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Small Fayetteville Home Perfect for Geothermal
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2.0 and Beyond

The second quarter of 2014 saw the implementation of standard training materials for our Certified GeoExchange Designer course. The second quarter of 2014 also saw the groundwork completed for the strategic implementation of what we have termed “IGSHPA 2.0.” The fourth quarter edition of Geo Outlook will contain a full article detailing the basis of the association redesign, process for strategic planning, progress to date and future strategic plan.

The IGSHPA staff continues to be focused on improving our member services while staying close to IGSHPA 2.0 developments. The Baltimore conference in October commands its fair share of effort and resources as we approach that critical event. Please help us make the conference a great success. I am available to speak with anyone who has an interest in the conference but has yet to make a decision to attend. Conference information can be found at www.igshpaconference.com.

This issue of Geo Outlook details the great benefits that can be realized through the proper and effective designs and installs of ground sourced heat pump technology. Whether it is apartment buildings and villages using 340+ tons or small houses using 2 tons to achieve efficiency, reliability and comfort; the customer expects the design to be right and the install to follow the design. The articles speak of how magic happens when a system is properly designed and implemented. Under-design a system and it fails on comfort and reliability. Over-design a system and it fails on economics. Install it wrong and nothing works. IGSHPA 2.0 is dedicated to providing the training, member services and advocacy resulting in brand recognition giving great confidence to manufacturers, designers, dealers-installers and to end users. We plan to take GSHP technology from a niche market to the mainstream in the long term. It will take all of the geothermal industry working together to make this happen.
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INDUSTRY LEADERS

Brian Castelli

Brian T. Castelli has pursued his commitment to energy conservation at every stage of his career. He has expertise in energy efficiency, renewables, emission deductions and electricity demand reduction.

In early August 2014, Castelli was named Chief Executive Officer of the Home Performance Coalition. HPC was created in 2013 through the merger of Affordable Comfort, Inc., and the National Home Performance Council to unite the many voices of the home performance and weatherization industry. Castelli brings three decades of diverse and collaborative leadership experience with contractors, utilities, service providers and government agencies to this position.

The Home Performance Coalition creates energy-efficient, healthy, sustainable homes through education, training, advocacy and outreach.

Affordable Comfort, Inc., is a division of the Home Performance Coalition that serves as an unbiased go-to resource for home performance and weatherization, bringing together industry leaders for the purpose of education, professional networking and business-to-business collaborations.

The National Home Performance Council is a division of the Home Performance Coalition that works with federal governmental agencies, utilities, state programs, contractors and others to strengthen and advance the whole-home energy efficiency upgrade industry through standards development, stakeholder engagement, policy analysis and research.

A former Alliance to Save Energy Senior Fellow, Castelli has both national and international experience in the energy field. He served in a number of positions in leadership with ASE, including the Chief Operating Officer and Executive Vice President for Programs and Development. Prior to 2005 when he joined the leadership of ASE, Castelli ran his own energy-consulting firm.

He has also served as the Washington Liaison for the California Energy Commission, where among other tasks he prepared energy efficiency policy recommendations and position papers for the Governor of California. Castelli also was a consultant to the National Association of State Energy Officials.

As a presidential appointee in the Clinton Administration, Castelli served as chief of staff to the U.S. Department of Energy’s assistant secretary for energy efficiency and renewable energy from 1994-2001. He managed 550 staff members, more than $1 billion in programs and research, and directed the development and implementation of energy policies, regulations, codes and standards and programs.

Castelli also oversaw the work of the Deputy Assistant Secretaries for the Offices of Industrial Technologies, Building Technologies, Transportation Technologies, and Renewables. He worked closely with DOE senior leadership on international energy issues and participated and led numerous delegations to other countries around the globe, including a deep involvement in developing energy-efficiency measures for the eventual closure of the nuclear reactors in Chernobyl, Ukraine.

Castelli has worked on clean energy and climate change policies, regulatory issues and deployment programs in 30...
countries, and has most recently been engaged in work throughout Asia and the Middle East.

Prior to DOE, Pennsylvania Governor Bob Casey appointed Castelli to the Pennsylvania Energy Office in 1988. As executive director he ran the state’s energy policies and programs, managed the state energy office and the Pennsylvania Energy Development Authority and took the lead on responding to energy emergencies. Notably, Castelli developed a revolving loan fund for energy-efficiency measures, a Green Buildings program for cutting energy use and costs in all commonwealth-owned or operated buildings, and drafted legislation for and implemented an alternative fuel vehicle program.

