Scenic St. George, Utah, Enjoys Low Energy Bills

A GeoExchange home in St. George, Utah

The Builder

LeRoi Merrill, president of MBM Construction, Inc., has been building homes in St. George, Utah, for the past 28 years, after 12 years of home building experience in Idaho. Several years ago, Mr. Merrill decided to base his business not only on quality and integrity, but also on building the most energy efficient homes available in the area. MBM Construction has achieved its goal through quality construction practices, the use of energy saving building materials, and space conditioning their new homes exclusively with GeoExchange K systems. To convince clients unfamiliar with GeoExchange technology, MBM Construction, Inc., pays the heating and cooling bills for the first year. MBM Construction submeters the GeoExchange system in each of their homes.

Some Sample Homes

A prime example of MBM Construction's dedication to energy efficiency is the 3,067-square-foot home it recently built on the speculation that a family of four would be attracted to its scenic St. George views, stylish design, and low projected monthly energy bills. As with all Mr. Merrill's homes over the past few years, the home features 6-inch exterior walls boasting an insulation R-value of 21 and vinyl-framed, double-pane windows with a low-E coating. These features, together with Merrill's strict construction practices, result in a heating load of 18,326 Btu per hour and a cooling load of 28,084 Btu per hour. The St. George area experiences relatively moderate winters with temperatures down to 10EF, but afternoon temperatures in the 40s. Summer is a different story, with temperatures regularly topping 100EF and highs up to 114EF.

Air conditioning and heating are provided by a 2½-ton Addison GeoExchange heat pump connected to a closed-loop ground heat exchanger arranged in vertical boreholes. In the St. George area, about 200 feet of borehole are required per ton of system cooling. The GeoExchange system has a heating Coefficient of Performance (COP) of 3.5 and a cooling Energy Efficiency Ratio (EER) of 13.5. Put in perspective, the GeoExchange homes here are more likely to be 80 to 100 percent more efficient than air source equipment in heating and 30 to 40 percent more efficient in cooling. (With a desuperheater, at least 40 percent of the water for the home could be heated for free.)

Table 1 compares the projected annual heating, cooling, and water heating costs of the installed GeoExchange system with an air-source heat pump, gas furnace with electric air conditioner, and propane furnace with electric air conditioner.

The projections in the table were provided by Earth Energy, Inc., the Rocky Mountain/West Coast distributor for Addison's line of GeoExchange heat pumps. Actual operating costs depend on as-built

construction details and the lifestyle of the occupants. However, every submetered GeoExchange system designed by Earth Energy and installed by their dealers has proven to operate below projections. In contrast, the actual operating costs of conventional systems in similar homes in the area have been higher than the projections in Table 1.

Other examples of homes that MBM Construction has built in the St. George area include the Griffith house, which has 2,071 square feet of conditioned space and is heated and cooled by a 31/2 ton Addison GeoExchange system tied to a vertical closed-loop ground heat exchanger. Based on an electric rate of 4.6¢/kWh, the Griffith's projected annual heating bill is $65, and the annual cooling is estimated to cost $175. MBM Construction also built a 2,963-square-foot home for Layton and Betty Ott. Their 41/2 ton Addison GeoExchange system with vertical ground loop is estimated to heat the house for $89 a year and cool it for $278 per year. Like the Griffiths and the Otts, Rex Davis is extremely happy with his 4-ton Addison GeoExchange system projected to heat and cool his new 3,331-square-foot house for $342 per year at a rate of 4.6¢/kWh.

The above examples show a wide range in the conditioned floor space served per ton of system capacity. While all are MBM-built homes in the St. George area, the houses differ in architectural style and orientation on the lot. For example, the number, size, and orientation of windows can significantly impact the heating and cooling loads. This illustrates the importance of a comprehensive energy audit to determine actual building loads and of designing a GeoExchange system specifically for each particular house. A detailed design approach can avoid over sizing, reduce costs, and improve the performance of the system.

Design Assistance and Training

Earth Energy, Inc., of Montrose, Colorado, in addition to being a GeoExchange system distributor, also offers complete training and ground-loop design support for their dealers. Mr. Terry Proffer, president of Earth Energy, Inc., is certified by the International

Ground Source Heat Pump Association (IGSHPA) as an accredited GeoExchange system installation instructor. Mr. Proffer is an experienced, degreed geologist with more than 15 years in geological and geophysical exploration work in the petroleum industry. This experience has given Mr. Proffer the skills to verify quality ground-loop designs.

The design and installation track record of Earth Energy, Inc., and fellow Addison distributor in Montana, Earth Energy Technology, Inc., includes successful GeoExchange system installations in the harshest environments, including Alaska, and the coldest geographic location in the lower 48 states, the Gunnison Basin of Colorado. Earth Energy requires all their dealers to become IGSHPA-certified installers within a year of coming on board. GeoExchange system distributors, such as Mr. Proffer and the many HVAC contractors that have gone to the time and expense attaining IGSHPA certification, are concerned that unqualified contractors could seriously harm the hard-won reputation of the GeoExchange industry.

HVAC Contractor

One of Earth Energy's extremely qualified dealers, Paxman Heating and Cooling, Inc., is located in St. George, Utah, and installs GeoExchange systems in MBM Constructions' homes, including those highlighted in this case study. Paxman Heating and Cooling has been in business for 13 years and has installed GeoExchange systems for the last six years. Owner Kelly Paxman estimates that he has installed more than 200 GeoExchange systems to date, and the rate of GeoExchange system installations is increasing.

