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The really good thing about working with non-profits is that they are generally Board managed by individuals with different backgrounds and experiences that can be helpful in developing marketing skills and plans. Depending on the non-profit, the Board members can be homogenous in their backgrounds or diverse such as you would find in school where election to the Board brings a variety of individuals. Some members represent groups concentrating on curriculum, others on sports, music, etc. But you can be assured that they are professional in their approach and are accustomed to listening to new ideas from a variety of sources. How to convince someone or a group to embrace the GSHP technology has been a challenge. Unless you are directly involved in this side of the business, it is real difficult to understand. What should be an easy sell can easily become a competition of “friends” of the Board. A person should always remember that a GSHP sell is a loss to someone else’s competing technology. Business as usual is a tough competitor.

One common misconception is that this technology is only for the rich and size is important. Small houses are perceived to not be worthy of GSHPs. Their utility bills are small because the building is small. But small savings to one person can be large to a family that makes every dollar important. An example of this is the Habitat for Humanity programs around the country.

Larger non-profit structures are excellent candidates for accolades by projecting “green” concepts, which plays to the high efficiency advantage of GSHPs. GSHPs, when included with other technologies, can sometime be lost. There is nothing to see or brag about because the real important elements of the system are buried safely underground.
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Eve London
Product Manager
Trane

Eve London has been employed with Trane since 1998 and is the product manager for water source heat pumps and ground source heat pumps. London has 11 years of experience in the HVAC industry, having held a number of marketing positions within Trane on other product lines including commercial self-contained and dedicated outdoor air equipment prior to Ingersoll Rand’s acquisition of Trane.

London has been involved in the geothermal industry for five years promoting geothermal heat pump equipment and technology in commercial applications. She presently serves in Large Unitary Product Management with Ingersoll Rand Climate Solutions in Macon, Ga. London has a bachelor’s degree in industrial engineering from Georgia Institute of Technology and a master’s degree in engineering management from Mercer University. She currently serves on the IGSHPA Advisory Council.

Steve Smith
President & CEO
Enertech Manufacturing, LLC

Steve Smith is a managing partner, President and CEO of Enertech Manufacturing, LLC, which produces GeoComfort, Hydron Module, and TETCO brand geothermal heat pumps at their facility in Mitchell, South Dakota. Smith was introduced to geothermal systems in 1983 as Director of Marketing & Member Services for an electric cooperative in southwestern Illinois, and later managed the startup geothermal distribution company of Soyland Power Cooperative, Applied Energy Systems of Illinois, Inc. In 1996, he and his wife, Karen, started Enertech, Inc., a dedicated geothermal distribution company in Greenville, Illinois, and expanded its territory across the upper Midwest, becoming the largest stocking geothermal distribution company in North America. In 2007, the Smiths, along with additional managing partners, purchased the manufacturing facility and intellectual property of Hydron Module, Inc., located in Mitchell, South Dakota. Smith holds an AAS in Mechanical Technology from Kaskaskia College and a BS in Business from Greenville College.
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Leopold Center

Greenest Building In The World

By Janet F. Reeder
“We knew the project was going to be the highest scoring job in the country,” Brady Farrell says of the Aldo Leopold Legacy Center in Baraboo, Wis. Farrell installed ground-source heat pumps for the project which, has since been dubbed the greenest building in the world by U. S. Green Building Council President Rick Fedrizzi.

The ALLC was built as an outreach of the Aldo Leopold Foundation, to further the philosophy and work of Leopold, an American ecologist, forester and environmentalist who was instrumental in helping set this country’s environmental ethics and wilderness conservation policies.

Farrell, who is vice-president at H & H Industries in Madison, Wis., installed five Florida Heat Pump units for ALLC. Heating and cooling units included three 5-ton, and one 2 1/2 ton. A 2-ton unit is dedicated to hot water.

“It was a really unique project in that all the people who were involved were completely bought in,” Farrell said.

“Most jobs you just kind of build. This one—everyone lived. The ‘buy-in’ was just terrific.”

**Aldo Leopold Legacy Center Draws Attention to Sustainable Building**

The ALLC is described as an exceptional example of a well-designed marriage between sustainable technology and conservation ethics. Built with the specific goal of demonstrating how hu-
man activity, the built environment and nature can be woven together holistically to reap shared ecological benefits, the ALLC is also intentionally a testament to Leopold’s land ethic.

Aldo Leopold Foundation Executive Director, Buddy Huffaker, was a driving force in the project’s design and thoughtful implementation of sustainable technologies.

