GEO OUTLOOK

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Ground Source Heat Pumps Contribute to a Dream Home

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Directors' Forum

Notes from GHPC

By Wael El-Sharif
Executive Director,
Geothermal Heat Pump Consortium

In an October 1998 article in the Appraisal Journal, it was reported that a home's value increases by $20 for every $1 reduction in annual utility bills. The National Association of Realtors uses this data to help their clients gauge the value of their homes or buildings. This acknowledgement of the value added by energy conservation measures, especially geoexchange, couldn't be better for our industry.

As natural gas prices continue to rise, more people are choosing geoexchange as the best value for their HVAC investment dollars. In fact, our industry's manufacturers are reporting that shipments have doubled since the beginning of Fall 2005, and we at the Consortium have no reason to believe these sales will slow down.

Americans are now eligible for tax credits through the 2005 Energy Policy Act. Furthermore, our industry's growth has given us more competitive pricing, lowering the costs of installation to make it easier for our customers to begin saving immediately.

With more than 1 million installed systems in the United States, we as an industry are again poised for an explosive growth spurt. Together we can make 2006 our best and most successful year to date, and so long as we keep doing what we've been doing, the sky seems to be the limit for how far we can grow.

Notes from IGSHPA

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

The GSHP industry is growing, but in order to become part of the mainstream, new markets like low cost energy efficient housing with integrated heating/cooling and water heating must be recruited. A team explored such a system for low cost housing where all piping equipment was placed by a drop-in method and immediately hooked up to the cold water inlet and a ground heat exchanger. Because a majority of this configuration can be done in a factory, costs were reduced. The result is a new product for the manufacturers and more systems installed.

Creativity will help advance the growth of the industry. Paul Saurer's (deceased) design was a perfect example. He designed the centralized air distribution system to be fully integrated with the GSHP unit. With air coming from the center of the building and distributed outward toward the walls, better efficiency could be achieved with reduced duct runs and unnecessary expense. A single bore hole drilled beneath the structure would eliminate final grading and interference of the ground heat exchanger by other trades. His approach was to "work the problem that faces production building."

The term "think outside the box" maybe a little overused today, but for our industry it is on target. We need to take the covers off the box and look at the possibility of simple modifications that can increase our rightful market share.

Industry Leaders

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Peter R. Smith

President
New York State Energy Research and Development Authority (NYSERDA)

Peter R. Smith, a strong proponent of geothermal heat pumps, was recently appointed president of the New York State Energy Research and Development Authority. Prior to his appointment, Smith was vice president for Programs and Program Director for Energy Analysis.

Today, he is responsible for the overall management of the Authority, a public benefit corporation of the state of New York with assets of more than $330 million. One of our industry's 2006 Technical Conference presenting sponsors, NYSERDA is also the third-party administrator of New York's five-year, $750 million public benefits program, which was created as part of the State's move to electric competition.

Smith has more than 26 years of experience in analyzing and studying energy and environmental issues and problems. He holds a masters degree in public administration from the Nelson A. Rockefeller School of Public Affairs and Policy, State University of New York at Albany, and a bachelor of arts from LeMoyne College in Syracuse, New York.

Jack Henrich

President
Bergerson-Caswell

Jack Henrich has a bachelor of science in mechanical engineering. He has been with Bergerson-Caswell, Inc. since 1968 and is currently president. His certifications include:

NGWA - Master Ground Water Contractor,
IGSHPA - Accredited Installer, and
IGSHPA/GHPC/AEE - Certified GeoExchange Designer.

Henrich is a member of the IGSHPA Advisory Council, a director for the National Ground Water Association, and president-elect of the Minnesota Water Well Association.

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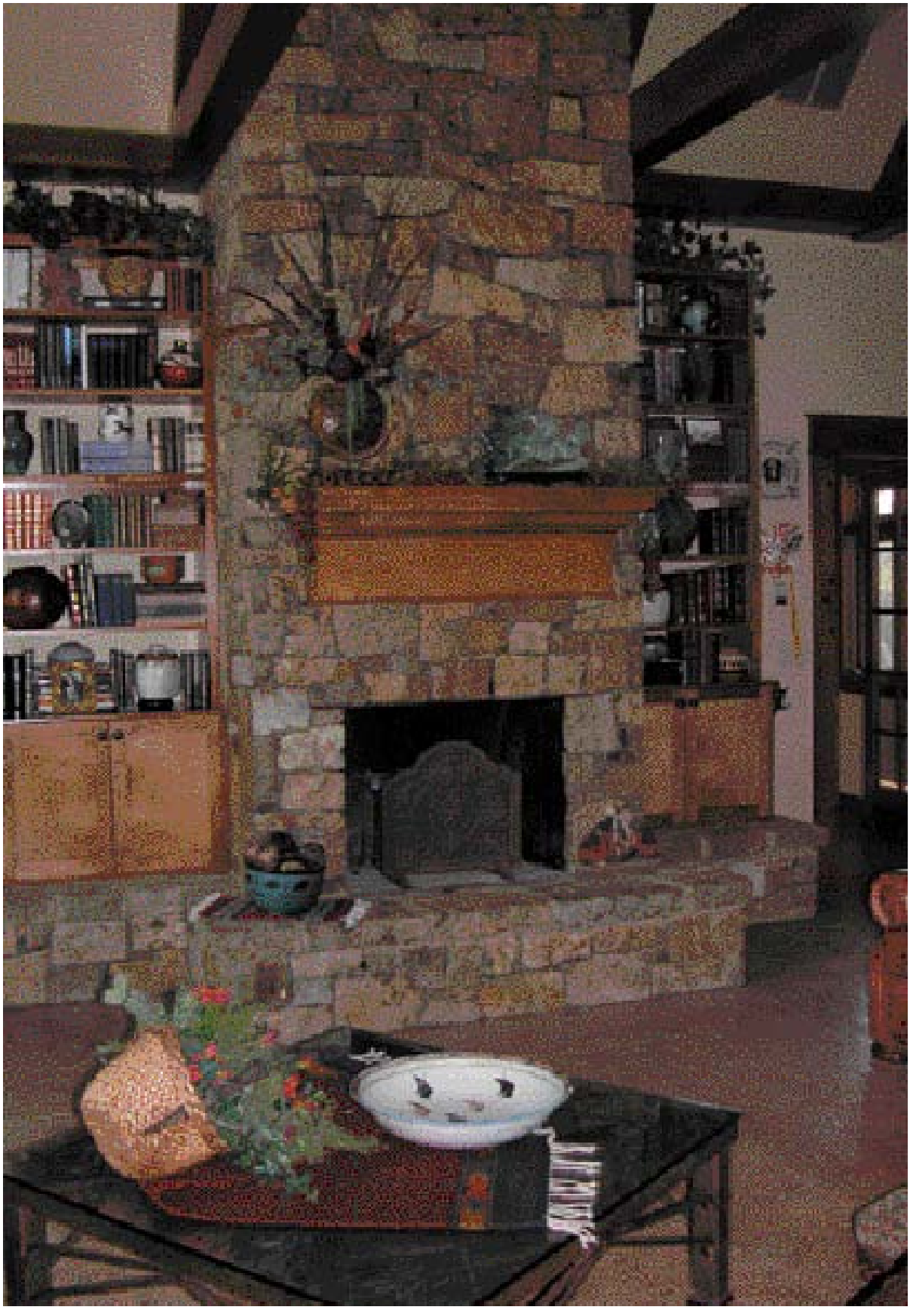


Photo courtesy of IGSHPA.

GSHPs Contribute To a Dream Home

By Kelly Green and Dara McCoy

For Jim Bose, Executive Director of the International Ground Source Heat Pump Association (IGSHPA), a dream home was defined not only by land, square footage and intricate features, but also by energy-efficient technologies that keep the home comfortable regardless of the season. Bose's 5,500-square-foot, two-story house built on five beautiful acres in Stillwater, Okla., is heated and cooled by a ground source heat pump system and radiant panel flooring. As a man who has made his living convincing others about the benefits of ground source heat pumps, building his first home with such a system in 2000 was a personal monument to his life's work.

"I've talked about it all my life," said Bose. "It was more than excitement."

The home contains a total of 14 tons of heat pump units. One 5-ton unit, manufactured by Florida Heat Pump, heats the floors and three 3-ton units, manufactured by ClimateMaster, cool the home. The horizontal system took 500 feet of 3/4-inch polyethylene pipe to fill 10 trenches that were 7 feet by 250 feet. Bose said the trenches were dug in one day and, overall, the installation process went quickly and smoothly.

"Efficiency is the whole name of the game," Bose said. "Ground source systems use less energy than anything we know of, No. 1 according to the Environmental Protection Agency."

To increase the efficiency of the system, the GSHP is paired with radiant panel flooring. The flooring system works by circulating hot water through pipes buried beneath the home's concrete floors. Bose said, if done correctly, radiant panel will always add to overall efficiency because the floors can be cooler than the air and still provide the same level of comfort. This way, he saves the additional power that would be needed to raise the air temperature.

"It's the most comfortable system you can imagine," Bose said. "It's almost 20 to 30 percent, if not better, more efficient than air geothermal heating."

John Fantauzzi, Technical Director for the Radiant Panel Association, agrees. He said ground source heat pumps work very well with radiant heating when they are designed and installed correctly. "Radiant systems are very efficient and comfortable," Fantauzzi said. "When coupled with the efficiency of the heat pump, the benefit is cumulative."

The U.S. Department of Energy estimates a cost of about $1 per day per 1500 square feet to operate a GSHP system. Bose said his home utility costs fit well within those numbers. Bose also approximates he has saved at least $3000 a year by choosing to heat his home with this technology over natural gas. His all-electric home receives the heat pump rate from the local utility, which in the winter locks in the monthly cost at 4 cents per kilowatt hour after the first 600 kilowatt hours.

"From an economic standpoint, it was the smartest thing I ever did," Bose said.

Starting from the Ground Up

Bose began his journey with geothermal in the 1970s when he consulted for an owner whose heat pump was dumping scalding water into his pool. After finding an old engineering textbook, Bose used the heat pump concept to fashion the homeowner's pump to circulate the hot water through pipes, rather than dumping it into the pool. Convinced the technology could benefit other homeowners, as well as the environment, Bose made the technology the focus of his career. He continued doing contract work and installed several ground source heat pump systems in the Stillwater area. Since the completion of his doctorate degree in 1966, he has also continued his geothermal research and development at Oklahoma State University. Because of this, Oklahoma has become the center for ground source heat pump research, development and promotion and Bose has become a trusted source for the reliability and efficiency of the systems. Realizing his efforts could go only so far, Bose formed IGSHPA in 1987 with the mission of promoting the technology through training and communication.

Photo courtesy of IGSHPA.

The manifolds for the home's radiant panel flooring system are located above the floors in a small cabinet, which allows for easy access and the ability to control distribution.

"Promoting a certain technology is not something a university typically does," Bose said. "We formed the association because this industry needed a peer-reviewed group of industry leaders to set the manufacturing and training standards."

While Bose enjoys the numbers and technology of the system, his wife Brenda loves their home's heat pump and radiant panel flooring for different reasons. She said the system fits well with the craftsman style she wanted for the home.

