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Drilling More Than Oil Wells in Houston

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Schools 2013

There is nothing more exciting about this industry as when you are able to take a “non-believer” and convince them to join the GSHP community. Over two years ago, a member of the local school board and I embarked on selling a GEO as they are called in these parts. It was not easy, but the result was that both of the new grade schools went from conventional to GSHP. I was totally unaware of all the trips and traps that we encountered along the way. The technology was not unknown to the School Board, but the balance between the Superintendent wanting more classroom square footage in lieu of energy efficiency was our first hurdle.

Along the way, the architect was reluctant because of another new concept that had been tried that was not working well, the construction oversight person was looking at saving money for the School District, and building space was tight.

One problem we faced was a lack of comprehensive data on what their existing buildings operating costs were. A quick but very rough study showed clearly that their newest “high efficiency structure” was no better than the oldest building that used window air-conditioners. Some board members used incorrect electric rates and failed to include demand charges.

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DRILLING MORE THAN OIL WELLS IN HOUSTON

By Dara McCoy
“For Texans, the 20th century did not begin on Jan 1, 1901, as it did for everyone else. It began nine days later, on January 10, when, spurtting drilling pipe, mud, gas and oil, the Lucas No. 1 well blew in at Spindletop near Beaumont,” according to “Oil and Texas: A Cultural History” in the Texas Almanac 2000-2001.

It was that precise moment that would vault Houston, into an epicenter of the Texas oil boom of the 20th Century. It was a discovery that would go on to redefine the economy and even culture of not only Houston, but also the entire state. A lot of wells have been dug into the earth in the Houston region, but few of them have been geothermal.

When Spring Independent School District (ISD) set out to build a new elementary school in 2008, they never envisioned being the first school district in Houston to use geothermal HVAC, much less the two-story, 105,000-square-foot, LEED Gold building that exists today. In fact, the original design plans for the facility were a simple, repeat build. It took open-minded leaders within the school district, an engaged project team, and the impact of a national economic collapse to open a window of opportunity to create the school’s high performance building.

“There were some changes in leadership and on the curriculum side of the district, and what we found out is that we really needed to start over,” said Jeff Windsor, director of construction and energy at Spring ISD. “This was about the same time as the downturn in the economy, and construction costs were coming in considerably less than they had just the year before. It was kind of like this perfect storm.” Though the original repeat build design had set the budget for the project, declining costs in construction, energy efficient technologies, and commissioning for LEED certification made it possible to re-design and build an award-winning school.

“Gloria Marshall exhibits the notion that you can create this high performance building and high performance learning environment without spending more upfront for the typical prototype,” said Tracy Eich, design principal on the project for SHW Group.

The benefits of natural sunlight have been written about extensively in case studies and trade publications in the design industry for decades, but
it was the potential impact of natural lighting in classrooms on educational outcomes that interested Spring ISD, and ended up driving the re-design. The district’s original prototype school was a conventional compact, square building that would have provided natural light to about 15 to 20 percent of the classrooms, said Eich.

SHW Group ended up proposing a two-story building design that created opportunity for natural light in all the classrooms. Early on in the re-design, the project team also began hearing questions about energy efficiency and potential savings to operating costs from Spring ISD board members, who were seeing a different kind of light in face of a state and national public education-funding crisis.

The 105,000 square-foot school won AIA and Caudill Awards for its architectural and educational design.

(Photo by Luis Ayala-SHW Group)
THE COMPLEX MONITORING SYSTEM LINES COME TOGETHER IN A JUNCTION AREA FOR THE HOME'S SLAB LOOP SYSTEM.
“People are trying to control operational costs,” said Russell Buras, president-CEO at LoopTech, the project’s geothermal installer. “Districts get their bond money at a long-term fixed rate, but their operational and energy costs will most likely increase in the future.”

With energy savings coming to the forefront of the design discussion, SHW Group conducted a national search for a mechanical engineering firm with credentials in energy efficient building, and selected CMTA Consulting Engineers based in Louisville, Kentucky. Mark Seibert, project manager for CMTA, said his firm takes a “global approach” to reduce energy consumption.

Seibert says everything is on the table, from energy hogs like HVAC and lighting down to the IT Department and kitchen. In addressing the top energy use in a building—HVAC—CMTA recommended a geothermal heat pump system for the school.

“Geothermal is not always the best fit for each individual client, but it’s probably our favorite system,” Seibert said. Though armed with data and years of experience designing geothermal systems all over the nation, CMTA faced doubters about the technology’s viability in Houston. “We had to overcome the stigma that it can’t be done in Houston,” Seibert said.

Geothermal technology has been around for a long time, and to discover that the first geothermal school in Houston was built in 2010 seems a bit surprising. Why would Houston school districts be such late adopters?

“The Houston environment presents challenges to the design of a geothermal system,” Windsor said. “Our district needed to see a system in the Houston area that had been in operation for a few years and a computer model of the system that included data from test wells drilled on the actual school site before we could commit to using the system.”

