Frequently Asked Questions
For PSNH's ENERGY STAR® Homes Program - Geothermal Option

What is geothermal heating?

"Geo" refers to the ground and "thermal" refers to heat. Geothermal refers to heating and cooling through the use of ground water in one of three common strategies (more about this later). The earth acts as a giant solar collector, a heat sink if you will. In New England, our ground water below the surface is roughly 50-55 degrees F virtually year round. Surprisingly, there is quite a bit of heat "trapped" in the underground water even at these temperatures. The challenge is to find a way to extract it. Instead of creating heat, a geothermal heat pump actually "moves" heat in the desired direction. In the winter it captures the latent heat stored in the ground using a compressor to "bump" up the temperature to the desired heating temperature in the home say, 70 degrees F. In the summer it captures the heat in your home and moves it back to the ground. A heat pump acts much like your air conditioner or refrigerator in the way that it moves or transfers heat. The only difference is that a heat pump can act in reverse mode as well.

The two most popular types of geothermal systems are open and closed loop systems.

Open loops take water from domestic water wells, circulates it through the heat pump then puts water back into the same well. This process lowers the temperature of well water about ten degrees. The coldest well water normally gets is 45 degrees.

Closed loops circulate a heat exchange fluid such as a water / food grade glycol solution or refrigerant through pipe that is buried below frost. The temperature below grade is around 50 degrees. The temperature of the fluid being circulated can get down to 32 degrees.

The open loop uses more pumping energy, but has higher temperature source (on average) increasing mechanical efficiency. The closed loop uses less pumping energy but performs the heat exchange with a lower temperature reducing mechanical efficiency.

What is a direct exchange geothermal system?

Direct exchange geothermal systems use copper earth loops to directly exchange heat with the earth, thus eliminating the water circulating loop and intermediate heat exchanger. These systems are most compelling when water production from wells is low and would require extra costs for geothermal application.

Why would I want to use geothermal?

Geothermal systems have lower ongoing operating costs than conventional fossil-fueled systems. Program participants (using PSNH's discounted HEATSMART Rate Option) average roughly 50 cents per square foot per year for heat, domestic hot water and air conditioning. Code built fossil fuel homes with air conditioning would expect to pay more than double that. Of course, there are the environmental benefits of using a 'recycled' heating source instead of a fossil fuel. Although electric rates fluctuate and tend to increase over time, they are not subject to the same market volatility and huge price spikes as fossil fuels.

What does it cost to install geothermal equipment?

The cost of a simple, single zone, forced hot air system should be around $5,000 per ton (i.e., 12,000 BTU increment) for everything. Installed costs will vary with options, different types of distribution systems, and how you connect to the earth, i.e. closed loop, open loop.

What is a Home Energy Rating?

A home energy rating involves an analysis of a home's construction plans and onsite inspections. Based on the home's plans, a nationally certified Home Energy Rater uses energy efficiency modeling software to perform an energy analysis of the home's design. This analysis yields a projected, pre-construction HERS Index. Upon completion of the plans review, the Rater will work with the builder to identify the energy efficiency improvements needed to ensure the house will meet ENERGY STAR® performance guidelines. The Rater then conducts onsite inspections, typically including a blower door test (to test the leakiness of the house), a duct blaster test (to test the leakiness of the ducts), and an inspection to confirm that insulation has been properly installed and to ensure that common thermal bypasses are not present. Results of these tests, along with inputs derived from the plans review, are used to generate a final HERS Index for the home.

The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2004 International Residential Code which is similar in performance to NH's residential energy code, the 2006 International Energy Conservation Code) scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0.

The lower a home's HERS Index, the more energy-efficient it is in comparison to the HERS Reference Home. Each one-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home. For example, a home with a HERS Index of 80 is 20% more energy-efficient than the HERS Reference Home and a home with a HERS Index of 65 is 35% more energy-efficient. Think of your home energy rating as a “miles-per-gallon” rating for your home, only a lower number is better. The ENERGY STAR® Home designation in New Hampshire begins at a rating of at least an 80 for the Traditional - Non Geothermal Program Track. However, the ENERGY STAR Homes Program - Geothermal Track requires a HERS Index of a 65 or better (again, lower is better).

What incentives does PSNH offer?

