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NOTES FROM IGSHPA
By Jim Bose
Executive Director:
International Ground Source Heat Pump Association

This is a reprint of a column that originally ran in the second quarter 2007 issue of the Geo Outlook.

Twenty years ago IGSHPA was founded to begin a grass roots effort for a new technology: geothermal; and take it into the mainstream of HVAC technology. Early on, industry leaders recognized that training on the design and installation of these systems was the foundation upon which the industry and association should be built. The installer’s course was developed by a handful of forward thinking individuals. The first class in Stillwater in 1984 trained three new installers. At that time, research was just beginning across the country. Researchers were working with “pioneers” who were successfully installing geoexchange systems so the new science would flourish without unnecessary failure and gain the financial support of federal, state and private funding agencies. Consequently, data and training materials needed to support this emerging technology came into being.

Each and every player in this industry by their work; successes and failures, has woven the fabric of information that evolved into materials that support training today. In other words, everyone in this industry is a trainer. All that is known worldwide about this industry has been enhanced by people in the field and their willingness to share that information with each other. Competitors worked together to forge this industry. In this issue, you will read about that success and notice that everyone’s achievement is interwoven with their competition. They are the builders of this industry.

As this industry grows, it will be important to remember the lessons that these pioneers have learned over the last 30 years. So, when you think about geoexchange technology; remember who planted the seed – IGSHPA and its members.

Note: IGSHPA is now in its 24th year. Our training has increased to over 1000 students per year. We recently conducted our first accredited installers course at our new state-of-the-art training facility in Stillwater, Oklahoma. We continue to grow and look forward to another 24 years.
Air Coil Failures?

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Visit www.enertechgeo.com/tradeshows for a listing of upcoming shows or email us at info@enertechgeo.com.
Ted Striplin has been with McElroy Manufacturing, Inc. in Tulsa Oklahoma, for 37 years. In that time he was National Sales Manager for 14 years before assuming responsibilities as Product Manager developing the UltraMc, the ultrasonic fusion joint inspection instrument. Later he took the task of Product Development Director liaising with the engineering group in developing new fusion and geothermal products. In 1999, Striplin assumed the role of International Marketing Manager as McElroy stepped up their international business effort.

Throughout his career, Striplin worked with many of the pipe manufacturers in developing fusion parameters for pipe and fittings to be used with the McElroy fusion equipment. Actively working with ASTM, PPI, and an Associate Staff with the Department of Pipeline Safety a division of PSMA (DOT). His work with the International Standards Organization led to a committee chairmanship, the first in TC138 that was not held by a European. TC138/SC4 WG6 is responsible for writing standards for polyethylene pipe fusion equipment and joining parameters worldwide.

Striplin was first introduced to geothermal systems in 1981, when he and David Dutton, a colleague at McElroy, helped Dr. Bose and OSU staff install the first all PE loops using McElroy designed and manufactured HDPE U-bends. Being big believers in ground source heat pump technology, they jumped at the opportunity to become one of the ten founding Charter Members of IGSHPA. McElroy decided to take on the role of a pipe distributor when the geothermal business level was too low to attract the pipe manufacturers’ attention. After five years or so the market grew to a level that the pipe manufacturers assigned product managers and took over the pipe business allowing McElroy to focus once again on their fusion equipment. Striplin was a member of the Advisory Council for several years and chairman for two years. McElroy’s business internationally and domestically really took off and required them to fall away from IGSHPA activity for a few years but with the encouragement of Striplin and Jim Craig, McElroy Senior Management agreed to become active once again. They kept track of the happenings of the industry those few years and are pleased to see the growth that they knew would be coming. Striplin immediately jumped into activity with the technical committees working on standards to ensure the successful growth of geothermal.
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WORKING TOWARD
NET-ZERO PRODUCTION
HOME BUILDING

BY JANET F. REEDER
Somerset Drilling’s crew was able to install a loop field and contain drilling fluids in the upscale development in spite of the small lot size.

A new research home in Cobblestone Estates outside of Pittsburgh, Pennsylvania, doesn’t look any different from the other homes in the upscale neighborhood now that it is completed. But it is very different.

Unless you were in the neighborhood when the drilling rig came out from nearby Somerset Drilling, you probably wouldn’t know about the energy efficient geothermal measures now buried in the ground beside and underneath the footprint of the home.
A demonstration project lab home, designed to approach net-zero energy usage, the house is replete with features that focus on energy conservation and innovative green building materials and practices.

Pittsburgh-based Integrated Building and Construction Solutions (IBACOS), and its Best Practices Research Alliance have constructed this initial test home in a well-orchestrated plan to promote increased energy efficiency practices in production home building.

