



Geo Heat Pumps: Leading Energy Utility Marketing Programs

By Dr. Katherine Johnson

Fifth Edition



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CONSULTING GROUP

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Introduction

Geothermal heat pumps (GHP) are an energy efficient technology that continues to gain traction as a viable heating and cooling system in the United States and around the world. Although this is a proven technology that has been in use since the 1940s, installation rates still lag behind its full market potential. GHPs continue to garner interest, however, and several high-profile installations include Buckingham Palace, the U.S. embassy in Seoul, South Korea, and 2008 Summer Olympics venues in Beijing, China.

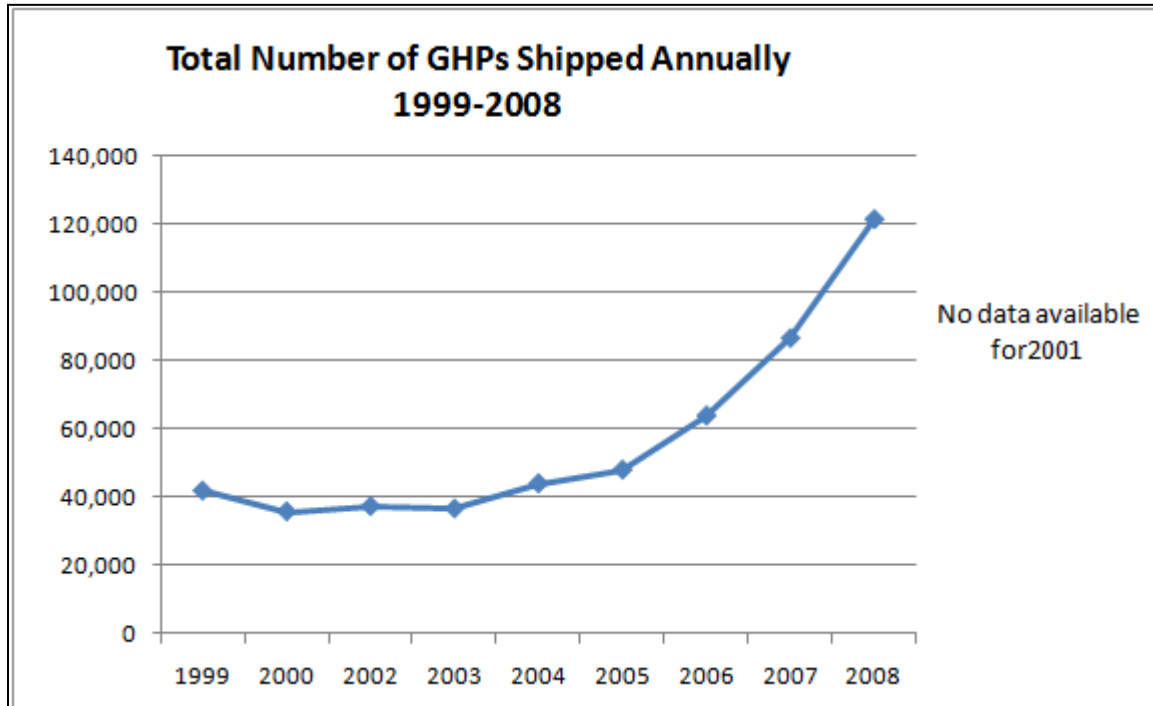
GHPs appeal to customers, utilities, and energy organizations because it is a “green” technology with a proven track record in reducing carbon emissions. According to the U.S. General Accounting Office, for every 100,000 residential units installed, the U.S. can save more than 37.5 trillion British Thermal Units (BTUs) of energy used for space conditioning and water heating. Currently, the amount of emission reductions attributed to GHPs nationwide is six million tons of carbon dioxide (CO₂) based on estimates from government and industry sources. One continuing challenge for the GHP industry is the multitude of names by which this technology is referred. GHPS are also called ground source heat pumps, earth source/earth coupled heat pumps, geothermal heating and cooling systems, direct exchange, “geo”, and other names. This report will refer to the technology as geothermal heat pumps, or GHPs.

While the name may change, the technology is essentially the same. Every geothermal heat pump system consists of three major elements: a *geothermal heat pump* to move heat between the building and the fluid in the earth connection, an *earth connection* for transferring heat between its fluid and the earth, and a *distribution subsystem* for delivering heating or cooling to the building. To heat a building, the heat is extracted from the fluid in the earth connection by the geothermal heat pump and distributed through a system of air ducts. Cooler air from the building is returned to the geothermal heat pump, where it cools the fluid flowing to the earth connection. The fluid is warmed again as it flows through the earth connection. The process is reversed to cool the building.

Before discussing the various players in the geothermal heat pump market, it may be helpful to have a general understanding of current market conditions.

The GHP market is a very small part of the larger heating and air conditioning market, which is estimated to have a value in product shipments of more than \$16 billion, according to the 2006 U.S. Census Bureau Annual Survey of Manufacturers. Of this total market, GHPs classified as cooling equipment, account for less than one percent of the total. This market is split evenly between residential and commercial applications, with only a very small market for industrial applications.

According to the most recent industry surveys from the Energy Information Administration (EIA) 2009 data the U.S. GHP industry has experienced double digit growth in the last few years. This growth has been fueled by the soaring energy prices for traditional fuels as well as the desire for reliable and clean energy alternatives. In 2008, total geothermal heat pump shipments increased 28 percent to 121,243 units while the capacity shipped rose 29 percent to 416,105 tons (see Figures 1 and 2). Despite the higher initial cost compared to traditional heating and cooling systems, the high efficiency and ongoing cost-saving potential have made GHPs the heating and cooling system of choice for many consumers.



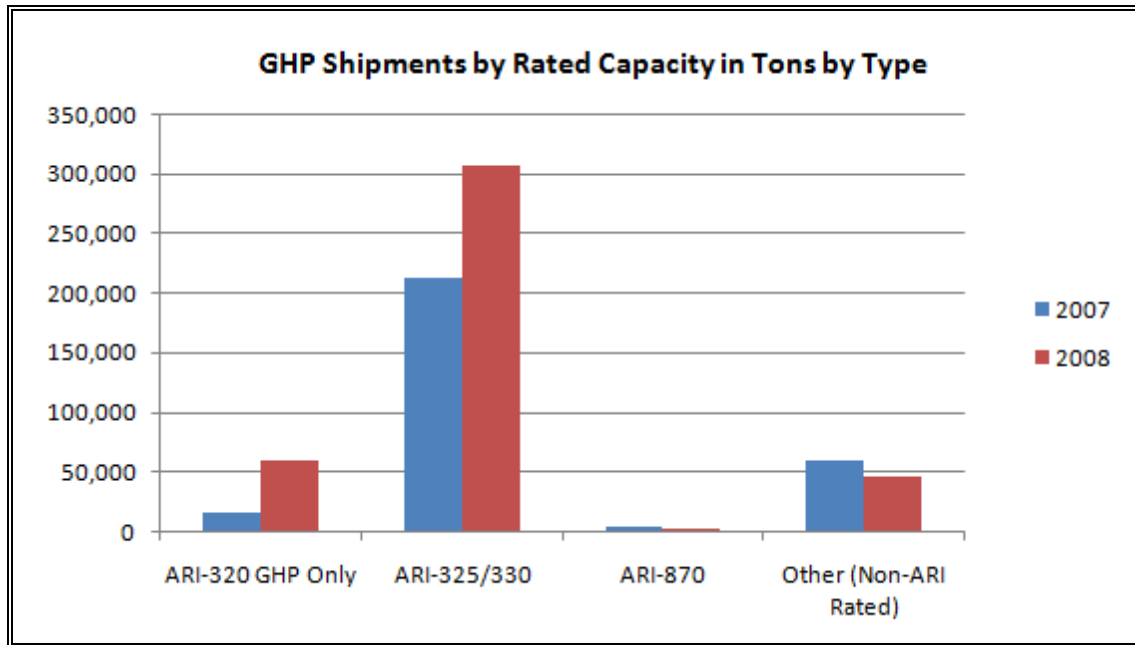
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey" October 2009.

Figure 1: Number of GHPs Shipped Annually

Today, approximately 80,000 units are installed annually, of which 46 percent are vertical closed loop systems, 38 percent horizontal closed loop systems and 15 percent open loop systems. Over 600 schools have installed these units for heating and cooling, most notably in Texas. In the United States, a heat pump is rated in tonnage, and is equal to 12,000 BTU/hr or 3.51 kW¹. A unit for a typical residence would be approximately three tons or 10.5 kW of installed capacity.² The Geothermal Heat Pump Consortium (GHPC) reports there have been more than one million systems installed in the United States.

¹ Rafferty, K., 1997. "An Information Survival Kit for the Prospective Geothermal Heat Pump Owner." GeoHeat Center, Klamath Falls, OR (available at: <http://geoheat.oit.edu>).

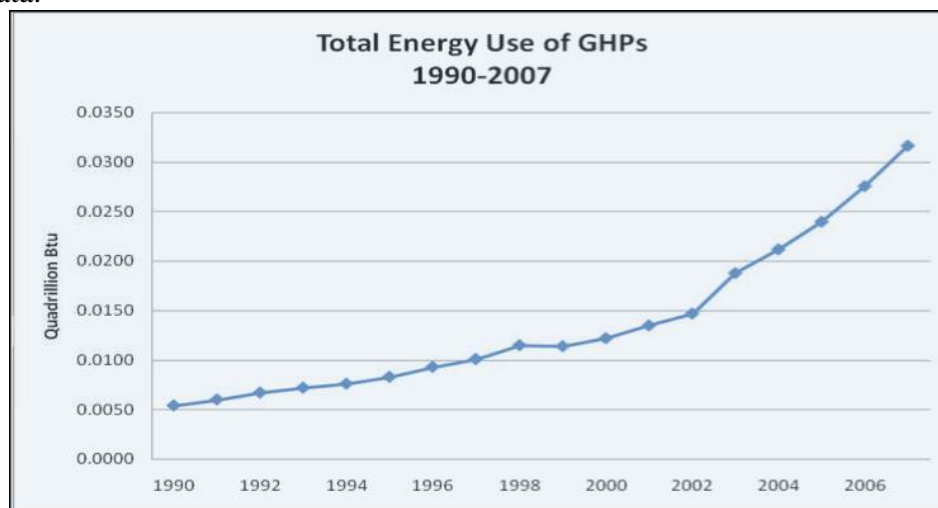
² GEOTHERMAL (GROUND-SOURCE) HEAT PUMPS- A WORLD OVERVIEW, J. Lund¹, B. Sanner², L. Rybach³, R. Curtis⁴, G. Hellström, ¹Geo-Heat Center, Oregon Institute of Technology, Klamath Falls, Oregon, USA, ²Institute of Applied Geosciences, JustusLiebig University, Giessen, Germany, ³Institute of Geophysics, ETH, Zurich and GEOWATT AG, Zurich, Switzerland, ⁴EarthEnergy Systems, GeoScience Ltd., Falmouth, Cornwall, UK, ⁵Department of Mathematical Physics, Lund University of Technology, Lund, Sweden. GHP Bulletin, September 2004.



Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." October 2009.

Figure 2: GHP Shipments by Rated Capacity in Tons by Type

Figure 2 illustrates the estimated total energy usage in BTUs through 2007, the most recently available data.



Source: John Lund, Oregon Institute of Technology, Geo-Heat Center (Klamath Falls, Oregon, March 2008).

Figure 3: Total Energy Use of Geothermal Heat Pumps 1990-2007

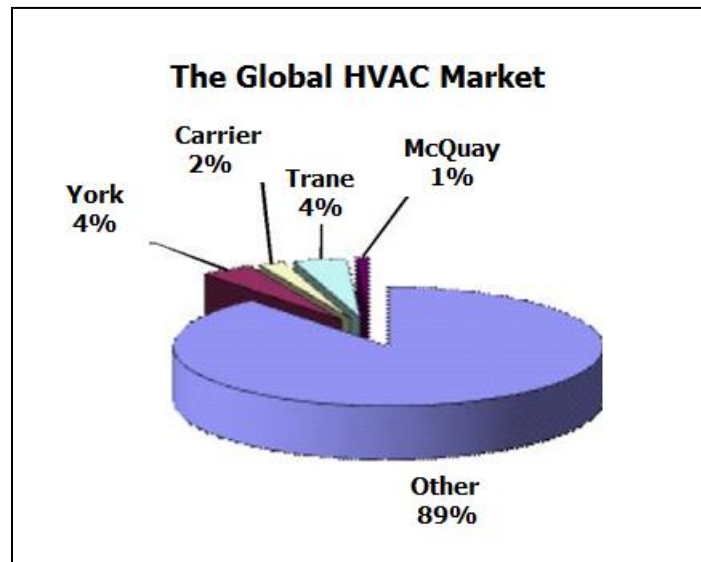
Worldwide, geothermal heat pump installations are growing. According to the most recent information the U.S. still accounts for the largest number of installed tons, with the next largest group of installations in Canada. Figure 3 summarizes the number of GHPs installed outside the United States, based on the available data. Overall, GHPs still represent a very small part of the total market.



Source: Renewable Energy Annual, 2007

Figure 4: Distribution of U.S. GHP Exports Worldwide

Figure 5 displays the estimated total global market share of the leading HVAC firms.

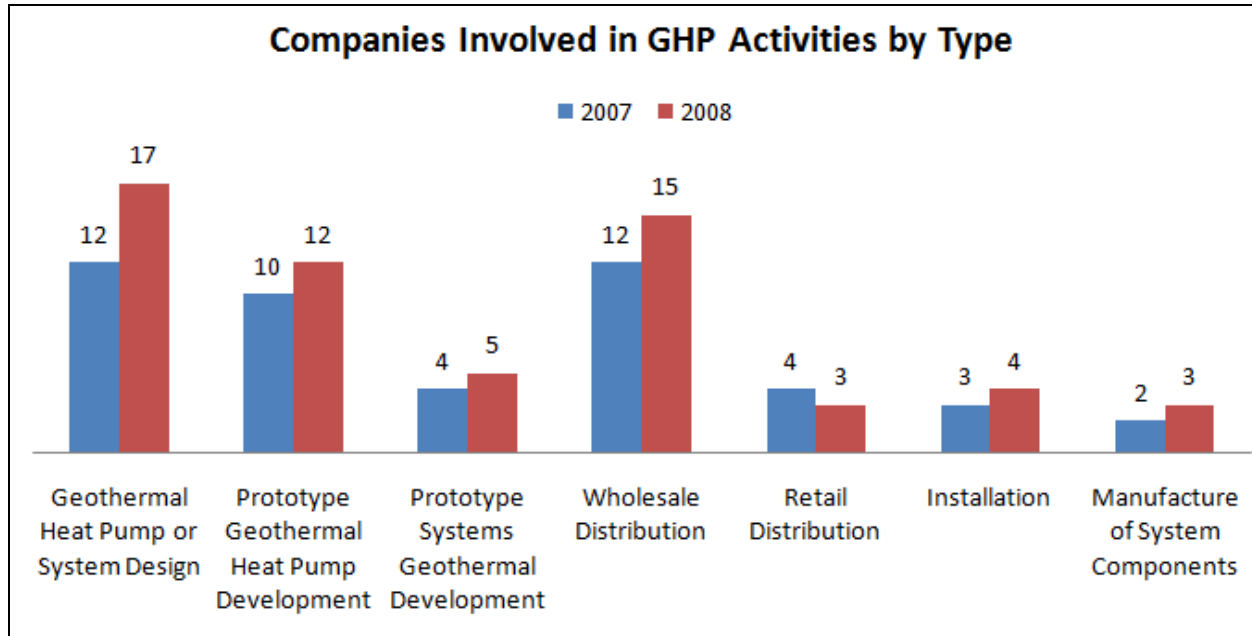


Source: Lucas, J & Ravenscroft, A, May 2002

Figure 5: The Global HVAC Market

As Figure 5 illustrates, the HVAC market is extremely fragmented and no one firm controls more than four percent. The GHP market is no different. It is comprised of an array of diverse manufacturers. Although there are several leading GHP manufacturing firms, their total revenues pale in comparison to those of global HVAC firms such as York and Carrier.

Figure 6 illustrates the diverse activity types these firms use in developing the GHP market.



Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." October 2009.

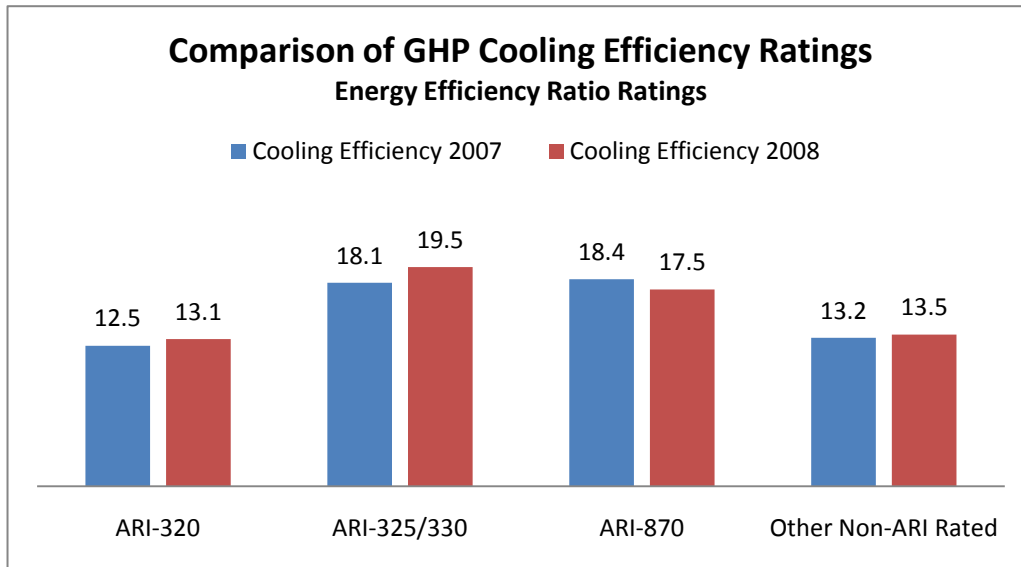
Figure 6: Companies Involved in Geothermal Heat Pump Activities by Type, 2007 and 2008

Performance Ratings

One confusing aspect of geothermal heat pump technology is equipment rating. These heating and cooling performance values are useful for comparing units of the same type (i.e., ASHP* to ASHP or GHP to GHP). Unfortunately, the ratings used for different types of equipment are not comparable. * ASHP – Air Source Heat Pump

For water source heat pumps (the type of heat pump used in all GHP systems), cooling performance is defined by an index called EER (Energy Efficiency Ratio). This is the cooling resulting in units of BTU/watt hr. Electrical input includes compressor, fans and a pumping allowance. Heating performance is defined by an index called COP (Coefficient of Performance). This is the heating produced by the unit (in BTU/hr) divided by the energy equivalent of the electrical input (in BTU/hr). The COP also includes a pumping allowance. (Rafferty, 2008).

Figure 7 compares the EER ratings for GHP systems from 2007 to 2008. As this figure shows, the efficiency ratings are rising steadily for GHPs across all categories except ARI-870. These EER ratings are much higher compared to standard cooling equipment.

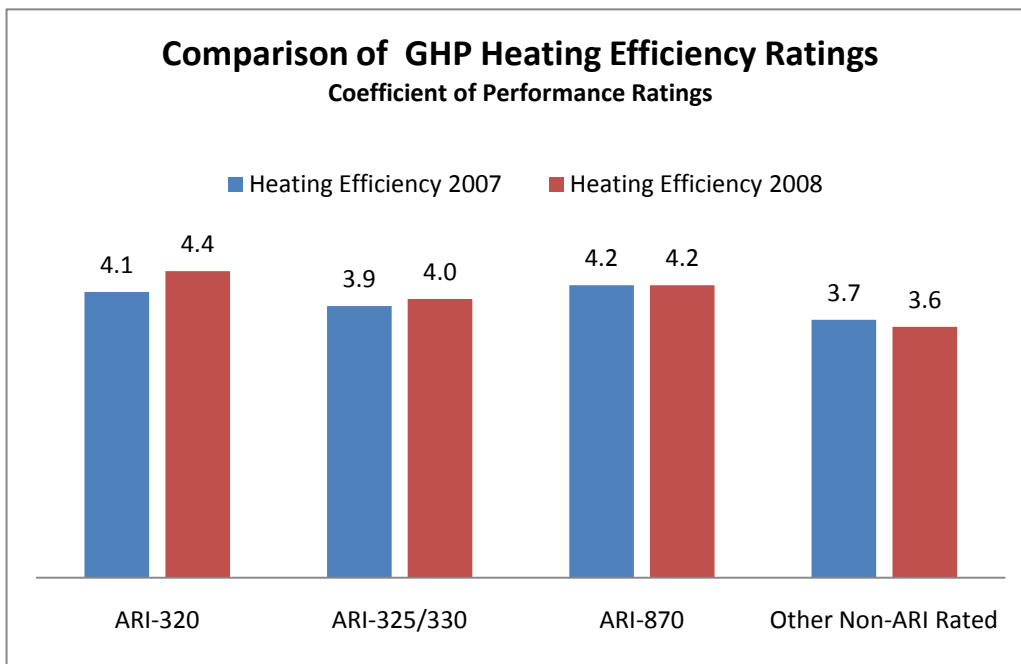


Notes: EER = Energy Efficiency Ratio. One ton of capacity is equal to 12,000 Btus per hour.

Efficiency is expressed as BTUs of output per watt-hours of input. The greater the EER the more efficient the unit.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." October 2009.

Figure 7: Comparison of GHP Cooling Efficiency Ratings 2007-2008



Notes: COP = Coefficient of Performance. One ton of capacity is equal to 12,000 BTUs per hour.

Efficiency is expressed as BTUs of output per watt-hours of input. The greater the COP the more efficient the unit.

Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey"

Figure 8: Comparison of GHP Heating Efficiency Ratings 2007-2008

GHPs are also maintaining high COP ratings across all types, with only a slight dip in the COP for Non-ARI rated units. Overall, these two figures demonstrate the superior heating and cooling efficiencies of GHPs, which leads to significant energy savings for their users. These savings range between 30 to 60 percent and are achievable because GHPs are much more energy efficient compared to conventional systems.

Table 1 lists the rated efficiencies and installed-cost estimates for a range of residential space-conditioning technologies as of 2007. These estimates were prepared by Navigant Consulting and are included in its report, “*Ground-Source Heat Pumps: Overview of Market Status, Barriers to Adoption, and Options for Overcoming Barriers*,” *Final Report*, U.S. Department of Energy, Energy Efficiency and Renewable Energy, Geothermal Technologies Program, 2009.

Table 1: Comparison of Efficiencies and Installed Costs for Typical Residential HVAC Systems

Technology	Rated Cooling Efficiencies	Rated Heating Efficiencies	Typical Installed Cost
Gas-Fired Furnace	--	Typical: 80% AFUE; 780 kWh/yr ENERGY STAR®: 90% AFUE; 500 kWh/yr 2007 Best Available: 96% AFUE; 275 kWh/yr	\$24.00/kBtuh \$32.70/kBtuh \$44.00/kBtuh
Oil-Fired Furnace	--	Typical: 81% AFUE; 850 kWh/yr ENERGY STAR®: 83% AFUE; 800 kWh/yr 2007 Best Available: 95% AFUE; 650 kWh/yr	\$23.80/kBtuh \$26.20/kBtuh \$50.50/kBtuh
Central A/C (Air Source)	Typical: 13 SEER ENERGY STAR®: 14 SEER Best Available: 21 SEER	--	\$814/ton \$886/ton \$1714/ton
Central Heat Pump (Air Source)	Typical: 13 SEER ENERGY STAR®: 14 SEER Best Available 17 SEER	Typical: 7.7 HSPF ENERGY STAR®: 8.2 HSPF 2007 Best Available: 10.6 HSPFb	\$1450/ton \$1570/ton \$2300/ton
Geothermal Heat Pump	Typical: 16 EER ENERGY STAR®: 14.1 EER Best Available: 30 EER	Typical: 3.4 COP ENERGY STAR®: 3.3 COP 2007 Best Available: 5.0 COP	\$3000/ton \$2830/ton \$5250/ton

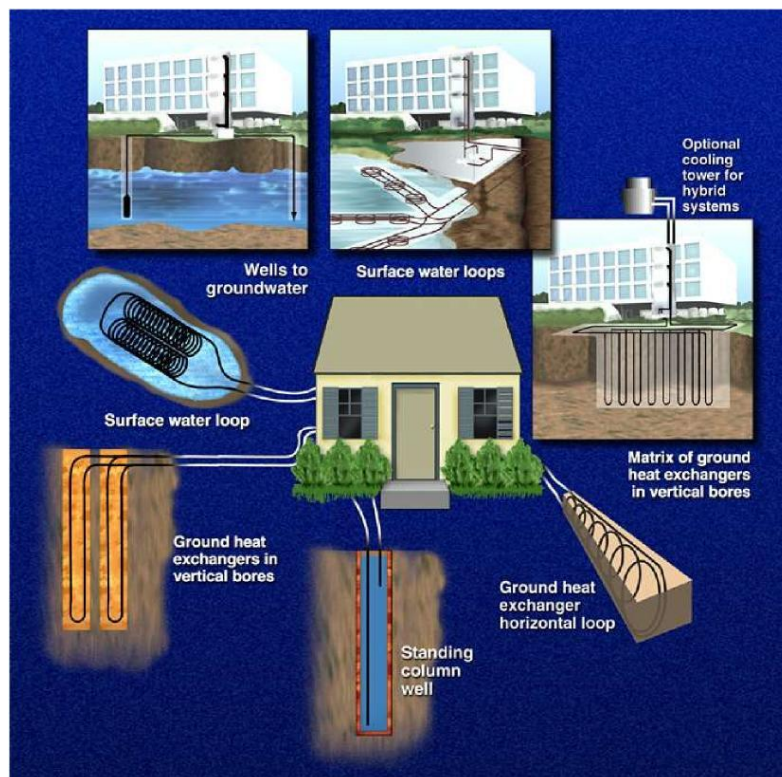
Source: GSHP Report, Navigant Consulting 2009, p. 33

Average Geothermal Heat Pump Installation Costs

Another critical element of the GHP market is the cost of components required to install and operate a GHP. Geothermal heat pumps are comprised of three elements:

- GHP itself, which consists of an indoor or outdoor unit that regulates heating and cooling
- Ground Heat Exchange Loop, which can be configured in a variety of different ways
- Distribution System, required to adequately move the air or fluid throughout the building.

As shown in Figure 6, there are a number of GHP system options. Systems using closed loop, vertical-bore ground heat exchangers are by far the most common, especially in commercial buildings. Ground resources including the Earth, surface water, sewage treatment plant effluent, among others, whether alone or in combination with outdoor air in a hybrid configuration, offer great potential. The GHP infrastructure can be designed at the scale of a community or a building, and it can serve new construction or retrofits of existing communities and buildings (Hughes 2008, pp. 12-13)²



Source: Hughes 2008, p. 13

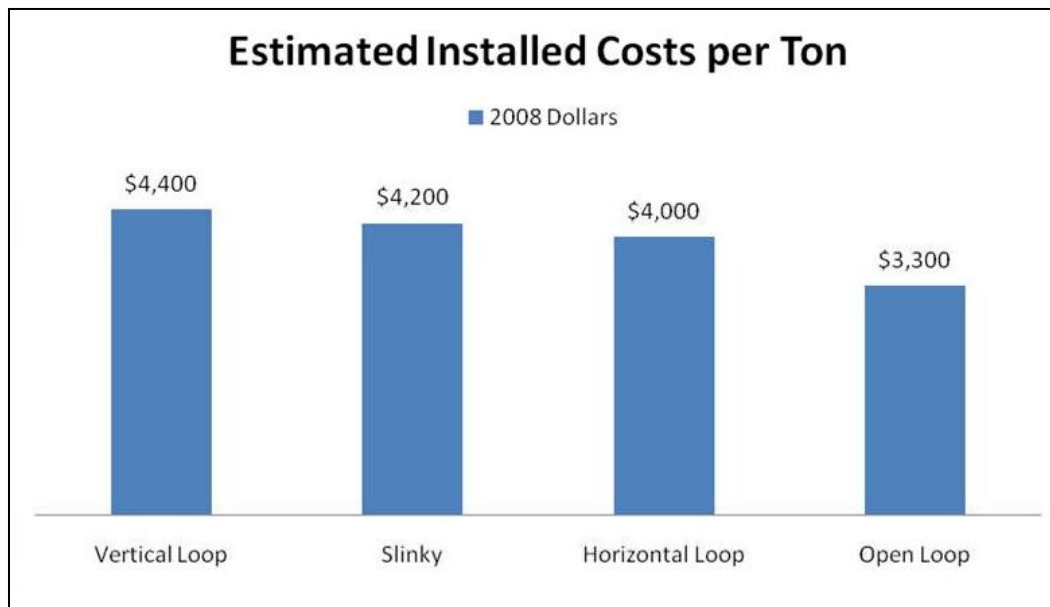
Figure 6: GHPs Offer Flexible Installation Alternatives

Direct exchange systems run refrigerant through the ground loop to exchange heat directly. Such systems do not have to seal a pump, but require a much greater copper tube length and refrigerant charge. They are not commonly used and therefore it is difficult to estimate installation costs.

