GEO OUTLOOK

The Publication of the GeoExchange Industry

Premier Issue

Geothermal Helps Sisters Fulfill Mandate

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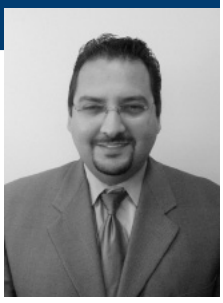

By Wael El-Sharif
Executive Director,
Geothermal Heat Pump Consortium

Opportunity Knocks At the Industry's Front Door

Welcome to the first issue of Geo Outlook! The Geothermal Heat Pump Consortium is excited to launch this national magazine with its closest ally, the International Ground Source Heat Pump Association. We hope that this joint undertaking will build on the hard work and effort that you, the industry, perform every day to further the advancement of geothermal heat pump technology. Year after year, our successes continue to carve a growing and permanent place in the HVAC market.

2003 has brought tremendous opportunities for the geothermal heat pump industry. On the national level, policymakers on Capitol Hill have been debating national energy legislation for more than a year, discussing issues that will dramatically shape our energy world for the next decade. Debates have focused on issues ranging from drilling for oil and gas in Alaska's Arctic National Wildlife Refuge, to restructuring the electricity industry, to raising standards for vehicles.

And while ethanol is now more than certain to become a permanent fixture in meeting our nation's demand for fueling cars and trucks, this year's energy debate has also featured geothermal heat pump systems and the important benefits that this renewable energy technology can make to help meet our ever-increasing space conditioning demands.

By the time you receive this first issue, it is my hope that a new energy policy will be in place, and one that has our technology playing a key role. Throughout the debate on this energy bill, the need to support renewable and energy efficient technologies has been a fundamental component for both the House of Representatives and the United States Senate.

The Consortium has been working to make certain that geothermal heat pump technology is treated equally as other renewable technologies, helping to ensure that our technology gets a fair share of the federal dollars spent on research and development (R&D.) Both the House and Senate, in their separate versions of energy legislation, support funding for R&D activities that will continue to improve and advance our technology. And both bills eliminate the sunset clause for performance contracting, a successful tool for many in the industry involved in projects with the federal government.

In addition, this year, for the first time ever, the U.S. Senate supported a tax credit for homeowners who purchase a geothermal heat pump system. If this incentive remains in the final version of the bill, it will greatly increase the opportunities for consumers to know that they have a great option to meet their heating and cooling needs. One that will significantly cut their energy bills, help improve the environment and greatly increase the efficiency of their home or business.

The Senate bill also directs federal agencies to identify barriers that are preventing our technology from advancing and to assist with finding ways to eliminate those obstacles.

Keep your fingers crossed!

Directors' Forum

Notes from IGSHPA

By Jim Bose
Executive Director,
International Ground Source Heat Pump Association

One sign of maturity for a new industry is how well it markets its technology and benefits to its members and customers. The environmental benefits that the ground source heat pump provides, demands our best marketing efforts to meet an increasing worldwide demand for energy. The ground source industry, with strong support of the IGSHPA and GHPC governing bodies, is taking this marketing step by introducing Geo Outlook, a magazine that brings together the various industry partners that have brought us to where we are. We will accomplish this by featuring an array of topics of interest to our members, including stories on installation and machinery advancements and exciting developments with ground source technology. We will also concentrate on what we have accomplished in the past so that we can relay to the broader industry the advantage this technology offers.

We are a family whose members consist of marketing and technical organizations, research programs, manufacturers, distributors, dealers and installers, government agencies and customers of our products. Our industry is still young and small enough that our success strongly depends on our willingness to work together for mutual benefit.

Where are we in our progress? We offer a technology that is strongly based in science, rich in application and worldwide in distribution. We are recognized in research programs at major universities and government laboratories. We continue working on installation methods, codes and standards, training, design materials and certification programs. IGSHPA's annual technical conference held each spring is growing in numbers, and in the quality of exhibits and technical presentations.

More importantly, what needs to be done? We need more people involved in all aspects of this industry. Wael El-Sharif, in his editorial comments stressed what GHPC and its membership is doing to advance ground source's cause on the Washington and government scene. We are making progress, but it is slow going and will only get better if each of us gives it the time it deserves. Our hope is that Geo Outlook will present our industry in such a way that increasing numbers of new customers and new markets will be attracted because of our quality installations and their operating performance.

To preserve what we have accomplished and further increase market penetration, the technology must be appropriately applied. Its applications and geographic locations should be carefully selected and targeted, with stronger emphasis placed on marketing our accomplishments. Our two organizations are working collaboratively to increase the quality and quantity of installations. We must take pride in offering a technology that ranks number one in efficiency, is clean and safe and leaves a heritage to our children of a better way of extending our natural resources.

Please join with our organizations in moving this technology to the level it so richly deserves.