"The style of this house is so compatible with the GSHP," she said. "It's just such a friendly, peaceful way to heat and cool a house."

The benefits of a good system or a good installation often cannot be seen when trying to make a house a home, but they can shape the environment. The grandchildren can play comfortably on the warm, sandstone concrete floor, which covers the entire house. The Bose's

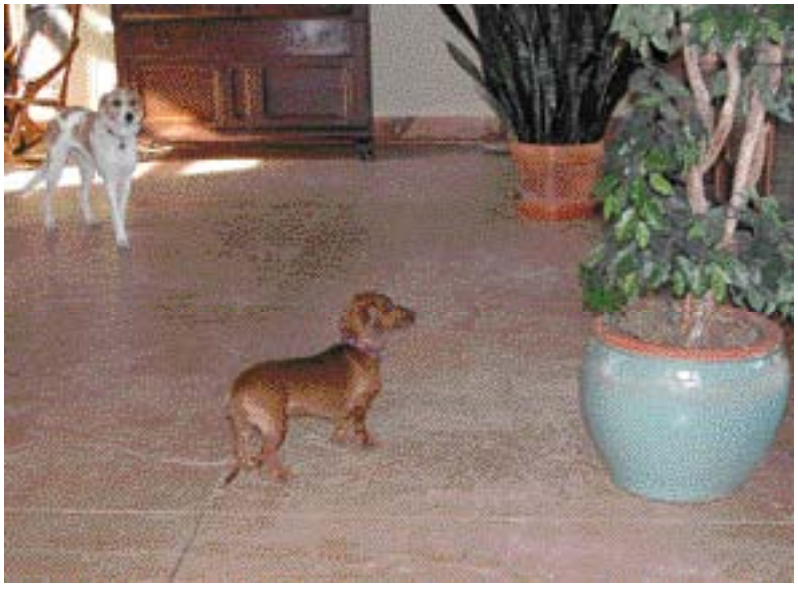


Photo courtesy of IGSHPA.

Even the Bose's family pets have no complaints about the home's non-traditional heating and cooling system.

can entertain any number of guests without the room temperature getting too hot or too cold. They can also relax with a book or music in a noiseless environment or have one of the four family pets curl up comfortably on bare concrete. All these things make a home.

"The concrete floor makes it a good radiation system," said Bose. "The heat that's in the slab is radiated to the building space, and the nice thing about it is that the upstairs loft on the whole second floor is open to the lower floor, but it's never overheated."

For the Bose family, it's all about the complete experience of heating and cooling their home in a different way. The combined comfort of the GSHP and radiant flooring make an atmosphere that just has to be experienced or lived in to believe. Brenda said despite the size of the house, the rooms are always cozy and comfortable, thanks to the even distribution provided by the system.

"We knew from the science, from the technology, that it was good, but until we lived in a home heated and cooled like this we just had no idea that it would be this comfortable," Brenda said. "You can't describe it in words."

◆

Stockton

Photo courtesy of IGSHPA.

Buried in the Bose's front lawn is 500 feet of polyethylene pipe that help to deliver both a comfortable and efficient living environment.

Combined Technologies Deliver Efficiency

By Jennifer Hale

In Hickory, N.C., resides a 1200 square feet, three bedroom, two bathroom, zero energy home. One might assume a structure such as this was built by research engineers or architects; however, it was built by volunteers! Habitat for Humanity of Catawba Valley in Hickory, N.C. has made sure homeowners feel they have an exceptional product. Habitat has not only always provided high quality homes, but has also been stamped with the stigma cliché of a home built by volunteers.

"We decided if we are going to build affordable housing it needs to be affordable for the lifetime of the house not just for the initial purchase," said Mitzi D. Gellman, Executive Director for Habitat for Humanity of Catawba Valley, and this is exactly what she and her staff of volunteers did when they built North Carolina's first zero energy home in the summer of 2005.

A Zero Energy Dream

A couple of years ago, Gellman and the team at Catawba Valley Habitat for Humanity began to look at how they could improve the energy efficiency of their homes. Being a non-profit organization, money was an obvious stumbling block for their dream. Good fortune seemed to step in and some grant money became avail-

Photo courtesy of Catawba Valley Habitat for Humanity.

The home was outfitted with a small front porch to help it blend in with the folk fashion of the neighborhood around it.

Photo courtesy of Catawba Valley Habitat for Humanity.

The home contains a number of energy-efficient design standards, including a row of windows that capture as much southern light as possible.

able through a program called Advanced Energy out of Raleigh, N.C. Improvements in caulking, insulation and other standards associated with improving the efficiency of a home were included. Habitat took advantage of this grant, trained its volunteers through Advanced Energy classes and found itself nominated for a National Homebuilder's Association award for affordable energy housing.

Habitat received the third place prize in a nationwide energy-efficiency competition and caught the attention of Appalachian State University (ASU) in Boone, N.C. As luck would have it, ASU was the recipient of a grant for affordable energy and looking for a non-profit organization to become part of their team.

"They knew our mindset was already geared toward building affordable, energy-efficient housing, so ASU, one hour from our offices, began developing a program with us to build the most energy-efficient home possible," said Gellman.

The beautiful result of the merger of ASU and Habitat was a $30,000 grant from the Department of Energy; a dream-come-true for Habitat. Additional funding for the house was provided by The Beaver Family Foundation, a Hickory-based philanthropic organization and WaterFurnace also graciously donated a GSHP system. Tom Trantham, a local WaterFurnace representative, donated the equipment and supervised the installation of the GSHP loop. The grant then covered most of the extra expenses needed to make the house a zero energy home.

A Dream Comes True

With the funding in place, Habitat then identified a location. It was chosen to be the first of eight houses in what will be called Ridgeview Village, a neighborhood of Habitat homes to be built in the Ridgeview Neighborhood, the oldest African American community in Catawba County. Before Habitat, there had been no construction in this historic neighborhood since the early 1960s.

Through the help of the City of Hickory, N.C., Habitat purchased the piece of property for Ridgeview Village at a low cost. After the city acquired the property, which had some old apartment buildings on it, the buildings were demolished and sold to Habitat for the cost of the land. Habitat is working to acquire an additional piece of property, which would allow three or so more houses to be added to the village.

Although the Hickory community is fairly prosperous, 20 percent of its citizens live in substandard housing. Roughly 230 people in this community exist day-to-day without plumbing, and approximately another 15 percent of the homes don't have adequate heating and air conditioning. The construction of Ridgeview Village will serve as a nice breath of fresh air to the surrounding community.

The physical appearance of the house has an arts and crafts design and blends in with the other homes in the neighborhood. It contains a front porch rather than a large deck to exhibit a folk fashion. Most of the homes in

the Ridgeview Neighborhood were built in the 1920s, so Habitat attempted to stay away from a newer style home that would cause a clash with the existing neighborhood.

To make this a zero energy home, the structure is oriented to capture as much southern light as possible and is outfitted with a ground source heat pump (GSHP), photo voltaic (PV) panels, and energy-efficient insulation and windows. The passive solar design of the home and use of efficient ventilation and fans also cut energy costs.

"A group of around 80 volunteers worked to build this house and as a result we were all able to walk away with a sense of what it involves to make a home energy efficient," said Gellman. "We were also exposed to the many different technologies available for energy usage and consumption. Due to the current energy crisis, this is the perfect time to promote a concept like this."

"I already have a house of my own and my initial response was to put a GSHP system in my own house!" – Mitzi Gellman, Executive Director for Habitat for Humanity of Catawba Valley

There are 24 PV panels on the home, which make up about a 4.5 kilowatt system. People who come to tour are drawn by the panels visibly located on the outside of the house because they create a noticeable glare from the reflection of sunlight.

Courtesy of WaterFurnace and with the aid of Trantham, the home also contains one GSHP. A volunteer construction team installed the horizontal system under Thrantam's supervision. The shallow loop runs 6 feet under the ground, is 150 feet long and contains pipe 2 inches in diameter. The home contains the smallest system produced by WaterFurnace, a 1-ton unit. Habitat's heating, ventilation and air conditioning (HVAC) contractor also worked with Trantham to connect the loop to the system.

"Although very exciting, this project has made me frustrated with my own living situation," said Gellman. "I already have a house of my own and my initial response was to put a GSHP system in my own house! It is such a great concept that more people should be utilizing."

According to Rob Howard, Construction Project Manager for Habitat for Humanity of Catawba Valley, many people who come by to tour the house are specifically interested in the GSHP system. Located in a utility room in the center of the home, the heat pump is the only visible part of the system available for guests' view.

"Probably the greatest benefit of the house is providing an educational tool for builders in the area," said Howard. "We have had one of the local architectural firms tour the house and bring their draftsmen in to take a look because they are trying to promote green energy, renewable energy, and affordable heating and cooling concepts to their clients."

Howard's construction office is currently located in the zero energy house. For about a year, the home will be used as a model home for educational purposes and a Habitat office. The tours will allow more people to view the house, as well as the many technology advantages it showcases. Habitat is trying to draw as much attention to the home as possible and it seems to be working. Howard acts as a tour guide for the home while he explains its energy-efficient benefits. The zero energy home was Howard's first geothermal project, but he would love to participate in more in the future.

"This project was very fun!" said Howard. "I hope to build my own house one day and would love to incorporate a GSHP system. The concept of the system makes a lot of sense because ground temperature is much more stable than air temperature."

A Fairy Tale Ending

There is no family in the house yet. When a family does move in they will be ensured a happily-ever-after, with a home saving them money on energy for a lifetime. Habitat currently receives $2 to $3 a month back on energy bills and this benefit

will continue once a family moves into the house.

"It is a great feeling to get a check back from Duke Power every month," said Gellman. "We are making more electricity than we are using and this is an anomaly unto itself. We aren't actually paying anything on electricity bills."

