# GEO OUTLOOK

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## GSHPs Help Olympic Village Reach LEED Gold

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# Geo Outlook

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*Cover photo courtesy of Timothy Ryan.*

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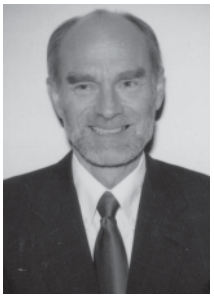
# Directors' Forum

## Notes from GHPC



**By John Kelly**
**Executive Director,**
**Geothermal Heat Pump Consortium**

Ground source heat pump (GSHP) systems can be retrofitted to both residential and commercial properties. These can be the most challenging GSHP projects to undertake, but they can also be the most rewarding.

For example, many older buildings have hot water radiators and lack air conditioning. So, installation of a GSHP heating and cooling system may require installation of ductwork. Existing properties may also have well-established landscaping and access to the property for installation of the ground heat exchanger piping may pose challenges.

Meeting these challenges can be well worth the effort, since GSHP systems provide added comfort as well as demonstrated savings on utility bills. And a GSHP system can be expected to operate efficiently longer than a conventional system, with heat pump life over 20 years and the ground heat exchanger projected to last 50 years or more. Historic properties can be especially attractive retrofits, since GSHP systems can be installed without rooftop or other outside equipment that detracts from the historic architecture of the building.

By the way – new Federal tax incentives can help with retrofits as well as with new construction. Homeowners and eligible contractors may qualify for a tax credit of up to $2000, and commercial properties may qualify for the new 10% investment tax credit. So check with your tax advisor to see how these new incentives may apply to your situation.

## Notes from IGSHPA

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

Retrofitting of existing buildings with geothermal heat pump systems will continue to be an excellent market because of the huge inventory of buildings that have older and inefficient equipment. The broad range of customers with this inventory includes military housing, municipal governments, individuals and large track owners. There are numerous successful examples of each of these groups. The real trick in the retrofit business is getting a successful start by knowing what to expect without the benefit of complete inspection/specifications that comes with new construction. If complete construction or as-built documents are not provided, then responsibility for "unexpected costs" must be addressed before project initiation.

Municipal governments across the country have large numbers of older housing with inefficient HVAC units. In these cases there can be hundreds of similar units making for excellent retrofit opportunities.

Additional electrical costs need to be considered if a fossil fuel system is being replaced by a GSHP system. Demolition, asbestos removal, relocation of underground services, new mechanical rooms, etc. are just a few costs that need to be addressed up front. Depending on local codes, the cost of adding capacity for new fresh air requirements can be significant.

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# Industry Leaders

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## Terry Proffer, CGD

**Principal**
**Major Geothermal**

Terry Proffer has designed, consulted or installed thousands of tons of heat pump capacity throughout the U.S., Canada and Asia since 1993. His system designs drive forced air, radiant, snowmelt, domestic hot water and industrial process water applications. He has trained over 500 contractors and engineers through IGSHPA and other training classes, and consulted with Colorado's Division of Water Resources to implement improved regulations for closed and open loop installations and licensing. Proffer is an IGSHPA accredited installer, IGSHPA trainer, Certified GeoExchange Designer, factory-certified ClimateMaster trainer, and a member of Rocky Mountain ASHRAE. In addition to 15 years as a petroleum geologist, Proffer's GSHP experience includes heat load analysis, loop design, thermal conductivity testing, and field installations. In 2007, Proffer and Major Geothermal, a Rocky Mountain GSHP wholesaler and design/consulting firm, formed Practical GeoExchange Solutions with Ed Lohrenz and GeoXergy of Winnipeg, Manitoba, Canada, to provide specialized training, peer review and consulting services for engineering, design and end-user clients.

## Bernard "Barney" Camponeschi

**Geothermal Sales Manager**
**Performance Pipe**

Barney Camponeschi has been geothermal sales manager since September 2007 for Performance Pipe, a Division of Phillips Chemical Company LP since 1996. He is also territory sales manager - Natural Gas Distribution and has held that position since 2003. He is a 1973 graduate of Northwestern University, where he received his Bachelor of Science degree in chemical engineering. Camponeschi is also a member of IGSHPA's Standards Committee. Performance Pipe is North America's largest HDPE pipe manufacturer.

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# GSHPs Help Olympic Village Reach LEED Gold