Buras also points out that energy has been cheap, but rising costs are now making people look at their options. Geothermal heat pump technology boasts eye-popping energy efficiency—sometimes 60 percent for heating, but...
warm weather Houston would require many more cooling days than heating days.

“Houston has been a slow adopter of the technology because people tend to think more on the heating side,” Buras said. “However, the cooling side is still 25 to 30 percent more efficient, and that’s been proven down here.”

It isn’t that geothermal systems hadn’t been proposed in the Houston public education market, but inexperience with the systems in the region may have put geothermal at an unnecessary disadvantage, Seibert says. He mentions an attempted elementary school project that came in with such high cost estimates that geothermal was not selected.

“It affected this market for some time,” Eich said. “Many people in the engineering community were saying you couldn’t do it in Houston, but they had no experience with geothermal.”

So, the entire project team set out to overcome the existing negative perception. First, SHW Group and CMTA proved they had enough experience to design a successful geothermal system by bringing tons of data and project examples to the table. Then, they addressed the question, “Can it really be done here?”

The project team toured multiple non-educational geothermal projects in Houston done by LoopTech, including West Conroe Baptist Church, a large church just a few miles from the construction site. “They were working fine, and people loved them,” Windsor said. “Two, nearly three years into operation, and the equipment was still pristine. The whole operation was just excellent.”

Test wells were drilled and studied. CMTA’s energy savings models predicted 30 percent energy reduction for the building, and Spring ISD now was unafraid of being the first adopter of the technology. LoopTech installed a water-source geothermal system with 286 wells at an average 275-foot depth each that comprised two closed-loop
systems, one placed beneath a parking lot and one underneath an athletic field. The 275-ton system is comprised of 116 ClimateMaster units.

The Gloria Marshall Elementary School opened in 2011 to a well-earned fanfare. It garnered LEED Gold for its use of multiple energy efficient and environmentally conscious technology and building practices. The project incorporates trees recycled from the construction site, and collects rainwater in a 20,000-gallon Wunderground tank for the school’s grey water use and irrigation-free landscaping. In addition to the geothermal system, the school saves power by using natural light for at least 70 percent of its illumination needs. The school also generates energy from rooftop photovoltaic cells and an on-site wind turbine.

Most of the environmentally efficient features also have a corresponding educational element. Students can see rainwater collection pipes that run through their science labs, study the eco-pond fed by rainwater collection, and interact with a video display that explains how geothermal technology works and how much energy the school is saving.

The project won an American Institute of Architects (AIA) Houston chapter Honor Award in 2011, the state’s TASA/TASB Caudill Award for educational building design, and a national 2011 William W. Caudill Citation in American School & Universities’ Architectural Portfolio competition. Seibert has also been notified that the project has won an Energy Star Award with a score of 94. Naysayers appear to have become silent supporters.

“I think it has shocked everybody how well it has worked,” said Seibert. “You had a lot of people who put their reputation on the line with this facility. People considered this project on the edge, and everyone’s extremely happy how it turned out.”

As of January 2013, the school runs at 25 kbtu per square foot annually—half the district’s average of 52 kbtu per square foot. “We’ve saved an average of $50,000 a year in just electricity,” Windsor said. “That’s a teacher.” The district as a whole has learned a lot about energy efficiency. Windsor has helped the district lower its kbtu per square foot average from 67 in 2008-09 to 52 in 2011-12.

What about the warmer climate in Houston? “Even in the summer of 2011 when we had that horrendous drought down here, it cooled just fine,” Windsor said. “We had running cracks in the area that showed a lot of ground movement. Of course that makes you worry, but we did not have a minute’s problem with our field, and we maintained our cooling in the building.”

The Houston market has definitely taken notice. In 2011, Windsor gave 15 energy-related tours of the school. Last year, he did about 10. A second geothermal school was built in Houston for Sheldon ISD in 2011, and Windsor knows of several more districts considering the technology.

“Gloria Marshall has had a huge impact on our market in Houston, from both the engineering side and the education side,” Eich said. “As a project, it was so rich and deep from the engineering and educational standpoint that it has gotten a tremendous amount of attention, and it really has moved the engineers and the architects in this market forward.”

Gloria Marshall Elementary School’s geothermal use may help prime the Houston market for ground-source heat pump technology in the area’s future educational institutions.
Virginia's York County Schools Sold on Geothermal

By Janet F. Reeder
Schools in York County, Virginia, are seeing their long-term plans to go geothermal change the overall energy savings picture there. Associate Director for Capital Plans and Projects for York County School Division, Mark Tschirhart, has been involved in promoting the technology for a number of years. Tschirhart is a certified energy manager, a certified commissioning professional, and a member of the Association of Energy Engineers. He is also completely sold on GHP systems for schools.

Tschirhart acknowledges that today's positive picture of the energy savings being realized by the county's schools did not come about without an early struggle. Like so many other school districts around the country, it took some convincing for York County School Division to be able to pursue geothermal systems.

But the naysayers were finally won over largely because the county put geothermal in the York County Health and Human Services building late in the 1990's. Large amounts of equipment are concealed in a specially constructed mechanical mezzanine area the school created by remodeling to a gabled roof.

