GEO OUTLOOK

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Greensburg is Back in Business

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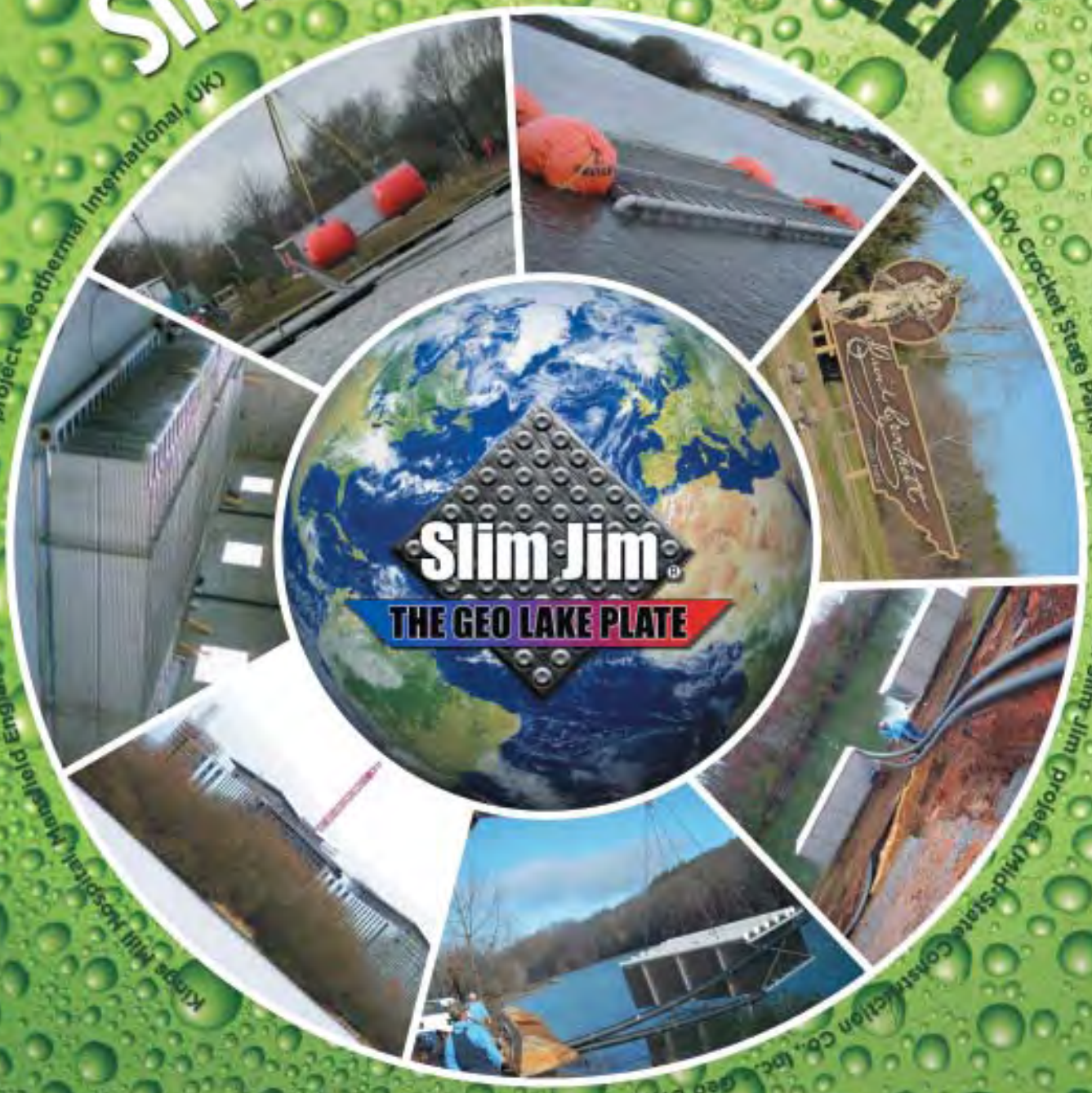

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Directors' Forum

Notes from GHPC

By John Kelly
Executive Director,
Geothermal Heat Pump Consortium

Green is definitely the color of the decade! So it's fitting that Greensburg, Kan., is going green, too. In recovering from the F5 tornado that devastated the town in 2007, Greensburg has adopted a Long-Term Community Recovery Plan that aligns with its new slogan of "Greensburg: Better, Stronger, Greener!"

The plan embodies a simple guiding principle: "keep the things that have made Greensburg and Kiowa County a good place to live, work, and own a business, and then suggest ways to build upon strengths of the community to make it prosperous, appealing, livable, and sustainable."

The sustainable building program seeks to identify and utilize energy-efficient alternatives and create community renewable resource opportunities. Environmental quality can be enhanced by using geothermal heat pump systems to provide heating and cooling without any impact on local air and water quality. Renewable energy employs local professionals and trades to manage, install, operate and maintain the systems, allowing money to remain in the community producing more jobs rather than being exported from the town to import energy. And renewable energy mitigates the risk of energy supply interruptions and the impacts of energy price spikes on the local economy.

While few of us will ever experience what the people of Greensburg did, their progressive approach to rebuilding provides a role model for communities planning for a greener future.

Notes from IGSHPA

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

This issue of Geo Outlook is a special tribute to a community, not so much for its commitment to sustainability, but to its leadership at a time in which it could have given up because of a devastating tornado that nearly leveled the small city. Very few communities are faced with the decisions that had to be made at a time when there were few experiences to draw from, yet Greensburg, Kan., found a way.

Many of us in the geoexchange business collaborate with individuals, community leaders, etc. when time for careful planning is available. We talk of starting with a clean sheet of paper and imagine what dreams could be accomplished if only given the opportunity. Well such an opportunity was made available to a community that was not seeking to be in the limelight! While they work hard and tirelessly, we will benefit by being able to share from their experiences.

This story is a commitment by our staff to share some special benefits that come from an association of members who, for many reasons, have chosen to make a difference in the lives of individuals and groups.

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Tom Huntington came to WaterFurnace Renewable Energy, Inc. as president and CEO in May of 2009 from Johnson Controls Inc. From 2000 to 2005, he served as president of York's $1 billion Unitary Products Group, then led the same division four additional years, following the acquisition of York by Johnson Controls. Prior to York, Huntington served as senior VP of engineering, and VP of global sales and marketing at Bristol Compressors. From 1992 through 1995, Huntington helped grow Evcon Industries from $35 million to $150 million in sales prior to York's acquisition of the company. He is a member of the Planning Board for the Air Conditioning, Heating, and Refrigeration Institute, former chairman of the Gas Appliance Manufacturers Association, and a member of the board for North American Technician Excellence. He holds a master of science in engineering administration from Syracuse University and a bachelor of science in electrical engineering technology from Rochester Institute of Technology.

Jeff Hammond

Vice President, Marketing and Product Development
Enertech Manufacturing, LLC

Hammond joined Enertech Manufacturing LLC in 2008 with 22 years of experience in the geothermal industry. Hammond's experience in the industry ranges from positions in research and development, engineering, training, sales and marketing. Before joining Enertech Manufacturing, Hammond worked at ClimateMaster for nine years and at WaterFurnace International for 12 years. He earned his bachelor's degree in business administration from the University of St. Francis in Fort Wayne, Ind., and an associate of applied science in electrical engineering technology from Purdue University in West Lafayette, Ind. Hammond has been a member of ASHRAE since 1990, has served on IGSHPA technical committees for geothermal standards and training, and is currently a member of IGSHPA's advisory council. His current projects include developing new product lines for TETCO Geothermal, GeoComfort and Hydron Module brands of geothermal heat pumps.

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Editor's Letter

Greensburg and Geo Outlook

A May 4, 2007, tornado changed Greensburg, Kan., forever. If you ask the locals they will tell you they will never forget–but they have moved on past the storm that put them on the world's stage. Everything they do as a community today has two purposes: sustainability and honoring their roots in the small southwestern Kansas community that now has 800 residents, down from the 1,400 people who once lived, worked and played there.

Early in the process of making decisions, Greensburg's leaders made a huge leap into the future. They knew the old Greensburg was like every small, rural community in America, a comfortable but stagnant and slowly dying town full of history and buildings built nearly 100 years ago.

The choices they made led them to give serious thought to the next 100 years. In a short span of time when they literally had nothing to lose, they set themselves to the task of learning and adopting the most promising sustainable technologies available.

When I first came to the International ground Source Heat Pump Association in 2008, I realized that Geo Outlook needed to find a way to tie into the progressive activity of this little community, a community that stared tragedy and devastation down and elected to plan for a future with far more than it had ever had. Our visits to Greensburg revealed even more use of geothermal technology than expected. I am pleased to dedicate this entire issue to the people of a remarkable city that through disaster gained hope and vision.