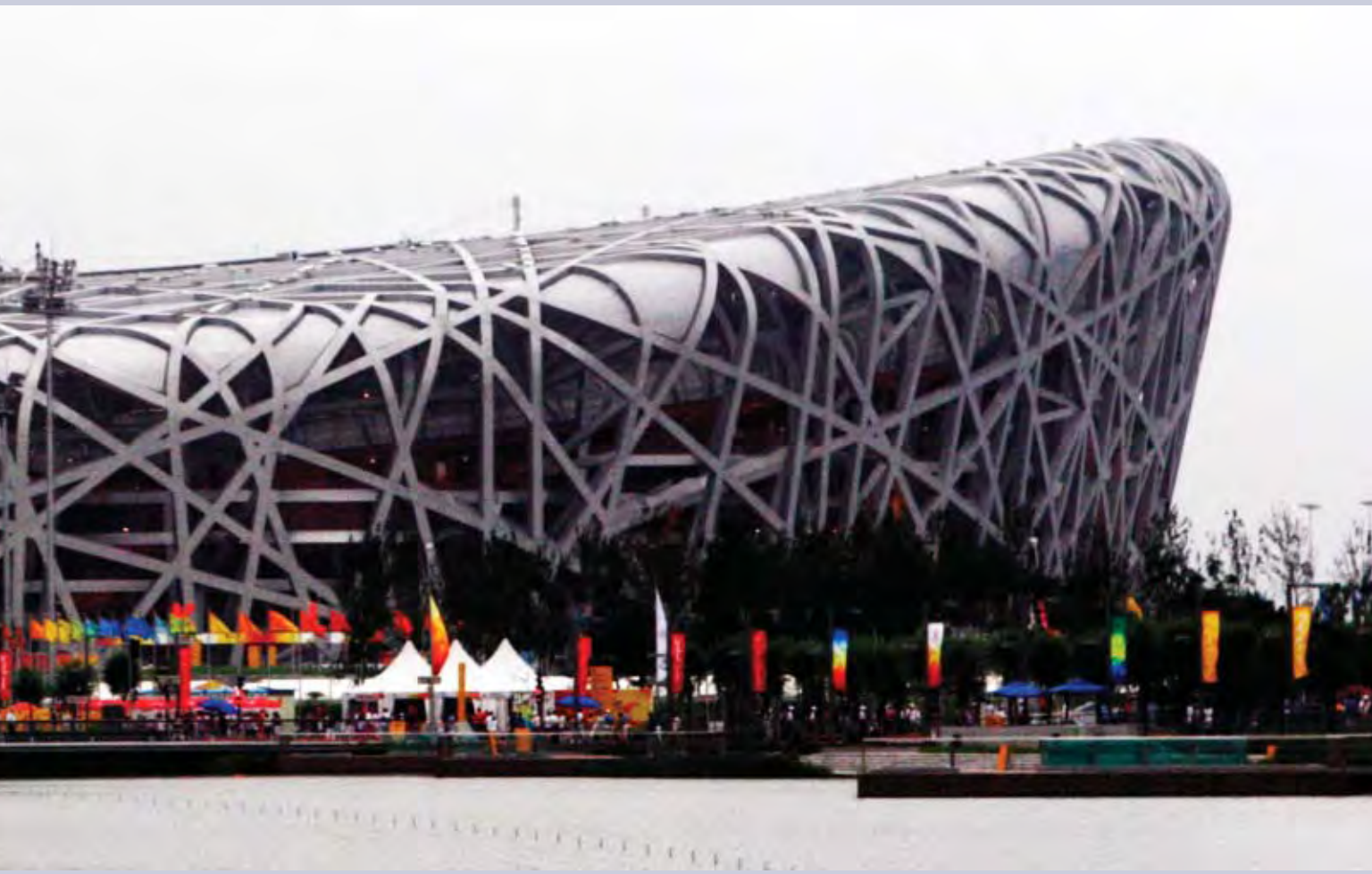
By Janet F. Reeder

Phil Schoen has had the enviable opportunity of getting a first hand look at China as the country steps up sustainable and ecological building efforts.

The Oklahoma businessman has made several trips to the area to both advise and train in geothermal ground source heat pump (GSHP) applications.

Schoen, the president of Geo-Enterprises, Inc., of Catoosa, Okla., was in China last fall working with Chinese engineers who installed equipment and oversaw drilling to support GSHP technology in the expansive National Stadium and other athletic facilities connected to it in China's Olympic Green.

"During the time I worked over there, we were actually on five or six different projects," Schoen said.

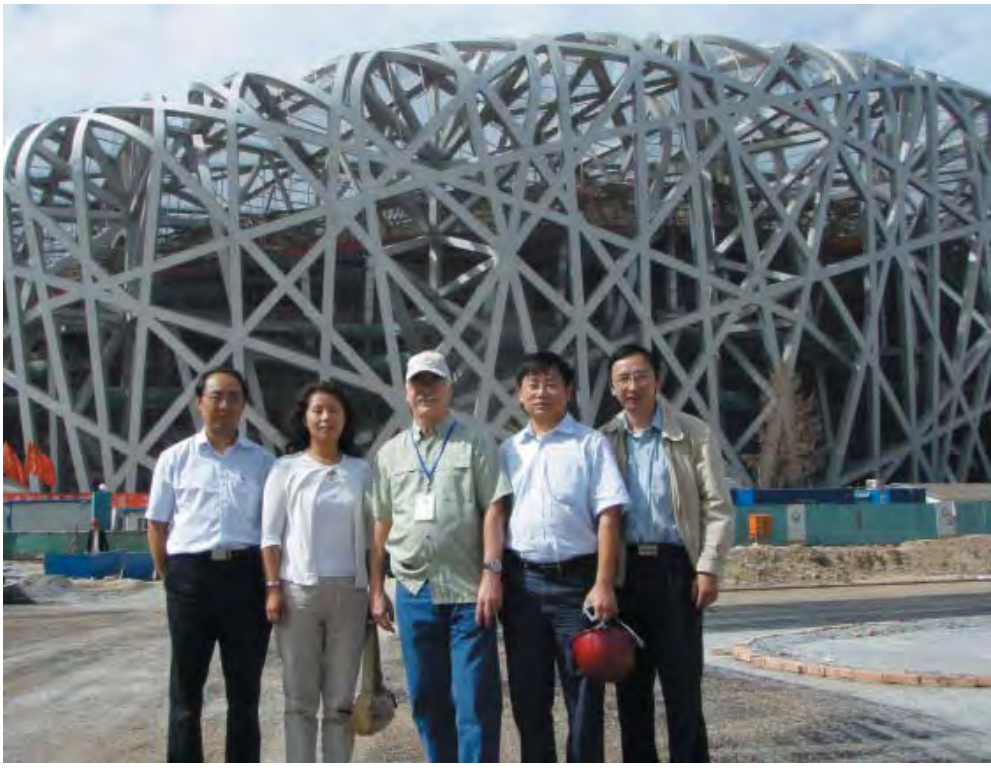


*China's National Stadium*

"One of them was the Bird's Nest Stadium–it had 104 boreholes on the track and field area. You probably saw it during the beginning of the Games."

The site of the opening ceremonies, named the Bird's Nest by the Chinese people, has extensive GSHP systems that use the earth's constant temperature to heat and cool the interior.

Planning for the National Stadium's GSHP installation started in 2004, Schoen said. He said it is probably some of the first GSHP work done by the People's Republic of China.



*Huaquing Group engineers with Phil Schoen on site at the National Stadium. (Photo courtesy of Geo-Enterprises, Inc.)*

Scholars and engineers in China started looking at ways to make Beijing a showcase of environmentally friendly and sustainable technology years before the country realized the bid had been won to host the coveted 2008 Olympic event.