Stakeholders

The York County School Division Chief Operating Officer, Dick Hixson, who at that time was responsible for the buildings and maintenance of YCSD schools, also had more personal experience with geothermal. Hixson, a retired Navy mechanical engineer, saw the operational advantages of geothermal heating and air-conditioning system in his home. "The York County School Division Chief Operations Officer had a geothermal heating and air-conditioning system in his home before the school division decided to install geothermal systems at a cost savings of 60% and was an advocate for the move to geothermal," Tschirhart said. "He had already realized the tremendous energy and utility cost savings of geothermal." The YCSD Chief Operations Officer had a geothermal heating and air-conditioning system in his home before the school division decided to install geothermal systems in the schools.

"I think they kind of wondered why we should be on the leading edge of the technology when it could fail," Tschirhart said. "They didn't know enough," Tschirhart says. He thinks that the prevalent opposition at that time stemmed from concerns over a lack of information about the success of the technology. "I think they kind of wondered why we should be on the leading edge of the technology when it could fail," Tschirhart said.

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Selling Geothermal to YCSD

Initial efforts to move in the direction of ground-source heat pump technology saw an early set back when bonds for the first well field failed to pass in 1990. "They didn't know enough," Tschirhart says. He thinks that the prevalent opposition at that time stemmed from concerns over a lack of information about the success of the technology. "I think they kind of wondered why we should be on the leading edge of the technology when it could fail," Tschirhart said. "They didn't know enough," Tschirhart says. He thinks that the prevalent opposition at that time stemmed from concerns over a lack of information about the success of the technology. "I think they kind of wondered why we should be on the leading edge of the technology when it could fail," Tschirhart said.

But the naysayers were finally won over largely because the county put geothermal in the York County Health and Human Services building late in the 1990's. Large amounts of equipment are concealed in a specially constructed mechanical mezzanine area the school created by remodeling to a gabled roof.
Tabb Middle School First of Many Geothermal Schools for York County

Tabb Middle School was the first York County School Division school building to have a geothermal heating and air-conditioning system installed. YCSD now has a total of nine schools with geothermal, and is planning the tenth.

Originally built in 1967, Tabb Middle School underwent a complete renovation in 2000. At that time, a classroom wing, a new media center, and an auxiliary gym were also added. Total square footage increased to 96,284.

Design for Tabb Middle School’s renovation focused on the school’s educational environment and a desire to incorporate high performance sustainable building practices and features.

Stone ballast was removed from the existing rubber membrane roof and a gabled roof was built over it. Savings were realized from the reduction of construction debris that needed to be hauled away.

But more importantly, the design allowed provision of additional attic space to be used for the mechanical mezzanine needed for the HVAC equipment. The school gained an updated curbside appearance and also placed mechanical units out of sight and under the protection of a roof.

An additional 8,371 square foot classroom and media center wing were also part of the renovation. The extra area gave the school more classroom space, additional shelf space and room for more instructional technology.

Tabb Middle School’s energy saving measures for the renovation involved replacing the electric water heater with a high-efficiency gas water heater and installing low-flow plumbing fixtures throughout the school. Lighting changes involved replacement of the original T-12 lighting fixtures with new high-efficiency T-8 fluorescent lights in all classrooms and offices.

A new Direct Digital Control (DDC) building automation system was incorporated to provide individual building automation controls for each classroom. The system allows the teacher to adjust the temperature by 3 degrees up or down for comfort, and also override the “off” schedule in 1-hour increments.

The DDC system provides the heating and air-conditioning system setback temperatures at night and on weekends and holidays. The start and stop times for HVAC equipment are recalculated.
daily based on room temperature and outside air temperature.

Exterior lighting is also controlled based on time of day and outside light levels. The DDC system records temperatures, alarms, and equipment run times to verify proper operation and permanent CO2 and humidity monitoring.

In 2003, the school installed occupancy sensors in classrooms to control lighting. The sensors also trigger the building automation system to reset room temperature set points when rooms are unoccupied.

In the geothermal change over, original air-to-air heat pumps, which had reached the end of their life span, were replaced with a high-efficiency geothermal heating and air-conditioning system. The system utilizes 82 Florida Heat Pump units installed in the specially created attic mechanical mezzanine area.

A closed ground-loop system, installed by Pinkston Geothermal, is comprised of 192 vertical bores at 200 feet deep on 20-foot centers. No glycol is used in the loop. Circulation pumps used are 50-horse power. The outside air make-up design includes four SEMCO units equipped with dual heat wheels for energy recovery. Tonnage for the centralized closed loop well field is 192, with a cost of $350,000.

Moseley Architects of Virginia Beach did the architectural work for the project that began in June of 1999 and finished in September 2000. Jeff Harris, who was with Moseley at the time, has done a lot of retrofit geothermal, especially with schools.

“Clients seem to like it. It is a little more up front cost. But it is an efficient system with low maintenance. It works well. And it has a fairly quick pay back period, so that is appealing,” Harris says. “It is becoming more common all the time,” he said. “It is definitely becoming more popular.” Harris says other schools in the area are slowly moving in that direction.

