piece of property. Parking is typically limited to faculty parking and bus lots at schools without a driving student population. High schools and universities have significant student and facility parking areas.

First cost issues on new or retrofit applications are typically addressed by bond issues. Also, alternative financing means such as energy savings performance contracts, loop field leasing, and other creative financing venues may reduce or eliminate capital investment by paying for the system with operating cost savings (as compared to other HVAC technologies).

The key issue is life cycle costs (LCC). Schools and universities are long term owner/operators of their properties, so LCC should be a key part of the selling proposal/buying decision. GSHP systems have outstanding LCC performance for two primary reasons:

1. Because they are indoors, away from weather and environmental extremes and in a relatively controlled environment, GSHP units have a longer equipment life than competing systems, reducing capital replacement costs.

2. The buried ground heat exchanger should equal or exceed the life of the building. It’s like having a boiler and chiller that never needs maintenance, replacement, make-up water; water treatment – the list goes on and on.

Mr. Rawlings has more than 30 years experience in the geothermal industry. He is a Certified GeoExchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.
Centennial Plastics’ Geothermal CenFuse Pipe is FIRST to Receive the new Geothermal Certification from NSF International!

Centennial Plastic’s Geothermal CenFuse pipe is used in environmentally friendly geothermal heating and cooling systems that are 40% to 75% more efficient than air-source heat pumps, and natural gas or oil furnaces.

Now, Centennial Plastics is proud to announce that our CenFuse Pipe is the first to be certified by NSF International to meet its strict Geothermal Standard.

What does this mean to you, the installer? Your customers can be assured that you are using geothermal pipe products that have been independently tested by one of the most respected authorities on public health and safety.

Preserving our aquifer is our priority. Our new NSF Geothermal Certification confirms our commitment by providing the highest quality geothermal polyethylene pipe on the market today.

Centennial PLASTICS LLC

Quality and Service That Soars

Products sold exclusively through qualified Centennial Plastics’ distributors.
In today’s economic climate, the choices you make for your homes are more important than ever. That’s why offering WaterFurnace geothermal heating & cooling systems is a smart choice. In fact, WaterFurnace geothermal systems can be the best and easiest way to transform an ordinary home into a truly green one – a big step toward qualifying for the federal energy credit of $2,000. It’s a smart investment for your business and for your clients.

Consider the benefits you could enjoy...
- A competitive edge over other contractors who offer only less efficient ordinary systems
- Opportunity for added sales and profits
- Highly satisfied clients (think referrals)
- Sales support by WaterFurnace factory representatives
- Special pricing for model home installations
- Volume rebates