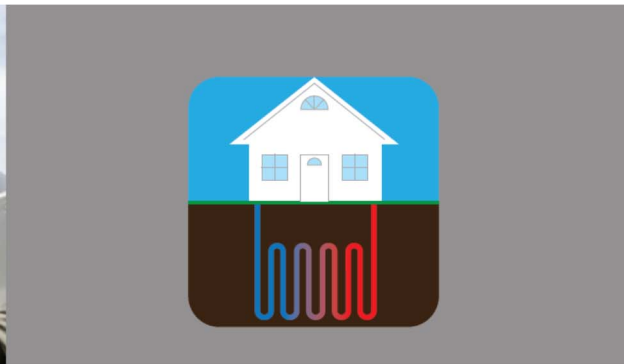




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## Overcoming the First Cost Barrier to Ground Source Heat Pump Technology: The Utility Ground Loop Service Provider Concept



## **Overcoming the First Cost Barrier to Ground Source Heat Pump Technology: The Utility Ground Loop Service Provider Concept**

### **Background:**

Energy has become a defining issue of our time and climate change is a concern that we can no longer choose to ignore. The effects of Super Storm Sandy, on the Eastern seaboard from Florida to Maine, have reinforced the growing sense in political circles that the reality of climate change has put our nation at risk.

The US Department of Energy (DOE) reports that building energy use accounts for 36% of all primary energy used in the United States, and 40% of the total energy used in those buildings is for space conditioning (heating and cooling) and water heating.

Geothermal heat pump systems (GHPs), a technology that uses the earth's thermal properties in conjunction with electricity to provide space conditioning and water heating to facilities, is a technology that the U.S. Environmental Protection Agency (EPA) has stated reduces greenhouse gas emissions by up to 40% over conventional HVAC systems.

Although this technology has been used successfully since the early 1970's, it has not seen widespread use because one of the main barriers - and some think the only barrier - is its first cost.

The primary cause of this high first cost is the installation of the ground loop heat exchanger (GLHE), which can represent up to 60% of the total cost of the system. Removing this barrier, through utility or third party ownership, would ensure the widespread adoption of the technology and make it the most energy efficient, environmentally sensitive and cost effective heating and cooling system on the market for years to come.

The purpose of this whitepaper is to explore the ground loop service provider concept, the various methods to accomplish it, and the targeted market potential for this technology.

### Third Party Loop Ownership

This whitepaper will analyze three scenarios for this initiative: utility owned, third party owned, and third party owned w/utility participation.

#### **Utility Owned** - How does it work and why would utilities participate?

A utility installs the loop and leases it back to the end user. The contract remains with the property and is billed as a line item on the end user's monthly bill. The utility is allowed to use the Business Investment Tax Credit and all other federal incentives provided for the installation of energy efficient and renewable energy technologies, including a 100% MACRS (Modified Accelerated Cost Recovery System) first year depreciation Investment Tax Credit.

This is a "rate recoverable" long term asset to the utility.

It is a permanent demand reduction technology and with increased use can negate (or limit) the need to build more generation capacity.

It is an electro-technology that enables Electricity Load-Balancing and Energy Management in response to peak heating and cooling periods.

A Renewable Portfolio Standard (RPS) is a State regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal. In some States, the energy savings from GSHP's are eligible technologies that the local utilities can count as part of their RPS requirement.

It can employ renewable resources where other technologies fail. An example of this is that GHPs work year round in parts of the U.S. that do not receive enough wind or solar gain to make those technologies efficient.

It provides utility customers with a system that delivers proven "comfort."

It becomes a Distributed Energy Resource (DER) that has both a renewable energy aspect that originates from the ground and an energy efficiency portion that contributes to lower utility bills. It can become a Distributed Energy Services business unit with focused services providing enhanced, value-added, custom designed HVAC alternatives that may allow utilities to meet or exceed their renewable mandates.

This has been proven by the Western Farmers' Cooperative in Oklahoma. They have created a **Geo Validation Program** that replaced residential HVAC systems with GHPs

and experienced a reduction of about **1.5 kW** per home (3 ton Capacity) or **0.55kW per installed ton of capacity**.

This program has demonstrated that this demand side measure can reduce the capacity of the cooperative's generation plant by one third.

This validation program saw the peak demand for the HVAC systems in the participating homes drop by **39 percent**. It also demonstrated that this small program was able to generate a **32 kW "virtual" peaking plant**, which was obtained at roughly **one third** the cost of new generation.

### **Third Party Owned**

This is similar to a Power Purchase Agreement (PPA) but it is a thermal power purchase agreement contracting long term (20 -25 years) to own and operate the system.

The third party owner forms a special purpose entity that owns the energy producing asset and in a sense becomes a mini utility that sells the end user energy (BTU / kWh) at a specific rate.

The third party may also take advantage of the 10% Business Investment Tax Credit and all other federal, state and local incentives including the Modified Accelerated Cost Recovery System (MACRS) first year depreciation tax deduction.

