Heat Pumps

Potential for the High Weald

There is great potential across the High Weald for utilising heat pumps, particularly as they have no impact on the landscape. Ground source may be particularly suitable for new dwellings or for buiding refurbishments. Air source heat pumps can be fitted to most buildings with little visual impact. With many properties having wells there is also good potential for these to be utilised with Water source heat pumps.

However care needs to be taken if considering horizontal Ground source systems to ensure that there is no damage to archaeological features or important habitats.

Introduction

Heat pumps use the same technology as refrigerators but in reverse, moving heat from one place to another, and transferring it at a higher temperature. As in a fridge, heat is removed from the contents (the *source)* and discharged elsewhere (the *sink)*.

Heat pumps can provide space heating, cooling and water heating.

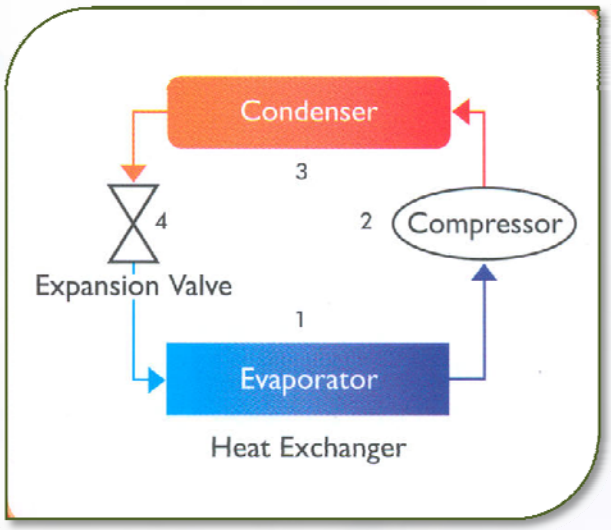
In heating applications, heat is removed from ambient air (air source heat pump), water (water source heat pump) or soil (ground source heat pump) and delivered to where it is needed, for instance to provide domestic heating via a wet (radiator or under floor) heating system. In cooling applications, the reverse happens and heat is removed, to be discharged to the ambient air, water or soil.

Heat pumps are not truly renewable as the working fluid is driven around the system by an electrically powered pump, to be 100% renewable the pump would need to be connected to a renewable energy supply.

Heat Pump efficiencies are normally quoted as the **Coefficient of Performance** of system; they are typically in the range 3 to 5, depending on the source (ground air or water) temperature, temperature range and constancy.

In others words, extracting heating from renewable sources requires just 1kw of electrical input in order to generate 3kw to 5kw of heating output. Therefore they are 3 to 5 times more efficient than a fossil fuel boiler, even in the lowest winter temperature (*source: BSRIA report 18733/3 edition)*

How do they work?



- Working fluid (usually water and antifreeze) in the evaporator is colder than the heat source, therefore heat moves across causing refrigerant to evaporate.
- The vapour moves to the compressor, where it reaches a higher temp and pressure.
- The hot vapour enters a condenser and gives off heat at a useable temperature as it condenses – this is transferred to the heating system and stored in a buffer tank.
- The working fluid then moves to the expansion valve, where it drops in pressure and temperature and returns to the evaporator.

What is a Ground Source Heat Pump?

Ground source heat pumps (GSHP) currently offer the greatest year round energy efficiency due to the steady ground temperature below our feet, which in the UK at a depth of about 2m maintains a constant temperature of 9 – 12C degrees year round. GSHP can transfer this heat from the ground into a building to provide space heating and pre heated domestic water (the water is heated indirectly).

This constant ground temperature gives a good, steady coefficient of performance (COP), with typically 1 unit of electricity creating 4-5 units of heat.

A typical well designed GSHP system can provide 90-100% of a households heating requirements, with any gap usually made up by an immersion on the water tank.

The amount of solar radiation landing at any point on the Earths surface depends on latitude and climate – not soil type, although loose dry soil traps air and is less effective at heat transfer than moist packed soils.

GSHP capture heat from the ground by collectors, water and coolant filled pipes, which are either sunk into boreholes(vertical systems) or coiled (into slinkies) and buried in quite shallow trenches (horizontal systems), 1-1.5m deep.

On average in the UK 10m of trench will provide 1kw of heat and a 70m borehole will provide between 3 and 5kW of heat delivered from the heat pump.

What is an Air Source Heat Pump?

Air source heat pumps (ASHP) capture heat energy from the surrounding air. These systems are easier to retrofit than GSHP and are installed above ground level. However air does not store heat as effectively or at as a constant a temperature as the ground, therefore offering lower efficiences, with a typical system having a COP of 3, and providing around 70% of a buidings annual heat requirement.

They are however cheaper and easier to install than GSHP.

What is a Water Source Heat Pump?

Water source heat pumps (WSHP) gather heat from a body of water such as a lake, pond or river although aquifers or wells offer a more practical source. Water gives up its heat quicker than soil which its advantageous to the sytem efficiences, with a typical system having a COP of 4-5.

If I have an existing well can I use that?

Existing wells on properties offer good potential for WSHP as the water temperature in wells tends to be fairly consistent, this has a disadvantage in the summer as the ground is often warming than well water but in the winter, when most heat is required, the water is warmer than the ground. This means that the system can run more efficiently in the winter. Extracting heat from a well also means that ground works are kept to a minimum.

