



Pollution-free Heating and Cooling: Geothermal Heat Pumps

By Mark Snyder

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What is Geothermal?

Many people, when they hear the word "geothermal", think of those old plants that were built out in Western states to generate electricity using underground reservoirs of hot water or steam. Known as "direct-use" systems, they trade off dependence on fossil fuels for impacts on the hot springs from which they draw their energy.

In recent years, newer technological advances have allowed for the development of ground source heat pumps that can provide buildings with heating in the winter and cooling in the summer, all in one unit. This means that instead of having both a furnace and an air conditioning unit for a home, only a single heat pump system is needed.

How Does it Work?

Ground source heat pumps use the earth as a heat source in the winter and a heat "sink" in the summer. Much of the upper 10 feet of the Earth's surface maintains a nearly constant temperature between 50 °F and 60 °F. A ground source heat pump consists of a closed-loop piping network buried near the building and connected to a heat exchanger and ductwork going into the building. In the winter, heat from the relatively warmer ground is pulled into the building by the heat exchanger, and in the summer, hot air from the building is pulled into the relatively cooler ground by

the heat exchanger. Some heat pump systems also include a secondary heat exchanger that allows heat from summer air to be used for heating water in the hot water tank.

What Are the Benefits?

First, geothermal heat pumps tap into a clean, efficient, renewable energy source for heating and cooling the home. It replaces the furnace that burns oil or natural gas as well as the air conditioner that uses huge amounts of electricity generated from burning coal. According to the U.S. Environmental Protection Agency (EPA), geothermal heat pumps are 48% more efficient than the best gas furnaces and 75% more efficient than the best oil-burning furnaces. Geothermal energy is also "homegrown," reducing our dependence on imported oil or natural gas.

Geothermal energy is reliable and lowers utility bills. You don't have to worry about outages caused by peak power demand or price spikes caused by distribution shortages as have been seen lately with natural gas. Estimates show many households can save 25% or more on utility bills.

For folks in rural areas, geothermal energy can replace a cumbersome propane heating system or avoid the cost of extending natural gas service.

Lastly, folks who have installed geothermal heat pumps in their homes have appreciated how much quieter, reliable and low-maintenance these systems are compared to the traditional furnace and air conditioner. Since heat pumps are much smaller than traditional systems, they can be installed completely indoors, protecting them from harsh weather and preventing outside units from becoming an eyesore in the yard.

Something to keep in mind is that geothermal heat pumps are not just for homes. Commercial-sized systems are available which can service schools, apartment complexes or other larger buildings. One such system was installed at the elementary school in Onamia, Minnesota. The 79,700 square foot building uses an ECONAR GeoSource Commercial Line system with 230 tons of heating/cooling capacity. Onamia's system heats, cools, dehumidifies and illuminates the school at half the cost of just heating the adjacent high school, which uses a traditional furnace system!

With benefits such as these, it's no wonder that geothermal heat pumps are growing steadily in popularity. According to the US Department of Energy, over 50,000 geothermal heat pumps are installed in our country each year!



Renewable Energy Alternatives in Minnesota

By Tim Bethke

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Although Minnesota is a state with zero fossil fuel (coal and oil) reserves, we have an abundance of solar (sun) and wind resources. The majority of our electricity is generated from coal and nuclear power. However, we are on-track for meeting our renewable energy standards (25% by 2025) from renewable energy sources, including wind, solar, biofuels, biomass, hydroelectricity, and geothermal. This article focuses on solar and small wind systems for homeowners.

The majority of our renewable energy power production today is from large wind farms in southwestern Minnesota. Minnesota currently ranks 4th in the nation for wind energy output. Wind energy will continue to play an important role in our energy future.

Residential Solar

Most people have the perception that solar does not work in Minnesota due to our long cold winters. In fact, Minnesota receives as much sunlight as parts of Texas and Florida. We receive an average of 4.6 hours of sunlight per day throughout the year. By comparison, Stuttgart Germany receives an average of 3.1 hours of sunlight per day and Germany leads the world in installed solar capacity! According to the National Renewable Energy Lab, Minneapolis has the 4th highest potential of annual rooftop solar power generation in the country! We have a great opportunity to change how and where we produce our electricity.

The most common types of solar systems include solar photovoltaic (PV) and solar thermal. Solar photovoltaic systems convert energy from sunlight into electricity. Solar thermal systems are used to heat water

(indirectly) to meet domestic hot water and/or space heating needs.

Small Scale Wind Systems

As mentioned above, Minnesota has the capacity to produce electricity from wind resources. According to Windustry, a local wind energy development organization, home and farm wind systems (turbines) are generally less than 100 kW in capacity and produce electrical power for on-site use. These turbines are suitable for use with single homes, small businesses, family farms, agricultural operation, cabins, and even sailboats.

Generally, a site with an annual average wind speed of 12 miles per hour or greater has enough wind to justify installing a turbine. A good place to begin determining your wind resource is the National Renewable Energy Laboratory's wind resource maps (nrel.gov/gis/mapsearch). Type Minnesota into the search box, download the map for Minnesota, and locate the general area where your property is located. This will give you a fairly good sense of the average wind speed in your area, at no expense.

How to Begin

Homeowners considering investing in a solar or wind system may want to start with a home energy audit to identify areas of the home where energy is escaping. You will learn about your home's energy consumption and identify the major energy consumers in your home. A well-insulated and well-sealed home is an important first step in energy conservation, along with using energy efficient appliances, lighting, and electronic devices.

For more information on renewable energy and much more, visit our website at

WWW.DOITGREEN.ORG.



Next, schedule a site assessment from an experienced professional to determine whether your property is suited for a solar or wind system. Solar systems ideally face south on a roof or property that receives full sun throughout the day. Small wind systems need to be located in an area that receives unobstructed wind. They are better suited for rural areas, where more open space is available, versus urban areas.

One of the major advantages of solar and small wind systems is distributed power generation, the ability to generate and deliver electricity right at the source. The most typical solar PV or small wind installation is a grid-connected system. Your home electricity needs are met through the renewable energy system and existing utility grid, so you will have a constant supply of electricity.

Costs for solar and small wind systems are determined by the size and complexity of the installation. A solar thermal system generally offers the lowest out-of-pocket costs with the shortest return on your investment or payback. This is followed by a solar PV system or small wind system. Always consult with a professional installer for detailed information about your installation and costs. There are federal tax credits, state and/or utility rebates, and other incentive programs that can significantly reduce your out-of-pocket costs.

Minnesota has ample solar and wind resources to support our energy needs now and in the future. We have a strong and growing base of companies in the state to support solar and wind installations. Go Solar! Go Wind!