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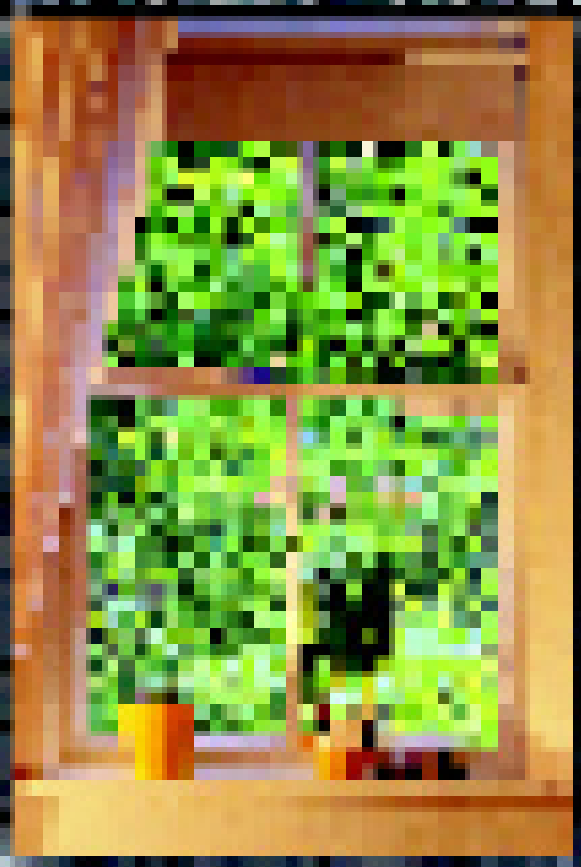

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John Turley, Middleton Group

Wael El-Sharif

Executive Director
Geothermal Heat Pump Consortium, Inc.
Washington, DC

Wael El-Sharif is the Geothermal Heat Pump Consortium's Executive Director. Mr. El-Sharif has been with the Consortium since March 1995 and has served in various capacities in business development, marketing and infrastructure strengthening. As Business Development Director, Mr. El-Sharif developed, implemented, and directed internal and external business planning and business development activities, initiatives and market mobilization programs. As Marketing Director, he led and managed the Consortium's marketing programs, marketing communications and strategic outreach endeavors. Before joining the Consortium, Mr. El-Sharif was a consulting engineer for the Edison Electric Institute's Electrotechnology Policy and Planning department. He earned a Bachelor of Science degree in Computer Engineering and a Master of Engineering Management in Marketing of Technology from the George Washington University.

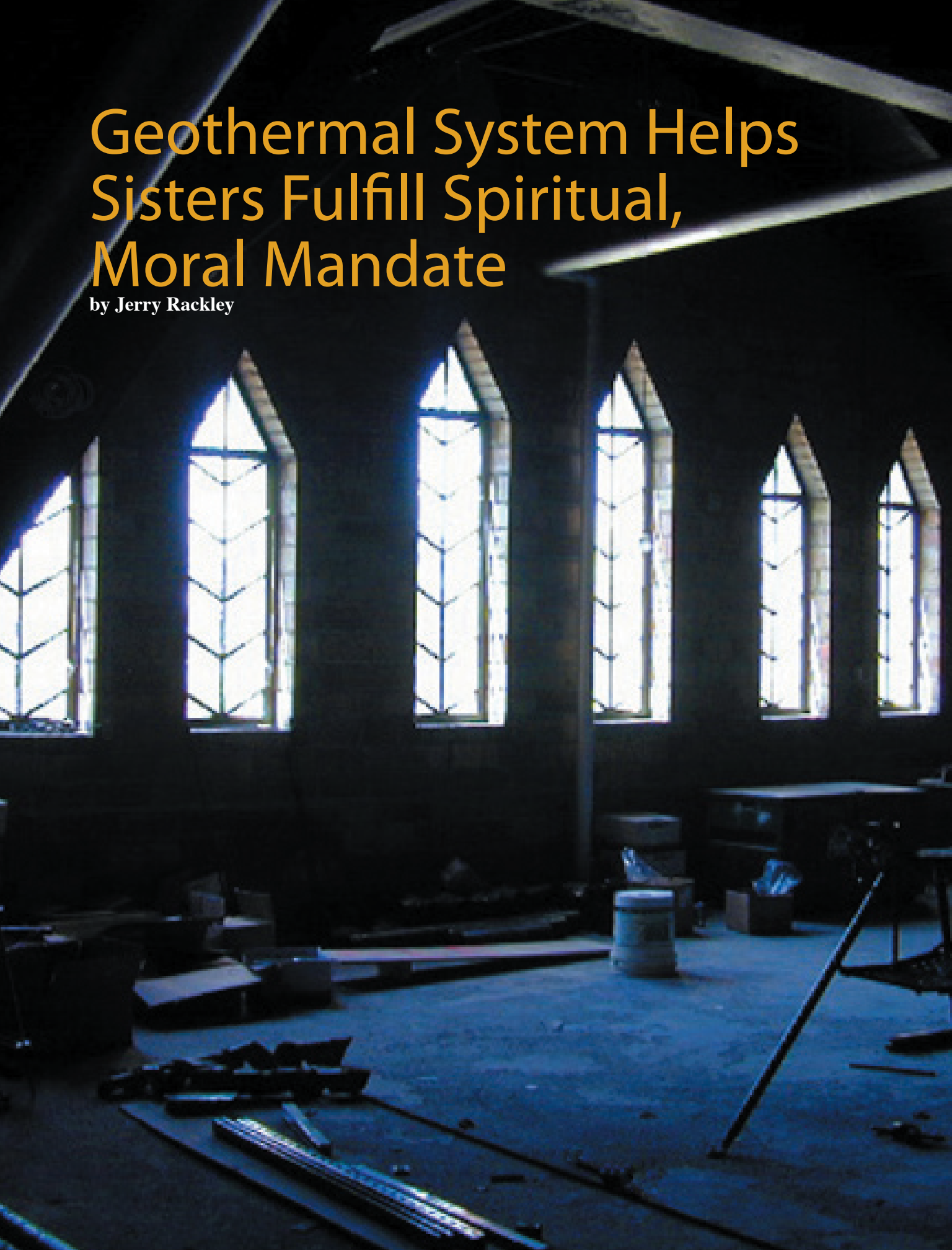
Jim Bose, Ph.D.