From current Mayor Bob Dixson to City Manager Steve Hewitt, County Commission Chair Gene West and a long list of other leaders–and the many businesses and residents who are rebuilding sustainably–your example is powerful in a time when our country needs to embrace changing and amending its attitude and allocation of natural resources and energy.

Today, Greensburg is a showcase for our technology. It is unlikely there is another place on earth where you could find the variety of installations of ground source heat pumps coupled with other alternative energy-efficient measures within walking distance of each other. It is certain that no other small town has the same high percentage of residents who can and do discuss knowledgeably the benefits and return on investment of geothermal systems.

GreenTown's Chain of Eco-Homes could become an excellent showroom–or as GreenTown Director Daniel Wallach says "living tradeshow"– for our industry to educate thousands of eco-tourists who are already visiting Greensburg to see what the green buzz is all about there. Small businesses and industries are sorely needed and are being actively recruited to support the growing economy in Greensburg. The Planet Green's ongoing program documenting the recovery efforts of the town has provided Greensburg a worldwide stage to show how serious it is about sustainability. Its stage will continue to provide our industry needed and credible exposure to the public.

Geo Outlook is proud to share these stories of the forward thinking and state-of-the-art energy-efficient products and technologies Greensburg is determined to incorporate into what looks to be the greenest town in America.

Janet

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Greensburg is Back in Business

By Janet F. Reeder

"Welcome to a LEED Platinum building," Bob Wetmore proudly proclaims while sitting behind the desk in his new office in Greensburg, Kan. He can explain his pride. It is also shared throughout the community, a place where there are other LEED Platinum projects still on the drawing table or already under construction.

As executive director of the Kiowa County Economic Development Corporation, Wetmore describes the new Sun Chips Business Incubator in Greensburg as the "nerve center" for the community. He says it is also "extreme green" and offers an example to the rest of Greensburg as well as the country for what is possible in pursuing energy savings in a building.

And the rest of the country is watching, at least on television, as Greensburg's rebuilding efforts play out on Planet Green's second season of "Greensburg." The show focuses on the recovery of the small, tornado-devastated rural community and has brought a noticeable influx of visitors to town to see first hand what rebuilding Greensburg green is really all about.

Wetmore's diverse background in public relations from a large Chicago firm might make him appear out of place, but he is actually only one of a growing number of professionals who have chosen to return to Greensburg to aid in rebuilding efforts. Although not originally from Greensburg, he grew up within a short drive in neighboring Dodge City, Kan.

He credits real efforts to get things going again for businesses to return to Greensburg to Jeanette Siemens, a local resident and predecessor who is now retired. Wetmore said Siemens came in as interim economic development director and started planning for the return of Greensburg businesses out of a tent right after the tornado.

The Sun Chips Business Incubator is one of the most popular stops on the recently established GreenTown Tour of the city's Green Initiative projects. Wetmore says that millions of dollars of planned effort could not buy the kind of diversity found in Greensburg today.

Key to the economic rebuilding of Greensburg's downtown, the Sun Chips Business Incubator is set to house local businesses and provide vital economic infrastructure. The building is filling up fast with tenants. Dedicated April 26 this year, just short of the two-year May 4 anniversary of the town's destruction, the building is the first the City of Greensburg has built.

Kansas State Highway 54 frontage of the Sun Chips Business Incubator shows the striking roofline and architectural style of the building. (Photo by Janet F. Reeder)

With 9,580-square-feet of retail, office and commercial space the two-story facility is set to house five street-level retail shops and nine second-level professional service offices. A safe room that serves the community as a storm shelter is also incorporated into the structure.

Total project cost excluding land was $2.9 million. Financial contributions include a $1 million donation from Frito Lay's Sun Chips Division and $400,000 from the actor and environmental activist Leonardo DiCaprio. The City of Greensburg, Rural Development and USDA funds were also needed to make the project happen.

Energy efficiency in the design and construction includes a well-insulated building envelope, extensive use of day lighting, controlled high-performance lighting, rooftop photovoltaic applications and ground source heat pumps. Together these features reach modeled energy savings of approximately 57 percent.

Susan Reinecke shows off a piece of stained glass made from glass salvaged after the Greensburg tornado. Reinecke and her husband Scott own Studio 54, one of the first businesses to open in the Sun Chips Business Incubator. The couple invested their retirement money to stay in town and open the stained glass gallery. (Photo by Janet F. Reeder)

Waldinger Corporation's Wichita division installed a multistage geothermal heat pump system to heat and cool the Sun Chips Business Incubator. Kelly Kreie, with Waldinger, said the closed-loop forced-air system uses 15 FHP ECO and ESO Series units. Kreie said the system incorporates "a wheel unit that pre-cools and pre-heats" as part of the energy recovery ventilator (ERV) system. One pump is designated to work with the ERV for efficiency.

Kreie said his crew has been pleased to be in Greensburg. "Just to be a part of the rebuilding has been very satisfying," he said. Projects there have given many contractors their first real opportunity to work on LEED designed commercial buildings. "We wanted to be on the frontline there," he said. Waldinger's work force has employees who grew up near Greensburg, and Kreie said they tried to use as many local contractors as they could for their projects.

High-efficiency motors, fans and thermodynamically controlled economizers with demand-control ventilation and CO2 sensors are also employed for each pump. Energy Efficiency Ratio (EER) ratings range from 14.1 to 18.7 for cooling and coefficient of performance (COP) from 3.1 to 3.8 for heating. Bathroom exhaust fans that provide the minimum outdoor air for each space utilize ERVs with a 70 percent efficiency rating.

Because the interior design of the building leaves the ceiling open for viewing to showcase all energy features, the plenum return is not ducted, Kreie said. Waldinger started work in the summer of 2008 and finished its part of the project in April 2009.

Mike Peterson of Peterson Irrigation in Lindsborg, Kan., drilled 22 boreholes at 340 feet deep for the vertical loop. Peterson has been working in Greensburg since right after the tornado. The Sun Chips Business Incubator was the first of a number of government, commercial and residential geothermal projects Peterson has been involved with in Greensburg. He said his efforts there have also been featured on the Planet Green.

Troy Coffman, with LoopMaster International Inc. out of Indianapolis, Ind., oversaw the installation of the loop. Coffman said 1-inch SDR-9 polyethylene pipe was used down the well. The project used a total of 16,960 feet of pipe in 1-inch, 1 1/2-inch, 2-inch and 3-inch dimensions, all manufactured by Centennial Pipe, Coffman said.

"LoopMaster worked well with all the other trades on site with limited area for the tie-in," Coffman said. "It was a basic geo loop without any problems." LoopMaster completed the tie-in for the system in November of 2008.

LoopMaster became involved in the Sun Chips Business Incubator because of previous work with Peterson Irrigation. "LMI was brought to the table by Peterson," Coffman said. We have worked together on several projects in Kansas and have become a very efficient team."

"Greensburg is the only community LoopMaster has worked with that has committed to rebuilding 90 percent towards green," he said. Coffman said it has been a rewarding experience for him and his company to be helping in those efforts.

Insulating concrete forms used for the walls provide continuous R-22 insulation and high wind protection, with continuous R-30.3 deck roof insulation. The fiber-cement cladding also added significantly to the high-energy performance of the building's exterior envelope.

A rain screen system with cement fiberboard panels that reduce long-term maintenance costs and provide moisture protection is also incorporated into the exterior cladding. The slab perimeter includes an additional R-10 insulation.

Other energy-saving features employed by the Sun Chips Business Incubator include a rainwater collection system that provides 94.5 percent total water savings. A recycled gray water system is also used. Waste diverted from the landfill during building construction totaled 419,600 pounds. Building material used on the project included 25 percent recycled material.

Window glass heat transfer rate, or U-Value, is rated at 0.28, with a solar heat gain coefficient of 0.27 and 63 percent visible transmittance. Skylights used are rated with a reduced solar heat gain coefficient which is less than that of conventional skylight units.

The geothermal mechanical room of the Sun Chips Business Incubator where everything is open to view, is a popular feature of GreenTown's tours of sustainable buildings in Greensburg. (Photo by Janet F. Reeder)

Orientation of the building was considered for the storefront, with glazing oriented for optimization of both north- and south-facing day lighting and passive solar gain. Summer solar gain is controlled through overhangs. Recessing east glass also minimized morning glare and solar gain.