² Hughes, P. 2008 "Geothermal (Ground-Source) Heat Pumps: Market Status, Barriers to Adoption, and Actions to Overcome Barriers," Oak Ridge National Laboratory, ORNL/TM-2008, December, pp. 12-13.

The U.S. Department of Energy (DOE) also commissioned the Oregon Geo-Heat Center to estimate these average costs for a residential GHP installation per ton. The results are summarized in Figure 7.

These costs are based on the differences in installation costs for air source heat pumps, gas with air conditioning, ground water, or GHP installations with horizontal, vertical or “Slinky” ground loops. Traditionally a horizontal installation is less expensive than drilling and installing the loop pipe vertically. The “Slinky” configuration involves drilling a relatively shallow trench and coiling the loop pipe over itself.



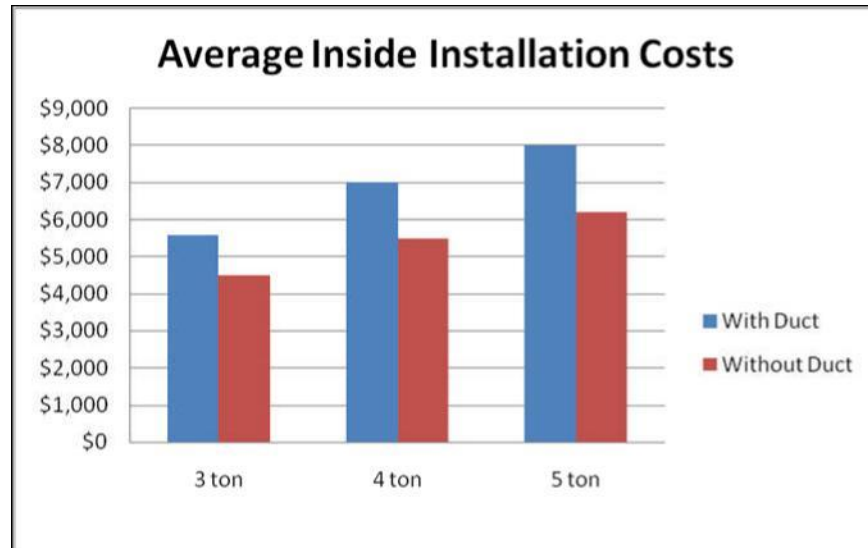
Source: K. Rafferty, March 2008

Figure 7: Comparison of Installed Costs per Ton for Geothermal Heat Pump³

As this figure shows, the cost of the GHP depends upon the installation configuration. Ground water or open loop installations are the least expensive, while vertical, horizontal and the horizontal “slinky” loops are the most expensive installations.

These increased costs are driven by the cost of the unit itself, the ground loop and the air or fluid distribution system. In fact, if ductwork is needed then the price to install a GHP rises \$6,000-\$8,000 depending upon the size of the installed system, as illustrated in Figure 7. So a customer purchasing a GHP for a home not only pays a \$4,000-\$6,000 premium for the equipment, but could also pay another \$6,000-\$8,000 premium for the duct work.

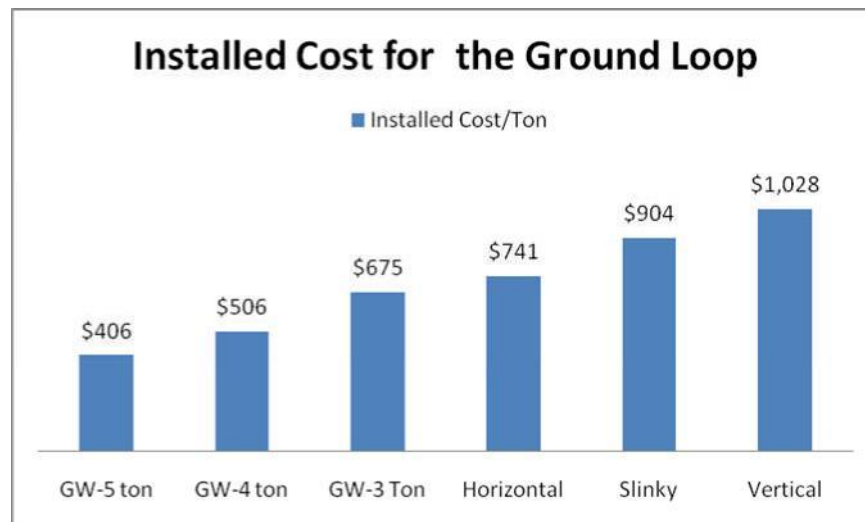
³ Rafferty, K. “An Information Survival Kit for the Prospective Geothermal Heat Pump Owner,” Geo-Heat Center, Oregon Institute of Technology, Klamath Falls, OR March 2008.



Source: K. Rafferty, Geo-Heat Center, March 2008

Figure 8: Average Inside Installation Costs

Furthermore, the cost of the ground loop will also vary depending upon the size of the unit and the soil conditions. Figure 9 summarizes the costs for the ground loops for GHP units based on an average installed cost/ton.



Source: K. Rafferty, Geo-Heat Center, March 2008

Figure 9: Average Installed Costs for Ground Loops

As Figure 9 shows, the ground water systems are still the most cost-competitive, while the geothermal vertical installations are the most expensive. These are average costs, and depend upon a number of factors, including soil conditions and the region of the country. In some locations, where drillers are relatively easy to find, the installation costs have been reduced. In fact, negotiating with drillers for a set fee for a job and promising volume work has been one of the most successful strategies utilities have used to lower some of these costs.

The total installed costs of GHPs are also significantly higher compared to the installation costs

for conventional systems, such as ASHPs or natural gas furnaces with central air conditioning. Conservatively, GHP owners may have to spend twice as much to install this system. These findings are also consistent with the estimates shown in Table 1.



Source: K. Rafferty, Geo-Heat Center, March 2008

Figure 10: Comparison of Installed Costs for 3 Ton Systems

According to both the DOE and the GHPC, the total cost for installing a GHP ranges from \$15,000 to \$19,000, depending upon the cost of the loop, the size of the system and the need for duct work. Table 1 illustrates these costs from a study funded by the GHPC, and also demonstrates the value that utility rebates play in moving this market forward.

Table 1: Average Capital and Operating Costs for Geothermal Heat Pumps in 2008 Dollars

HVAC System	Capital Investment				Annual Costs				
	Installed Cost		Utility Rebate	Net Cost	Heating	Cooling	Water Heating	Domestic Energy	Total Operating
	EIA	GHPC							
Geothermal Heat Pump	\$20,550	\$26,418	\$4,070	\$22,347	\$1,066	\$289	\$333	\$736	\$2,135
Oil-fired Furnace & Electric Air Conditioning	\$13,700	\$22,194	0	\$22,194	\$2,092	\$510	\$284	\$784	\$3,669

Notes: This table is for a specific home in Connecticut and may not be indicative of other homes or homes in other regions of the country. The geothermal heat pump equipment and ductwork cost was \$14,441 and the ground loop \$11,977 adjusted for 2008 dollars. The oil-fired furnace and electric central air conditioning system was estimated at \$22,194. The heating and cooling costs were based on comparisons from WSU's heating and cooling calculators using 2008 dollars. This calculation assumes the installation is for a standard GHP system that provides only heating and cooling and water heating is provided separately. www.energyexperts.org

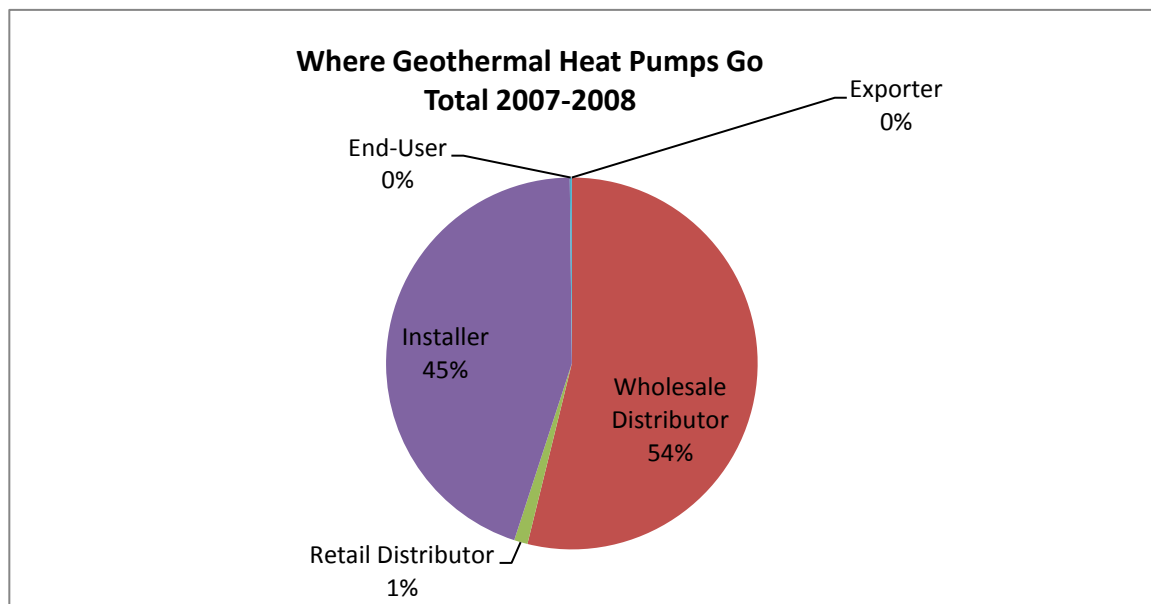
Sources: Energy Information Administration (EIA), Office of Integrated Analysis and Forecasting. "Energy Crafted Homes in Connecticut, 1998

Distribution Strategy for GHPs

In the traditional HVAC market, three separate groups are involved in moving the merchandise from the manufacturer to the customer:

- The *distributor* or wholesaler who acts as a middle man between the manufacturer and the dealer. Distributors typically carry a wide variety of equipment and are more commonly used for commercial/industrial applications or for specialty markets.
- The *dealer* who provides the equipment to the customer. Generally, manufacturers have proprietary agreements established with specific dealers.
- The *installer*, who may also be a dealer. At the residential level, dealers and installers are often the same. At the commercial and industrial level, these may be separate entities, or the installation company may receive the equipment from a distributor rather than a dealer.

In the GHP market, installers play the most critical role. Figure 7 illustrates that most GHPs are sent directly to wholesale distributors (54 percent) while installers handle nearly all of the remaining market (45%).



Source: Energy Information Administration, Form EIA-902 "Annual Geothermal Heat Pump Manufacturers Survey." October 2009

Figure 7: Where Geothermal Heat Pump Units Go

Commercial and Institutional Installations

GHPs have also been installed in hundreds of commercial and institutional buildings throughout the U.S. Table 2 compares operating costs and efficiencies of commercial space conditioning equipment.

Table 2: Competing Commercial Space-Conditioning Technologies

Technology	Rated Cooling Efficiencies	Rated Heating Efficiencies	Typical Installed Cost
Gas-Fired Furnace		Typical: 80% thermal High Efficiency: 82% thermal	\$8.1/kBtuh \$8.8/kBtuh
Oil-Fired Furnace		Typical: 81% thermal	\$8.1/kBtuh
Roof-Top Air Conditioner	Typical: 10.1 EER High Efficiency: 12.0 EER		\$65.6/kBtuh \$85.0/kBtuh
Roof-Top Heat Pump	Typical: 10.3 EER High Efficiency: 11.7 EER	Typical: 3.2 COP High Efficiency: 3.4 COP	\$73.0/kBtuh \$97.0/kBtuh

Source: GSHP Report, Navigant Consulting 2009, p. 36.

GHPs have been installed in some very large commercial installations. Among these is a 24,000-square-foot administration building at Fort Polk, LA, and an 80,000-square-foot office building in Allentown, PA, as well as numerous schools throughout the U.S. The Fort Polk Project illustrates the diversity of applications in which GHPs have been used in commercial settings. This \$18-million project, completed in 1996, was expected to reduce annual maintenance and energy costs by more than \$3 million — a \$44 million savings over the life of the project. The 300-mile facility houses 23,000 military personnel and includes a military hospital, administration buildings, training centers and storage facilities.

The geothermal installations included replacing more than 3,000 air source heat pumps with GHPs. This replacement effectively raised the installed SEER levels from seven to 15.5, a significant energy savings and performance improvement. The total installation involved vertical drilling of more than 1.8 million feet, or approximately 686 square miles. This project is the largest GHP installation in the world, and involved more than nine separate drilling contractors⁴. An evaluation of a 4,000-home comprehensive GHP retrofit at U.S. Army Fort Polk showed that GHPs reduced summer peak electric demand by 7.5 MW, or 43 percent, and reduced electricity consumption in post housing by 33 percent, while eliminating natural gas consumption completely.⁵

⁴ “Geoexchange Savings Millions at Fort Polk, LA, GHPC Case Study, Washington, D.C.

⁵ Hughes, P. J., and J. A. Shonder, 1998. “The Evaluation of a 4000-Home Geothermal Heat Pump Retrofit at Fort Polk, Louisiana: Final Report,” ORNL/CON-460, Oak Ridge National Laboratory, 1998. (Available at www.ornl.gov/femp)

Figure 12 illustrates the average installed costs for two GHP installations in two locations for a 14,000 square foot office building. It also demonstrates that the total installation costs will vary based upon a number of factors, including climate, soil type and drilling costs.

Source: Analysis by S.P. Kavanaugh (1998), for the US Department of Energy Oak Ridge National Laboratory, December 2001

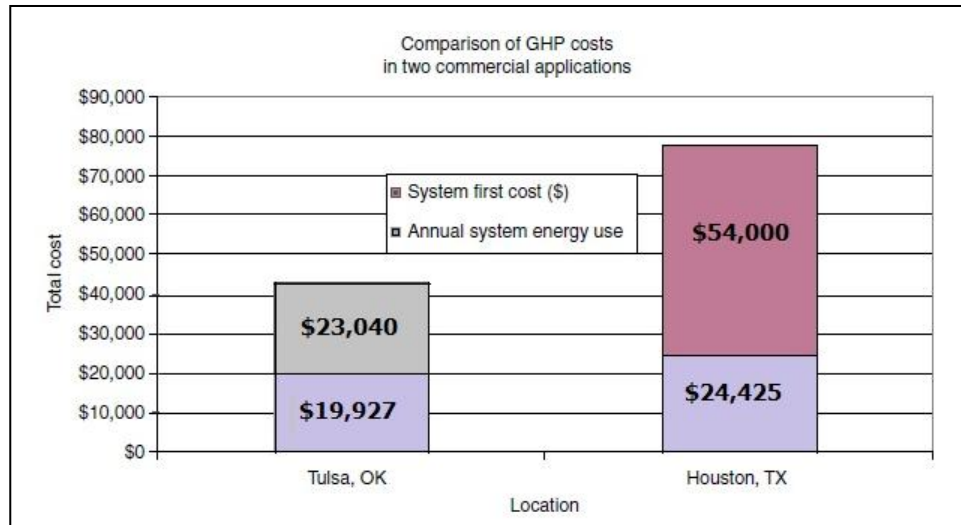
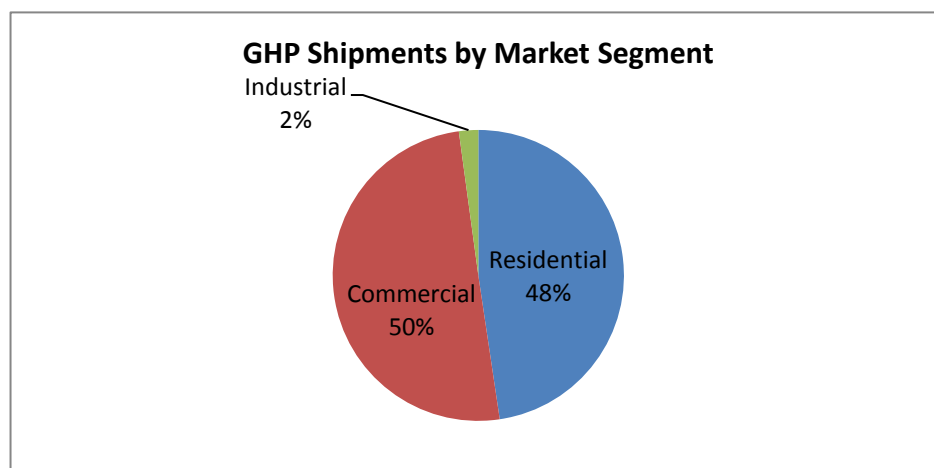


Figure 12: Comparison of Commercial GHP Installation Costs in two Commercial Applications

Installation Trends

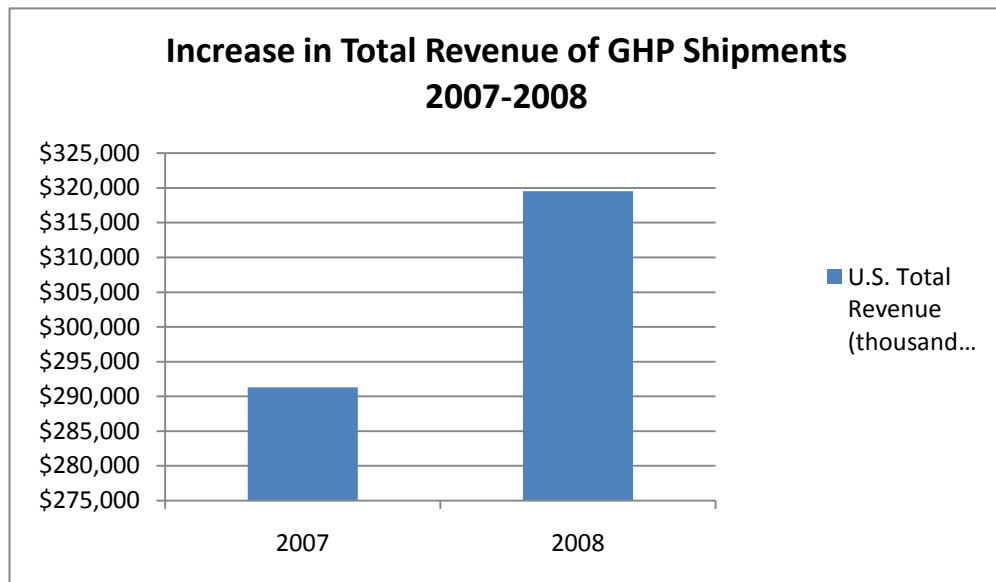
GHP installations are still relatively evenly split between the residential (48%) and commercial (50%) sectors. Note, in this figure, government installations are included in the commercial sector. The institutional market, which includes schools, still remains a relatively small part of the overall market (2%) as shown in Figure 8.



Source: Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey," October 2009

Figure 8: GHP Shipments by Market Segment

Installations of GHPs have increased significantly recently. Figure 9 illustrates this dramatic increase, using the most current information available. The increase in GHP sales, as reflected by a 9 percent increase in total shipment value from 2007 to 2008.



Source: Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey," October 2009.

Figure 9: GHP Shipments by Market Segment

The map in Figure 10 shows the changes in installation rates across the U.S. from 2007 to 2008. GHP installations continued to increase in New England, including Vermont and Maine. Other states that reported significant increases in installations included South Dakota, Alaska, and Hawaii — but this is due to the fact that GHPs are finally being installed in these states. Meanwhile, most states showed steady increases in GHP installations, while installation rates dropped in Louisiana, South Carolina, Oklahoma, Colorado and Virginia. This suggests that GHPS may have reached market saturation levels in those areas.

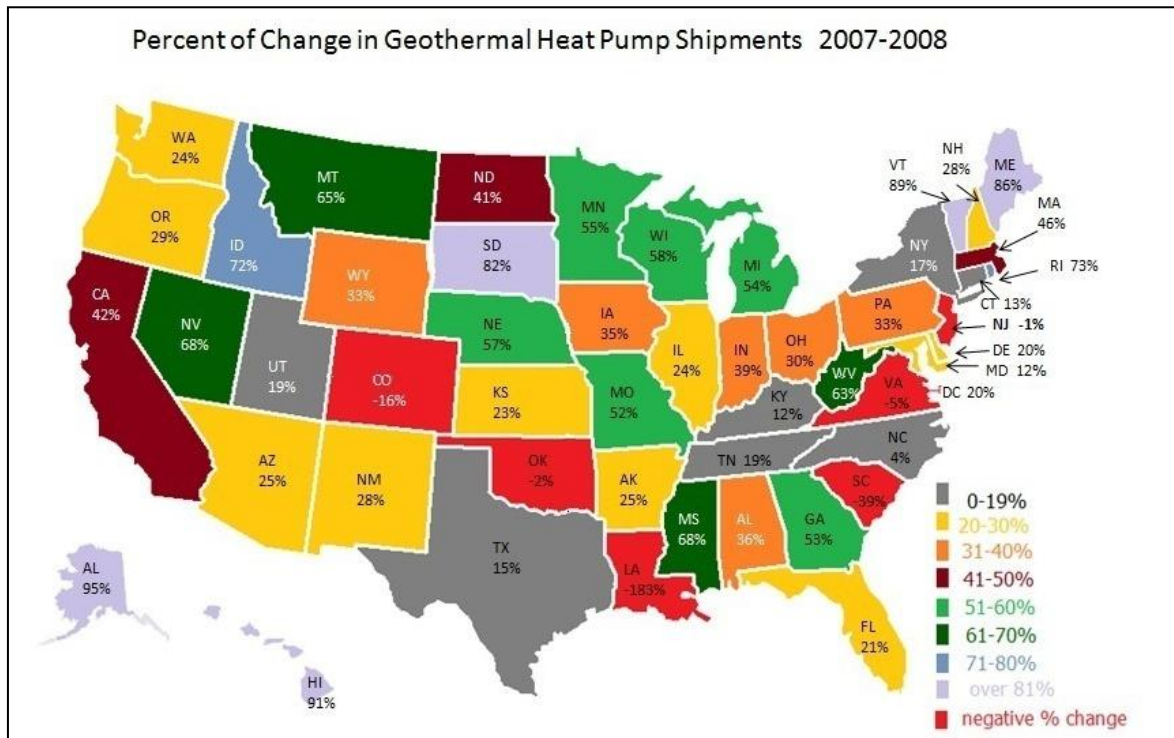


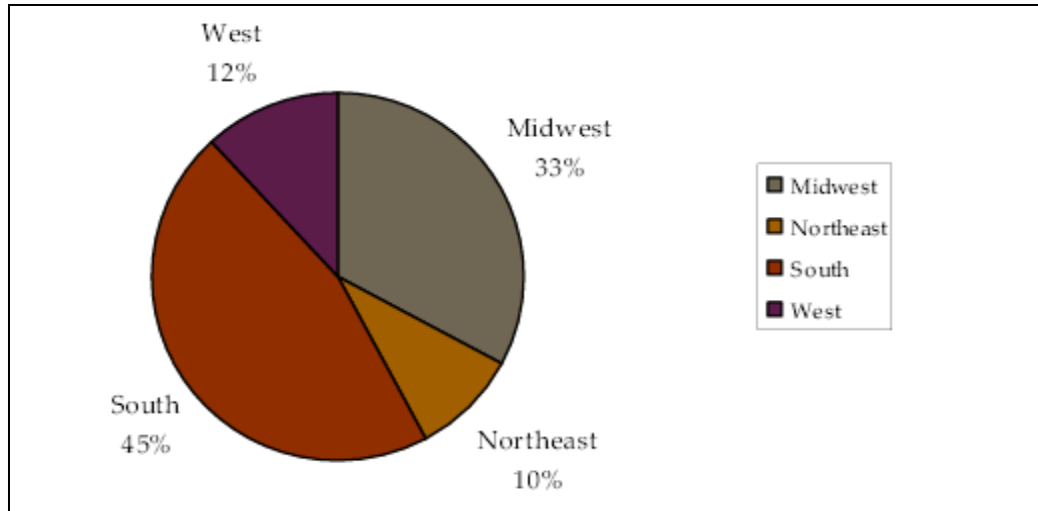
Figure 10: Percent of Change in Geothermal Heat Pump Shipments 2007-2008

Table 3 provides this information in more detail for each U.S. state.

Table 3: Geothermal Heat Pump Shipments by Destination, 2007 and 2008

(Rated Capacity in Tons)				
Destination	2007	2008	change	%
Alabama	1,259	1,963	704	36%
Alaska	5	107	102	95%
Arizona	4,926	6,608	1,682	25%
Arkansas	3,028	4,057	1,029	25%
California	5,499	9,522	4,023	42%
Colorado	4,899	4,233	-666	-16%
Connecticut	3,101	3,577	476	13%
Delaware	1,464	1,835	371	20%
District of Columbia	1,432	1,792	360	20%
Florida	9,841	12,439	2,598	21%
Georgia	3,744	8,013	4,269	53%
Hawaii	15	174	159	91%
Idaho	327	1,180	853	72%
Illinois	20,296	26,599	6,303	24%
Indiana	11,118	18,119	7,001	39%
Iowa	8,288	12,801	4,513	35%
Kansas	2,094	2,720	626	23%

Kentucky	9,632	10,931	1,299	12%
Louisiana	1,704	603	-1,101	-183%
Maine	103	719	616	86%
Maryland	9,472	12,048	2,576	21%
Massachusetts	4,188	7,719	3,531	46%
Michigan	6,031	13,075	7,044	54%
Minnesota	7,669	17,124	9,455	55%
Mississippi	545	1,711	1,166	68%
Missouri	4,123	8,585	4,462	52%
Montana	623	1,755	1,132	65%
Nebraska	5,456	12,618	7,162	57%
Nevada	1,371	4,286	2,915	68%
New Hampshire	2,406	3,324	918	28%
New Jersey	2,807	2,785	-22	-1%
New Mexico	1,296	1,806	510	28%
New York	16,174	19,589	3,415	17%
North Carolina	2,527	2,645	118	4%
North Dakota	2,044	3,483	1,439	41%
Ohio	14,304	20,332	6,028	30%
Oklahoma	9,210	9,036	-174	-2%
Oregon	1,671	2,343	672	29%
Pennsylvania	15,032	22,494	7,462	33%
Puerto Rico	-	21	21	100%
Rhode Island	93	339	246	73%
South Carolina	3,403	2,455	-948	-39%
South Dakota	744	4,215	3,471	82%
Tennessee	8,200	10,144	1,944	19%
Texas	8,719	10,207	1,488	15%
Utah	2,167	2,689	522	19%
Vermont	61	543	482	89%
Virginia	9,073	8,610	-463	-5%
Washington	2,980	3,936	956	24%
West Virginia	289	771	482	63%
Wisconsin	3,135	7,522	4,387	58%
Wyoming	282	420	138	33%
Shipments to United States/Territories	238,870	346,622		
Exported	52,430	69,483		
Total Shipments	291,300	416,105		
- = No data reported.				



Source: EIA Survey of Geothermal Heat Pump Shipments 2006, Table 3.2 (2008) Navigant Report, 2009, p. 31.

Figure 11: GSHP Shipments by Census Region in tons (2006) - Weighted by Population

GHP systems offer a great deal of flexibility, having been installed in thousands of commercial applications from guard shacks to high-rise office buildings, not to mention in thousands of houses and schools across the United States. GHPs also offer significant benefits to customers willing to pay the higher upfront installation costs. These benefits include:

- *Substantial Cost Savings:* GHP systems can save as much as 50 percent compared to airsource heat pumps and up to 45 percent over fossil-fuel (gas, propane, or oil) furnaces.
- *Economical Rates:* Some utilities offer special, lower winter rates for GHP customers, offering even more savings.
- *Environmentally-Friendly:* GHP systems are a “renewable” energy source that encourages conservation of natural resources.
- *Financing:* Some utilities offer financing through either private financing or utility-sponsored loop leases.

Even though GHPs have been around for decades, this is still a niche market. This technology still faces numerous challenges, including reduction of first costs, raising awareness, and developing a sustainable infrastructure.

Conclusions

According to the most recent government estimates, there are approximately one million GHP installations in the United States. These installations have led to significant energy savings and reductions in carbon emissions resulting in:

- Eliminating more than 6.2 million metric tons of CO₂ annually
- Saving more than seven billion kWh annually
- Savings more than 36 trillion BTUs of fossil fuels annually
- Reducing electricity demand by 2.3 million kW

Industry Consolidation

In the past few years, there has been a noticeable trend towards industry consolidation. These shifts include the acquisition of GHP firms by large, international companies such as BOSCH purchasing FHP and Daiken buying McQuay. In addition, several of the small to mid-range manufacturers were purchased by Enertech Manufacturing including Hydron Module and TECO. Johnson Controls also purchased York, and are “eyeing the market” according to industry insiders.

Overall, these acquisitions signal a renewed interest in the GHP market among the four major segments: government agencies, utilities, contractors/installers, and drillers. This interest has been fueled, in large part, by the introduction of tax credits. These tax credits were the result of lobbying on behalf of the GHP industry by ClimateMaster President, Dan Ellis.

These market trends have also led to the rebirth and rebranding of the Geothermal Heat Pump Consortium led by John Kelly to form a new organization named GEO.