“What we are looking for in this project are some of the same solutions that would be viable in a typical low energy house. And how they would work in a production building setting,” says Dave Stecher. Stecher is a building performance specialist with IBACOS. Stecher stresses that the project will closely examine the repeatability of the construction processes used and the costs, as both are integral to production builders. Research will also monitor energy savings from materials and systems, in order to encourage their use by builders and homeowners.

A team leader for the Department of Energy’s Building America program, IBACOS is taking part in the effort to research design, construction and financial methods that can
lead to affordable, net-zero energy homes at the production building level throughout the country.

IBACOS partnered with Cobblestone builder S&A Homes and a number of other suppliers and tradesmen to construct the Energy Efficiency Lab Home, a 2,772 square-foot test home finished in October of 2010. S&A Homes, a founding member of the Alliance, builds all of its “E-Homes” to exceed ENERGY STAR® standards.

S&A Vice President, Chris Schoonmaker, says the Lab Home fits the company’s business model and will help them incorporate additional high-quality, high-performance technologies and best energy practices into the homes they offer.

Schoonmaker, in a greenbuildingelements.com article this spring, said that S&A sees the Lab Home as, “the next step in the evolution towards achieving the ultimate in energy efficient homes.” He said that homeowners who want to help the environment or save on energy bills, also want “affordable, stylish homes in the right location.”

Stecher says the project is aimed at aiding any builder working in a typical suburban development to include energy saving measures at a higher level than is currently practiced.

“The repeatability of the process and, of course, the costs are both important to consider,” Stecher said. He adds that they are discovering that some things they are doing in the Lab Home may not be as easy to transfer to production building.

“A particular detail that may be important to the energy savings of the house may be doable on a small basis, but could be very difficult if you do it on multiple homes,” Stecher said. “Costs also can add up and take away from profit margin for the builder, in that case.” During the Lab Home’s construction, Stecher said it was important to get workers in all areas involved.

“That was a large part of what we did in this project,” he said. “We worked with all of the trades to both educate them and to get their feedback while the house was being constructed.”

Stecher mentioned that the framing for the home was a good example of something that was not typical. He said that working with the framers to let them understand that changes were made to offset or minimize thermal bridging in the walls, helped them to buy in to the different practice.

“One of the things we found out was that framing layouts are done by computer for each house,” Stecher added. “Somebody doesn’t do that by hand. And in this case, the software wasn’t set up to allow for the offsetting of the studs,” he said.

“It is interesting details like that, that point out potential problems in production building. If you were just going to do it on a one-time basis, you wouldn’t necessarily be concerned about it. When you cost a house, all of those details have to be worked out,” Stecher said.

Christopher Sylves with Nittany Geothermal oversaw the installation of the loop systems and consulted for the project. Nittany also subbed the drilling for the vertical loop to Somerset Drilling out of Somerset, Pennsylvania. He says that S&A Homes had not done geothermal applications and they asked Nittany to guide them through the process.

“We knew the vertical system would work,” Sylves says. “We wanted to experiment with the horizontal loops in the footprint.” Sylves says two 150-foot vertical wells were drilled to support a 2-ton Carrier heat pump system for the standard geothermal installation. Charter Plastics 3/4-inch HDPE pipe was used for the vertical loop. A second horizontal loop system is comprised of a series of loops under the slab.
Monitoring the efficiency and cost of this system is an important part of the project’s research.

“It is about two feet below the slab with a sand and crushed stone mixture on top. Actually the loops look like a radiant floor job,” Sylves said.

“One of the challenges in a suburban neighborhood development is cost of the drilled wells—and then if you want to do a horizontal loop area, it is the lot size,” Stecher says. “And you have additional excavation costs if you want to do a horizontal loop.”

Stecher adds that the horizontal loop under the basement slab is separated from the basement slab by 2-inches of extruded insulation, in addition to the 8-inches of crushed limestone.

“We did modeling to see if this was going to freeze the slab or if it was going to work at all. Looking at this, we want to find out if it extracts or rejects heat from the area below the house. And what the impact is of that, and the impact on this of fluctuating ground water moisture content in the ground,” Stecher said. “Also, is this ground loop actually pulling energy from the house through the basement slab?”

“This home is all about testing efficiencies. They are going to shut off the vertical system and fire up the horizontal system and see how it all works,” Sylves said. He describes the Lab Home as an attempt to try to show production homebuilders that geothermal can be achieved, even in planned developments.

Sylves and other project partners want to help dispel known negative misconceptions about the cost and production schedule cycle and other notions they feel are misguided that have kept mainstream builders from including geothermal in their homes.