Strategic window placement of south facing clerestories and skylights allow most of the building to be lit by natural daylight, allowing less use of artificial lighting and significant energy savings. Retail and conference areas utilize continuous dimming controls while

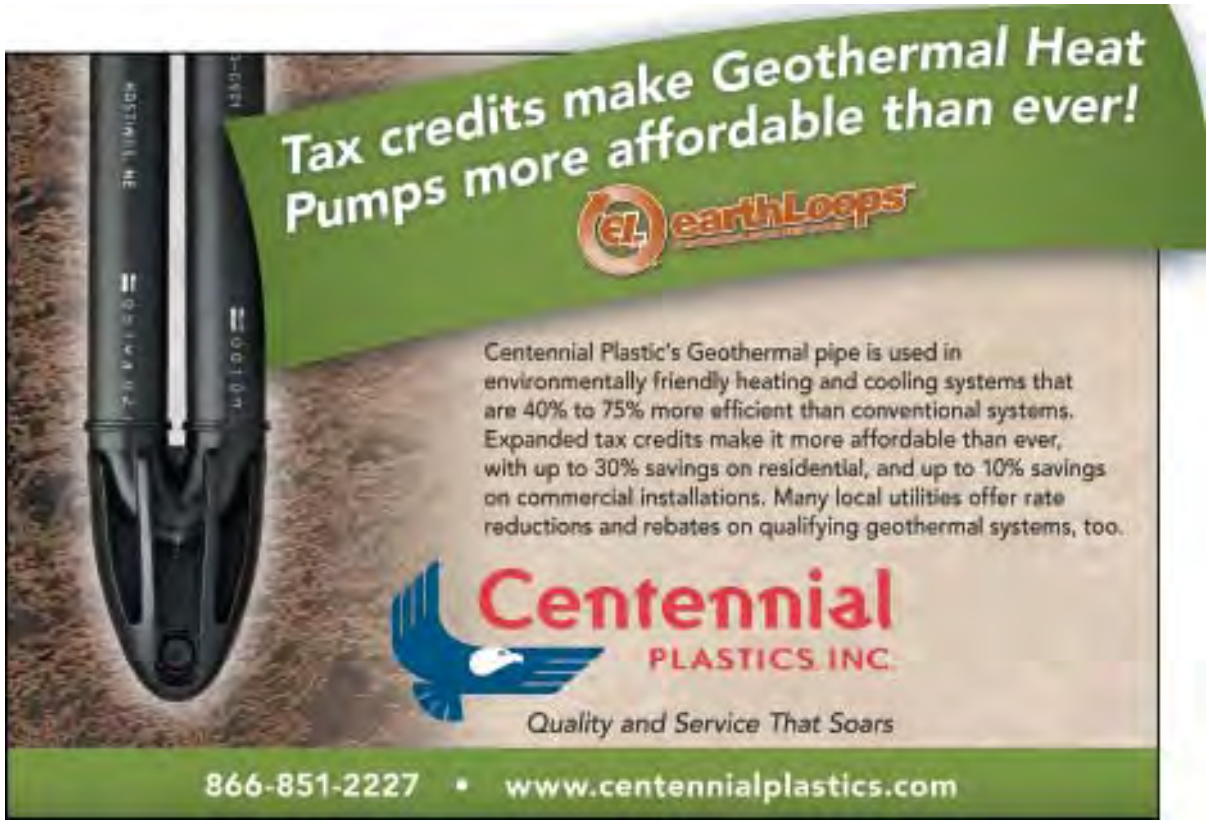
office areas have three-step dimming from 100 percent, 50 percent and off. A 33 percent reduction in lighting power density from a conventional building is expected. Motion sensors are in use in all areas except for retail space.

The Sun Chips Business Incubator's photovoltaic system is comprised of a 6.8 DC kW PV rooftop installation set to provide an estimated 10 percent of the building's total energy needs and should offset the peak power anticipated.

Wichita's McCluggage, Van Sickle & Perry Architectural firm designed the building. Contractor for the building was Compton Construction Corporation, also of Wichita.

◆

La Terra, a shop specializing in natural mineral makeup and skin care essentials, is also located in Greensburg's new Sun Chips Business Incubator. Glenda Nichols, owner of La Terra, is a certified natural health practitioner and certified massage therapist. She is also certified in aromatherapy. (Photo by Janet F. Reeder)



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Rebuilding Home is Family Affair

By Linda Allen

Starting over – from scratch – is not what most people plan or even want to do in their retirement years. But when nature has its way with your home and your life – Midwesterners do what they have always done – get tough and rebuild.

Mabel Schmidt, a retired Greensburg, Kan., nurse in her 80s, is doing just that. Her 2007 tornado experience could have convinced her to leave and never come back to Greensburg where she has lived all her life. Many did leave, choosing not to deal with the destruction and memories.

As the sirens screamed their warning on May 4, 2007, Mabel and a visiting brother and sister left her home and sought shelter in the basement of the Greensburg Mennonite Church, barely 10 minutes before the storm struck. They finally emerged from the rubble of the church 12 hours later, located by a K-9 search and rescue dog.

Joel Schmidt examines the plans for the home he is building for his mother in Greensburg. (Photo by Janet F. Reeder)

Her son, Joel, rode out the storm huddled in a ditch south of town. When he got into Greensburg he had to abandon his truck because all the streets were blocked with debris. Navigating on foot without familiar landmarks anywhere, Joel finally managed to get to his mother's home to find only the foundation was left.

"We feared the worst," he said. "We didn't want to think of the possibilities. She could have blown away. Nothing remained of her house except a few garage items, some clothing,

books, old and new coins, my dad's wedding ring and family pictures."

Rebuilding Mabel's home has become a family affair. Joel took on the challenge to build a new home for his mother. She's always wanted a new house, he said. James Schmidt, a cousin and architect, designed the 1,750-square-foot ranch-style home with lots of ideas and input from Mabel. Two brothers and Joel's son, Logan, make up the rest of the family construction crew.

The Schmidt house is one of the first houses in Greensburg to incorporate energy-saving ground source heat pumps. Mabel wants to go as green as their funds will allow.

"Cost was one of the biggest reasons we chose geothermal," Joel said. "We had to put in a heater and air conditioner anyway, but the difference in the cost of a standard high-efficiency furnace versus geothermal should pay out in about five years."

The ground source heat pump system is located in the basement of the new Schmidt home. The large basement is also well insulated and will have several extra bedrooms when finished. (Photo by Janet F. Reeder)

Mike Weber of Weber Refrigeration and Heating in Dodge City, Kan., with 20 years of experience in geothermal, worked with Mabel and Joel to calculate installation and utility costs. He used a comparison of natural gas, electric and heat pump systems.

The geothermal system cost $27,000, about $10,000 more than a conventional heat and air conditioning system. The geothermal system qualifies for the American Recovery and Reinvestment one-time tax credit of 30 percent of the total cost of the system. In addition, Carrier offered a factory rebate of $600 on the system they chose. The tax credit and rebate brought the cost of the system down to about $18,000.

Weber further projected annual utility savings over the other systems at $416. "Without any increases in energy pricing this is a simple return on investment of 21 percent," he said. Weber used a 6 percent expected annual inflation of energy pricing, which shows the geothermal system would save about $15,000 over 20 years.

Sticker shock for the upfront installation of a geothermal system keeps many homebuilders and owners from using the technology. Weber is an enthusiastic advocate of the long-term return on investment. "All green technology ideas and costs need to be based on return on investment," Weber said. "I'm excited about geothermal. I think anyone who knows all the facts would buy geothermal."

Weber installed a Carrier YDV 3-ton heat pump unit with a heat recovery ventilator. "One unique thing we

do is size heat pumps for both heating and cooling modes so people won't have to use supplemental heating and cooling," he said.

Mike Peterson of Peterson Drilling in Lindsborg, Kan., drilled the boreholes. Three wells support the system: one at 205 feet deep and two at 190 feet deep, arranged in a tripod formation.

The system uses 3/4-inch SDR11 polyethylene pipe, grouted with Baroid Benseal, specifically for residential use. It is not thermally enhanced. Each well has its own valve system to determine and regulate flow. Peterson drilled many of the geothermal wells in Greensburg and has enjoyed being associated with the community's efforts to build and live sustainably.

Besides housing the heat pump, the two-bedroom basement also has a Healthy Climate humidifier. Instead of using vent fans in the bathrooms, the unit draws air from each bath and the utility room. It exhausts air to the outside and draws fresh air in through the heat exchanger.

Logan designed the control panel for the system. Viega donated a MANABLOC® Homerun Water Distribution System for each rebuilt or repaired home in Greensburg. The system supplies hot and cold water for a typical 1,200-square-foot home and includes a Viega PEX Press MANABLOC®, tubing and all fittings required to operate the system.

To help lighten the spirit of volunteers and workers, someone has painted a happy face on the basement floor of the Schmidt home. (Photo by Janet F. Reeder)

The system uses two water heaters. One will receive and store water from the geothermal system. Joel said he gets almost 100-degree water from the one that

A rambling ranch-style home, the Schmidt house will have a stucco finish to complement the unusual roof made from recycled beverage cans. (Photo by Janet F. Reeder)

heats the house – another energy and cost saver that allows about 50 percent free hot water.