Mr. Kelly said, *“The GHP market is getting stronger. Sales were flat the last few years, but the incentives/tax credits were really helping the contractors and drillers out. Otherwise, we would really be down. From what I’m hearing there are pretty strong growth projections. The manufacturers are satisfied and are not concerned about the length of the economic downturn. Overall, I am optimistic and think there is continuing strength in the GHP market.”*

This renewed interest in the industry has led three of the four major GHP manufacturers; WaterFurnace, ClimateMaster and GeoComfort (Enertech) to fund the new GeoExchange Organization to support the heat pump industry. The only major player, Bosch-FHP has decided not to support this new association. This organization is also reaching out to the smaller GHP manufacturers as well as drillers and installers as a way to promote the overall market, rather than individual firms. Mr. Kelly said that Dan Ellis, President of both ClimateMaster and CEO of the new GEO organization, views his role as more of an “industry ambassador” rather than a representative from one particular company.

Another positive trend in the market has been the continuing interest in promoting energy efficient installations in government facilities. While this technology is still not fully understood in the governmental sector, Mr. Kelly believes that installations in these types of facilities are likely to continue.

“I think we will see another big round of government buildings and manufacturers like Trane and Johnson Controls, who are ESCOs (Energy Service Companies) may be a prominent part of that market because they are in government buildings. We already have Executive Orders telling government agencies to do this type of installation. So even though the rest of the market is stalled, this administration is pushing government agencies towards GHPs,” Mr. Kelly added.

Lastly, the renewed interest in energy efficiency across the country has also led to increased interest among utility organizations. Therefore, this may point to a return to more utility GHP programs.

“I think there is a potential for utilities to begin to play a positive role and there is increasing interest to get back involved with the industry. I see potential for another big swing to this market by them,” Mr. Kelly said.

The overall forecast for the GHP market appears favorable, as the industry seems to be gearing up for another surge in interest and sales.

Industry Links

The following organizations are able to provide more detailed information about both the costs and benefits of purchasing and installing a GHP system:

- DOE Geothermal Technologies Program
- Geo-Heat Center
- Geothermal Heat Pump Consortium — now named GEO
- International Ground Source Heat Pump Association (IGHSHA)
- U.S. Department of Energy – *Energy Efficiency and Renewable Energy, How To Buy and Efficient Ground Source Heat Pump*
- ENERGY STAR®, *Geothermal Heat Pump Systems*
- American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE)
- Air-conditioning and Refrigeration Institute



The Colorado Geo Energy Heat Pump Association (CoGEHPA)

CoGEHPA is a member based organization that represents a community of professionals who seek to expand the use of geexchange systems (ground source heat pumps) throughout the region. CoGEHPA's goals include educating the public and end-users about the benefits and applications; training installers, builders and designers; establishing quality assurance standards; and monitoring and engaging in legislative affairs.

Summary of Utility Programs

Reasons for Selecting These Utility Programs

All of these utilities agreed to participate in our report by offering telephone interviews, and most internally reviewed a manuscript draft about their program. Other utilities were approached to participate, but declined for various reasons. Still other utilities were considered for participation, but were later excluded because their experiences largely mirrored the case studies presented here.

Common and Best Practices Program Characteristics

This is the first essential element to program success. It means the ability to identify, encourage, train and support the drillers, dealers, and installers who deliver GHPs. Utilities that have been able to foster these relationships are able to develop a competitive marketplace, resulting in a more favorable pricing structure, a more knowledgeable infrastructure and a truly competitive market. *GulfPower* and *Muscatine Power and Water* have been among the most successful utilities at developing a strong contractor relationships.

Table 6: Utilities By Best Practices Characteristics

Utility	Contractor	Experience	Patience	Vision
Muscatine Power and Water	1	1	1	1
Gulf Power	1	1	1	1
Otter Tail	1	1	1	1
Plumas- Sierra	1	1	1	1
Delta-Montrose	1	1	1	1
Northeast Utilities	1	1	1	1
First Energy	1	1	1	
Yellowstone Valley	1	1	1	
Tennessee Valley Authority (TVA)	1	1	1	
Bonneville Power Administration (BPA)	1		1	
Palmetto Electric	1	1	1	
Tallahassee			1	

Experience in Geothermal Heat Pump Installations

This is another critical element to program success. While some utilities are relatively new to geothermal programs, such as *Muscatine Power and Water*, they were able to rely on advice and guidance from geothermal experts, such the Iowa Heat Pump Contractors Association and the International Ground Source Heat Pump Association. However, the most successful geothermal programs have been those where developers gained experience and then leveraged this experience to further build the market. *Otter Tail Power*, with its strong word-of-mouth and customer referrals, illustrates the benefits that gaining and building experience offers.

Patience to Develop a Market

Patience is a virtue in this market. It takes time to develop a contractor infrastructure, to identify the best applications for geothermal, and to install the units. Patience is also necessary on the part of the customers, since the payback for GHPs can be longer compared to conventional systems. However, as the customers soon learn, patience can be rewarding. Utilities such as *Otter Tail Power* have demonstrated the patience necessary to foster a GHP program despite occasional setbacks and have gained enhanced load profile and satisfied customers.

Vision

Developing a successful GHP program also requires looking beyond the short term and envisioning a new and better market. *Muscatine Power and Water* is among the most forward-thinking utilities involved in geothermal programs. While it recognizes the shortcomings in the current situation, the utility thinks creates the infrastructure and environment necessary to succeed.

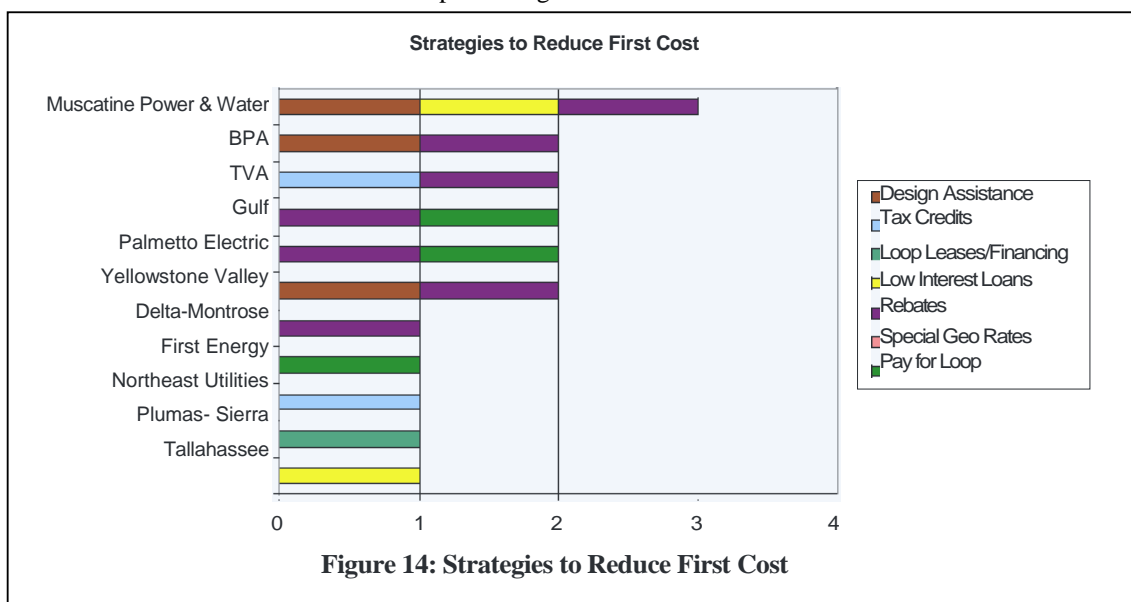
Common and Best Practices Marketing Approaches

These utility profiles also described some of the most successful marketing approaches used to make geothermal programs successful.

Reduce the First Cost Barrier

The utilities profiled in this report demonstrated great creativity in developing strategies to lower or eliminate the biggest barrier to geothermal installations: the higher incremental first cost, as shown in the following graph.

While most relied on some type of incentives, at least initially, many of these successful utilities also developed alternative financing strategies. *Plumas- Sierra* offers loop leasing and other utilities are considering similar approaches. *Muscatine Power and Water* intends to offer a long-term geothermal loan program in the next year. *Northeast Utilities* (NU) also developed a strategy to eliminate the installation cost from the buyer's decision process by paying this cost directly. As the profiles illustrate, these utilities did not simply rely on the standard rebate and incentive structure when it came to promoting GHP installations.



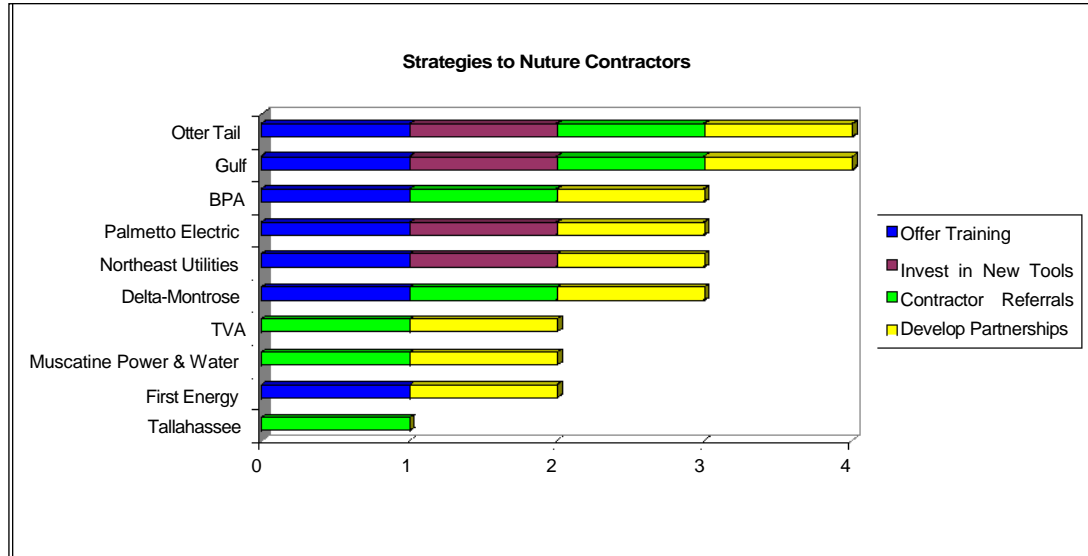
Nurturing Contractor Development

These utility profiles also illustrate some of the more successful strategies that have been used to develop a sustainable contractor infrastructure. These strategies include investing in new tools and technologies to assist in the geothermal installation process, holding design and training sessions for architects and engineers to educate them about GHPs, developing a contractor referral network to support the local drillers, installers and dealer and developing a partnership where all parties work together. The following graph shows these strategies grouped by utilities, highlighting the different approaches used by each utility profiled.

As this chart illustrates, *GulfPower*, *BPA*, and *Otter Tail* have certainly had the most success in developing a strong contractor infrastructure, while other utilities rely more heavily on the supporting an already strong infrastructure through its contractor referral network.

Figure 15: Strategies to Nurture Contractors
Creating/Generating Enthusiasm at All Levels

Perhaps the most overlooked part of developing a successful GHP program is creating a sense of enthusiasm. However, this is a necessary element to long-term program success. This enthusiasm is



developed in several ways.

One technique, for example, involves installing GHPs at utility headquarters and in employees' homes. This is a powerful testimonial to potential buyers that the utility believes in this technology.

This strategy has been used effectively at a number of utilities, including *Plumas-Sierra*, *Palmetto Electric* and *GulfPower*. Each of these utilities has numerous staff members with geothermal systems installed in their homes. Moreover, *Palmetto Electric* and *Yellowstone Valley* have also installed GHPs at their headquarters buildings.

Another technique for creating enthusiasm for GHP installations is to foster a "geo culture," or creating a sense of pride in ownership among geothermal customers. This is also a successful strategy for building word-of-mouth among potential customers and leads to further installations and a broadening of the "geo" mindset. This strategy has been most effectively demonstrated in *Delta-Montrose's* "geo customer dinners," and through the customer tours and demonstrations offered by *Otter Tail Power*.

A third element necessary to creating enthusiasm for GHPs is showcasing high-profile installations in new and compelling ways. For example, *First Energy* often holds its dealer training seminars at Richard Stockton College, home to one of the largest GHP installations in the world. This technique demonstrates the utility's belief in the system, and reinforces the versatility and overall superiority of GHPs to potential customers.

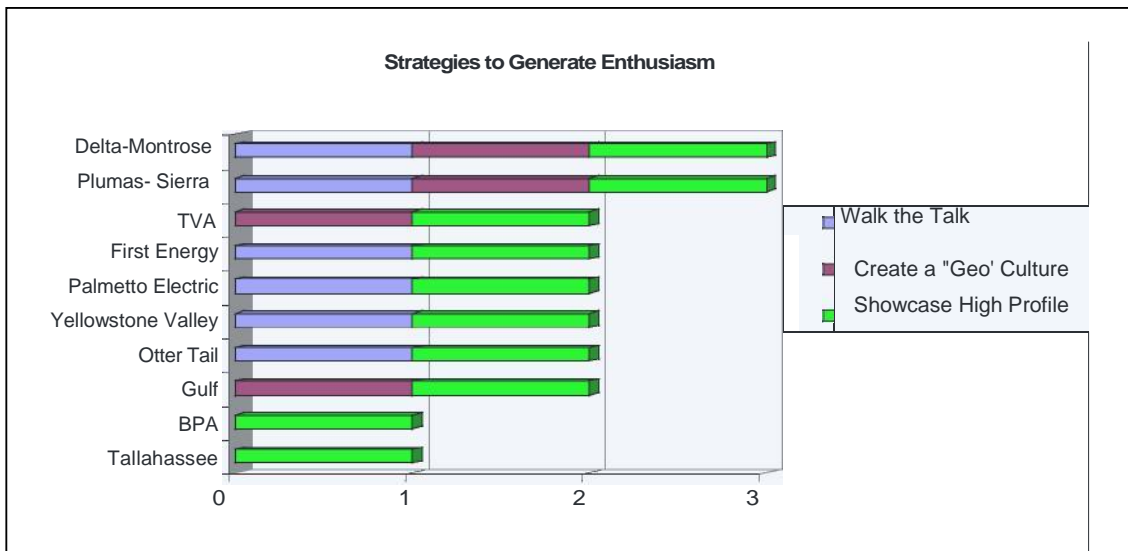
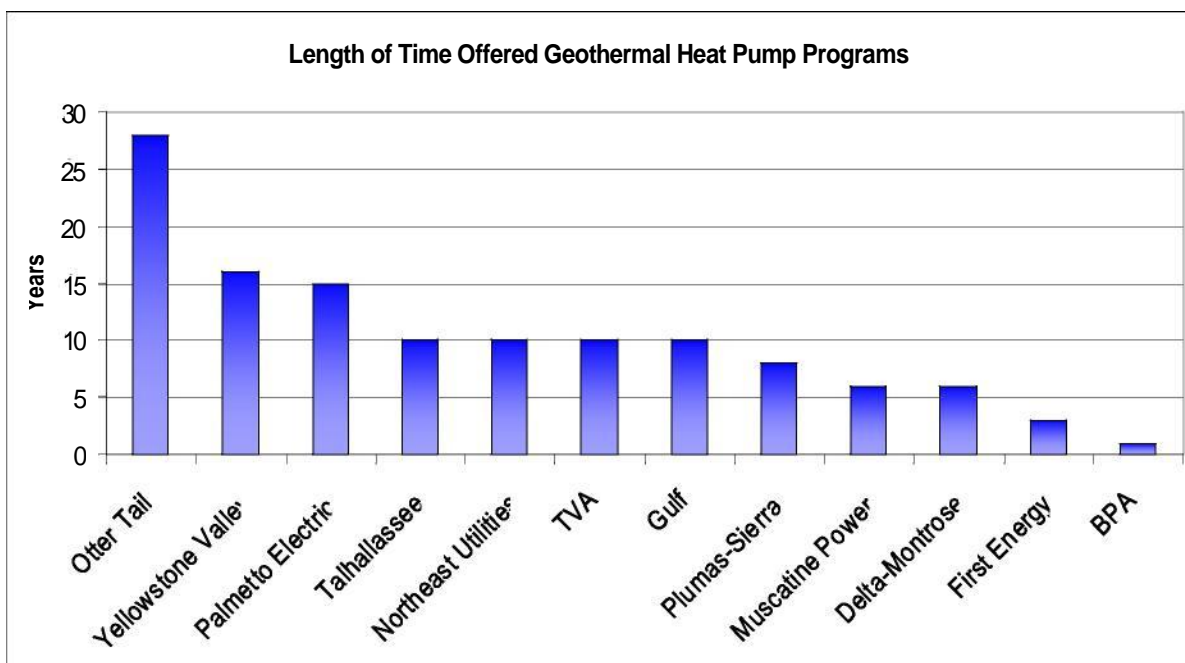


Figure 16: Strategies to Generate Enthusiasm

These utility profiles also demonstrate that not all successful utility programs have been around for two decades or more. Indeed, as following the graph shows, while *Otter Tail* has been promoting GHPs for a quarter of a century, some other successful utilities have been involved in geothermal installations for just a few years. Thus, it is not the length of time that is an indicator of success, but rather it is the commitment that



the utility makes to promote this technology.

Figure 17: Length of Time Offered GHP Programs

Summary of Partner Offerings *Reasons*

for Selecting These Partners

This report also features 16 profiles of trade allies that have been active in the geothermal industry. These trade allies or strategic partners include GHP manufacturers, architects, engineers and non-profit associations dedicated to promoting this technology. This is not designed to be a comprehensive list but rather an indication of the types of companies that have committed resources.

Future Prospects for Programs *Common*

Challenges Inhibiting Future Success

While everyone profiled in this report believes strongly in GHPs, this technology still faces numerous challenges. These challenges include reducing first costs, raising awareness and developing a sustainable infrastructure.

Utilities have aggressively tackled the first cost barrier, but there are still customers who are unwilling to commit the extra dollars required in the beginning to install GHPs. This resistance is sometimes not justified, because some utilities such as Otter Tail Power find several tax strategies and lending sources for reluctant customers. However, this is still a legitimate concern and has to be overcome through case studies, demonstrations, analyses and salesmanship.

Although GHPs have been around for decades, this still remains a niche market. There are “core geo junkies” who love the technology, but outside this narrow market it is relatively unknown.

As a *Delta-Montrose* employee observed, despite the publicity this technology has received, there is still only about 50 percent awareness.

Lastly, the largest stumbling block is developing a competitive and sustainable infrastructure among drillers, installers, and dealers. *Plumas-Sierra* encountered similar difficulties until it was able to develop an effective driller network.

<i>Most Promising Strategies to Overcome Challenges</i>
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Despite these obstacles, the technology continues to improve. Utilities, manufacturers and drillers are committed to exploring new ways to further drive down the cost of installations, whether it is by developing new types of drilling tools, pursuing new types of geothermal systems or installing units with improved refrigerants. Among manufacturers, *WaterFurnace* and *FHP* continue to refine and broaden their product lines. These improvements include more environmentally friendly refrigerants and new types of hybrid units.

Several drillers are also investing in new types of drilling heads, designed for smaller yards and more urban locations, all with the support of local utilities such as *NU* and *Delta-Montrose*.

The National Rural Electric Cooperative’s Cooperative Research Network (CRN) recently completed field tests of a promising new hybrid version of a GHP. This geothermal prototype is a combination of an air-source heat pump and a geothermal (a.k.a. ground source or geo-source) heat pump. It was designed by GeoFurnace Development, Inc., and is being built by CoEnergies/

GeoFurnace⁶ Heating & Cooling. The initial field testing, conducted in Alabama, demonstrated that this type of heat pump offered several advantages over air-source heat pumps, including lower demand and greater comfort. The heat pump operates at lower ambient temperatures without using supplemental strip heat. It defrosts without using strip heat, without creating a “cold blow” effect that customers find uncomfortable and without extracting heat from the living space. The system also uses significantly less ground loop -- about one-third to one-half the buried tubing that a full GHP requires in a standard installation. This unit is still in the testing stages. For more information, contact the Cooperative Research Network (<https://crn.cooperative.com>).

Future Prospects For Technology

As one geothermal program manager observed, “GHPs are a product of the future, and probably will always be.” GHPs continue to offer a promising future, however, it will continue to languish unless its proponents can create enough of a market presence to be noticed by bigger manufacturers.

One way to increase GHP visibility is to start substituting GHP installations in conventional air conditional applications. This is driving *Delta-Montrose* to promote a new type of GHP using direct exchange technology. Also, this idea has been contributing to *WaterFurnace*’s and other manufacturers’ double-digit sales growth.

Related Programs/Vendors/Events as Future Indicators

The best way to track activities in the geothermal industry is to become involved in the numerous associations dedicated to promoting GHPs. In addition to the GHPC, the International Ground Source Heat Pump Association provides numerous training opportunities to help strengthen the contractor and driller infrastructure. There are also regional and local GHP associations, scattered throughout the United States.

In Canada, there is now a Canadian GHP Association promotes this technology throughout Canada. Internationally, GHPs are also popular choices in several countries throughout Europe and Asia.

The websites listed in this report provides additional information. These links provide the best sources of information on the current and future prospects of this exciting technology.

⁶CoEnergies is a partnership between GeoFurnace Development Inc. and Delta-Montrose Electric Association of Montrose, Colorado.

About the Author and Johnson Consulting Group

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Introduction

Katherine Johnson is President of Johnson Consulting Group, a woman-owned strategic marketing firm specializing in the energy efficiency field. Katherine has conducted marketing analysis activities to determine technical and market potential for a variety of energy efficient technologies. She has also designed, launched, implemented, and evaluated marketing and program activities for energy organizations throughout the United States. As the Marketing and Finance Manager for the Geothermal Heat Pump Consortium, Katherine managed a \$3 million initiative to develop and implement a national branding strategy for an energy efficient technology. She has a Masters in Business Administration from Rollins College with concentrations in Marketing and Finance, an undergraduate degree in Business-Journalism from Indiana University.



Experience: More than 17 years experience in strategic planning, marketing, management and financial consulting for energy utilities and telecommunications firm throughout the United States. Also, launched new energy efficient technologies in the marketplace; directed complex, large-scale market research studies for utilities, non profits, and government organizations. Katherine received her Doctorate of Business Administration from the University of Southern Queensland, Australia in 2010. She holds a masters degree in business administration from Rollins College with concentrations in Marketing and Finance, an undergraduate degree in Business-Journalism from Indiana University.

President, Johnson Consulting Group, Frederick, MD: 2008 - (Formerly with Market Development Group)

- **Consortium for Energy Efficiency:** As lead contractor, Katherine provided assistance in refining and deploying EPA's Energy Star Purchasing Tool Kit targeting state and local government procurement officials. She also wrote case studies highlighting effective strategies used by municipal governments to adopt energy efficient equipment.
- **New York State Energy Research and Development Authority:** Key project team member in the first state program ever to target local decision-makers. Prepared case studies documenting anticipated savings from program participation. Presented findings to elected officials, technical staff, and end users in various presentations throughout New York State. This project scope expanded to target large cities, and state colleges and universities, and now includes analyzing the entire "plug-load" of a building to identify energy savings strategies. Ms. Johnson directed 14 projects at locations throughout New York State, including the University of Buffalo.
- **Department of Energy:** Assisted in a comprehensive analysis of the Commercial Building Sector, identifying key trends in market development, consumer attitudes and

behaviors that will influence how commercial buildings operate. This ground-breaking study identified the likely effects that improvements in communications, technology, and materials will have on how various commercial segments use commercial building space. This report has major implications for energy usage and consumption characteristics. It is currently being updated with interviews of chief energy stakeholders and decision-makers throughout the commercial buildings market.

- **Pacific Gas & Electric:** As the principal researcher and interviewer for commercial and industrial baseline studies, this study examines the effects of market transformation in motors, HVAC, and refrigeration markets. She has also conducted extensive interviews with Energy Service Companies (ESCOs) throughout the United States to determine trends in energy efficiency technologies and likely marketing strategies.
- **Southern California Edison:** As a subcontractor to TecMRT Works, KJ Consulting provided the utility with an in-depth analysis of hard-to-reach customers located throughout California. This joint utility sponsored study included a comprehensive mapping analysis, detailed segmentation studies of various ethnic and demographic groups, and action plans describing appropriate vehicles to reach core groups.

Marketing and Finance Manager, Geothermal Heat Pump Consortium, Inc., Washington, D.C. (1995-1996)

- Managed marketing and financing initiatives for a \$100 million six-year industry/government collaborative to increase installations of an alternative energy technology.
- Worked with 120 member utilities to develop innovative marketing and financing strategies to promote geothermal systems. Directed \$3.2 million in marketing and financing projects at member utilities, including a \$750,000 national awareness campaign.
- Identified and promoted alternative financing options to utilities, lenders, governmental agencies, and trade associations. Facilitated the development of partnerships between utilities and national financing organizations.

Associate, Barakat & Chamberlin, Washington D.C. (1993-1995)

- Team leader for consulting engagements for investor-owned utilities. Provided strategic recommendations for program improvement, assisted in new product development, market potential, and competitive assessment studies.
- Project manager for engagements targeting the residential and commercial totaling more than \$1 million. Projects included the following:
- **Consolidated Edison:** Katherine led the evaluation activities of this comprehensive, three-year program analysis of Consolidated Edison's Low-Income Energy Efficiency Program. Her work included conducting focus groups with landlords, building owners, and supervising the implementation of tenant questionnaires. Her analysis identified new ways to deliver effective customer education and increase measure persistence among participating customers.
- **Delmarva Power:** Katherine was the on-site project manager for eight program evaluations. Ms. Johnson was responsible for questionnaire development, design and

analysis for commercial, industrial and residential energy conservation programs. She prepared summary reports and provided recommendations to company management.

- **New England Electric System:** Katherine was the project manager and key researcher on projects regarding adoption rates and trends for energy efficient motors among commercial and industrial customers. Her responsibilities included conducting key interviews, program evaluation, interview design and analysis.
- **Potomac Edison Electric Corporation:** Areas of responsibilities included questionnaire development and analysis of the success rates of various residential energy conservation programs. Katherine also identified key barriers to technology adoption, determined measure persistence and recommended strategies for future program design, including an analysis of the most effective technologies to include in future programs.

Research Director, The Corps Group, St. Louis, MO. (1992-1993)

- Co-authored a white paper describing the key issues facing the telecommunications and electric utility industries after deregulation.
- Conducted focus groups with customers and staff members to determine the appropriate strategies to install customer-friendly automated voice-response systems. Designed customer satisfaction surveys and tracked long-term performance of this voice-response system. Succeeded in increasing customer satisfaction 95% in just three months.
- Developed and implemented complex sampling designs and determined appropriate segmentation studies for utility marketing programs in Northern California.

Project Manager, Aragon Consulting Group, St. Louis, MO. (1991-1992)

- Improved customer satisfaction at a major utility as part of a \$3 million research study.
- Performed in-depth analysis of energy efficiency products and services for a major utility company. Identified market potential and sales revenue projections for residential, commercial, and industrial products and services.
- Supervised ongoing marketing tracking studies, mystery shopping, and consumer panels for Fortune 500 firms specializing in the residential market.

Education

- Doctorate of Business Administration, University of Southern Queensland, Australia
- Masters of Business Administration (Dean's List: 1990)
- Rollins College, Roy E. Crummer Graduate School of Business, Winter Park, FL
- Bachelor of Science in Business and Journalism (Dean's List: 1983) Indiana University School of Business, Bloomington, IN
- Katherine got her start in the business world by working as a bilingual tour guide at Walt Disney World in Florida. Her tour guests included the Crown Prince of Morocco and members of the International Chamber of Commerce. She keeps her French language skills current through extended boat trips on French canals during summer vacations with her family.

About Johnson Consulting Group

Johnson Consulting Group is a woman-owned strategic consulting firm specializing in the energy efficiency field. It is headquartered in metro Washington D.C. We also have an administrative office in Portland, Oregon and satellite offices in Winter Park, Florida and Ouray, Colorado. Prior to starting Johnson Consulting Group in 2008, Katherine was the majority owner in Market Development Group

Free Quarterly Newsletter

Johnson Consulting Group offers a free quarterly email highlighting relevant topics and events. To sign up for a free subscription and view the latest issue as well as an archive of past editions visit <http://www.johnsonconsults.com>.



Utility Case Studies



Bonneville Power Administration (BPA)

P.O. Box 3621

Portland, Ore., 97208-3621

Phone: (503) 230-4002

Program Name: Performance Tested Comfort System™

Program Website: www.ptcsnw.com/

Corporate Website: www.bpa.gov

Ownership: Federal utility



Number of Customers and Service Territory: BPA's service territory covers all of Washington, Oregon and Idaho and western Montana, as well as small contiguous portions of California, Nevada, Utah, Wyoming and eastern Montana. BPA's wholesale customers include public utilities, public utility districts, municipal districts, public cooperatives, some investor-owned utilities and a few large industries such as aluminum companies.

BACKGROUND

History

The Bonneville Power Administration, headquartered in Portland, OR, is a federal agency under the U.S. Department of Energy. Congress and the Roosevelt Administration created BPA in 1937, just before completion of Bonneville and Grand Coulee dams in 1938 and 1941. One of BPA's early missions focused on electrifying farms and small communities with public power. These rural areas were not profitable for private utilities to serve. Today, BPA markets the power generated at 31 federal dams, one nonfederal nuclear plant at Hanford, Wash., and some nonfederal power plants, such as wind projects.