He said that the retrofit for geothermal could be done without putting the slope roof on older buildings, but that doing so made a more visually appealing solution for Tabb Middle School. Tabb’s project was a significant renovation, Harris says.

“It provided a challenge trying to conceal all the piping and units that are required,” Harris said. Creating the attic space or mechanical mezzanine area over the existing flat roof worked well. “It helps to conceal the mechanical equipment and area.”

Harris said he is not the geothermal expert, though he is continually learning more on each project. “We had a good mechanical engineer on the job that deserves credit,” he said.

Kevin Allen with Thompson Consulting Engineering of Newport News, Virginia, specified and designed the geothermal system and loop. Bayside Contracting Inc., out of Newport News, Virginia, did the heat pump installation.

A natural fit for the geothermal exchange loops, the school’s practice field serves a hidden but vital part in TMS’s energy efficient ground-source system.

(Photo by Mark Tschirhart)
Energy Savings and Conservation

“One of the major things I do is educate about geothermal,” Tschirhart says. Helping other school leaders to understand YCSD’s systems and the potential for savings and reasonable payback is a rewarding part of Tschirhart’s job.

“The fantastic thing for school buildings is that they are never going to sell. They are making a long term investment,” Tschirhart says. Their success allows them to serve as an example for other schools that seek them out for information.

“I would say that York County School Division is on the forefront in this area in terms of school systems,” Harris says. “They have had a lot of other school systems’ personnel come through and tour their schools to get a better understanding of what a geothermal system consists of. And there have been a lot of seminars and conferences that talk about this and tout its benefits.”

Energy savings for YCSD go hand-in-hand with their commitment to conservation and reduction of pollution for the Chesapeake Bay and surrounding area. Early efforts involving a performance contract in 1997 that saw the move to T-12 fluorescent lighting and the Direct Digital Control system, paid for themselves in energy savings.

The move to geothermal has also allowed the division’s schools to do away with harmful chemical water treatment systems on building cooling towers. The strategy to reduce the amount of pollution entering the bay by cutting the amount of electricity consumed in the schools each day has also been successful and rewarding. Less coal or natural gas is burned to generate electricity and thus less pollution is created that can enter the Chesapeake Bay.

Associate Director for Capital Plans and Projects for York County School Division, Mark Tschirhart routinely checks the school district’s systems. Tschirhart also conducts tours of the district’s facilities for other school officials considering geothermal.

(Photo by Mark Tschirhart)
“We have reduced division-wide natural gas consumption by over 52 percent directly due to the geothermal heating and cooling systems we have installed,” Tschirhart said. Since 2004, YCSD has seen a reduction of energy usage that translates to nearly $3 million in savings.

They have also won many environmental impact and energy efficiency awards. YCSD is a K-12 Energy Star Leader and has a total of 12 Energy Star Certified buildings, Tschirhart says.

Additional Geothermal Schools in the York County School District

Seaford Elementary
34 WaterFurnace units, 110 tons
Exterior Mechanical Rooms

York High
102 Florida Heat Pump units, 540 tons
Classroom Ceilings

Extend Center (Talented and Gifted Program)
8 Florida Heat Pump units, 24 tons
Hallway Ceiling

Yorktown Middle
82 Florida Heat Pump units, 360 tons
Classroom Ceilings

Bruton High
Instructional Wing
53 ClimateMaster units, 128 tons
Mechanical Corridors
Activity Wing
32 ClimateMaster units, 192 tons
Mechanical Corridors

Queens Lake Middle
47 WaterFurnace units, 95 tons
Mechanical Mezzanine

Dare Elementary
33 Florida Heat Pump units, 118 tons
Exterior Mechanical Rooms
Dare Elementary Addition
2 Florida Heat Pump units - 9 tons
Exterior Mechanical Rooms

York River Academy
18 Florida Heat Pump units, 72 tons
Hallway Ceilings
Taking Oklahoma CareerTech’s GSHP Program National

By Janet F. Reeder
Oklahoma CareerTech Technical Program Supervisor Jim Bullington and Gordon Cooper Technology Center HVACR Instructor Jerry Pickering examine connections on a flush cart donated to the program by Geo-Enterprises of Catoosa, Oklahoma.

(Photo by Janet F. Reeder)
If Jim Bullington’s plans succeed, an initiative he started in his home state of Oklahoma will spread to the whole country. And the ground-source heat pump industry will benefit greatly.

Bullington has become the impetus for seeing that all of Oklahoma’s CareerTech HVACR programs include ground-source heat pump training in their existing curriculum.

But Bullington isn’t stopping there. After months of discussions with International Ground Source Heat Pump Association Executive Director James Bose, Bullington believes his Oklahoma GSHP Initiative should go national. As the assistant state program administrator for Trade and Industrial Education at the Oklahoma Department of Career and Technology Education, Bullington is in a position to help make that happen.

He is already working with Oklahoma’s CareerTech schools and his trade and industrial education instructors to beef up geothermal offerings in existing HVACR training. A number of IGSHPA allies and Oklahoma geothermal business leaders are assisting Bullington’s efforts.