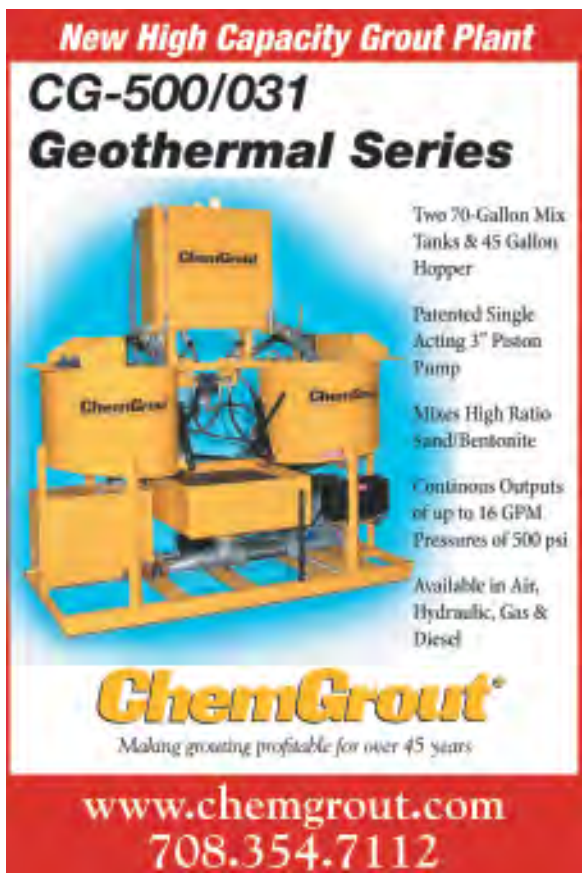
Additional energy-saving features in the three-bedroom, three-bath house include low-E argon-filled Kolbe windows, insulated concrete panels, Energy Star appliances and a breezeway to enjoy prairie breezes and the view.

Shingles for the roof are made from 98 percent recycled aluminum beverage cans. They have a 50-year warranty and are designed to withstand 100-mph winds. Exterior finish will be three-coat masonry stucco.

Volunteers from across the country and Canada have helped with the construction. A plumber from Pennsylvania roughed in the plumbing in the baths, and a group of students from Tagwi High School in Avonmore, Ontario helped install shingles.

Joel admits his first efforts at sustainable green building have included a major learning curve but have been fun, exciting and at times challenging. From the experience, he and Logan have formed J & L Construction LLC.

It's been an unsettling two years since the big storm. Mabel lived in the FEMA Park until it closed. She now stays with Joel and his wife, Patsy, until her new home is ready. Joel hopes she can move into her new home by the end of summer 2009. Until then, he tells everyone who asks, "It'll be done in two weeks." He doesn't say which two weeks.



Greensburg City Hall in an Elite Class

By Janet F. Reeder

Greensburg's City Hall exterior and interior has more than 50,000 reclaimed bricks from the city's original power plant, natural day lighting windows and water catchment systems on the roof. (Photo by Janet F. Reeder)

The Sun Chips Business Incubator and the silo from Farmer's Grain and Supply Company can be seen in the background of what will be the Main Street entrance to the new Greensburg City Hall. (Photo by Janet F. Reeder)

J. Michael Gurnee recently watched the drilling for the geothermal loop for the new Greensburg City Hall from his office in a temporary trailer across the street. Until the new building is finished, city offices will remain in the generic looking structures that have lined several main corridors of downtown Greensburg, Kan., for the past two years. The new building is nothing like the rectangular office trailers spaced around several quads used to keep the city in business.

Berkebile Nelson Immenschuh McDowell Architects (BNIM), of Kansas City, Mo., designed the new city building to LEED Platinum standards. And if the finished product meets the design specs, the citizens of the small Kansas community might have the first LEED Platinum city hall in the country. The city will celebrate at the opening, but it won't be the city's first high-ranked project as Greensburg already has three LEED Platinum buildings.

Gurnee is community development director for the City of Greensburg. He said following the recovery construction process has been educational for him and many of the city's employees.

"Greensburg passed a resolution in city council that all public buildings over 4,000 square-feet would be built to LEED Platinum standards," Gurnee said. "The building will be used for city offices and council meetings and any and all types of public meetings. The council chambers can be used as a meeting facility."

Gurnee's description of the building as "very modern in style" is an understatement. Architectural features of the Greensburg City Hall easily set it apart from any other city halls around the state and country.

"It's the way to go," Gurnee said. "It is what's needed to create the energy efficiency we want. But when you get down to the real details, it is the points on the LEED also. But it all comes together. We wouldn't have gone LEED unless we wanted the energy efficiency of the alternative systems."

The Greensburg City Hall is expected to cost around $3 million. Funding includes a grant from the USDA Community Facilities Program for $900,000, $282,000 in insurance proceeds, $1,188,525 from FEMA, $396,172 from Kansas Department of Emergency Management and a City of Greensburg contribution of $185,803.

"It is going to save us quite a bit on municipal buildings," Greensburg Mayor Bob Dixson said about the facility. Dixson mentions looking at the investment versus the payout and said it becomes apparent quickly that the savings are there.

"That's the whole goal," Dixson said. "We would hope that we could cut some energy bills and consumption by 50 percent at the minimum. We haven't been up and running to have real-time data yet."

Dixson is quick to say he wasn't the mayor at the time Greensburg was hit by the tornado and can't claim credit for what he feels is the positive direction the city has taken. He commended the city's leadership from the beginning and said it has all been an educational process. He is not the first to mention the steep learning curve the city's leaders and even contractors involved in rebuilding have had to address to move into all of the new technologies incorporated in city and county projects.

"The first thing we had to do was change our whole thinking process because we had been so dependent on

A worker finishes up installation of special glasswork on the exterior of the Greensburg City Hall. Interior work has begun and the city hopes to occupy the building this fall. (Photo by Janet F. Reeder)

fossil fuels," Dixson said. "Now when we have the opportunity to rebuild, we can do more than retrofit, we can implement those technologies from the ground up."

Dixson often reminds local residents of concepts of sustainability, a term he and others in Greensburg prefer over the word "green." He tells them the earth-conscience and energy-saving concepts are not new to the prairie abiding folks in his area of rural Kansas. Reminding them their families have always understood conservation and the wise use of resources helps them see the transition of some of those theories into today's energy- and resource-saving technologies.

"Our ancestors pumped water out of the ground that they could cool their milk and eggs with," Dixson said. "Then they pumped it up into a reservoir where the sun heated it all day and they could use the hot water for bathing in the evening." Other analogies can be found in the advances of crops and agriculture, both key to the area, he said.

The open-loop system for Greensburg's City Hall is comprised of two 5-inch cased wells that average 135-

feet deep, said Mike Peterson of Peterson Irrigation in Lindsborg, Kan., who did the drilling. Peterson said the water table in Greensburg is approximately 90-feet deep. Pumping equipment includes Franklin sub-drive submersible variable frequency drive units. Peterson has done much of the drilling in the community, including both commercial and residential projects.

General contractor for the Greensburg City Hall, Kenny Orr of Orr Construction, said the permitting process with state agencies is done assuming the system will run at the peak of design around the clock, even though the facility will have normal weekday business hours.

"These pumps are capable of pulling 75-gallons per minute, and that is what the system is designed to do," Orr said. "In a year we are pulling out almost 40 million gallons of water and then turning right around and reintroducing it right back in."

BNIM and the mechanical contractors chose the open-loop system largely because of the small building site and the city's financial base for the project. Engineering consulting on the project is contracted to BGR Consulting Engineers of Kansas City, and mechanical contracting is with Glassman Corporation of Hayes, Kan.

Orr said one unusual feature of the construction is the way ductwork was designed in the large open room set for the Greensburg City Council chambers.

"The ducting is actually in the floor," Orr said. "It is a concrete duct lined with a concrete liner. So there is no overhead ducting in that area. The rest of the building's office areas are regular overhead ducts." The effort will allow planned use of day lighting from the special-shaped glass, as well as a view of the recycled wood beams reclaimed from a Kansas ammunition facility.

The ground source heat pump system is designed using six WaterFurnace heat pumps. They vary from 850- to 1,700-cubic-feet-per-minute and include NDO26, NDO49, NDO64 and NC15 model units.

Other energy features of the building include insulated concrete form walls and minimal east-to-west facing windows to reduce heat gain and glare. The site is also a previously developed site, and it is close to community resources. Low water usage fixtures and energy-efficient office equipment are also planned.