In partnership with other Northwest utilities, BPA funds the Northwest Energy Efficiency Alliance, which works to bring new energy-efficient products into the marketplace. BPA supports the ENERGY STAR® program, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy, which helps consumers choose energy-efficient products.

Relevant Program Name & Description Performance Tested Comfort System™

BPA has approached the GHP market from a unique direction. It focuses on raising the overall standards of the contractors installing the equipment by requiring contractors to complete a certification program. Once they have completed this program, they are then eligible to participate in the rebate programs offered by BPA's local public power districts (PUDs).

The program is called Performance Tested Comfort System (PTCS) which is a branded program established by the Regional Technical Forum⁷ BPA, through its Contract Rate Credits, provides funding and the infrastructure support for the utilities offering the PTCS program. The training, held at locations throughout its four-state service territory, concentrates on ways to improve the overall heat pump performance by focusing on proper insulation, duct sealing and heat pump installation.

The Regional Technical Forum (RTF) was established by an act of Congress as an arm of the Northwest Power & Conservation Planning Council to develop standards to verify and evaluate conservation savings. The RTF establishes and maintains the standards for the PTCS program. For more information go to the RTF web site: <http://www.nwcouncil.org/energy/rtf/Default.htm>

The program centers on three areas:

1. Contractor training to the established specifications
2. Reporting the details of each heat pump installation for tracking and quality control
3. Quality assurance testing by sampling 10 percent of all completed installations.

This program's objective is to 'improve the overall quality' of the heat pump installations in BPA's service territory, according to Ottie Nabors, the PTCS project manager for BPA.

Day-to-day support of the program is provided by engineering consultants hired to provide the certification and quality assurance services, while the BPA's utility partners are involved in the actual commissioning and record-keeping process. The quality assurance is designed to provide feedback to the contractors and the utilities to improve the quality of heat pump installations.

Dates Offered: Since October 2006.

How/Where Marketed

BPA markets this program through the public utility districts. In exchange for a utility's participation in the program, BPA pays them a rebate for each heat pump installed (either air source or geothermal). The rebate amounts, which vary depending upon the PUD's location, range from \$800 to \$1,500.

"The rebates are based on climate zone and the savings potential to BPA," Nabors explained. However, many utilities offer additional incentives above the amounts provided directly by BPA.

How Customers Enroll/Sign-Up

Through the PUDs. Only certified contractors can install the GHPs, and in order to receive a rebate the utility must be participating in this program. Nabors estimates that so far 30 PUDs in four states are marketing this program.

Number of Installations

Information not yet available; however there have been more than 300 contractors who have become certified through this program.

Price/Cost to Customer

Initially training costs have been paid by BPA. As initial training needs are met, training costs will transition to a cost-sharing arrangement with the utilities. The contractor may also have to purchase additional equipment such as a blower door to perform the commissioning. However, the purchase is not necessary if the participating utility is the commissioning the project and has the necessary equipment.

Key Vendors/Partners/Allies

- **BPA's Public Utility District**, the local municipal utilities that purchase power from BPA, verify the quality of installations in their service territories. Their role includes:
 - Verify systems meet specifications
 - Make a determination of duct location
 - Maintain the necessary equipment documentation including rating, size, etc. PTCS Commissioned Heat Pump Certification
 - PTCS Duct System Certification
- **Other energy efficiency organizations:** The PTCS standard is also used by the Northwest Energy Star New Residential Construction Program. BPA worked closely to make sure that the program Energy Star standards were consistent with the Program.
- **The contractor community:** This is the core constituency that is responsible for installing the equipment. They have to be willing to invest both their time and resources to complete this rigorous program. In addition, many of the PUD's also require that GHP contractors are also certified by the International Ground Source Heat Pump Association in order to participate.

Keys Reasons for Success/Failure

- The program is contractor-oriented rather than customer oriented. BPA has set ambitious energy-savings goals, and in order to reach those objectives they have to be certain their heat pump installations are done properly. This program provides them with the skill set needed to help the utility achieve its energy savings.
- The program requires good data tracking and recording. This is an essential program element that is often overlooked in contractor-oriented utility programs. But good record keeping is essential in order for local utilities to manage the process and provide service to their customers, and also for BPA to accurately estimate potential savings.
- Quality control means that there will be follow-up inspections of the work installed, which will in turn reinforce the contractor skill sets and “raise the bar” in the quality of heat pump installations in the Pacific Northwest.

<i>LESSONS LEARNED</i>

- **BPA didn’t reinvent the wheel.** Rather than coming up with a new standard for contractor training, BPA leveraged an existing training standard into its new program.
- **BPA didn’t operate in a vacuum.** It recognized that these contractors operate in different states and therefore worked with the State of Oregon to make certain the requirement for customers in Oregon to receive tax credits were the same as the program standards. This reduced another potential barrier to contractor recruitment by standardizing the program across four states. It also matched the program standards to those used by other energy efficiency programs such as Northwest ENERGY STAR®.
- **BPA remains flexible to contractor concerns.** Now that the PTCS program has been launched, they are looking at ways to “train the trainer.” BPA will start recruiting experienced HVAC contractors as trainers as a way to extend their reach further into this community. It is also looking for ways to partner with local community colleges that offer courses in HVAC.

Future Plans

BPA plans to look for ways to work with local community colleges to provide training. They also want to continue to provide their utility partners with the resources needed for them to monitor and verify local installations.

Best Way to Learn of New Developments: program Website

Primary Staff Contact

Ottie Nabors
 PTCS Project Manager
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Delta-Montrose Electric Association

11925 6300 Rd.

Montrose, CO 81401

Phone: (970) 249-4572

Program Name: CO-Z Energy

Program Website: <http://www.dmea.com/geoex/co-zfacts.htm>

Corporate Website: <http://www.dmea.com>,

Ownership: Rural electric cooperative



Number of Customers and Service Territory: Delta-Montrose Electric Association (DMEA) serves 28,000 customers in four southwest Colorado counties.

BACKGROUND

Delta-Montrose Rural Power Lines Association was organized in August 1938. DMEA is a private, non-profit cooperative owned by its members. DMEA has a history of developing innovative energy programs that have won praise and recognition at the regional and national level.

“I think DMEA is one of the most innovative co-ops in the country,” said Peggy Plate, former Energy Services Manager for the Department of Energy’s Western Area Power Administration (WAPA).



History

Reasons for program, past/recent activities/programs and or primary drivers. DMEA developed its GeoExchange program as a way to provide service using the concept of “chauffage” or guaranteeing heating bills. Chauffage is a popular financing plan used in Europe and its intent is to lower energy costs by financing the installation of energy efficient technologies and then recouping the investment from the energy savings from these installations. DMEA took this concept into the single-family residential market a step further than the Europeans in designing its geothermal program.

DMEA’s program is called “CO-Z,” and “the intent is to remove the first cost barrier” associated with GHP installations, said Paul Bony, DMEA’s marketing and customer service manager. “DMEA took the loop lease concept to the next level through the development of the chauffage concept.”



DMEA viewed this program as a way to target both new construction and existing home (retrofit) markets. Targeting the retrofit market offered a new opportunity to increase GeoExchange installations in DMEA’s service territory, while installations in the new construction market would allow DMEA to reach new members as they moved into its territory.

According to the co-op’s research, forced-air fossil fuel systems accounted for approximately 50 percent of the total systems in its territory. This represented an attractive target market for GHPs as a strategy to convert current gas and propane members to GeoExchange systems.

One senior DMEA staff member explained that the retrofit arena made an ideal target market for GeoExchange installations “because the duct work was already in place.” GeoExchange would be positioned as a split-system — offering geothermal heating and cooling with a gas or propane back-up heating source.

The co-op also identified “basic houses” as sites for pilot GeoExchange installations. “We targeted houses that had existing gas furnaces...houses that weren’t really tight,” a DMEA staff member explained. This was done deliberately to determine if it was possible to retrofit existing homes with geothermal systems.

DMEA also wanted to increase GeoExchange installations within the new construction market so the co-op approached builders. Historically, custom builders and higher-end customers in the new construction market have been an easier market in which to promote new technologies such as GeoExchange because financing costs can be included in the mortgage. It is also often easier to install the necessary equipment as a new home is built.

The Co-Z program has been in continuous development for the past four years, because it was necessary to gather all the energy information required to properly calculate the actual operating costs of geothermal systems. But the Co-Z program is not like traditional ESCo financing programs, because DMEA does not monitor actual energy consumption. Rather, the cooperative relies on the energy model it created to guarantee the GeoExchange energy consumption.

This program also fits in with the overall corporate strategy of DMEA. “GeoExchange systems support our board of directors’ vision of providing a variety of high-quality, affordable energy services to our members,” says Dan McClendon, DMEA’s general manager.

From an economic point of view, geothermal systems represent high load factor and low peak load impacting kilowatt-hour sales to the cooperative. “We are making more money on kilowatt hour sales and we are recouping our expenses for advertising, sales and installation through an imbedded fee,” Bony explained.

Relevant Program Name & Description Co-Z Energy

In the Co-Z program, DMEA pays for the installation of major components of a GHP (GeoExchange) system for a homeowner. The program does not include ductwork or other “inside the house” elements. The program originally relied on outdoor split GeoExchange equipment. In 2002, the co-op expanded its Co-Z offering to include more options including package systems and a loop only payment option.

Price/Cost to Customer

The Co-Z Energy Plan is a monthly service agreement between the customer and DMEA. The plan includes the following elements:

- Custom design of a geothermal system
- Installation of the outdoor portion
- Ongoing maintenance and repair
- An energy credit rate lock, adjustable in five-year intervals based on the system’s estimated energy usage

The Co-Z Energy Credit is intended to cover the majority of the system’s estimated energy operating costs averaged over 12 months. Steve Metheny, chief operating officer, explained: “The GeoExchange system is financed for 50 years on a monthly lease payment that includes equipment maintenance. The lease is about \$66 per month for my system and that includes financing the outside unit and the split system duct work.” However, the monthly cost is much lower compared to the monthly costs to heat with propane. “It costs about \$1,400 a year to heat with propane and that is without any air conditioning compared to the geothermal system that provides heating and air conditioning for about \$320 to \$420 per year,” Metheny said.

Dates Offered: Pilot efforts began in 1997 and the formal program was launched in September of 1998. ***How/Where***

Marketed

DMEA promotes its CO-Z program by building awareness of geothermal systems and creating a culture among geothermal owners.

“People are not exposed to geothermal and they don’t understand the benefits. We educate the population about the process and the overall concept,” Bony said.

For example, DMEA has enlisted a well-known geothermal expert, Doug Rye, to talk to prospective owners about the benefits

that geothermal systems offer, especially in New Jersey in conjunction with building an energy efficient home.

The Co-Z program is also promoted in articles in the cooperative's newsletter, on displays at the annual meeting, and on the co-op Website.

DMEA is also creating a "geo culture" among system owners. "Sales is a one-on-one process, but when we hit the hundred mark with installations, then we invited all the geo customers to a dinner... We are building a culture for everyone and using it for future referrals," Bony said. The cooperative is also "looking for better ways to streamline the (installation) process and better ways for real estate professionals to understand geothermal systems," he added.

Number of Customer Sign-ups

According to DMEA, 500 sales have been recorded to date at year-end for geothermal systems, but that doesn't count sales of GHPs by other installers in other markets in Colorado.

"Another market is opening up in Durango, CO, and three neighboring utilities are now asking us to work with them to promote GeoExchange in their service area doing something (in geothermal)," Bony said. This includes Xcel Energy, one of the largest investor-owned utilities in the country.

Key Vendors/Partners/Allies

DMEA took a unique approach to developing relationships with trade partners. Since there wasn't an infrastructure in place to support a geothermal program, DMEA set out to develop it. The electric cooperative is the owner of a heating and air conditioning company called *Intermountain Energy Services One*, owns a stake in a GHP manufacturing company called Co-Energies, and has been providing research and development assistance to a drilling company called *TEI Rock Drilling*. "We started up our own HVAC company with the goal of controlling our pricing, quality and customer care. We became profitable this year," Bony said. *Intermountain Energy Services One* installs and services the geothermal systems sold as part of the CO-Z program.

Despite all the growing pains, DMEA set into motion the elements required to grow a sustainable geothermal market. In that way, DMEA has already distinguished itself from the scores of other utility programs that have offered geothermal programs and achieved limited success.

Key Reasons For Success/Failure

Although DMEA has been successful in its geothermal program, technological barriers still exist that hamper market development. For example, DMEA reported manufacturing defects with some of the geothermal systems installed, and problems with the electronic thermostats used. Bony said he believes manufacturers may be losing their enthusiasm for the geothermal market. "The manufacturers are cutting back and have the philosophy of not worrying about the installations. They are getting out of the residential market," he explained.

"Technical support from the equipment manufacturers is way down compared to 10 years ago," he added.

Contributing to the problem of diminished manufacturer support is the growing shortage of skilled geothermal technicians. "The average HVAC technician is middle aged and we are hitting the wall with technical talent," Bony said. "We cannot get enough good technicians...there is a shortage of skilled technicians available."

Lastly, DMEA's staff also worries about the relatively low level of awareness of geothermal technology. "We promote the program via word-of-mouth and through our campaigns, but there is still only a 50 percent awareness of geothermal."

He summed up the reasons for geothermal's continual failure to expand nationwide: "There is no long-term philosophy in this market, no long-term investment. Utilities might support it but the utility market is not stabilized...GeoExchange is under-funded."

LESSONS LEARNED

DMEA illustrates several critical lessons that are important to understand for a utility that wants to develop a successful geothermal program:

- **Think outside the box.** DMEA took a sophisticated but little used European financing tool to form the basis of its geothermal “lease” program. Chauffage is not commonly used among utilities, especially rural electric cooperatives, because it requires investment and entails market risk. However, as DMEA has demonstrated, this risk can be managed through careful modeling, and it can be profitable. DMEA estimates that it will net \$700,000 in present value revenues from the first 150 geothermal installations they have so far -- a pretty handsome return on a \$200,000 investment.
- **Don’t depend on others to create the geothermal program.** DMEA had many reasons not to develop and deploy a geothermal program. The manufacturers have taken a step back from the market and so have many utilities. Moreover, there is a critical shortage of skilled technicians. Installers, and drillers charge market-busting rates. But DMEA didn’t let any of these obstacles stop them from pursuing the market. Rather, they created the market themselves. They solved the problem of the lack of skilled technicians by creating their own heating and air conditioning company to focus exclusively on the installation of geothermal systems. They are working on new drilling methods and have invested their own funds in a direct-exchange geothermal system that minimizes the hassle and cost of equipment installation, while opening the market to include small lot homes. In other words, they depended on themselves to make the program successful – with no excuses.
- **Create a “geo culture”.** DMEA also learned the importance of building on previous success. By fostering a sense of community among GHP owners, DMEA has developed a powerful internal sales force. This sense of camaraderie is especially effective within a member-owned cooperative, where community ties are strong.

Best Way to Learn of New Developments: From the Website, newsletter and the trade press.

Key Staff Individuals

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First Energy

Clean Energy Program

300 Madison Ave.

P.O. Box 1911

Morristown, NJ 07962-1911 Phone: (800)823-6462

Program Name: New Jersey Clean Energy Program-Energy Efficient Commercial & Industrial Construction Program

Corporate Website: www.firstenergycorp.com **Ownership:** Investor-owned utility

Number of Customers and Service Territory: Counties Served: Burlington, Essex, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union and Warren. Provides approximately 44 billion kilowatt-hours of electricity to more than two million customers in New Jersey and Pennsylvania.

GPU, Inc., a Pennsylvania Corp., is a company registered under the Public Utility Holding company Act of 1935. Its three domestic electric utility subsidiaries Jersey Central Power and Light (JCP&L), Metropolitan Edison Co. (Met-Ed) and Pennsylvania Electric Co. (Penelec) conducted business under the name GPU. *Please see Background section.*

BACKGROUND

In November 2000, GPU, an investor-owned utility, was merged with FirstEnergy Corp, and is now operating a subsidiary of First Energy Corp. Revenues in 2000 were \$5.2 billion, against \$4.8 billion in 1999, and total assets at 2000 year-end were \$19.3 billion, compared to \$21.7 billion at year-end [1999](#). Net income for the year 2000 was \$233.5 million or \$1.92 per share, against \$459 million or \$3.66 per share in 1999.

History

While GPU Energy has offered rebates for geothermal installations in New Jersey since 1991, deregulation of the New Jersey electric utility market and the mandate by the New Jersey Board of Public Utilities for all the utilities to offer comprehensive rebates, led to the inclusion of geothermal rebates in the statewide energy efficiency incentive programs contained in New Jersey's Clean Energy Program. This program has a component specifically targeting commercial and industrial construction called New Jersey Smart Start Buildings and a residential program called ENERGY STAR® Homes, both of which are funded through "societal benefits" charges that offer rebates to encourage the installation of various energy efficient equipment, including geothermal.

Relevant Program Name and Description

New Jersey Clean Energy Program-Energy Efficient Commercial & Industrial Construction Program

This program supports a variety of technologies, including GHPs, fuel cells, photovoltaic as well as design assistance and special grants for other technical assistance. The New Jersey Smart Start Buildings program offers financial incentives to encourage the installation of qualified energy efficient equipment or grants to make customers facilities more energy efficient.



Eligibility Requirements

Commercial, educational, governmental/institutional, industrial and agricultural customers in New Jersey and served by sponsoring utilities are eligible to participate. Eligible construction projects include: new construction, renovations, additions, remodeling, equipment replacement and manufacturing process improvements. The NEW JERSEY Utility Collaborative, including GPU Energy, anticipates that schools, group housing and the hospitality industry will be prime targets for geothermal installations.

Dates Offered

May 2001 was the effective date for New Jersey Smart Start, although First Energy had previously offered the same rebate through its Powersavers Program.

Price/Cost to Customer

Customer receives rebate of \$585/ton installed and also receives incentives to support design and additional installation costs on facilities over 50,000 square feet. The incentive structures are summarized in the following tables.

Design Support Incentives

Pre-design planning session	Up to \$1,000.00
Design simulation and screening	\$5,000.00 or more
Detailed analysis of energy-efficiency measures	Up to \$5,000.00
Multiple Measure Bonus	10 percent above the incentive measure

Qualifying Equipment Incentive**Geo-Thermal Heat Pumps**

Open Loop & Closed Loop	\$585 per ton
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How/Where Marketed

First Energy and other New Jersey Collaborative members are targeting key decision-makers, such as architects and engineers, through design seminars, training sessions and meetings. Other activities include conferences, trade shows, demonstration projects and general rebate presentations. First Energy also targets key trade allies through a number of professional organizations such as the Air Conditioning Contractors Association, ASHRAE and the Northeast Heating and Cooling Council.

First Energy provides case studies that promote the benefits and suitability of geothermal installations in New Jersey, such as showcasing Richard Stockton College and many other schools that use the technology.

How Customer Signs Up

A customer may register a project via an online registration form on the New Jersey Smart Start Buildings Web site and then download specific applications for the qualifying technologies. Once the technologies applications are submitted, the utility company sends a commitment letter that locks in the rebates at present level for two years.

Number of Customer Sign-ups

First Energy's activities have led to a variety of installations in a range of commercial and industrial applications. These include installations in 17 schools, a hotel, US Army officers' quarters, post offices, office buildings, an environmental center and a state historical tourist center.

How Service Is Delivered and Billed

The Smart Start program delivers rebates to customers for qualifying technology, however the collaborative that offers the program does not install the technologies nor finance them.

Key Vendors/Partners/Allies

First Energy recognizes the importance of developing the infrastructure and therefore works closely with loop installers, HVAC contractors, architects and engineers.

Key Reasons For Success

According to program managers Steve Bauman and Doug Shattuck, First Energy has all the elements required for an effective program: a favorable political climate, geology well suited for geothermal installations, a strong core of qualified contractors and installers, and an impressive track record in promoting GHP installations.

LESSONS LEARNED

The program implementers credit the success of this geothermal program to learning and applying the following lessons:

- **Know what can and can't be controlled, and focus on those factors that can be controlled.** For example, utilities cannot control geology or soil conditions, but they can have a positive impact on developing the infrastructure, raising awareness, and promoting energy conservation policies.
- **Geothermal installations are an application, not a religion.** As appealing as the technology is, GHPs are simply not the best application in all cases. Building a successful program requires targeting geothermal installations to the right applications.
- **Building a market requires a long-term commitment.** In New Jersey, geothermal technology is just one of several applications that are being promoted through the Clean Energy Program. It takes time to build the infrastructure and cultivate the relationships needed to develop a successful geothermal program.
- **Regulators must be included in infrastructure development.** The regulatory environment was critical to promoting and funding geothermal programs in New Jersey, and thus regulators are an important market segment to address when designing and deploying a GHP program.
- **Believe in geothermal heat pumps.** To be truly successful, a utility has to believe that this is a worthwhile technology and be willing to provide the long-term commitment required to properly develop this market.

Future Enhancements Planned/anticipated

The New Jersey Collaborative will continue to work within the context of New Jersey Smart Start Buildings to promote the technology. Ongoing efforts are being made at the state level with the Economic Development Authority to consider geothermal as a reference system to consider when developing or renovating schools under the New Jersey School Construction and Finance Act. This bill has allocated up to \$12 billion to be spent on New Jersey schools over the next ten years.

Best Way to Learn of New Program Developments

The New Jersey Clean Energy and New Jersey Smart Start Buildings Web sites (www.NewJerseycleanenergy.com and www.NewJerseysmartstartbuildings.com) are the best ways to keep up with new developments. For specific information contact Steve Bauman who can provide case studies and customer contacts. [Email: powersavers@gpu.com](mailto:powersavers@gpu.com).

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Gulf Power Co.

One Energy Place

Pensacola, FL 32520-0231

Program Name: GoodCents® Efficiency-Geothermal Heat Pumps

Corporate Website: www.southernco.com/gulfpower

Ownership: Gulf Power Co. is an investor-owned electric utility headquartered in Pensacola, FL selling electricity throughout Northwest Florida.



Number of Customers and Service Territory

Gulf Power's service territory spans the area from the Alabama border on the west to the Apalachicola River on the east; from the Alabama border on the north to the Gulf of Mexico on the south. Gulf Power serves more than 373,224 retail customers directly, and indirectly serves over 13,415 customers through the wholesale delivery of electricity to one investor-owned electric utility and one municipality. Gulf Power-generated electricity reaches customers in 71 towns and communities in Northwest Florida. It has approximately 1,400 employees.

BACKGROUND

Gulf Power Co.'s was founded in 1925 through the purchase of the Pensacola Electric Co. by Southeastern Power and Light Co. Southeastern was a holding Company that operated electric, gas and St. railway systems in Alabama, Georgia and Mississippi. In 1926, Gulf Power Co. acquired the Chipley Light and Power Co. The company prides itself on rates that are the lowest in Florida and among the lowest in the nation.

History

Gulf Power has the lowest electricity price in the state and one of the lowest in the nation. As a subsidiary of Southern Company, Gulf Power gains the benefits of large economies of scale while retaining the small company flexibility to develop successful, innovative products. The GoodCents Home is one such product developed at Gulf Power. The Southern Company is one of the largest investor-owned utilities in the United States with more than 26,000

employees and more than \$17 billion in earnings.

Relevant Program Name and Description

GoodCents® Efficiency-Geothermal Heat Pumps

Dates Offered: Since 1995

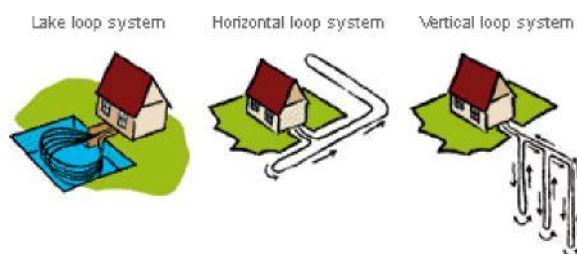
Price/Cost to Customer

When the geothermal program was first getting started, Gulf Power offered rebates to reduce the incremental costs of installing the systems. The utility offers a \$150 per ton incentive for closed-loop GHPs.

Keith Swilley, district manager for Gulf Power and one of the architects behind Gulf's geothermal program, explained that commercial installations usually get paybacks in five years or less and residential installations usually have a payback of seven or eight years. "That is very competitive," he added.

The energy savings sell themselves. For example, Swilley said, he paid \$25 in August to cool his 2,500 square foot home and \$14 in January to heat it because he uses a GHP. He added that GHPs are used to supply heating, cooling and water heating.

"Commercial customers are getting very good savings especially when they are using it with a water heater. One hotel saved \$15,000 in six months just on energy costs for heating the outdoor pools," Swilley added.



While Gulf Power does not offer rebates, the utility does provide design assistance, contractor referrals and life cycle costing to interested customers.

“We will usually run a lifecycle cost for anybody who considers a geothermal installation,” he added.

How/Where Marketed

In the past, Gulf Power did more high visibility marketing such as field days and some bill inserts. However, now that the geothermal market has developed, the utility relies more on word-of-mouth advertising.

“We are not spending more in dollars, it is more of a one-on-one approach. The dealers are pushing and promoting it,” Swilley said. “We don’t spend the money to advertise. This is still a niche market and just continues to build.” Gulf Power also offers a \$500 rebate on GHP systems.

How Customer Signs Up

By contacting Gulf Power. The utility provides information on GHPs and also a list of qualified dealers.

Number of Customer Installations

Gulf Power estimates that more than 5,200 tons of GHPs have been installed throughout its service territory. Geothermal has been a very popular choice among military installations and schools located throughout Gulf Power’s territory. The utility also has a number of installations in commercial offices, retail establishments, and within the residential market.

“The installations are growing more on the commercial side...we do one or two a month and are slowly building the market through contact rather than through mass-market advertising,” Swilley said.

“We are not going ‘gangbusters,’ but we consistently have something going on,” he added.

Gulf Power was also among the first utilities to successfully install GHPs in a condominium complex. He added that geothermal installations have also been done in several low-income multifamily housing projects.

The most widespread installations are in military housing. “We have done over 1,000 to 1,500 installations in military housing. The Energy Reduction Mandate was the original driver for the installations at Pensacola NAS, but now the housing administrator believes 100 percent in geothermal installations. They have had good results, so every bit of money they do geothermal,” Swilley said.

How Service Delivered and Billed: Directly with the contractor/dealer.

Key Vendors/Partners/Allies

Gulf Power worked hard to develop the commercial infrastructure necessary to support a geothermal program. In the beginning, they sought out the dealers they thought would be most interested and willing to build a geothermal business.

“We learned which dealers and installers supported it and were willing to invest in it,” Swilley said. “We also found out from customers what dealers were supporting geothermal...and those (dealers) that were no longer receiving utility referrals.”

“There has been a market shakeout...I think the geothermal market has gotten down to the core of the business, those long-term (dealers and contractors) willing to invest in it.”

Key Reasons For Success/Failure

Gulf Power’s geothermal program has been successful because the utility was able to engender trust among both trade allies and customers.

Swilley explained Gulf Power’s success this way: “We actually say the word, and actually promote it.”

Moreover, Gulf Power staff was willing to discuss geothermal as a viable electric option when it seemed appropriate. Rather than pitching the technology as the ultimate solution, utility staff instead promoted

geothermal when it made sense.

Gulf Power was also able to build on its success and use one successful and highly visible project to sell the next one.

LESSONS LEARNED

Gulf Power's slow and steady approach to building a sustainable geothermal program illustrates the following lessons. Gulf Power shows how to develop a stand-alone program, one that has found a market and keeps plugging away on a consistent basis.

- **One satisfied customer can lead to hundreds more.** Mass market advertising is fun and even glamorous, but in the long run it doesn't mean much if the advertiser doesn't have integrity. Gulf Power offers its customers integrity. It stood behind the installations it was involved in, it didn't get ahead of itself, and always made sure that its customers were well-served. That type of advertising is priceless.

Gulf Power also demonstrates the value of word-of-mouth for the marketing of this technology. Though the utility doesn't actively promote the technology to its customers, the market has been growing steadily during the past 10 years.

Gulf Power has a sustainable program that no longer needs utility dollars to make it successful. The utility has effectively seeded the market and developed a sustainable infrastructure. Now, word has spread among satisfied customers, dealers and installers.

- **Patience pays off.** Gulf Power also didn't give up. As Swilley explained, "We are doing 200 units right now and have already done 500 to 600 units at Eglin AFB...the previous commander was not open to much, but now facilities people are looking at geothermal. We are even doing a test installation in the commander's house. Things can get done if you reach the right person -- the key influencer."

Gulf Power was also careful to find the right match for geothermal installations. The utility has found the niches that work best for geothermal installations in its service territory: institutional markets such as schools and military installations, buildings with high heating loads, such as hotels with outdoor pool heaters, and residential homes.

Although the company doesn't need to promote geothermal systems any more as part of a formal program, it remains committed to the technology. Gulf Power staff refer customer inquiries to dealers and then follows up to make sure that geothermal systems are being promoted when appropriate.

Future Enhancements Planned/Anticipated: None needed ***Best***

Way to Learn of New Developments: Website

Key Staff Individual/Primary Staff Contact
Keith Swilley, District Manager
District Manager
(877) 655-4001

Muscatine Power and Water

3205 Cedar St.

Muscatine, IA 52761-2204 Phone: (563) 262-3354

Program: Muscatine Power and Water Ground Source Heat Pump (GSHP) Rebates

Web site: www.mpw.org/energy.htm

Ownership: Municipal utility

Number of Customers and Service Territory

The utility service territory covers 24 square miles. Service is provided to approximately 11,156 electric customers and approximately 9,412 water customers.

