Bibeault Ground Source Heat Pump Story

Mark and Gina Bibeault constructed their new home near Abiquiu, north of Española, where only expensive propane for heating and electricity for cooling are available. Mark, a mechanical engineer at Los Alamos Laboratory, and his wife designed a highly energy-efficient home with a geothermal ground source heat pump system that provides both heating and cooling capabilities year round.

The two-and-a-half ton hydronic heat pump system also provides domestic hot water, requires minimal maintenance, and will pay for itself in energy cost savings in about ten years. Ton, as used here, is a measure of the refrigeration capacity of a heat pump system. One ton of refrigeration is equal to 12,000 BTU/hour. A hydronic system uses water as the heat transfer medium.

“What we are really interested in doing is living a normal life, as efficiently as possible, by minimizing the amount of resources we have to use to do that,” said Mark Bibeault.

The Bibeault’s geothermal system is comprised of an earth loop, heat pump and house loop. The house loop is a traditional radiant floor design of brick on sand. The earth loop consists of piping laid in the earth, about seven feet underground. The piping can be laid in long horizontal trenches or vertically, like digging a well. The Bibeaults chose the trenching option and had four trenches dug, each 200 feet long. In each trench there are four loops of piping that amount to 3,200 feet. The pipes hold a glycol water mixture that conducts the heat exchange with the earth. The glycol provides protection against freezing.

The earth’s temperature five to seven feet below ground stays constant within a range of 50 to 60 degrees throughout the year. The hydronic system utilizes this natural phenomenon as a heat sink or heat source (depending upon the season) in a very efficient manner without direct use of fossil fuels. In the wintertime, the hydronic system helps provide warmth while transferring heat from the earth loop to the house loop. In the summer, the same system provides cooling by transferring heat from the house loop to the earth loop.

“What we have is a brick on sand floor, and imbedded in the sand is the radiant floor piping. This is connected up to the heat pump,” explains Bibeault. “So in the winter setting, we have this ground loop of piping that picks up heat from the earth at approximately 55 degrees Fahrenheit. It comes into the heat pump, which evaporates a refrigerant into a gas state. The heat pump has a compressor which compresses the refrigerant gas and creates the hot temperature, which we then heat exchange and run that nice warm fluid through the floor in the house. That heats the house.”

During the summer, the process is reversed to cool the house. Heat energy absorbed by the same radiant floor system is discharged into the earth. The radiant floor cooling is made possible by the use of an “ice battery,” a 200-gallon cooler that acts as an intermediate heat exchanger between the earth loop and the house loop.

The heat pump transfers heat directly from the cooler to the earth loop or to heat domestic hot water, until the cooler literally freezes. This is done in batches. The house loop is continuously heat exchanged with the cooler, effectively cooling the brick floor in the house. The temperature of the cooler increases until the heat pump repeats drawing down the temperature of the cooler.

“In the summer, we’re taking heat out of the house and depositing it in the earth, but before we do that, we actually move some of that heat into our domestic hot water tank,” said Bibeault. “This doubles the efficiency of the system in the summertime. We’re cooling the house and creating domestic hot water for showers and doing that very, very efficiently.”

In areas where natural gas is unavailable, ground-source heat pumps provide an economical option for domestic hot water and space heating and cooling. Bibeault estimates he saves about $3,500 a year in utility bills, because he uses very little propane and electricity. Those who heat with propane pay an average of $700 a month in the winter. The Bibeaults’ utilities average $120 a month year round for a 2,450 square-foot home.

In addition to utilizing an energy efficient heating and cooling system, the Bibeaults designed their home to be as energy efficient as possible, in the selection of building materials, double pane windows, orienting south-facing windows to maximize passive solar gain in the winter, and utilizing interior insulated blinds to control heat loss or gain. They also harvest rainwater for outdoor plants and use a solar powered pump for domestic water use.

“Efficiency and conservation are things that we have direct control over ourselves and we choose to do that. The ability to increase your standard of living, but at the same time reduce the cost, is a very appealing thing to do. It makes you warm inside. It just makes you smile.”