

By Tim Pullen

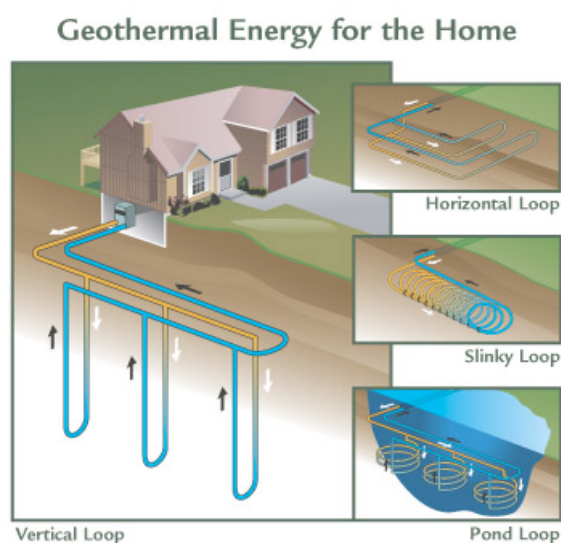
Heat Pumps

How does it work?

There are 3 kinds of heat pumps:

- Air source
- Ground source
- Water source

The operating principle of all three is exactly the same as a domestic refrigerator. Heat is extracted from the source (air, ground or water) using compression and expansion technology and in effect amplified to be usable to heat the home.



Air source are getting big press at the moment as they are considerably cheaper and easier to install than ground or water source and efficiency levels have risen so that they are becoming more economical to run.

Ground source use an array of pipes buried to a depth of 1.2m or more in the soil, where the soil is a constant 7°C to 10°C, unaffected by the weather going on at ground level. Alternatively a series of boreholes can be drilled but generally a horizontal ground array is less expensive. Brine or a refrigerant is pumped through the pipes, which is warmed by the surrounding soil. The advantage these have over air source is that the heat source (the soil) is a relatively constant temperature, and a higher temperature than air in winter. Therefore the efficiency is higher.

Water source use an open-loop system, or 2 open pipes. One extracts water from the source and the other returns the water to the source. These are generally most expensive to install but efficiency can be 25% higher than ground source and 50% better than air source.

Care needs to be exercised with air source heat pumps as the temperature of the heat source (the air) varies greatly through out the year. And consequently the efficiency of the heat pump will vary.

How well do they work?

The heat pump is operated by electricity and broadly the best you can expect is to get 4 times as much heat out as the electricity you put in. So an 8kW heat pump (a common size for a typical house) will require 2kW of electricity to run it. This is known as the Coefficient of Performance (COP). A COP of 4 is fairly standard and a heat pump's COP rating is generally given for its most efficient operating conditions – often quoted as “annual average COP”.

Heat pumps are best suited to running underfloor heating as this needs a far lower water temperature than other forms of heating and the heat pump will be running at its most efficient. They do not deal well with domestic hot water or radiator heating because the COP falls as the temperature of the output water rises.

Generally the COP as advertised assumes a source temperature (i.e. the temperature of the air, ground or water the heat is being extracted from) and a demand temperature (i.e. the temperature of the water you want). The closer together those two temperatures are the higher the COP.

The advertised COP is generally based on a source temperature of 7°C to 10°C, with a demand temperature of 35°C to 40°C. If you want your heat pump to deliver hot water at 65°C then you will get a different, and significantly lower, COP.

One way around this problem that the manufacturers have found is to include an electric heater in the heat pump. The COP figure only considers the energy consumed by the heat pump, not that consumed by the electric heater. So they can truthfully advertise a COP of, say, 4 and output temperature of 65°C. But the reality of your electricity bill could tell a very different story.

To be clear, WeatherWorks are big fans of heat pumps, but we don't necessarily believe everything the suppliers tell us. Treat with caution anyone who tells you that their heat pump will deliver water at 65°C and maintain a COP of 4 or more.

Can I install a ground-source heat-pump for my home?

There are really only 2 factors to consider: the heating distribution system, which ideally will be underfloor heating and the amount of space in the garden. Broadly you will need 50 sq metres per 1kW output - so a 10kW heat pump will need 500 sq m of garden space. Heat pumps can run on vertical arrays and/or boreholes but this tends to be an expensive option and used only in special circumstances.

Are grants available?

The Low Carbon Build Program has ended and grants are no longer available from central Government. Some local authorities are still offering grants for some technologies (generally not biomass, though) and some suppliers are offering “grants”. Beware of these as a cost comparison with a supplier NOT offering a grant may bring a surprising result! And they all attract VAT at 5%.