Loop installation took a day and a half and was done with consideration of the fact that underground caverns exist in the area. Sylves said they had to do some bridging with the grout. The project involved some voids and some water management during drilling. Discharge was pumped through a silt bag, and was not a difficult task.

“It was a great proving ground for us to show that we can do this in these planned residential neighborhoods and discharge water and still control erosion,” Sylves said.

Although the Lab Home will be unoccupied for the three-year study, measures have been taken to simulate occupancy. It will be measured extensively.

The under slab loop will be a particular focus of the study. “The under slab installation was pretty straightforward,” Sylves said. He plans to follow the research results closely.
“There is a large amount of instrumentation in the house,” Stecher said.

“We have heat flux transducers set up to measure how much energy flows through and is transferred,” Stecher says. Great attention has been paid to careful placement of sensors to monitor the slab loop as well as all the other space conditioning features of the home.

“We have heat sensor measures around the footprint of the house and at points in the slab as well as at the underside of the foam insulation and also at the surface of the slab. We will be able to see changes in the temperature as the heat pump turns on and off for operation during the year,” Stecher said.

“From this we are hoping to validate the hypotheses that this is an effective solution for a ground loop placement in housing,” he said. Stecher says that from a cost standpoint, the horizontal footprint loop is about a quarter of the installation cost of the drilled wells. He does mention that the footprint of the house limits the loop size, which needs to correlate to the load of the home. “It helps to justify the additional costs that are necessary to reduce the load,” Stecher said.
Other testing involves the distribution systems for the HVAC, with traditional ductwork and a non-traditional experimental ducting system of a reduced size routed to less space than the standard system. A third system involves distribution of air in only two locations, one on the first floor and one on the second floor. “Because the thermal enclosure is so good,” Stecher asks, “is it really necessary to distribute air to every point in the house? Or can we get away with this diffused distribution strategy that relies on the natural conductive properties in the house for the distribution of the air?”

Validation of any of the research hypotheses will result in viable solutions Stecher says can be applied to the home building industry. He sees the value of research as vital to increasing the energy efficiency of today’s homes. “The house as a whole meets a certain level of energy efficiency, but the individual actions necessary to get this level of energy efficiency could be independently applied,” Stecher said. “The insulation, windows—all of the different practices—you can separate them out and you will end up with different levels of energy consumption in the end.” He feels this will be useful information for both builders and homeowners, especially when it is not practical to select every single practice.

The Lab Home heat pump system also features an optional desuperheater attachment, backed up to two Rheem Marathon electric water heaters. Plumbing utilizes Uponor AquaPEX. An energy recovery ventilator, the UltimateAir RecoupAerator 200DX, by Stirling Technology Inc., circulates fresh air. The project’s garage also has a scalable solar system of 16 roof-mounted 250-watt AC solar panels made by Honeywell.

Key energy focused features include an R-60 attic with 13-inch raised heel trusses and insulation under the slab and in foundation walls. R-40 exterior walls use staggered-stud framing, and are complemented with continuous extruded polystyrene (XPS), and house wrap, spray foam in band joists and in penetrations to the interior and exterior, and blown-in fiberglass and drywall in the interior. LED and CFL lighting is also used throughout the home. Triple-paned low-E windows, multi-layered doors and reflective shingles, coupled with the other energy conscious features, all add up to an expected 70 percent decrease in the heating and cooling needs for the home.

Designing the Lab Home, with modeling, development and permitting, took nearly 17 months. That extensive effort included meetings with trade people to help them both understand and execute the technologies and processes unique to the Lab Home.

With the increasing interest in high-efficiency homes, creating tighter building envelopes will change the HVAC needs and distribution systems they use. The Lab Home’s work exploring several options for space conditioning in a near-zero energy home will yield important and credible information to the industry as these changes continue.

The home will be closely monitored for three years. More information on the study will be available at www.there-searchalliance.org/lab-home.aspx.
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The Olivers designed the home for entertaining gatherings of family and friends, which led to spacious common areas like the kitchen. The separate zoning of the main floor and basement was also part of the designing for guests to create comfortable temperatures on each floor. (Photo provided by Greg Rau, Apple Tree Homes)
After spending four years searching for a floor plan for their custom designed, rustic ranch home, Craig and Anna Oliver had another decision to make regarding their dream home. They had to weigh the options on which energy system could comfortably and affordably heat and cool their 4,700-square-foot home in the harsh Kansas climate where they live. The couple did not know if the typical forced-air gas furnace was going to be the comfortable and efficient system they wanted.
The ranch home was built using various woods including walnut flooring and knotty pine and alder accents to create a rustic appearance for the interior of the home.

