High Up Farm, High Up Lane, Leek, ST13 8SD

Installation of Ground Loop Array for a domestic Ground Source Heat Pump

Principle

This application proposes the installation of a ground loop array to provide the heat source for a Ground Source Heat Pump to be installed in the farmhouse at High Up Farm.

The main farmhouse is currently powered by domestic heating oil (kerosene) to provide heating and hot water, which is a fossil fuel and non-renewable, it has large carbon footprint. Although the house is well insulated, having been built in 2003, the use of heating oil still produces Carbon Dioxide emissions.

A Ground Source Heat Pump is an electrically powered system that provides heating and hot water, using a compressor in a similar way that a fridge does, to compress a coolant liquid to generate heat and transfer cold.

In a fridge the interior is cooled and the 'waste' heat is dissipated from a radiator on the rear of the fridge.

In a GSHP the heat is transferred to a hot water tank to supply heating and hot water to a house, the cold is carried in the coolant liquid through the ground loops in the field, which have a large surface area, enabling the constant heat below the ground to warm the coolant up by a few degrees and the whole process continues. The constant heat below the ground in the field is actually heat from the sun warming the ground, annualised over the year. The source of the heat is therefore solar radiation stored in the ground.

Electricity is used to power the compressor and pumps in a GSHP.

For each kilowatt of **electric** power supplied to run the ground source heat pump unit, around four kilowatts of **heat** energy are produced. This means the heat pump has a "coefficient of performance" (COP) of 4.

Compare this to an electric boiler, which typically has a COP of 1 (1kW of electricity used to generate 1kW of heat). In practice then, a high COP of 4 means the system is 4 times more efficient and the end user benefits from significantly reduced carbon emissions compared to traditional heating systems.

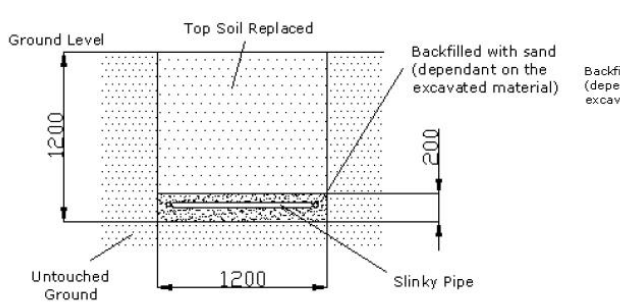
Switching from an oil boiler to a GSHP will therefore save all of the carbon dioxide emissions associated with the use of heating oil as a fossil fuel, and by purchasing electricity from a 100% renewable tariff the electricity that is used is also from a renewable source.

The chosen supplier of the GSHP units and pipework for the system is Kensa Heat Pumps, a UK company. The Heat Pump units are designed and manufactured in the UK and post-installation servicing and follow up support is also provided by the company.

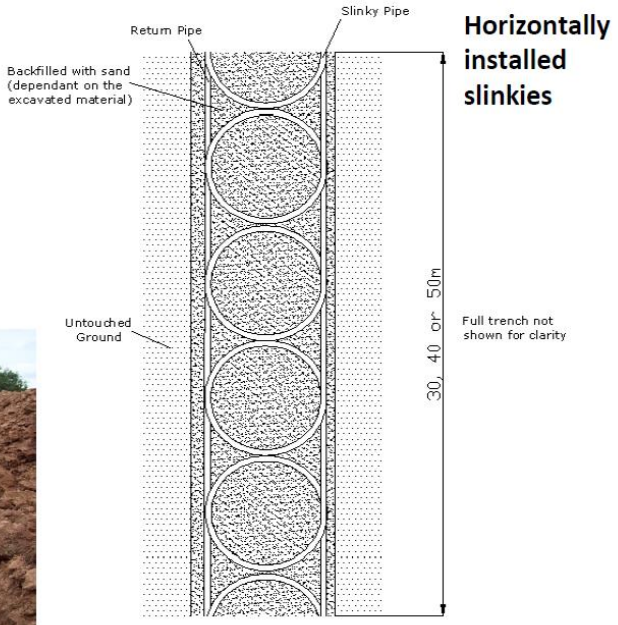
Infrastructure

The actual infrastructure required for this project consists of the below-ground installation of 4 x "slinky" pipes each in a 40m trench in the field, to absorb heat from the ground, all connected to a below-ground manifold with a feed and return connection going to a Ground Source Heat Pump unit which is located in the outbuilding granted planning permission under SMD/2016/0691 and now constructed. This building was originally intended to house a biomass boiler system (also a renewable energy technology) however that system would have an associated air pollution in the form of fine particulates. It was therefore decided that given the space available in the field for the ground loops, a Ground Source Heat Pump system would actually represent a more environmentally friendly solution and also remove the requirement for regular deliveries of biomass.

Kensa recommends the use of slinky ground arrays as they are the most cost effective way of installing ground arrays due to the fact that they reduce the amount of digging required. They can be installed on their edge vertically or laid flat in the bottom of a trench horizontally.







The field surface will be reinstated immediately after installation of the plastic pipes and re-seeded with a pasture seed mix.

The installation of the ground loop array in the field is considered to be an engineering operation that requires planning permission. If the ground loops could have been located entirely within the domestic curtilage the installation would be 'permitted development' and not require planning permission.

The 4 'slinkies' all connect together at a manifold which is also installed below ground, and has typical Inspection Chamber lid visible on the surface ("manhole cover") see image below:



From the manifold, 2 underground pipes connect to the GSHP Unit located inside the domestic outbuilding, which also houses a large hot water cylinder and Buffer Tank which provides heating by connecting to the existing underfloor heating system (installed at the time the farmhouse was built) and hot water by connecting to the existing pipes from the oil boiler system (that will be removed).

The GSHP unit for the farmhouse has been specified as a 15kW unit, this unit will be inside the domestic outbuilding so this is not relevant to the planning application, but is included for information:



Evo Heat Pump: In Brief

- 15% gain in efficiency* minimises running costs & maximises RHI income.
- ErP A++ rated, with SCOPs to 4.7 at 35°C.
- 60°C domestic hot water**
- Pioneering Genesis System Manager.
- Industry-leading noise reduction.
- Ease of installation.
- Dimensions (H x W x L (mm)): 1145 x 600 x 575.
- Models: 7kW, 9kW, 13kW, 17kW single phase and 15kW three phase.



Conclusion

It is respectfully requested that planning permission is granted for the installation of the ground loop array in the field to serve a Ground Source Heat Pump in the domestic outbuilding at High Up Farm.

The proposed renewable energy system will replace the existing oil-fired boiler system serving the farmhouse and provide a sustainable heating and hot water solution, removing the carbon dioxide emissions associated with the use of heating oil.

If any further information or clarification is required, please contact:

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