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How does a Geothermal Energy System Work?

The purpose of this memo is to explain how residential geothermal systems can benefit a home in New England. If you would like a more detailed explanation please contact the RMLD Energy Efficiency Engineer (jcarpenter@rmld.com), or visit Energy.Gov and search for geothermal.

In New England the temperature significantly fluctuates between the winter and summer. Homes are essentially heated using water in a coil, radiator or baseboard. The earth temperature is about 55° Fahrenheit a few feet under ground. Heating and cooling extreme temperatures is where the majority of our energy is used. During the winter we need to heat our homes from a potential temperature of 0° F (or more!) to a comfortable 70° F or so. During the summer we need to go from 95° F down to a comfortable 75° F or so. In other words our systems need to prepare for a 100° F difference! To reduce this amount we can utilize the earth temperature and supply a consistent 55° F starting point. That 100° F difference would be changed to 25° F or so. How does that big split cost more money? If you want your car to go faster you need to increase fuel flow compared to idle. If you want your heating system to give more heat you need to add more fuel. Compare it to going 100 miles/hour verses going 25 miles/hour. Using the geothermal energy from the earth evens out the temperature difference allowing your system to require less oil, gas, or electricity during the winter and/or the summer months.

To harness this 55° F earth temperature we dig down at least a few feet and bury a long coil or tube for fluid to run through it. The hot fluid from the A/C compressor can reject its energy/heat using the 55° F earth temperature prior to going through a phase change to provide cold air. In the winter this same 55° F water can effectively pre-heat cold outside air prior to the additional heating needed to heat the home to a comfortable temperature.

To install a geothermal system you will need to find a good contractor. They will need to either drill holes (6 inches in diameter) 100 to 300 feet deep, or they can bury coils (100-500 feet in length) a few feet underground. A pump will circulate water through it and into your HVAC system via a heat exchanger. It can then be utilized as described above. You can even put coils at the bottom of a pond or lake!

Cost varies, but you can expect to pay around $3000/ton of your HVAC system. With geothermal you can expect a payback of around 5 years, and systems are expected to last around 20 years.

Some of the benefits of a properly designed geothermal system are downsizing of the HVAC equipment, reduction of toxic refrigerant (ozone depletion and global warming), and reduced needs for excessive heating and cooling thereby saving money in the summer and winter.

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Below is a diagram showing the basic components of a typical home HVAC system. Hopefully this will allow for easier visualization of the potential of a geothermal system. If you have further questions please contact Jared Carpenter, Energy Efficiency Engineer at the RMLD (**jcarpenter@RMLD.com**).