The U.S. Green Building Council awarded the Beijing Olympic Village a Leadership in Energy and Environmental Design (LEED) Gold Award for successfully carrying out their "Green Olympics, High-Tech Olympics and People's Olympics" for the 2008 Games. A Chinese release states the award affirmed the cooperation between China and the United States in clean energy technology for the Olympic Games.

China's Chen Zhili, head of the Beijing Olympic Village, says she hopes such exchanges and cooperation can be strengthened. Zhili voices China's hopes and advocates popularizing energy conservation and pollutant reduction technologies to build more environment-friendly projects and contribute to China's sustainable economic development.

"Water to water heat pumps work with geothermal heat exchangers to serve various areas, some of which are suites or athletic dressing areas," Schoen said of the stadium's systems.

The technology, developed and promoted by the International Ground Source Heat Pump Association (IGSHPA), out of Oklahoma State University's College of Engineering, Architecture and Technology, allows the stadium to heat and cool much of the facility's athletic suites, media rooms and underground venue using the most energy efficient, environmentally friendly and sustainable technology available.

Ground source heat pump technology is definitely something China as a country is interested in as it lunges forward building for an increasing population and growing economy.

Schoen said China's Ministry of Construction has focused on GSHP technology and that six or more other Olympic buildings, including part of the Aquatic Center are using the technology as well as a growing number of public buildings throughout China.

Major efforts to change the world's perception of the country from that of Earth's largest pollution ravaged continent, to an upcoming "green" leader, have placed China on center stage. The 2008 Olympics allowed the

country to stretch out by declaring and building the "greenest" Olympics ever, while spotlighting the country's recent but massive response to overreaching pollution and ecological concerns.

The move toward energy conservation and higher environmental standards is apparent throughout the larger cities of China, but nowhere as apparent as in Beijing, where of the 2 million square meters of buildings used for the Olympics, nearly 30 percent were powered by clean energy like solar, wind and geothermal.

"It seems to be driven by the construction industry over there," Schoen said. "Certainly it is something the Ministry of Construction has focused on as very promising." Looking around, Schoen said he could see construction on as many as 20 projects.

For three weeks in October 2007, Schoen advised and trained Chinese engineers who worked on the project. With his company, Geo-Enterprises, Inc., and while serving as chair of the IGSHPA Advisory Council, Schoen has been involved in advocating and supporting numerous efforts to utilize the earth friendly, energy saving technology in a wide range of locations around the world.

Schoen, in fact, had to watch much of the Olympic coverage from job sites in New Mexico where he was overseeing GSHP applications on three projects, including a community center, an alcohol rehabilitation center and a school.

Schoen received help in his part of the Olympic project from Shawn Yunsheng Xu, a University of Missouri associate professor in engineering who has been instrumental in not only organizing Chinese interest for a chapter of IGSHPA, but also coordinated on site efforts and handled necessary translation.

Translation and publication of training material into Chinese was an important aspect of IGSHPA's role in the training sessions Schoen held for representatives of more than 70 Chinese companies.

Xu was instrumental in overseeing the translation of those training materials in a short time frame in order to have manuals available for the large number of interested Chinese engineers and company representatives who were

involved in geothermal aspects of the Olympic campus.

"He is native and he has spent a huge amount of time there," Schoen said. "He has been instrumental in almost everything on the project."

Zhongcheng Liu, head of the recently recognized IGSHPA Chinese Chapter, also worked with Schoen in overcoming the language barrier during training for the project. Liu is general manager of Suzhou Ji Neng Environment Energy Sources Technology Co. Ltd.

Schoen is returning to China this fall and will continue assisting in efforts to promote and develop GSHP technology there. He will spend more time on Beijing's Grand MOMA project, currently one of China's largest construction projects.

The Grand MOMA, an innovative new ecological residential community is adjacent to the embassy neighborhood and the Central Business District. It has been named by Time magazine as one of 2007's 10 architectural marvels whose eco-friendly approach has made it a showcase of innovation.

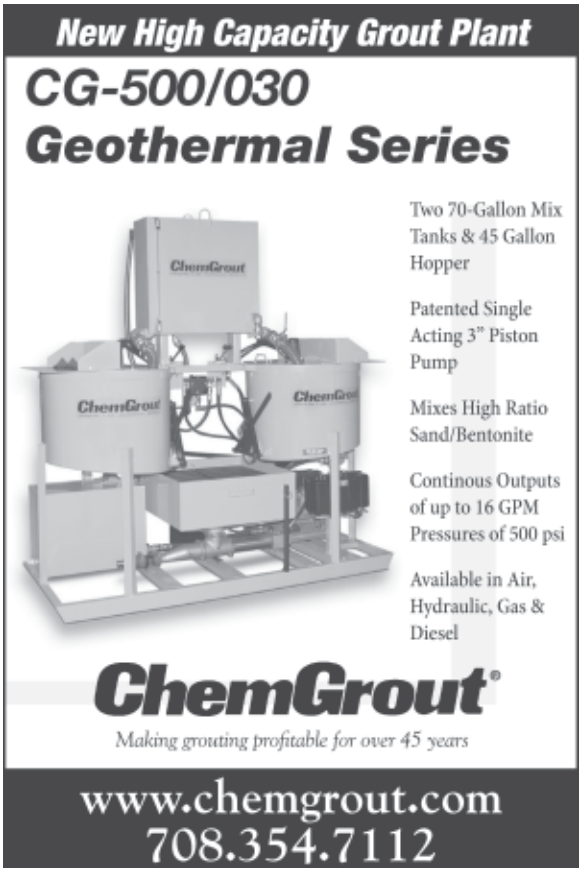
"It's a huge ongoing project," Schoen said. "It is state-of-the-art. Absolutely. It may be 60 percent built now."

The project is located in the same corridor of Beijing as the Olympics and includes radiant cooling with geothermal and pivoting walls, among other features, he said. The entire complex uses ground heat pump systems that utilize some six hundred 100-meter deep wells for heating and cooling.