BACKGROUND

Muscatine Power and Water (MP&W) began in 1900 as a water utility and became an electric utility in 1922. This utility has an active and long-standing commitment to energy efficiency to help its customers save energy dollars. To help promote energy efficient practices, MP&W has developed an extensive energy efficiency program, *Energize Muscatine*. This program was initially funded by a grant from the Iowa Department of Natural Resources. In 2005 alone through *Energize Muscatine* customers were helped to reduce their need for energy by a total of 10,093,236 kWh-for a total energy cost savings of \$1,425,625. For his part in these efforts, MP&W's full-time energy services advisor, John Root, received the U.S. Department of Energy's 2001 Rebuild America Partnership Leader of the Year Award.

MP&W offers energy-efficiency programs, including its GHP program, as part of a comprehensive conservation effort. The utility is required by the Iowa Utilities Board to file an energy efficiency plan with the Iowa Utilities Board every other year. MP&W is not mandated to spend a specific amount, but is required to offer programs to customers and provide program details in the plan.

MP&W also educates customers on managing energy usage. This leads to further protection of the environment by reducing demand on scarce and expensive natural resources. As a utility, excess energy is sold on the wholesale market, which ultimately results in much lower electric prices for their native retail customers.

Relevant Program Name & Description Geoexchange

- Ground Source Heat Pump (GSHP)

Recently, MP&W increased its energy saving incentive program to include larger rebates for residents and business owners who install GHPs.

Residential

Residential customers are eligible to receive rebates of \$150 per ton for single stage units and \$300 per ton for dual stage units up to \$2,000 maximum. All customers must follow the utility's sizing recommendations, provided free by the utility, in order to qualify for the rebates.

Residential customers also receive an all-electric rate discount of \$0.01 per kWh for electric consumption over 700 kWh, from October through May. They also receive an electric water heater discount of up to \$5/ month.

Commercial I

Small commercial customers are eligible to receive the same rebates as the residential customers, up to a \$2,000 maximum, provided they follow the utility's sizing recommendations.

These customers will also receive a 20 percent discount on entire electric bill from October through May, if the following conditions are met:

- At least 50 percent of the total electric load of the premise must be the load of the building(s), which includes the permanent electric space heating facilities.
- The electric space heating system must be installed permanently and must be the only heat source in the building(s).

They are also eligible to receive an electric water heater discount of up to \$6 per month.

Large Commercial

These rebates are handled on a case-by-case basis. Customer cannot reduce load by more than 10 percent per year for the two years following payment of rebate.

Eligible customers receive rebates of \$300 per ton for the first 20 tons, \$200 per ton for the next 20 tons, \$100 per ton for the next 20 tons, \$50 per ton for the next 20 tons and \$25 per ton for the next 20 tons. Depending upon the size of the Geo Exchange system installed, the payment of rebates may be spread over a three-year period to provide for responsible budgeting.

Dates Offered: The program has been offered for the past five years.

How/Where Marketed

Through the utility Website and in customer educational materials.

How Customer Enrolls/Signs Up

Complete an application for the loan, which is available on the Website www.mpw.org/energy. ***Number***

of Installations

There has been a total of 210 tons installed mainly concentrated in schools and various other commercial applications, according to Energy Services Advisor John Root.



Price/Cost to Customer

Local banks have agreed to provide a low interest energy efficient home improvement loan.

- Prime minus one percent
- See example of potential savings listed below:

Geo Exchange Loan PMT vs. Energy Savings**Rebates and Tax Credits: Are *not* included in these Numbers**

Size of System in Tons	Ground Loop Installation Cost per Ton	Amount of Loan @ 7.25%	Monthly Loan Payment	Monthly Energy Savings	Increased Monthly Cash Flow first 5	Increased Monthly Cash Flow after 5 years
6	\$1,200	\$ 7,200	\$ 143.42	\$ 191.00	\$ 47.58	\$ 191.00
6	\$1,500	\$ 9,000	\$ 179.27	\$ 191.00	\$ 11.73	\$ 191.00
5	\$1,200	\$ 6,000	\$ 119.52	\$ 159.17	\$ 39.65	\$ 159.17
5	\$1,500	\$ 7,500	\$ 149.40	\$ 159.17	\$ 9.77	\$ 159.17
4	\$1,200	\$ 4,800	\$ 95.61	\$ 127.33	\$ 31.72	\$ 127.33
4	\$1,500	\$ 6,000	\$ 119.52	\$ 127.33	\$ 7.82	\$ 127.33
3	\$1,200	\$ 3,600	\$ 71.71	\$ 95.50	\$ 23.79	\$ 95.50
3	\$1,500	\$ 4,500	\$ 89.64	\$ 95.50	\$ 5.86	\$ 95.50
2	\$1,200	\$ 2,400	\$ 47.81	\$ 63.67	\$ 15.86	\$ 63.67
2	\$1,500	\$ 3,000	\$ 59.76	\$ 63.67	\$ 3.91	\$ 63.67
1	\$1,200	\$ 1,200	\$ 23.90	\$ 31.83	\$ 7.93	\$ 31.83
1	\$1,500	\$ 1,500	\$ 29.88	\$ 31.83	\$ 1.95	\$ 31.83

Assumption 1: Energy savings of \$382 per ton per year (Based on Heating Energy Equivalents from Iowa Energy Center)

Assumption 2: Cost of installing ground loop will be either \$1,200 or \$1,500

Assumption 3: The bank providing the loan is offering a low interest Energy Efficiency Loan

Assumption 1: All the banks in Muscatine have agreed to offer low interest Energy Efficient Loans of Prime minus 1 percent

Not

Key Vendors/Partners/Allies

Participating Dealers:	Contact Name	Phone
Attwell Heating, Air Conditioning & Geothermal	Mike Attwell	563/323-5110
Price Heating and Cooling	Dave Price	563/785-4404
Bills Heating and Cooling	Ron Gully	309/762-9396
U.S. Air	Paula Wright	563/288-7247
Moody HTG & AC	Dan Moody	563/263-8372
K&E Distributors	Mike Kruegen	515/996-2094
Odessa Mechanical	Nile Hayes	319/523-8130
Svoboda Heating & Cooling	Cory Ritter	563/506-0937
Custom Air	Kyle Hogan	563/264-0206
Keller Construction	Kerry Keller	563/263-3084
Hoover Heating and Cooling	Jim Hoover	563/506-8244

Keys Reasons for Success/Failure

MP&W was able to establish a successful GHP program because of the partnerships the utility developed within the community. When the utility decided to enter the market, there were no local contractors interested in installing GHPs. However, through Root's relationship with the Iowa Heat Pump Association, the utility was able to recruit local contractors to become IGHSPA-certified. This has led to a fairly strong relationship.

The utility also developed a loan program through local banks as a way to reduce the initial up-front costs associated with these installations.

Finally, MP&W believes that GHPs are just one element of a successful utility program. "This is a process. First we focused on making our customers' homes as energy efficient as possible," Root said. "Then we moved to GHPs, and once we have them installed, we are going to move towards installing solar PV systems." The GHP program is just part of the utility's larger overall goal to save energy and improve the operating efficiencies of its own power plants.

LESSONS LEARNED

- **Competition builds a market.** MP&W's threat to get into the GHP installation business was just the catalyst needed to recruit local contractors to become IGHSPA-certified.
- **Take the long-term view.** MP&W views this GHP program as a part of their long-term effort to enhance their commitment to improving overall plant efficiency and encourage customers to adopt renewable technologies.

Future Plans: none at this time

Best Way to Learn of New Developments: The utility Website.

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Northeast Utilities (NU)

107 Selden St.

Berlin, Conn., 06037;

Phone: (800) 286-5000

Corporate Web site: www.nu.com

Program Name: **Energy Star® Homes Program**

Program Web site: www.psnh.com/

Ownership: Northeast Utilities (NU) is an investor-owned utility consisting of three electric subsidiaries and a natural gas subsidiary.



Number of Customers and Service Territory

NU serves more than 1.7 million electric power customers in Connecticut, Massachusetts and New Hampshire and 187,000 natural gas customers in Connecticut. NU is one of the largest competitive energy suppliers in New England and is a major energy trader in the Northeast.

BACKGROUND

The Northeast Utilities system was formed on July 1, 1966, when three companies - The Connecticut Light and Power Co., Western Massachusetts Electric Co. and The Hartford Electric Light Co. - affiliated under the common ownership of Northeast Utilities (NU), the system's parent company. The NU system was the first new multi-state public utility holding company system created since the enactment of the Public Utility Holding Company Act of 1935. In 1967, Holyoke Water Power Co. joined followed by Public Service Co. of New Hampshire in 1992. On March 1, 2000, NU's merged with Yankee Energy System, Inc. NU gained nearly 181,000 natural gas customers in Connecticut through Yankee Gas. NU has more than 7,000 employees.

Electricity Service Territory

CL&P 4,400 square miles [149 communities in CT]

WMECO 1,490 square miles [59 communities in MA]

PSNH 5,445 square miles [198 communities in NH]

Total 11,335 square miles [407 communities in CT, MA and NH.; includes city of Holyoke, MA., served by Holyoke Water Power Co.]

Natural Gas Service Territory

Yankee Gas 1,995 square miles [69 communities in CT]

Source: NU WebSite

History

Reasons for program, past/recent activities/programs and or primary drivers. NU has promoted energy efficient new home construction for a number of years through its Energy Crafted Home (ECH) program. However, this program was meeting with limited success throughout NU's service territory. The ECH program was difficult to attract builders to and was being used by only a few custom home builders. "It was a tremendous amount of work," explained Cheryl Mattson, senior residential program administrator.

So, in 2000 NU adopted a new home ENERGY STAR® Home (ESH) standard. It had lower standards compared to Energy Crafted Home and was easier for builders to use. The utility also started looking at the incentive structure for GeoExchange and came to the conclusion that it needed to fully subsidize the cost of the loop installation. It was difficult to get incentives to pay for a dollar-per-ton basis. "I think there is still a level of uncertainty in geothermal installations with the loop and this took the uncertainty out of customer's hand," Mattson said. Geo Heat

Now, all of NU's subsidiaries promote geothermal systems through the ENERGY STAR® Homes program. The utility promotes geothermal technology under its conservation load management program. NU is not trying to promote fuel switching, but rather trying to promote a more efficient alternative to other electric

heating choices such as baseboard heat.

Relevant Program Name and

Make Your Home An Energy Star®

Description Energy Star Home Program

GHPs are just one of many technologies eligible to receive incentives. The utility subsidizes the cost of drilling and loop installation of geothermal systems in homes that meet the ESH's standards. These standards include installing energy efficient shell measures, water heaters and lighting.

Price/Cost to Customer

The incentive structure varies depending upon the customer's electric rate and can be as high as \$7,200 depending upon the measures a customer selects when building a new home.

The difference between NU's subsidiary on the installation and loop costs and the higher initial cost of the equipment is about \$4,000, Mattson explained. "Customers are willing to pay that. We pay for loops based on bids we get from local contractors and we are able to secure pricing. From the customer point of view, they don't have to worry about the unseen cost of the drilling and loop insulation."

Dates Offered: Program started in 1994-1995

How/Where Marketed

The program is being promoted through the ENERGY STAR® brand, which has helped raise awareness among residential customers. "The good thing about ENERGY STAR® brand is that it is being applied to all technologies. Labeling the brand makes it easier for residential customer to adopt the technology," Ms. Mattson added.

The program also has been promoted heavily within the contractor community. "The marketing program took off well through word-of-mouth among well drillers and HVAC installers compared to mass market advertising. We have had more installations compared to the past, but with less advertising dollars," Mattson said.

Number of Customer Sign-ups

NU had more than 100 installations in 2000, and the program was fully subscribed with 65 houses within two months of program launch in 2001. Moreover, NU has been able to reach production builders that have hundreds or thousands of homes rather than just targeting the small custom builders.

Key Vendors/Partners/Allies

Subsidizing the looping and installation costs of geothermal installations, has further encouraged the market infrastructure in NU's service territory. As Ms. Mattson explained, "developing incentives has encouraged dealers to reduce costs and so we have had some success. Contractors are developing specialized experience with some loops installations in Rhode Island, Massachusetts, and New York."

Key Reasons For Success/Failure

The lack of market infrastructure stalled the growth of NU's geothermal program. Furthermore, high interest rates and lack of competitive loop prices made it more difficult for customers to commit to a geothermal system. "For five years, we did less than 50 installations per year. That was pretty low," Mattson said.

The higher efficiency standards for NU's new construction program also made the program "a difficult sell," according to Mattson.

But the shift to the ENERGY STAR® Home Program has made the geothermal program more attractive to builders. "We are seeing more interest in geothermal...but it has taken a long time to get there," Ms. Mattson added.

With the increased interest in geothermal systems, NU has now found a “good alternative to electric resistance heat,” she said.

LESSONS LEARNED

NU’s experience with its geothermal program emphasizes two major lessons.

- **The importance of reducing customers’ uncertainty in the installation process.** NU’s efforts in the geothermal market were largely stalled by customer uncertainty. They were reluctant to invest in something they couldn’t see -- the underground loop that is integral to the operation of a geothermal system. Rather than relying on the traditional incentive structure, NU decided to subsidize the portion of the installation causing the most uncertainty: the loops.

“We learned that there was too much uncertainty in the building process for them to also worry about the geothermal loops. Now, the customer doesn’t have to worry about them,” Mattson said.

This change in strategy paid off. NU now has about “100 houses in the pipeline” and has been able to negotiate flat rates with loop installers, further reducing NU’s costs. Moreover, another loop installer has invested in specialized geothermal equipment that will continue to lower the cost of loop installations.

- **The value of affiliating with the ENERGY STAR® brand.** Although ENERGY STAR® HOMES have lower standards compared to Energy Crafted Homes, NU took the long view. They reasoned that it would be more cost-effective to appeal to production builders rather than custom builders. So, NU’s decision to switch to the ENERGY STAR® brand has led to long-term benefits. The program now reaches thousands of homes annually instead of just a few hundred and has led to an increased interest in energy efficiency among both builders and customers. “The name change just made sense for us,” Mattson noted.

New Home Construction Program

The New Hampshire Electric Cooperative is offering a residential new construction program that offers up to 50 cents per square foot of heated living space (up to \$1,250 per home) for homes that choose GHPs for their primary heating system, and up to \$500 in incentives toward the cost of an ENERGY STAR® home certification, regardless of what type of fuel is used to heat the home.

Program participation requirements include:

- Program will apply to new home construction only.
- The new home must be in the New Hampshire Electric Cooperative service territory
- The home design must meet approved specifications.

For more information, please visit www.nhec.com/renovation.html.

PSNH ENERGY STAR® Homes Program

Public Service of New Hampshire (PSNH) promotes the Energy Star Homes Program, which provides incentives for first-time builders and for the installation of energy efficient equipment. The program promotes the use of GHPs and offers additional incentives for installation.

Future Enhancements Planned/Anticipated

NU doesn’t anticipate any changes in its geothermal programs. However, with the investment by dealers and contractors in the geothermal business in NU’s service territory it will continue to benefit from a more competitive pricing structure.

Mattson also anticipates that the switch to a different refrigerant for cold climates could lead to further interest among dealers and customers in geothermal systems.

Best Way to Learn of New Developments: Website, company newsletters **Key**

Staff/Individuals

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Otter Tail Power

Otter Tail Corp.
PO Box 496
215 S Cascade St.
Fergus Falls, MN 56538-0496;
Phone: (218) 739-8200
Program Name: Geothermal Heating and Cooling
Corporate Website: www.ottertail.com
Program Website:



Number of Customers and Service Territory: 250,000 in Minnesota, North Dakota, and South Dakota

BACKGROUND

Otter Tail Corp. is headquartered in Fergus Falls, Minn., and Fargo, N.D. Its utility subsidiary, Otter Tail Power Co., provides electricity and energy services to nearly a quarter million people in Minnesota, North Dakota, and South Dakota. Otter Tail Corp. operating revenues grew 11.4 percent in 2001.

History

Reasons for program, past/recent activities/programs and or primary drivers. Geothermal systems fit naturally with Otter Tail's business philosophy and competitive position. As Bill Klyve explained, "Otter Tail has a 95 year history in the area, and our customers call the utility about everything. People call Otter Tail for advice. Geothermal fits in with a lot commercial applications."

Relevant Program Name & Description

Geothermal Heating and Cooling

Otter Tail Power Co. Minnesota customers are eligible for rebates of \$18 per 1,000 Btu of heating capacity for GHPs that:

- Meet ARI Standard 330-90.
- Have COP of 3.3 or greater

Dates Offered: Since 1977. **How/Where Marketed**

Since Otter Tail targets commercial and industrial customers, most marketing is directed at key decision-makers. One particularly effective strategy has been to link prospective customers with current owners of geothermal systems. Otter Tail provides lists of customers that have installed these systems, and arranges for tours of the facilities to demonstrate the systems' effectiveness

first-hand. This lets the owners "sell the system" and has been one of the most effective marketing tools Otter Tail uses, explained Klyve.

Other marketing activities include giving presentations to school boards and church boards. Otter Tail also offers design assistance and provides information on costs of operating geothermal systems compared to other alternatives such as fuel oil and natural gas.

These strategies seem to be effective. "We don't get every one, but we get a lot of geothermal jobs," Klyve added.



even

How Customer Enrolls/Signs Up

Interested customers contact Otter Tail Power for information on enrollment. ***Number***

of Installations

Otter Tail staff estimates that there have been about 800 residential and commercial installations. This includes more than 25 installations in schools, nearly two dozen in churches and banks, and 12 in office buildings. There also have been a variety of installations in auto dealerships, manufacturing firms, health care facilities and lodging facilities.

Price/Cost to Customer

Otter Tail offers rebates and incentives to Minnesota customers for a variety of applications including GHPs through the state's Conservation Improvement Programs (CIP). Otter Tail also offers different financing programs for its customers to defray costs associated with the equipment and ductwork.

Otter Tail also recognized that geothermal systems fit well with many interruptible and off-peak rates. So, these lower rates provide an incentive to install geothermal units. By qualifying for lower rates, customers further lower their energy costs, Klyve added.

This approach has been instrumental at lowering the installation costs of geothermal systems. Klyve said, "We have had customers get positive cash flow from day one of the installation."

Key Vendors/Partners/Allies

Otter Tail has developed a group of installation contractors and drillers that are experienced in geothermal systems. This has driven down installation costs for these systems.

Keys Reasons for Success/Failure

The staff at Otter Tail attributes its success in its geothermal program to several factors, including the higher fossil fuel costs and the need to provide balanced heating and cooling throughout year.

Otter Tail often helps its commercial customers find competitive financing if it is required to "seal the deal." "We often don't have the best deal, so we talk to leasing companies and find about leases or grants that are available to schools or other tax-exempt entities," Klyve added. For example, South Dakota has an Institutional Conservation Program that includes a grant from the state to help defray costs for energy efficiency installations in various public buildings. These grants can total up to \$50,000 for qualified installations.

Geothermal systems are also successful applications given the vagaries of the Midwest climate, which can mean commercial buildings need to provide both heating and cooling in extreme temperature ranges, Klyve explained. GHPs are ideally suited to provide the level temperatures in these conditions at an affordable price.

LESSONS LEARNED

Otter Tail exemplifies the effectiveness of pursuing a long-term GHP program. In fact, this utility has been so effective in increasing geothermal installations that it has lost count of the total number of installations.

- **Spread the word.** In essence, Otter Tail is reaping the benefits of promoting geothermal systems in a consistent manner for more than two decades. For example, in De Smet, S. D. several offices, two churches, a school, and a bank have installed GHPs. De Smet only has a population of 1,100. This is just one example of how success can grow and multiply as the word spreads about GHPs.
- **Geothermal systems can be cost competitive.** By looking generally at energy usage and energy rates, Otter Tail has found ways to make geothermal systems even more cost effective. By marrying the application with the lower off-peak rates, Otter Tail has made geothermal installations a cost-effective choice.
- **Geothermal systems require on-going utility support.** Despite Otter Tail's success, one of the biggest challenges still facing this utility and many others is the continued need to promote geothermal systems to the design community. "It is still not the number one choice that is being brought to the table by the A&E's. If a utility is going to make this a successful program, it can't rely on the design community. You have to sell it time and time again. If the utility doesn't promote it or facilitate the decision-making process, then geothermal isn't happening," Klyve explained.

Future Plans: None announced

Best Way to Learn of New Developments: Otter Tail Website, trade shows

Primary Staff Contact

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Bill Klyve
Energy Management Representative - Morris, Wahpeton, Milbank
(800) 493-3299

Palmetto Rural Electric Cooperative

1940 Highway 278

Ridgeland, S.C., 29936;

Phone: (843) 726-5551 Corporate Website: www.palelec.com

Program Name: Buried Treasure®

Program Website: <http://www.palelec.com/conserve/treasure.html>

Ownership: Rural electric cooperative

Service Territory

Palmetto Electric's service area includes Beaufort, Hampton and Jasper counties. Palmetto Electric has around 55,000 members.



BACKGROUND

History

Reasons for program, past/recent activities/programs and or primary drivers. Palmetto Electric's interest in GHPs is based on the utility's desire to promote energy efficient installations to its customers and to provide an alternative to back up strip heat. The back up strip heat used in many homes makes Palmetto Electric a winter peaking utility and that technology "drives our peak up", explained Parrish Neville, marketing representative and geothermal manager for Palmetto Electric.

Relevant Program Name and Description

Buried Treasure®

The **Buried Treasure®** program offers information and rebates for installing a ground source heat pump.

Price/Cost to Customer

Offers \$200 rebate to residential customers up to \$1,000. The average cost for drilling the wells is about \$1,000.

Dates Offered: Since 1990 How/Where Marketed

This utility program has been operating for more than a decade. Initially, it was advertised more heavily through radio, newspaper advertising and contractor outreach. In recent years, this media outreach has slowed down considerably. Now, the program is promoted through Palmetto's general marketing information.



Palmetto REC offers its members rebates up to \$1,000 depending upon the size of the system. However, smaller lot sizes and housing association covenants make it more difficult to actively promote geothermal systems to its members.

How Customer Signs Up

Interested customers sign up through the electric utility.

Number of Customer Sign-ups

The REC estimates that GHPs have been installed at least 300 homes, totaling about 600 to 700 tons. There have also been a few commercial installations including one in the REC's headquarters office and one at a local bed and breakfast.

How Service Delivered and Billed

Customers sign up through the REC and make their own arrangements for installations. **Key**

Vendors/Partners/Allies

Palmetto Electric has worked closely with well drillers and dealers throughout South Carolina. They did looping and sizing training with HVAC, extensive training with Manual J. for all contractors. In the past, they have been involved with all the HVAC dealers.

Key Reasons For Success/Failure

Palmetto Electric demonstrates that it is possible to “succeed in the geothermal market without really trying.” Although the rural electric cooperative does have a geothermal program, it is not actively promoted to its members. Palmetto Electric doesn’t have to sell GHPs to actually get installations. Rather, it is the convergence of a number of factors that have contributed to the success of this program:

- The concentration of affluence that makes first-cost issues irrelevant
- The favorable soil conditions making it ideal for geothermal conductivity
- The attractive temperature range that further appeals to customers needing both heating and cooling year round.

As Neville explains, “The primary reason for interest in geothermal in South Carolina is the aesthetics. Homeowners don’t have outside units or noise. It is basically ‘out of sight, out of mind.’”

Furthermore, geothermal systems are popular in the posh Hilton Head area. “We are putting in GHPs without the rebates. Hilton Head has high quality homes and they want the best system there is and so they go for geothermal,” Neville said. “Our customers want the best systems they can have for their high-end homes,” he added.

The location and climate surrounding Palmetto REC are also favorable to GHP installations. “The soil conducive to installation sandy soil loops closed loops on the island,” Neville said. “The ground temperature is perfect and the water temperature is between 65 to 68 degrees. This is a perfect place for this type of installation.”

However, it has been difficult to establish a more successful geothermal program because of the lack of qualified contractors and the strict zoning requirements in many housing areas. These barriers tended to limit the potential of this market.

Neville explained other concerns that hamper further development of a more successful geothermal program. “Without a lack of infrastructure, it is hard to make it grow. We don’t have good competition in the market. There are not many installers or drillers in the area doing it, so there are problems when dealers just dabble in it.”

He added that the housing rules also made it difficult to promote geothermal installations as much as the REC would like. “We have ordinances and covenants regarding yards pertains to drilling and tree removal. This makes it more difficult and more expensive to install ground loops.” Furthermore, the neighborhoods or plantations in Palmetto’s service territory have stringent regulations regarding the removal of trees even on private property. This complicates the installation process because “we can’t cut down a tree without getting approval from both the neighborhood and the town,” Neville said.

LESSONS LEARNED

Palmetto Electric demonstrates that lasting program success depends on more than favorable conditions. Rather, successful geothermal programs also require cultivating a strong infrastructure to foster competitive prices and a lasting market.

Future Enhancements Planned/Anticipated

Renew emphasis in its program in the next year or so.

Best Way to Learn of New Developments: Website provides information on the geothermal program. **Key**

Staff/Individuals

Parrish Neville
Key Account Manager

Tom Trout
Original Program Manager

Primary Staff Contact

Parrish Neville
Key Account Manager
(843) 726-5551

Plumas-Sierra Rural Electric Cooperative

73233 State Route 70

Portola, CA 96122-7064;

Phone: (530) 832-4261 or (800) 555-2207 Program Name: Geo Exchange Heat Pumps Corporate Website:

www.psln.com

Ownership: Plumas-Sierra is a member –owned electric cooperative with more than 8,000 customers.

Service territory: Operates in Plumas, Sierra, and Lassen Counties, CA and Washoe County, NV.

BACKGROUND

The Sierra Nevada Mountains are home to what is seen as one of industry's first and most dynamic GHP programs. Plumas-Sierra REC has a long and distinguished history of developing innovative energy services promoting renewable energy sources.

Plumas-Sierra developed one of the first GHP programs in California. It also installed the first all-geothermal subdivision in California, and developed the first loop-lease program.

History

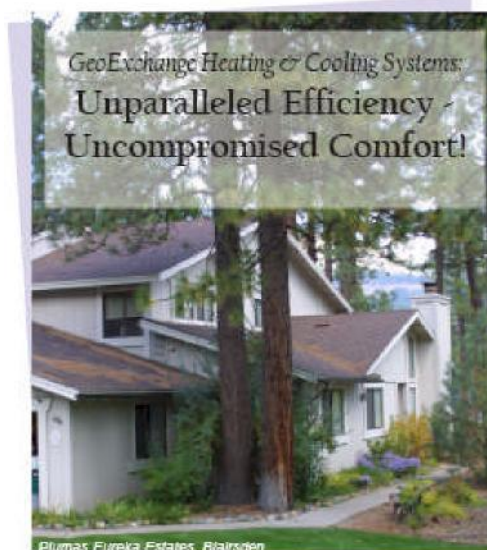
Reasons for program, past/recent activities/programs and or primary drivers. Plumas-Sierra was interested in promoting geothermal installations as a way to build load and move customers to a more environmentally friendly heating source. The current geothermal program evolved from a pilot program started in 1993. This pilot began as an experiment to test the effectiveness of offering a long-term loop lease to offset the higher installation cost of GHPs. Paying the loop cost over time significantly reduces the upfront expense of a geothermal installation and makes geothermal a more price-competitive option. The pilot ended in 1996 and a full program was launched in 1997 with some major changes.

Relevant Program Name and Description

GeoExchange Heat Pumps

Plumas-Sierra offers a 30-year non-transferable interest-free loan, and the monthly payment is added to the customer's monthly electric bill. The amount of the loan is based upon the size of the loop installed as part of the geothermal system.

The program includes price points to allow for installations from three-to-ten tons. The pricing schedule is summarized in the following table. Plumas-Sierra has installed systems up to 40 tons and sets those price points on a case-by-case basis. In 2007, Plumas-Sierra will be installing its largest residential system at 27 1/4 tons.



Price/Cost to Customer**Monthly loop lease charges billed to customer on their electric bill:**

Example of GeoExchange Monthly Loop Lease Payments		
Heat Exchanger Size	Horizontal Loop	Vertical Loop
3 ton	\$12.45	\$17.95
4 ton	\$14.95	\$22.95
5 ton	\$17.95	\$27.95
6 ton	\$20.45	\$31.95
7 ton	\$22.95	\$36.95
8 ton	\$25.95	\$41.95
9 ton	\$28.95	\$44.95
10 ton	\$31.95	\$49.95

Since many of the GHP installations are in vacation homes, customers are able to leave their heating on all winter, reducing concern about frozen pipes or having to winterize the home. Since GHPs are so cost-effective, the customer's heating bills remain relatively low even though they are operating throughout the winter.

As an additional incentive to the interest-free loan for both new construction and retrofits, Plumas-Sierra offers an 85-gallon Marathon Water Heater with every GHP system installed. Plumas-Sierra is then able to obtain the water-heating load, benefiting both the cooperative utility and its customers (members). About 98% of customers take advantage of the water heater, but if they choose not to, they receive a \$500 credit on their electric bill. Customers may also purchase one additional water heater at half price.