Castelli is the author of numerous articles, studies and reports on energy related issues. He has participated in myriad state, national and international forums and conferences offering comments on the role of energy as it pertains to climate change, the environment, economic development, minority business opportunities and national security. He currently serves on the boards of a number of energy related companies and advisory councils.

Castelli holds two degrees from the University of Pennsylvania, a Bachelor of Science in chemical engineering and an MBA in industrial/environmental management from the university’s Wharton School.

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With mountains in the background, the newest apartment complex in Brighton, Colorado is setting the bar for energy efficiency and occupant satisfaction.

(Photo courtesy of SLN Advertising for Bosch)
Solaire Puts GSHPs in Affordable Housing

By Janet F. Reeder
Just being in a scenic area near Denver makes the Solaire Apartments in Brighton, Colorado, special. Other features that make it a standout project are not as visible as the mountains and outdoor panoramic views offered to new tenants.

As Brighton’s first multi-residential complex built in at least a decade, the Solaire apartments started with a high level of interest. That interest spread as the 11 apartment buildings and clubhouse using a total of 342-tons of Bosch GSHP units began shaping up last fall. Before construction was completed, all apartments were spoken for, largely because of Solaire’s campaign about how economical the geothermal exchange system would make utility bills for renters.

Solaire is promoted as a new eco-friendly community, and sustainable living is emphasized at the development. President and CEO for The Commonwealth Group, Brock Vinton says, “Solaire Apartments has one of the region’s largest geothermal energy systems that will not only help reduce energy expenses for our residents but it will lower the building’s overall carbon footprint.”

Brock believes the sustainable feature will also help keep units filled.

In addition to geothermal heating and cooling, Solaire is designed with sustainable features such as water efficient fixtures, high performance windows, energy efficient insulation and Energy Star appliances.

Trey Austin, of Geo Energy Services, says the project is the largest geothermal multi-family housing project in Colorado. Austin was brought into the project to confirm geothermal redesign work done by the GSHP installer, Conald Frank. As a HUD project, Solaire also had extra layers of review. Frank says that Austin is highly respected in the industry and his stamp on the project verified the redesign.

“It was a long process from design to construction in part because HUD was involved and the City of Brighton was trying to push the envelope with

**Can-America Drilling’s Wayne Arde and his crew drilled the boreholes for the heat exchange area of the project.**

*(Photo courtesy of Geo Energy Services)*
energy efficiency and still essentially do apartments for affordable housing,” Austin says.

Frank, owner of SMC Geothermal, was involved in a redesign of the geoexchange for the project to increase not only energy efficiency, but also to decrease the initial costs for the GSHP installation. “I did the initial design. But I am not an engineer,” Frank said.

“That is why we brought in Geo Energy Service’s Trey Austin.” Frank says that Austin confirmed the design with a recommendation to update the bare-bones loop specs Frank was mandated to use by 10 percent.

“That would make me look like a super hero,” Frank said, “because I would have better efficiency.”

Frank is currently monitoring loop temperatures and says they have been impressive.

“The original design for the project had a big central pumping loop,” Frank says. “All the buildings were interconnected and it would send water down the line all over the whole project, all the time.”

The view alone makes Solaire apartments a popular choice. Units were taken as quickly as they were available for lease. (Photo courtesy of SLN Advertising for Bosch)

North American Regional President of TTNA-Bosch Themotechnology, Richard Soper, was on site for the grand opening of the Solaire apartment project. (Photo courtesy of SLN Advertising for Bosch)
The changes Frank made in design decreased the cost of pumping.

“The pumping costs that they had for the original design was going to be more in one month than we will have in a whole year by a long shot,” Frank adds. The new design has also radically increased efficiency, he says. The project does not have a backup system. “We don’t have any strip heat. We don’t have any boilers. We don’t have any chillers,” Frank says. “We only have a geothermal system installed in this project,” he said. “It kept the costs way down because we didn’t have all those other parts that were added on. We are covering our loads very well, because we designed our system very, very closely to what the loads were.” Frank says, “If you design properly, you don’t have a bunch of oversized equipment, and you have much better efficiency.”

Austin, who says he came into the project late, mentions that the HUD review was expeditious when it finally began, and that nothing came back on the project. “Design conditions were whether to integrate all the buildings into a central loop field or separate out for individual buildings,” he said. “We determined it was more economically feasible to separate out the loop field by building.” Another hitch that impacted the workflow involved how much of the project to do from the start.