“The interest the building has gotten from the green design and construction community tells me that—yes, we have done some things differently here,” Huffaker said.

**Highest Rated New Construction LEED Project**

An interpretive center with commercial offices, the ALLC is the highest rated USGBC LEED-New Construction project yet completed. The LEED Platinum project also has been rated by the U.S. Department of Energy as a Zero Energy Building. Efficiency in design and construction allows the ALLC to produce about 10 percent more energy than needed for building operation.

Gregg Tucek with Oscar J. Boldt Construction Company’s Madison, Wis., office, served as project manager for the ALLC. Tucek was impressed with the Foundation’s approach of shifting focus from the actual buildings to the natural spaces they were being built to educate about and protect.

“The Leopold Foundation itself wanted to build a zero energy or carbon neutral building. And in addition, they wanted to use the facility to educate people to be more environmentally sensitive,” Tucek said.

The ALLC project’s approach to energy use, as well as recycled and locally
available materials allowed “a marriage of traditional methods of building and the new technologies like geothermal, photovoltaics and everything else,” Tucek said.

**Radiant System Heats and Cools**

“Because the geo system is so much more efficient at what it does heating and cooling space, it was definitely a piece of the entire puzzle,” Tucek said. Three one-story buildings comprise 11,900 total square feet of space, with a little under 9,000 square feet of that space conditioned through the use of geothermal radiant systems. Variable speed pumps slow down as each zone in the building reaches the desired temperature, saving energy.

A recycled stone aqua duct system channels rainwater from the roof of the main building into a rain garden and holding area while serving as the focus of the courtyard. Photo by Mark Heffron, The Kubala Washatko Architects Inc.
Tucek said the use of radiant cooling was the most unusual aspect of the project for him and that care had to be taken to fine tune that system. Heated or cooled water flows through floor panels in the exhibit hall, library, office area and breezeway to condition the air for the facility.

The main building floor is a system of concrete slabs housing radiant tubing filled with a food-grade glycol, a safe vegetable-based product that prevents water the system uses from freezing. Heat pumps in the basement absorb heat in winter or dissipate it to the loop in the summer. The ground-loop system was designed and installed by Gordy Oosterhouse of G.O. Loops in Randolf, Wis. Sam’s Well Drilling, also of Randolf, completed drilling for 19 geothermal wells 220 feet below the surface. The system utilizes 8,400 linear feet of tubing.

The Leopold Foundation has done a good job of separating the functions of the facility and turning off heating or cooling to unused areas in order to fine tune the energy usage to succeed in their goal of net zero, Tucek said.

Staff controls the system through a Web-based control interface. The Foundation has also used a maintenance contract with mechanical and

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A thermal flux zone acts as a buffer and reduces heat gain and loss between the main office and the outdoors. Photo by Mark Heffron, The Kubala Washatko Architects Inc.
controls contractors who can access systems to respond to operational issues or tweak control settings if needed.

**Designed for Extreme Efficiency**

The Kubala Washatko Architects Inc., of Cedarsburg, Wis., studied ecological and cultural values in considering building placement, using a long narrow footprint to take full advantage of natural daylighting and ventilation.

Joel Krueger, TKWA's project manager says two goals in the design process were to show extreme energy efficiency in a commercial setting and to also show the relative ease of installation of selected systems.

The project’s design team worked hard together to successfully combine new technologies with other low-tech and low-energy but long-proven building approaches to create the best possible design.

TKWA's design allows low-mechanical assistance and minimum user effort for the low-tech, high-yield strategies that provide better than half of the project’s energy savings. The Legacy Center is the first building to earn a LEED Innovation point for carbon-neutral operations.

Careful design utilizes north-facing clerestory windows that daylight the exhibit hall. A south-facing thermal flux zone, with sliding wood doors and operable windows helps manage natural ventilation and solar gain or provides passive solar heating in winter. Stained concrete floors work as a thermal mass and reduce temperature fluctuations while also supporting radiant heating and cooling through the ground-source heat pump system.

**Earth Tubes Provide Ventilation**

A large underground earth tube system supplies tempered ventilation air to the facility in all seasons. An additional component of the GHP system, the tubes greatly improve efficiency for both heating and cooling. Instead of delivering needed ventilation air at Wisconsin’s outdoor temperature range of -20 degrees to 95 degrees, the earth tube system allows pre conditioning of ventilation air to supply it at temperatures that range from 17 degrees to 74 degrees, Tucek says.
Created by burying 66 sections of 24-inch pipe at a depth of 10 to 12 feet, the earth tubes cover nearly 5,000 square feet. A third of the system is underneath the building area. Air from the system is filtered and treated with ultra violet lamps removing any mold and bacteria before it circulates through the building.