Two years ago, GeoExchange systems represented about 25 percent of the HVAC systems Mr. Paxman installed. Today, they account for half of Mr. Paxman's business.

GeoExchange Systems and the Real Estate Business

Local St. George Realtor Bob Richards is impressed with the energy efficiency of the homes built by LeRoi Merrill and thinks GeoExchange systems are a great idea. However, he has observed that most clients and many of his fellow Realtors are unaware of GeoExchange technology. Education is the key, says Mr. Richards. He thinks that targeting the real estate industry with GeoExchange system information could provide a real service by bringing Realtors up to speed on the technology. The Realtors, in turn, would then educate their clients. The Geothermal Heat Pump Consortium agrees. So, Realtors, look for fact-filled GeoExchange articles soon in Today's Realtor, Real Estate Business, and other trade publications.

According to Earth Energy's Terry Proffer, who has helped design and install many GeoExchange systems in the western United States, homes with these systems in some areas of the country command a higher price than similar homes without. Mr. Proffer says that some GeoExchange system homeowners see a 5 to 15 percent higher value for their homes over the life of the structure.

However, the word of GeoExchange systems' reliability, durability, energy, and maintenance savings needs to spread to all areas of the real estate industry before widespread adoption will be realized. In addition to Realtors, home inspectors and appraisers need to be trained to recognize the true value of GeoExchange systems to homeowners. According to Stan Blake, who operates a real estate appraisal service in St. George, home appraisers are hesitant to assign a value to a GeoExchange system without actual market data documenting that homes with GeoExchange systems sell for more than similar houses that do not contain them. Mr. Blake is familiar with these systems since he has appraised several of LeRoi Merrill's new houses. As a result, Stan has appraised these houses a little higher because of the GeoExchange systems -- by about half the installed GeoExchange system cost. Mr. Blake suggested that more "spec" homes with GeoExchange technology, perhaps encouraged through a few well-placed manufacturer discounts, could provide the market data documentation needed by appraisers to fully value GeoExchange systems.

Key Players

Builder:
MBM Construction, Inc.
P.O. Box 604
St. George, UT 84771
(801) 673-2959

Local St. George Realtor:
Bob Richards
201 East St. George Boulevard
St. George, UT 84770
(801) 628-1606

GeoExchange System Manufacturer:
Dave Phillips
Addison Products Company
7050 Overland Road
Orlando, FL 32810
(407) 292-4400

Local St. George Home Appraiser:
Stan Blake
Blake Appraisal Service
P.O. Box 2259
St. George, UT 84770
(801) 628-2849

GeoExchange System Distributor:
Terry Proffer
Earth Energy, Inc.
P.O. Box 3256
Montrose, CO 81402-3266
(970) 240-8332

Utility:
St. George City Utility Commission
175 West 200 North
St. George, UT 84770
(801) 674-4212

HVAC Contractor:
Kelly Paxman
Paxman Heating and Cooling, Inc.
1325 South 320 East, #5
St. George, UT 84790
(801) 628-4172

Leading by Example

The people involved in this project do not just sell and install GeoExchange systems, they live with

them. LeRoi Merrill has a GeoExchange system in his 3,600-square-foot house and spent just $328 for heating, cooling, and water heating over the entire year of 1996 ($91 heating, $191 cooling, and $46 water heating). A GeoExchange system heats and cools Terry Proffer's 3,200-square-foot house in western Colorado for $296 a year. Both these systems are submetered. Finally, potential customers can see a GeoExchange system in operation in Kelly Paxman's new shop!

The St. George case study showcases successful GeoExchange system installations in a climate where the summer temperatures peak at almost 115 F. But, what about cold climates? How about Gunnison Basin, Colorado, which has the coldest average climate anywhere in the lower 48 states with an annual average temperature of just 35 F including summer highs? Can a GeoExchange system actually heat a house where the temperature this winter fell to 36F below zero and stayed there for several days? Commercial pilot and owner Wally Cox sure thinks so. An Addison water-to-water GeoExchange heat pump connected to an in-floor radiant system keeps his new 3,000-square-foot home comfortably warm all year round. So confident is Mr. Cox in the design, installation, and operation of this GeoExchange system that his home high in the Rocky Mountains is designed without a back-up heating system.

Table 1 - Operating Cost Comparison for 3,067-ft2 Spec House

HVAC System Alternative	Annual Heating Cost	Annual Cooling Cost	Annual Hot Water Cost	Total Annual Cost
GeoExchange System	$64	$166	$98	$328
Air-Source Heat Pump	$218	$592	$183	$993
Gas Furnace/ Electric Air Conditioner	$314	$592	$122	$1,028
Propane Furnace/ Electric Air Conditioner	$839	$592	$337	$1,768

Operating costs simulated by Earth Energy, Inc. Costs above are based on an electric rate of $0.046 cents/kWh, a natural gas rate of $0.55/therm, and a propane rate of $1.40/gallon. The GeoExchange system assumes a desuperheater to help heat domestic water. Air-source heat pump assumes an electric water heater. Gas furnace assumes a gas water heater. Propane assumes a propane water heater. Operating costs of the GeoExchange system are based on the actual heating and cooling loads of the spec house as determined by a comprehensive energy audit. Operating costs of the conventional HVAC systems assume system capacities, building loads, and equipment efficiencies common to most local installations.