

GROUND SOURCE HEAT PUMPS

GSHPs are renewable energy heating and hot water technologies that use thermal energy stored in the ground to heat and cool buildings. GSHPs can operate efficiently even in cold climates and can provide significant energy savings over traditional heating and cooling systems.



HOW DOES A GSHP WORK?

It works by extracting heat from the ground during winter and transferring it to the building for space heating. In summer, the process is reversed to provide cooling by extracting heat from the building and transferring it back into the ground.

WHAT ARE THE COMPONENTS OF A GSHP?

A GSHP SYSTEM CONSISTS OF TWO MAIN COMPONENTS:

- **A ground loop:** This is a series of pipes that are buried in the ground. The ground loop circulates a fluid that absorbs or releases heat from the ground.
- **A heat pump unit:** This unit is located inside the building and exchanges heat between the ground loop and the building's heating and cooling system.

KEY BENEFITS OF GROUND SOURCE HEAT PUMPS:

- 1. Energy Efficiency:** GSHPs are highly energy-efficient, offering significant reductions in energy consumption compared to traditional heating and cooling systems. They can achieve a high coefficient of performance (COP) by utilising renewable heat sources.
- 2. Cost Savings:** By utilising the stable ground temperature, GSHPs can help reduce energy bills and provide long-term cost savings. Although the upfront installation costs are higher, the energy savings over time can offset the initial investment.
- 3. Environmental benefits:** Ground Source Heat Pumps have a lower carbon footprint compared to conventional heating and cooling systems. They utilize renewable energy from the ground, reducing reliance on fossil fuels and contributing to reduced greenhouse gas emissions.
- 4. Versatility:** GSHPs can provide both heating and cooling for residential, commercial, and industrial buildings. They can be used in various climates and are suitable for new construction as well as retrofit applications.
- 5. Durability and Low Maintenance:** GSHPs are known for their durability and require minimal maintenance. The ground loop system is typically designed to last for decades, and the components inside the building require routine check-ups and filter replacements.
- 6. Noise Reduction:** GSHPs operate quietly compared to traditional HVAC systems. The main components are located indoors, eliminating the need for noisy outdoor units.

EXAMPLE CALCULATION FROM INVESTING IN GROUND SOURCE HEAT PUMP

Installing a GSHP system for a small-scale business in UK, with an annual energy consumption of 40,000 kWh could lead to significant benefits. Assuming 40% energy savings, the estimated savings would be approximately 16,000 kWh per year. This translates to potential cost savings of around £2,400 per year based on an assumed energy cost of £0.15/kWh.

These estimates highlight the potential economic and environmental benefits of investing in a GSHP system for energy-efficient heating and cooling in the given scenario.

Action 1	Cost Savings (£/year)	kWh Savings	CO2e savings (tCO2e/year)	Capital Cost (£)	Payback Period (years)
Ground Source Heat Pump	£2,400	16,000	3.4	£30,000	12.5

CONSIDERATIONS FOR GROUND SOURCE HEAT PUMP INSTALLATION:

- **Site Suitability:** An adequate site assessment is crucial to determine if the ground conditions and available space are suitable for installing a GSHP system. Factors such as soil type, available land area, and geological characteristics need to be evaluated.
- **Installation Process:** Ground Source Heat Pumps require drilling boreholes or installing horizontal ground loops. The installation process should be carried out by experienced professionals to ensure the correct sizing, loop design, and system configuration.
- **System Sizing:** Sizing of the GSHP system is essential for optimal performance and efficiency. It should be based on the heating and cooling demands of the building, as well as the ground conditions and climate.
- **Regulatory Compliance:** Check local building codes, permits, and regulations related to GSHP installations. Some regions may offer incentives, grants, or tax credits for adopting renewable energy systems like GSHPs.

In addition to the above factors, there are several other things to consider when installing a GSHP, such as:

- **Type of GSHP system:** There are two main types of GSHP systems: horizontal and vertical. Horizontal systems require a large amount of space, while vertical systems require less space but are more expensive to install.
- **Size of the GSHP unit:** The size of the GSHP unit will need to be matched to the size of the building and the heating and cooling load.
- **Efficiency of the GSHP unit:** GSHP units vary in efficiency. It is important to choose a unit with a high COP (coefficient of performance) to maximize energy savings.
- **Warranty:** GSHP units come with a variety of warranties. It is important to choose a unit with a long warranty to protect your investment.

It is important to consult with a qualified GSHP installer to discuss your specific needs and to get an estimate for the cost of installation.