“It seems to be a real common sense thing if you can pull it off,” Tucek said he knows of earth tube systems used in Canada and Europe. “You need the space for it,” he said.

One interesting feature of the ventilation system, Tucek also points out, is that the air flow can be reversed. In the winter, the system directs warm air to the floor where it rises and then returns to the mechanical room from near the ceiling. But that changes when the season turns to warmer weather.

“When they are cooling they actually change dampers in the mechanical room, basically reversing the ducts of the system so that air comes in at the top of the room and then falls to the floor where it is returned. I think that is pretty unique. It is the first time I have seen that,” Tucek said.

Financing the Project

The $3.9 million project was started in June 2006 and completed in the
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Awards

Gaining Platinum USGBC LEED-NC, DOE’s Energy Efficiency and Renewable Energy Zero Energy Building (ZEB) and recognition by LEED as their first carbon neutral building set the Aldo Leopold Legacy Center firmly at the pinnacle of all coveted building awards.

Notable among other awards the ALLC has received are:

- The American Institute of Architects - Committee on the Environment (COTE) 2008 Top Ten Green Projects Award

- The Concrete Producer Magazine - 2008 GreenSite Project of the Year – Best Commercial Project

- International Masonry Institute 2007 Wisconsin Golden Trowel Award – Sustainable Use of Masonry – Best in Category

- Forest Stewardship Council – Designing and Building with FSC Award 2007

- Midwest Construction Best of 2008 – Award of Merit

- Wisconsin Builder Magazine – Top Project of 2007

- Wisconsin Sustainability and Energy Efficiency Leadership Award 2007 – Award of Excellence

- Canadian Wood Council / Wood Design and Building Magazine - 2007 Wood Design and Building Citation Award

spring of 2007. Funding for the project came largely from a multi-year Leopold Foundation Land Ethic Campaign. The Kresge Foundation provided a $300,000 challenge grant and a $50,000 green building planning grant. Sweat equity also played a large part as volunteers stripped bark from Leopold pines and contributed in many other ways.

The largest investment in the project was the $240,000 for the solar photovoltaic system. Installation of the system grew from the Foundation’s decided commitment to the net-zero, carbon-neutral building.

**Alternative Technologies and Local Sourcing Important**

Instead of just technological solutions, TKWA’s Allen Washatko said the entire design team was motivated to maintain the incredible ecological and aesthetic inspiration of Aldo Leopold and his family. The design included natural resources from the site and building materials from the area.

Nothing the team designed into the project, except local lumber, would be hard to find in other locations.

The roof-mounted photovoltaic system is one of the largest in Wisconsin. The 39.6-kW array produces more than 110 percent of the Center’s projected needs and is a large factor in reaching the building’s net-zero energy goal. The system includes 198 panels and is capable of generating 60,000 to 70,000 kilowatt hours of electricity per year.

Thinning the forests planted nearby in the 1930s by the Leopold family, improved the forest health and provided 90,000 board feet of wood for the project. Milled locally, that wood and other site-harvested cherry, maple and other woods became flooring, paneling, windows, doors and furniture.

A massive stone veneer fireplace used for supplemental heating was made from reclaimed stone from the Dane County Airport Hangar in Madison. Wood stoves in several areas are used for supplemental or backup heat.

Water saving features include composting toilets, dual flush toilets and waterless urinals. A large recycled stone aqueduct funnels rain water from the standing-seam metal roof into a rain garden and creates a focal point for ALLC’s courtyard.

Huffaker makes presentations to visitors about the energy conservation and sustainable features of the ALLC. “We often like to say that we use ‘state of the shelf’ technology rather than cutting edge,” Huffaker said.

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Various energy aspects will continue to be monitored to ascertain their efficiency and to make any needed adjustments.

Mike Utzinger, University of Wisconsin-Milwaukee School of Architecture, served as the environmental building consultant for the project and continues to assess energy use.

Initial energy modeling was done by David Bradley of Thermal Energy Systems Specialists, LLC, of Madison.

The Future

Huffaker says he sees two distinct audiences who are both interested in the ALLC. One is already more conservation minded. He said it often includes professionals from wildlife, recreation, forestry and other related areas. Huffaker said many of those people often have studied Aldo Leopold’s work and writing. They come and they get introduced to what he calls “the great wave of the green building movement.”