Plumas-Sierra also offers a \$1,000 incentive for retrofitting an existing home, but if the customer chooses to take advantage of the water heater, the value of the water heater is subtracted from the \$1,000.

Although the installation cost for a GHP is 10 percent higher than a conventional HVAC installation, (with the loop lease) the combination of the free water heater and lower monthly energy bill makes this an appealing program.

Dates Offered: Full program since 1997

How/Where Marketed

Plumas-Sierra provides a comprehensive marketing package to prospective customers, including a CD, an PDF document outlining the program and brochures developed from the Geothermal Heat Pump Consortium materials.

Plumas-Sierra sums up their marketing philosophy this way: make GHPs very easy to understand using terms that a layman understands but does not insult an engineer. This approach has made the GHP system a popular choice for new homes, giving Plumas-Sierra one of the highest ratios of installations for any utility in the U.S. The cooperative's loop lease program has also led to new and retrofit installations in modular and manufactured housing.

How Customers Sign Up: Interested customers sign up through PSREC.

Number of Customer Sign-ups

Since 1997, Plumas-Sierra has installed over 2000 tons of geothermal. Ninety projects were completed by 2001 which consisted of a town home subdivision and golf cottages. Other projects included a 10,000-square-foot vacation home, an animal rescue facility, five mobile homes, a PSREC board of director's home and several employees' homes. Plumas-Sierra averages 35-40 GHP installations per year.

Plumas-Sierra has also retrofitted several golf course clubhouses in the area. They have also arranged GHP installations in community centers, rural health care facilities, community water service districts and volunteer fire departments.

Plumas-Sierra has been successful in gaining a following in the manufactured home industry. A large percentage of builders of these homes are retrofitting and installing geothermal systems. Buyers are ordering homes with the standard propane or electric furnace they are required to take due to code and then replacing them with GeoExchange systems.

How Service Delivered and Billed

Plumas-Sierra controls costs by coordinating the scheduling of the drilling to maximize effort. This strategy allows drillers to drill all planned installations and leave. Every attempt is made to schedule drill jobs by subdivision to accommodate the driller. This reduces the cost per job substantially.

Key Vendors/Partners/Allies

Plumas-Sierra has developed strong relationships with manufacturers, suppliers, HVAC contractor/installers, drillers and builders throughout its service territory. These relationships have contributed to the program's phenomenal success.

Their contractors have at times not been able to keep up with demand. The contractors had to either refuse work or only work for one particular builder. In 2006, Plumas-Sierra arranged training for three additional geothermal contractors, increasing their qualified number of geo installers to eight.

Key Reasons For Success/Failure

Plumas-Sierra's geothermal program is successful because the utility has developed successful strategies to:

- **Reduce first-cost barrier.** The loop lease program reduces the upfront installation cost. PlumasSierra has developed a chart comparing propane costs with geothermal costs. This has been highly effective at demonstrating the savings with geothermal. Plumas-Sierra's customers can install the loops for the geothermal system and receive a free 85-gallon hot water heater for as low as \$12.45 a month (interest free, non-transferable over 30 years). While this does not cover the cost of the interior unit, it certainly makes geothermal an attractive option.
- **Foster trade ally development.** Plumas-Sierra has developed a good relationship with builders because they know the integrity of the co-op. In the beginning, some builders would not even talk to the utility, but now they exclusively recommend GHPs because they report the utility is straightforward, helps to coordinate the entire process, and has provided them with definitive rules for installations.
- **Familiarity with equipment and installations.** The cooperative has an excellent track record with geothermal installations it is familiar with the geology of the area, knowing what conditions to expect when then drill rig is on site.
- **Teamwork.** The enthusiasm for geothermal is contagious. The engineering and energy services departments work well together to promote geothermal installations with both customers and builders.

LESSONS LEARNED

- **Foster good relationships.** Plumas-Sierra's experience demonstrates the importance of fostering good relationships with the contractors. By creating an infrastructure, everyone benefits the dealers, drillers, installers, the utility and, most importantly, the customers.
- **Patience pays off.** This program also illustrates that patience pays off. The utility had to change the mindset of the current user in their territory. Education is key to the success of the program because builders and customers still don't understand how GHP technology. Fossil fuel prices in Plumas-Sierra's territory are extremely high, so customers and builders are now realizing geothermal is their best option not only for the environment, but for savings on customers' energy bills.

Future Enhancements Planned/Anticipated:

The cooperative continues to improve and expand the program. PSREC helped to streamline the permitting and approval process with Plumas County. Setback requirements to water, sewer and leach fields have been adjusted making installations easier and more cost effective. They will also continue to recruit new geothermal contractors and experienced drillers.

Best Way to Learn of New Developments: Website, news releases, Ruralite and conferences ***Key***

Staff/Individuals

Robert Marshall, General Manager
 Jessica Nelson
 Sharon Schwillling

Primary Staff Contact

Sharon Schwillling
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Tallahassee, City of

300 S. Adams St, Box B-32

Tallahassee, FL 32301

Phone: (850) 891-2375; Cell: (850) 524-9363; Fax: (850) 891-6127

Program Name: Go Green Tallahassee Energy Loan Program

Corporate Website: www.talgov.com

Program Website: www.talgov.com/you/energy/energy_programs.cfm

Ownership: Municipal utility



Number of Customers and Service Territory

Tallahassee's electric system has a total generating capacity of 667 megawatts and maintains over 2200 miles of transmission and distribution lines, including 500 miles of underground distribution lines. The municipal utility employs more than 300 people and serves more than 100,000 homes and businesses in the Tallahassee area.

BACKGROUND

History

This municipal utility has been operating for more than 100 years. It offers both gas and electric service to 100,000 customers. The utility has been promoting energy efficiency programs for about 10 years as a way to offset rising energy prices.

Relevant Program Name & Description

Go Green Tallahassee Energy Loan Program

The City of Tallahassee has a low interest loan program for qualified customers. The utility will loan up to \$7000 at five percent interest for up to a five year term and the loan is billed on the utility bill. It is a dual-fuel utility and loan for NGF/AC (14 SEER); HP (14 SEER) equipment. A closed loop, water source heat pump is (included in the heat pump measures. ?????

Dates Offered: Offered for more than 10 years.

How/Where Marketed: On the Website

How Customer Enrolls/Signs up

Customers complete a loan application, and if they have an acceptable credit history they will receive loans up to \$7,000 for five years.

Number of Installations: Less than ten annually in the past few years.

Key Vendors/Partners/Allies: Work with a local driller who specializes in close loop vertical drilling.

Keys Reasons for Success/Failure

The program is being reformulated as the City of Tallahassee considers new ways to promote energy efficiency and conservation to its citizens. Although this program was popular a few years ago, interest has waned in the geothermal market because it is primarily an application considered for new construction only. Since the City of Tallahassee is a dual-fuel utility, GHPs have to compete against other gas appliances, which also qualify for utility rebates. This has made GHPs a harder technology to sell in this market.

Julian Ganoudis, a key accounts and energy services representative at the City of Tallahassee, explains that energy efficiency programs are challenging in Tallahassee because it is both the “hottest and coldest” place in Florida.

However, this community is also very environmentally conscious, and therefore is committed to exploring more programs promoting energy conservation and efficiency as a way to offset rising prices and delay or mitigate the cost of building new power plants. “We view these efficiency programs as a way to help us fight the battle” against rising customer rates, “Ganoudis explained.

LESSONS LEARNED

- **GHP’s still can’t compete with natural gas alternatives.** GHPs cannot always compete effectively against natural gas technologies, which makes it a harder sell in areas served by dual-fuel utilities.
- **GHP’s are a complex sale.** The complexity of the GHP installation scares off potential trade allies, especially builders, therefore it remains a niche-oriented product in many regions. Without the infrastructure in place, first-costs are still too high to make GHPs an attractive option. However, the low-interest loans offered by this utility has proven to be a success low-risk strategy to overcoming this barrier.
- **GHPs can be part of a larger portfolio of program offerings.** The City of Tallahassee offers its customers the option of GHP systems as a way to promote a comprehensive energy efficiency program.

Future Plans: None announced

Best Way to Learn of New Developments: program Website

Primary Staff Contact

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Tennessee Valley Authority (TVA)

400 W. Summit Hill Drive

Knoxville, TN 37902-1499

Phone: (865) 632-2101

Program Name: EnergyRight® Heat Pump Program

Corporate Website: www.tva.gov



Number of Customers and Service Territory

The utility serves 8.3 million customers. It's service territory includes most of Tennessee, and parts of Mississippi, Kentucky, Alabama, Georgia, North Carolina and Virginia, and covers 80,000 square miles.

BACKGROUND

The Tennessee Valley Authority (TVA) is a federal corporation created during the depression to provide low-cost, reliable power in rural communities. As the nation's largest public power company, it operates fossil-fuel, nuclear and hydropower plants. Recently, TVA has also been focusing more on using energy from renewable sources and promote resource conservation.

History

TVA was created in 1933 to provide flood control, navigation and electric power in the Tennessee Valley region. It provides wholesale power to 158 municipal and cooperative power distributors, 62 large industrial users and government installations throughout the region.

Relevant Program Name and Description

EnergyRight® Heat Pump Program

TVA has developed both residential and commercial programs to promote GHP installations as part of its overall focus on renewable energy and environmental conservation.

For its residential customers, TVA created the EnergyRight Heat Pump Program, which provides both financing and lists of qualified contractors to install GHPs. As part of this program, TVA had developed a list of pre-screened installation contractors.

TVA has also developed a successful GHP program targeting the small commercial and institutional markets throughout its service territory. To date, GHPs have been installed in more than 200 schools throughout its service territory.



In addition to low-cost financing, TVA also provides commercial and industrial customers considering geothermal installations the following services:

- Site-specific feasibility studies. Prepared by an independent engineering firm, these studies compare various types of space-conditioning systems in terms of initial costs, annual energy and maintenance costs and life-cycle costs.
- Drilling test bores. This ensures that sites are suitable for geothermal-loop field piping.
- Soil thermal-conductivity testing. This assesses the capacity of the ground at a site to transfer energy to and from the geothermal-loop field piping.
- Technical assistance for design engineers.
- A credit on power bill if customers meet certain eligibility requirements
- Leasing options for a geothermal system.

Price/Cost to Customer

Price varies, depending upon the installation costs for both residential and commercial programs. However, TVA provides low-cost financing of GHPs for both residential and commercial installations.

Dates Offered

TVA has been promoting GHPs since 1996. It began promoting residential GHPs in 1998.

How/Where Marketed

TVA markets the program through its 158 municipal and cooperative power distributors. TVA supports this program through marketing, cooperative advertising and technical support.

How Customers Sign Up

Residential customers contact their local power distributor or TVA directly. Schools and commercial accounts contact TVA's Large Commercial and Industrial Department.

Key Reasons For Success/Failure

TVA has developed a successful GHP program because it has:

- ***Identified the “bestfit” for geothermal systems:*** TVA's approach to the GHP market has been focused on specific customer markets. It was an early pioneer in promoting GHPs to schools. It also identified other “geo-appropriate” markets such as aquaculture farms that would find GHPs as the most cost-effective choice.
- ***Offered strategies to reduce first cost barrier:*** TVA provides interested customers with the financing to offset the higher first-cost associated with GHP installations.
- ***Provided support to critical trade allies:*** Through its qualified contractor network for residential customers, the design, technical and drilling support for commercial customers, TVA is demonstrating its faith in GHPs. By encouraging the development of a strong infrastructure, TVA has laid the groundwork necessary to support a comprehensive GHP program.

<i>LESSONS LEARNED</i>

- **Identify GHP-appropriate customers.**
- **Provide customers with the supporting information.** This includes materials such as design assistance, drill test boring and other critical testing.
- **Financing lowers first costs.** The financing provides a way for customers to pay for the installation through low-cost financing and energy credits.

Future Enhancements Planned/Anticipated: None anticipated at this time

Best Way to Learn of New Developments: The Website

Primary Staff Contact:

Steve Morrow, TVA Marketing Manager

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Yellowstone Valley Electric Cooperative

P.O. Box 249

250 Cooperative Way

Huntley, MT 59037-0249;

Phone: (406) 348-3411

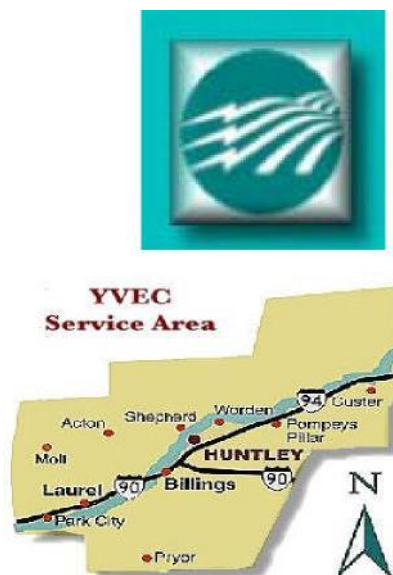
Program Name: Geothermal Heat Pump Program Corporate

Website: www.yvec.com

Ownership: Yellowstone Valley Electric Cooperative (YVEC) is a private, non-profit electric cooperative owned by its members in Montana. It is one of the oldest electric cooperatives and currently has approximately 50 employees.

Number of Customers and Service Territory

YVEC serves 13,500 customers on 2,200 miles of electric lines in Yellowstone, Stillwater, Carbon, Big Horn, Musselshell and Treasure Counties.



BACKGROUND

YVEC is one of the oldest and most successful geothermal programs in the United States. The cooperative was begun in 1937 by a group of early Montana settlers and its staff believes this pioneering spirit continues today, as demonstrated by its commitment to innovative electric programs.

History

The GHP program was initially developed as a way to promote this new technology to cooperative's members. However, with the advent of deregulation and the increased competition from natural gas providers, geothermal systems are now also viewed as a way to retain customers and compete more effectively with natural gas.

Relevant Program Name and Description

Geothermal Heat Pump Program

YVEC offers rebates of up to \$1,000 to residential customers and up to \$5,000 for commercial customers to encourage the installation and offset the higher cost of GHPs. YVEC's program promotes the superior energy efficiency, comfort, and safety that GHPs offer customers.

Dates Offered:

YVEC started offering GHP rebates in 1989.

Price/Cost to Customer

Yellowstone Valley Electric Cooperative's rebate structure minimizes the out-of-pocket installation costs to its members.

- Residential installations - \$200/ton rebates with a \$1000 maximum are available.
- Commercial buildings - \$150/ton rebates with a \$5000 maximum are available.

There is also a state tax credit of \$1,500.

"The system costs is about 1.5 to 2 times more than a conventional system." Says Geothermal Program Manager Brandon Wittman. "However, with the incentives and the tax credits, we are able to bring down

the extra cost to only \$4,000. This makes geothermal a good buy for customers since the higher installation costs is offset by lower heating and cooling costs."

How/Where Marketed

YVEC has prepared a marketing package that it sends to interested customers. This information packet includes:

- A description of the program and the incentives provided
- Lists of qualified GHP dealers and installers
- Informational materials describing how and why GHP systems work
- Diagrams of the GHP process
- A summary of the benefits that geothermal systems provide to the environment, fuel savings and customer savings.

How Customers Sign Up: Enrollment is through the REC. ***Number***

of Customer Sign-ups

To date, there have been about 400 commercial and residential GHP installations throughout YVEC's service territory. The cooperative averages about 25 installations per year, which is fairly high considering the entire service territory has only 13,000 people.

According to Wittman, Yellowstone Valley continues to promote installations among both commercial and residential customers. Recently, the cooperative installed a 40-ton system with 30 wells for its new office headquarters in Huntley, Mont.

"We have been pretty successful in the commercial and residential areas and the commercial market is making strides," he added.

How Service Delivered and Billed

YVEC works closely with the trade allies to facilitate the installation of a GHP system for its customers. The cooperative also helps customers complete the required paperwork to qualify for Montana's state tax credit of \$250 per year for up to four years. This state tax credit is designed to encourage the purchase and installation of energy efficient equipment such as GHPs and is often a contributing factor in encouraging customers to select GHPs.

Key Vendors/Partners/Allies

Through the years, YVEC has developed relationships with the drillers and dealers operating in the cooperative's service territory.

Wittman explained: "The utility acts as a facilitator in the installation process. There are three reliable dealers in this area that install geothermal and each is highly recommended. We have formed a relationship. Each dealer installs a variety of equipment from various manufacturers. We also have a good relationship with a local driller working for Bertram."

Key Reasons For Success/Failure

YVEC credits the Geothermal Heat Pump Consortium with providing the resources to help promote this program to commercial customers.

"The GHPC funded a feasibility study and a thermal conductivity test and that led to getting the first school GHP installation in Montana. That is now a showcase for the cooperative and has helped get the commercial jobs flowing," Wittman said.

LESSONS LEARNED:

YVEC has learned two important lessons on how to maintain the momentum and interest in a GHP program. These lessons include:

- **Continue to promote the program.** YVEC’s program has been running for some time, and after 10 years interest started to wane in this technology. So, rather than stopping, YVEC decided to re-energize the program through advertising and promotion. This strategy has worked, and now the utility is back on track and reaching its goal of 25 installations a year.

Moreover, YVEC has also learned the value of showcasing high visibility projects. Given the success of its commercial installation, the cooperative is also negotiating with a builder to install a GHP system in a new multi-million home subdivision.

“We are going to put in a geo-exchange system at cost in a model home in this new subdivision of \$2 and \$3 million homes. This is a high visibility project and provides us a way to compete with natural gas” Wittman said.

- **Develop a relationship with the local contractors.** Contractor relationships are the essential ingredient to program success. YVEC has wisely fostered relationships with three separate dealers, thereby offering customers a true competitive choice among geothermal systems. It also has a strong relationship with one of the largest drillers in the United States. This strategy of friendly competition benefits everyone—especially the customer.

Future Enhancements Planned/Anticipated

YVEC is continuing to promote GHP systems through its high visibility installations and on-going marketing activities.

Best Way to Learn of New Development:

YVEC promotes the GHP program on its Website, through trade shows, bill stuffers, newsletters and also word-of-mouth.

Key Staff Individual and Primary Staff Contact:

Brandon Wittman Program
Manager [Email: bwittman@yvec.com](mailto:bwittman@yvec.com)

Manufacturer Profiles



**Addison Products/Heat Controller.**

7050 Overland Rd.

Orlando, FL 32810-3404

Phone: 407/292-4400; Fax: 407/290-1329

Website: www.addison-hvac.com

Email: info@addison-hvac.com

Company Ownership

Addison is a privately-held subsidiary that was acquired by Heat Controller in 1995, then by Fedders Corporation in 2004, and finally by heating system manufacturer Roberts-Gordon in 2008. Since the acquisition, Addison has expanded into more gas fired heating products with a continuing focus on commercial and institutional applications.

History

Addison was formed in 1949. In 1990, the company sold its Michigan plants and redirected its capital investment. In 1993, Addison acquired Energy Conservation Unlimited, Inc. Its line of heat recovery products was acquired by Heat Controller, Inc., in 1995.

Company Location

The company is headquartered in Orlando, FL, and rents a 6,500 square foot manufacturing facility.

Number of Employees: 200

Annual Revenue: \$50-\$100 million

Market Position

Addison Products is among the top five manufacturers in the GHP market. It ranks itself in the top three in the commercial market and in the top five in the residential market.

Markets Served (applications and geographies)

The firm has developed a durable GHP unit specifically designed for hard-use applications such as seacoast installations.

Addison Products relies on generating sales from its OEM relationships and word-of-mouth referrals from dealers and distributors. It does not have a strong dealer network and instead prefers to handle large installations by company representatives. The company does have a distribution network in all 50 states, although its distributors are concentrated primarily in Florida and Georgia.

Addison Products has had success in commercial geothermal and water source installations – particularly in institutional settings such as schools, military and multi-family installations.

Product Line

Addison positions itself at the higher end of the market with its components and cabinetry. It manufactures a complete line of vertical water source heat pump ranging from one-to-six-ton models for its residential product line. Its line of GHPs includes sizes from one to 40 tons and water source heat models up to 100-ton models. Addison's products feature heavy-duty components that are specifically resistant to salt water corrosion.

TRS-Series --3 to 35 Tons

Available in air-cooled and water-cooled models, the TRS-Series is a rooftop heating and air conditioning system configurable to a variety of HVAC needs. The air-cooled models include an air conditioning unit (TRSA) and a heat pump unit (TRSH). Water-cooled models include a water source heat pump (TRSW) and a geothermal water/ground source heat pump (TRSG).

Using the R410A refrigerant, the TRS-Series is available in a 100% outside air version. With easy access to supply blower/motor assemblies, condenser coils and fan, the TRS-Series is easy to maintain. These units offer a host of configurable options for heating, cooling and dehumidification. Typical applications for the TRS-Series include institutional, industrial and commercial such as restaurants, shopping malls, schools and manufacturing areas. The versatility of the TRS enables the precise requirements of new building construction and retrofit projects to be met in educational and institutional facilities, mid-sized office buildings, and a countless number of commercial applications including restaurants and hotels.



WW-Series - 3 to 35 Tons

With R410A refrigerant, the W-Series is available in heating only (WWH model line), cooling only (WWC model line) or both (WWR model lines). The W-Series units provide warm or cool water. The load side can be composed of fan coil units, radiant coils, baseboard radiation or process application. The source side can be composed of a cooling tower, geothermal loop, well, lake, etc.

The W-Series is well suited for commercial and industrial process cooling and/or heating applications. Chiller applications include: commercial air conditioning, spot cooling, computer room cooling, industrial process cooling, or injection molding cooling. Heating applications include hydronic, snow and ice melting, swimming pool heating, and domestic water heating.



Competitive Strengths: Addison manufactures a durable product line and offers a full-range of heating and cooling systems. It has also developed strong OEM relationships with larger firms that are interested in promoting GHPs but do not want to make the capital investment decision.

Competitive Weaknesses: Its products tend to be higher priced compared to other GHP brands, but since the product is not marketed as a “premium heat pump” to customers, this difference may not be readily apparent to customers. Addison also has limited its dealer/distribution network to the Southeast, which may have curtailed its market opportunities for expansion.

Primary Competitors

WaterFurnace, ClimateMaster and FHP-BOSCH, but most of its competition is in the commercial segment.

Contact:

Kristen Perry, 908/604-8686, ext. 4278; kperry@fedders.com; www.addison-hvac.com

Bard Manufacturing Company, Inc.

1914 Randolph Drive; P. O. Box 607
Bryan, Ohio, USA 43506-0607
Phone: 419/636.1194; General Fax: 419/636.2640
Website: <http://www.bardhvac.com>
Email: bard@bardhvac.com

***Company Ownership***

This is a privately-held corporation that has been a family-owned business for four generations. The company was established in current form in 2006 as a privately-held corporation.

History and Company Location

Bard Manufacturing Company's headquarters are in Bryan, Ohio with additional manufacturing facilities located in Madison, Georgia and Saltillo, Mexico.

Number of Employees: 99

Annual Revenue: \$12 million

Market Position: N/A

Markets Served (applications and geographies)

Bard Manufacturing Company produces heating and cooling products for the telecommunications, modular, school, light commercial, and residential markets. However, it has mostly focused on the schools market, leveraging its position as a wall-mount supplier of air conditioners into geothermal heat pump applications.

Product Line**Geothermal Heat Pumps**

- GeoTec Series
- Vertical Up Flow
- R-410A 'Green' Refrigerant
- Step Capacity Scroll Compressor
- Suitable for Ground Water or Earth Loop applications
- Cupro-Nickel or Copper Coaxial Water Coil
- Slide-In Electric Heater Packages
- Domestic Hot Water Heat Exchanger:
 - Factory installed, but requires optional DPM26A Pump Module
- Variable speed ECM Blower Motor
- ARI 330 Certified
- ETL Listed US & Canada
- Limited Warranty Policy

GeoTec ~ GV Series
Step Capacity Water-To-Air Heat Pumps

Nominal Cooling Capacities	Range from 2.0 to 6.0 Tons
Nominal Heating Capacities	Range from 23,000 to 75,500 BTUH
Electrical Options	230/208-1-60 (All Models)
Cooling Efficiency (EER)	Range from 18.7 to 30.6 EER
Heating Efficiency (COP)	Range from 4.2 to 5.4 COP
Electric Heat Options	Ranges from 4.5 KW to 18 KW
Specified Applications	<ul style="list-style-type: none"> • Ground Water • Ground Loop • Fresh Water Applications

Competitive Strengths: Has a strong natural market inroad into the schools market, a key area for GHP installations; and offers a full range of products.

Competitive Weaknesses: Is primarily a niche player and is focused on its other applications. It is not viewed as a major player among the “Big 4” in the market.

Primary Competitors

WaterFurnace, ClimateMaster and FHP-BOSCH but only in the institutional market

ClimateMaster

7300 SW 44th St.; P.O. Box 24788
Oklahoma City, OK, 73125
Phone: 405/745-6000; Fax: 405/745-3629
Website: www.climatemaster.com



Company Ownership: LSB is a publicly-held Corporation

Company Description

ClimateMaster manufactures a full line of heating, cooling and refrigeration equipment. It also has a full product line targeting residential, commercial and institutional GHP markets.

History

ClimateMaster is a subsidiary of LSB Industries, a diversified manufacturing and chemicals company based in Oklahoma City, Okla. ClimateMaster manufactures a full line of geothermal energy products, including water source heat pumps, residential and commercial units, software and all supporting materials. With an estimated 40% market share in 2009, LSB is the industry leader in water source heat pumps (WSHP) which include GHPs. LSB has the broadest WSHP product offering in the industry.

Company Location: Oklahoma City, OK

Number of Employees: 350

Annual Revenue

LSB Industries reported sales of \$538.1 billion from its diverse operations, of which about 34% of \$180 million were from geothermal and water source heat pumps. Sales geothermal heat pumps to the single family residential sector increased 4% during 2009.

Markets Served (applications and geographies)

ClimateMaster is trying to build a national market presence. The company also has an established dealer and distributor network for residential, commercial and industrial customers. ClimateMaster also has one dealer relationship with the one of the original founders of WaterFurnace to represent its Canadian market.

The Company has completed the largest geothermal shared energy project in the world at Fort Polk, LA (5000 units). Its other key market segments include the largest air conditioning equipment manufacturer in the world, air conditioning distributors, major mechanical contracting firms, home builders, the United States Army, and the United States Air Force. According to industry insiders, "ClimateMaster has been the leader in moving the market along," and the other major manufacturers are watching this company very closely.

Product Line

ClimateMaster makes a full-range of GHPs for residential, commercial and industrial applications. The company offers a broad range of high efficiency water-source heat pumps including its new product series Tranquility 27®. This product is extremely energy efficient as well as “environmentally-friendly” by using zero ozone depletion refrigerant, making any of the Tranquility 27® series units an extremely environmentally-friendly option. The company is also introducing a new line of GHPs that will be linked to the Smart Grid, according to a company spokesman.

Commercial Units

Its newest product line features the Tranquility Series: Tranquility 27® (TT) Two-Stage Series, and the Tranquility 20® (TS) Single-Stage Series Units.

Tranquility 27™ Two-Stage (TT) Series Units



- Sizes 026 (2 ton, 7.0 kW) through 072 (6 ton, 21.1 kW)
- Environmentally-friendly EarthPure®
- HFC-410A refrigerant
- Exceeds ASHRAE (90.1)
- Copeland UltraTech two-stage compressor and variable speed ECM fan motor

Tranquility 20® Single-Stage (TS) Series Units



- Sizes 006 (1/2 ton, 1.8 kW) through 070 (6 ton, 21.1 kW)
- Environmentally-friendly EarthPure® (HFC-410A) refrigerant

- Exceeds ASHRAE 90.1)
- Copeland Scroll compressor (size 018 and above)
- Multi-speed PSC fan motor (optional variable speed ECM motor on size 018 and above)

Residential Units

Its residential systems offer similar features and benefits: Tranquility 27® Two-Stage Series, and the Tranquility 20® Single-Stage Series Units.



Using EarthPure® Ozone Safe Refrigerant, the Tranquility is a breakthrough in efficiency providing you with the greatest energy savings of any space conditioning system and unprecedented environmental protection at the same time. The Tranquility 27® with two-stage compressor and variable speed fan, and the single stage Tranquility 20® offer the latest in geothermal technology.

The Tranquility 27® is the highest efficiency water-source heat pumps on the planet offering an unprecedented 27EER to 31EER.

Advantages

- **Triple Function:** Offers heating, central air conditioning, and domestic hot water in one unit
- **Comfort:** Tranquility 27® automatically adjusts to satisfy changing weather conditions by using advanced Two-Stage compressors and a variable speed air delivery system that responds to your comfort needs.
- **Long System Life:** The elegant yet durable design of the Tranquility series ensures long life, dependable operation and low maintenance. All Tranquility air coils are specifically treated for longevity.
- **MERV 11:** Superior air filtration improves indoor air quality. Compared to traditional fiberglass air filters, the MERV 11 removes up to 9 times more dust, lasts 3 times longer and captures nearly 100% of pollen and spores.

Two-Stage Comfort

The Tranquility 27® is automatically adjusts itself to provide the optimum, consistent indoor air temperatures regardless of the weather extremes.

