



Sharing what we know... Sheet : Ground Source Heat Pumps



Ground source heat pumps (GSHP) transfer heat from the ground into space heating inside a building and, in some cases, pre-heat domestic hot water. For every unit of electricity used to pump the heat, 3-4 units of heat are produced.

How it works

Heat pumps work in the same way as refrigerators, but instead of removing heat from a box in our kitchens and expelling it outside, heat pumps use heat from outside to warm our homes. The process has four stages: heat extraction, compression, heat rejection, expansion.

Heat extraction. Heat from the ground is absorbed at low temperatures into a refrigerant fluid inside a loop of pipe (a ground loop) buried underground.
Compression. The refrigerant then passes through a compressor that raises it to a higher temperature.

Heat rejection. This heat contained in the refrigerant is exchanged with cold water which, once heated, is used to heat the home and provide domestic hot water.

Expansion. The cooled ground-loop refrigerant passes back into the ground where it absorbs further energy from the ground in a continuous process, for as long as heating is required. Normally the loop is laid flat or coiled in trenches about two metres deep.

Heat pumps use a wet central heating system, either through underfloor piping or large wall hung radiators, to circulate heat in a home and potentially also a hot water cylinder. They work at lower temperatures over longer periods of time compared with gas boilers. These systems work best in well-insulated and draught-proofed homes, particularly in homes with a high thermal mass.

Costs and savings

A typical GSHP installation costs £14,000 to £19,000, depending on whether the loop is laid vertically or horizontally. Running costs vary depending on the size of the property and insulation.

Existing System to be replaced:	Fuel Bill Savings by replacing the old system (£ per year):	Carbon Dioxide Savings by replacing the old system (tonnes per year):
Average Gas Heating System	£25 – £30	2.5 – 2.7 tonnes/year
Average Electric Heating System	£1,000 – £1,090	20 – 30 tonnes/year
Average Oil Heating System	£20 – £30	3.9 – 4.2 tonnes/year
Average LPG Heating System	£530 – £570	3.1 – 3.9 tonnes/year
Typical Solid Fuel Heating System	£400 – £440	9.9 – 10.6 tonnes/year

<https://energysavingtrust.org.uk/advice/ground-source-heat-pumps/>

A number of financial incentives can help with the cost of this technology. These include the Green Homes Grant Local Authority Delivery scheme and Renewable Heat Incentive

Key considerations

- **Accessibility and outdoor space.** The ground loop can be installed either vertically or horizontally. Space must be allocated to either method. The ground must also be suitable for digging a trench or borehole. In addition, your garden needs to be accessible for the machinery used for installation.
- **Heating system.** GSHP perform well with underfloor heating systems or warm air heating systems. If you have radiators, you may be able to reuse these but some may require upsizing. This is because GSHP operate with lower temperatures than traditional boilers. GSHP efficiency remains constant throughout the year because the ground has a relatively fixed temperature of 10-13°C.
- **Air tightness and ventilation.** It is essential that your home is well insulated and draught proofed in order to minimise heat loss because of the lower operating temperatures. With reduced air leakage, you may need to add mechanical ventilation to your property.
- **Engineering calculations.** The heat pump must be sized correctly so that that a backup supply is not needed, which would significantly reduce efficiency and increase running costs.
- **Disruption.** The installation can take several weeks, however once it is installed it will not affect the functionality or look of your garden.

Walking our Talk...

Eco-retrofit

South Downs Eco Lodge



We installed five boreholes to a depth of 120m. These are linked to the plant room and from there into a wet heating system providing space heating and hot water. This is coupled with a mechanical ventilation and heat recovery (MVHR) system to extract and return heat before it is evacuated from the building. The ground source heat system is integrated with photovoltaic panels on the roof which provide electricity from sunlight. Any electricity excess to demand is used to heat hot water before being returned to the grid.