Bullington’s interest in ramping up GSHP training efforts in Oklahoma is a reflection of growing national interests to ensure well-trained technicians are coming through the pipeline to match actual and anticipated growth of the geothermal industry.

Oklahoma’s unique vocational education system, CareerTech, has for years trained high school students and adults to meet the state’s vocational and trade needs for qualified workers. Now, through collaboration with a number of ground-source heat pump industry leaders and IGSHPA, they are poised to potentially help spread GSHP training to a new level.

While most states have training programs in their vocational and technical education system to provide instruction in the HVACR trade as well as other business and industry areas, Oklahoma’s CareerTech differs in a very positive way. Students from the state’s secondary education system

Tony Hise, an Oklahoma Army National Guardsman, and first year full-time student at Gordon Cooper, learns about fusion techniques. Hise will graduate in March of 2013, and plans to have a long fulfilling career in the HVAC and geothermal industry.

(Photo by Janet F. Reeder)
have access to training provided by Oklahoma’s CareerTech facilities. High school students living in a technology center district attend tuition free, while adults are charged nominal tuition. Technology center students also are able to earn highly affordable and transferable college credit from area colleges in many career majors.

Oklahoma’s CareerTech system is often used as a model for programs across the United States and around the world. The Oklahoma Department of Career and Technology Education provides leadership and resources to ensure standards of excellence throughout the statewide system. The system offers its programs and services throughout nearly 400 public school districts, 29 technology centers with 57 campus sites and 14 skills centers located in correctional facilities. Each technology center works closely with advisers from local industry to ensure that students learn the skills needed to be valued members of the workforce.

Bullington is banking on the strength of his state’s program to be able to lead other states into GSHP training for their HVACR components. So far he has 18 of his 20 locations ready to get more serious about the curriculum when it is released. He has spent countless hours researching equipment to assist that effort. “What I have is all optional,” Bullington says. The 100 hours or more that he has put in researching material and equipment has produced a unitary equipment list with parts numbers, prices and other information from a dozen or more vendors that will allow a program’s instructor to build the units needed to support instruction.

A “training station” incorporates three major components that when brought together allow hands-on experience for the students. For programs that do not have any GSHP equipment, Bullington has a package system available. For training, instructors need at least one ground-source heat pump, and having more

The three-piece ground-source heat pump training unit at Gordon Cooper Technology Center is comprised of a ClimateMaster Tranquility 27 (TT) Series Residential Vertical Up-Flow Unit, three 500-foot 3/4-inch HD Polipro piping loops and the flush cart. The loops and flush cart were built and donated by Geo-Enterprises.

(Photo by Janet F. Reeder)
than one brand is even better for training purposes. Many have been fortunate enough to have units donated from industry manufacturers such as ClimateMaster, FHP Bosch and WaterFurnace.

Bullington says other components, are also integral to the training stations. His research has been directed toward a unitary portable system. “Training requires several pieces, not just the heat pump,” he says. Two other components are the loop cart, and a stand-aside flushing and purging cart. Additionally, the equipment for fusing polyethylene pipe and sample piping is also needed.

All of the parts that comprise the training station require different skills and different verifications. He explains that the programs are not able to include more than basic information about drilling and design software and other areas that will require additional professional training and certification when students find employment.

“We are mainly trying to get these students who will be leaving as technicians, to be able to understand the technology and get over any trepidation that they have about servicing,” Bullington said. “They will be able to at least walk up and take pressures, take temperatures, calculate latent Btus and tell whether or not the system is performing up to potential.”

Bullington says that ideally the students “will go through all of the motions that are required in commissioning a unit, troubleshooting a unit, putting the pipe together and if they have the opportunity, they are going through all of the steps to the pipe
and fusion and headering of the pipe to bring it all the way into the building.”

Currently the curriculum being developed will be for 30 hours of instruction. “That is a reasonable amount of time where we could make a student familiar and fit in four or five labs,” he says. He expects the curriculum will be online and students will be able to be self-paced.

“The contractors I have talked to that are hiring these students are sending them on for IGSHPA training. We don’t know what they are going to wind up in, so we try to make them aware of everything. Then when they get on a job the contractor can decide if they are going to be a ground-source technician, they probably should go to Stillwater and get that certification from IGSHPA,” Bullington said.

Oklahoma’s Gordon Cooper Technology Center HVACR Instructor Jerry Pickering instructs a popular residential and light commercial heat and air program in Shawnee. He teaches students from 16 years old to adults, including returning military veterans. High school students take two years to complete the program, while adult students can finish in a year.

“We are full all the time,” Pickering says. “I have a waiting list.” An active lab is a bonus to his school’s program, he says. On the day that Pickering was interviewed, Jim Bullington also visited the program to deliver some donated equipment. Pickering says he has seen “fantastic support” from the industry.

Geothermal is added toward the end of Pickering’s instruction. “As they get to their air-to-air heat pumps, the logical progression is to go on to ground-source heat pumps.”