◆

*Timothy Ryan, an Oklahoma State University 1984 journalism graduate who has worked on the past four Olympics, provided the Bird's Nest photos for our article. A long-time world traveler, Ryan celebrates his work in a personal blog carried by Reuters, Fox News and The Chicago Sun Times.*

*"From the Far Away, Nearby–A Celebration of Travel, Nature and the Poetry of Place," http://www.adventuresoftimtim.blogspot.com/.*



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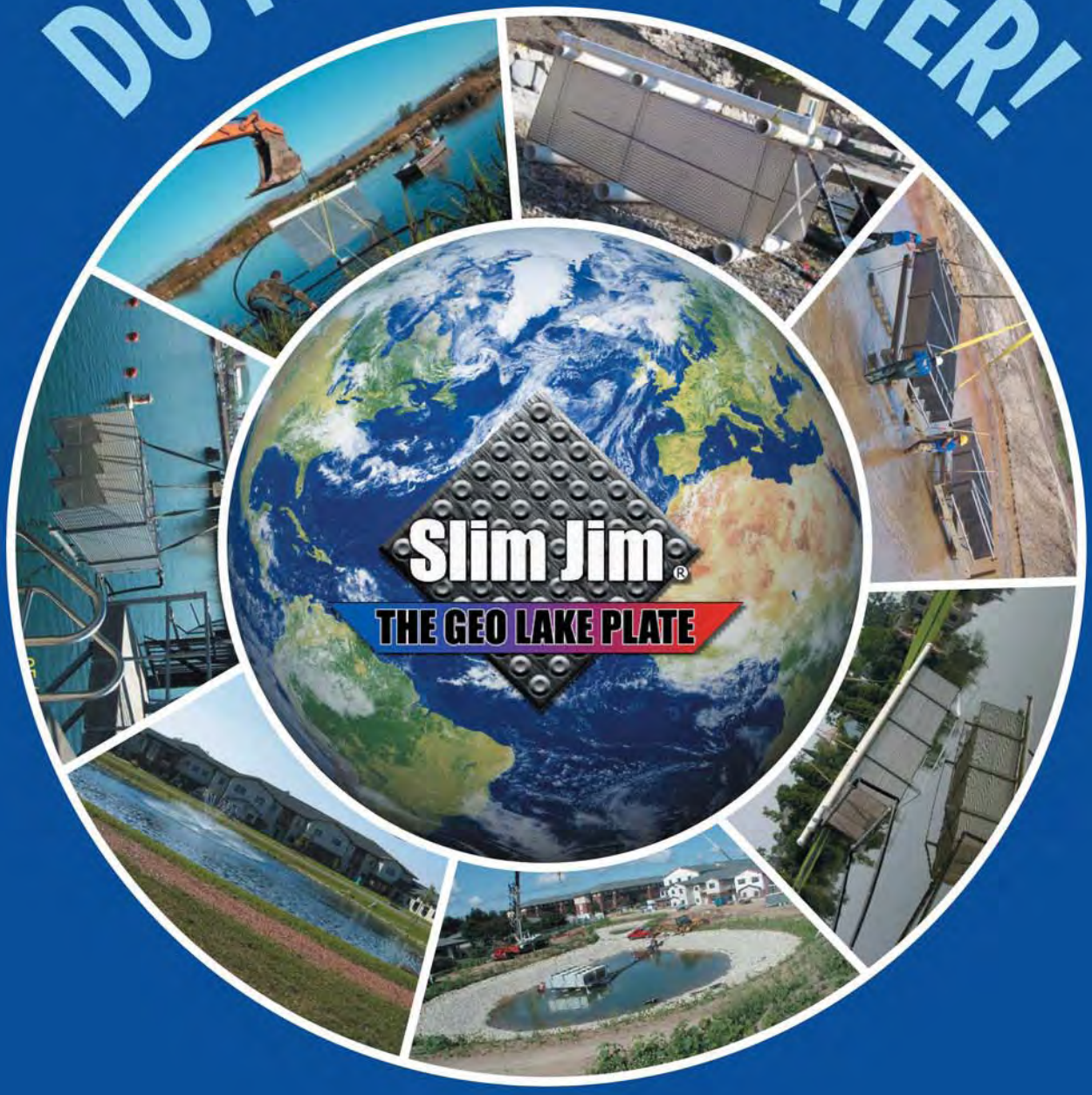


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# A Leader in GREEN Senior Living

**By Marie Kadavy**

*Committed to sustainable design, Hebrew Senior Life incorporated environmentally friendly features into its Dedham, Mass., community, NewBridge on the Charles.*

Surrounded by 100 acres of preserved natural environment and bordered on three sides by the Charles River, Hebrew Senior Life's NewBridge on the Charles, in Dedham, Mass., is being built with future generations in mind. NewBridge, a continuing-care retirement community, is committed to sustainable design, and at its completion, the campus will be heated and cooled by the largest ground source heat pump (GSHP) system in New England. The 1,600-ton hybrid system is just one of many green building features included in the 1-million square feet of facility space.

Scheduled to open in phases beginning in the summer of 2009, NewBridge offers a variety of living options for its residents. The campus will include independent living villas, apartments and cottages as well as a community center and a school, which will facilitate intergenerational programming between its K-8 students and the NewBridge residents. NewBridge will also offer residents 24-hour healthcare on the campus where as many as 2,000 people will live, visit, work and learn daily.

## An Environmentally Friendly Approach

For Hebrew Senior Life, the decision to install the GSHP system was less about payback and initial costs and more about the organization's strong desire to be environmentally friendly, said Michael Crowley, vice president of project management services and the project director of NewBridge on the Charles.

"In many ways, the location of the project helped to encourage the entire team to think about what we could do to make sure we're good stewards of the environment," Crowley said. "The 162 acres was really one of the most spectacular natural environments–lots of meadows, forests, of course the Charles River–just a beautiful piece of property. I think we took our cue from the location, and we wanted to be as responsible as we could in making sure that the buildings that were built and the systems that supported them reflected our care for the environment."

Len Fishman, president and CEO of Hebrew Senior Life, was committed to the use of environmentally friendly features and installing a geothermal system. "I would credit Len with really being the driving force behind ensuring we are one of the greenest continuing-care retirement communities in the United States," Crowley said. "We have a number of board members who were also very supportive of both the geothermal system and other green initiatives throughout the campus."