“They weren’t sure if they were going to construct all the buildings, or build a few first and see how the sales went. As it turned out, there was such high demand for these building, it just flowed through continuously on the construction,” Austin said.

Collaboration was unique on the project, Austin says, because the developer, architect and engineering team brought the geothermal contractors in to the project right away. Austin says it allowed a clearer understanding that particularly aided a consistency to the mechanical rooms. Each apartment unit uses a separate Bosch BP Series water-to-air heat pump. One-bedroom units have 1-ton BP012’s, while two- and three-bedroom units utilize a 1 1/2-ton BP018.

Bosch Thermotechnology Corporation Business Development Manager Mark Stimson commends the pumping design approach taken by Frank. “He came in with a different approach and they liked what he had to offer. And...
A look at one section of the mechanical room for each building shows one of the Spirotherm units Conrad Frank used to coordinate pumping systems to create the project’s above average efficiency.

(Photo courtesy of Conrad Frank of SMC Geothermal)
he executed it,” Stimson said. Bosch distributor Brian Fowler of GeoSource Geothermal Systems supplied the units.

Can-America Drilling’s Wayne Arde did the heat exchange work for the project. Arde’s crew drilled 112 boreholes from 330-390 feet deep for Solaire. The loop field used 1-1/4 inch pipe, down 5-1/4 inch boreholes, grouted and stubbed-up for the tie-ins.

Frank remembers the driller used three different rigs throughout the project, and often had to move a rig in or out to other projects. He was working a military project in Colorado Springs at the same time. Frank said the winter drilling was brutal and thawing out rigs was routine. Each building has two sets of five wells for the 20 to 24 apartments per building.

Architect for the Solaire project was Godden Sudik. Hinton Construction was general contractor and Given and Associates was mechanical contractor.

SMC Geothermal generally does residential work in areas like Steamboat and Breckenridge, and installs geothermal in homes from 1,200 to 16,000 square foot and larger. The Solaire project was about a 2-1/2 year commitment for SMC. Frank spent a lot of time doing the socket pipe fusion inside the apartments, and was glad to enlist his son Christian to assist any time he was out of school. The sheer amount of overhead work was grueling, Frank says.

Toward the end of the project when Frank was setting equipment in the small mechanical rooms for the buildings, a friend of Arde’s told him about a radio-frequency fusion method he had seen at an IGSHPA conference the year before. He shared the information with Frank.

Frank found the Triton system worked well in the tight space of the mechanical areas. “It was an incredibly good use in the pump rooms,” Frank said. “It just made that room so much easier to do.”

Another component that aided in Frank’s installation is a Spirotherm separator. He explains what happens in the mechanical room using the Spirotherm unit.

“On one side of the hydro-separator is the house loop. It flows out through the house and comes back to the hydro-separator,” he says. “If there is a temperature difference between one side of that loop and the other side, then it flows out to the ground loop. Then it exchanges the heat into the ground or picks up the heat from the ground. Otherwise, it is just circulating inside the building and we don’t even circulate out to the ground loop.”

This pumping scheme is one key to the efficiency of the system. Wilo variable speed pumps were used for the building circulators with differential temperature controls for turning the ground loop on and off.

“When heating and cooling is going on together, we just transfer heat from one side of the building to the other,” Frank says. “And it just costs 100-watts of power.” Frank said the same scenario is used in geothermal for schools.

“When you hang around this stuff for thirty-something years, you start
Conrad Frank of SMC Geothermal, and his son Christian, work side-by-side on the project. Frank was introduced to the Triton fusing system late in the project and said it was perfect for the tight space of the mechanical areas.

(Photo by Brian Perkins for Triton)
Frank says. A general contractor who moved to Colorado from North Dakota 30-years ago, Frank has focused on geothermal for the last eight years. Frank has used mostly Bosch equipment for years, he said. The choice was perfect for this project for several reasons.

“They make them very specifically for apartment units,” Frank said, regarding the BP012 and BP 018 Bosch heat pumps used in the Solaire project.

“They are right-sized and energy efficient.” Name recognition from Bosch is huge, Frank says.

“Everybody connects the Bosch name with everything from dishwashers and appliances to car parts. They all know that Bosch equipment is superior,” Frank says. “Even if they’ve never heard of geothermal, they have heard of Bosch.”

Frank calls the Bosch heat pump units he used in the Solaire project “right-sized and energy efficient.” He says the name recognition of Bosch is huge.