The third party owner can also take advantage of any Renewable Energy Credits that the loop may accrue in states that have it in their Renewable Portfolio Standard (RPS) which is a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass, geothermal and other alternatives to fossil and nuclear electric generation.

There are several examples of this model at work in the market today:

1. Orca Energy is a third party thermal service provider for the thermal energy provided by the geothermal heat pump system. Under master agreements with developers and builders of master planned communities, the builder agrees to allow Orca Energy to charge the homeowner a one-time connection fee and then bill a Monthly Utility Charge (MUC) consisting of a capacity charge and a variable monthly energy charge. These charges are indexed to the Consumer Price Index (CPI). The MUC is designed to be set at or below actual space heating/cooling and hot water energy costs as compared to a conventional HVAC system. This provides the homeowner with stable and predictable energy costs over time without having to provide the upfront capital for the ground loop.

2. EcoSmart Solution (ESS) develops and implements alternative energy structure programs in large-scale real estate projects. The ESS solution locks in lower costs for energy by employing ground-source geothermal technology for heating and cooling the home, together with solar energy generation, to achieve Zero Net Energy (ZNE) use. The homeowners incur no upfront costs for the geothermal system, as the ground loop infrastructure is pre-installed throughout the community. Homeowners enjoy peace of mind with an extended warranty and no maintenance costs for the first three years. In a development in Austin, Texas the energy costs will be fixed at approximately \$175 a month, which covers the costs of the geothermal infrastructure equipment, a solar PV system, LED-lighting package, appliances and other technologies, and includes a maintenance service.

With a combined geothermal-solar system, many buildings can achieve ZNE status, and a homeowner's utility-supplied energy use will be minimal to none as they return excess solar-generated energy to the grid. The savings in utility electricity costs will be equal to or greater than the monthly ESS energy fee. The EcoSmart program delivers the value of energy efficient technologies without requiring upfront costs from the homeowner or builder.

### **Third Party Owned W/Utility Participation**

This model operates the same as above but the utility collects the energy payment on their bill for a percentage of the profits or a flat fee, as this gives added security on the energy payment.

### **Market Potential**

Eliminating the "first cost" barrier by utility/third party ownership of the ground loop heat exchanger could move the GHP market from a current 2% share to a 30% share in a relatively short time. Here are the projected impacts the residential and commercial markets would have on our industry:

**Residential:** A 30% share of the residential market = 14,400,000 homes, assuming a 4 ton system for each, which equates to 57,600,000 tons.

**Manufacturing:** 14,400,000 heat pumps would be needed, assuming \$2,500.00 per ton, which would equate to \$144,000,000,000 in revenue for the GHP manufacturing community.

**Developers would be a major target market in this initiative.**

**Commercial:** A 30% share of the commercial market would be 1,164,000 buildings, assuming 20 tons per facility = 23,280,000 tons.

**Manufacturing:** Assuming 5 ton heat pumps that would equate to 4,656,000 heat pumps that must be manufactured @ \$2,500.00 per ton - that would add up to \$58,200,000,000 in revenue for the GHP manufacturing community.

**Institutional: Schools, Universities/Colleges, and Hospitals & Prisons**

**K-12 – Facts:**

The average age of a K-12 school in the U.S. is 42 years old.

Energy is the second most costly item in the school budget (salaries and benefits being first) and the only one that school boards can control.

The economic downturn has had a dramatic impact on school districts throughout the US, forcing teacher layoffs, eliminating non-academic programs (Physical Education, Music, Art etc.).

This poses a great opportunity to promote GHP technology to the school districts, (Assuming utility/third party loop ownership)

K-12 Schools 132,656 (Public - 98,706, Private - 28,220, Charter - 5,714)

Total K-12 enrollment - 55,235,000

School Construction to start in 2013, \$10,560,002

**Universities/Colleges Facts**

There are 4,096 universities & colleges in the US, below is the institutional breakdown.

Public 4 year – 615

Public 2 year – 1,092

Private 4 year - non-profit – 1,536

Private 4 year - for-profit – 169

Private 2 year – non-profit – 184

Private 2 year – for-profit – 500

Total enrollment (age 18 to 24) approximately 38 million.

### **Hospital Facts**

There are a total of 5,724 hospitals in the U.S.

The average age of their physical plant is 10.8 years old according to a recent study by Moody.

### **Prison Facts**

There are 1,821 prisons nationwide, 102 are federal, 1719 are state-run and 415 are privately owned.

### **Conclusion**

Several utility CEO's and PSC/PUC regulators have all acknowledged the importance of GHP technology in the overall landscape of the energy industry. Third party loop ownership is the key to success, and it is going to happen sooner rather than later -- we must keep the dialogue going and stay "ahead of the curve."

GHP technology and the benefits it provides (energy independence & security, environmental stability and economic prosperity) is a solid fit for Bosch's value proposition for dynamic development of the company and the long term success of the corporation by shaping changes in the market and technology. It also addresses the everlasting goal to always provide the customer with innovative solutions from Bosch.

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