Executive Director
International Ground Source Heat Pump Association
Stillwater, OK

Jim Bose is the Director of the Division of Engineering Technology at Oklahoma State University. Dr. Bose has research interests in energy conservation and specifically ground-source heat pump technology. He has been principal investigator on a number of private and government contracts, including the Electric Power Research Institute, the National Rural Electric Cooperative Association, the American Society of Heating Refrigeration and Air-Conditioning Engineers, the Department of Energy, the Oklahoma Department of Commerce and others. He has traveled in conjunction with the International Energy Agency (IEA) to China, Sweden, and Austria in promoting ground source heat pump technology. He authored several design and installation manuals for ground-source heat pump systems. He is active in the International Ground Source Heat Pump Association and serves as the Executive Director. He works extensively with research agencies, manufacturers and contractors, and lectures extensively on energy conservation and the benefits of ground source heat pump systems.

Geothermal System Helps Sisters Fulfill Spiritual, Moral Mandate

by Jerry Rackley



Cover Story

Since 1845, the Sisters, Servants of the Immaculate Heart of Mary (IHM Sisters) have been educating people. When the order was founded 158 years ago, its goal was to educate girls. Today the IHM sisters are educating the world about sustainability and the philosophy of green design by installing a geothermal heating and cooling system in their renovated Motherhouse. Although the system came online this year, its installation was set in motion about a decade ago when the Sisters decided to become advocates of the environment and educate others about environmental issues.

Photo courtesy of Denyse Burkhart

IMC Motherhouse is home to retired nuns. The sisters decided on a geothermal unit as a part of their home's renovation.

The IHM Motherhouse, located on a 280-acre campus in Monroe, Michigan, is a home for retired sisters. Originally built in 1932, the classic art deco structure contained 376,000 square feet of space. A few years ago, with the building showing signs of its age and having antiquated systems that weren't functioning, the sisters had to make a decision about their 70-year old home - should it be replaced or renovated? In keeping with their calling to educate, the sisters decided that a renovation would showcase the wise and appropriate use of resources, not the depletion of them.

A Vision for Geothermal

"We wanted to teach through this project that you could renovate in a sustainable way," said Danielle Conroyd, IHM Project Director for the Monroe Campus, Long Range Master Plan. "The World Commission on the Environment defines sustainability this way: 'meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.' This concept guided our renovation effort. For us, it's not just about green design. It's a spiritually based vision expressing the right of all creation to thrive and flourish. We're learning how to say that we're not the center of the planet, that our demand should not outstrip the ability of the earth to sustain life. We see this as a spiritual and moral mandate." Geothermal heating and cooling is a technology that reduces dependence on non-renewable resources and thus is a major component of the green design philosophy. It was the desire to use renewable energy sources that led the sisters to choose this type of system for the renovation project.

With this vision for renovating the Motherhouse, the sisters hired Susan Maxman & Partners architects as the design team to begin the transformation of the building. Heating and cooling the Motherhouse to meet the needs of the residents, whose median age is 84, was a high priority. H.F. Lenz Company, a member of the architect's design team, was responsible for the engineering and design work. Very soon afterwards, the sisters hired the Christman Company to manage construction.

Photo courtesy of Denyse Burkhart

Ariel photo shows magnitude of this geothermal undertaking.

"We expected a lot of revisiting of decisions, and recommitting to the decisions made in support of our vision," stated Conroyd. "Inevitably, unanticipated conditions are encountered, causing 'rethinking' of some decisions, so we hired the construction manager during the design phase of the project so this firm could be part of the decision-making process as well."

Project Challenges

H.F. Lenz Company project engineer Bill Devlin designed the geothermal system for the Motherhouse. "Since this was a very old building, it was very difficult to get a balanced heating load throughout," stated Bill Devlin, Project Engineer with H.F. Lenz Company. The reason for this was primarily the age of the residents. "It is a heating-dominated building, harder to heat than cool." The challenge of integrating a state-of-the-art geothermal system with a 70-year old building created resolve for the team to do the job well. "When technologies get misused, the solutions get a bad rap," said Lynn Rogien, Project Manager for the Christman Company. "But when used smartly and correctly, they work well and people realize they can save a lot of money."

Devlin designed the heating and air-conditioning system within the Motherhouse, the geothermal system on the campus grounds, and the central plant that tied the two together. Construction began in Spring 2002. The central plant utilizes a 450-ton high-efficiency centrifugal chiller by Trane. Inside the Motherhouse, 466 fan coil units, over 10 miles of pipe and almost 6 miles of ductwork help heat and cool the interior. Outside the Motherhouse is the geothermal field - a system that includes 47 miles of piping and 232 bore holes each 450 feet deep.

Devlin and the entire project team overcame a number of problems presented by the age of the building. "This building is old and considered historical, which presented many challenges. Locating air-handling systems, getting outside air into the building, figuring out duct and pipe distribution were huge challenges. The building was never set up for this. It is a completely concrete structure, with concrete beams that didn't line up floor-to-floor, so getting a vertical shaft through the building was very challenging." The solution was to do

most of the work in the attic of the building.