Advanced Two-Stage Technology allows the Tranquility 27® to operate at the most efficient level for all weather conditions. The Tranquility 27® has the industry's highest efficiency ratings.

Advanced two-stage design allows the Tranquility 27® to match performance to meet all weather conditions:

- On those cold winter days the second stage automatically engages when needed
- During the hottest months the second stage automatically engages when needed to provide additional cooling.
- In mild spring and fall months only the first stage is needed to provide optimum indoor comfort.
- Using an electronic variable-speed fan motor, the Tranquility 27® provides comfort, maximum efficiency, superior year-round dehumidification, and low utility bills.

The Tranquility 27® (two-stage) has an EER rating of 27; the Tranquility 20 (single stage) has an EER rating of 20.

Competitive Strengths: ClimateMaster is the largest *global* provider of ground and water source heat pumps. It also has the beginnings of a national dealer network and an experienced senior management team. It has one of the broadest product lines for both residential and commercial/industrial applications. The company is positioning itself as the market leader by taking the lead in both lobbying for industry tax credits and restarting the trade association, GEO. Dan Ellis, the company CEO, is a very active and committed industry spokesman who has done an excellent job of “making the case” for GHPs for more than two decades. The company is clearly positioning itself to be a major player in the Smart Grid market and has rapidly increased its overall market presence through increased advertising in mainstream magazines, such as TIME. ClimateMaster appears determined to maintain its position as industry leader.

Competitive Weaknesses: ClimateMaster’s market position hovers between one and two in the U.S. market position. It is constrained by the concentration of dealers and distributors largely in the Southeast and parts of the Northeast. It has been developing dealers through education and outreach in key markets. The company seems also content to focus on opportunities in the U.S. rather than moving into the European markets

Contact:

Paul Bony, Director of Residential Market Development,
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**Econar Geosystems**

Suite 120 – Meridian Business Center
7550 Meridian Circle

Maple Grove, MN 55369

Corporate Phone: 763/582-1400; Corporate Fax: 763/ 241-3111

Sales Phone: 800/4-ECONAR; Sales Fax: 763/441-0909

Website: www.econar.com

Company Ownership:

Econar and another small, geothermal heat pump company, Hydro Delta, were both acquired by Research Products Corporation. According to the company, the acquisition is a significant step for Research Products to provide environmentally-friendly products for a growing Earth-conscious market. The new entity will be Econar GeoSystems LLC.

“This little brand in Minnesota was bought by a regional company, Research Products Corp. who saw the long-term potential in the HVAC market. This company owns Aprilaire a filtering company as well,” explained one industry observer.

This move further reinforces the industry consolidation that is occurring among the smaller, niche players in the GHP market. Both Econar and Hydro Delta have established themselves as high-quality limited focused GHP manufacturers. Now, their product lines have merged, but the company is still focusing most of its activities on the regional markets in the Upper Midwest and Canada. The Hydro Delta product line is now marketed as an extension of Econar under the brand name Hydro Heat.

Research Products Corporation is a leader in the residential and light commercial HVAC accessories market. The company offers a range of air filtration products including Aprilaire branded humidifiers, whole-home air cleaners, ventilation and zone control systems, central dehumidifiers and thermostats. Its other non-installed product lines include EZ Kleen® Air Filters, Kleen-Gard® Grease Filters, CoolPad® Evaporative Cooler Media, Neotex® Neoprene Mesh Matting and RP® Paint Arrestors. It has a well-established national dealer network.

History

Econar has been producing geothermal heat pumps in Minnesota for over two decades. Minnesota’s cold winter climate has driven the design of Econar’s heating and cooling equipment to what is known as a “Cold Climate” geothermal heat pump. This cold climate technology focuses on maximizing the energy savings available in heating dominated regions without sacrificing comfort. The company specializes in applications in small commercial businesses such churches, banks, schools, car washes, fish farms, ice rinks, swimming pools, restaurants in addition to residential homes.

Company Location

Its manufacturing plant is in Appleton, Minnesota and headquartered in Elk River, Minnesota. Hydro Delta closed its Pennsylvania location and has relocated to Econar’s offices in Minnesota.

Number of Employees: 75**Annual Revenue**

Annual revenues overall were less than \$5 million for Research Products Corporation, which includes both its Econar and Hydro Heat GHP lines as well as its Aprilaire filtering product

lines. GHP revenues are estimated to be about \$2.5 million.

Market Position

Econar is among the most financially successful small GHP manufacturers and overall, ranks in the Top 10, despite its recently expanded product line. The company remains a small niche player.

Markets Served (applications and geographies)

The acquisition by Research Products Corporation will expand its distribution to Research Products' large dealer and distributor base around the country. Econar has a strong regional distribution operation in Southern Minnesota, Iowa, Wisconsin, and Southeastern South Dakota through an exclusive agreement with Terra-Therm, the Midwest's largest distributor of geothermal heat pump systems, radiant floor heat systems, high-efficiency gas and electric radiant floor water heaters, and all the component parts. Econar also has similar distribution agreements with firms in Michigan, Indiana and Canada.

Product Line

Econar builds heating output GHPs specifically designed for harsh Northern climates. Econar is well known for hydronic water-to-water heat pumps. In addition to its own products, it also markets products formerly manufactured by Hydro Delta under the Hydro Heat product line.

Forced Air Systems

Forced air systems are commonly used in homes and businesses today. Conventional ductwork distributes hot or cold air and provides humidity control. Econar products that can be used with this type of system include:

GeoSource™ Ultra®

Forced Air Vertical • 1.5, 2, 3, 4, 5 & 6 Ton Heat Pumps



Air Heat Exchanger

High-density technology air coil with copper tubing in aluminum fins designed for Cold Climate regions provide the highest heating output in the industry at comparable cooling capacities.

Electrical Controls

Compressor lockout is activated by electronic monitoring of low or high pressure for maximum system protection.

Filter/Drier

Assures a clean, dry refrigeration circuit.

Reversing Valve

All copper with low-pressure drop for maximum efficiency.

Water Heat Exchanger

Brazed plate stainless steel heat exchangers provide maximum heat exchange at minimum pump pressure for reduced pumping costs.

Hot Water Generator (Optional)

A double-wall desuperheater coil saves up to 65% on annual domestic water heating costs.

Refrigerant

Utilizes R410a refrigerant, a chlorine-free HFC refrigerant that does not harm the earth's ozone layer.

Blower

Standard high efficiency PSC motor or Optional Variable speed Electronically Commutated Motor (ECM) provides quiet, efficient air circulation.

Thermostatic Expansion Valve

State-of-the art thermostatic expansion valve provides precise refrigeration control under a wide range of conditions.

Charge Optimizer

Balances refrigerant charge in heating and cooling modes allowing optimum ColdClimate capacities and efficiencies.

Compressor

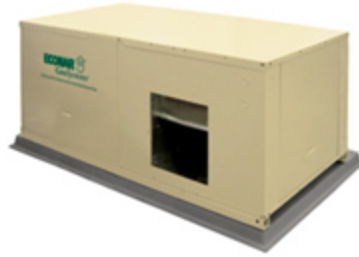
A hermetically sealed, Compliant Scroll™ by Copeland® delivers the highest efficiency and lowest sound level in the industry.

Cabinet

Vertical configuration with fully insulated baked-on powder epoxy finish over galvalume metal resists corrosion.

GeoSource™ Ultra®

Forced Air Horizontal • 1.5, 2, 3, 4, 5, 6, 8 & 10 Ton Heat Pumps



Air Heat Exchanger

High-density technology air coil with copper tubing in aluminum fins designed for Cold Climate regions provide the highest heating output in the industry at comparable cooling capacities.

Electrical Controls

Compressor lockout is activated by electronic monitoring of low or high pressure for maximum system protection.

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Charge Optimizer

Balances refrigerant charge in heating and cooling modes allowing optimum ColdClimate capacities and efficiencies.

Compressor

A hermetically sealed, Compliant Scroll™ by Copeland® delivers the highest efficiency and lowest sound level in the industry.

Cabinet

Horizontal configuration with standard right end air discharge or optional front-right air discharge configuration. Fully insulated baked-on powder epoxy finish over galvalume metal resists corrosion.

GeoSource™ Vara 2 Plus™



This is a two-step compressor driving R-410a refrigerant and use an energy efficient variable speed Electronically Commutated blower Motor (ECM). T

Two-step scroll compressor: Controls heating or cooling more closely to the building's load. During most of the season, first stage engages operating at peak efficiency, but during cold or hot spells, the second stage engages providing full capacity heating or cooling at the high efficiencies GeoSource heat pumps are known for.

Using ColdClimate technology, the Vara 2 Plus' first stage is designed to meet more of the seasons comfort needs providing maximum savings.

R-410A refrigerant: The next generation of refrigerant with no ozone depletion potential and increased energy savings.

ECM motors: The next generation in motor technology provides increased energy efficiency in two ways. First they operate far more efficiently than traditional PSC (Permanent Split Capacitor) motors. Where they really shine is when operated at lower fan speeds. PSC motors can be set to lower speeds but their energy consumption does not drop as fast as fan output. ECM motors realize significant savings as fan output is lowered. Secondly, ECM motors maintain compressor efficiency by increasing fan speed as airflow restrictions occur. By assuring compressor-required airflow, system efficiency and low operating costs are maintained. High energy efficiency, low cost operation, environmentally friendly and comfort, all from one ECONAR GeoSource Vara 2 Plus heat pump.

Its Hydro Heat Product Line includes the following heat pumps.

Mega-Tek
TWIN SINGLE TECHNOLOGY

Mega-Tek models with Two Stage Compressors provide space heating, air conditioning and optional patented "On Demand" water heating with integrated Desuperheater technology. Systems have standard variable speed blower and advanced diagnostic boards. Capacities: 3-1/2, 4-1/2 & 5 tons.

Extended Range

Extended Range models available with and without patented "On Demand" water heating provide space heating, air conditioning and patented dedicated water heating. Capacities: 1 to 6 tons. Full range of commercial voltages & phases available upon order. Desuperheater models also available.

HORIZON
Horizontal Heat Pump Series

Horizon models provide high efficiency space heating and space cooling. Horizon models are ideally suited to the commercial retrofit market. Optional Desuperheater available upon order. Capacities: 1/2 to 6 tons. Full range of commercial voltages & phases available upon request.

Magnum
HYDRONIC SERIES

Magnum water-to-water models are used for radiant floor heating and hydronic boiler/chiller applications. Optional patented "On Demand" water heating and Desuperheater also available upon order. Capacities: 3, 4 and 5 tons. Full range of commercial voltages & phases available upon request.

Primary Competitors

Enertech (GeoComfort) and Nordic (Maritime) in Canada.

Competitive Strengths: The expanded dealer network and the integration of Hydro Delta's product line may expand the opportunities for Econar substantially. This firm has a strong market position to remain a key niche player on a regional basis within the GHP market. It also has retained some competitive advantages through its patents on hot water heating functions as well as improved GHP performance. It can certainly continue to grow its market with its claim as a major player for "cold climate" applications.

Competitive Weaknesses: Even though the company was purchased nearly two years ago, it has not yet changed substantially its dealer network. This may signal that there is a disconnect between the air filtration market niche, with its focus on programmable thermostats and dehumifiers, and the larger and more substantial price of a GHP system. These are ancillary products but it is not clear how well these two product lines will work together to deliver a full-system solution to customers. The company also does not seem to be well integrated yet with either its parent company, Research Products Corporation or its sister firm, Hydro Delta. So far, it appears these companies are following parallel but not complimentary paths.



Enertech Manufacturing

2506 S. Elm Street

Greenville, IL 62246

Phone: 618/664-9010, Fax: 618/664-4597

Websites: www.geocomfort.com; www.hydronmodule.com; www.tetco-geo.com

Company Ownership

This is a privately-held company that is headquartered in Greenville, IL.

History

When a company goes on a buying spree in the GHP market, it emerges as Enertech Manufacturing, LLC. This company was created through the merger and acquisitions of GeoComfort®, Hydron Module®, and TETCO® brands. The former manufacturing plant for Hydron Module is now used to manufacture GHPS across all brands.

Enertech launched its GeoComfort brand in 2003, which is actually a WaterFurnace product. More recently, the company expanded its operations to acquire the small East Coast GHP manufacturer, TETCO, as well as the South Dakota niche company of Hydron Module®. TETCO was bought in July 2009.

Company Location

All manufacturing operations for both TETCO and Hydron Module have been consolidated at the Mitchell, South Dakota manufacturing location.

Number of Employees: 49

Annual Revenue: \$5.6 million

Market Position:

One of the top four GHP manufacturers in North America.

GeoComfort's Product Line

The GeoComfort product line provides highly efficient, reliable and quiet operating, year-round comfort solutions for homes or business.



Compass GX Series Two-Stage

Features:

Two-Stage Operation

Multi-Positional Vertical Cabinet

Upflow, Downflow, Right Hand Return, Left Hand Return

2 through 6 Tons



GT Series Two-Stage

Features:

Two-Stage Operation

Horizontal and Vertical Configurations

Optional Split and Hydronic Heating Combination Units

2 through 6 Tons



GS Series Single Stage

Features:

Single Stage Operation

Horizontal and Vertical Configurations

Optional Split Compressor and Air Handler Units

1.5 through 6 Tons



Compass GWT Series

Features:

Two-Stage Operation

Radiant Heating Ready

2 through 12 Tons

Energy Star Qualified

Hydron Module® Systems Product Line

Hydron Module® also offers a host of standard features that make them second-to-none in the industry.



Revolution HX Series Two-Stage

Features:

Two-Stage Operation

Multi-Positional Vertical Cabinets

Upflow, Downflow, Left Hand Return, Right Hand Return

2 through 6 Tons



H-Series Two-Stage

Features:

Two-Stage Operation

Horizontal and Vertical Configurations

Optional Split and Hydronic Heating Combination Units

2 through 6 Tons



H-Series Single Stage

Features:

Single Stage Operation

Horizontal and Vertical Configurations

Optional Split Compressor and Air Handler Units

1.5 through 6 Tons

TETCO® Geothermal, a division of Enertech Manufacturing, LLC, announces the introduction of the ES4 series of geothermal water-to-air and water-to-water heat pumps. The ES4 series will replace the ESIII models, and will be produced in Enertech's Mitchell, South Dakota plant.

The new ES4 series vertical units have many unique features, including field conversion for supply and return connections. The ES4 vertical units, Available in 3 to 6 tons (2 ton available late 2010) are designed with on-board diagnostics, ultra quiet operation, and highest COPs and EERs in the industry. The ES4 series (models TXT024-072) replaces the ESIII series (models TVT028 – 066).



TETCO water-to-water units also include significant upgrades. The new ES4 series Units are available in sizes 2 to 12 tons (models TWT026 – 144), and replace the ESIII series (models TWS036 – 060). All models feature two-stage capability and external fault/run lights.

How/Where Product Sold

Through more than 1000 dealers in North America, Enertech has a strong dealer network and has added new features for customers including the ability for consumers to email dealers directly from the website. They can also view a map of dealers in their area without having to navigate to a separate webpage. Additionally, those dealers that offer GEOSmart financing, a financing program specifically for geothermal systems, are clearly identified on the locator.

Primary Competitors

WaterFurnace, FHP-Bosch, GeoComfort (Enertech) and Trane

Competitive Strengths: Enertech has snapped up three very successful product lines that, while successful on their own, will be much stronger now that the brands have been consolidated to some degree. The centralization of manufacturing operations in South Dakota will keep the overall costs competitive while also maintaining a high degree of product quality.

Competitive Weaknesses: Right now, there are three brands sold under one company. These brands, all of which are recognized in various regional markets, have not yet created a national identity for Enertech. Moving forward, the company may continue to reposition all of its products under the “GeoComfort” brand. But that is a challenging task that will require a fairly sophisticated level of marketing directly to key distributors. Therefore, this brand trio may continue to confuse customers and perhaps even cannibalize sales among brands within the company.

Contact: Jeff Hammond, V.P. Marketing & Product Development,
Phone: 618/664 9010; email: jhammond@enertechmfg.com

FHP-Bosch Group

601 NW 65th Court

Ft. Lauderdale, FL 33309

Phone: 954/776-5471; Fax: 800/776-5529

Website: www.fhp-mfg.comEmail: heatpump@fhp-mfg.com**Company Description**

FHP was acquired by Bosch in 2007, as part of the company's larger strategy to establish itself in the heat pump market on a global scale. In addition to purchasing FHP, a leading provider of geothermal heat pumps, the company previously acquired the largest manufacturer of electric heat pumps in Sweden in order to become a major player in the European markets. Both these moves are viewed as part of Bosch's overall strategy to position itself more strongly in the European markets rather than increasing its overall market position in the U.S.

The GHP business is operated as part of Bosch's Thermotechnology Division, headquartered in New Hampshire. This division has been active in promoting renewable energy technologies since 2005 and includes a broad range of equipment such as water heating, solar photovoltaics, and integrated energy solutions for the commercial and industrial sectors.

FHP, the geothermal heat pump manufacturing division, has been a leader in the industry in building both water source and GHP heat pumps. The company offers a full product line for both the residential and commercial markets. FHP has a strong reputation in building quality equipment, and its manufacturing operations are based in its Fort Lauderdale location.

The assimilation of FHP into the Bosch product line has been slow and steady. As one industry insider observed:

"Bosch has taken its time with FHP. They have been very patient in how to approach the U.S. market and are gradually rebranding it FHP-Bosch. The major push is they are integrating the business with a broader thermo technical concept... they have completely redesigned the company's brand and have integrated it with Bosch pushing the market. It has just been very slow but you see the change in where they are marketing the products."

Other GHP manufacturers have been also watching Bosch's integration with FHP to determine if the firm is gearing up for a big push in the U.S. or abroad. So far, there are two theories according to industry insiders as summarized in the following observations:

"The industry forecast is that the Germans bought FHP so that they could have a deep U.S. manufacturing capability to take GHPs back to Europe and focus on that market. They could be a big presence in the European market compared to other players like ClimateMaster."

"Bosch has deep pockets and market muscle."

These observations suggest that the GHP community recognizes that FHP-Bosch will be a major player in the industry going forward. However, the company's reluctance to support the newly revitalized and rebranded GEO has been somewhat of a surprise. While the company is active in a number of trade associations, such as IGSHPA and AHRI, FHP has not taken as active a role in supporting GEO compared to ClimateMaster, WaterFurnace and GeoComfort (EnterTech). This was viewed as "surprising" given that the company is positioning itself as a player in the U.S. market.

History

The company was founded in 1969 and specializes in water source and GHPs. In January 2007 it was purchased by BOSCH. Bosch LLC's consumer goods and building technology division also got a boost in 2008. The company cut the ribbon on an expanded production plant for geothermal heat pumps, used in residential climate control. The general view is that the company is becoming "very German" in its outlook.

Number of Employees: 195

Market Position

FHP-Bosch is in the Top Three overall in the water source and geothermal industry.

Relevant Product Name and Description

Residential Products

Water Source and Geothermal Heat Pumps

Residential Product Finder

Series	Water to Air	Water to Water	Ultra Efficiency	Superior Efficiency	Extreme Efficiency	High Efficiency	Size (in tons)
AP	√				√	x	2
AP Split	√				√		2
EC	√					√	½ - 6
ES	√		√				1 ½ - 6
ES 2 Stage	√		√				2 - 6
EV	√		√				1 ½- 6
WT		√			√		2 - 6
WW 1 Stage		√	√				2-6

Table 4: Summary of Key Product Specifications for FHP-Bosch's GHPs for Residential Applications

Series	AP	ES	ES 2 Stage	EV	EC	WW	WT
Water to Air	√	√	√	√	√	x	x
Water to Water	x	x	x	x	x	√	√
Size Range	AP025-AP071	ES018-ES070	ES025-ES071	EV018-EV070	EC007-EC070	WW024- WW072	WT025- WT071
Sizes Available (Tons)	2,3,4,5,6	1.5,2,2.5, 3,3.5,4,5,6	2,3,4,5,6	1.5,2,2.5, 3,3.5,4,5,6,	0.5, 0.75, 1, 1.25, 1.5, 2, 2.5, 3, 3.3, 3.5, 4, 4.25, 5, 6	2,3,4,5,6	2,3,4,5,6
Efficiency (GLHP)	EER:18.0- 28.5 COP:4.1-4.8	EER: 15.6-19.6 COP::3.3-3.5	EER: 15.5- 24.5 COP: 3.6-4.0	EER: 15.0-18.5 COP: 3.3-3.4	EER: 14.1 - 15.8 COP: 3.1 - 3.6	AHRI has no rating for WW units according to (AR/ISO 13256-1)	
Efficiency (WLHP)	EER: 16.0- 20.0 COP: 5.1-6.5	EER: 13.6-16.0 COP: 4.3-5.6	EER; 13.5- 17.5 COP: 4.4-5.4	EER: 13.0-15.5 COP: 4.2-5.4	EER: 12.5 - 14.0 COP: 4.2 - 5.1		
Stages	2 Stage	1 Stage	2 Stage	1 Stage	1 Stage	1 Stage	2 Stage
Configuration	V, H, C, S					Water to Water	
Refrigerant R-410A	√						
Compressor	Ultra Tech Scroll	Scroll	Ultra Tech Scroll	Scroll	Rotary EC007 - EC015 Recip EC018 - EC042 Scroll EC048 - EC070	Scroll	Ultra Tech Scroll
ECM Motor	√	√	√	x	x	N/A	x
Electric Heater	Optional				x	N/A	x
Hot Gas REheat	x	Optional				N/A	x
Hot Gas Bypass	x	Optional				x	x
Coated Evaporator Coil	√					N/A	x
Desuperheater	Optional						
Floating Base	√						
Stainless Steel Drain Pan	√					N/A	x
Filter Rack; Filter	4 sided rack; 2 inch (MERV11)	4 sided rack; 1 inch/ optional 2 inch			2 sided rack, 1 inch/ optional 2 Inch 4 sided	N/A	
Insulation	½” thick foil faced glass fiber	½” thick, multi density, coated, glass fiber				½” thick foil faced glass fiber	
Energy Star Rated	all rated					N/A	
Warranty Residential	5 year parts, 10 year refrigerant circuit, 10 year compressor						

Commercial Product Finder

Series	Water to Air	Water to Water	Ultra Efficiency	Superior Efficiency	Extreme Efficiency	High Efficiency	Size (in tons)
RT	Energy Recovery Rooftop Heat Pump						
AP	√				√		2 - 6
EP	√				√		.5 - 6
CA	√		√			√	3/4 - 1 1/2
EC	√					√	1/2 - 6
EC Large	√					√	6 - 30
ES	√		√				1 1/2- 6
ES 2 Stage	√		√				2 - 6
EV	√		√				1 1/2- 6
MC	√		√				30 - 60
TRS	√			√			3 - 35
WW 1 Stage		√		√			2 - 6
WW 1 Stage		√		√			10 – 17 1/2
WW 2 Stage		√		√			10, 20 - 35

Table 5: Summary of Key Product Specifications for FHP-Bosch's GHPs for Commercial

Series	Water to Air	Water to Water	Size Range	Sizes Available (Tons)	Efficiency (GLHP)	Efficiency (WLHP)
AP	√		AP025-AP071	2,3,4,5,6	EER:18.0-28.5 COP:4.1-4.8	EER: 16.0-20.0 COP: 5.1-6.5
ES	√	x	ES018-ES070	1.5,2,2.5,3,3.5,4,5,6	EER: 15.6-19.6 COP::3.3-3.5	EER: 13.6-16.0 COP: 4.3-5.6
ES 2 Stage	√		ES025-ES071	1.5,2,2.5,3,3.5,4,5,6	EER: 15.5-24.5 COP: 3.6-4.0	EER: 13.5-17.5 COP: 4.4-5.4
EV	√		EV018-EV070	1.5,2,2.5,3,3.5,4,5,6	EER: 15.0-18.5 COP: 3.3-3.4	EER: 13.0-15.5 COP: 4.2-5.4
EC	√		EC007-EC070	0.5, 0.75, 1, 1.25, 1.5, 2, 2.5, 3, 3.3, 3.5, 4, 4.25, 5, 6	EER: 14.1 – 15.8 COP: 3.1-3.6	EER: 12.5 – 14.0 COP: 4.2 - 5.1
EC Large	√		EC072-EC360	6,8,10,12.5,15,17.5, 20,25, 30	EER: 14.0 – 17.9 COP: 3.2-4.2	EER: 13.0-16.0 COP: 4.2-5.6
CA	√		CA009-CA018	0.75,1,1.25,1.5	EER”14.0-16.0 COP:3.1-3.3	EER”12.0-13.3 COP:4.2-4.6
WW		√	WW024-WW072	2,3,4,5,6	AHRI has no rating for WW units according to (AR/ISO 13256-1)	
WW		√	WW1120-WW210	10,15,17.5		
WW 2 Stage		√	WW122	10	AHRI has no rating for WW units according to (AR/ISO 13256-1)	
WW 2 Stage		√	WW 240-WW420	20.30.35		
MC		√	MC360	30	Units are only rated up to 130 Thsd. BTUH	
MC		√	MV480-MC720	40,50,60		
TRS		√	TRS036-TRS084	3,4,5,6,7	EER: 14.1-18.5 COP:4.85-5.61	EER:126-16.4 COP:4.2-5.61
TRS		√	TRS096-TRS360	8,10,12.5,1517.5,20, 25,30		
TRS		√	TRS420	36		

Strategic Alliances

FHP works closely with leading Energy Service Companies around the country. For example, FHP has worked closely with AMERESCO and Co. Energy to provide over 3000 installations in military facilities.

Primary Competitors

ClimateMaster, Trane and WaterFurnace

Competitive Strengths: The acquisition by Bosch has strengthened its overall market presence in both the residential and commercial markets - and it is likely to remain a major player in the GHP markets. It has also begun to successfully integrate FHP's core competencies—that is excellent product design and strong knowledge of the U.S. market, to its larger focus on energy efficiency and renewable energy offerings through its Thermotechnology Division. Its strong combination of in-depth understanding of the GHP product, the market drivers, and the ability to offer more comprehensive solutions to residential and commercial customers will make FHP-Bosch a formidable competitor to the other “big three” GHP manufacturers in the next few years.

Competitive Weaknesses: Although, FHP-Bosch is one of the largest water source and geothermal manufacturers, it does not have the name recognition of its well-known competitors yet. It also has to determine if it wants to create increased awareness in the US markets or just use its manufacturing capabilities from FHP to dominate the European heat pump market.

FHP has worked on major geothermal installations around the world. It has also worked closely with most of the large investor-owned utilities and rural electric cooperatives.

Total Number Deployed (products and utilities)

FHP has sold thousands of systems around the world, particularly in schools, military bases, residential and institutional applications.

How/Where Product Sold

FHP uses independent wholesalers and commercial representatives throughout the United States and also exports equipment for overseas sales. Through Bosch, it has more than 300 representatives worldwide.

Best Way to Learn of New Developments: Website

Key Individual: Cliff Young, President

**Mammoth WEBCO, Inc.**

13200 Pioneer Trail, Suite 150

Eden Prairie, MN 55347-4125

Phone: 952/358-6600; Fax: 952/358-6700

Website: www.mammoth-inc.comEmail: info@mammothwebco.com***Company Ownership:***

Mammoth-WEBCO, Inc., a subsidiary of CES Group, Inc., manufactures innovative custom air conditioning solutions for controlling the environment inside buildings, and in manufacturing processes. Solutions include: integrated Prefabricated Equipment Centers (iPECT™), ULTRALINE™ Roof-Mounted DX Systems, Packaged Water Chillers, Industrial Air Handlers, V-Cube™ Floor-by-Floor Packaged Self-Contained A/C, Replacement Multizone Rooftop A/C, Water-Source/Ground-Source Heat Pumps, and EPiC DDC Controls. The company was renamed Mammoth-WEBCO, Inc. in January 2009.

CES Group, Inc. is a wholly-owned subsidiary of Nortek, Inc., a multi-billion dollar diversified manufacturer of branded residential and commercial ventilation; home technology convenience and security; and heating, ventilating, and air conditioning (HVAC) products. HVAC applications are sold under such leading brands as CLEANPAK™, Governair®, HUNTAIR®, Mammoth®, Temtrol®, Venmar CES™, Ventrol®, WEBCO™, and Eaton-Williams®. Mammoth has been manufacturing custom HVAC equipment since 1935. Mammoth is a CES Group™ company. This affiliation extends Mammoth's marketing research and provides a wealth of additional engineering and application expertise. Its goal is to offer high quality custom HVAC equipment and systems through trained representatives, to meet the needs of each customer.

Company Location

Mammoth is headquartered in Eden Prairie, Minnesota. CES Group and its subsidiaries serve customers through 12 manufacturing locations.

Number of Employees: 375***Annual Revenue***

Its parent company reported annual revenues of \$2.2 billion; estimated revenues for its custom HVAC products are \$50 to \$100 million. However, its parent company is emerging from bankruptcy protection so detailed financial records are not available at the time.

Market Position

It is a major player in the commercial custom HVAC business but not at all involved in the traditional GHP markets.