However, there are also some disadvantages to consider. Extracting water from the ground, in some cases, will need a license. This can be checked with your local council. There is also a significant amount of energy required to pump water from a deep well to the heat exchanger in the heat pump. Another precaution is that the well needs to have a rapid replenishment rate. This will need to be tested.

What about costs and maintenance?

Costs of instalation vary greatly and it is important that you speak to an expert installer.

However, a typical system to heat a 3 bedroom house would require an 8kW system, which would cost in the range of £800 - £1400 per kW of peak output with trench systems being at the lower end of the range. Typical installed cost of an 8kW system would be between £8000 and £14000 plus the cost of the distribution system (ideally underfloor heating).

An equivelant air source system would cost between £500 - £700 per peak kW output, but has a lower COP and cannot provide year round heating requirements meaning more electricity or alternative heating source will be required.

The cost of a water source heat pump varies greatly depending on the water source, but can be cheaper and as efficient as a ground system if an existing well feature is used.

Savings per year depend on the price of the fossil equivalents, which are rapidly increasing in price, although on average replacing oil, LPG or electricity will save 3 times the amount as replacing gas. Typically as of June 2008 this would equate to annual savings of between £600 and £750 for oil, LPG or electricity and £200-£300 for gas.

If using grid electricity to provide the power for the pump and compressor then a ‘cheap’ night time tariff is best utilised.

Very little maintenance is required although air source pumps may require more regular inspection (and may have a shorter lifespan) due to the exposed parts outside of a building.

SWOT analysis

A SWOT Analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture.

STRENGTHS	WEAKNESSES
• Very good paybacks achieved • Can provide space and water heating • There is a heat pump to fit most circumstances and budgets • 3-5 times more efficient than a conventional boiler • A GSHP can provide upto 100% of a buildings heating requirement – therefore no back up system required. • No planning required in most cases. • High COP in well insulated buildings	• Not 100% renewable as requires electricity • GSHP not easy to retrofit • Requires a 'wet' heating system ideally under floor heating • An ASHP may provide only 70% of a buildings heating requirement and therefore requires a back up system
OPPORTUNITIES	**THREATS**
• GSHP ideal for new buildings / refurbishments • ASHP can be easily retrofitted to existing heating systems • Existing wells can be utilised using a WSHP, although abstraction licenses may be required	• Reliant on grid electricity (unless attached to another renewable technology)

Planning Issues

Planning within the High Weald AONB

The High Weald Unit's role is to interpret government policy in the light of the AONB Management Plan (http://www.highweald.org/text.asp?PageId=254) and to provide advice to local authorities and others regarding planning applications. The Unit also responds to consultations regarding new planning policy at national, regional and local level, again based on the Components of Natural Beauty identified by the Management Plan. The Local Council is of course the responsible body as regards the exercise of planning powers.

Planning guidance (see below) actively encourages renewable development but makes allowances for designated areas such as the High Weald AONB:

In sites with nationally recognised designations planning permission for renewable projects should only be granted where it can be demonstrated that the objectives of designation in the area will not

be compromised by the development, and any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by the environmental, social and economic benefits.

Planning permission

Installing a ground source or water source heat pump system does not usually need planning permission and should fall within permitted development rights.

Air source heat pumps will become permitted development as soon as standards and safeguards have been established to deal with noise.

If you live in a listed building or a conservation area, however, you should contact your council to check on local policy.

Building Regulation

Installing a ground source heat pump will not be captured by the building regulations. But building regulations will normally apply to an installing an air source heat pump.

It is advisable to contact an engineer who can provide the necessary advice.

Contacts

District or Borough Council Planning Departments for the High Weald area:

Horsham: **01403 215187**	Crawley: **01293 438787**	Mid Sussex: **01444 458166** **(main switchboard)**
Tandridge: **01883 732859**	**Wealden:** 01892 653311 (main switchboard)	**Rother:** 01424 787600
Hastings: **01424 783300**	**Sevenoaks:** 01732 227000 (main switchboard)	**Tonbridge & Malling:** 01732 844522 (main switchboard)
Tunbridge Wells: **01892 526121** **(main switchboard)**	**Ashford:** 01233 637311 (main switchboard)	

Further Information

Planning Policy Statement 22: Renewable Energy –
http://www.communities.gov.uk/publications/planningandbuilding/pps22

Planning for Renewable Energy: A Companion Guide to PPS22 -
http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable

High Weald Management Plan - http://www.highweald.org/text.asp?PageId=254

Useful contacts

Ground Source Heat Pump Association – www.nef.org.uk/gshp

The UK Heat Pump Network – www.heatpumpnet.org.uk

The IEA Heat Pump Centre – www.heatpumpcentre.org.uk

Centre for alternative technology – www.cat.org.uk

Renewable energy association – www.r-e-a.net

Carbon Trust – www.carbontrust.co.uk

Energy Savings trust – www.est.org.uk

Potential Grant sources

Low Carbon Buildings programme – www.lowcarbonbuildings.co.uk

England Rural Development Programme – www.seeda.co.uk

WARR partnership (LEADER) – www.warrpartnership.org.uk

High Weald AONB (Sustainable Development Fund) – www.highweald.org

Carbon Trust (Interest Free Loans) – www.carbontrust.org.uk

Enhanced Capital Allowance Scheme – www.eca.gov.uk