Greensburg City Manager Steve Hewitt shows the area where the geothermal wells will tie into the building's ground source heat pump system when the mechanical phase of the work takes place. (Photo by Janet F. Reeder)

The sawtooth roofline repeats that of the Greensburg School and is angled to take advantage of natural lighting. The roof is also part of the rainwater collection system incorporated into the structure designed to support the drought-resistant native plants used in the landscaping. Existing topsoil was also conserved on site. The City Hall will have a recycling program, and a rooftop photovoltaic array system will supply much of the needed power. Low volatile organic compound materials were also used in the building's interior space.

Real efforts were made to use as much local and recycled material as was feasible for the Greensburg City Hall project. The nearly 5,000-square-foot building looks good and has a great story behind it, says Greensburg's City Manager Steve Hewitt.

"There is over 50,000 brick on that building interior and exterior," Hewitt said. "And the brick comes from our power facility. Some of the brick is over 90 years old. It really gives a very unique look to that building. You can't get that look with brick today. It has a tremendous amount of history still in it."

Hewitt said a quote by Winston Churchill works well for Greensburg. He said Churchill was quoted as saying while men build buildings, buildings define men.

"We wanted a powerful look for a government building," Hewitt said. "It really looks great and it tells a great story."

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Greensburg School Sets Sustainable Example

By Linda Allen

A 6-inch block of wood reclaimed from the old gym floor sits on Darin Headrick's desk. For the superintendent of USD422 Greensburg Schools in Greensburg, Kan., the laser engraved image of the former school building on the wood block is a treasured memento of the past. It is prominently displayed in Headrick's temporary trailer office.

Masonry workers construct the massive wall that will support the first of two gymnasiums. Part of the ground heat exchange system is buried at the base of the wall. (Photo by Janet F. Reeder)

The school's future is mapped out on the wall behind his desk – in the floor plan of the new, eco-friendly school to replace the one the tornado destroyed on May 4, 2007.

Greensburg Schools had already joined the sustainable movement before the F5 tornado changed its plans and location. The school had started on an energy retrofit of the old building with a projected $36,000 annual savings just in lighting improvements.

The tornado upgraded its plans and moved the school's location to the south part of town to allow for future expansion. When school opened in September 2007, three months after the tornado, there were 196 students. Student population increased to 210 the second year and is anticipated to be 240 for the 2009-10 school year. Student capacity for the new building is 375. Greensburg will offer all classes and activities that were available before the tornado in the upcoming school year.

"Our school's growth is testimony to young families coming to Greensburg," said Steve Hewitt, city manager. "The rebuilding of our city has created jobs bringing more people to Greensburg."

The contemporary design of the school indicates its readiness to educate for the future. The sawtooth roofline identifies the new Greensburg School as a school with a vision and commitment to the future. It's not the familiar red brick, boxy design of the past.

BNIM Architects of Kansas City, Mo., designed the campus, which separates the student population by grade level into three islands. Pre-K through elementary, middle

Greensburg Superintendent Darin Headrick holds a plank with a laser image of the old school. The wood was salvaged from the gymnasium floor. (Photo by Janet F. Reeder)

school and high school each have their own area to meet their academic and space requirements. Educational amenities include several classrooms equipped with iTV–an interactive technology for simultaneously teaching multiple classrooms in different schools–science labs, an art and music wing, and a distance-learning center. Other features include two playgrounds, two gyms, a football stadium/track and field complex, courtyards, cafeteria and kitchen.

The new K-12 facility will use geothermal for heating and cooling. Geothermal was an easy decision for the administration and school board. Budgets and energy savings dominate building considerations for public-use buildings, especially schools. With no government or utility grants or incentives, return on investment was an important consideration for annual operating expenses and long-term durability of the building.

Of the $49 million project, $700,000 is dedicated to the geothermal system, of which $530,000 is for the well field. The estimated energy savings are 40 to 50 percent from the previous facility built in 1925. "Although the payback is estimated to be about 10 years, it really doesn't matter because it is the right thing to do," Headrick said.

Stubbed 6- and 8-inch pipes headered at the north wall of the main building sit ready for the tie-in once the well field is drilled. Geo-Enterprises of Catoosa, Okla., is scheduled to begin drilling in September 2009. The well field, located east of the school, will have 97 boreholes each at 410 feet deep.

The closed-loop system designed by BGR Consulting Engineers of Kansas City, Mo., will use 6- to 8-inch steel pipes in the main lines and 1 3/4- to 3-inch pipes in branch lines. The loop field design contains 14 rows of double loops for supply and return.

Commercial Mechanical Inc., of Wichita, Kan., will begin interior mechanical work in late 2009. The forced-air system specifications call for 54 heat pumps. The majority are WaterFurnace models NDO38 and NLV120. Other manufacturers include Addison, model TRS240 and 200, and ClimateMaster, model TRC09.

General contractor for the project is McCown Gordon of Kansas City, Kan. Both BNIM and McCown Gordon have experience with LEED school projects, although this is the first ground-up project for McCown Gordon. For BNIM and McCown Gordon, the Greensburg School project is more than a job – it's a commitment.

Both firms sent volunteers to help the community move forward after the tornado. BNIM worked with community officials and state and federal organizations to initiate recovery discussions and plans. McCown Gordon sent volunteers to help with a Habitat for Humanity house. It was a natural next step to stay involved in the community with the school project. McCown Gordon also gave a Dell laptop to each graduating senior in 2008.

For project superintendent, Kenneth Bonin, this is his first experience with a geothermal installation. Like many green technology installations in Greensburg, it has been a huge but exciting learning curve, he said.

Natural ventilation and operable windows will sup-

Signs created by future graduating classes of Greensburg High School decorate the construction fence at the new school site. (Photo by Janet F. Reeder)

port the geothermal system in building comfort. The clerestory roof, which allows indirect daylight without admitting direct heat, will maximize natural daylight in the main gym. Use of natural daylight throughout the building will reduce the need for on/off rheostats. All contribute to user comfort and enhance the learning environment.

Other sustainable features include wind-generated electricity for a portion of the building's needs, use of recycled, reclaimed and regional building materials, low volatile organic compound materials, collection and reuse of rain and storm water in above-ground cisterns, sustainable and easy-to-maintain surfaces, and indoor water control systems.

The school will serve as an education model/eco-lab for students and the public in construction and daily use. Construction began in November 2008. Students, teachers and the community can watch the daily progress as their new school takes shape. McCown Gordon regularly provides updates and activities to involve the students and community in the reconstruction of their school. "Everyone's excited," Bonin said.

"Green technology features will be used as teaching opportunities for students and educating the public beyond the classroom," Headrick said. "People can come in and see all the components and ask questions."

Plans to showcase the geothermal system for the public are still in the design process, Bonin said. There will be a walk out to the well field with a diagram or stakes showing locations of the wells. The public can visit the mechanical room to understand how the heat pumps work. McCown Gordon is working on a model showing how the system works projected on a LCD screen.

Even the concept and design phase of the project was a learning experience for students. School administrators and

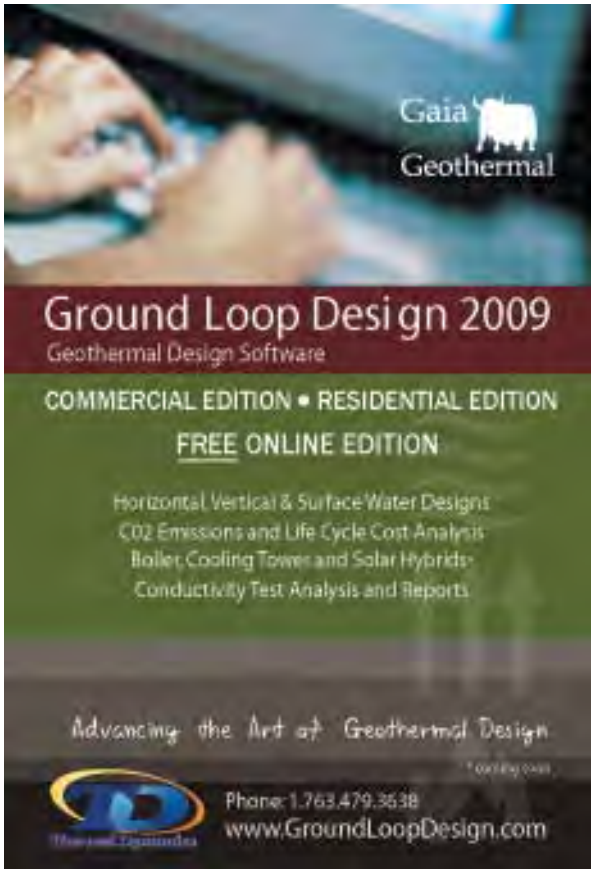
students worked with BNIM to design the 120,000-square-foot facility to meet LEED for Schools Platinum standards.

The completion date for the new school is projected for August 2010 with the first graduating class in 2011. The project is right on target to meet the deadline. Students currently attend class in 28 trailers.