The team overcame other challenges within the building as well. The design called for keeping the central plant within the confines of the building. "We went into a very limited space and worked around existing conditions to put in a chiller and boiler plant. This called for hiding the piping and masking the noise," continued Devlin.

Installing the Geothermal Field

On the outside, the Middleton Corporation and Jackson & Sons Drilling Company had the subcontract to install the turnkey geothermal field specified in the design. A "turnkey" field means the entire field up to and into the building: drilling of vertical bore holes, piping and grouting these holes, "headering" up (putting a manifold on the specified number of holes to make a circuit) the vertical bore holes and the installation of a pre-cast concrete vault where all field piping went into a secondary manifold. Each circuit was put on an isolation valve in the vault, allowing them to shut off a circuit without having to shut off the entire field. By having this vault outside, it saved space in the mechanical room. From this vault, two 12-inch lines ran about 700 feet to the building mechanical room.

During the installation of the geothermal field the greatest challenge of the project was encountered, specifically in drilling the holes. Drilling began in early April 2002. A test drill revealed a layer of loose rock strata existed between approximately 100 and 220 feet below the surface. "The formation into which we drilled was hard, fractured limestone, fairly near the surface," said Greg Wells, Geothermal Sales Engineer with Jackson & Sons Drilling and Certified Geoexchange Designer. "The rock was very fractured and in these fractures there was groundwater."

The drilling was done using air-rotary technology - an air hammer with a 6-inch bit. As the hammer

The Sisters went beyond their heating and cooling needs in their successful attempt to have a green renovation. They reused and recycled numerous materials either in their renovated facility or by donating them to local charities and recycling facilities. They also installed water conserving and energy efficient systems throughout the building. The land surrounding the facility was also considered as part of the renovation. They are working to reestablish the native trees into the landscape by planting native trees as non-native trees die.

The materials they reused from their existing building and landscape were:

- Approximately 800 wood windows, 500 cherry wood doors and millwork
- 100+ period light fixtures retrofitted
- Marble pieces reused for countertops on cabinetry and windowsills
- Topsoil removed during construction was reused in the landscaping

The materials they donated to local charities or recycling facilities were:

- 45, 260 sq. ft. carpet
- Sinks, toilets, wiring, and duct work
- Radiators and cabinets
- 50% of plaster used by local paving company
- Over 30% of construction debris

Green products used during construction were:

- Drywall material-made from recycled paper content and gypsum
- Trex,™ -made from recycled wood and plastic was used for the outside veranda
- Floor coverings-made from linoleum and cork, which are rapidly renewing materials
- Benjamin Moore's Eco-Spec™ paint-low volatile organic compounds, such as this paint do not release many pollutants

Water conservation:

- 30% reduction in fresh water consumption
- 55% overall reduction in water consumption
- A greywater system was installed for use in toilets
- 7,270 gal/day of water is diverted to the constructed wetlands to be filtered for use in the greywater system instead of the city water treatment plant

was run, air was injected into the hole to bring debris to the surface. The result was thousands of gallons of groundwater per minute coming out of the holes being drilled, which totaled nearly a million gallons per day. To deal with the displaced water, Jackson & Sons Drilling dug containment ponds to store the water, allowing the sediment to settle out before pumping it into the local storm sewer system.

The volume of water was not the only drilling challenge encountered. The fractures in the rock were so large, that in some instances the air pressure from the drilling process pushed groundwater into previously drilled adjacent holes and pushed the pipe in these holes right out of the ground. For Greg Wells and his crew, it was an exasperating process. "Prior to the start of the project, estimates were that it would take nine to 10 hours to drill holes to a depth of 450 feet. In reality, it took as long as 18 hours to complete a hole. At one point, we had four or five drilling rigs being run at one time. So much air was being injected into the formation as a result of all this drilling, that the formation became unstable and cave-ins were common. It was costly and time consuming."

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Photo courtesy of Denyse Burkhart

Men from Jackson & Sons Drilling Company work hard to complete the drilling.

Many holes were drilled multiple times, and drilling conditions were almost impossible. During the insertion of the pipe, even after successfully drilling a hole, cave-ins would occur, making it necessary to re-drill the hole. The Jackson & Sons Drilling team ultimately decided to pull half the drilling equipment off of the site, because it was doing more harm than good. Working overtime and on weekends, the job was completed on time in late September 2002. "The drilling conditions were very tough," said John Turley, President of the Middleton Corporation. "Completing the drilling on this project was a heroic effort."

The drilling of the holes for the geothermal field taught the team that words have meaning when dealing with local regulatory bodies. Whether you call it a hole or a well does make a difference to government regulatory bodies, so the team was careful to always refer to what was being drilled as a "hole." "A well is for extracting water," explained Rogien. "To drill a well,

you have to have a permit. This may seem like it is just semantics, but it is important. Code officials may not understand this distinction, so engineers need to take the time to educate them."

Once the holes had successfully been drilled, pipes were inserted - one to carry water down, and another to carry water back up, connected at the bottom with a "U." These pipes were then linked together via a 1.25-inch diameter flexible plastic piping system. A series of 10 holes and associated pipes were connected to a branch main, 2-inches in diameter to form one circuit, creating a total of 23 circuits in the geothermal field. If there is a leak or problem with any circuit, it can be shut down for repair without shutting the system down entirely.