(Photograph provided by Greg Rau, Apple Tree Homes)
“Our systems are taxed to the maximum here,” Greg Rau, the general contractor for Apple Tree Homes, said. “We fight highs and lows. Forced-air gas fire gives even temperature, but in the end, it is the cost savings that drives it.”

The home, which is set on a 5-acre rural lot in Lawrence, Kansas, limited the homeowners to the options of propane, natural gas or geothermal energy for space and water heating, Jeff Messick, the design architect for HMA Architects, said. During the designing process, the Olivers approached Rau with the idea of installing a geothermal system.

Oliver had looked at geothermal systems while building a previous home with Apple Tree Homes. David Reynolds, the previous owner and general contractor of Apple Tree Homes, pitched the idea of a geothermal system to him at that time. Oliver decided on a forced-air gas furnace for that home, but he kept the geothermal system in mind for a future dream home.

“The idea was driven by the homeowner, but I always present geothermal systems as an option,” Rau said. “I think it is the best system out there. It makes our houses energy efficient and comfortable.”

Rau, a Certified Green Professional by the National Association of Home Builders, hired Jim Guffey, the owner and president of ECS Geothermal in Smithville, Missouri, for the project. ECS Geothermal has installed over 2,000 geothermal units in the Kansas City area since 1993. The Olivers particularly wanted the home to have an efficient system because the home has more square footage than other homes they had previously owned. ECS Geothermal designed the system, ductwork and sizing of the geothermal loop field to meet the family’s request.

“The difference in new construction is we are using our design to the highest efficiency,” Guffey said.

The Olivers researched the long-term savings associated with geothermal systems, and budgeted for the additional cost for the system during the bidding process for the home. The total installation cost for the geothermal system was $29,000. Since they planned to live in the home long-term, they knew the up-front cost could be recouped with savings in their energy bills.

“The owner was making a long-term commitment to living in this house,” Messick said. “That made the up-front cost easy to justify. The win-win is that the owner saves money while conserving energy.”

The 4,700-square-foot-home has 4,580-square-feet of finished space that is conditioned using a 6-ton WaterFurnace Envision unit. The unit has a two-speed compressor with a variable speed fan to make the unit quiet and comfortable in the home, Guffey said.

The loop, designed and installed by ECS Geothermal, is a horizontal loop system with six trenches at 130 feet long. The system is a closed loop system. All lines are thermally fused and have a warranty of 55 years.

The system, along with space conditioning, is responsible for 70 percent of the domestic hot water supply. The Oliver’s geothermal system pulls water from the water heater and circulates it through the heat exchanger. Warmed water is then returned back to the tank allowing for pre-heated water, Guffey said.

“Geothermal models can provide all of your hot water needs on de-
The home is built on a 5-acre property in the Estates of Northwood, a neighborhood in the rural area of Lawrence, Kan. The property is surrounded by a wooded area and a retention pond in the back of the home.


mand at the same high efficiencies of the forced air models,” Guffey said. The system can save up to 75 percent on water heating bills, according to Guffey.

The rural location required a septic system for the home. This required design coordination to ensure the geothermal field was laid out separately from the septic system.

“The earth loop may drop below freezing in the winter and could damage your septic system,” Guffey said. The geothermal system placement is approximately 100 feet away from the home in the opposite direction of the septic system.

With the use of geothermal, the builder recommended upgrades to insulation to make the building envelope tighter and more efficient. The Olivers, with Rau’s help, chose open-cell-spray-foam insulation for the walls.

The Olivers completed construction on their home in the fall of 2008. They have seen cost benefits from their geothermal system and upgraded insulation over the last two and a half years. The homeowners received a $3,000 tax credit as well.
WaterFurnace Envision units and the hot water system are housed in the mechanical room. The units provide stable and comfortable temperatures to the 4,700-square-foot home.

(Photos provided by Greg Rau, Apple Tree Homes)
as noticeable savings in their electricity bill. The two-year average for the electricity bill is $185 a month, according to the homeowners.

“We always kind of like to conserve and we are green people, but it was more cost driven than anything else,” Oliver said.

The home uses a two-zoned system with the main floor on one thermostat and the walkout basement on another. This allows the home to keep separate temperatures on the two floors, which is important when entertaining guests, Rau said. The Olivers have seen significant differences in the way their previous forced-air gas furnace and their new geothermal system heat and cool.

“The main thing we like about our geothermal system is there are no rushes of hot or cold air,” Oliver said. “It doesn’t make the drapes swing. You never notice it.”