Pickering’s students are very excited about having ground-source heat pump training included in their program. “They know that it is a big deal with the contractors and that it is really catching on and getting strong in the market,” he says. “They see that in real life their knowledge of geothermal is going to make them much more employable.

And of course, that is what we are all about.”

Meridian Technology HVACR Instructor Travis Snowden, in Stillwater, Okla., agrees with Bullington that adding GSHP training to his program is a win-win situation. Students will be able to work when they finish the CareerTech HVACR programs, and adding GSHP makes them even more employable, Snowden says.

“It just makes them more marketable. And that is what we are after here,” Snowden said. He adds that students who successfully complete the program can bypass two years of their apprenticeship for their journeyman’s license. It is appealing to students that they can finish the program and then work one year under a contractor and sit for their journeyman license.

“It is something that gets them a little further along and it gives them a really good chance of passing that journeyman’s test, which is fairly difficult,” Snowden said.

Moving Oklahoma’s model for GSHP training in the CareerTech system to a national level will be well worth the effort. More information, including CareerTech state director contacts, training station material lists and information on how to contact Bullington is available at www.gshp.okcareertech.org.

Pickering says the equipment in his lab, including this flush and purge unit, provides an “excellent setup” for teaching his students about geothermal technology.

(Photo by Janet F. Reeder)
Tulsa, Oklahoma’s Educare III MacArthur school, a state-of-the-art facility, is set to make a difference.

(Photo courtesy Kinslow, Keith and Todd Architects)
National School Program
Catching on to Geo

By Linda Allen
Schools all over the country are searching hard for ways to implement energy cost savings while still maintaining comfortable and appealing learning environments for instructors and children. One national program that has begun to tie all of those elements together successfully is the National Educare Schools organization. With schools in Arizona, Central Maine, Chicago, D.C., Denver, Kansas City, Miami-Dade, Milwaukee, Oklahoma City, Omaha, Seattle, Tulsa and West DuPage (West Chicago), the innovative educational organization is set to make a real difference.

In fact, that program has anchored more schools for their system in Tulsa, with three, than anywhere else in the nation.

Educare, a national state-of-the-art early childhood school program that provides education and care for children from birth to age 5, and their families with full-day, year-round early childhood education, family support services and ongoing medical care, is growing to meet a national need. And in Tulsa, they are doing so with intelligent and cost-effective choices.

When a project like Educare III-MacArthur combines early childhood learning and green technology, it’s a double win for our future. The George Kaiser Family Foundation (GKFF), a nonprofit based in Tulsa, Oklahoma, and Tulsa Public Schools are principal partners in the construction of Educare’s third Tulsa school that offers early childhood education opportunities to at-risk children in Tulsa and includes geothermal technology. GKFF has supported both Educare and its mission for childhood education and geothermal energy savings for several years.

Educare’s national program is dedicated to helping at-risk children from birth to age five achieve school readiness. Seventeen schools in 12 states currently serve approximately 2,000 children and their families. A number of additional schools are in the development stage, two in California, one in New York, and one in Kearney, Nebraska.

Oklahoma leads the nation in Educare programs with four schools, the three located in Tulsa and one in Oklahoma City.

Educare schools are designed to nurture a child’s natural desire to learn through research-based activities and parental involvement. Goals of the program are school readiness, family involvement in the child’s education and breaking the cycle of poverty. Each school is designed and operated on core features of the Educare model, including continuity of care through full-day, full-year services, small class size with high staff-to-child ratios and on-site family support. Other features of the Educare model are focus on language, literacy, problem solving,
Educare MacArthur incorporated ample space for meetings of families, social workers and others involved in the children’s educational needs.

(Photo courtesy K & M Shillingford)
numeracy and social skills.

“Although Educare doesn’t have space specifications, it far exceeds the strict standards and safety requirements of child care licensing,” said GKFF Senior Program Officer Annie Van Hanken. “There is a strong insistence on community meeting space and access to the outdoors and a great fidelity to a quality model. This means buildings are all state-of-the-art and close to 30,000 square feet and serve about 200 children and their parents.”

Kinslow, Keith and Todd Architects of Tulsa designed all three Tulsa Educare schools. The firm, which was founded in 1989, has been named on several “best of the best” lists and annually designs an average of three-million-square-feet of space.

The 32,667 square-foot MacArthur school serves 164 children with 50 staff members. The building includes 16 classrooms plus ample meeting and training space for social workers, speech pathologists, nurses, visiting artists and other personnel to support family involvement in the children’s education. The design includes multiple play spaces to boost the children’s development. Space layout minimizes transitions since each child stays with the same team of teachers from birth to age three. Ages three through five move to a preschool classroom with a different team of teachers.

Geothermal was chosen for its energy efficiency, low maintenance and low operating costs. Educare II-Hawthorne, the second of the three Tulsa Educare schools, opened in 2010, with geothermal. Whit Todd, principal at Kinslow, Keith and Todd, said a cost analysis between the traditional rooftop units at Educare I, and the geothermal system at Educare II showed greatly reduced maintenance costs over time at Educare II. The positive experience with that geothermal system helped to endorse the choice for the new school and served as a model for design and construction.