With the geothermal field in place, Middleton Corporation made sure it was working properly. "We were responsible for the hydrostatic testing of the field," stated Turley. "This included flow testing of the field to ensure design flow rate through the field. We also flushed the system of air and filled it with water. In our seven and a half years of doing geothermal projects, this is one of the largest we've done and certainly the largest system of its kind in the state of Michigan."

Photo courtesy of Denyse Burkhart

The chiller is installed.

System Becomes Operational

The geothermal system at the Motherhouse was completed in December 2002 and became operational in January 2003. So far, this sustainable renovation project has won a Clean Air Excellence Award from the EPA and an award for leadership in sustainability from the Michigan American Institute of Architects. The system performed well during its first Michigan winter. Every sister has a thermostat in her room, letting her control temperature individually. The reliability of the system was recently tested during the power blackout that affected the Northeastern U.S. When the power went out, the geothermal system continued to function normally, running its pumps using a generator. It worked just like it was supposed to.

The approximate cost of the system was $1.7 million. "In most cases, the construction cost of a geothermal system is higher than a non-geothermal system," Rogien concluded. "But, if you can spend more money up front, your operating costs go down. Over the life of a building, you'll spend about 15 to 20 percent building a system and about 80 percent operating it. So the

System Vital Statistics

- 484 vertical fan coil units
- 232 bore holes, each 450 feet deep
- 47 miles of piping in geothermal field
- 24,539 fittings
- 2,159 valves
- 5.87 miles of duct
- 830 fire dampers
- 1,200 grills, registers and diffusers

savings and payback are significant over the life of a building. The geothermal industry needs to get better at communicating these economics because they are to the industry's advantage. The reality is this: the person ultimately delivering this message to the owner is the designer or architect or engineer, and it doesn't matter if they are motivated by either sustainability or operating costs. It's not about making money verses improving the industry. You can do both."

Today the Motherhouse is serving the educational purpose the sisters envisioned for its renovation. "The building is a metaphor for the whole way in which we need to live in relation to each other and to the planet," observed Conroyd. "We want to be as benign a presence as possible and value the gift. The sisters view the Motherhouse and where it sits as a gift. We want to make sure it is still viable for future generations."

◆

Contributing Parties

- H.F. Lenz Company - Engineering www.hflenz.com.
- The Christman Company - Construction Manager www.christmanco.com
- GEM Industrial Inc. - Prime mechanical contractor www.rlcos.com/gem/index.html
- The Middleton Corporation - Geothermal subcontractor
- Jackson & Sons Drilling - Drilling subcontractor www.jacksongeothermal.com

Jerry Rackley is a freelance technical writer based in Stillwater, Oklahoma.

Sorority Leads Its House into 21st Century with New Heat Pump

by Kathryn Jones

Since its formation at the University of Arkansas over a century ago, the Chi Omega sorority has provided its members with unique opportunities in scholarship, life-long friendship, and leadership. At Oklahoma State University (OSU), leadership roles were certainly needed as the women of Chi Omega led their house into the 21st century together with the innovative technology of geothermal.

August temperatures in Oklahoma, which were well over 100 degrees for weeks in a row, made sorority rush week unbearable for the recruits. Walking several blocks along Greek row between parties left the recruits sweaty, sticky and hot - until they stepped into the refreshingly cool Chi Omega sorority house. This welcome change experienced by the recruits and Chi Omega members alike, was brought on by a new ground source heat pump, which consisted of a hybrid system with a closed circuit fluid cooler. However, the impetus for installing the technology was more than just making the house comfortable for members and their potential guests. It was about saving money, preserving the environment and replacing their old system with one that would sustain many more years of utilization.

Photo courtesy of Adam Huffer

Belinda Hammergren, president of the Chi Omega House Corporation, and Dr. Jim Bose, executive director of IGSHPA, discuss the plans regarding the heat pump installation.

Researching the Technology

In December 2000, the house corporation board, a group of Chi Omega alumnae who manage house operations, hired SPARKS, a mechanical and electrical consulting engineering firm from Tulsa, Oklahoma, to evaluate the mechanical systems of the house. SPARKS concluded that the existing HVAC unit needed to be replaced.

"The old system had been patched, patched, patched for a long time," Lois Mickle, treasurer on the board, said. "Many checks are written simply for maintenance, and we thought if we could get rid of writing so many checks for the old unit, we'd be sitting pretty."

Photo courtesy of Ken Helt

Mark Swift of Geo-Enterprises, Rick Dense of Dense Mechanical and David Carpenter of Geo-Enterprises finish a fusion project.

After SPARKS' investigation, Lori Beth McDonald and Katrissa Riffel, two additional board members, decided to work on convincing their fellow sorority sisters and corporation board members to investigate the benefits of geothermal technology replacing their old HVAC unit. Ms. McDonald previously worked at OSU with Dr. James Bose, executive director of the International Ground Source Heat Pump Association (IGSHPA). She said she had learned a lot about ground source technology while working with Dr. Bose and wanted the Chi Omega house to experience the geothermal monetary and environmental benefits. Ms. Riffel, whose home has a geothermal system, worked together with Ms. McDonald to get the board's approval. "I have a heat pump in my house and it has been very efficient," Ms. Riffel said. "The bills [with the old HVAC unit] were astronomical. We put in a geothermal system and the bills really dropped."

D.J. Pettit, corporation board member, said the decision to install this system would have been more difficult to make had it not been for Ms. McDonald and Ms. Riffel's input. "Personal experience means a lot, especially when you're dealing with something new like this," Ms. Pettit said.