Markets Served (applications and geographies)

CES Group provides custom HVAC solutions for the following markets: office, education and healthcare which includes specialized needs for critical industrial environments such as: biotechnology and pharmaceutical manufacturing, data centers and aerospace, and cleanrooms

used in semiconductor manufacturing. Clients include engineers and contractors serving the education, office, high-tech, industrial, and medical industries

CES Group provides custom and integrated solutions incorporating Mammoth® heat pump technologies. All of Mammoth's products are sold through experienced local representative firms.



Model	Type	Tonnage Range	Typical Application	Special Features
C Vintage	100% Outside Air	6 to 32 Tons	Commercial Geothermal	
D Vintage	V-Cube™ Lite	14 to 45 Tons	Commercial Geothermal	Waterside Economizers, VFD, DDC Controls Belt-Driven Fan
J Vintage	Water-to-Water	5 to 30 Tons	Commercial Geothermal	410A Refrigerant Brazeplate Heat Exchangers
L Vintage	High-Efficiency Twin Circuit Horizontal & Vertical	6 to 23 Tons	Commercial Geothermal	Waterside Economizers, VFD, DDC Controls Belt-Driven Fan
N Vintage	High-Efficiency Horizontal & Vertical	Y2 to 6 Tons	Multi-Family Commercial Geothermal	HP-4 Microprocessor
P Vintage	Medium-Efficiency Horizontal	Y2 to 5 Tons	Multi-Family Commercial	HP-4 Microprocessor
R Vintage	MCHH Units	3/4 to 6 Tons	Condos	Hydronic Heat Mechanical Cooling Units

Primary Competitors

Trane, Johnson Controls, Lennox and McQuay

Competitive Strengths: The company can provide integrated full service HVAC solutions, of which GHP systems are just one component. It has long-established ties with key equipment specifiers in several commercial and industrial segments.

Competitive Weaknesses: This company's parent is emerging from bankruptcy. The marketing and the overall positioning of the company appears chaotic. The GHP market is not a major area of focus, but rather just one arrow in their quiver.

Contact: Dennis Nelsen, Product Mgr, Mammoth, Inc., Eden Prairie, MN

Phone: 952/358-6656; Email: dnelsen@mammoth-inc.com

McQuay International

13600 Industrial Park Blvd.

Minneapolis, MN, 55441

Phone: 800/432-134; Direct 763/553-5330; Fax 763/553-5177

**Company Ownership**

Publicly-traded company, subsidiary of OYL Industries and Daikin Industries, a Fortune 1000 company.

Company Description

AAF-McQUAY is a part of Daikin Industries. The company makes and markets commercial air-conditioning and air-filtration products and systems for commercial, institutional, and industrial clients worldwide. Its AAF International division makes air-filtration products under the AAF and AmericanAirFilter brands. Products include replacement filters and environmental products (air pollution-control products and systems, machinery filtration products, and acoustical systems). The McQuay International arm produces commercial air-conditioning and refrigeration equipment (chiller products, air handling systems, applied terminal systems, and industrial refrigeration). The company operates plants worldwide.

As part of the ongoing consolidation in the GHP market, McQuay was purchased by Daikin Industries, a large multinational company headquartered in Japan. However the company is not viewed as a major player in the GHP market. Rather, this technology is not considered an area of focus for this global giant. But, if the company decided to enter the GHP market, it would have major market muscle and the ability to become a real contender.

Company Locations: 12 locations worldwide.

In 2008 McQuay International, along with its parent, announced plans to build a new \$50 million global research and development center in Minnesota. The new facility will support product development and testing for company systems worldwide.

Number of Employees: 5,000

Annual Revenue

Annual sales for the total company were \$950 million; GHPs accounts for a very small percentage of the company's overall revenue.

Description

McQuay is the second largest air conditioning, heating, ventilating and refrigeration company in the world. It relies on developing customized HVAC systems that can save you money while providing optimal overall system performance and occupant comfort.

McQuay offers a complete line of water source heat pump systems for boiler/tower (water loop) and geothermal (ground loop or ground source) applications.

Its high-efficiency, self-contained McQuay WSHP units may be placed in any location within the building and connected via a water loop. Heat is added and rejected from the loop using a boiler and a cooling tower, or using geoexchange from natural sources such as the ground, a pond or a well. Each unit responds only to the heating or cooling load of the individual zone it serves. This provides a comfortable environment for occupants, better control of energy use for building owners and lower seasonal operating costs.

Water Source Heat Pumps

McQuay offers a complete line of water source heat pump systems for boiler/tower (water loop) and geothermal (ground loop or ground source) applications.



- Enfinity™ Console In-room Unit
- Enfinity™ Vertical Floor Mounted Unit
 - Console in-room ½ to 1½ tons
 - Horizontal ceiling-mounted ½ to 10 tons
 - Vertical floor-mounted ½ to 25 tons
 - Rooftop Outdoor Curb-mounted 3 to 35 tons
 - Water-To-Water Floor-mounted 3 to 35 tons
 - Geothermal Resource Center
 - Vertical Stack ¾ to 3 tons

Market Position

This is one of the largest manufacturers in the world, but GHPs remain a niche product. It is in the top 10 among GHP manufacturers.

Markets Served (applications and geographies)

Sells GHP systems worldwide.

Primary Competitors

Mammoth-WEBCO, Trane and Carrier

How/Where Product Sold: Through its dealers and distributors worldwide.

Competitive Strengths: This is a global company with an international base of operations. It has a solid reputation for engineering excellence and a diverse product line. It also has a special focus on national accounts with a dedicated service team and specialized marketing outreach.

Competitive Weaknesses: GHP's remain a niche product, and therefore the company has not spent a lot of time or effort promoting GHP's domestically. Furthermore, it does not seem all that interested in promoting its GHP product line, but rather views it as a complimentary product to its larger focus on the custom HVAC market.

Contact

Americas Headquarters
13600 Industrial Park Blvd.
Minneapolis, Minnesota 55441
800/432-1342 (Toll Free)
763/553-5330 (Direct); 763/553-5177 (Fax)

Maritime Geothermal Ltd.

170 Plantation Rd, PO BOX 2555

Petitcodiac, NB E4Z 6H4

Phone: NB 506/756-8135; ON 613/482-1369; Fax: 506/ 756-2988

Website: www.nordicghp.com**Company Description**

Maritime Geothermal Ltd. is a privately-owned business which began manufacturing water source heat pumps in Petitcodiac, New Brunswick, Canada under the trade name Nordic in 1983.

History

The firm is a partnership. Its first product, a three horse power (hp) open loop passive cooling Nordic ground water heat pump was built in 1983. By 1990, the firm had developed a full line of active cooling or reversing heat pumps and also developed a heating only and reversing water-to-water models ranging from two to five tons.

The company has also expanded its product line to include a direct expansion geothermal system to appeal to the residential market through decreased installation costs. In 1998, the firm extended its geothermal unit capabilities to include a “triple function” that offers domestic hot water assist, air heating and cooling and full capacity hot water for hydronic applications including in-floor radiant distribution systems.

The firm also expanded its product line to include indoor pool conditioners in 1995, a complimentary product to its GHPs. The firm began expanding operations to produce units for commercial jobs, including the larger capacity “W” series units for fish hatcheries and tree nurseries. Our W commercial units have been used in other applications as well such as nursing homes, prisons, churches, ice rinks, government facilities etc. These installations range from 10 to 35 tons. The range of its commercial products is now 12 - 65 tons.

Year Started: 1984**Annual Sales:** \$5 million**Number of Employees:** 15**Market Position**

Although, it is not as large as some of the competitors, it has developed an extensive line of GHP products for both commercial and residential markets — while remaining profitable.

Total Number deployed (products and utilities):

Maritime Nordic sells to all Canadian provinces as well as sales into the U.S. and parts of Northern Europe. About 50 percent of all sales are from commercial applications, while residential sales comprise the remainder of its overall sales. Most residential applications are in the 2 to 2.5-ton range.

Price Structure: Price varies by product series, options and unit size.**Future Enhancements Planned/Anticipated: Company Expansion**

Maritime Nordic has outgrown its current location and is planning to move into a new 10,000-square-

foot facility on a 10 acre lot. The move will double the current staff from four to seven. In the past, space restrictions have limited the company's production capacity to no more than 350 units annually. The move to a larger location will allow them to expand both staff and production capabilities.

How/Where Product Sold

The firm relies primarily on a dealer and distributor network to promote and install units. Most installations have concentrated in Canada, the northern United States, Ireland, Belgium and Hungary. These locations are most suited to its particular product line that provides a good match between water source heat pumps and in-floor radiant heating. In particular, in-floor radiant heating is especially popular in Ireland and Northern Minnesota.

How/Where Marketed

Marketing strategy relies heavily on word-of-mouth and inquiries generated from the Internet. President Glenn Kaye said this firm doesn't have the resources to promote geothermal and compete with the marketing promotion used by larger companies such as WaterFurnace. He says WaterFurnace's promotion of the technology over the years has actually increased interest in geothermal and been beneficial for many smaller companies such as Maritime Nordic.

Key Partnerships/Relationships

Maritime Nordic is working closely with an engineering firm in Canada — Secondaire. This firm has developed a bore hole testing machine that helps ensure proper sizing for geothermal installations. Kaye explained that the machine is brought on site and can estimate the numbers of BTUs/square linear foot that can be achieved at a particular location. These tests have provided more accurate results than the standard geothermal sizing software, and have reduced the problems associated with the vagaries of soil conditions that often adversely affect geothermal installations.

Relevant Product Name and Description

RS series: Liquid-to-air for use on open water wells or closed loops, active cooling and domestic hot water assist. Split Compressor unit for use with remote air handler.

RH series: Liquid-to-air for use on open water wells or closed loops, active cooling and domestic hot water assist. Horizontal design. Left or right hand return. Field configurable end or side supply.

TFH series: Liquid-to-air and liquid-to-water multi function unit. For use on open water wells or closed ground loops. Active cooling, full capacity hot water output and domestic hot water assist. Horizontal design.

EMW series: Energy module Liquid-to-water, for use on open water wells and closed ground loop. Hot water output up to 120 degrees for hydronic applications. Integrated with 30 gal hot water tank and in-floor circulation pump for ease of installation.

EMWT series: Liquid-to-water dual tank energy module. For use on open water wells or closed ground loops. Hot water output up to 120 degrees hydronic applications. Integrated dedicated hot & cold tanks (30 gals/ea) with instant switching from heating to cooling for commercial applications. Domestic hot water assist

EMW HSC series: Liquid-to-water dual tank energy module. Heating and simultaneous cooling for commercial applications. For use on open water wells or closed ground loops. Hot water output up to 120 degrees for hydronic applications. Integrated dedicated internal hot & cold

tanks (30 gal). Domestic hot water assist.

DXS series: Direct expansion-to-air split compressor unit for use with remote air handler. Direct expansion uses refrigerant filled copper pipe buried directly in the earth to move energy to and from the home. Domestic hot water assist.

DXW series: Direct expansion-to-water. Hot water output up to 120 degrees for in-floor heating or any other hot water requirement. Direct expansion uses refrigerant filled copper pipe buried directly in the earth to move energy to and from the home. Domestic hot water assist.

DXTF series: Direct expansion-to--water and DX-to-air. Multi function DX unit. Air heating and cooling and hydronic heating full capacity hot water and domestic hot water assist. Direct expansion uses refrigerant filled copper pipe buried directly in the earth to move energy to and from the home.

DXTFS series: Direct expansion-to-water and DX-to-air split compressor system for use with remote air handler. Multi function DX. Air heating and cooling and hydronic heating full capacity hot water. Direct expansion uses refrigerant filled copper pipe buried directly in the earth to move energy to and from the home. Domestic hot water assist.

EMDX-series: Direct expansion-to-water Energy Module. Integrated 30 gal storage tank and circulation pump for hydronic applications. Hot water output up to 120 degrees. Direct expansion uses refrigerant filled copper pipe buried directly in the earth to move energy to and from the home.

W commercial series: Liquid-to-water for use on open water wells or closed loops. Sizes range from 12-65 tons.

Nordic Ice series: Liquid-to-water for use on open water wells or closed loops. Contain R404a refrigerant for low temperature operation suitable for Ice rink applications. Sizes range from 12-65 tons.

Primary Competitors

ClimateMaster, Trane, WaterFurnace, Bard and Enertech

Competitive Strengths: Maritime Nordic has been able to carve out a niche within this already highly specialized market place, an GHP system that is integrated plumbing fixtures such as the storage tank and circulator pump. Its geothermal units can provide either ground-source or water-source heating, and also offers the ability to provide “triple function” capabilities with its heat pumps offer air heating & cooling and water heating to its customers.

This capability has provided Maritime Nordic with an edge in the geothermal marketplace to exploit the in-floor radiant heat market. To diversity its operations, the firm also offers a line of pool conditioners which uses similar technology to GHPs.

Maritime Geothermal is also the only GHP manufacturer in Canada that has its own CSA certified testing facility. The firm also just recently received AHRI certification on its products. These improvements have contributed to a solid growth, according to the company, of 22 percent annually.

Competitive Weaknesses: This will remain a small and niche-oriented company. Although it has broadened its product line and increased sales, it still does not have the marketing capabilities to compete effectively against the dominant players in this market. Instead, it will continue to focus on the high-end part of the Canadian market.

**Trane**

7610 Industrial Highway
Macon, GA 31216
Website: www.trane.com

Company Ownership: Privately-held subsidiary of Ingersoll Rand

Company Description

The Trane Co. is one of the largest HVAC manufacturers in the world. It plays a rather limited, but high profile role, in the GHP market. It is a subsidiary of Ingersoll Rand and supplies heating, ventilation, and air conditioning systems to both the residential and commercial markets around the world.

The combination of Ingersoll Rand and Trane in 2008 created a giant in the climate control industry, with Trane products adding to Ingersoll Rand's existing brands that include Thermo-King. In light of the economic downturn Ingersoll Rand has been restructuring its manufacturing operations in order to cut costs. As a result hundreds of jobs have been cut at Trane plants. Shortly before it was acquired by Ingersoll Rand, Trane disposed of its vehicle braking and plumbing operations to concentrate on its air conditioning and heating and ventilation business. According to industry insiders, Trane is not interested in becoming a major player in the GHP industry.

"Trane- sitting back. It views GHPs as a "one-for-one" competitor with its traditional line of business and that it is parasitic of sales. They are not committed to the market but rather they are following the market, but GHPs it is not a focus for them. Trane is not a true believer in the technology... they are getting out of the residential side of the market entirely."

History

It began as a family business in 1864 founded by James Trane. Trane's first air conditioning unit, the Trane Unit Cooler, was developed in 1931. In the mid-1950s, Trane began manufacturing unitary, or self-contained, air conditioning units for commercial use.

In 1982, Trane acquired the central air conditioning department of General Electric. This acquisition propelled Trane into a strong position in the market for small central air conditioning equipment, used primarily in residential buildings. The purchase included manufacturing facilities located in Tyler, TX, Trenton, NJ, and Fort Smith, AR, and GE's extensive national distribution system.

The Trane Co. was acquired by American Standard, Inc. in 1984, and is a major component within American Standard. Following a leveraged buyout in 1988, American Standard returned as a publicly-held corporation. In February, 1995, American Standard divested its vehicle components and plumbing businesses to concentrate on its HVAC operations in 2007. It renamed itself Trane, after that division. Trane was acquired by Ingersoll Rand in 2008 for \$10 billion in 2009.

Company Locations: La Crosse, WI. and Tyler, TX.

Manufacturing Locations

The company sells its products through sales offices and dealers around the world. Trane does business through 400 locations in more than 100 countries. It has nearly 30 manufacturing plants

in places such as the U.S., Brazil, China, Europe, Mexico and Asia.

Number of Employees: 29,000

Annual Revenue

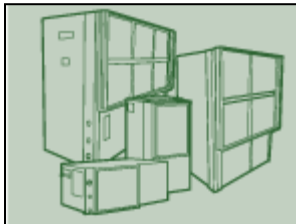
Ingersoll Rand reported annual revenues of \$13 billion, of which \$2 billion was attributed to Trane through its acquisition. However, Its GHP sales account for an estimated less than 1 percent of total sales. While Trane has a formidable presence in the HVAC industry, it is not viewed as a serious contender in this market.

Market Position

Trane is a market leader in the residential, commercial, and industrial heating and air conditioning markets. It also a market leader within the geothermal industry and has one of the largest and most diverse product lines of geothermal systems.

Relevant Product Name and Description

Trane offers a broad variety of commercial applications. Schools, office buildings, health care and rehabilitation facilities, condominiums and retirement facilities are just a few of the types of buildings utilizing the energy conscious water-source design of the 6 through 25 ton horizontal and vertical water source heat pump.



- Horizontal/Vertical WSHP ½ to 5 tons
- Horizontal/Vertical WSHP 6 to 25 tons
- High Efficiency H/V WSHP 1½ to 6 ton
- Console WSHP
- Vertical Stack WSHP

Trane has developed a key accounts program to help develop comprehensive solutions for its large retail accounts such as retail chains, restaurant chains, convenience stores and department stores.

The Trane Co. has sponsored special reports based on roundtable discussions examining various aspects of HVAC operations and management. This report, "Best Practices in HVAC Management", takes a more in-depth look at the best practices in HVAC as implemented by some of the nation's leading chains.

It also features case studies on installations targeting key markets including schools, data centers, hospitals, and cleanrooms.

Association Memberships

Trane also works closely with a number of trade associations including the Air-conditioning and Refrigeration Institute, the American Society of Heating, Refrigeration, and Air Conditioning Engineers, the Geothermal Heat Pump Consortium, and the International Ground Source Heat Pump Association.

Competitive Strengths: Trane has a strong dealer network, a solid industry reputation and a diverse product line. It could be a market leader, if it did not view GHPs as a “parasitic” product line.

Competitive Weaknesses: Trane has not emphasized GHPs as much as it could, given its size and influence in the heating and cooling industry. Rather, Trane seems content to market geothermal as a niche product, designed more for showcasing interesting engineering solutions rather than devote resources to creating a significant market. Trane has exited the residential GHP market and does not seem to want to promote this technology in any obvious way.

Primary Competitors

WaterFurnace, ClimateMaster, Enertech

Markets Served (applications and geographies)

Trane operates through a network of independent distributors and company-owned offices serving nearly 6,000 independent dealers. There are also 7,600 sales engineering and service professionals serving Trane's global market and more than 2,000 service technicians.

Contact

Eve London, GHP Manager, Phone: 478/784-2458; Email: elondon@trane.com

WaterFurnace International

9000 Conservation Way Fort Wayne, IN 46809;
Phone: 800/ 934-5667; 260/ 478-5667 ext. 3221; Fax: 260/ 478-3029
Website: www.waterfurnace.com

***Company Ownership***

A subsidiary of WFI Ltd., a publicly-traded company on the Toronto Stock Exchange.

Company Description

WaterFurnace Renewable Energy (formerly WFI Industries) makes and sells geothermal HVAC systems. The company has installed more than 300,000 units. Its LoopMaster subsidiary installs geothermal loops that heat and cool homes and businesses by circulating pressurized water through hundreds of feet of looped pipe that is buried on-site.

WaterFurnace named Tom Huntington as president and CEO in 2009. He succeeded Bruce Ritchey, who retired from the company after 10 years in the position. Huntington was previously with the Building Efficiency Division of Johnson Controls.

History

WaterFurnace is one of the first companies that specialized in manufacturing GHPs and in marketing total system packages for closed loops. It has been in business for 25 years and has had more than 200,000 units installed. The company pioneered the use of “closed loop” geothermal systems to heat, cool and provide hot water for residential homes and commercial building.

Company Location: Fort Wayne, IN

Number of Employees: 285

Annual Revenue: \$129 million

Market Position

WaterFurnace is the industry leader in residential geothermal sales and in the top five in commercial and institutional sales in the United States and Canada.

Product Line

WaterFurnace manufacturers a complete line for residential applications including geothermal and water source heat pumps. Its residential GHPs are sized between three quarters and six tons.

WaterFurnace Geothermal System Types:

A All-In-One
S Splits
H Hydronic

All-In-One Systems:

Provide year round comfort. Built to heat through the winter months, and provide cooling all summer. WaterFurnace geothermal heat pump systems replace the traditional indoor furnace/outdoor air conditioning applications.



Envision (NSV, NSH, NDV, NDH)

A 30 EER / 5 COP **Top of the line.** Exceptional comfort with unmatched performance and savings.



Synergy3D (SDV)

A **H** 23.7 EER / 4.5 COP **3-in-1 System.** Forced air heating and cooling. Capable of radiant floor heat.



Legend (LSV, LSH)

A 18.5 EER / 3.8 COP **Great choice** for excellent performance.



Envision Outdoor Split (NDS)

S 25 EER / 4.6 COP

Outdoor Unit. Used with remote air handler or gas furnace.



Envision Split (NSZ, NDZ)

S 24 EER / 4.5 COP

Versatility. Used with remote air handler or gas furnace.



Envision Air Handler (NAH)

Used with split units to move air to and from the home.



Envision NSW (NSW)

H 17.5 EER / 3.1 COP

Hydronic. Add-on to other unit for high volume hot water users. Perfect for radiant floor, spa, pools, fan coils.










Envision NDW (NDW)

H 22.5 EER / 3.5 COP

Hydronic. Perfect for radiant floor, spa, pools, snow & ice melt.

WaterFurnace's Commercial GHP Line

	 Versatec Ultra	 Envision	 Envision (XL)	 Envision Console	 Envision Hydronic	 Envision Hydronic (NDW)	 NXW Chiller
Style	Water to Air	Water to Air	Water to Air	Water to Air	Water to Water	Water to Water	Reversible Chiller
Capacity Range (Tons)	0.75 - 6	0.75 - 6	7 - 25	0.75 - 1.5	2 - 5	8 - 15	8 - 45
Sizes Available (Tons)	0.75, 1, 1.25, 1.5, 2, 2.5, 3, 3.5, 4, 5, 6	Single Speed: 0.75, 1, 1.25, 1.5, 2, 2.5, 3, 3.5, 4, 5, 6 Dual Capacity: 2, 3, 4, 5, 6	7, 8, 10, 13, 15, 20, 25	0.75, 1, 1.25, 1.5	2, 3, 4, 5	8, 10, 12, 15	8, 9, 10, 12, 15, 18, 20, 30, 45
Efficiency ARI/ISO 13256-1 GLHP	13.5 - 18.5 EER 3.0 - 3.8 COP	17.3 - 30.0 EER 3.5 - 5.0 COP	17.4 - 20.8 EER 3.4 - 4.2 COP	14.2 - 16.0 EER 3.1 - 3.5 COP	11.0 - 13.5 EER 3.0 - 3.1 COP (13256-2 GLHP)	18.4 - 22.5 EER 3.3 - 3.5 COP Part Load (13256-2 GLHP) 15.8 - 17.2 EER 2.7 - 3.1 COP Full Load (13256-2 GLHP)	15.4 - 18.7 EER 3.0 - 3.5 COP
WLHP	12.0 - 15.7 EER 4.3 - 5.1 COP	14.5 - 21.0 EER 4.9 - 6.4 COP	15.4 - 18.9 EER 4.9 - 5.5 COP	12.3 - 13.6 EER 4.3 - 4.9 COP	N/A	N/A	N/A
Compressor	Rotary or Scroll	Ultra Tech Scroll or Rotary	Scroll	Rotary	Scroll	Scroll	2 - Scroll

	Versatec Ultra	Envision	Envision (XL)	Envision Console	Envision Hydronic	Envision Hydronic (NDW)	NXW Chiller
Refrigerant	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A
Blower	ECM or PSC	ECM or PSC	Belt Drive	PSC	NA	NA	NA
Cabinet Configuration	Vertical: Upflow Horizontal	Vertical: Upflow, Bottomflow Horizontal	Vertical: Upflow, Side Discharge Horizontal	Console: Floor Mount	Compact Unit	Compact Unit Top & Back mounted water connections Field switchable control box.	NA
Control Type	Versatec Micro-processor Board FX10	Premier Micro-processor Board FX10	FX10	FX Platform Micro-processor	Water to water micro-processor control FX10	Water to water micro-processor control FX10	FX10
Desuperheater	015 - 070 Vertical only	018 - 072	NA	NA	030 - 060 models only	N/A	NA
Available Voltages	208-230/60/1; 265/60/1; 208-230/60/3; 460/60/3; 575/60/3	208-230/60/1; 265/60/1; 208-230/60/3; 460/60/3; 575/60/3	208-230/60/3; 460/60/3; 575/60/3	208-230/60/1; 265/60/1	208-230/60/1; 265/60/1; 208-230/60/3; 460/60/3; 575/60/3	208-230/60/1; 208-230/60/3; 460/60/3; 575/60/3	208-230/60/3 (30 ton only); 380/60/3; 460/60/3; 575/60/3
Weight Data - LB [KG]	110 - 405 [50] - [184]	307 - 485 [139] - [220]	620 - 843 [281] - [382]	210 - 235 [95] - [107]	202 - 360 [92] - [164]	390 - 420 [177] - 190	1163 - 1920 [518] - [871]
Sound Data	Contact Factory	Contact Factory	NA	Contact Factory	54 to 58 dBA	Contact Factory	65 to 78 dBA

Association Memberships

- International Ground Source Heat Pump Association
- Geothermal Heat Pump Consortium
- Air-Conditioning & Refrigeration Institute
- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- Association of Energy Engineers

Competitive Strengths: WaterFurnace has the benefit of being the first to market a GHP, and it essentially helped create this market. It continues to broaden and expand its successful line of GHPs. WaterFurnace remains committed to moving the geothermal market forward.

WaterFurnace's sister company is LoopMaster, headquartered in Indianapolis, IN. This is one of the largest geothermal looping contractors in North America. Originally, the company specialized in residential applications but now has concentrated on the commercial and institutional markets.

WaterFurnace also has both a broad and deep product line and offers competitively priced products. The company is also developing a strong dealer network.

WaterFurnace is also seriously positioning itself as a "green company" to both investors and customers. It renamed itself WaterFurnace Renewable Energy and has developed policies and procedures to promote overall "green building" practices.

Competitive Weaknesses: WaterFurnace's commitment to promoting GHPs waivers depending upon its financial position. Occasionally some dealers and installers have complained that its products have not been consistently high-quality.

Although the company has the dominant market position, it has never been one to take the lead in promoting the industry or the technology. Rather, that role has been ceded to Dan Ellis of ClimateMaster and one of the original founders of WaterFurnace. It is quite likely that as the market consolidation continues and this industry matures, ClimateMaster may take away the market lead from WaterFurnace.

Market Position

WaterFurnace is the industry leader in residential geothermal sales and in the top five in commercial and institutional sales in the United States and Canada. Its rivals consistently view WaterFurnace as the leading GHP manufacturer in North America. It is estimated to control about one-third of the total GHP market, and the same percentage within the residential market.

Markets Served (applications and geographies)

WaterFurnace sells its systems through HVAC contractors and distributors mainly in the U.S. and Canada, but is increasingly looking overseas for growth, particularly in emerging markets such as China and India. It sells its products in about 30 countries.

In light of a steep downturn in new housing starts, WaterFurnace has been emphasizing dealer-direct and commercial sales, as well as private label manufacturing. The company hopes that the higher prevalence of geothermal heating and cooling systems in Canada and Europe will eventually translate stateside, and that the repeal of a cap on tax credits for geothermal products in the U.S. will help drive sales.

WaterFurnace relies on a network of independent dealers and distributors in the United States, Canada, Europe, Asia and Australia. In the United States, WaterFurnace focuses on the dealer direct and distributor market to serve its residential customer base with dealers that have

developed contacts with builders and homeowners.

The firm employs a unique marketing strategy -- participating in hundreds of small home and garden shows around the country. This has been an effective way to reach potential customers looking to build or remodel their homes. The company also participates in the national home and garden shows including National Association of Home Builders show, a biannual event targeting the construction trades. Although this company takes a national approach in its marketing, its strongest area of market penetration remains in Midwestern states such as Indiana and Michigan.

Primary Competitors:

ClimateMaster, FHP and Trane.

Key Customer Accounts

WaterFurnace works closely with a variety of utilities around the country including:

- Large municipal utilities such as TVA,
- Investor-owned utilities such as First Energy
- Rural electric cooperatives such as Delta-Montrose Electric Association

Price Structure to Utility and Customer

Varies depends upon installed tonnage and if rebates/incentives are available to defray installation costs.

Total Number Deployed

WaterFurnace has been involved in some of the largest and most successful installations in the United States in thousands of commercial, residential and institutional customers' applications.

How/Where Product Sold: (direct sales, reps., etc.)

WaterFurnace products are sold and serviced through a network of independent dealers, commercial representatives and independent distributors throughout the United States, Canada, Europe, Asia and Australia.

WaterFurnace focuses on the dealer direct market and the distributor market. "We focus on those direct dealers who market to builders and homeowner -- those who are leaders in distributor marketing," Cooper explained.

How/Where Marketed

WaterFurnace relies heavily on face-to-face selling to promote its products to commercial and industrial customers. WaterFurnace also participates in home and garden shows around the country to demonstrate its systems to residential customers. These activities seem to be paying off.

"We are seeing a tremendous awareness of geothermal compared to two years ago," Cooper said. The company also attends all of the national shows, such as Greenprints, Energy 2002 and NAHB.

Best Way to Learn of New Developments: website, news releases and trade shows.

Contact

Tony Cooper, Vice President, Sales and Marketing
Phone: 260/479-3221; Email: tcooper@wfiglobal.com