(Photo by Brian Perkins for Triton)
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Small Fayetteville Home
Perfect for Geothermal

By Paige Worley

A.J. and Myria Allen worked with local architects, Albert and Lisa Skiles to create their energy efficient dream home in Fayetteville, Arkansas.

(Photo courtesy of Skiles Architect, PA)
Myria Allen, a professor at the University of Arkansas in Fayetteville, wanted her passion and concern for the environment reflected in the recent design of her dream home.

Allen, who grew up in the Appalachian Mountains, often hikes, kayaks and enjoys a love for the outdoors. She has developed a strong sense of responsibility to protect the environment, she said. Her husband, A.J., who retired from the Parks Department with the City of Fayetteville, shares her commitment.

“When it came time to build a house I thought our house should reflect our values,” she said. “Our values are to live as lightly on the earth as we can.” As Graduate Coordinator of the Department of Communication, Allen felt the new home needed to be an expression of the couple’s shared commitment to sustainability.

“But I also wanted to live in a beautiful home,” she said. “Working with our architect, we were able to create a home that was beautiful, functional and as environmentally friendly as we could achieve.” Though small, the home is spacious with a wing-like roof, cathedral ceilings and clerestory windows that all support the energy conservation nature of the home’s intentional design.

The home is definitely an example of energy efficiency and has been toured by Allen’s students and others in the area who are interested in sustainable building. The Allens have opened their home for fund-raising tours for community schools and churches. They believe the opportunity to view the home lets others consider alternative energy efficient building features. The home is close to the University of Arkansas campus.

Myria and A.J. worked with Albert and Lisa Skiles of Skiles Architect, PA in Fayetteville to design the home in 2010. Because energy efficiency was a high priority, there were many different elements to consider incorporating into the design.

The design features the Allens selected included passive solar heating, SIP roof panels, radiant heat concrete floors, a screen porch to shield solar heat gain from the west and the workshop across a breezeway that shields the main house from north winds. The home also features Energy Star® appliances, water-wise water fixtures and Ultrex Low-E II windows.
Low impact site strategies, including minimal concrete surfaces at the drive and parking areas, were incorporated to allow for site water infiltration. They also included native plants for the landscaping. The front garden captures and filters rainwater and reduces runoff into the neighboring tributaries. The shed roof allows for ease of rainwater collection.

Low VOC paint with minimal coverage, as well as recyclable and durable cladding was used throughout the home.

When looking at HVAC systems, geothermal was “a wise investment,” Myria Allen said.

“When we built the house, the government was giving a 30-percent tax rebate on geothermal in residential installations,” she said. “That really made it an option for us.”

The Energy Improvement and Extension Act of 2008 allows a one-time tax credit of 30-percent of the total investment for residents who install geothermal systems.

Bringing everything together meant thinking outside the box for Josh Liljenberg, with 1st Choice Home Comfort in Rogers, Arkansas.

(Photo courtesy of Skiles Architect, PA)
residential ground loop or ground water geothermal heat pumps through the end of 2016.

Skiles Architects worked with the Allens to incorporate as many environmentally responsible features as possible. The linear design, along with the proper orientation, is optimal for passive solar design. There’s an opportunity for cross ventilation with awning windows low and high. There’s also a thermal mass of the concrete floor with no additional flooring on the slab, Architect Lisa Skiles said.

“All of the decisions were reinforced by the team’s green building intentions,” Lisa Skiles said.

The architects had 1,360 square feet to work with, which was a challenge, Skiles said. The original plans had the geothermal unit in a closet inside the home, but space limitations changed that plan.

“Given that the Allens wanted a workshop near the home, we decided to put the mechanical equipment for the geothermal system within the workshop and not in the conditioned home,” Skiles said.

“We had to think outside of the box, literally,” Josh Liljenberg, with 1st Choice Home Comfort, of Rogers, Arkansas, said. “We relocated the mechanical closet to the free standing workshop 10 feet away.” Everything but the heat pump unit is in the workshop area.

Relocating the flow center and the radiant panel was a challenge for Liljenberg, who designed and installed the geothermal and radiant floor systems. To make it work he ran conduit, piping and wiring between the house and the workshop.

