Lake Country Drilling, out of Ardmore, Okla., brought their rig and crew to the installation site.
(Photo courtesy of Bill Holloway)

Researcher's Home Checks Out New Concentric Loop

By Kaylie Lathe

A ground-source heat exchange loop that requires half the footage per ton than a conventional loop requires quickly drew the attention of Bill Holloway. Holloway is a senior research engineer in electrical engineering technology at Oklahoma State University. He is involved in a number of research projects with IGSHPA. The more he found out about the innovative loop, the more interested he became.

Rygan Corporation of Tulsa, a material sciences company that specializes in composite engineering and thermodynamics, designed and manufactured the loop. Holloway approached Rygan and offered to have the loop installed in his home and for research to be done on the system performance. The Rygan loop proved to be highly efficient and ideal for projects with little land available for drilling.

Rygan Product Manager Lane Lawless explains what makes the Rygan HPGX® loop different from the conventional HDPE loop.

"The material used in our system is a low thermal resistance composite material that is designed to impose

Holloway's home was equipped with conventional heat and air for 30 years prior to the Rygan HPGX® loop and heat pump installation.

(Photo courtesy of Bill Holloway)

One 300-foot borehole was drilled for the loop to be installed for a 3-ton heat pump.
(Photo courtesy of Bill Holloway)

Installation of the rubberized inner tube of the Rygan HPGX® loop went as planned.
(Photo courtesy of Bill Holloway)

minimal thermal resistance between the working fluid and the formation for easier and more efficient heat transfer," Lawless said. "It's a stronger material with a higher mechanical strength and a much thinner wall."

The way the HPGX® loop is fused is also unique to Rygan's loop. Instead of using conventional heat fusion methods, Rygan chemically fuses the loop. Lawless says the idea of chemical fusion is borrowed from the oil and gas industry, which has been using it for decades. Lawless says Rygan saw the need for something stronger and more secure in geothermal installations.

"Any time you have high stress or corrosive fluid and it's going to be a direct burial with material like ours, it's going to need to be chemically fused," Lawless said.

Drilling was done by Lake Country Drilling out of Ardmore, Okla. Holloway was impressed, saying they did an excellent job of drilling the borehole. The heat pump, installed by Kyle Kelty and Fred Schroder of B&L Heat and Air of Stillwater, Okla., was a 3-ton ClimateMaster Tranquility 27. Kelty enjoyed working with Holloway and says he really benefited from his extensive knowledge about geothermal.

"We don't normally have homeowners who actually have background or knowledge on what we're doing, so that was good." Kelty said. He says the unique outside installation did not affect his work inside. The installation of the heat pump unit was routine business as usual.

"As far as the indoor installation goes, it was run of the mill, there wasn't anything any different," Kelty said. "We took a gas furnace out and put the heat pump in. Holloway already had it all planned out, so it went well."

While Kelty's installation was typical, he says he was interested in what was going on outside. The Rygan installation is unusual in residential geothermal but has been used commercially all over the country. Research from Holloway's home will help to support residential applications of Rygan's materials. Lawless says the differences are in the mechanics of the loop.

"The Rygan loop is a concentric loop that is a specifically engineered composite fiberglass system with a rubberized inner tube," Lawless said. "The composite shell has low thermal resistance while the inner rubberized channel has high insulation which maintains thermal separation between two flow channels."

At Holloway's home the loop required one 300-foot well, which amounted to 100 feet per ton. A carbon-based grout with a high thermal conductivity was used in the loop installation. Each 20-foot section of the outer pipe was chemically fused with a two-part epoxy and threaded together.

A carbon-based grout was used with the installation of the composite fiberglass Rygan HPGX® loop.
(Photo courtesy of Bill Holloway)

Holloway, who has a typical sized city lot, says the installation made sense for his project. "The advantage is that it takes less real estate and linear bore footage per ton than a conventional loop," Holloway said.

He had been studying how he could put geothermal in the limited space of his yard. He was excited to finally do the retrofit of his residence and to assist with research on the Rygan system.

Lawless and his team have been collecting data on the system's performance in Holloway's home since July 1, 2012. Lawless points out that the data proves the system's efficiency.

"The average entering water temperature for the entire cooling period was 78.63 degrees and the average entering water temperature during the heating period was 56.89," Lawless said. "The average of those numbers is 65.94 degrees, and that's almost identical to the formation temperature. This means it is staying roughly within 10 degrees of the formation temperature in both heating and cooling mode, which means the loop is going to last and be efficient for the life of the system."

In other words, as Holloway said, the loop will not heat up over time. Holloway can feel the difference between the natural gas heat his home had and the system it has now.

"We had gas heat for over 30 years–the one thing I noticed right away was the improved comfort," Holloway said. "The air from the heat pump did not dry out the air as much in the winter and we did not have cold spots in the corners of the rooms like with gas heat."

Holloway also noted that the thermostat was set to 73 degrees in the summer and the temperature stayed constant through the hot weather. With the conventional air conditioning, the indoor temperature would fluctuate. Holloway advises homeowners looking to retrofit their home with geothermal to consider a few other improvements as well.

Drilling started with an air hammer before hitting water at 120 foot and 170 foot.
(Photo courtesy of Bill Holloway)

Rygan's header of the single, 300-foot borehole before being covered.
(Photo courtesy of Bill Holloway)

Without negotiations of who would repair the lawn after the installation, Holloway was left cleaning up the post-installation mess himself.
(Photo courtesy of Bill Holloway)

"I would suggest homeowners who are retrofitting have an energy audit done and consider new windows, insulation and weather stripping," Holloway said. "They are important if you want to maximize the benefits of geothermal." He also advises any homeowner considering geothermal to always have a contract that clearly defines who does what.

"Since I was my own contractor, I was left with a big mess in the front yard," Holloway said. "Water was hit in two places and that turned my yard into a small lake." It could have been more of a problem if more boreholes had been needed, he says.

Rygan's Brandon Larson further explains the advantages of the loop. "The real value is that you get more heat exchange per linear foot, so you're able to do more heating and cooling with less footage and that less footage equates to less land needed," Larson said. Lawless agrees with Larson and echoes the praise for the loop's advantages.

"It will be an advantage anytime you want an efficient process for installing a heat pump with minimal drilling and land destruction," Lawless said. "The fact that we only needed the one borehole with minimal lateral work mitigated what would have been an even bigger mess."

In the end, the data proved the system to be an efficient choice for the Holloway home. For more information on the research of this system, contact Holloway at bill.holloway@okstate.edu or go to Rygan's website www.rygancorp.com/projects_new.htm where more information is available on the system and the research conducted at Holloway's residence.