Even seniors moving onto the campus were very knowledgeable about green technology to the surprise of Crowley. Many soon-to-be NewBridge residents follow environmentally friendly practices in their current homes, such as recycling and using compact fluorescent bulbs, and were pleased to hear of the community's focus on the environment. "This is a very educated and

*In October, circulating and testing began for one of the two ground heat exchanger fields, and this winter, the system will provide temporary heat as construction continues.*

*The continuing-care retirement community's ground source heat pump system totals 1,600 tons and is the largest system in New England.*

environmentally aware population that will be moving onto the campus," Crowley said. "I think that the feedback that we received from them helped solidify our own desire to move forward with not only the geothermal but also a whole host of green initiatives."

## The Largest System in the Area

Crowley reported no major installation challenges for the largest system in New England compared to the challenges of a smaller development. He said the basic principles apply no matter what the size of the system. In an urban setting with less land area, a similar project may have encountered more obstacles, but because of the land the site offered, the team faced no size-related complications for the 1,600-ton system. "There isn't a system this size in that area of the country," said Trey Austin, vice president of Geo-Energy Services and project consultant. "Everyone needed confirmation that that large of a system would in fact work."

Before drilling began, a number of test locations were drilled and a geological survey was completed. "I think we were fairly confident in terms of the types of conditions we would encounter while drilling," Crowley said. "All of the study work we completed before the drilling started was accurate."

The two ground heat exchanger fields include 408 boreholes drilled 500 feet deep. Four drill rigs in operation six days a week for a 6-month period drilled the 5-inch bores. Water circulates through the closed-loop system's 1-1/4-inch loop pipe. The system was designed by Alderson Engineering and installed by Chesapeake Geosystems Inc. Trane heat pumps will provide heating and cooling for approximately 80 percent of the campus.

Drilling for NewBridge's borefields was completed in the summer of 2008, and in October, circulating and testing began for one of the fields. Crowley said a goal was set to get the system running to provide temporary heat for buildings that are under construction, and this

*Completing a number of test locations and doing a geological survey prepared the team for the site's conditions.*

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winter, the system will do just that.

Due to a large imbalance between the heating and cooling loads, a hybrid system was installed, offsetting construction expenses and reducing capital costs, Austin said. In the warmer seasons, the GSHP system is supplemented by the hybrid cooling tower. The cooling tower dissipates some of the heat that is generated by the system by taking the excess heat out of the water returning to the ground.

## A Wealth of Green Elements

In addition to preserving the surroundings and using energy-efficient heating and cooling, NewBridge will implement low-impact design and make the most of its surface area. The campus' other green features will include a rainwater collection system for irrigation and natural building components, such as red cedar shingles, cork flooring, and blue stone and copper facades.

NewBridge's environmentally friendly measures are expected to reduce CO2 emissions by 34 percent a year, the equivalent of taking 1,700 cars off the road. The GSHP system will reduce electrical demand and energy use as well, with estimated energy savings projected at $325,000 annually with savings increasing as fuel costs rise. The system is expected to use 20 percent less energy than its conventional counterpart, and Hebrew Senior Life expects a 7-1/2-year payback period for the $4-million system.

## A Leader for Geothermal, A Leader for Senior Living

Although the NewBridge on the Charles development was not eligible for any tax incentives or grants to help offset the initial cost of the system, Hebrew Senior Life helped successfully introduce legislation in Massachusetts that would reclassify geothermal heating and cooling so that it would be treated as a renewable energy for funding purposes. "While the legislation doesn't benefit us, we thought it was an important enough issue, and that particularly other not-for-profits would benefit from our taking the lead on encouraging the legislature to rethink how geothermal heating and cooling was classified," Crowley said.

Crowley hopes Hebrew Senior Life is able to set a new standard for what other continuing-care retirement communities can do to ensure their facilities incorporate green design and technology, he said. "I hope this is an example of a seed being planted, and through the years we'll bear fruit right across the country," Crowley said. ◆

*All photos courtesy of Hebrew Senior Life.*

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# Summit's Twin Maples Green Design Showcase

**By Linda Allen**

*Twin Maples in spring splendor.*

**What do you do** when a 100-year-old historic mansion faces the bulldozer and wrecking ball? For Twin Maples, located in Summit, N.J., its salvation came from the Summit Fortnightly Club. With a vision for the future and a desire to preserve the past history of its home since 1949, the Fortnightly Club secured grants plus over $1 million of in-kind donations to resurrect and upgrade the house.

A major goal of the effort was to retrofit the mansion with green technology and eco-friendly materials.

"Our vision with the renovation was to show the public what you can do to an old house to save it and to become energy efficient by using green technology. There are many historic homes in the northeast that can

*Bucks County Artesian Well Drilling Co., Inc. drilled four boreholes to 450 feet deep for the 12 ton closed loop system.*

be preserved and can use green technology. We want Twin Maples to be a lesson and example of how that can be accomplished," said Heidi Evenson, spokesperson for the Fortnightly Club.

Stately Twin Maples has long been a centerpiece of design and history in Summit. Built in 1908, Twin Maples was designed by Alfred F. Norris of New York and Montclair. The facade of the neoclassical style home boasts a full height, three story porch supported by massive columns that reminds one of the White House.

The Fortnightly Club and its sister organization, the Summit Junior Fortnightly Club headquarter at Twin Maples. The two clubs have a distinguished history since 1893 of community service in Summit and central New Jersey, including health, educational, literacy, arts and youth projects.

Starting in July, 2007, Twin Maples received a total makeover from basement to roof to enter its second century as a showplace and center for charitable work for the community. Over 40 designers cooperated to incorporate today's best green design and practices in sustainable building. Their challenge was to update and modernize the house while preserving its architectural integrity and historic character. Its listing on both the National Register of Historic Places and the New Jersey Historical Register presented restrictions on design and construction techniques.

High on the list of modifications and improvements was a geothermal system to replace the gas-fired steam boiler system and radiators. Green consultant, Anna Hackman and mechanical contractor Antonio Poccia of Perfection Contracting, Inc., advised the Fortnightly Club of the advantages of a geothermal system: low fuel costs, greater comfort, quietness, durable equipment, low maintenance, and environmentally friendly. Additionally it has a good payback in energy savings, especially in the northeast. Such benefits made it an easy decision to incorporate ground source heat pumps in the renovation.