Summer’s Well Drilling Inc., of Gentry, Arkansas, drilled two boreholes, The home’s passive solar design and SIP panels added to the energy efficiency of the custom home. (Photo courtesy of Skiles Architect, PA)

Designing for natural lighting by using large expanses of glass and clerestory windows makes the kitchen area bright and inviting. (Photo courtesy of Skiles Architect, PA)
about 20 feet apart and 200 feet deep in the back yard. Then, a Rheem labeled ClimateMaster 2-ton Tranquility 27 (TT) series two-stage horizontal vertical and downflow EarthPure® model with hot water, was installed by Liljenberg. The project exemplifies the benefits of geothermal in a residential area, Liljenberg said.

“The concept is behind geothermal,” Myria Allen says. “I especially enjoy it in the summer. It is quiet and cool.”

Allen said, with the tax credit, the geothermal HVAC system and radiant flooring cost them $19,993. Myria and A.J. Allen found a way to fit geothermal into their energy-efficient dream home. They are pleased to be living in a home that is consistent with their personal commitment to the environment.

The Allen home was completed in 2011, and has earned EnergyStar 5+ Certification and has a HERS rating of 60. It was also featured in the online edition of Dwell Magazine in September 2011.

(Left) A 2-ton Rheem labeled ClimateMaster Tranquility unit handles the 1,340 square foot home. (Right) Everything but the heat pump unit itself is in the adjoining workshop.

(Photos courtesy of Myria Allen)
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Flagstone from the original site was carefully worked by a mason and reused to create the spacious and functional patio and retaining wall for the rear of the Castelli home.

(Photo courtesy of Brian Castelli)
New CEO for Home Performance
Coalition Advocates Geo
By Janet F. Reeder
Brian Castelli has spent most of his career helping governments and even countries make important decisions about energy. So when he began planning a new home, he looked at anything that would make it a showcase for energy efficiency.

As the newly selected President and CEO of the Home Performance Coalition, a 2013 merger of Affordable Comfort, Inc., and the National Home Performance Council, Castelli will narrow his focus again to residential energy efficiency.

Castelli and his wife, Stephanie, reside in Falls Church, Virginia, where they bought a home in 1976. The house was built in 1954, a time when most builders and homeowners were unconcerned with energy costs or efficiency.

“We love the neighborhood. We love our neighbors. We are inside the beltway here,” Castelli says. The Castelli’s made every possible energy improvement to the older home, including added insulation and energy efficient windows. Castelli says even though they had the lowest energy costs of all their neighbors, they still wanted to have a more efficient home. They had also outgrown the smaller house. The Castelli’s ended up demolishing the older home and rebuilding on the same lot.

The street side view of the home’s front shows the Castelli’s spacious new residence built on the same lot of the former home. Orientation of the new home was changed to allow for passive solar design.

Castelli’s library, daylit for practicality, offers a real warmth from the choice of hardwoods.

(Photo courtesy of Brian Castelli)
Castelli worked with J.P. Brehony Homes, a custom builder in the area. The architect was Robert Kendall of Great Falls, Virginia.

“We needed to rebuild something we could entertain in,” Castelli said. It also needed to be really energy efficient, he said. “Geo was the first choice in my mind,” Castelli said.

“We started right from the inception with Brian, having the architect do a sun study on the design,” Brehony said. The study determined passive solar orientation for siting the new home. Relevant energy related building information for determining overhang sizing and placement was gained in the study. Though no solar technology was installed when the home was built, the home is solar ready and will eventually have PV installed, Castelli says.

Castelli proposed and promoted the sustainable energy features he envisioned for the new home with the architect and the builder. He realized quickly that he needed to quit making assumptions that they knew as much, or were as passionate as he is, about sustainable building. And at times, he introduced new ideas and technologies to both of them.

Brehony normally uses high-end gas HVAC systems, and tried to convince Castelli that he could beat the expected higher expense of the geothermal system.

“When all the bids came back, he pointed out to me that the lowest was the high-efficiency gas,” Castelli says. “I told him that was only for first cost and that he had failed to take into account the 30 percent federal tax credit, which made the cost of the geothermal $1,000 less than the gas system.” Castelli

The great room reflects the Castelli’s taste and attention to a comfortable living space. (Photo courtesy of Brian Castelli)
Careful planning and working within the constraints of the property allowed boreholes to be drilled in the driveway area.

(\textit{Photo courtesy of Brian Castelli})

admits that one of the most attractive benefits of choosing geothermal was paying the utility company less money.

“To be very honest with you, the other thing that I love about the house is the comfort and how long it takes for the temperature inside the house to change when there is a big change in the weather outside,” he said.