In rural communities, the school is the heart of the community – the glue that holds the community together. "As community leaders, we are making 100-year decisions," Hewitt said. "We try to never lose the concept of doing it for the future for the right reason. It's all about the kids."

McCown Gordon Assistant Project Superintendent Darin Dunlap shows the location of well heads in a mechanical room area that await tie-in to one part of the school's heat pump system. (Photo by Janet F. Reeder)

With its sustainable design and future vision, Greensburg Schools are prepared to carry the school and community forward through the next century. "When the school is done, we will have more to do," Headrick said. "With sustainability, you just keep on keeping on."



Kiowa County Courthouse– Sustaining Greensburg's Past

By Linda Allen

New energy-efficient windows update the original exterior of the Kiowa County Courthouse and add to the overall efficiency of recent renovations. (Photo by Janet F. Reeder)

Renovation of the Kiowa County Courthouse has been one more golden opportunity for Greensburg, Kan., to go green. They're going for the gold – LEED Gold certification, that is, in the upgrade of the 95-year-old building.

The courthouse suffered exterior cosmetic damage in an F5 tornado in 2007. The fury of the storm hurled a small four-door Chevy from the police impound yard through the roof of the building. A gaping hole resulted that allowed three days of rain to pour into the building, soaking county records and documents. Quick response after the storm salvaged most of the papers, but interior water and structural damage required a complete gutting of the structure back to the concrete pillars and floors.

The Long-Term Community Recovery Plan for Greensburg, developed in August 2007, ranked the recovery value of the courthouse as high because of its community prominence, cultural value and public use. The timing was also right to upgrade building code and accessibility requirements.

In keeping with the community's overall efforts to maximize sustainable technology in all public buildings, the courthouse makeover incorporates a number of eco-friendly energy and cost savers. Central to the $5 mil-

lion makeover is the ground source heat pump (GSHP) system designed to heat and cool the building. Reduced energy costs and increased energy savings were decision makers in the choice of GSHPs. Other selling points were ease of operation and maintenance over conventional heating and air-conditioning systems, said Gene West, Kiowa County commission chair.

"The geo system is a retrofit for the historic building," said Travis Barnes, facilities manager. "It is not listed on the National Historic Registry, so there were no restrictions that affected the installation of the system."

The geothermal team included Professional Engineering Consultants (PEC) of Wichita, Kan., who provided electrical, mechanical, structural and civil engineering services for the project. Employees from PEC were in Greensburg soon after the tornado to help with recovery assistance. Dale Maltbie, president of PEC, grew up near Greensburg, and several other employees had long-time connections to the town. Like other Kansas-based businesses, it was a natural role for them to help other Kansans return from disaster to recovery and reconstruction of their town and their lives.

Mike Peterson of Peterson Drilling in Lindsborg, Kan., was the driller. He brought designer and installer LoopMaster of Indianapolis, Ind., to the project. The two companies have partnered on several geothermal projects, including others in Greensburg. Coonrod Construction, general contractor, and the Waldinger Corporation from Wichita, Kan., installer of the heat pumps and cooling condensers, made up the rest of the geothermal team.

The well field, located south of the building, contains 32 wells at 330-feet deep. LoopMaster designed and installed the vertical, closed-loop system, which covers 23,260 feet. The system uses 1-inch, 1 1/2-inch, 2-inch and 3-inch polyethylene 200-pound pipe manufactured by Centennial Plastics LLC. The pipes are protected with Baroid thermally enhanced grout rated for thermal conductivity of 1.0. Troy Coffman, LoopMaster general manager, said the installation was a basic install with no problems even with the limited area for the tie-in.

Ease of installation ended when the mechanical work moved inside the building. The low ceiling height, dating back to the original 1914 structure, posed a challenge in both the design and installation of the heat pumps. Kelly Kreie, project manager at the Waldinger Corporation, said the installation was a different and difficult design to incorporate and install.

Travis Barnes, Kiowa County Courthouse facility manager, explains the location of the loop field for the new geothermal system at the courthouse. (Photo by Janet F. Reeder)

Workspace was especially tight in the basement for installation of the ductwork, heat pumps and piping. Chris Wapelhorst, interim mechanical engineer at PEC, had to go on site to physically identify every beam for the design and placement of the heat pumps. Limited space required splitting up the 13 pumps, which are 1 ton or less each. These retrofit challenges increased installation of the mechanical system to about $55 to $60 per square foot.

A unique feature to the system is the air-to-air recovery unit. Depending on the season, all air coming into the system is preheated or pre-cooled, and the system exhausts either the hot or cold air with energy recovery ventilators.

The forced-air system uses 30 FHP units, all ECO, ESO and CA console series models. The GSHPs for the multistage system have an Energy Efficiency Ratio ranging from 14.1 to 18.7 for cooling, and a coefficient of performance ranging from 3.1 to 3.8 for heating. The heat pumps use high efficiency motors and fans.

The GSHPs complement the other energy-saving features of the courthouse that create a tight, comfortable building envelope. The original building had 2-inch thick uninsulated walls. The renovation filled the empty space with spray foam insulation.

High-performance glass replaces the glass-block windows, which were blown out during the storm. The windows look the same as the originals but maximize day lighting and minimize solar gain and heat loss.

Sustainable features include a 15,000-gallon cistern to collect rainwater for flushing toilets, a storm water collection system for irrigation and native landscaping with drought-resistant plants.

Employees and the public can look forward to a more comfortable building in the extreme summer and winter weather. Temperatures more than 100 degrees in the summer and below freezing in the winter are common in southwestern Kansas. The GSHPs will keep the building at a constant, comfortable temperature throughout the year. Estimated summer energy savings are significant–from $4,500 per month to $2,000 for the 18,600-square-foot, three-story building.

Kiowa County Commission Chair Gene West shows the pumping units for the new geothermal system and the tight space they occupy in the basement of the courthouse. (Photo provided by the Kiowa Signal)

Redesign of the Kiowa County Courthouse interior included a facelift to the third-floor court room. (Photo provided by the Kiowa Signal)

The total renovation project came in just under the projected $5 million budget. The county contributed $800,000 of which $500,000 was from money previously put aside in the building fund before the tornado. A USDA loan of $300,000 rounded out the county's portion of the project. Other funding sources included: $1.9 million from a USDA Rural Development grant; $1.86 million from insurance proceeds; $315,000 from FEMA and $42,000 from the State's Department of Emergency Management.

Kreie estimated the cost of the geothermal installation at about $1 million. Although GSHPs might have been more expensive than a conventional heating and air system, West said the long-term savings and ease of operation make it worth the extra dollars. Anticipated payback time for the entire project is five to seven years with the improved energy efficiency.

The Greensburg and Kiowa County public were introduced to the new-old building with a ribbon-cutting ceremony July 10. The renovation retains the historic design and integrity of the building. "We tried to make the exterior as near as possible as the 1914 building," West said.

Much of the previous space has been reallocated and several offices relocated within the building. Original doors and transoms salvaged from the storm welcome patrons. Recycled tile and carpet have been used throughout the building.

Surrounded by the modern architecture of neighboring buildings, the courthouse is a historic landmark and placeholder for 19th-century architecture in Kansas, successfully blending the style of the past with the energy-efficient technology of the 21st century.

The Greensburg community planning leaders decided early on in the reconstruction process that new buildings in downtown Greensburg should be built with durability to last through the 21st century. The Kiowa County Courthouse, one of the few survivors in the rubble of downtown Greensburg, has already proven its durability. With the upgrades and renovation, the courthouse is ready for another century of service.

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GreenTown
Nonprofit Spurs on Sustainable Effort

By Linda Allen

The Silo Eco-Home, modeled after the Greensburg grain silos that survived the tornado, is the first in a series of a dozen homes planned as part of GreenTown's Chain of Eco-Homes. GreenTown's office will be located in the facility when it is finished. (Photo by Janet F. Reeder)

Though modest and cramped, the storage room "office" of Daniel Wallach still suggests the scope of his vision for the recovery and future of Greensburg, Kan. Wallach is executive director and founder of GreenTown, a multifunction nonprofit organization that provides resources, information and support to rebuild Greensburg as a model green community. From planning, education and outreach to advocacy and fundraising, GreenTown works to connect residents with technology and resources for sustainable living.

"One of the ways I conceptualized Greensburg from day one was a living trade show where consumers can come and learn in an unbiased way about green technology," Wallach said. He believes manufacturers, product vendors and other environmentally conscious businesses will want to associate with the Green Initiative in Greensburg. He believes the relationship can be mutually beneficial. And it does appear to be working that way for early partners involved in rebuilding the community.

"There are a lot of trade shows you wouldn't think of missing," he said about green product advocates. "You show a week at a time and have to move all around the country. Here you can have a permanent display and demonstration of your product."