The system is used for both heating and cooling, depending on the season. The family has seen consistent and comfortable temperatures with few hot or cold spots in the home. The Olivers keep the thermostat at 77 degrees during the summer and rarely drop below that temperature in the winter. Oliver said they stay comfortable year round.

The home is built in the Estates of Northwood, a community with 13 other 5-acre lots. Reynolds owns the Estates of Northwood and so far Apple Tree Homes has built five houses in the subdivision, including the Oliver’s home.

Rau is now working on two other homes in the Estates of Northwood that are considering geothermal systems. The Oliver’s home is toured as an example for other clients pursuing geothermal systems.
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A House for Living
By Sara Fevurly

For Ashli Slawter, a residential architect who runs a firm from her home, green building design is a concept essential to her as a professional. Slawter has worked with numerous homes in her hometown of Ft. Thomas, Kentucky, using green design. As she and husband, John, prepared to build their family home, a green home with a geothermal system was the obvious choice.

(Photo provided by Ashli Slawter)
As a professional, my home should be a green home,” Slawter said. “I should be making all the right decisions and doing the right things that maybe other people aren’t doing. It is like a doctor doing surgery and not using the most up-to-date procedure.”

Slawter primarily works with additions and renovations in Ft. Thomas, where the homes are older, she said. Her focus is on making these homes more efficient. In the new construction work she has done, she has put in a geothermal system in every home, she said.

“Over the last five years, there has been a dynamic shift in what people are looking for,” Slawter said. “People are demanding energy efficiency and people are demanding better products.”

Slawter took herself through the same design process she takes her clients through while working on her home. When working with clients, she focuses on what design will work for their lifestyle and how to incorporate those ideas into their home. Her home’s design was planned for her family of four’s lifestyle. She spent extra time designing for her home to be as energy efficient as possible while keeping a flexible design for her family as her two children grow, she said.

“I focused on durability, sustainability and on making a green home for us to live in,” Slawter said. She designed the home with just the amount of space needed for her family to live in with no extraneous rooms, she said.

While designing her home, Slawter worked with Donnie Hutton of Del Monde Heating and Cooling in Independence, Kentucky, on the geothermal system. Hutton was included early in the process to help for LEED® certification, Slawter said. Hutton’s role in the LEED® certification was to complete an HVAC system and loop field while ensuring it was installed to specifications and providing all support documentation.

“Our method is to design as cost effectively of a LEED® home as possible,” Hutton said. “There are so many contractors out there that hear LEED® and throw every accessory
available at it to make sure it complies. If designed correctly, this isn’t necessary, as shown in Mrs. Slawter’s home.”

The loop, designed by Del Monde, and installed by NRG Solutions is a vertical loop with five boreholes. The boreholes are each 150 feet deep. A mixture of R-410a and methanol is used through a 3/4-inch U-bend pipe. The pipe length runs 750 feet.

A 4-ton ClimateMaster TTV049 system conditions the 3,400-square-foot home. The system uses a desuperheater to hook in the domestic hot water supply. The family saves on both energy and water heating bills.

The Slawters paid $26,204 for the geothermal system and received the 30 percent government tax incentive. Along with the savings from the tax credit, the Slaughters also should have an estimated 46 percent energy saving, Hutton said.

“For us, we were willing to give up other things to get the geothermal system,” Slawter said. “With the government rebate, it makes the geothermal system all the better.”
The homeowners requested one zone per floor with a basement, main floor and top floor. In their previous home, the Slawters had a gas furnace and one thermostat that left the basement cold and the top floor warm. The family has seen a more consistent heating and cooling of all three floors of the home with their zoned geothermal system, Slawter said. Designing the zones was challenging, Hutton says.

“It is a fairly modern and open floor plan, which caused some creativity in design as well as accommodating all of the ductwork necessary for zoning each floor independently,” Hutton said.

The house is currently in the process of seeking LEED® certification with a gold rating, Slawter said. The final inspection has been completed and the home is now waiting to go in front of the U.S. Green Building Council (USGBC) for final certification. If approved for final certification, this will be the first residential home in Ft. Thomas and Campbell County to become LEED® certified, according to the Northern Kentucky Home Builders Association website.

The green building process for certification began early in the design process with most of the paperwork completed before construction. The homeowners had to work with the various contractors, including Hutton, during the design process to determine where and how to gain points for LEED® certification, Slawter said. The home must receive 75 to 89 LEED® for Home points for gold certification, according to USGBC website.

The home includes numerous other energy efficient and sustainable features that help gain points for LEED® certification. The home has an air infiltration package with a highly insulated shell. The package is part of a process of sealing every part of the home that could be leaking air. The home is insulated below the slab and around the foundation.

