Ground Source Heat Pumps – An Introduction

Ground Source Heat Pumps take heat from the ground and transfer it into buildings.

How do they work?

Radiation from the sun heats the earth. The earth then stores the heat and maintains, just two metres or so down, a temperature of around 9-11ºC even throughout the winter. Thanks to ground source heat pumps we can tap into this constantly replenished heat store to heat buildings and provide hot water. The technology used is the same as that used in refrigerators. Just as a fridge extracts heat from the food and transfers it into the kitchen, so a ground source heat pump extracts heat from the earth and transfers it into a building.

How efficient are Ground Source Heat Pumps?

For every unit of electricity used to power the heat pump, approximately 3-4 units of heat are captured and distributed. In effect this means a Ground Source Heat Pump is 300-400% efficient in terms of its use of electricity. At this efficiency level there will be less carbon dioxide emissions than for a gas boiler heating system. In may also be possible to provide the required electricity by means of renewable energy, thus virtually doing away with any use of fossil fuels and reducing carbon emissions to zero.

What do they look like?

A Ground Source Heat Pump system comprises three basic elements - a ground loop, the heat pump itself, and a heat distribution system.

The ground loop is a pipe buried underground in a horizontal trench or a vertical borehole. Horizontal trenches are dug 1.5 - 2 metres below ground level and, although covering more land surface than a borehole, they are usually cheaper for smaller systems.

The Heat Pump in the GSHPA offices

The 'slinky' ground loop being installed in a trench at the National Energy Foundation

Boreholes are drilled to a depth of between 15 - 150 metres and benefit from higher ground temperatures than trenches. However, there are a variety of types of pipe (eg the coiled pipe known as a 'slinky') which can be used in a trench instead of a straight one, which increase the amount of heat absorbed from the ground and so enhance performance. The ground area required for trenches will vary with the location, the property and the heat output required. As a general guide, for a newly built 3-bedroomed house of around 120 m^2 with a heat loss of around 6kW, two trenches of 30-40 metres in length would typically be required.

A water/anti-freeze mixture is circulated through the pipe where it absorbs heat from the ground. A heat exchanger then extracts the absorbed heat and transfers it to the heat pump.

The third basic element of a ground source heat pump, the heat distribution system, can be either low temperature radiators or, preferably, underfloor heating. If the heat pump is asked to produce higher temperatures, for a conventional radiator circuit, then its efficiency will reduce.

Once a ground source heat pump is installed, there are no external fans and no external equipment is visible. The system is quiet in operation, issues no emissions, is very safe and requires very little maintenance.

Installation and Running Costs

The installation costs will depend on the site and the amount of heat output required. A survey is necessary to ensure that the ground at the location is suitable and to decide whether a horizontal trench or vertical borehole is most appropriate. As a general guide, the installed cost of a typical gshp system can be as low as £1,000 per kW. However, this cost will vary with the type of property and ground conditions. The Renewable Heat Incentive is financial encouragement to install ground source heat pumps: Ofgem will pay 4.5 pence per kWhour generated every year for 20 years.

Savings in running costs of 30% to 70% can be achieved depending on the type and price of fuel being displaced.

Further information is available from:

Ground Source Heat Pump Association
Tel: 01908 665555 www.gshp.org.uk