Perfection Contracting installed the geothermal system. The company has been installing geothermal systems for 26 years and currently services over 50 installed by other companies in addition to more than 50 they have designed and installed. The Twin Maples installation was a four-zone geothermal heating and cooling retrofit. The 6500 square foot house required three GSHP units, two in the basement and one in the attic. The 12-ton closed loop system uses heat pumps manufactured by WaterFurnace that circulate heat transfer fluid (a water and ethyl alcohol mix) through the earth loop and back.

Four boreholes 450 feet deep use 2-inch polyethylene pipe to the loop field and 1.25 inch U-bends down the bores. The earth loop was installed without tearing up the driveway and with minimal disturbance to the lawn.

The house originally used radiators for steam heat. For aesthetics on the first floor, the radiators had been installed in the basement, suspended from the ceiling. Antique grates allowed heat transfer from the basement to the first floor. The geothermal system was installed so that the grates on the first floor were used to supply the heat and air, leaving the aesthetics unchanged. On the second floor, new grates were cut into the ceiling. All radiators were removed.

Retrofitting new technology into an historic structure presents challenges unique to each project. One challenge at Twin Maples was installation of the duct system. The ductwork was incorporated into the structure without loss of usable space and utilized many of the existing floor grates. To install the attic duct system required cutting through 100-year old plaster and lath. The geothermal registers were installed so no repair to the ceiling was required. Poccia added water-based mastic to seal the ductwork.

Poccia is a minimalist when it comes to installation. "Our mechanical room is disappointingly not interesting. There's not much to see there.

We practice elegant design, which means we spend more time upfront to figure out the most direct route from one point to another for efficiency and function. The design process is more extensive, but it creates the

*Reworking the Cinema Room was the work of Interior Decisions designer Carla Trincanello.*

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highest efficiency. Fewer pipes and 90-degree bends require less pumping, which results in a quieter system, smaller equipment, and ultimately requires less electricity to run," he said.

A preview event before opening the house to the public entertained over 300 people. The GSHP system maintained a constant, comfortable 67 degrees during the event. "If you can't hear it, feel it, or see it, the system is working perfectly," Poccia said of the installation.

One goal of the show house is to show off the green technology used in the renovation. "An Alternative Energy Exhibit in the basement features a hands-on learning center with information on retrofitting historic and older homes," said Evenson. Examples of additional green features used in the renovation are displayed in the exhibit: energy efficient replacement windows; solar panels; soy-based insulation; energy star-rated appliances; resin-based roofing tiles made to look architecturally authentic to the original house and a variety of reclaimed and recycled materials used in the construction. The two basement GSHPs are also on display.

Lower energy costs were a major selling point for the Fortnightly Club. "We anticipate the GSHP system will reduce the operating costs of the home by 50 percent a year or more. Although the installation was expensive, the system should recover its costs in savings in five to seven years." said Evenson. For the Fortnightly Club, geothermal was a timely long-term investment and solution for energy savings.

Billed as a "Second Century of Service," Twin Maples made its public debut as a show house with a full social calendar of events to celebrate the history of the house, the Fortnightly and Junior Fortnightly Clubs and to showcase green technology. Throughout the month of October, the public was invited to a variety of events and open houses to show off the renovation. Now that the renovation is complete and the celebrations over, the Fortnightly Club plans to make Twin Maples available for use by other charities and non-profits in Summit and throughout New Jersey.

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*Photos courtesy of Marisa Pellegrini.*

# A Place to GROW

**By Megan Wible**

Perkins School for the Blind is a place for growth; however, it's not just students growing, but also plants. Serving as an oasis for students to play and learn about the environment, the school's Thomas and Bessie Pappas Horticulture Center, is one-of-a-kind. The total square footage of the handicap accessible center is 5,500, with the greenhouse being 1,500 square feet. The other 3,500 square feet are dedicated to a resource library, three classrooms and interactive water fountains.

*The Thomas and Bessie Pappas Horticulture Center opened in 2003 and allows students to discover the environment in a unique way.*

The Perkins School for the Blind in Watertown, Mass., has a long list of firsts that speak for its expertise. It was the first school for blind people in the United States and the first school in the world to formally educate a deafblind person. But Perkins is not limited to the 200 students on its campus. The school provides home services for about 500 young children and 700 adults. Also, 26,000 people in the New England area use the Perkins Braille and Talking Book Library. Perkins has a global reach by serving more than 20,000 deafblind children and

*Visitors to the center are surrounded by an abundance of plants, which serve as a therapeutic oasis for Perkins' students.*

their families in 63 developing countries. The school also developed the worldwide standard Braille-writing machine, the Perkins Brailler.

For those on campus the benefits are even greater. The school looks like any other campus and the structure is similar. The major difference is that the educational programs are tailored to meet each child's needs individually. Students participate in classes and therapy that will help them as they enter adulthood. They also participate in group projects, such as plays and choir. Now, with the 2003 completion of the horticulture center, students can participate in horticulture projects to help them better understand the environment. The building itself is environmentally friendly with the use of ground source heat pumps (GSHPs) to heat and cool the center.

## The practical choice

Geothermal heat pumps were the practical choice for the horticulture center, because of the school's history. "In the early '60s, a fall-out shelter was built in case of nuclear attacks," Rich Falzone, facility director of Perkins, said. Connected to the shelter was a 64,000 gallon tank that was used for drinking water.

"It wasn't until about eight or 10 years ago that they cleaned out the shelter," said Urshula Patel, vice president of general contractor Lake Contracting Inc. "Until then, there were still beds and canned food down there." Lake Contracting Inc. has worked on projects at Perkins for 25 years, but this was its first experience with GSHPs.