The second audience is composed of architects, engineers, planners and contractors who have never heard of Aldo Leopold. “But they have heard about the building, and then they get introduced to this larger and longer kind of conservation heritage that they didn’t know about.”

It is a created synergy Huffaker feels carries on the tradition of the forester and conservationist the ALLC strives to honor.
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Ground source heat pump (GSHP) technology is used to heat and cool homes and buildings across the world, but at Woodland Park Zoo in Seattle, it supports the life of 18 Humboldt penguins.

The Humboldt penguin exhibit, completed spring 2009, rises to new standards for the care of these endangered birds, for inspiring visitors and for conservation efforts at a sustainable zoo.

The Humboldt's New Home

Woodland Park Zoo has been a home to Humboldt penguins since the mid-1970s. The zoo recently completed its new and improved exhibit designed with nature and comfort in mind. “It is built to provide ways for them to nest, swim and hole-out that reflect their natural behavior,” Project Manager Monica Lake said. “It provides better visibility to guests of all sizes and it incorporates energy and water savings to make it a sustainable exhibit.”

Before building the exhibit, the zoo housed its Humboldt penguins in an older exhibit originally built for sea lions in 1947. “We closed that older exhibit in 2008 to begin construction, sent the birds on to other zoos and brought in a new flock of birds when the new exhibit opened in 2009,” said Rebecca Whitham, public relations coordinator at Woodland Park Zoo.
Humboldt penguins are found along the coast of Peru and Chile in the Humboldt Current and tend to live on rocky mainland shores, especially near cliffs, or on coastal islands, Whitham said.

“The exhibit’s sights, sounds and smells cater to the birds’ natural behavior and social dynamics while immersing visitors in a journey of penguin habitat conservation thousands of miles away,” Whitham said. “Shoreline cliffs, viewable nesting burrow entrances, crashing waves and a beach recreate this endangered species’ Peruvian desert coastal habitat.”

Unlike Antarctic penguins that huddle together in large groups to stay warm, Humboldt penguins seek the security of nesting burrows to warm up or cool down, Whitham said.

A GSHP system was installed in the exhibit in January 2009 and was chosen to maintain ideal temperatures for the birds to survive. “Humboldt penguins do best when their land is hot and their water is cold,” said Celine Pardo, a penguin keeper at Woodland Park Zoo. This made installing a GSHP system ideal for the exhibit because it is able to simultaneously heat the floor of the penguins’ nesting area and burrows and keep the pool water chilled.

With only about 10,000 to 12,000 Humboldt penguins surviving in the wild, the new Woodland Park Zoo exhibit can provide a sustainable refuge for up to 60 members of this endangered species. “The naturalistic exhibit simulates the coastal habitat where Humboldt penguins come ashore to nest,” Whitham said. “This beautiful, natural-looking exhibit mimics Punta San Juan, the desert home of the largest colony of wild Humboldt penguins in Peru.”

The Humboldt’s More Comfortable

Woodland Park Zoo had three goals in mind when choosing a heating and cooling system for its Humboldt penguin exhibit.
The zoo wanted to find a system with the least amount of impact to keep the penguins as happy as possible, as well as a quiet, unseen system for the visitors’ experience that would also be energy efficient, said Rick Grove of CDi Engineers, the engineer and loop designer on the project. With these criteria in mind, only one choice was clear and, thus, a GSHP system was chosen.

The loop field was installed 300 feet below the ground to ensure the penguin pool stays at a constant 55 degrees year round to provide for optimal health and comfort for the birds. “The system keeps it the right temperature without using energy,” Lake said.

But saving energy was only one reason the zoo decided to install a GSHP system in the exhibit. Woodland Park also wanted to avoid the disruption of loud noises created by conventional systems, said Gerard Maloney, of Earthheat Inc. in Duvall, Wash., the geothermal contractor on the project. A GSHP system offered less noise and, therefore, would not interfere with the experience of visiting the penguins.

Those working on the project took extra precautions to ensure visitors and inhabitants of the exhibit would not be bothered by the system or the equipment noise. “We get about 1.2 million visitors a year and about 90 percent visit the penguin exhibit,” Lake said.

To prevent noise from interfering with the exhibit, Gregory Drilling Inc., in Redmond, Wash., drilled eight boreholes at 300 feet deep where the ambient ground temperature remains 55 degrees year round. Photo by Tiana Klineburger in Seattle.
“The penguins appear to be adapting well to their new home and seem to be getting along swimmingly,” Pardo, a penguin keeper, said. “Wild birds, airplanes and other environmental noise and activity has proved challenging at times, but the penguins continue to adapt well.”