The movement toward sustainable building and living has gained momentum across the country and Wallach thinks those who can, should join in Greensburg's mission to provide a location where the technologies and products are showcased.

"If someone were thinking about building green, it would be worth it for them to come to Greensburg," Wallach said. "We're all about these different systems and helping people leave here much better educated."

GreenTown serves as a one-stop resource center for residents and tourists who want to learn about the town's Green Initiative. The office provides information and literature about green technology and sustainability, classes, speakers and a Web site. The outreach program solicits input from residents about current issues and concerns and distributes green information.

Even before the storm, Greensburg had begun thinking green with projects, like a planned energy retrofit for the school. Within a week after the storm, city leadership, including former Mayor Lonnie McCollum and City Manager Steve Hewitt were talking rebuilding sustainably for the entire community.

Wallach and his wife, Catherine Hart, arrived in Greensburg shortly after the tornado. "We saw tremendous devastation and tried to figure out 'how can we help? How can we rebuild green?'" Wallach said. Green living has always been Wallach's lifestyle. He is a man of passion and vision on a mission to promote sustainability through green technology. Using his prior experience in establishing nonprofits plus his vision, he and Hart created GreenTown. With Greensburg's collective decision to rebuild green, they were in the right place at the right time.

GreenTown's efforts extend to the greening of economic development. On the winds of the tornado came the opportunity for Greensburg to build retro-eco: using the pioneer skills, resources and practices of its prairie ancestors but with 21st-century, green technology.

Wallach said he tells locals the kinds of ideas a farmer would have come up with to use on his own are the same type of ideas that apply to building sustainably. "Now it is something that has economies of scale and technologies," Wallach said. "It is accessible and makes sense for so many people."

"People like being associated with comeback stories. A lot of people and companies want to be associated with Greensburg. Credibility and integrity are this community's greatest assets as we continue to promote ourselves and to find ways to stay on the cutting edge of sustainability."

Geothermal fits the vision and mission of Greensburg and GreenTown. "Geothermal – ground source systems are a perfect example," Wallach said. "You can talk for hours, and people don't understand what they are. But if you take someone into a conditioned space that has a geothermal system and show them the system, they will walk out knowing exactly what it is and they will want one."

He cited several public buildings that are incorporating ground source heat pumps in their new facilities: City Hall, Sun Chips Business Incubator, Greensburg

The features and sponsorship information for the Silo Eco-Home is conveniently located near the structure's entrance to inform the many visitors already coming to Greensburg to learn about green building. (Photo by Janet F. Reeder)

K-12 Schools and 5.4.7 Art Center. The Kiowa County Courthouse installation is a retrofit that includes geothermal. At least seven residences have also rebuilt using geothermal.

Long-term plans for Greensburg's GreenTown include the Chain of Eco-Homes project, a series of homes that will showcase a wide variety of green building possibilities. The first eco-home, the silo home, should be open this summer.

Mason Earles, project director and AmeriCorps volunteer, said the purpose of the house is to feature green building techniques, energy-efficient products and services, and real-world data on usage, prices and specs. As part of the project's eco-tourism plans, the homes will be available for overnight stays so visitors can have an immersion experience in green technology before investing.

"The new office of GreenTown will occupy the second floor," Earles said. "The first floor has one bedroom, which will be used as a bed and breakfast to showcase the latest in green technology. We want our guests to leave better educated about green technology and possibilities."

The 2,200-square-foot silo house is modeled after the local co-op grain elevator, one of the few Greensburg structures to survive the 200-plus mph winds of the tornado. The central core of the house is a cylinder–an above ground safe room with pre-cast concrete walls and roof.

Future eco-homes include a solar eco-home, a homestead home that will use local materials, resources and knowledge, a live-where-you-work home and possibly a geothermal house.

GreenTown recently began offering tours of green buildings so visitors can see the green technology being installed and be able to watch it in action.

"Many people do not know about geothermal," said John Winkler, GreenTown project manager. "When they see the Business Incubator and learn of its anticipated 57 percent energy savings, they want to know more. People actually want to see how eco-savings are created."

Emily Schlickman, project manager for the Chain of Eco-Homes and another AmeriCorps volunteer, had some experience with green technology and geothermal from the University of St. Louis, before coming to Greensburg.

"I had heard and read about the technology in school," Schlickman said. "Without the hands-on experience, I didn't really understand it. When I went to the basement of the 5.4.7 Art Center, I saw how the pipes came into the area and how they heated and cooled the building." Schlickman said that type of "aha" experience is the purpose of GreenTown's experiential tours and live-in visits.

Eco-tourism fits the green theme of Greensburg. In addition to the Big Well, the largest hand-dug well in the world, and the 1,000-pound Pallaside meteorite, both of which will receive new facilities in the makeover, there are nearby wetlands, a wildlife preserve plus birding opportunities that draw tourists to the Greensburg area. GreenTown wants to be ready with eco-homes to complement the tourist experience.

"Ultimately, sustainability relies on the ability to bring new, high-quality jobs to town," Wallach said. The city is actively seeking businesses that want to come to town and tie in to the successful marketing of green in Greensburg.

Greensburg might well be on the verge of becoming a hub for manufacturers of green products and services. It would certainly fit GreenTown's master plan to bring sustainable living and building to bring new, high-quality jobs to town. A convention center is in the talking stages for trade shows and exhibits. A straw bale wall manufacturing concern is also interested.

Greensburg continues to attract attention and tourist traffic as it leads the way and sets the standard for green communities. It received the presidential stamp of approval in President Obama's first address to the nation on February 24. He recognized Greensburg as "a global example of how clean energy can power an entire community – how it can bring jobs and businesses to a place where piles of bricks and rubble once lay."

For more information about GreenTown, contact Daniel Wallach at 602-549-3752 or at http://www.greensburggreentown.org/.

Function and Beauty Married in 5.4.7

By Janet F. Reeder

The 5.4.7 Art Center in Greensburg, Kan., was conceived and constructed by 22 University of Kansas architecture students in the Studio 804 graduate program. It is the first LEED Platinum building designed and constructed by students, as well as the first LEED Platinum certified structure in the state of Kansas.

An undertaking of huge proportion that also served as the final project for the graduate-level students, design and implementation for the structure had to take place in the short time span allowed by their program. Reclaimed wood from an abandoned building at the Sunflower Army Ammunition Plant in De Soto, Kan., had to be salvaged

Greensburg's 5.4.7 Art Center, the first LEED Platinum building in the state of Kansas, showcases art and sustainable alternative technology. Built by students, the facility stands out in the small prairie town as a striking representative of the future of green building. (Photo by Janet F. Reeder)

Studio 804 graduate architecture students at the University of Kansas designed and built Greensburg's 5.4.7 Art Center as a final project. They have been recognized for the first LEED Platinum project built by students anywhere. (Photo provided by Studio 804)

and moved before the project could get off the drawing board. Prefabricated in the Studio 804 warehouse in Lawrence, Kan., the structure was split into seven modules and hauled 325 miles across Kansas to Greensburg where it was set up and finished. Professor Dan Rockhill, head of Studio 804, remembers hauling the modules from Lawrence to Greensburg on St. Patrick's Day in what he said was the worst rainstorm ever.

Students did the planning and construction in the course of a semester of their college work. Three weeks after the tornado, Rockhill began talking to his students about a possible sustainable project in Greensburg. Design work started on January 3, and by February 4, Rockhill's students had started construction in their warehouse in Lawrence. Students often worked into the night under floodlights or car lights after the modules were in Greensburg.

Owned and operated by the 5.4.7 Art Center, a nonprofit corporation, the center earned the highest U.S. Green Building Council's certification through the use of geothermal heat pump technology, wind turbines, photovoltaic panels, recycled building materials and a host of other features chosen for their ecological or sustainable value.

The distinctive appearance of the structure's glass facade raises questions from those who worry about Greensburg's experience from the tornado. While unusual architecturally, the thick tempered glass panel exterior serves functionally by assisting in cooling the inside of the building. It also protects the recycled timber exterior from the elements. The green-tinted highly visible facade is stronger than windshield glass and is rated to withstand high winds.

The 1,650-square-foot interpretive gallery was completed in May 2008 in time for the first anniversary of the tornado that destroyed Greensburg. The facility is named for the date of that F5-rated tornado.

"It is unlike anything you will see in this part of the state," Director Stacy Barnes said. Barnes has seen a positive response to the city's first art gallery and said it is being well utilized by the community.

Both passive and active systems are incorporated into 5.4.7's sustainable energy design and capabilities.

Instead of a traditional heat and air unit, heating and cooling of the center is supplied by a geothermal system through the use of three 200-foot boreholes in a vertical closed loop.