“But I also knew that it was, frankly, in my mind, the most responsible thing to do for heating and cooling,” he said. “You use less energy. I consider geothermal an efficiency measure. You are 70 percent more efficient than any other heating and cooling measure.”

All County Heat & Air Conditioning, out of Manassas, Virginia, handled the geothermal installation. Patrick Dennis, owner at All County, says they were doing quite a bit of geothermal installations and service in the area. “Most are very large homes,” he says. “The utility costs are low and comfort

A Honeywell two zone panel system is shown in the mechanical area in the home’s basement.

(\textit{Photo courtesy of Brian Castelli})
level is high. That’s what we are gunning for,” Dennis says.

The design of the system still stands out to Dennis, who taught HVAC for more than 20 years and has served as a dean at Northern Virginia Community College. Patrick’s son, Jamie Dennis, was a key to the installation at the Castelli’s.

All County contracted the drilling out to Scott Miller at Northern Virginia Drilling. The driller handled the exchange field and all outside work, Dennis said. Three 400-foot boreholes were set in the driveway area. All County completed the loop work from the foundation wall to the equipment, including the flow centers. The scope included the distribution system ductwork, all the controls, including

A Honeywell 200 cfm ERV fresh air ventilation system was chosen to provide needed ventilation due to the home’s extremely tight envelope.

(Photo courtesy of Brian Castelli)
a multi zone airsided system, and some radiant areas that included the master suite and the bathrooms.

“We split the house into two zones on the main level because the master suite was located over an unconditioned garage,” Jamie Dennis said. “The master suite also uses staple-up RAHAU® radiant tubing to combat a cold floor,” he said. The radiant flooring was also used in the basement and was installed by another contractor when the basement was poured.

“All County used Florida Heat Pump Aquarius equipment, with a 5-ton unit on the main level and a 3-ton split system for upstairs,” Jamie Dennis said. All County was introduced to J.P. Brehoney and the Castelli’s after the exterior shell of the home was already complete, he added.

“We needed to start on the project when the permits were approved,” Jamie Dennis said. “Which didn’t leave much time for a job with that amount of details. But Brehoney and his lead, Dan Sommerville, did an excellent job to keep everyone on target.”

“To coordinate all that with the radiant took some work,” Patrick Dennis says. “But it all came together sweetly.” All County has done geothermal in a number of high-end homes, he says. “It was your magazine, Geo Outlook, that referred him to us,” he said. “Castelli is very passionate about geothermal.”

Jamie Dennis, who now works for Columbus Temperature Control in Ohio, remembers the Castelli project well. He was in charge of the interior system design and installation, including ductwork design, the radiant and geothermal piping. A stand-alone 50-gallon water heater was used for the radiant system. And a Rinnai tankless water heater was also incorporated into the plumbing for the domestic hot water.

Castelli required that the insulation be installed at double the R-value of the model energy code, making a very tight envelope on the home. A Honeywell ER200B2006 ERV unit was installed for fresh air ventilation.

HDPE was used for all outside piping. Interior plumbing was done in copper and insulated to prevent condensation. The system design includes a reverse return with two headers coming back to the mechanical area. Each of the geothermal units uses a dedicated dual pump flow center. He used purging T’s at the foundation wall, to facilitate...
flushing the field independently. Both units and flow centers can be flushed at the same time with a purging cart.

At Columbus Temperature Control, Jamie Dennis says he works more on the control side than the mechanical now, dealing with variable frequency drives, pump staging, heat lag and things like lighting and humidity control. He said in the commercial area they are seeing a lot of conversions to wireless controls in schools and government institutions. He still talks up geothermal all the time.

“I just made a jump from residential high-end to the light commercial/industrial high-end niche market,” he says. “I don’t have my hands on the piping anymore. I do more of the controls, sales and support.” He says that monitoring demand is a big part of his work. “Data is power,” he says. “The more you can provide, the better you can find solutions to lower energy costs.” He says that where residential energy efficiency works on tightening the envelope, commercial works more on equipment efficiency and the ability to control the equipment’s run time to reduce demand.

Jamie Dennis spent enough time with the Castelli’s on their project to realize how much of an advocate Brian Castelli would be for geothermal. He still laughs when he remembers what Stephanie told him shortly after the project was finished. “She told me that when they have dinner parties, Brian takes guests to the mechanical room first,” he said. “That’s good. I like that.”