High-efficiency plumbing fixtures, solar panels, a cool roof and compact fluorescent lights are energy and ecological features in the home. The home also uses Apex fiberglass siding, a durable and sustainable siding.

Slawter, who is from Montana, drew inspiration from her home state. She designed the home to be warm and woody while still maintaining a contemporary style, she said. The couple also enjoys sailing and decided to incorporate sailing-
inspired elements such as cable rail in the home. Slawter aimed for the home to have a Pacific modern feel while still maintaining a comfortable atmosphere, she said.

“It is a house for living and not just to be looked at,” Slawter said. “It is comfortable for our family.”

Construction on the home began in September 2010 and was completed in May 2011, Hutton said. Shortly after completion, the Northern Kentucky Home Builders Association and The Greater Cincinnati Home Builders Association showcased the home in the 2011 Cavalcade of Homes during the first three weekends of May 2011. The Cavalcade of Homes is a tour of new homes in the northern Kentucky and Cincinnati area.
ARCHITECT NO STRANGER TO GEO

BY LINDA ALLEN

What began as a company project to learn about the LEED® process has become a personal mission for Dr. Charles Pickering, president and CEO of Pickering Associates, Inc. an architecture and engineering firm in Parkersburg, West Virginia.
A five-ton dual capacity Water Furnace GHP, 80-gallon Marathon water heater and dehumidifier service the 3000 square foot home. (Photo courtesy of Pickering Associates, Inc.)
“I was interested in obtaining my certification and several others in the organization were also interested in learning more about the process. It was also an opportunity to practice new Building Information Management (BIM) software called REVIT for 3D modeling,” Pickering said.

During the design and construction phases of the Faith Meadows project, Pickering decided to become the owner/occupant of what should be West Virginia’s first LEED® platinum certified house.

“It’s difficult to say I believe in green technology if I don’t live it,” he said. Completion date is scheduled for August 2011 when he anticipates receiving official LEED® certification and getting to live with the technology he advocates and sells.

Pickering is no stranger to green design and living. His current home is a renovated 1860s barn, which boasts many green features including a retrofit geothermal system. “We were green before green became cool,” he said of his lifestyle and business. Pickering Associates, Inc. has utilized structural insulated panels (SIP) and geothermal systems for ten years. Pickering is a LEED® Advanced Practitioner for Building Design & Construction (AP BD+C) certified, a credential created by the Green Building Certification Institute to denote practical knowledge of the Green Building Design + Construction LEED® rating systems.

Pickering chose geothermal technology to heat and cool the Faith Meadows residence because it offered the maximum efficiency of any system available, and he was familiar with its comfort and operation. He chose a geothermal dream team of Yoder Geothermal of Sugar Creek, Ohio, for the loop installation and Steers Heating and Cooling of Parkersburg, West Virginia, as the HVAC contractor. Their combined 123 years in business – Yoder since 1937 and Steers since 1962 – in addition to Yoder’s 7000 plus loop installations and Steers’ 300 plus systems, attest to their quality and reputation.

Yoder Geothermal President, Tim Yoder, describes his company as solely a loop contractor. They work with over 1,100 HVAC contractors and install between 325 and 425 systems annually, mostly residential. Yoder Geothermal drilled the five 165-foot deep wells required for the closed loop system. Limited space required a vertical loop for the 10 x 20 foot geo field.

“We can deal with a small footprint as long as we can get our rig in the space,” said Yoder. “We used 3/4-inch heavy
duty polyethylene pipe down the hole and 1-1/4-inch pipe for the supply and return through the loop. Once the grout was in place, we turned the project to Steers,” he said.

Steers Heating and Cooling and Yoder Geothermal have partnered on many residential projects for over ten years. Both contractors described the Faith Meadows project as a straightforward installation with minimum challenges.

Bruce Bolden, Steers Heating and Cooling vice-president, said the company’s work is equally split among residential, commercial and industrial projects. Most of their geothermal work is new construction, but they also upgrade older systems with new technology as it becomes available.

Steers Heating and Cooling is a dealer for WaterFurnace, the ground source heat pump (GSHP) unit chosen for Faith Meadows. One 5-ton, dual capacity GSHP services the 3,000 square foot house, which has three zones – bedrooms, living room and a 600-square-foot music studio for Pickering’s wife, who teaches violin. The zones are partitioned and set on a timer to control heating and cooling comfort based on occupancy. Bolden gives a strong endorsement for zoning the loads of the house to get the right size and right fit for the heat pump.

The system uses Environol as the circulating fluid, which WaterFurnace recommends because it is environmentally friendly and contains no petroleum products.
The GSHP system includes a Marathon hot water system that will allow the heat pump to produce all the hot water required by the house. An 80-gallon storage tank will collect and hold the water.