Recognized for its quality installations, IGSHPA member, K&M Shillingford (KMS), worked with Kinslow, Keith and Todd for the

Spacious grounds give the school both a buffer zone and create an inviting campus.

(Photo courtesy Kinslow, Keith and Todd Architects)

(Below) Main pumping units support the ground-source heat pump system for Educare MacArthur.

(Photo courtesy K & M Shillingford)
installation of the geothermal system. The firm is the oldest geothermal contractor in the US and recently received recognition by the Air Conditioning Contractors of America (ACCA) as the best commercial contractor of the year for 2012. ACCA is a national organization of heating and cooling manufacturers, distributors and contractors. Educare III was one of KMS’s 184 commercial and residential installations in 2012.

A central plant with variable speed pumps was designed to meet the varied use requirements of the building. The closed-loop system is a vertical installation of 95 wells at 300 feet deep. The system circulates a mixture of 80 percent water and 20 percent glycol.

“A challenge of the installation was the distance of the well field from the building and the location of the mechanical room in the center of the building, a distance which increased the length of the piping. Four sets of 4-inch pipes come into the building under the slab. The piping then distributes to the geothermal heat pumps throughout the building,” said Jay Murphy, co-owner of K & M Shillingford.

Total tonnage of the system is 145 tons with 16 horizontal package units and 15 rooftop units. ClimateMaster manufactured the heat pumps.

The building boasts an abundance of windows to maximize natural light, which helps the children experience and enjoy nature. Outdoor activities are part of the daily schedule. Each classroom includes doors to outside play areas so children can be involved and active in the outdoors, weather permitting.

A unique feature of the school is the art rooms. Integration of the arts is a core feature of the Educare model.

KMS Project Manager Walter Dean checks on the piping fusion and installation at Educare MacArthur.

(Photo courtesy K & M Shillingford)

Piping comes in under the slab from the system’s borefield. Header piping inside the building then connects the borefield to the heat pumps throughout the building.

(Photo courtesy K & M Shillingford)
At Educare III, each art room has tall glass, overhead doors that open to a covered outdoor classroom, which allows the children to create art projects on the patio areas. “We wanted to make sure the art rooms were handled separately. Each room has its own heat pump so doors can be opened on moderate weather days,” said Chief Operating Officer Phil Morgan, who is in charge of finance, operations and maintenance for the Educare schools.

Public and private funds financed the $9 million project. Installation costs of the geothermal system were approximately $1 million with no rebates or government or utility incentives. Projected energy savings are 43 percent, which should take about 4 1/2 years to pay back the system costs.

Educare III opened in August 2012, so it is too early to determine utility costs and savings of the system. “The most appealing feature to me in my operations role for the schools is the ability to get into the ABS control system to manage temperature settings and set points. I can monitor temperature and revise set points as necessary as well as occupancy times with the remote site control. Hands down, it’s an improvement on standard HVAC systems,” said Morgan.

Funding is an ongoing concern in education. Energy savings are a way schools can create and maintain an affordable learning environment. Architect Bond Manager for Tulsa Public Schools, Chris Hudgins, repeated the school’s satisfaction with the geothermal system. “The yearly cost savings in utilities is a great reduction in our annual expenses. We’ve found geothermal easy to maintain with little to no long-term maintenance.”

The anticipated long-term savings of the geothermal system combined with the educational mission of Educare create a positive return on investment for our environment and Tulsa’s children. It is exactly what schools all over the country are looking to achieve.
Art is a core feature of Educare's curriculum and the art rooms include tall windows and overhead doors that give access to an outdoor covered classroom area. (Photo courtesy Kinslow, Keith and Todd Architects)
IGSHPA Accredited Trainer Chris Balbach answers questions from students in a recent class.

(Photo by Abhishek Ghale)
New IGSHPA Building Load Analysis Workshop A Success

By Janet F. Reeder
The International Ground Source Heat Pump Association’s newest training class has already proven to be a success, according to IGSHPA Training Program Manager, Roshan Revankar. The class is expected to become a popular workshop for those seeking information about determining building loads and how that information relates to GSHPs.

The first offering of the Building Load Analysis and Pumping course (BLA) was held January 7-8, 2013, at IGSHPA’s Training Center in Stillwater, Okla. A spring BLA class is set for April 8-9, 2013. Registration and course information is at www.igshpa.okstate.edu/training/bla.asp.

The two-day program is designed to impart specific training in load analysis and pumping design with a focus directed at designing highly efficient ground-source heat pumps. A strong base for building simulation calculations and factors in design is presented. The attendees also gain hands-on building simulation experience with eQUEST simulation software and pumping calculations. Individual membership with IGSHPA is included for those who successfully complete the BLA class. Those completing the class can also earn 2.0 CEU credits.

The BLA course is designed for professional engineers, registered architects, installers and contractors. Revankar says the course is a great foundation for individuals looking to take the Certified GeoExchange Designer (CGD) course and apply for Association of Energy Engineers (AEE) certification. Workshop information can help utility representatives serve as a source of information regarding money-saving concepts for both their utility and their clients.