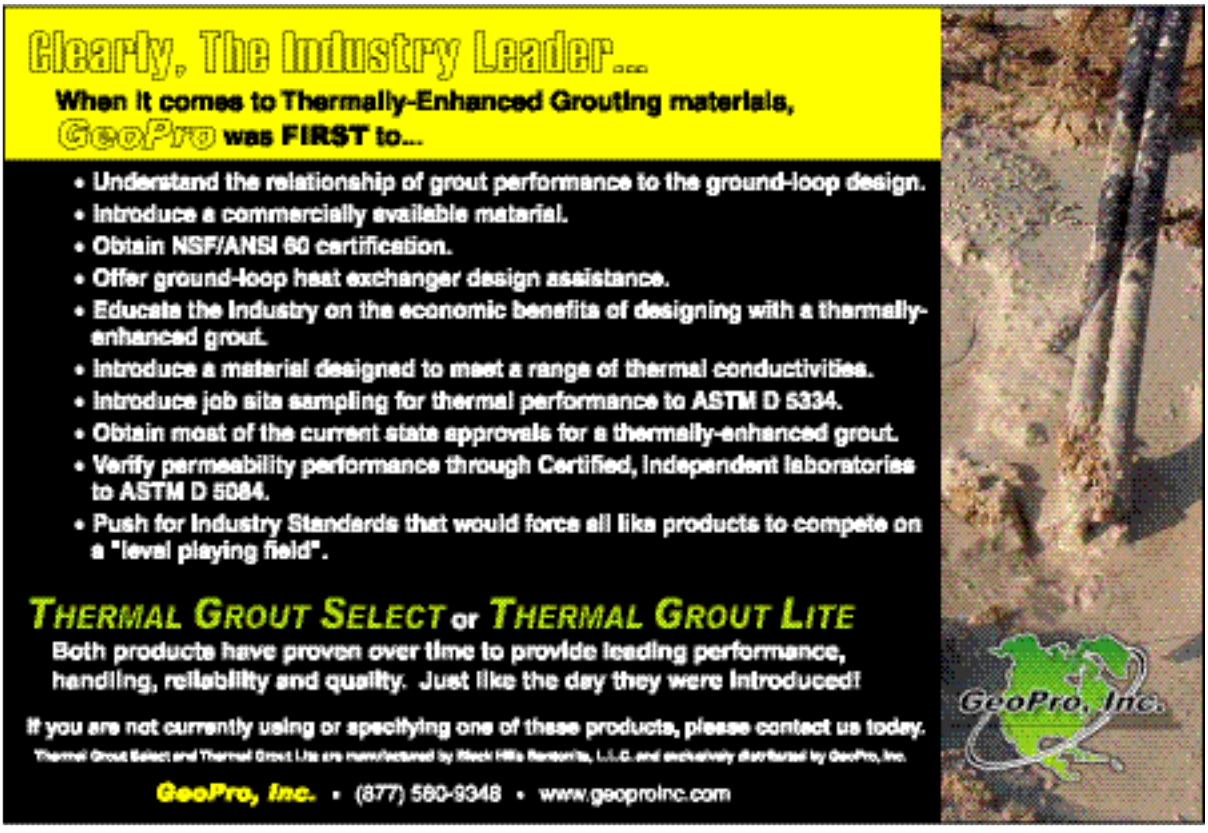
The Green Building Initiative (GBI) of North Carolina also rewards the home for making its own electricity and selling it back onto the grid. Habitat has received checks for about $200 every two months from the GBI. They are buying all the power needed to run the house off the energy grid and selling back all power produced by the house. Credit by GBI is only given for power put back onto the grid.

"We are buying power from Duke Energy at about 8 cents per kilowatt hour, but GBI is giving us 18 cents per kilowatt hour for everything we put back," said Howard. "When a family moves into the house, it is amazing that we will be able to pass this same benefit on to them, at least until the contract from GBI runs out."

Prior to this project, Habitat already participated in the Energy Star Program, which offers an advanced energy guarantee to its home owners. All of their homes are usually locked in with a guaranteed energy bill not to exceed an average of $15 to $25 each month. The zero energy home, however, enabled Habitat to offer not only savings on energy bills, but also a payback check for home residents.

"We are hoping the house will be a tool for people to realize there are other ways to provide power, energy and heat to a home," said Gellman. "With a few changes, we can all do ourselves a favor and save the sparse resources now available. This zero energy home was an experiment to see just how good a product Habitat can build and we hope this same process will become standard within the next five or ten years."

For more information on the zero energy home, Catawba Valley Habitat for Humanity or the many opportunities available to aid in provided affordable housing for hard-working, low-income families, visit www.hickoryhabitat.org.



Extreme Makeover: Energy Edition

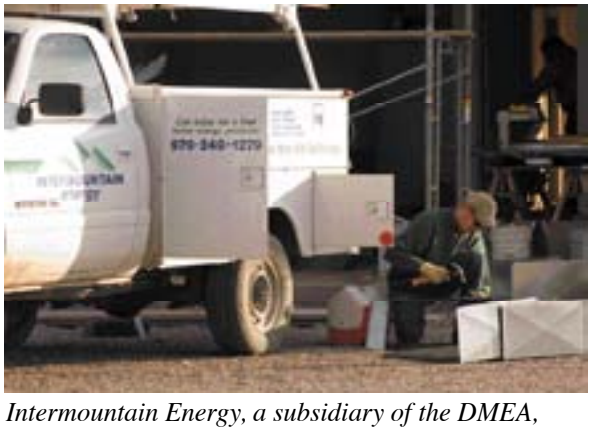
By Kelly Green

Three lucky Colorado families will be paying lower energy bills for a lifetime thanks to a creative contest sponsored by their local utility. The Delta-Montrose Electric Association (DMEA) began working years ago to educate its members about the benefits of all-around energy efficiency. The DMEA's board of directors has been on a mission to help people of Colorado reduce their energy use by 25 percent by 2010 and has worked for the past six years to promote the value of ground source heat pumps (GSHPs) through its wholly-owned subsidiary, Intermountain Energy. The DMEA sees itself as an entity with a tri-fold responsibility: to conduct efficient operations, promote whole-home energy efficiency to its members and be a part of renewable energy programs.

In the summer of 2005, the DMEA decided to take its campaign to the next level. The western Colorado electric cooperative sponsored a Home Energy Makeover Contest and Workshop that awarded one inefficient home with an energy improvement package of $25,000 and two other homes with improvement packages totaling $10,000.

Ed Thomas, Market Development Manager for Intermountain Energy, said the inspiration for the contest came partially from the hit reality television show and partially from a similar program conducted the previous year in another part of the state. According to Thomas, the main goal of the Home Energy Makeover Contest was to inform homeowners, contractors and even banks that home energy improvements don't cost, they pay.

"We wanted people to know through this contest that there were things they could do to better manage and control their utility bill," Thomas said. "We wanted to get across the idea that you can fix up your home, one time, in ways that will reduce your energy bill every month."



Intermountain Energy, a subsidiary of the DMEA, focuses solely on the installation and promotion of ground source heat pump systems.

Ed Thomas of Intermountain Energy presents to more than 50 Colorado residents who attended the DMEA's workshop to learn how they could lower their utility bills through home improvements.

The Contest

Starting July 1, 2005, any member of the DMEA was welcome to submit a registration form that included: the age of their home, the total square footage and the utility costs for the previous 12 months. Rosalie Cruthers, contest runner-up, said she and her husband decided to enter not only because of their high energy bills but also because they were excited to find out there was something they could do to help them save.

To ensure fairness, all applications were sent directly to the Colorado Energy Science Center (CESC), a non-profit organization based in Denver. Analysts at the CESC converted electric, gas and propane use to British thermal units (Btus) and ranked the 130 entries based on total Btu usage and Btu usage per square foot.

"This wasn't just a random drawing; it was a very methodical process," Thomas said. "The results were based strictly on the overall energy efficiency of the house."

The top ten homes were given an extensive energy analysis courtesy of the DMEA using a blower door analysis to test for air leakage and an inventory of everything in the house that used energy. Intermountain Energy then compiled a list of suggested improvements for each home that were categorized as good, better and best. The first place home received the best improvement package, which totaled $25,000 and included the installation of a ClimateMaster ground source heat pump system. The second and third place homes received the better improvement packages, each a $10,000 prize. Thomas said the DMEA selected improvements that were the most cost-effective for each specific home.

"We were absolutely surprised at the potential savings," said C.W. Norris, the contest's grand prize winner. "I would definitely recommend this process for other people."

Fourteen local vendors, including two banks, sponsored the contest through product donations in exchange for promotional consideration throughout the campaign. The improvements, advertising, and any other costs related to the contest, were paid for by the DMEA.

"We wanted the banks involved because we wanted to help determine this from a home improvement loan standpoint," Thomas said. "We wanted them involved in how we went through this process of evaluating a home and how we articulate to the homeowner and the contractor the value of home energy improvements."

The Workshop

The DMEA held a public workshop in November to reveal the three winning homes and their new energy-efficient improvements. Contest co-sponsors presented their recommendations and several attendees expressed interest in receiving a similar energy analysis of their own homes. According to Thomas, about 50 people attended the workshop including the second and third place contest winners and some of the other contest finalists.

"The DMEA has had success with workshops in the past but we wanted to take this one to the next step," Thomas said. "Rather than just talking about doing this stuff the DMEA decided to just apply it in a house and then show everybody the value of the improvements."

Because the contest only awarded three homeowners with the cost saving, energy- efficient improvements,

the DMEA has established the Home Energy Makeover Guide. The guide is an online tool available at www.dmea.com that allows homeowners to see the savings created by home energy improvements. The guide is broken down into an appliance calculator, a home energy calculator, a lighting calculator and an energy library where homeowners can research how energy is used in their home. It is important for both homeowners and contractors to understand, according to Thomas, that a house is a system and savings are interrelated. Even though the renovations are still in progress, Cruthers said she already feels more comfortable in her home.

"I can already see a difference just with the additional insulation," Cruthers said. "I think it would be great if other homeowners decided to do this."

The Results

Thomas said he knows there is more to this contest than just energy savings. The utility can determine the initial value in terms of energy, but ultimately the winning homeowners will begin noticing their homes are more comfortable while their utility bills remain manageable. The campaign also succeeded in bringing together the DMEA and local vendors with the purpose of increasing energy efficiency among Colorado homeowners. According to Thomas, this could be the launch of a utility audit program that partners with the local contractors to provide specific energy improvement plans to interested homeowners.

"The contest has been neat in the way it has rallied us together," Thomas said. "This contest has given us the chance to work with the local providers to see how a whole-house energy analysis program might work."

The three winning homes will continue to be analyzed by the DMEA for the next 12 months. Case studies discussing the homes' energy savings as well as the homeowners' reactions to the improvements will be available at www.homeenergymakeover.com.

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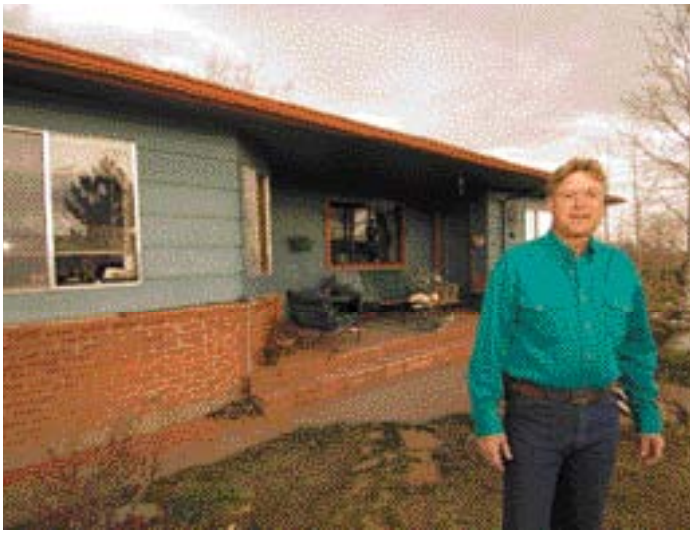
All photos in this article courtesy of Tri-State G&T. Photographer: David Tejada.