Editor’s note: Castelli says his longtime friend and former associate Jack DiEma, IGSPA’s marketing chair, has been recounting the virtues of ground-source heat pumps to him for more than 30 years. DiEma and Castelli were involved in a number of geothermal projects in the past that included a geothermal system at Lower Merion High School and at the former Dick Clark Bandstand building conversion in Philadelphia. Castelli took that advice to heart in building his new home and has been very pleased with the results, both from a comfort and lower energy consumption viewpoint.

For more information about Brian Castelli and his recent change to CEO and president of the Home Performance Coalition and their mission, see his profile in this issue of Geo Outlook.
Carondelet Village
Benefits from Geo

By Paige Worley
Sisters of St. Joseph of Carondelet planned Carondelet Village as an energy efficient continuing care retirement community in St. Paul, Minnesota, to care for their nuns and members of the community.

(Photo courtesy of Steen Engineering)

The Bethany Care Center, a cinderblock building the St. Joseph of Carondelet sisters have lived in since the 1950s, had a fragile, broken infrastructure. The sisters worked with Presbyterian Homes and Services to build a new facility that would also create a joint ministry. Their shared mission and vision for Carondelet Village is to enrich the lives of older adults through services and communities that reflect a life of faith. They engage in this ministry with common values and shared wisdom.

When Sister Margaret Belanger first began looking at designs for a new facility, energy efficiency was a high priority for her. Although she had researched and tried to see how they could use it, she didn’t think geothermal was possible until her team met with Steen Engineering out of Minneapolis, Minnesota. Steen Engineering designed and incorporated the mechanical and electrical infrastructure in the Sisters of St. Joseph of Carondelet’s new buildings.

Sister Belanger’s main concern from the beginning was the small space they had to work with. After Steen Engineering developed a plan to utilize the parking lot for the geothermal boreholes, Sister Belanger was convinced they could use the energy efficient technology, she said.

“And in the long run, it would be less expensive to do geothermal than solar or other systems, so that’s when we made the decision to go geothermal,” she said. The sisters were able to look at the projected long-range energy cost savings to support their final decision. Thought went into planning the new facility to include integrating the electrical backbone for installing PV panels some time in the future.

“We did everything we could that was reasonable and within our budget,” Sister Belanger said.

The new 330,000 square-foot complex was designed to be as energy efficient as possible. A portion of the roof is green and the rest is white, to avoid heat absorption. Motion sensors control common-area lighting. All appliances are energy efficient.

A hybrid closed-loop geothermal system was designed, involving forced air water-source heat pumps, a water-source

In addition to the traditional stained glass in the chapel area, natural lighting is abundant through the planned use of window areas to brighten the important space. (Photo courtesy of Steen Engineering)
heat pump for pool dehumidification, and waterside heat recovery. Steen Engineering worked with a local rep and used mostly Florida Heat Pump units. ClimateMaster heat pump units were utilized to meet space requirements in a few areas.

Xcel Energy, a gas and electric supplier for St. Paul, Minnesota, worked with the nuns, designers and engineers on energy conservation measures. Sister Belanger said the company gave them a break on utilities.

“We got a significant break because of the geothermal, lighting and heat recovery systems we were putting in,” she said.

Construction began on phase one of the project by general contractor Frana Companies and Associated Mechanical in 2011. The sisters continued to live in the Bethany Care Center during the first phase of construction. After the completion of the first phase, the nuns moved in to the new area and the old Bethany Care Center was torn down.

Phase two started and boreholes were drilled in that area for the geothermal heat exchanger. A parking lot was constructed shortly after.
The building was originally fitted with a deliberately undersized cooling tower and boiler plant. It ran on this system for the first year while the geothermal system was under construction.

Conventional mud rotary drilling was not feasible with less than 50 feet to bedrock so pneumatic air drilling was employed to create the boreholes. Bergerson Caswell Well Drilling and Pump Repair of Maple Plain, Minnesota, took the project over, completing work for 172 vertical boreholes 285 feet deep for the ground-source system.

At a total of 465 tons of GSHP, close to 400 heat pump units were used throughout the facility. The original cooling and boiler tower was left in place to create the hybrid system, says Steen Engineering’s Mark Brengman.

“We are told now that the cooling tower has to run very little, if at all, even though it was undersized and designed to be a true hybrid system,” he said. “The boiler is used minimally to heat the balance of the ventilation air where the heat recovery system leaves off.”

Reliable power is a must for Carondelet Village residents who require life-sustaining equipment. Steen designed a redundant system with two 1000 kW emergency generators which ensures that power will always be available for the most vulnerable patients during a utility outage.

