

Ground Source Heat Pumps: From Green to Gold

According to the U.S. Department of Energy, in 2010, 56 percent of the energy used in



residential buildings and 31 percent in commercial buildings -- 40 percent of all energy used -- was used to heat and cool the structure and provide hot water. Jack DiEnna, Executive Director, The Geothermal National and International Initiative (GeoNII), says “Geothermal heat pumps go beyond being a ‘GREEN’ technology... They are a ‘GOLD’ technology.”

Electric generation costs continue to rise with the cost for fuel and increased regulation on carbon dioxide and other emissions. The resulting focus on alternative energy sources has driven the surge in development of wind, solar and hydroelectric installations. But these technologies are costly and force expensive improvements to the power grid to bring the energy to populated areas. In an effort to encourage consumers to adopt more responsible energy consumption habits, such as using appliances at different times of the day to minimize unnecessary energy usage during peak periods, electric utilities have adopted rate strategies that reward customers who keep a low “energy profile.” This is reflected in significantly lower cost per kilowatt-hour when electricity use is lowest and higher cost when heating and cooling equipment is working hardest.

Higher efficiency heating and cooling equipment presents an alternative to increased generation by using less electricity to do the same work. In recent years, air conditioning manufacturers have been required by legislation to increase the efficiency of their products. An improved technology, first developed in 1946, that has been getting more attractive for 66 years is the ground source heat pump, sometimes called geothermal. Ground source heat pumps, or GSHPs, take advantage of the earth’s relatively constant, moderate ground temperature to provide heating, cooling, and domestic hot water more efficiently and less expensively than would be possible through other conventional heating and air conditioning technologies. According to the National Institute of Building Sciences, “Geothermal heat pumps use 25% to 50% less electricity than conventional heating or cooling systems. Relative to air-source heat pumps, they are quieter, last longer, need little maintenance, and do not depend on the temperature of the outside air.” The EPA in its April 1993 report, *Space Conditioning: The Next Frontier*, called the GSHP “the most energy efficient, environmentally clean and cost effective space conditioning system.

With generating utilities and cooperatives concerned about reducing peak demand, consumers concerned about reducing their energy costs and preserving the environment, and federal tax credits up to 30 percent of the cost to install GSHPs, the industry has never enjoyed a more

positive environment to flourish. And flourish it has, with an annual growth rate of 15 percent - up from 10 percent just five years ago.

Yet, as Dan Ellis cautioned, “How can you create a market for geothermal if there’s nobody there to service the demand?” Ellis is CEO of ClimateMaster, the largest and most well-known manufacturer of geothermal heat pump systems in the world. Dr. Jim Bose, too, expected the need for installers and service technicians to be critical. Bose, Ph.D., Mechanical Engineering, is the Executive Director of the International Ground Source Heat Pump Association and Professor and Director of Oklahoma State University’s Engineering Technology Division in Stillwater, Oklahoma. “Sooner or later, everything you do at the University winds up in the hands of a technician.”

In 1988, using a federal grant supporting energy efficiency and renewable energy projects, IGSHPA partnered with seven Oklahoma Technology Centers to install closed-loop ground heat exchangers and GSHP’s and to train the instructors, students, and local contractors and service technicians. Funding was limited, however, and the schools were not able to add the necessary service equipment to repeat the training on a continuing basis.

Since then consumer interest not only in more economical equipment but more environmentally friendly systems, has grown tremendously. Greater awareness of the GSHP as an alternative, the understanding of the payback in energy savings and lower maintenance costs and long expected lifetime, and the 30 percent federal tax credit, has catapulted this technology into the limelight.

This and other recent developments have brought about an effort to revive and expand GSHP training in 20 HVAC programs statewide. The intent was to familiarize HVAC students with all aspects of GSHP system design, installation, troubleshooting and repair including the associated technology of high-density polyethylene (HDPE) pipe fusion, which is the most common technology used in GSHP ground heat exchangers.

With international leadership for the industry at Oklahoma State University, the International Ground Source Heat Pump Association (IGSHPA), and the Oklahoma Department of Career and Technology Education, all based in Stillwater, Oklahoma, the state is poised to take the lead in training.