A 200 cfm Alpine AprilAire Energy Recovery unit is part of the system to offset VOC gases and remove stale air, which is required for LEED® certification. It also helps maintain a constant humidity level through all seasons for high comfort levels.

Total cost of the system was $36,000, which included the wells, zones, economizer, duct insulation and pipes to the hot water heater. Federal and state tax incentives were the only cost offsets available.

With a Home Energy Rating System (HERS) of .61 and coefficient of performance (COP) of 30 for the GSHP unit, estimates project the Faith Meadows house will use approximately 61 percent of the energy of a new house of the same size using a traditional heating and cooling system. Normal rating in the West Virginia region to get the energy star rating is 14.

Recycled, reclaimed and locally produced materials were used as much as possible in the construction. All wood was Forestry Stewardship Council certified. Additional green features of the house include SIPs and insulation made from recycled post-consumer paper to create a tight envelope. Low-VOC paint, dual-flush toilets, low-flow showerheads and faucets, ceramic tiles made from recycled materials, bamboo flooring and natural fiber carpeting continue the menu of green features.

Roof-mounted solar panels and site orientation take advantage of solar energy and natural lighting for the house. The REVIT software was used to model the solar loading and shading of the house at various times of the year. The roof is a special fiber slate made from recycled cuttings that are a byproduct during the factory production of diapers. Although more expensive than other roofing materials upfront, they have a 50-year guarantee.

A green roof tops the area over the music studio, creating a natural habitat for birds and an artistic aesthetic for the home. The collection of green features is anticipated
Recycled fiber slate, solar panels and shading help maximize LEED points for platinum certification.

(Photo courtesy of Pickering Associates, Inc.)
to recover 70 percent of construction costs during the life of the house.

Pickering has taken a leadership role in promoting and educating the public in his region about sustainability and renewable energy.

“LEED® and geo are nicely paired. Geo is an incredible heat exchange medium all year long. Start with the insulation value and high efficiency of the heating and cooling system to create a tight envelope for an energy efficient building. That can provide a block of points for LEED®. Increasing the energy efficiency of the building drives the point system. LEED® platinum requires 90.5 points to qualify. Currently we’re at 106,” he said about his platinum plus achievement. (Energy and atmosphere make up 35 percent of LEED® point distribution.)

Pickering’s interest in green construction goes beyond achieving LEED® certification. His lifestyle, business and design decisions are based on the bigger picture of sustainability and the responsibility of leaving the earth in good condition for future generations.

In his presentations, Pickering often cites the wisdom of Native American elders: “Treat the earth well. We do not inherit it from our ancestors; we borrow it from our children. Every decision we make relates to the welfare and well-being of the seventh generation to come.” That’s a platinum plus construction philosophy.
IGSHPA Partners with Hope Crossing for Research

By Janet F. Reeder

Central Oklahoma Habitat for Humanity’s Hope Crossing development continues to provide a vital location for both showcasing and testing ground source heat pump technologies and products. It is in fact, an ongoing research area and living example of residential geothermal use and practices.

This spring, a collaborative research effort is underway in the Oklahoma City area development already known for being Habitat for Humanity’s largest housing community in the United States, as well as the largest housing development in the country using geothermal in all homes. The 59-acre five-phase development project will eventually include 240 brick, three-bedroom, two-bath, 1,250 square-foot energy efficient homes.

IGSHPA is partnering with a number of collaborators in the research geared toward examining recent advances in borehole heat exchanger designs and drilling methods. Objectives include identification of designs that will reduce the required depth of boreholes and study thermal performance.

Beginning in April 2011, work began for the new ground heat exchangers and related instrumentation for the eight new installations in the study. Types and overall specifications for each heat exchanger dictated the borehole depth, diameter and grout to be used in each installation.

The research will compare the newly installed heat exchangers to a single U-tube heat exchanger with standard bentonite grout, as in current use throughout the development’s existing homes. Hope Crossing’s homes currently are supplied with a 2-ton ClimateMaster Tranquility heat pump unit typically using a 400-foot borehole and the single U-tube heat exchanger.

Testing and data collection will be performed at each installation and will include logging of vertical boreholes, grout sampling, in-situ thermal conductivity tests and on-going data logging to monitor the ground loop and heat pump systems for a two-year study period.
Ground Heat Exchanger Installations Studied

The eight new installations use a variety of heat exchanger design, borehole depths, drilling techniques and grouting practices and material. Borehole heat exchanger types include single U-tube, double U-tube, and coaxial pipes. Drilling methods are conventional methods or sonic methods.