After Lake Contracting discovered the tank, "our HVAC contractor suggested a geothermal system," Patel said. The pre-existing well and tank eliminated the need for an estimated 1,500 foot well, which saved Perkins $70,000. The location, while an asset, posed a challenge. The shelter was dug down into a hill and there was no access road nearby. A temporary road was installed so that the glass portion of the greenhouse could be assembled by crane. It had been shipped from the Netherlands–unassembled–in a cargo container. Another hardship was the record-breaking cold weather. In order for the mortar and concrete to cure properly, Lake

Contracting had to tent and heat the building site.

Matching the architectural style of the present-day horticulture center to other campus buildings built in the early 1900s, was no easy task. Two architects later, a design was selected that meshed well with the pre-existing buildings, Patel said. The center is made from bricks manufactured by the same company that supplied them for original campus buildings.

The total installation cost of the 30-ton system was $130,000 with an estimated payback period of five to seven years. The three 10-ton ClimateMaster units were installed by Walsh Mechanical of Abington, Mass. Savings are currently at 10 percent for the horticulture center and are projected to grow even more. The center has other environmentally friendly features, including ENERGY STAR lighting and appliances.

The school is considering using more geothermal and other environmentally friendly products for future projects on campus. "Geothermal is part of the answer to fossil-fuel independences," Falzone said. "I would use it again."

If they choose to do so, some of the work will already be done. The horticulture center uses 30 tons, but the capacity of the well is 60 tons, meaning three more 10-ton units could be installed for other buildings on campus. "The capacity to handle additional building was definitely a benefit for the campus," Patel said.

## The old and the new

In the early 1820s, medical student John Fisher traveled to the world's first school for the blind in Paris. After seeing a school of its kind, Fisher decided America needed to have a school for the blind, as well. The school was started in Fisher's father's home after receiving a charter from the Commonwealth of Massachusetts. It had grown so much in a year that it needed a bigger place, and was moved to the larger home of vice president and trustee, Thomas Handasyd Perkins. Six years later, it had outgrown that location as well. It was then that Perkins sold the home and donated the money so that the school could continue thriving. With Perkins' donation, an old hotel was converted into the school's south Boston location. In 1912, Perkins moved again to where it resides today–a 38-acre campus on the Charles River.

The need for places like Perkins, Helen Keller's alma mater, continues to grow. Seventy percent of blind Americans are either unemployed or underemployed. However, education can change these numbers: 80 percent of those who read Braille are employed. Perkins' vision includes raising awareness, providing education and building a brighter future for its students. It is accomplishing this by its willingness to adapt to a changing society, including everything from its educational methods to the use of a geothermal system.

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*Photos courtesy of Perkins School for the Blind.*

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# First **McDonald's** Restaurant Goes Geo

**By Jennifer Mornhinweg**

*A Pensacola, Fla. McDonald's boasts a first for the corporation, with installation of GSHP technology for heating and cooling.*

Because McDonald's makes the environment and energy conservation a priority, the introduction of a ground source heat pump (GSHP) system in a McDonald's restaurant is no longer just an idea for one McDonald's restaurant in Florida.

While each McDonald's restaurant is a small local business, there are more than 31,000 restaurants in 118 countries around the world. As a global family, the company's operations have significant environmental impacts. McDonald's has a broad commitment to environmental stewardship, reaching from the front counters of their restaurants back into their supply chain.

*The McDonald's system required drilling 44 boreholes at depths of 300 feet or more.*

## Match Making

Frank Kohout, corporate mechanical engineer for Worldwide Development at McDonald's Corporation in Oakbrook, Ill., said the local utility, Gulf Power Company, a subsidiary of Southern Power Company, originally brought the idea of installing a GSHP to John and Susan O'Connor, McDonald's owner/operators in Pensacola, Fla.

GSHP technology was not new to the O'Connors, who rebuilt their home in 2000 and had a GSHP installed in it. The couple was impressed enough with the GSHP system in their house, to look at installing one at one of their restaurants.

O'Connor has been in the McDonald's business for about 42 years, and he is familiar with the changing restaurant industry.

"I am the American success story," he said. He started working at McDonald's when he was 16 years old making 75 cents an hour. He continued to work at the fast food restaurant through high school and college. Then in 1986, he moved to Pensacola and bought his first McDonald's restaurant. Less than 20 years later, the O'Connors had nine successful McDonald's restaurants in Pensacola. Unfortunately, in 2004 Hurricane Ivan destroyed four of the restaurants.

McDonald's Corporation started looking at green technologies that included GSHP systems, to test in restaurants in the early spring of 2007, Kohout said. Timing worked out well for the O'Connors, as they were looking at installing a GSHP system in a restaurant they were planning to rebuild.

"We realize ground-source heat pumps might not be applicable to every McDonald's restaurant in all our areas of the world," Kohout said. The test for

McDonald's will validate energy savings and put together a business case of criteria to determine applicability for their restaurants, Kohout said.

After contacting several different McDonald's markets about participating in a company-sponsored test, Kohout was informed the O'Connors were interested in GSHP technology. By March 2007, Kohout and the O'Connors were discussing how they could implement a GSHP system into the Pensacola Restaurant they were rebuilding.

McDonald's Great Southern Regional Development Team. He also worked with Gulf Power Company, who recommended Greg Tinkler of Redding Linden Burr Consulting Engineering, from Houston, Texas.

"It was important to find an engineer who would understand how to design a geothermal system for a restaurant since it is different than a typical institutional or commercial building," Kohout said.

Kohout said designing a system to address the heat load originating from the kitchen is important, since the

*McDonald's opted to place units in the ceiling cavity of the Pensacola location.*

## Rebuilding and Creating

After the match was made, the rebuilding process began on the 4,500-square-foot McDonald's in August 2007. Designing and installing a GSHP system involved a number of steps that required working with McDonald's people from local and national levels.

During the rebuilding process, Kohout worked with the McDonald's U.S. Development Team as well as the

amount of heat varies by sales and even hours of operation. Kohout asked Tinkler to size the GSHP system for a 24-hour operation in case the O'Connors ever decide to change their hours.

"McDonald's also has a bigger air conditioning load than you typically expect for a restaurant due to all the cooking equipment in our kitchen. And cooling our kitchens is a competitive advantage when hiring crew

*Drilling was coordinated with the other work, allowing the project to stay on schedule.*

people, since it creates a more comfortable working environment," Kohout said.