Incentives are structured to help cover some of the incremental costs associated with building to higher performance levels. For 2008, the ENERGY STAR Homes Program - Geothermal Track offers incentives based on the conditioned living area of the home at the following schedule:
Less than or equal to 2,400 square feet, the incentive is calculated at $2.25 per square foot;
Greater than 2,400 square feet, the incentive is calculated at $2.00 per square foot.
The incentive caps out at $7,500.

In addition to the incentives offered by PSNH, qualified projects may be eligible for a federal tax credit of $2,000 - ask your HERS rater for more information. Also see www.energystar.gov and search on "tax credits"

Why does PSNH offer these incentives?

Energy efficiency programs like these are made available to NH residents as a result of a state-wide utility partnership. This state-wide effort has resulted in NH residents and businesses saving millions of dollars each year on their energy bills. PSNH believes that this helps to boost the state’s economy. Additionally, building energy efficient homes and installing energy efficient heating and cooling equipment results in reduced pollution and provides both health and environmental benefits – all of these help to further boost our economy and, better yet, improve quality of life. PSNH is proud to sponsor programs like these. (To see what other programs are available, please visit our website at www.psnh.com.)

What things should I focus on when building a geothermal ENERGY STAR Home?

There are three key attributes to a successful geothermal project.

1. Build the best building shell you can; the biggest "bang for your buck" comes from a well insulated, well sealed building envelope. The ENERGY STAR® Homes Program takes a holistic perspective on achieving energy efficiency. Rather than mandating prescriptive requirements for insulations, windows, mechanicals etc…the house is looked at as a system of integrated components. Changing one part has implications for the whole system; however, this flexibility consistently yields homes that perform beyond the minimum energy efficiency requirements. Consult with your Home Energy Rater for design and construction ideas and analysis.

2. Properly installed geothermal equipment can deliver $3.00 worth of heat or more for every $1.00 of electricity put into the system because they "move" heat, rather than "make" heat as in a fossil-fueled system. Make sure you have a competent team of experienced geothermal designers and installers who are committed to quality and energy efficiency.

3. Plan to take advantage of PSNH's HEATSMART Rate Option which gives qualifying customers a discount on their separately metered geothermal heat pump's energy usage. Currently, the discount is approximately 23% based on rates in effect as of January 01, 2008. See the PSNH HEATSMART Info Packet for more information and for an Application Form.

What is the HEATSMART Rate Option?

PSNH's HEATSMART Program provides qualifying customers with a discounted kilowatt-hour rate for their separately metered electric space heating (and cooling if using a heat pump) and electric water heating.

In exchange for the lower rate, customers agree to allow PSNH to briefly interrupt service to their heating circuits during periods of high demand for electricity. An eligible backup heating source is required.

Customers who choose to take advantage of the HEATSMART rate option, are responsible for 1) the cost of hiring a licensed electrician to install a separate electrical panel and for the wiring of the electric heating circuits to this panel and 2) the cost associated with, if not already present, the back-up heating source.

Are there any special electrical service requirements for the HEATSMART Rate Option?

While there is no requirement to have any special electrical service, it is strongly recommended you look into your service requirements before ordering service. Most customers who build homes with geothermal heat pumps utilizing HEATSMART elect to take advantage of a 400 amp service entrance and have two 200 amp panels - one for the geothermal system the other for the balance of the home's loads.

(For more information refer to the HEATSMART Rate Option Info Packet, which includes FAQs, a Program Application, and a list of PSNH contacts, or calls our customer service reps. at 1-800-662-7764.)

Describe what building to a HERS Index Score of 65 means in terms of heat loss?

Heat loss for an ENERGY STAR® Home with a rating of 65 is normally 4 watts of heat loss, per hour, per square foot of living space. To convert heat loss in watts to the universal measurement of British Thermal Units (BTUs), the formula looks like: 6 watts X 3.413btus/watt = 20.47 BTU per square foot per hour.

Heat pumps are sized in tons which are 12,000 BTUs per hour of heating or cooling capacity.

So a 2,000 ft² house X 20.47 BTU/hr per ft² = 40,956 BTU per ft² per hour / 12,000 = 3.4 tons required to heat down to minus 3 degrees F outside, 70 degrees F inside (electric resistance coils in the ductwork plenum make up extra heat if the geo heat pump cannot provide adequate heating, generally if it's colder than say minus 3 degrees F outside). Rounding up to the next incremental size unit yields a 4 ton unit for a typical 2,000 ft² home.