Stillwater Power in Stillwater, Oklahoma, where the Chi Omega house and OSU are located, enticed the women to delve further into investigating such remarkable technology. The utility company offers a rebate program for geothermal customers in residential areas, which include the houses on OSU's Greek row. According to Mike Herron, director of Stillwater Power, once the heat pump is installed and operational, the residential customer is billed at the residential heat pump rate designed for ground source and air source heat pump customers. The customers are then given a one-time rebate of $200 per ton of energy used.

However, this rebate program was scheduled to expire in June 30, 2003. Since the system would not be operational until the next month, July 2003, Ms. McDonald said it seemed unfortunate they would be missing out on the rebate by one month. Therefore, the board asked for an extension for this rebate offer and Stillwater Power granted it to them. This savings proposed an extra incentive for the board to take on such a giant project.

"We based a lot of our decision on the fact that we would get this rebate. Of course, we were going to have to replace the old system anyway, so we were looking for alternative ways to save on our energy bills each month

while being environmentally friendly at the same time," Ms. McDonald said.

The corporation board, which is headed by President Belinda Hammergren, Vice President Karen Stewart, Treasurer Lois Mickle and Secretary Julie Fernald, and also includes additional alumnae, needed no further explanation. They were ready to make their decision to have a ground source heat pump installed.

" Probably the greatest challenge for the house board was to weigh the additional up front costs of the geothermal system against future benefits," said Ms. Hammergren. " We believe we have made a long-term investment in our house that will pay dividends for decades to come."

Working Under Pressure

Phil Schoen, President and CEO of Geo-Enterprises Inc., the company who assisted in the installation of the heat pump units, worked hand-in-hand with the Chi Omega board; SPARKS, who selected the system; C & S Heating and Air, who installed the loop; Dense Mechanical, who installed the system; and Heritage Construction, the general contractor of the project. This construction team, along with assistance from Dr. Bose, came up with a design system for the home that allowed for individual temperature controls in each of the 38 bedrooms instead of multiple rooms on the same thermostat. "It's going to lower their utility bills. More importantly, it's going to give them more comfort and individual room control at a lower operating cost," Dr. Bose told the Stillwater NewsPress.

Mr. Schoen said the units that were selected were very quiet. Because of this, Dense Mechanical was able to hide the units in the areas above the closets in the women's rooms. The common areas, such as the foyer, living and dining rooms, had other units. A total of 55 units were installed.

The units, in addition to an Energy Recovery Ventilator (ERV), work together to heat and cool the house. The ERV pulls in air from outside and either heats and cools it as appropriate. As the air is either heated or cooled, it is blown into a 100 percent outdoor air heat pump, which preconditions the air to the temperature of the building inside.

Mr. Schoen said one of the biggest challenges was working with a house that had been added onto several times since the original building was constructed in 1928. As one crew removed the old ductwork throughout the house, Mr. Schoen said the other crew had to be patient with installing the new units. "No one could really do anything until everything was demolished," he said.

And because the house had so many different additions, the crew kept finding some surprises. Hidden brick and additional sections of the house, which were not previously known about, seemed to appear from

Photo courtesy of Ken Helt

Rick and Bob Dense with Dense Mechanical unpack the heat pump units.

Photo courtesy of Ken Helt

The units were installed in these spaces above the closets in the women's rooms.

underneath the sheetrock and walls as the team installed the system. "[The installation] went smoothly, but keeping in mind, it was a retrofit, so it was a challenge," Mr. Schoen said. "It was a work in progress and some [plans] changed as we went. Everyone did a great job coordinating things."

Managing the team was not the problem for Heritage Construction; they were under pressure to complete the project in the 2002 and 2003 summers between school years. Construction was done in a phase-by-phase situation because no work could be done during the school year with 85 women still living in the house. Dr. Bose told the Stillwater NewsPress "the big challenge in a retrofit like that is to be able to get into it and get the work done without interrupting the normal schedule of the sorority." The construction team was very flexible and worked around the university's school calendar. "We were moving furniture out before school even ended for the summer," Ms. Mickle said.

Phase one including drilling 30 305-foot boreholes and installing 1-inch diameter pipe under the Chi Omega parking lot, 100 feet from their back door. "Significant land surface was needed to accommodate the spacing for the number of wells needed for such a large project," said Ms. Hammergren. "We were fortunate that one of our parking lots is located adjacent to the house, which enabled us to gain the cooling capacity we needed."

Phase two meant installing the rest of the system in 2003, and Mr. Schoen said this was the most time-constraining part of the project. "Anytime you try to cram a 6-month-long project into two months, you're going to have some problems, but Heritage Construction certainly accommodated. They did a tremendous job."

And accommodate they did. Hiring people to work under these conditions can be demanding, Mr. Schoen said. "Nobody wants to work from five in the morning to midnight and then come in to work on the weekends, too. And working in 100 degree temperatures with no air conditioning is very difficult," Mr. Schoen said.

Positive Results

The construction and installation conditions may have been difficult, but results were certainly worth the sweat and toil. The Chi Omega women couldn't be happier about their new system and the board has heard nothing but positive feedback from the current members. "Most of all, the [house] members like having their own thermostats in their rooms," Ms. McDonald said. There are some limits to the controls, however. "There's a 10 degree spread to adjust the temperature of the rooms. That way the girls can't turn the air conditioning down to 50 degrees and then just let it run," Ms. McDonald said.