All the work finally paid off when a closed-loop vertical system was installed. Kohout said there are 55 boreholes going down more than 300 feet, and the total tonnage of the system is 40 tons, with six 6-ton units and one 4-ton unit.

Kohout and Tinkler had assistance on the project from local contractor Danny Marshall of Energy Systems. The collaborative efforts allowed the O'Connor's existing restaurant to be rebuilt and reopened within three months.

"Leaving enough time for drilling, and the coordination of this system with other building trades," were challenges for the project, Kohout said. He mentioned a design difference in GSHP systems that also changed the exterior appearance of the building "We have a lot of equipment in our ceilings. These units are not on the roof as they would be in our traditional restaurant, they are in the ceiling cavity."

## The Savings and Results

Kohout said they are looking at a payback of five to ten years. "We are just waiting for energy results at the end of the year," Kohout said.

"There is certainly a long-term pay-off–by managing our energy uses, we will conserve natural resources and help control greenhouse gas emissions. This is another piece of McDonald's strategy to fulfill its continued commitment to social responsibility and good business practices," he said.

The growing popularity of green technologies like GSHP systems can be attributed to positive feedback from individuals and companies. Geothermal technology is the most energy-efficient and environmentally clean heating and air conditioning system available today, according to the Department of Energy. DOE also notes ground-source heat pump systems have the lowest life-cycle cost of any HVAC system today. These facts contribute to a number of utility companies promoting GSHP systems. Kohout said Gulf Power Company provided a $16,000 rebate for this project. The company not only promotes GSHP systems but it also offers a $400-per-unit-ton incentive for geothermal installation. There are other stipulations that can be found on their Web site.

Gulf Power Company is monitoring the power in the O'Connors' restaurant and another similar

McDonald's restaurant nearby using the typical air-cooled rooftop HVAC equipment. Both stores are similar in size, and more importantly, also have similar sales volume, which is a key because sales drive energy use more than square footage, Kohout said. McDonald's will be able to compare the energy savings between the stores. The restaurant contains the standard energy saving elements McDonald's specifies on its new restaurants, such as T8 fluorescent lamps.

"We need to understand the cost benefits of this system and some of the design parameters before we would introduce it at any other McDonald's restaurant," Kohout said. "Reducing energy use, that's the key," Kohout said.

"One thing we do understand is this is not going to work for every restaurant. There are areas that have poor soil conditions; there are areas where the utility cost isn't enough for the payback. There are a lot of things to explore."

The O'Connors were featured on CNBC's "The Color of Money" television show in November 2007. "It was nice to have McDonald's recognized for doing this green project," O'Connor said.

O'Connor said while they are the only McDonald's GSHP system in the world being monitored by McDonald's, the customers see no difference in their store, and they have no idea a ground-source heat pump provides the comfort level.

Kohout said the building seems to be drier and cooler than other nearby McDonald's restaurants, a challenge in that part of the country.

He also said the system has run very well, and there is a lot of interest from other owner/operators looking into this technology.

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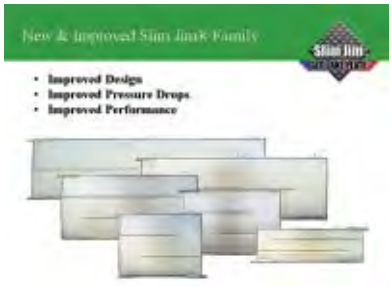
*Photos courtesy of McDonald's Corporation.*

# Product Showcase

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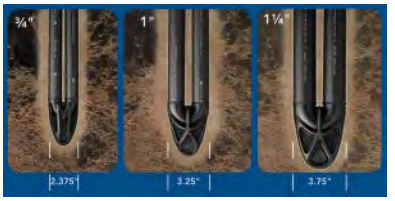


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# Earth Insights

If you have a question about geothermal installation, design or troubleshooting, send it to Phil Rawlings in care of *Geo Outlook*, Oklahoma State University, 374 Cordell South, Stillwater, OK 74078 or via e-mail to igshpa.news@okstate.edu.

# Geothermal Retrofit Applications

Retrofit applications are a prime example of the 5 "Ps" – "Proper planning prevents poor performance." They are also a showcase for Murphy's Law – "What can go wrong will go wrong." Just because you are planning to use some portion of the current system installation, do not assume that it is appropriately sized and/or in good working order. Verify that it is or be prepared to make the necessary adjustments. For example:

• Is the ductwork properly sized? This is particularly problematic in northern climates where the existing ductwork system may have been designed for heating only – approximately 300 CFM per nominal ton instead of the 400 CFM typically required for cooling. This is an even bigger problem with today's upscale GSHP units with variable speed fans because they are programmed to put out approximately 400 CFM per nominal ton and will do so, regardless of static pressure, creating noise and air flow velocity issues.

• Ductwork damage or failure – ductwork can be inadvertently stepped on or otherwise damaged and be restricted or blocked, joints can be loose or separated, and/or insulation can come loose. Has that been checked?

• In the south many systems use a bottom return and top discharge on furnaces and air conditioning units with low side wall return air. Is there adequate space for return air ductwork in the mechanical closet?

• If there was a raised platform for the original equipment, is it adequate for the GSHP? If so, what about vibration and noise transmission preventative measures?

• Is new thermostat wire required? Existing system control wire may not have the necessary number of leads.

• Condensate – heating only systems may not have a floor drain in the mechanical area or closet. Will you need a condensate pump and where will you discharge the condensate?

• Accessibility – in an older home, are the stairs into the basement strong enough to support the weight of two workers and the heat pump? In homes with attic systems, is the scuttle hole or pull down stairs 1) Large enough for the unit and 2) Strong enough to support workers and the unit? In equipment closet installations, is the door large enough to accommodate the GSHP unit?

• Ground heat exchanger piping access – just because there is room to install whatever ground source system is used on the outside, don't forget house entry and piping access to the equipment from the point of entry. This is especially true on multi-story structures.

These are some items that are easily addressed with proper planning but more difficult to overcome if ignored or overlooked.

---

*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.*

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