Because the system ultimately supports the life of the penguins, one compressor was needed in case of complications with the pump and another was needed in case the first compressor fails. “They need to have some redundancy in the system,” Maloney said.

Apart from typical equipment issues, Maloney said he didn’t run into any problems during installation and there have not been any problems since the system was installed.

The zoo has been monitoring the system and reports it is performing well. “The system is working so well that the tankless water heater will be used fewer hours than originally expected,” Grove said.

The total installation cost for the project was $236,000, and local utilities assisted with the cost. “The system impressed the utility so much that they gave a rebate to the zoo,” Grove said.

The uniqueness of this project came from the basis of the design, which won many awards, including the City of Seattle Design Excellence Award. “It really is the pinnacle of Woodland Park,” Maloney said.

**Humboldt’s Home Now Truly Green**

Not only was the exhibit built to save energy but also to conserve and protect the water used by the penguins. A 1,700-square-foot constructed wetlands area filters backwash water so the pool seldom needs refilling. “We filled the pool in February and have not had to refill it yet,” Lake said.

The exhibit conserves water by filtering storm water on site in two ways. First, it collects rainwater from the roof and uses it to replace any pool water lost naturally through evaporation, Whitham said. All rainwater that falls onto the paths will filter back into the ground to recharge the earth. Second, dirty but nutrient-rich water from the penguin pool trickles through the constructed wetland that was modeled on a natural filtration ecosystem. “Here, plant roots and microbes will naturally absorb these nutrients, returning purified water to the penguin pool,” Whitham said.

Those plant roots and microbes in the constructed wetlands area are similar to those in natural wetlands and filter...
the pool water to rid it of feathers, fish scales and bird excrement. “This means clean water for the penguins and for us, as no pollution will enter our lakes, streams or Puget Sound,” Lake said.

Water conservation methods incorporated into the exhibit also aid its GSHP system. “Water from around visitor paths is directed through pervious concrete to percolate into the soil over the geothermal wells to help maintain the wells in a moist earth environment,” Grove said. The exhibit also incorporates “active water” that aids in evaporative cooling to reduce the cooling load of the system on hot days and is seen by the public as a surge wave coming out of the rocks into the pool, he said.

Using the earth’s natural systems will save the zoo 3 million gallons of water and 75 million British thermal units per hour of energy every year. “That’s like saving 24 million pints of drinking water and heating five new, two-bedroom townhouses each year,” Lake said.

Bears and Tigers Next Geo for Zoo

So far, the Humboldt penguin exhibit is the only exhibit in the zoo that currently uses a GSHP system, but plans to install another in the upcoming Asian bears and tigers exhibit have already been made, Lake said.

“I never thought geothermal would be a life-support system,” Maloney said. “It shined a bright light on geothermal.”

The exhibit was built to conserve energy, as well as water. Water conservation methods keep the water clean and save the zoo 3 million gallons of water a year. Photo by Ryan Hawk.
Surrounded by the Wasatch Front Mountain Range and riparian wetlands, the Utah State Botanical Center’s Wetland Discovery Point in Kaysville, Utah, provides a learning experience for school-age children focusing on the importance of conservation.

Certified LEED Platinum, the 3,300-square-foot facility was designed with ground source heat pump (GSHP) technology and other environmentally friendly features to provide an example of how a green design can function without disrupting the surrounding ecosystem.

LEED Platinum Sets it Apart from Others

The $1.5 million Wetland Discovery Point, completed in 2009, is one of three buildings in the state of Utah, as well as the first Utah State University building, to earn the highest certification by the U.S. Green Building Council according to the USGBC Web site. In addition to a LEED-Platinum rating, the facility also received a Merit Award from the American Institute of Architects. LEED Platinum is difficult to achieve, Utah Botanical Center’s Director David

(Continued on pg. 31)
The geothermal system was certainly one major aspect of a concentrated approach to develop an environmentally sensitive and conservative building. -Anderson

Photo by AJC Architects.
Anderson said. “It reflects the commitment of Utah Botanical Center and the backing of Utah State University to provide leadership on important environmental issues.”

While the primary purpose of the Wetland Discovery Point is to offer a venue for environmental education, its high profile location allows more than 100,000 passing cars to view the visually appealing, yet highly efficient, LEED-Platinum building every day, Anderson said.

**GSHP System Contributes to LEED**

Because the building was designed to focus on net-zero energy consumption, a water-to-water GSHP coupled to a radiant slab was chosen for the building’s heating and cooling system, eliminating ductwork and saving the cost to extend natural gas service.