Home Energy Makeover Contest Winners

The Grand Prize Winner – The Norris'



Square Footage:.....2600
Year Built: 1959
Heat Source: .....Propane boiler
Received the following improvements totaling $25,000:

- Ground source heat pump system provided by ClimateMaster and Intermountain Energy
- Low-E windows
- Cellulose insulation in attic and crawlspace
- Marathon water heater
- Air leak sealing
- Air purification system
- 10 compact fluorescent lamps
- Low-flow showerheads and faucets

First Runner-Up – The Cruthers'

Square Footage:.....1500
Year Built: 1971
Heat Source: ..... Gas furnace
Received the following improvements totaling $10,000:

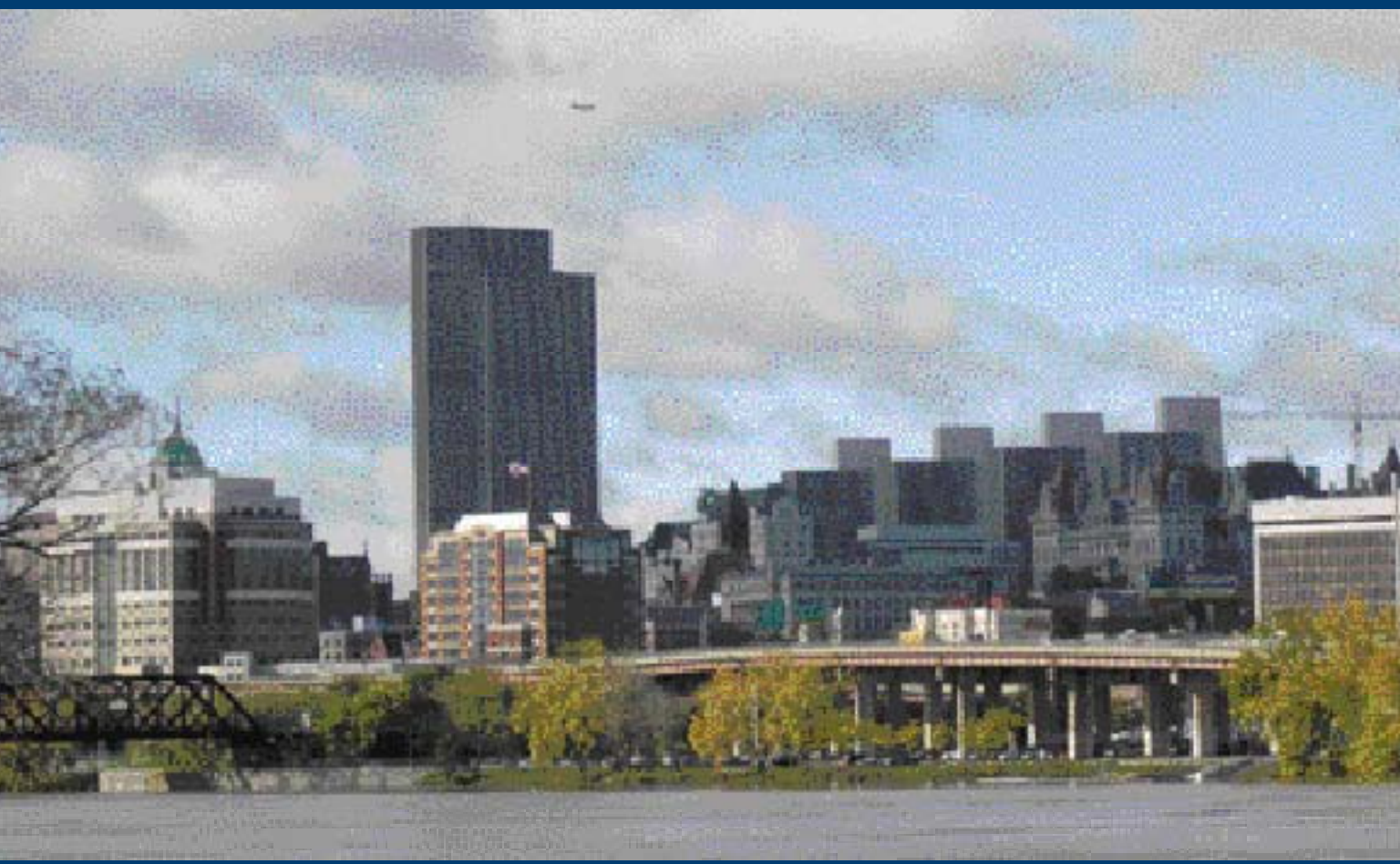
- Low-E windows
- Cellulose insulation in attic
- ENERGY STAR refrigerator-freezer
- Air leak sealing
- Duct system improvements
- Air purification system
- 10 compact fluorescent lamps
- Low-flow showerheads and faucet aerators

Second Runner-Up – The Green's

Square Footage:.....2000
Year Built: 1982
Heat Source: ...Electric resistance
Received the following improvements totaling $10,000:

- Low-E windows
- Cellulose insulation in attic
- ENERGY STAR refrigerator-freezer
- Air purification system
- 10 compact fluorescent lamps
- Low-flow showerheads and faucet aerators

2006 Ground Source Heat P
Albany, N



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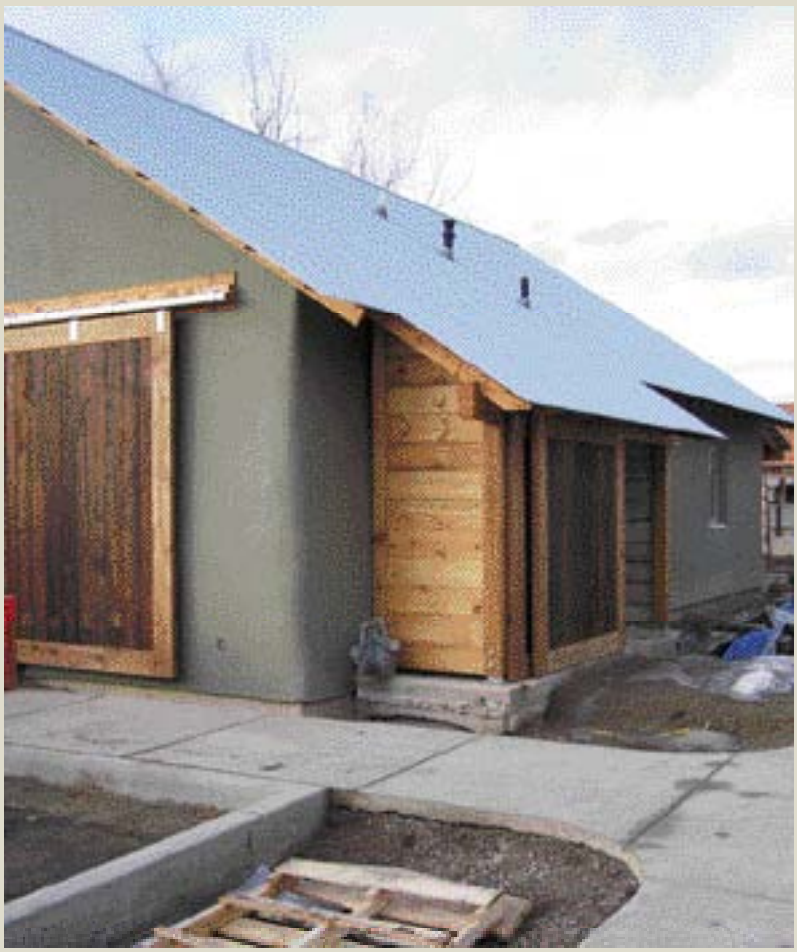
The "Green" Answer to Low-Income Housing

By: Trisha Swindle



The Orchard Gardens community barn will serve as host for a variety of resident activities such as barbeques and garage sales.

Low-income housing is not a phrase that inspires visions of neat, beautiful apartments. Instead our minds are filled with shades of institutional brown, crime, poorly kept lawns, and row after row of 2 and 3-story apartment buildings. These communities of low-income apartments are glaring examples of what future homebuyers try to avoid. A group of citizens from Missoula, Mont., are working to change the image of affordable housing. The non-profit organization homeWord not only strives to provide safe, affordable housing but also to use green technology in many different applications. To date, they have completed eight housing communities with 108 units in Missoula and Billings. Their newest community, Orchard Gardens, recently installed the first ground source heat pump system used in their projects.

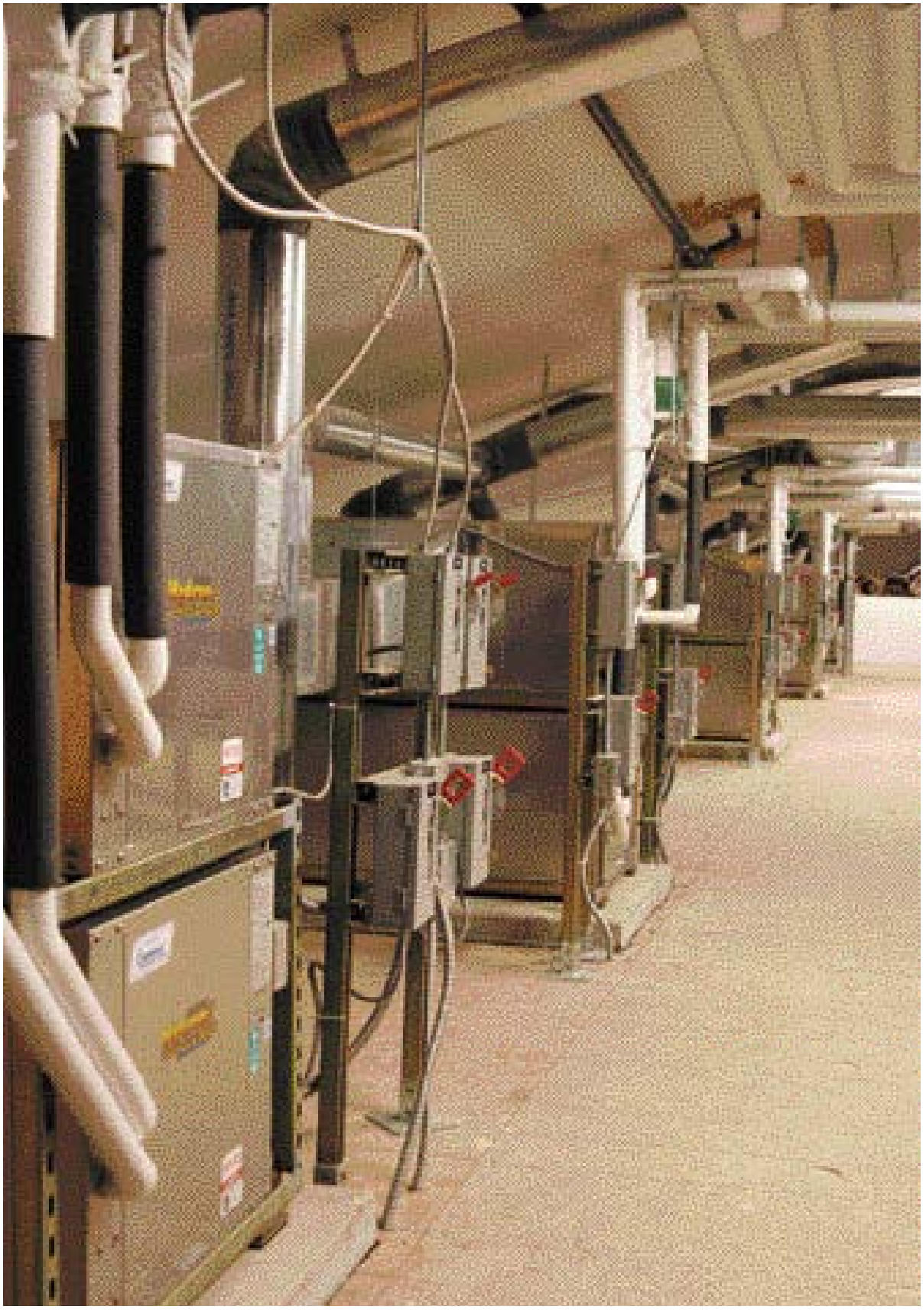
The Housing Crisis

HomeWord was created in 1994 by the Women's Opportunity and Resource Development Inc. or WORD, in response to the housing crisis that had developed in Missoula. More and more families were becoming part of the working, educated poor; especially single mothers. Thankfully this organization is in existence because today's statistics are not any better than the '90s. Although the creation of new jobs is on the rise, most of these positions are either professional or low-wage jobs. About 85 percent of Missoula's new jobs are in the low-paying service and retail industries. Over half of the residents in this community cannot even afford to purchase the average home in the city, and 28 percent cannot afford fair-market rent. Even more disturbing are the 43 percent of renter households considered rent burdened, paying more than 35 percent of their income for housing. Missoula, Mont., is not unique in their housing dilemma, however, their response to this problem is unique.