The retirement community has independent senior living apartments, assisted living units, memory care and care center suites with nursing help. The buildings are large enough to

Geothermal borefield pumps that handle moving fluid to and from the boreholes are 550 GPM each. Other core water distribution pumps for the system are 900 GPM each. (Photo courtesy of Steen Engineering)
Detail to daylighting is apparent in this inviting fireside seating space with floor to ceiling height windows. (Photo courtesy of Steen Engineering)
meet the needs of the nuns from St. Joseph of Carondelet and to also assist the community.

“The sisters of St. Joseph of Carondelet provided the land for the facility, and in return they had first priority on the care center for their sisters,” Brengman said.

The facilities include studios, a library, a large auditorium, a media theater, restaurant-style and casual dining, fitness and rehabilitation areas and a pool. The mix of recreational, dining and living areas creates a unique heating and cooling balance, because the activity rooms are usually at a much cooler temperature than the living units on the perimeter of the building.

“Because there’s a significant amount of common and interior spaces, it tends not to be cooling or heating dominant,” Brengman said. “The annual energy use profile is relatively balanced. Which makes it a fantastic way to swap and recover energy by using geothermal.”

Kirk Velett, with Insite Architects in St. Paul, Minnesota, said incorporating the various energy-efficient elements and

Pneumatic air drilling for the project was completed by Bergerson Caswell Well Drilling and Pump Repair, who drilled 172 vertical boreholes at 285 feet deep.

Workers lay out and tie together the borefield piping for one of the zones for the geothermal system at Carondelet Village.

(Photos courtesy of Steen Engineering)
staying on budget was challenging.

“When the cost analysis was done by Steen Engineering, it certainly showed that it had a fairly good payback, and that’s why we went with it,” Velett said.

For Sister Belanger and Velett, a favorite energy saving highlight in the design is the emphasis on natural lighting throughout the village.

“The sisters emphasized from the first meeting they wanted a lot of natural light, so that’s really where we started,” Velett said. “That was really important to them and it ended up being a great feature of the building.”

Each resident’s room has a window to allow individuals to benefit from the natural light. The use of natural lighting is extensive in common areas, corridors and lobbies. Velett says natural light cascades further into rooms and other areas.

The construction of the community cost $41 million total, including the geothermal system. Steen Engineering estimated that the village is saving $125,000 annually in energy costs with the geothermal system. Return on investment for the system is expected to be eight years.

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Two for the Price of One

I had a couple of calls over the last few weeks that were a surprise.

A contractor inquired if he could mix antifreeze materials—propylene glycol and methanol—in a ground loop. He was not the installing contractor and the installer was not available. The loop had been in operation for a while with what he thought was a propylene glycol and water antifreeze solution that protected to around 20º F. The overall system had been retrofitted with new GSHP equipment and some of the piping had been replaced, loosing some of the existing system fluid in the process. He needed to complete filling the system and place it back into service with an equal strength antifreeze solution to maintain the desired level of freeze protection. The contractor wanted to know if he could top off the system with an equal strength methanol and water solution.

First, I hadn’t ever considered mixing antifreeze materials, and second, had never even heard it discussed in all my years in the industry. Also, the existing antifreeze material must be identified. I told him I did not recommend mixing antifreeze materials, especially when the existing material is unknown. I suggested that he try again to get back with the original contractor to verify the existing antifreeze. Or, have a chemical analysis performed, identify the antifreeze previously used, and then top off the system with the same material. Finally, if he is unable to identify the antifreeze material in the system, the system should be flushed and filled with a new antifreeze solution.

Afterward, I decided to verify my assumptions with several national chemical suppliers. My recommendation was confirmed by all I talked with, so if you are thinking about mixing geothermal closed loop antifreeze materials, DON’T.

The second was from a new contractor awarded the maintenance contract on a military base GSHP system which had been in service for about 12 years. The contractor was calling because the project’s O & M manual I had provided at completion was incomplete—they “need preventative maintenance and long term maintenance requirements for HDPE pipe”. I asked if they had damaged piping that needed replacing. No, they just want to stay on top of things and make sure there are no issues further down the road. I used this “teaching opportunity” to tell them there is preventative maintenance or maintenance requirements on HDPE pipe—only repairs if it is damaged and refer him to internet HDPE information sources. I wonder who checked the qualifications of this contractor....

Mr. Rawlings has more than 35 years experience in the geothermal industry. He is the Director of Geothermal Services for Trison Construction, a Certified GeoExchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.
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