The need for a single, simple source of heating and cooling that is efficient on an annual basis was important for a net-zero facility, said Stephen Connor, principal in charge at Colvin Engineering Associates Inc. in Salt Lake City, Utah.

“The electric power used by the system, as well as by all building systems, will be offset by photovoltaic-generated electricity, and since that source of electricity is expensive, we needed to minimize the electric demand,” Connor said. “The GSHP provides a very efficient cooling source, and because it is a radiant system with natural ventilation, there are no fans, except small exhaust fans.”

The need for fan energy was eliminated by natural ventilation, as well as the ability to use the same prime-source equipment for radiant heating and cooling—both of which contributed to the building becoming LEED-Platinum certified, he said.

With a net-zero goal, a 5-ton closed-loop system was installed adjacent to the building. “The building site is in the middle of protected wetlands, so the footprint needed to be minimal,” Connor said. “With that in mind, we chose a loop field as close as possible to the building with the shortest feasible pipe run to the mechanical room.”

The system required five boreholes, which were drilled in June 2008 by Geo Energy Systems Inc., located in Cedar
City, Utah. Drilled by a Sonic rig, the target production was one 4 1/3-inch bore per day for five days, Spence Bowman of Geo Energy Systems said.

Thermal grout 1.07 was used to surround each 300-foot borehole’s pipe. The borefield contains 600 feet of 1 ¼-inch high-density polyethylene vertical-loop piping that circulates water, Bowman said.

While no major problems occurred during the borehole drilling, Bowman said they had to be creative when looking for a water source. “The building is surrounded by a wetland pond, but because of the state’s regulations, we couldn’t drill into the pond water,” Bowman said. “We have to use disinfected water during the drilling process.”

Mark Smith of Sound Geothermal Corp., explains another reason why a pond loop wasn’t utilized. “The depth of the pond is only approximately 6 feet,” Smith said. “A vertical borehole system was the least invasive approach to providing geothermal heating and cooling on a sensitive site.”

Drilled by Geo Energy Systems Inc. in Cedar City, Utah, the closed-loop system required five boreholes drilled 300 feet deep. Photo by Gary Neuenswander, Utah Agricultural Experiment Station.

Sound Geothermal Corp. in Sandy, Utah, designed the geothermal loop field and played a large role in the project. “We have worked closely with South Geothermal here in Salt Lake City, and they have been invaluable in coordinating thermal conductivity testing and loop field installation,” Connor said.

Inside the Wetland Discovery Point, the system consists of one Florida Heat Pump unit, which has a capacity of 37,000 British thermal units per hour, he said.

“The building modeling predicted more than 50 percent savings compared to the American Society of Heating and Air-Conditioning Engineers (ASHRAE) 90.1 2004 baseline with a payback in approximately 15 years,” he said.

In addition to using a GSHP system, Wetland Discovery Point uses flat-panel solar collectors to supplement hot water production for the building’s showers, sinks and radiant floor heating.

“If the solar tank is warmer than the building loop, and there is a call for heating, we extract heat from the tank and inject it into the building loop,” Connor said.

**Green Design Contributes to LEED**

“The geothermal system was certainly one major aspect of a concentrated approach to develop an environmentally sensitive and conservative building,” Anderson said. “LEED is a point-based system – the more points you earn, the higher the certification. So, site preparation, building materials, environmental sensitivity, system selection and looking at the entire project as a whole are critical.”

Built on the edge of wetland ponds and elevated over the floodplain, AJC Architects designed a building that incor-
The project was able to achieve 44.5 percent recycled content, according to LEED calculations. - Jones

Photo by AJC Architects.
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The Astec EarthPro Geothermal 4550X

Through extensive field studies with geothermal system installers and incorporated suggestions by veteran drillers, the Astec EarthPro Geothermal 4550X is designed to meet the specialized demands of geothermal system installations.

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- **Automated Pipe Loader System**
  A single operator can drill and trip out up to 600 feet (183 m) of pipe without winch assistance. Its pipe basket can hold up to 30 pieces of 20-foot (6.1 m) pipe in 3.5, 4, or 4.5 inch (89, 102, or 114mm) diameter. Rig is capable of drilling at depths in excess of 2,000 feet.

- **Central Ergonomic Controls**
  Dual multi-function joysticks are mounted on a console with adjustability for height and angle to reduce operator fatigue. The multi-functional LCD display provides data on drill operation in easy-to-understand terms.