Topics covered range from an introduction to building energy modeling to energy calculations and building simulation. On-site building example models are included in training with the eQUEST software program, along with information on pumping design for ground-source heat pumps.

“We added this course to fill in the missing link for installers to understand building modeling,” Revankar
says. The workshop is designed to give attendees a working understanding of how to calculate heating and cooling loads. “This can then be used in ground-loop design software to calculate loop field lengths,” Revankar says. He modeled the class framework after similar offerings by AEE and ASHRAE.

The early January BLA class had 14 attendees. Comments from those who took the course confirmed the need for this type of training in the industry. Many suggested the workshop should be lengthened to add additional information.

A number of those who attended had constructive input to offer after the course was over. Greg Wells says the class was taught by a “very knowledgeable instructor” and was “well done.” John Turley says the “hands-on software training” was what he liked most in the course. He also suggests adding another half-day to the workshop. Garen Ewbank says that Balbach is a “very competent instructor” and that the training and materials he presented were “extremely needed.” Young Chang suggested making eQUEST a separate two or three day training, “separated from the pumping part.”

Instructor Chris Balbach received high ratings and compliments from those who filled out class evaluations. As Vice President of Research and Development for Performance Systems Development of New York, LLC, Balbach guides the company’s internal software development teams. As a subcontractor to the National Renewable Energy Lab (NREL), Balbach has trained governmental clients worldwide. His field experience as an HVAC/R design engineer coupled with a background in simulation software development and understanding of monetizing energy savings make Balbach an expert in the area. He has a passionate belief that energy simulation tools, when properly used, often represent the best available technology for accurately estimating the potential for energy savings in buildings.

Balbach, an IGSHPA Accredited Trainer, is a member of IBPSA, AEE, and ASHRAE, and serves as programs committee chair of ASHRAE TC4.7 (Energy Calculations).

IGSHPA’s Training Center is equipped with the latest digital audio-video technology and provides students and instructors a state-of-the-art classroom setting for instruction. A large and well-appointed training lab is also available adjacent to the classroom area, and provides group and one-on-one training opportunities that are hands-on.

Those who are interested in more information about the BLA training, or other IGSHPA training can contact Revankar at 800-626-4747 for more specific information.
Project Negatherm Having Little Impact


The bill, from its introduction by Assembly members Das Williams and V. Manual Perez on February 24, 2012 to its being signed into law (September 2012) and beyond has received a great deal of industry and print media news coverage, including headlines such as “New California Geo Organization Seeks Legislation Promoting Geothermal Heat Pump Bill Sent to Governor”, “Renewable Energy Geothermal Heat Pump Bill Signed Into Law”, “California Lowers Hurdles for Ground-Loop Technology”, and others.

All that said, I was curious if the increase in industry related activity and/or marketplace pressure in California during 2011 and 2012 had any impact on the various county and municipal regulatory authorities since the regulation database that supported Project Negatherm was compiled. I recently reviewed current website postings for 31 counties or municipalities in the San Francisco/Sacramento and Los Angeles/San Diego areas of California versus their original Project Negatherm database information. Based on this comparison, permitting status is still a quagmire of variations and inconsistencies, but:

- When the Negatherm database was assembled, 5 of the 31 had geothermal or ground heat exchange included in their permitting language.
- Currently, 7 of the 31 have geothermal or ground heat exchange language included in their permitting.
- All other permitting information or forms classified geothermal ground heat exchanger drilling as either a Water Well – Other, Monitoring Well, Borehole, or Other, if identified as anything other than Water Well.
- Concerning permitting fees as compared to the Project Negatherm database:
  - Fifteen of the authorities were unchanged
  - Fourteen had modest to reasonable permit fee increases
  - Two had outrageous increases in permitting fees
  - Fees are typically significantly more expensive than those in other states
  - Curiously, there was one authority with an outrageous increase in each of the two areas of California investigated:
    - The County of San Bernardino reported a $155 per borehole permit fee to the Project Negatherm inquiry. Currently, their website Fee Schedule lists Well Construction – Geothermal with a Fee Amount of $759 per well.
    - Marin County reported a $364 fee for the initial hole and a $60 fee for each additional hole with a $2,000 maximum borehole permit fee per site. Currently, their website Fee Schedule lists Heat Exchange Wells with a Fee of $2,100 for the initial hole and $266 for each additional with no maximum.
    - As a point of comparison, the State of Missouri ground heat exchanger permit fee is $150 for a ground heat exchanger up to 50 tons, and $250 for a ground heat exchanger larger than 50 tons. Reasonable and certainly not a barrier to using this green, renewable, and sustainable technology.

So, it appears there has been little impact over this two-year time frame regarding recognizing geothermal heat exchanger wells in permit language; that permit fee price increases over the Project Negatherm amounts have typically been modest to reasonable (though typically higher than similar permitting requirements and fees in other states), and that two authorities do indeed have outrageous fees, even for California. Let’s hope for meaningful improvement in all areas in 2013 and beyond.

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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