The Oklahoma CareerTech System for years has been preparing technicians statewide to install and service conventional air conditioning and heat pump technology that GSHP operations are based on. Six hundred and four Residential HVAC Technicians completed training in 2012. Many of these students continued to CareerTech partner Oklahoma State University Institute of Technology. OSU-IT offers advanced HVAC skills and an Associate of Applied Science degree in Air conditioning and Refrigeration Technology which includes a course on troubleshooting and servicing GSHPs. According to Roger Shepherd, Program Chairman for the Air Conditioning and Refrigeration Department at OSU-IT, at any given time, 20 to 25 percent of their typical enrollment of about a hundred, have been through a CareerTech HVAC program.

Popularity and prevalence of the GSHP make the addition of this technology to HVAC curriculum imperative.

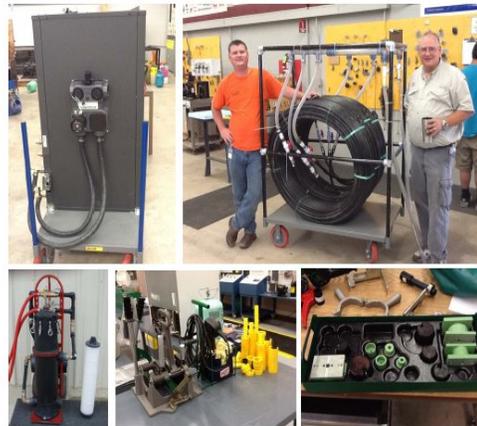
Students completing the HVAC career majors receive a certificate of completion and, in Oklahoma, credit toward apprenticeship hours required to apply for licensing. Students completing the GSHP Capstone course will receive an additional 30 hours credit and increased marketability when applying for jobs. Interest and enrollment in HVAC courses are high. For the past three years, statewide enrollment in twenty HVAC programs has averaged 600 students. For students completing a CareerTech HVAC program in 2012, over sixty percent were found to be employed in a position related to their Career Major. Positive placement rates are near 95 percent in some programs for Career Major completers. An additional 18 percent were found to be continuing their education.

Components of the initiative are:

- A 30-hour capstone course for HVAC students;
- An on-line, self-paced GSHP/HDPE curriculum;
- Instructors certified by IGSHPA through NATE, the North American Technician Excellence program, and HDPE pipe fusion;
- Consistent workstation and service equipment, made affordable by State-negotiated discounts; and
- A turn-key equipment list for school purchasing with model and part numbers and complete contact information for vendors, with instructions for constructing the workstation.



Oklahoma CareerTech Ground Source Heat Pump (GSHP) Initiative
To Prepare Service and Installation,
Troubleshooting and Repair Technicians
Equipment List, Vendors and Contact Information



Major sponsors:
IGSHPA
ClimateMaster
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Through a partnership between IGSHPA and the Oklahoma Department of CareerTech, instructor training and certification began in 2009 with two formal training/testing workshops, and training is ongoing for new instructors. Vendor participation was secured in fall 2011 with major educational discounts offered by ClimateMaster of Oklahoma City, McElroy Manufacturing of Tulsa, leading manufacturer of HDPE pipe fusion products, and GeoEnterprises of Catoosa, HDPE pipe and fitting distributor and service equipment provider. These discounts coupled with additional research and specification of the workstation design led to a unified vendor and equipment list.

In spring 2012, McElroy sponsored two instructor training workshops on HDPE fusion. A GSHP demonstration station was included in the Oklahoma SkillsUSA HVAC competition in 2011 and 2012. National SkillsUSA 2012 included a GSHP troubleshooting station for competitors.

Newly developed curriculum is expected to be available in early 2013. It will include instructional units on the design, installation, and commissioning of GSHPs; design, installation and troubleshooting of ground heat exchangers; pipe types and uses; HDPE pipe fusion; startup procedures; and troubleshooting GSHP systems.

As a result of the effort in this initiative, Oklahoma expects to become a national leader in GSHP education at the technician level, and thereby help Ellis realize his goal of a well-trained workforce prepared to install and competently service GSHP systems.

The Oklahoma CareerTech Agency anticipates making the curriculum available through the Multistate Academic and Vocational Curriculum Consortium. A “GSHP Technician Training Starter Toolkit” that includes an equipment and vendor list as well as assistance with workstation construction is available through the Trade and Industrial Education Division of the Oklahoma CareerTech Agency.

For more information visit GSHP.OKCareerTech.org

Jim Bullington is the Assistant State Program Administrator for Trade and Industrial Education at the Oklahoma Department of CareerTech. He previously served as a technician and trainer at IGSHPA, and is a Mechanical Contractor with eight years’ field experience including GSHP installations, both independently and while employed by IGSHPA.

Article notes supporting statements and quotes:

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