HomeWord's response to the problem was to develop a new kind of affordable housing; housing that was not just affordable, but housing that a community was proud to have as part of its neighborhood. They wanted their communities to use green technology and offer their tenants access to an assortment of social aid. This includes health department neighborhood nurse visits, tax return workshops and referrals to other social services as needed. These services help in attaining homeWord's ultimate goal-helping their tenants purchase their own homes.

The average two-bedroom apartment rent in Missoula is $725 a month for roughly 900 square feet. According to the homeWord Web site, the rent at the new Orchard Gardens will be between $300 and $695 a month. This price also includes all utilities. Tenants must have an income below 50 percent of the areas median income. The Web site also states that, "homeWord hopes to add an equity-building component to the Orchard Gardens project by setting up an Individual Development Account (IDA) savings mechanism for

Waiting for the finishing touches, this energy-efficient apartment building will soon be home to several Missoula families.



The magnitude of the Orchard Gardens project is apparent with one look at the facility's equipment room.

The open loop geothermal system circulates a 10 percent propylene glycol and 90 percent water antifreeze solution.

each resident. A portion of their rent, and potentially the cost of their annual energy savings, will go into a savings account to be used for buying a home, paying for education or starting a small business." Along with this exciting feature, 1 percent of each community's budget includes funding for public art.

Predatory Lending Practices

Throughout this process homeWord quickly discovered that predatory lending practices and companies also target this section of the population. Several groups were brought together to create a coalition to help combat this growing problem. Together with homeWord, such groups as Consumer Credit Counseling Service of Montana, the YMCA and Montana Legal Services Association established the Montana Alliance for Responsible Finance or MARF. Their Web site states that they "oppose predatory lending practices that target low income and other vulnerable households, threatening opportunities to build assets and economic stability. HomeWord is committed to raising public awareness of predatory lending so that individuals and communities understand the negative impacts of these loans, including financial crisis, bankruptcy, eviction and even foreclosure." To date, they have created a task force that works with services already in existence by providing training to advocates who work with low-income borrowers to help them avoid predatory loan terms. They have worked with the Montana Credit Unions for Community Development (MCUCD) to link together local credit unions for social service agencies to develop an alternative to high-cost payday loans. Finally, they submitted a payday lending reform bill (HB494) to the 2005 Montana Legislative Session, which received support from the Montana Attorney General's Office, AARP, Consumer Credit Counseling Services and many others. Currently this bill has been tabled due to the unrelenting pressure of the lucrative payday loan industry, but homeWord and MARF remain dedicated to furthering this cause in the effort to establish real change in the lives of the people they represent. The 2007 legislative session should be prepared to receive a similar bill that will attempt to protect the low-income borrower from predatory loan terms and costly payday loans.

Funding

One of the biggest challenges facing a non-profit organization is financing. HomeWord has found several ways around this obstacle as well. According to their Web site, some of their funding is federal money directed through the Housing Division of the Montana Department of Commerce. The division's Montana Home Investment Partnerships Program, or HOME, provides grants to develop affordable housing for low-income people. The majority of their funding comes from a low-income tax credit program. These tax credit programs allow investors to get tax credits for lending money to affordable housing developments, like homeWord. Then the program subsidizes construction costs upfront. By doing so, building costs are lower, which, in turn, greatly reduces the tenants' monthly bills. They also find historic tax credit opportunities and rent street-level commercial space within their apartment buildings. All these programs add to one thing-lower monthly payments for the tenants.

Creative Answers

HomeWord has inspired new ways of creating these projects. They implemented a new strategy idea called charrettes, which are brainstorming sessions involving

everyone with a stake in the new development. Getting all these groups of people together at the beginning of the building process saves time and money because certain miscommunications are avoided. Their goals of using green technologies are the most interesting. Local builders and engineers are gaining opportunities to try out new green technologies on these projects. This provides them with the chance to gain experience with these technologies and feel confident in selling them to future customers within the community. Local citizens are also influenced by homeWord's use of green technology. They feel inspired to put them to work in their own homes.

The ground source heat pump systems will provide both a comfortable and affordable living space for the residents of Orchard Gardens.

Orchard Gardens

Their newest project, Orchard Gardens, has taken the successes of the previous communities and expanded it even further. The average home in this semi-rural area sells for approximately $160,500. Situated on 4.6 acres in the rural part of Missoula, homeWord has managed to blend closeness to nature while easily accessing the town's modern necessities. The building is approximately 2.6 miles from downtown Missoula, which provides easy access to public transportation. A pedestrian/bicycle trail was created to link downtown to Orchard Gardens and further encourages the residents to conserve energy through walking or riding their bikes to town. This five building complex will accommodate approximately 60 residents in one, two and three-bedroom apartments. HomeWord Inc. worked with several teams of people to complete this project. The architectural firm MacArthur, Means and Wells, designed these beautiful buildings and worked with Sirius Construction to get them built. Associated Construction Engineering Inc. designed the GSHP system, and EMC Engineers Inc. reviewed the design and provided services as a commissioning agent/consultant.

GSHP

The Hydron ground source heat pump was installed by 4 G's Plumbing and Heating. The vertical open loop system was drilled by Camp Well Drilling and uses two supply boreholes and one return borehole at 140 feet deep. They used C-900 PVC pipes, two 6 inch diameter production wells and one 8 inch diameter production well. A 10 percent propylene glycol and 90 percent water antifreeze solution was used to combat the freezing temperatures encountered during Montana winters. A 64.5 total tonnage system was used for the four residential buildings, as the fifth building is a barn. Each of the 37 units had an installed tonnage between 1.5 and 2.5.

The total cost of installation for the GSHP was $561,000 and was funded by an anonymous donor interested in directing the use of their money for green technology. The annual energy usage for these apartments is 156,911 kW/h per year. The annual operating costs are estimated to be $4,625 per year or $92,500 over 20 years, but this estimate does include maintenance costs

and projected replacement needs for the GSHPs themselves. The anticipated payback period on these units is 20 years, however, due to the unexpected increase in energy costs this will probably need to be adjusted.

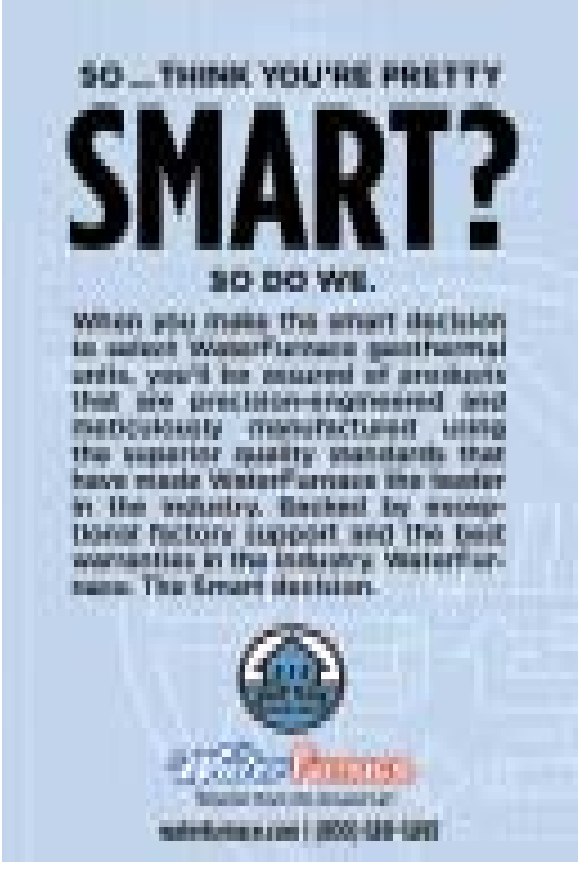
Other Green Technologies

HomeWord used a variety of green products and technology in the construction of their apartment buildings. Along with the GSHP, Orchard Gardens uses a photovoltaic system to offset even more of their utility costs. Sustainable harvested lumber was used in the construction of the building. About 35 percent fly ash was used in four building foundations and 100 percent fly ash was used in the foundation of the community barn. Metal roofing was used containing 30 percent recycled content. The buildings are set on the east/west axis to make use of natural light to save on energy costs. Inside the buildings, wheatboard cabinetry can be found along with recycled content flooring. All insulation is formaldehyde free and made from 25 percent recycled content materials. The road base is made from pulverized recycled glass. An underground parking facility was constructed for the residents to help maintain the beauty of this semi-rural site. Also, a first on this site, dual flush toilets were used. The Missoulian, a local newspaper, reported these toilets conserve up to 68 percent overall water use by providing two types of flushing-a high volume flush or low volume flush.

According to Heather McMilin with homeWord, the use of different green technologies is based on extensive site analysis and energy modeling. A GSHP was the most energy efficient and financially wise choice for this project. By using a GSHP in affordable housing, homeWord can pass along the money saved on utilities to their residents. During her time spent showing the apartments to future residents, McMilian said, "it was noticeable to everyone involved that the units were quite comfortable. I am confident that our residents will love their new comfortable homes."