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Also available is the EarthPro Geothermal 4550 truck-mounted version.
incorporated a number of green features that contributed to its LEED-Platinum rating. “Being that the Wetland Discovery Point is intended to teach and educate about nature and sustainability, it was intentional that the project illustrate as many sustainable strategies and technologies as possible—the building is the learning tool,” said Jill Jones, managing principal for AJC Architects.

From its architectural style to its materials and construction, Wetland Discovery Point offers an indoor and outdoor learning experience for more than 4,000 K-12 children each year, Jones said. The building’s V-shaped roof not only reflects the wings of the riparian wetland birds and insects that populate the area but also collects rain and snowmelt that are channeled to a cistern. The harvested water is then used to flush toilets and irrigate a landscape consisting of native and adapted plants that require a limited amount of water, she said. “The Utah Botanical Center has an extensive drought-tolerant planting concept for the project, and the irrigation system will only be in place for one year until the indigenous vegetation is established, after which the system will be eliminated,” Jones said.

To reduce mechanical operation costs, a 24-inch thick concrete trombe wall runs through the core of the building, Jones said. The wall acts as a thermal mass to collect the sun’s heat and redistributes it slowly throughout the night.

Not only was sustainable design taken into consideration during construction, but other environmentally friendly features were also implemented. The building utilizes low volatile organic compound paints, carpet and adhesives to improve indoor air quality. All the wood used for the structural beams and doors is from Forest Stewardship Council certified forests. Features, such as countertops and carpets, were purchased within 500 miles of the site to reduce transportation. The countertops and carpets, as well as steel and glass are high in recycled content. “The project sought to maximize the amount of recycled content,” Jones said. “The project was able to achieve 44.5 percent recycled content, according to LEED calculations.”

**LEED Platinum Contributes to Overall Mission**

“Utah State University has a strong commitment to be a leader in resource conservation,” Anderson said. “USU is in a great position to be an example—demonstrating ways to conserve, live more sustainably and maintain or improve quality of life.”
Frank Lloyd Wright designed with the environment in mind. With influences taken from the land, he sought not to create barriers to the outside world but to invite it in.

Wright is still widely considered an American architecture legend thanks in part to his signature Prairie Style. None of his works included a ground source heat pump (GSHP) system, but in a present-day restoration benefitting the 1908 Westcott House, environmentally friendly geothermal heating and cooling preserves one Wright masterpiece.

**From Construction to Restoration**

Burton J. Westcott, an entrepreneur, and his wife, Orpha, a forward-thinking woman of the community, commissioned Wright to design their Springfield, Ohio, home. Wright, recognizing the significance of The Westcott House to his developing Prairie Style, included the home in his 1910 Wasmuth Portfolio, the first major publication of his architectural designs, according to The Westcott House Foundation’s Web site.

After the passing of both Burton and Orpha in the 1920s, the house was divided into multiple apartments in the 1940s, undermining the home’s original design and purpose. In 2000, The Frank Lloyd Wright Building Conservancy purchased The Westcott House, which is on the National Register of Historic Places, before selling the home to The Westcott House Foundation with the intent that the newly formed nonprofit would restore the property’s historic charm, according to the Web site.

An experienced restoration team, including lead architect Chambers, Murphy and Burge Restoration Architects and engineering firm Schooley Caldwell Associates, took on the more than four-year task. “We were fortunate enough to have historic restoration architects that were really in tune with the Secretary of Interior standards,” said D. Shane Beckwith, project manager of The Durable Restoration Company, the contractor in charge of construction. “We all worked together to be able to come up with creative solutions.”

Restoration efforts included stabilizing the structure, re-finishing the home’s wood floors, trim and stucco, restoring windows and art glass, and replacing the red clay tile roof.
Projects, such as recreating the original reflecting pool, landscaping with the aid of Wright’s plans and refurbishing urns, which frame the front of the house, were incorporated in the exterior renovations. Layers of post-1908 paint were stripped away, and a number of modern mechanical systems were installed.

“We’re not fully possessed and obsessed where we have to use vintage and certain things, but we try to be practical about it, using the modern technology that we can without damaging the historic fabric that we have,” Beckwith said.

The Modern Day Heating and Cooling Solution

Wright always pushed the envelope, but that’s just one reason a geothermal system, a newer technology, was chosen for the Wright-designed home. “All along through their design, the architects wanted to go with a geothermal system,” Beckwith said. “We knew in the long run it would be more energy efficient for the operating expenses for the owner.”