IGSHPA’s partners in the study and their contribution focus include: Oklahoma Gas and Electric (OG&E), overall project coordination; Oak Ridge National Lab (ORNL), design input; Baroid-Halliburton, evaluation of drilling fluids and thermally enhanced grout; The Charles Machine Works Inc./Ditch Witch, drilling equipment technology; ClimateMaster, heat pump equipment; Geothex B.V., co-axial pipe; Central Oklahoma Habitat for Humanity, Hope Crossing homes site location; ComfortWorks, installation; Geo-Enterprises, Inc., heat exchanger and double U-pipe; Amasond, co-axial pipe; and Ewbank and Associates, engineering and oversight.

Data Analysis

Collaborators at IGSHPA and ORNL will analyze the data from the project. The two groups will coordinate work assignments and share interpretations and results.

Data collected during the installation of the ground heat exchangers includes well logs, grout samples and in-situ thermal conductivity tests. Together these data allow an evaluation and interpretation of the short-term performance of each installation during the in-situ test. Each in-situ test provides an estimate of soil thermal conductivity, as well as the borehole thermal resistance for each installation. Both of these parameters directly affect the performance of the heat exchanger. The well log data will also provide information about the effects of the two different drilling methods on the borehole and surrounding soil and rock.

ClimateMaster and OG&E have provided key partnerships with IGSHPA’s research efforts at Oklahoma City’s Hope Crossing development. Garen Ewbank visits with OG&E’s Vice President of Strategy and Marketing, S. Craig Johnston, at the job site.

(All photos Janet F. Reeder, IGSHPA)
Data collection during the two-year monitoring period allows evaluation of the heat exchanger performance during heating and cooling seasons. Because the heat pump in each home is identical, the project will focus on the ground heat exchangers and a comparison of the performance of the different ground loop designs.

Editor’s Note:
Geo Outlook has published an earlier article about the Central Oklahoma Habitat for Humanity Hope Crossing development titled, “ClimateMaster Generosity Provides GHPs to Habitat,” in our 2009 Volume 6, Number 1 issue.
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Sometimes, good friends can snap you back to reality. In a previous article I showed my frustrations about those that still consider Geothermal Heat Pumps (GSHP) a “new” or “emerging” technology. After the article went out, I was talking with Jeanne Knobbe at IGSHPA and mentioned again how that frustrated me and she said “Phil, think of it in the context of FIRE”….. OUCH!!

So, “once upon a time”, Jim Bose, Jim Partin, and Carl Ledbetter started playing in the dirt, and as the old saying goes, “The rest is history.” Geothermal heat pump systems were initially researched on the Oklahoma State campus in the mid-to-late ’70s, with the first marketed systems sold for residential applications in ’77. Earl Maroney is the real hero – he bought the first closed-loop earth-coupled heat pump system sold. Jim Partin’s new house was next – but – because of construction schedules, was the first system actually put into service. Jim’s system was the good news and the bad news.

The good news – the system started, performed well, and our industry had taken the first step on the way to what it is today. The bad news – they used the same materials used for developmental testing to construct the ground loops – 4” PVC. The results of using PVC on this and other initial applications is why our industry bans PVC for ground heat exchanger applications today, and why those of us that experienced those early system’s issues love HDPE’s strength, toughness, and heat fusion joining.

The original systems were Carrier 3-piece Air Source Heat Pump product conversions (Carl Ledbetter did the installations and at the time was a Carrier dealer in Stillwater, Oklahoma). One Carrier product available at that time had the indoor air handler, an indoor compressor section, and a separate outdoor condenser/evaporator. They replaced the outdoor condenser/evaporator with an indoor concentric water-to-refrigerant heat exchanger and converted the air source heat pump into a water source heat pump.

So, with all the product advancements and achievements of the industry over the last 30+ years, why am I talking about “ancient history?” Well, in this “green”, renewable, and sustainable age when some still consider GSHPs new technology, Carl Ledbetter recently forwarded me an e-mail from Jim Partin about the status of old #1 that readers might find interesting.

For reference, Jim’s system was a little less than 3 ton capacity serving his state-of-the-art (for ’77-’78) 2600+ square foot rural home northwest of Stillwater, Oklahoma. Not considering the loop change out performed shortly after being placed in service, here’s a little renewable, sustainable performance information that speaks for itself:

“Our GeoSystem is getting a little older each day, but is still working just fine. It was started-up in March 1978 and has 49,500 runtime hours on it. It has a tiny leak in one of the welds, but I add a little refrigerant from time to time. I have replaced the main relay twice and one of the pumps over the years. No other repairs were done.” Not bad…… Not bad at all!

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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