



Geothermal Systems

A geothermal heat pump system consists of indoor heat pump equipment, a ground loop, and a flow center to connect the indoor and outdoor equipment. The heat pump equipment works like a reversible refrigerator by removing heat from one location and depositing it in another location. The ground loop, which is invisible after installation, allows the exchange of heat between the earth and the heat pump.

Geothermal heat pumps can be open- or closed-loop. Open-loop systems draw well water for use as the heat source or heat sink, and after use, return the well water to a drainage field or another well. Closed-loop or earth-coupled systems use a water and antifreeze solution, circulated in a ground loop of pipe to extract heat from the earth. Ground loops can be installed in a vertical well or a horizontal loop. Vertical wells are usually more expensive and used where space is limited. The length of loop pipe required will vary with soil type, loop configuration, and system capacity. Loop length can range from 250 to 1,000 feet per ton of capacity.

Special heat pump features can include variable speed blowers and multiple-speed compressors. These features can improve comfort and efficiency in areas where heating and cooling loads are quite different. Add-on features include the capability to produce hot water.

Energy Efficiency

Heating efficiency is expressed as a Coefficient of Performance (COP). The higher the COP, the more efficient the system.

For example, a residential-sized geothermal system might have a COP of 3.4 or higher, meaning for every one unit of energy used to power the system, more than three units are put back into the home as heat. This compares to efficiencies of 0.92 for a high-efficiency natural gas furnace.

Cooling efficiency is measured as an Energy Efficiency Ratio (EER). The higher the EER, the more efficient the system. Keep in mind that both COP and EER are dependent on many factors, and that high-efficiency equipment comes with a higher price tag - but the energy savings can pay back in the difference in just a few years.

Environmental Benefits

Geothermal Systems average 40 percent greater efficiency than air-source heat pumps, 48 percent better than natural gas furnaces and 75 percent better than oil furnaces.

Geothermal systems currently in use help to remove more than 1.5 million metric tons of carbon emissions from the atmosphere every year.