Because the system allows for fresh air to enter the house, this eliminates the need for the members to open their windows for outside air. "The women were always complaining about being too hot in the summer and too cold in the winter. They're comfortable for the first time in a long time," Ms. Riffel said.

Replacing the old HVAC system was part of a renovation project that included alarms on the windows, a sprinkler system throughout the house, and renovation of the basement. "It's our job to make this house as safe and secure as possible for these women," Ms. Mickle said.

Community service is one of the six purposes Chi

Class in Conjunction with Energy 2003 Goes Smoothly

Design issues relevant to commercial and institutional ground source heat pump systems were covered at the Introduction to Heat Pump Technology class, held in conjunction with the Energy 2003 conference, on Aug. 17, 2003.

John Shonder of Oak Ridge National Lab; Phil Schoen of Geo-Enterprises, Inc.; and Larry Eitelman of Florida Heat Pump Manufacturing taught the class.

Many of the attendees were researching information on future projects they would be constructing. Some were members of the Air Force and the Navy who wanted information about future projects they were planning.

Mr. Eitelman covered basic geothermal issues. Mr. Schoen presented the mobilization of commercial geothermal projects and also reviewed a project he worked on in South Korea. Mr. Shonder wrapped the session up with lessons he has learned by working in the industry. The instructors took questions as they went.

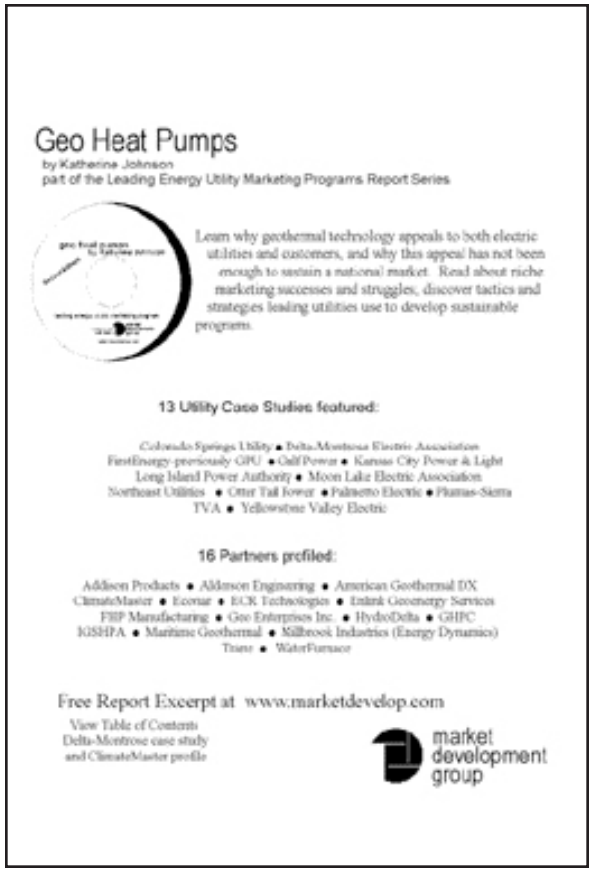
Energy 2003 is a federally sponsored annual educational forum. This year, the federal government and military energy managers, in addition to private sector energy officials, learned about technological advances offered by manufacturers, suppliers and service providers in the lucrative energy efficiency, water conservation and renewable technology industries.

For more information on Energy 2003, visit their Web site at www.energy2003.ee.doe.gov.

Omega's founders established over a century ago. Keeping with the founding purpose charged the sorority to be philanthropic in preserving their environment and the OSU campus for future community members. The women's decision to install this modern machine will affect many more people as the Chi Omega's ground source heat pump brings their house into the 21st century.

Contributing Parties

- Heritage Construction - General contractor
  heritage@sprynet.com
- SPARKS - In-house engineer, selected systems
  www.sparks-aei.com
- Dense Mechanical - Installed systems
  www.densemechanical.com
- Geo-Enterprises, Inc. - Assisted in installation
  www.geo-enterprises.com/expfile.asp


Geo Heat Pumps
by Katherine Johnson
part of the Leading Energy Utility Marketing Programs Report Series

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Buick Classic's Home Now a Geothermal Showplace

There must have been more pressure on Robert Dooley than a PGA pro feels trying to sink a 30-foot putt.

His company, RJ Dooley and Associates, was racing to finish the largest geothermal installation in New York state at the Westchester Country Club before the Buick Classic began. Dooley and his wife, Geraldine, the project's manager, had worked feverishly for 14 months to get the system up and running at the country club's 280,000 square-foot clubhouse. They finished on May 25. The Buick Classic, which traditionally opens the country club's season, started June 16, 2002.

The job entailed 492 WaterFurnace geothermal water-to-air and water-to-water heat pumps ranging from one to 30 tons (700 total HVAC tons) and 150 vertical bore holes, each 350 feet deep. The water-to-water units heat water for the kitchen and laundry.

"We had 60 to 70 people on the job. When the timing got tight, we would go up to 80 or 90 people," Dooley said.

Built in 1919 as the Westchester Biltmore Hotel and converted to the private club's use in 1929, the eight-story building presented an enormous challenge for Dooley. In addition to a large kitchen and several large banquet and meeting rooms on the first floor, the clubhouse's upstairs rooms are home to many club members. Of the original hotel's 340 guestrooms, two-thirds are residential apartments and the remainder is used for guests.