Building a Community

A straw-built community barn is included on their



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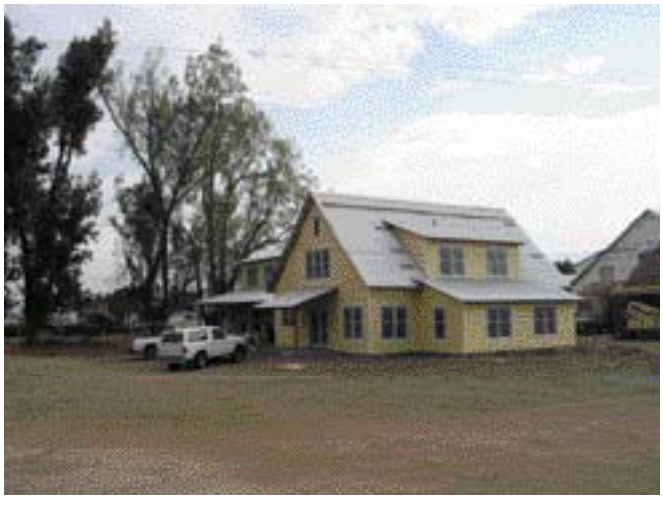
4.6 acres. This barn will be used for community events such as barbecues or garage sales. Encouraging a sense of community is part of living in a homeWord sponsored facility. Networking does not just apply to the office anymore. By developing a network of community friends and peers, residents are able to better care for their own families. Through resident meetings, the homeWord staff helps tenants create opportunities for building community. Such efforts include community potluck dinners, building the strawbale barn, creating a mosaic tiled wall, clothing swaps, pre-teen gatherings and book give-aways. HomeWord also makes time to educate the public about their upcoming projects and commitment to bettering the lives of their residents. In August 2004, they participated in the University of Montana's Homecoming Parade. Dressed to work in an orchard, they passed out caramel apple lollipops while walking behind a banner that read, "Putting the Orchard Back in Orchard Homes." Through educating the public in ways such as this, homeWord can find future funding and tenants all at the same time.

The Montana Contractors Association seeks out industry leaders to submit their work for a variety of awards including the Environmental Excellence Award. A lengthy essay must be written containing answers to the seven requirements listed below. For more information on these awards please visit their Web site at http://www.mtagc.org/.

Environmental Excellence Award Requirements:

1. Comprehensive Environmental Ethic Overview
2. Leadership and Innovation
3. Sustainable Environmental Results
4. Economic Results
5. Participation/Involvement
6. Benefits to Workers/Environment/Community
7. Transferability



Energy-efficient building technologies, including ground source heat pumps, have changed the image of affordable housing in one Missoula, Mont. community.

Award Winning Project

Recently the Orchard Gardens project and Sirius Construction earned the Award for Environmental Excellence from the Montana Contractors Association. Through their efforts, affordable housing has earned a new reputation in Montana. These apartment buildings provide housing that anyone would be proud to live in. Communities are designed to give residents a safe, affordable place to live while caring for the environment in which they reside. HomeWord serves as an example to other communities that green technology is not just for the wealthy. Instead, these carefully planned communities are an example of how using green technology can financially aid the growing working poor population of all our communities.

Getting Down to Zero

By Kelly Green

Homebuilders participating in a new initiative from the U.S. Department of Energy (DOE) could ease the pain felt by many homeowners this winter due to the rising cost of natural gas. These builders are offering zero energy homes with significantly lower utility bills compared to similar new homes. The Zero Energy Homes initiative, a key element of the DOE's Building America program, has the goal of establishing the needed capabilities for cost-effective zero energy homes in all continental U.S. climate zones. According to Lew Pratsch, Zero Energy Home Project Manager, a zero energy home will ultimately produce all the energy it needs over the course of a year and have a zero peak load on the utility grid. Today, the minimum standard for a zero energy home is to cut energy use by 50 percent.

Photo courtesy of Ideal Homes.

The zero energy home located in Oklahoma City, Okla., was built by Ideal Homes for less than $200,000.

"Geothermal heat pumps fit nicely into the Zero Energy Home effort," Pratsch said. "Our Building America teams have worked on houses in more than 20 states and they are increasingly using geothermal heat pumps."

The Zero Energy Homes program focuses mainly on research and development using six engineering teams under contract to the DOE. These Building America teams work with builders, both small and large, in different regions of the U.S. to build increasingly more energy-efficient homes. They work in all major climate zones - from the Southwest's hot-dry climate to New England's cold climate. Hundreds of zero energy homes have been built to date and the goal of the DOE

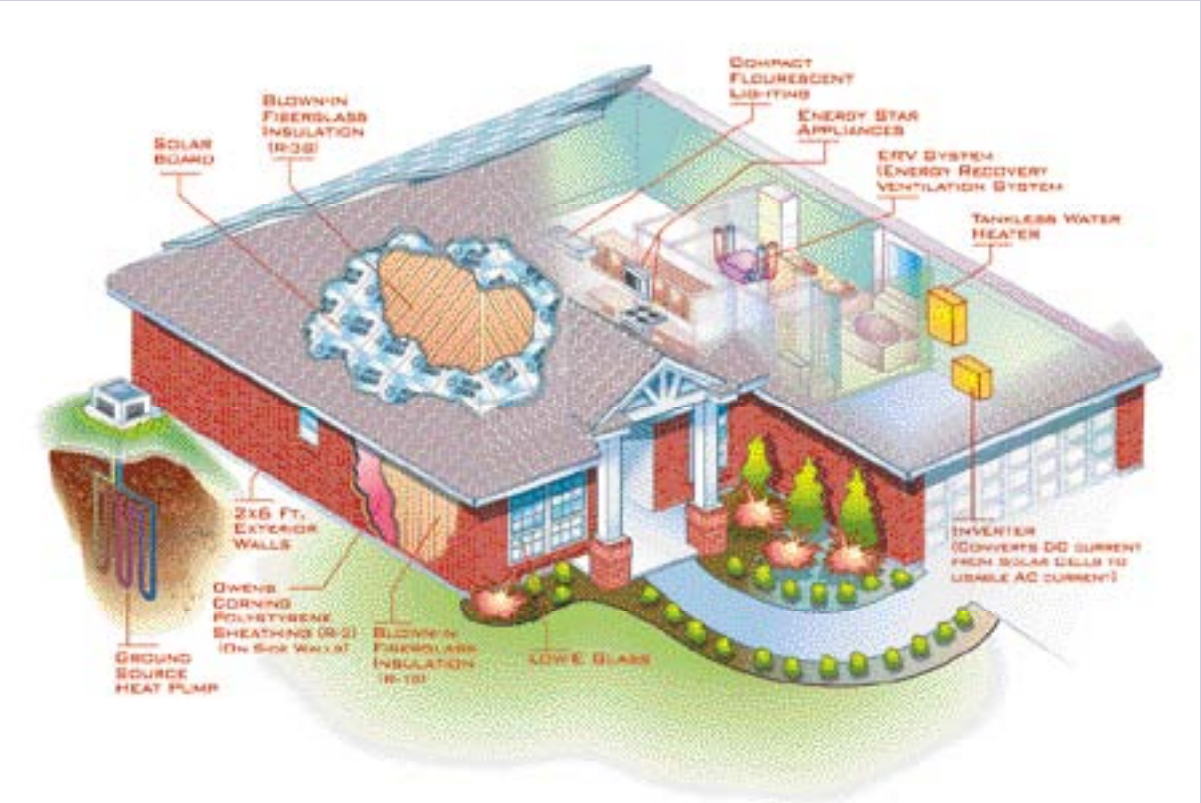


Illustration courtesy of Ideal Homes.

This illustration shows the many energy-efficient technologies incorporated into Oklahoma City's zero energy home.

is to eventually build entire subdivisions of zero energy homes.

"For us to advance to higher levels of energy efficiency, we work with homebuilders to construct homes above the energy building codes," Pratsch said. "Many of these homebuilders build Energy Star homes that cut whole house utility bills by at least 15 percent and are willing to build the best possible."

Working Toward Zero Energy Housing

Jeff Christian is an engineer working on the Zero Energy Homes project with Oak Ridge National Laboratory (ORNL) in Tennessee. According to Christian, his team is working to create a cost-effective package of technologies for zero energy homes. The ORNL completed construction on its fifth in a series of five zero energy research homes in December 2005. The homes range in size from 1060 to 2600 square feet and were built as part of a Habitat for Humanity housing addition known as Harmony Heights in Lenoir City, Tenn., only a few miles south of the ORNL.

Each of the five homes contains a modified set of technologies specifically designed for the mixed humid climate of East Tennessee. While none of the homes contain exactly the same combination, all five homes include the following:

- High-efficiency heating and cooling equipment
- Heat pump water heaters or a highly-efficient conventional electric resistance water heater
- Rooftop solar photovoltaic (PV) panels
- Structural insulated panels made of a thick sheet of foam insulation sandwiched between pieces of oriented board
- Airtight building envelopes
- Ducts located inside the conditioned space to minimize heat transfer losses
- Mechanical ventilation to ensure the house achieves the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) 62.2 Standard for ventilation and fresh air quality
- Reflective metal roofs

Photo courtesy of National Renewable Energy Laboratory.

The zero energy home known as the "Solar Patriot" was displayed on Washington, D.C.'s, National Mall before being transported to its permanent location in Northern Virginia.

- High-efficiency windows
- Passive solar principles
- Energy Star appliances
- 60 to 90 percent fluorescent lighting

The fifth house contains ground source heat pump systems manufactured by Waterfurnace. The third house contains a direct exchange geo system manufactured by American Geothermal. Energy costs for the first four homes range from 75 cents to a dollar per day based on the Tennessee Valley Authority's (TVA) current electric rate of $0.068 per kilowatt hour. The TVA also credits $0.15 per kilowatt hour for the power produced by the home's PV system even if that power is not put back into the grid. Energy costs are not yet available for the fifth house due to its recent completion, but Christian said he anticipates a cost of 60 cents per day.

A 2005 report written by Christian states the goal of the research is to help the building industry develop building methods and materials that will make low-cost near net-zero energy houses a possibility by 2010. Christian said also in the report that at this point PV systems are emphasized typically only at the higher end of the housing market due to the first-cost premium related to this technology. With the cost of fuel steadily rising, however, Pratsch feels that homebuyers in every market will soon begin searching for energy-saving alternatives that will translate to cost savings on their utility bill.

"After this winter, I think people will be interested in building more energy-efficient homes," Pratsch said. "We need homeowners to understand that they can get a higher level of energy efficiency and can always ask homebuilders for at least an Energy Star home, which saves 15 percent or more in energy use."

Ground Source Heat Pumps and Zero Energy Homes

Ideal Homes, a progressive homebuilder based in Oklahoma City, Okla., also has experience building highly energy-efficient homes. With design assistance from the Building America program, the company recently completed the nation's first true zero energy home to be built for less than $200,000. The house contains a ClimateMaster ground source heat pump system, 5.3 kilowatts of electric PV, a tankless hot water system, low-e glass windows and an energy recovery ventilation system. Like ORNL, Ideal Homes has been experimenting for years with ways to lower the cost of increasing energy efficiency. Ideal Homes builds about 500 energy-efficient homes annually and guarantees the heating and cooling bills for a majority of these homes.

"A ground source heat pump system is the technology that takes a house to zero energy," said Vernon Mckown, co-founder of Ideal Homes. "It is the only viable solution when the goal is zero energy."

To lower the initial cost of ground source heat pump systems, Pratsch said the Building America teams have done two things. First, they design the homes with tight building envelopes to decrease the total heating and cooling load.

"Our goal is to reduce the heating and cooling tonnage in each house by 30 to 50 percent," Pratsch said. "As we make the homes more energy efficient, we automatically reduce the size and cost of the ground heat exchanger."