Another consideration the restoration team made was preserving the look and feel of the home. Maintaining the historic integrity was essential for the house turned museum that would transport its visitors back to the time of the Wescotts. “We didn’t really want to have the sound or visual impact of having exterior units on the outside of the building,” Beckwith said. “We wanted to have the exterior look as much like it could in 1908 when the building was built.”

Wright worked to create flow not only from room to room, but he wanted those things that make up a house to be a part of the home just as his homes seamlessly became part of their natural surroundings. In the Wasmuth Portfolio, he wrote, “To thus make of a dwelling place a complete work of art, in itself as expressive and beautiful and more intimately related to life than anything of detached sculpture or painting, lending itself freely and suitably to the individual needs of the dwellers, an harmonious entity, fitting in color, pattern and nature the utilities, and in itself really an expression of them in character—this is the modern American opportunity.” Wright hid radiators and designed wall hangings and floor coverings to be part of the home, according to the Wasmuth Portfolio.

Preservation not only meant protecting the visual appeal but also guarding the composition of the building itself. “With the historic woodwork in the building, it had plaster...
Beckwith said, “We wanted to have the temperature controlled in a way that it would rise and it would fall and it would be more constant instead of having quick shots of heat and quick shots of cool, so we wouldn’t damage the historic fabric of the building.” The geothermal system fit that need ideally, he said.

The GSHP systems’ digital controls can be programmed for ramping up or ramping down for day-to-day activities and various functions and events, Beckwith said. One closed-loop system serves the nearly 6,000-square-foot main house, which was originally designed to have a boiler system, and another closed-loop system was installed for the 1,670-square-foot garage that now functions as the museum’s visitor center.

The main house’s original radiators, strategically placed throughout the house, were an integral part of the building and were reused using water-to-water heat pumps, not changing the visual impact of the building, said Troy Coffman, project manager of LoopMaster International. The main house also features forced air through Hauck Bros. Heating & Cooling’s delicately designed ductwork and water-to-air heat pumps.
A total of five units supply the house, and forced air provides heating and cooling for the garage via two water-to-air units.

In 2004, Crabtree Drilling, of Springfield, Ohio, drilled 14 boreholes at the desired depth of 200 feet in a bore field in front of the house facing High Street. Care was taken in the large front yard to not invade the gardens and reflective pool or damage the historic urns, which are the largest urns of any Wright property, Beckwith said.

A second bore field of eight boreholes was drilled in the backyard between the house and garage. The mud rotary drill rig met target production of two bores per day, and none of the 5-inch bores required casing. Crabtree Drilling was also responsible for inserting the polyethylene loop pipe, as well as grouting, Jacob Crabtree said.
Since the restoration was completed in 2005, The Westcott House operates as a museum offering public tours Wednesday through Sunday.

“It is quite a fantastic nonprofit, just the outreach that they do,” Beckwith said. “They’re still giving an enormous amount of tours through this economic depression that we’re having. They’re still able to generate enthusiasm to have a lot of people visit the house and offer outreach with children. It’s actually a model for nonprofits of how can you weather the storm and what can you do with partnering with other organizations to keep yourself alive.”

Wright may be known for his art glass windows and horizontal lines that mirror the land of the Midwest, but as his designs age, GSHPs may be the solution to conserving his lifetime of work. The buildings he designed will continue to be marveled for generations, but with geothermal heating and cooling, visitors and admirers can see Wright’s vision the way he did, and Wright-inspired nonprofits can reap the energy-saving benefits.
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Value Engineering

Late last year I attended an educational webcast on the new LEED version 3. Good program, well presented, and very helpful – EXCEPT FOR ONE POINT! Near the end of the program the presenter urged caution about allowing Value Engineering (VE) activities on a LEED project indicating something along the line that VE activities are “just reducing scope to reduce cost and could jeopardize LEED points.” Reducing scope is not the only basis for VE proposals. Like many of you, I have seen the ground heat exchanger designs with undersized or oversized loops, header piping systems that can not be properly flushed/purged, designs that use a vault on an eleven borehole well field, or other issues that are, after evaluation, inappropriate. The same can be said, although less often, about the inside mechanical work. Using a VE approach for correcting or improving a system design with problematic issues is meeting our obligation to provide the client with a properly functioning and satisfactorily performing GHPS both at commissioning and over the life of the system, not arbitrarily reducing scope. VE works to provide an improved, as well as cost effective, GHPS design and installation that still meets the specified requirements of the structure and qualifies for related LEED points.

Mr. Rawlings has more than 30 years experience in the geothermal industry. He is a Certified GeoExchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.
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