



Ground Source Heat Pumps – An Introduction

Ground Source Heat Pumps take heat from the ground and convert it into energy, which can be used to heat buildings.

How do they work?

Radiation from the sun heats the earth. The earth then stores the heat and maintains, just a metre or so down, a temperature of around 8-12°C even throughout the winter. Thanks to ground source heat pumps we can now tap into this constantly replenished heat store to heat buildings and even to provide hot water. The technology used is the same as that used in refrigerators. Just as a fridge extracts heat from the food and pumps it into the kitchen so a ground source heat pump extracts heat from the earth and pumps it into a building

How efficient are Ground Source Heat Pumps?

For every unit of electricity used to power the heat pump system, 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 many cases it 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 either a horizontal trench or a vertical borehole. Horizontal trenches are dug 1.5 - 2 metres below ground level and, although using more land than a borehole, are usually cheaper for smaller systems.



*The Heat Pump in the new offices at
The National Energy Foundation*



*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 size of ground area required for trenches will vary with the location, the property and the output required. As a very general guide, for a newly built 3-bedroomed house of around 120 m² in area with a heat loss of around 6kW, two trenches of 30-40 metres in length would probably be required.

A water/anti-freeze mixture is pumped 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 example in a conventional radiator circuit, then its efficiency will reduce.

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

Installation and Running Costs

Exact installation costs 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. Again as a very general guide, the installed cost of a typical system would probably be about £1,000 per kW. However, this cost may vary greatly depending on the type of property and ground conditions. A grant is available through Clear Skies (website: www.clear-skies.org tel no: 0870 2430930).

Savings in running costs of 25% to 50% are possible depending on the type and price of fuel being displaced.

Further information is available from:

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

The Energy Saving Trust - Ground Source Heat Pump – Fact Sheet 5
Website: www.saveenergy.co.uk/renewables/resource

Low Carbon Building Programme (*Grants - England & Wales*)
Tel: 0800 915 7722 / 0870 243 0930 Website: www.lcbp.org.uk

Scottish Community & Householder Renewables Initiative (*Grants - Scotland*)
Website: www.est.org.uk/schri

Energy Efficiency Best Practice in Housing - Good Practice Guide 339
Tel: 0845 120 7799 Downloadable from the GSHPA website – www.gshp.org.uk

International Energy Agency (IEA) Heat Pump Centre – 'Informative Fact Sheet – Closed Loop Ground-Coupled Heat Pumps' – January 2002
Downloadable from the Website: www.heatpumpcentre.org