Secondly, they employ innovative designs that better incorporate the geothermal system with the house. For example, Pratsch said that in at least one research home the ground heat exchanger was placed in the over

cut for the home's foundation. Because the system's tonnage had been cut in half, the system was small enough to be placed in the outer edges of the excavation. For a slab house Pratsch said Jim Bose, executive director of the International Ground Source Heat Pump Association, had suggested drilling a single vertical borehole below the slab, connecting it directly to the GSHP and avoiding the need to header and trench.

However, the GSHP systems are not the biggest cost-related obstacle facing the Zero Energy Homes program. The solar electric panels, which produce the home's onsite energy, are the most expensive. The panels on the ORNL's first four research homes, for example, produced between 20 and 27 percent of the homes' energy. Pratsch said with other available technologies, homeowners can usually still cut energy use by 30 to 40 percent.

"In national market research of 1700 homebuyers, over 80 percent indicated they were very interested in a zero energy home if there is a positive cash flow between the mortgage and the utility bills."

Lew Pratsch, Zero Energy Homes Program Manager for the U.S. Department of Energy

Doug Rye, a consultant who teaches over 150 seminars a year promoting energy-efficient building design, encourages homeowners to choose alternatives with low operating costs that last for a lifetime. He recommends extensive caulking, cellulose insulation and a ground source heat pump system.

"There is nothing to my knowledge that will heat and cool like geothermal," Rye said. "I have had geothermal personally for 19 years and I have been responsible for many thousands of other geothermal installations simply because I think it is the most efficient system available today."

Zero Energy Homes and the Consumer

Pratsch said that while the Zero Energy program will surely benefit the environment by reducing the country's energy usage, it will also benefit the homeowners who choose to adopt it. He said the concept will actually offer homeowners an improved comfort level because all the home's features will be properly designed and installed. For households on a fixed income, it will also offer the opportunity to lock in a higher percentage of the energy costs at a time when there seems no end to how high the costs will climb.

"I think it's really a matter of the homebuilder giving the consumer more choice when it comes to energy-efficient technologies," Pratsch said. "Many people are happy to do their part to help the environment if there is no added cost. In national market research of 1700 homebuyers, over 80 percent indicated they were very interested in a zero energy home if there is a positive cash flow between the mortgage and the utility bills."

Although cost-effective true zero energy homes remain the DOE's goal, the research conducted through the Building America program confirms that not only are energy-saving technologies readily available to homeowners today but also that homebuyers will purchase highly energy-efficient homes if offered. Hybrid car sales show that consumers are interested in energy efficiency and it seems that zero energy homes, or at least homes that cut energy use by 30 to 40 percent, are the answer for the American homeowner's rising utility bills.

A Pioneering Subdivision

by: Clarissa Gentry

The name Walden Pond often inspires thoughts of Henry David Thoreau's masterpiece, Walden. Thoreau's book was motivated by a two-year stay in a cabin on Walden Pond just outside Concord, Mass. It was during this residence that Thoreau "wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived." While living on Walden Pond, Thoreau chronicled his life with nature and, in addition, noted the disturbances and destruction of his beloved environment.

Photo courtesy of Mike Kapps.

The Walden Pond subdivision in Carmel, Ind., achieves a peaceful environment while providing energy savings for its residents through the aid of ground source heat pumps (GSHP).

"Every creature is better alive than dead, men and moose and pine trees, and he who understands it aright will rather preserve its life than destroy it," said Thoreau. "If a man walks in the woods for love of them half of each day, he is in danger of being regarded as a loafer. But if he spends his days as a speculator, shearing off those woods and making the earth bald before her time, he is deemed an industrious and enterprising citizen."

It is because of such statements that Thoreau unintentionally began the conservation movement, a movement that strives to balance preservation and growth. Over a century and half have passed since Thoreau lived isolated in a small cabin, but his influence on the environment and conservation continue today.

Case in point, a subdivision that successfully balances the struggle with conservation and development, also named Walden Pond, is located in Carmel, Ind. This 40-acre, 126-lot subdivision was constructed in 1988 outside Indianapolis on an old drive-in movie theater plot. Similar to the ideals Thoreau inspired, this development accomplished its clean, tranquil environment through the aid of ground source heat pumps (GSHP).

Innovative Promotional Program

Walden Pond was developed through a geothermal promotional program, System GT, sponsored by Public Service Company of Indiana (PSI), currently known as Cinergy. The goal of System GT was to reduce the cost associated with the installation of both vertical and horizontal loops, in order to take advantage of the envi-

Henry David Thoreau (1817-1862) inspired the modern conservation movement with his writings, including Walden.

ronmental and economical benefits GSHPs provide long term. PSI collaborated with LoopMaster International of Indianapolis, Ind., on a brake-even partnership.

"The way it worked was PSI paid for the entire cost of the loop installation," said Steve McGowan of LoopMaster, project manager for Walden Pond. "Then if we made money we'd split it with them and if we lost money they'd split it with us. It was actually a pretty exciting subdivision because it was the very first all-geothermal subdivision and we had people coming out to the job site continuously to see it."

To offset the costs for this ground-breaking development, LoopMaster preinstalled all the ground loops before the homes were built. According to McGowan, outlines for the foundations of the homes were drawn and then the pipes were set in the center of each lot. Half of the 126 homes consisted of horizontal loops and the other half were vertical loops. Corresponding with the first few installations, there was a switch in the industry from one-inch polybutylene pipes to one-inch polyethylene pipes due to advancement in technology.

"That was long enough ago that there was still a lot of work that needed to be worked out prior to where we are today," said McGowan. "The technology had to improve."

Each eco-friendly home averages about 1300 to 1500 square feet and features a 2 1/2 to 3-ton system that uses a WaterFurnace heat pump installed by William's Comfort and Air. The horizontal installations were 350 feet long with a six-pipe loop layout. Each vertical system had three boreholes per home at a depth of 150 feet.

The effort was worth it in the end. In a 1990 report conducted by the Electric Power Research Institute (EPRI), the pre-installation of multiple loops saved 34 percent on installation costs. The EPRI report also stated a $400 energy savings per year for each customer utilizing GSHPs, reports Home Energy Magazine Online. Indiana set the standard for geothermal and led the country in installations as a result of the System GT program, according to the Geothermal Heat Pump Systems web site.

Environmental and Economical Benefits

Residents of Walden Pond enjoy the privilege of tax credits on their property taxes. Due to the efficiency of GSHPs, they also save on maintenance costs. Homeowners receive some benefits for electrical usage from Cinergy. Norman Turchan, a resident of Walden Pond, is especially pleased with the quality and evenness of heating and cooling his geothermal system provides.

"Our home is a home with a lot of cubic feet, that is we have large, open cathedral ceilings," said Turchan. "Of course, we have a lot of area to heat and cool and you never have the feeling of 'well, the furnace is on.' That is not the case with the geothermal heat pump. It's ecologically a good approach to heating and cooling by using the earth itself as a source."

The Walden Pond development utilizes the environmental and economical benefits GSHPs provide to create the very first all-geothermal subdivision and set the standard for others to follow. Especially today, it is important to be conscience of the environment and conserve energy as more developments are built. Not only does this subdivision remain conscience of the environment and conserve energy, but it continues to pay off for its residents today by reducing the cost associated with heating and cooling their home. The use of GSHPs throughout the Walden Pond subdivision was a groundbreaking decision. Skyrocketing fuel costs today solidify the economic wisdom of that choice made over 15 years ago. Thoreau once wrote, "What is the use of a house if you haven't got a tolerable planet to put it on?" It seems that this Indiana subdivision lives up to the conservation goals stimulated by Thoreau.

Prototype of an Affordable Home

By Jennifer Hale

The current energy crisis floods today's news headlines. Not only is everyone checking the daily price of fuel, but people are also searching for ways to combat the soaring costs of heating and cooling their homes. Don McCarthy, project coordinator for Neighbor For Neighbor, a non-profit organization in Tulsa, Okla., will soon be seen as a good friend to at least one family. He has proven an energy-efficient home can be built with heating and cooling costs less than $20 per month and has named this solution the Millennium House. The original concept and design of the house was formulated by retired engineers Don McCarthy, Harold Schultz and Jim McUsic.

The home contains all the standard amenities while still being energy efficient, fire retardant and handicap accessible.

"Buying a home is one thing, but being able to afford to live in it is another," said McCarthy. "The Millennium House demonstrates it is possible to build a total electric home for about $50,000 to $60,000 using quality materials that produce healthy, safe and energy-efficient structures."

The home serves an easily replicable archetype of how to build not only an affordable and energy-efficient home, but also exhibit storm and fire resistance and healthy indoor air quality. All of these benefits reside within the home's handicap-accessible, low-maintenance living environment. One of the key ingredients to the Millennium House's energy efficiency is a ground source heat pump (GSHP), donated by ClimateMaster.

"We have the technology!" said Dan Ellis, president of ClimateMaster. "Let's get it to the folks who need it. The GSHP offers an economical, energy-efficient and environmentally sound method for heating and cooling a home. The payback begins on the first day of operation."

Neighbor For Neighbor Starts New Project

McCarthy, a retired engineer, has been a Neighbor For Neighbor board member since 1970. The non-profit organization was started in 1966 in Tulsa, Okla., by an ex-priest with a compassion for the poor. He wanted to create an organization that provided food, qual-

ity housing and dignity to those in need. As a result of his dream, a Neighbor For Neighbor food store is located in Tulsa today, and with the help of volunteer professionals, the organization also provides complete medical, dental, optometric and legal help for those in need. Advocacy programs, which strive to gain more justice for low income residents is another form of the organization's contribution. Neighbor For Neighbor receives no government funding and is not a United Way recipient. The community of Tulsa has benefited from the organization's steady growth each year.

Traditionally, housing has been only a small part of Neighbor For Neighbor's operation. Through his tenure at Neighbor For Neighbor, McCarthy has renovated around 30 homes, but the Millennium House is the first home the organization built from the ground up.

"I realized at one point that when we remodel a home we are still left with insufficient insulation and many things not up to code," said McCarthy. "A remodeled house is still an old house and I knew there had to be a better way to provide quality homes. I wanted to create homes that were super energy efficient, storm resistant, fire retardant and affordable not only to buy, but also to operate and live in on a monthly basis."

Building an Affordable Home

In the summer of 2005, McCarthy decided to make his idea a reality and prove an affordable home can be built. He purchased a lot of land located at Virgin and Wheeling in Tulsa, Okla., for $300, and began discussions of his plan with Manhattan Construction Company, who was quick to agree to participate in the project. Project Impact, the American Lung Association and the American Institute of Architects (AIA) teamed up with McCarthy and Manhattan Construction. With an impressive list of supporters, the project began.

Chuck Fedon of Manhattan Construction Company agreed to build the 1,280 square feet, 32 by 40, three bedroom, two bathroom Millennium House if McCarthy agreed to use steel for the studs and ancillary support for the interior walls. The constructed walls are 12 inches thick instead of the standard 4 or 5 inch wall. This allows the walls to withstand an F3 tornado, reduce the potential for fire damage and block outside noise while providing indoor comfort through energy efficiency.