The ground source heat pump (GSHP) system, coupled with the other active and passive elements are all part of an attempt to negate the building's energy use while providing a comfortable environment for visitors of the facility.

A 3-ton geothermal system was donated to 5.4.7 by O'Connor Company and installed by Scott Temperature HVAC from Lawrence. Evans Energy Development from Paola, Kan., did the ground heat exchanger work.

"We are happy with the outcome of this project and anticipate positive results to the community and the geothermal heat pump industry," O'Connor CEO Lynn Piller said. He feels his company's participation in the rebuilding of Greensburg is like planting a seed.

O'Connor Company is a Trane HVAC wholesaler with branches in Tulsa, Okla., Wichita, Kan., Kansas City, Kan., Omaha, Neb., and Des Moines, Iowa.

Intelligent passive design utilizes and harnesses fluctuations in temperature and air movement in relation to the location of the sun through the seasons. A

tight north facade negates cold winter winds, while the south facade uses extensive glass to light the space and heat the thermal mass provided by the concrete floor.

The building's three active systems are tied together in the basement of the building and are included as a tour of the facility for those who are interested in the sustainable technologies the center used. Energy produced by wind and solar technology is converted from DC to AC current and used or stored. Geothermal technology installed in the basement was intentionally left visible for viewing during tours of the facility.

Three Kestrel horizontal wind axis turbines produce 600 watts each; energy that is directed to four batteries for each turbine. They are expected to generate half or more of the power needed for the building. Prevailing wind in Greensburg averages 10-12 mph, ideal for the turbines.

Ten photovoltaic panels on the roof convert solar power to assist with electrical needs of the building. Plans call for the center to be off the grid as much as possible.

Sliding doors and operable skylights allow for natural ventilation of the building. Low volatile organic compound materials were used in the construction. Insulation is recycled newspapers and carpeting and countertops are also made from recycled materials. Half of the lumber used was Forest Stewardship Council certified. The 5.4.7 Art Center also has an established recycling program.

Conservation of water is also an aspect of the building's sustainability. Low-flow toilets and water fixtures and a rainwater collection system using a 1,500-gallon cistern used to irrigate drought-tolerant plants are also important sustainable features.

The 5.4.7 Art Center was constructed on a previously developed site and is close to community resources. Careful work allowed topsoil to be conserved during construction, and this allowed native prairie restoration on the site.

The new facility has already been used for many public gatherings, including the observation of the city's second anniversary of the tornado. The Chamber of Commerce and other groups hold civic meetings there, as does the 5.4.7 nonprofit board and other groups in the community. The space is also available for wedding parties and other family events.

A 3-ton Trane ground source heat pump can be viewed in the basement of the 5.4.7 Art Center during tours of the building. (Photo provided by Studio 804)

The 5.4.7 Art Center will provide Greensburg's citizens ongoing planned activities and opportunities to renew and continue their participation in visual and performing arts. Even as 5.4.7 fills its gallery space with exhibits, the mission of the nonprofit also includes assisting the community by providing after-school and summer art programs for adults, weekend workshops and visiting artist demonstrations.

The most important benefit of the 5.4.7 Arts Center, as the first LEED Platinum building in both the city of Greensburg and the state of Kansas, is giving the GSHP industry the opportunity for the world to take a look at how the technology can be applied in other cities globally.

It is oddly appropriate that such a unique structure would be found in a small prairie town–that while re-

Evans Energy from Paola, Kan., installed the ground heat exchanger for the 5.4.7 Art Center. (Photo provided by Evans Energy)

claiming its foundations, largely lacks any real visual beauty or relief from the stark reminders of the storm's damage. The very uniqueness of 5.4.7 symbolizes how unusual this community has become. Finding this elite award-winning building away from an urban setting where it might be more common, also exemplifies what the city wants the world to see from them.

Watching Greensburg through the filter of green building and sustainability reveals that the community's ongoing extraordinary perseverance in the face of such tragic adversity has marked the city for uncommon things. No other city of its size can boast of the number of LEED Platinum structures either already certified or planned or under construction.

Greensburg proudly showcases this building and others as it moves toward its goal of becoming a serious ecotourism destination as a city that chose sustainability to support recovery.

Earth Insights

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

Crime and Disasters

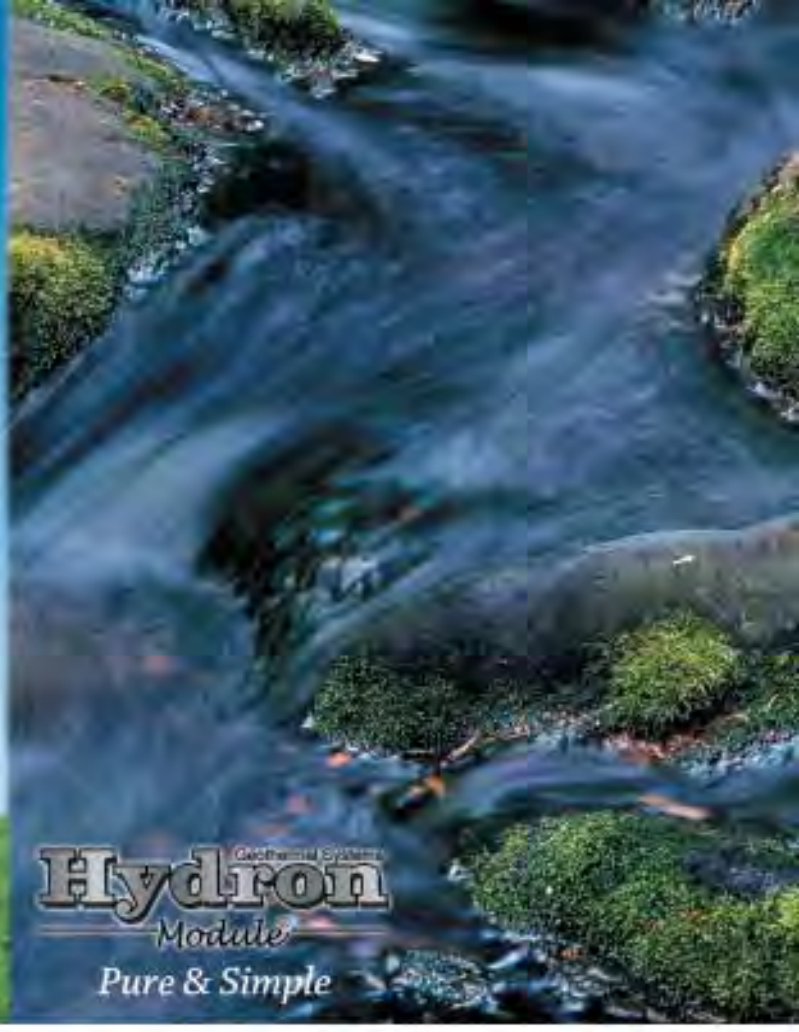
The last few years have been tough on outdoor heating, ventilation and air conditioning (HVAC) equipment. We've all seen the news; houses blown away or flooded, equipment pads with no condenser, outdoor coils beat flat by golf ball- to softball-size hail, large commercial air-cooled units with coils cut out and stolen and other similar occurrences. Natural disasters such as hurricanes, tornados, floods and others have damaged or destroyed equipment of all types. Also, the spiking recycle value of copper significantly increased the rate of equipment vandalism and/or theft. Combined, these circumstances have resulted in the destruction of thousands of pieces of outdoor equipment over the years.

Every time I see or hear of something like this, I think of geothermal heat pump system ground heat exchangers (GHEXs). They are buried underground – out of site, not making a sound, and out of harm's way. Unlike other systems, geothermal heat pump GHEXs can typically be reused when a damaged or destroyed structure is repaired or replaced. If a larger structure replaces the one that was destroyed, the GHEX can be modified to accommodate the larger structure by adding more capacity. Also, GHEXs are concealed underground, eliminating temptation for thieves and vandals. They don't get blown or washed away, they don't get stolen, they don't short out, they don't get damaged by hail, they don't get vandalized, and best of all, they don't wear out!

Our industry markets a benefit geothermal heat pump systems offer – no outdoor equipment in salt-laden or otherwise contaminated areas, but what about areas prone to natural disasters? While not the most positive marketing benefit, having a "condenser" that is not damaged by rising flood waters or flying debris might allow the structure to be conditioned as soon as power is restored. If there is a higher level of damage, as long as the GHEX can be located, flushed, purged and connected to the existing or replacement geothermal heat pump(s), it can be returned to service when power is available, regardless of the level of destruction for the structure.

Finally, after almost 35 years, our industry has reached the point where geothermal heat pump units are exceeding their life cycle and being replaced. However, it is only the geothermal heat pump unit, not the GHEX. The investment made in the GHEX when the system was originally installed was good and will remain good for many, many years to come. The GHEXs even withstand the ravages of the most common natural occurrence – time.

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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