Because the building also was a private residence, Dooley's company did its job in nine phases to minimize inconvenience to residents. Each apartment had its own

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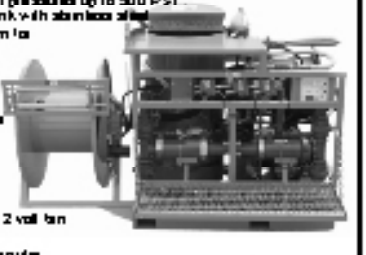
- Approx. weight 1,700 pounds
- Large stainless steel bag platform for operator's ease of loading
- Quality 30" x 15" grip tread foot platform
- Optional hose reel (holds up to 500' of 1" or 250' of 1 1/4" hose)
- Optional self-priming water pump
- Technologically advanced grout pump covered by United States patent D425,045,4



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- Dependable 5" bore 3" stroke piston pump
- Built tough chrome-lined cylinders with hammer union construction pump
- Strong 13 HP electric start Honda engine
- High capacity water fill pump and high pressure wash down line
- Efficient 10 gallon hydraulic oil reservoir with sight glass and thermometer
- Thermostatically controlled oil cooler with 12 volt fan (optional)
- Durable powder coat paint frame work
- Variable fork lift pockets on both sides of grouter
- Approx. weight 900 pounds
- Optional hose reel (holds up to 500' of 1" or 250' of 1 1/4" hose)
- Optional self priming water pump (as shown)
- Technologically advanced grout pump covered by United States patent D425,045,4

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Geothermal Loop Grouting Experts

Geo-Loop

air conditioner and now needed its own heat pump and individual controls and the entire building was heated by an antiquated steam boiler system. The earth loop covered 1-1/2 acres, with some holes bored within 15 feet of a putting green.

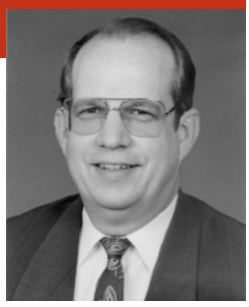
"It was a big challenge," Dooley said with some understatement.

It's also a big success. Working with a grant from the New York State Energy Research and Development Authority to promote the use of geothermal technology, the Westchester Country Club now is a shining example of how geothermal can save energy and protect the environment - on a small or large scale.

In the first seven months of 2002, the club saved $172,000 in electric bills over the previous year. The club is expected to reduce emissions of nitrogen oxide by .6 tons a year, sulfur dioxide by 1.2 tons and carbon dioxide by 345 tons - emission linked to smog, acid rain and global climate change.

Westchester Country Club stays "green" with new geothermal system. *Photo courtesy of WaterFurnace*

Earth Insights



By Phil Rawlings

If you have a question about geothermal installation, design or troubleshooting, send it to Phil Rawlings in care of *Geo Outlook*, Oklahoma State University, 499 Cordell South, Stillwater, OK 74078 or via e-mail to kathrej@okstate.edu.

What dictates borehole depth and spacing?

Commercial loop field grid design preparation – do you have:

a. Calculated, not estimated, heat loss and heat gain
b. Equipment selected
c. Loop design temperatures selected
d. Far field (ground) temperature (from thermal conductivity test(s))
e. Ground thermal conductivity (from thermal conductivity test(s))
f. Ground thermal diffusivity (from thermal conductivity test(s))
g. Thermal conductivity test bore well logs
h. Pipe diameter options evaluated
i. Grout options evaluated
j. Loop field space availability defined
k. Borehole depth possibilities defined
l. Environmental and code requirements defined

If you didn't answer yes to all of these, don't start design calculations!

Design – Well fields must be designed to accomplish two tasks: 1) to provide necessary heat source/heat sink capacity required by the system's heat pumps, and 2) to allow the earth to adequately dissipate surplus rejected heat or replenish the effects of absorbed energy over an annual cycle. Grid type well field design must consider the effects of system operation over the expected life of the system. Failure to consider the long term impact of heat rejection or absorption can result in distortion of far field temperatures over time. This distortion can cause cooling dominant loop maximum temperatures to go above design parameters, reducing capacity and efficiency. On heating dominant systems, temperatures can fall below design parameters, with the same results. In extreme cases, loop temperatures can reach levels that will cause system heat pumps to be shut down by their internal safety circuit.

Application – Site conditions can require variation from "normal" design practice. Space availability may require boreholes that are closer together, but deeper. Ground conditions may dictate that holes not be deep enough to accommodate a nominal ton (12,000 BTUH) of capacity, or they can be deeper and accommodate more than a nominal ton of capacity. There are no "rules-of-thumb" for variations in site conditions – don't assume, investigate!

Mr. Rawlings has over twenty-five years experience in the geothermal industry. He is a Certified Geoexchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.

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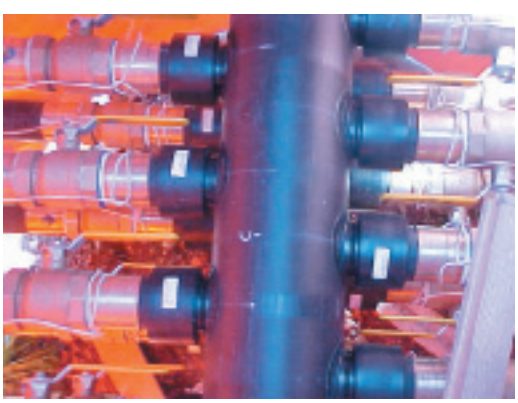

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