The engineers made McCarthy aware of other energy-efficient technologies he could integrate in this home, such as a GSHP. After he was sold on using a GSHP, McCarthy contacted Randy Brogdon, a current Oklahoma state senator, from ClimateMaster to meet with him. Before any questions were asked, Brogdon offered the donation of a GSHP unit for the Millennium House.

"ClimateMaster supports the efforts of organizations such as Neighbor For Neighbor in its efforts to offer affordable housing to low-to-moderate income families," said Ellis. "Our company was proud to contribute to the Millennium House project and sponsor its open house to the public."

The Millennium House contains a ClimateMaster Genesis series PSC 024 GSHP unit. Shoemaker Air Conditioning and Heating installed the 2-ton unit with a vertical ground loop. The installation required two, 175 feet boreholes, and the system uses 1 inch, Phillip's Driscopipe 5300 piping. According to McCarthy, the drillers started drilling at 9:30 a.m. and both boreholes, along with U-bend pipe fittings and polywing anchors, were in place by 3:30 p.m.

The actual construction of the house went up incredibly fast. All the concrete was poured and outside walls finished within one day. McCarthy gathered four volunteer engineers from ICF to help put up the outside wall and professional volunteers finished the remainder of the house.

Whirlpool also made a gracious donation by providing all appliances for the home. The Tulsa Partners, a public private partnership, with an advisory board of city planners, bankers, architects, engineers, and builders, also contributed $15,000 to the project. These funds were originally obtained from the Federal Emergency Management Agency's Project Impact program.

The Millennium House is the only home in Oklahoma certified by the American Lung Association. To meet this compliance, it contains no carpet and there is no vegetation within ten feet of the house to avoid mold and moisture. The GSHP also helps avoid moisture buildup

and is a technology the American Lung Association largely supports. A raised garden and ramps lead to the front door of the house and add wheelchair accessibility to conveniently accommodate the handicapped.

A family has not yet been chosen to reside in the home, however, it is completely finished and when the right family is found, the move-in can occur immediately. McCarthy is looking for a family who can utilize the Americans with Disabilities Act (ADA) compliance of the house.

"We could not be more pleased with the results of the Millennium House project," said Ann Smith, Neighbor For Neighbor Executive Director. "We are now in the process of selecting a family to move into the home."

According to McCarthy, data from the past six months on the Millennium House shows average heating and cooling operation costs should be around $230 per year. The lowest electric bill reported has been $28.06. Eighty percent of this bill accounts for lights and appliances and only 20 percent for heating and cooling. The data concludes a requirement of only an approximate $9 to $20 each month to heat and cool the home.

Setting a New Standard

The Millennium House has proven so far to be a success; however, McCarthy's plan has just begun. He hopes to build many more houses like this one. Through this project he has acquired all the needed data and publicity, through press releases and events such as an open house, required to start building a community of affordable and efficient homes. At the open house, held in mid-November 2005, visitors traveled from as far as 50 miles to view the main attraction, energy efficiency.

McCarthy plans to construct future homes himself with the help of volunteers. However, professionals will be used for heating, cooling and other specialized jobs. Since the Millennium House went up so quickly, he feels he can feasibly place eight to ten of these homes on a successive street.

"I would like to put up about 40 to 50 more of these houses within the next year," said McCarthy. "I feel genuinely confident we can get 20 to 30 volunteers to work for at least a couple of months and put these houses together."

The property for the homes has been located. With sparse construction in downtown Tulsa, McCarthy's plan is to change this by building the finest homes possible for low- to- middle income families right near the heart of Tulsa. He hopes to stimulate new verve in the area with a variety of people from different social classes.

"There are so many attributes to offer besides just a house. Hopefully many structures will start following this housing project and this area will become a place people want to live," said McCarthy. "It would be nice to build something similar to the Millennium Park in Chicago. I want to construct something to bring bright lights and new promise to the neighborhood."

The only problem with his phenomenal plan is the financing. However, McCarthy has confidence in his stout financial backers. Neighbor For Neighbor recently raised $3.5 million to move their offices into an old shopping mall, and donors to this project are also all interested in the energy-efficient housing concept. McCarthy feels they might be interested in helping out.

Tulsa's Vision 2025 includes a section seeking to replace the 6,300 sub-standard houses in the city. Reaching this goal would require remodeling 300 homes per year and McCarthy hopes the city will incorporate his ideas and use the Millennium House as a model for new construction. He feels this move to energy-efficient housing is the answer to the future of the housing industry.

"I am convinced this push for energy efficiency is going to be a real benefit for the housing industry because people's energy bills are going to go sky high in the next few years making it impossible for people to live in their houses," said McCarthy. "I see this house experiment as the tip of the iceberg with energy going up by double digits and salary only going up by three or four percent."

To learn more about Neighbor For Neighbor or how you can support the organization, visit www.neighborforneighbor.org or contact Don McCarthy at DMcCarthy20@cox.net.

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.

It's an Energy Conscious World

A client of mine recently asked a key question about geothermal heat pump (GHP) systems; "Considering how much energy they save, the reduced maintenance, and long life of the system, why doesn't everybody have one?" That's a good question. With all the energy cost trauma of the last year, why doesn't everybody have one, or want one? The reason–they're not bright and shiny enough!

A classic example is hybrid cars. Not real attractive, but everyone can see who is "doing their part" on energy conservation. Oh, really? I have a friend who drives a hybrid–it gets about 25 miles per gallon. I drive a big 4-wheel drive SUV–it gets 20 miles a gallon on the highway - and can handle rough construction sites. You can drive what you want or need to and still save energy and the environment.

Let's get real for a minute–let's compare a hybrid car to a GHP system in terms of:

Usage:

- How much do you drive your car? According to an ABC news program, the average American drives about 1.5 hours a day.
- Did you know the typical residential HVAC system (regardless of type) operates approximately 35% annually, or an average of 8.4 hours a day?

Energy Consumption:

- A car consumes fuel to create energy. One gallon of gas consumed at 25 MPG will only take you 25 miles.
- A GHP uses energy to harvest natural energy. 1000 KWH of electric energy used in a GHP will multiply harvested earth energy into the equivalent of 3,500-4,500 KWH worth of heating energy.

Environmental Impact:

- What kind of gas mileage do you get - poor, average, excellent? No comparison to a GHP!
- Installing the average size residential GHP system, which is 3 tons, or 36,000 BTUH, has the environmental impact of taking TWO CARS OFF THE ROAD or of planting 128 trees. (Information courtesy of GHPC)

Sustainability:

- To maintain its efficiency, any car needs oil changes, air and oil filter changes, regular tune-ups, proper upkeep, tire and hose replacement, etc. throughout its useful life.
- A geothermal heat pump unit needs air filter changes and repairs if something breaks and has an expected useful life of 20 years. You can't wear out the earth or the pipe. The ground heat exchanger will be as good 50 years from now as it was the day it was installed; with no maintenance.

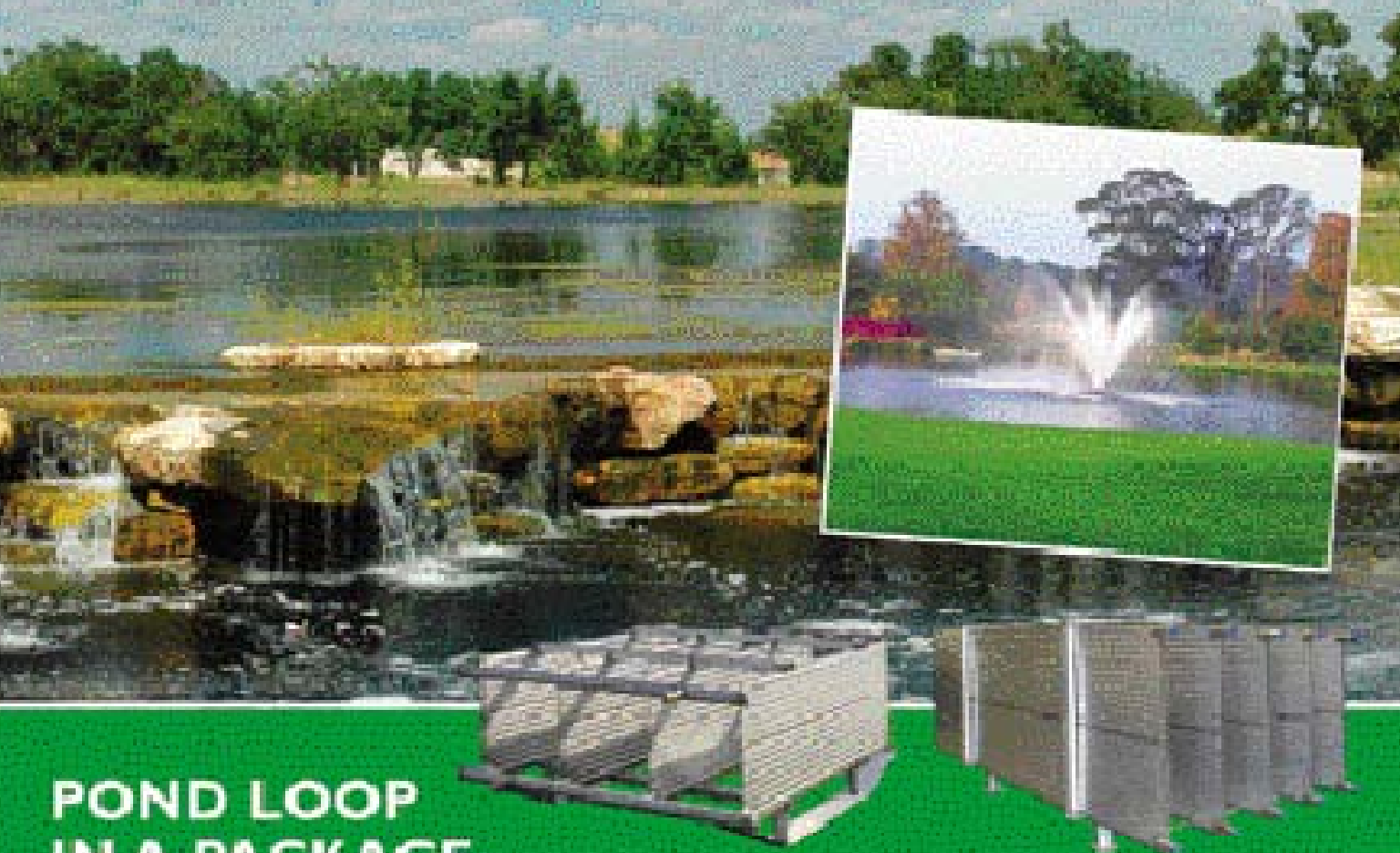
If you needed an average size HVAC system and you took the difference between the installed costs of a conventional system versus a GHP system, the GHP cost premium would be less than one fourth of the cost of a typical hybrid car. So, do you want to be bright and shiny, or

1.) Save a bunch of money, and

2.) Make the equivalent of two cars or more worth of environmental pollution go away every year - for the life of your heating/cooling system?

Mr. Rawlings has over twenty-five years experience in the geothermal industry. He is a Certified Geoexchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.

Some see a pond.
We see an emission free, fuel free power plant!



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