Heat Pumps

BPEX Knowledge Transfer

Application: hot water

There are several types of heat pump. All use the same basic principle of extracting heat from an external source and concentrating it to obtain a higher temperature, usually then applied to water for domestic heating and hot water.

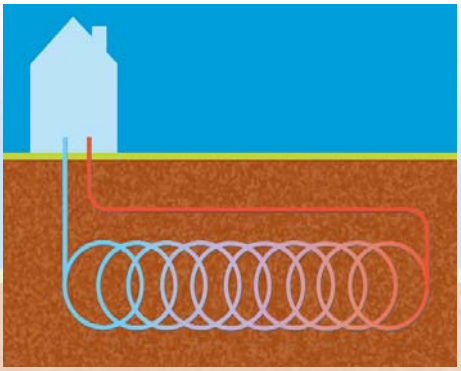
Heat pumps work in much the same way as a domestic fridge but in reverse. In a fridge the heat is transported from inside to outside, while a heat pump takes heat stored in the air or below ground and transports it via the heating system to the house interior.

Electricity is required to power a compressor and pump that drives fluid around an induction loop, but the amount of heat energy delivered is several times more than the electrical energy consumed. The ratio of the output to the input energy is called the Coefficient of Performance (COP).

Average COP over the year, known as seasonal efficiency, is around 3 - 4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 3 - 4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then a range of energy suppliers should be consulted to benefit from the lowest running costs, for example by choosing an Economy 10 or Economy 7 tariff.

Ground source heat pumps use a buried ground loop which transfers heat from the ground into a building to provide heating eg for hot water creep mats.

Thermalia ground source pump and compressor unit



Ground Source

Approximate costs and output:

Capacity:		5.4 kW
COP rating:		4.5
Capital cost:	~	£10,000 including supply, installation, groundworks
Annual output:		19,710 kWh
Annualised payback:	~	13 years (at £0.069 per kWh achieved by an oil-fired boiler, not including fuel inflation)

Grant funding or the proposed Renewable Heat Incentives should greatly reduce payback.

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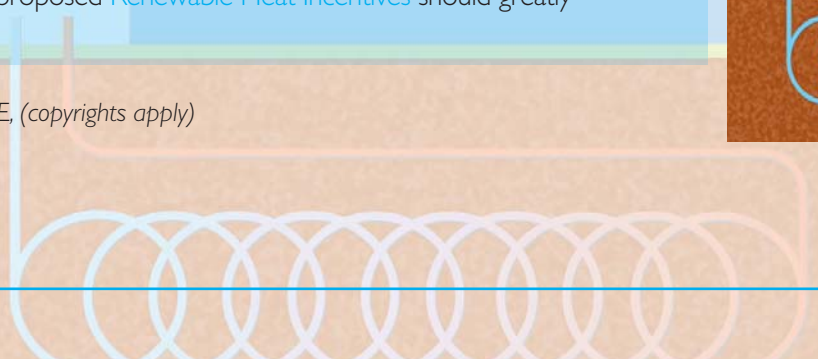

Heat Pumps

Ground Source *(continued)*

The ground loop is comprised of lengths of pipe buried in the ground, either in a borehole or a horizontal trench typically 1–4m below ground. The pipe is usually a closed circuit and is filled with a mixture of water and antifreeze that is pumped around the pipe absorbing heat from the ground which is multiplied and transferred inside.

Manure stores and dunging passages are a good source from which to draw heat as long as any induction loop in contact with manure or slurry is made from non-corrosive material and is not disturbed by agitators or emptying systems.

Ground source heat pumps are most efficient at lower air temperatures due to the temperatures below ground remaining constant while atmospheric temperatures drop. Therefore they are most suited to heating creep mats or underfloor systems inside well insulated buildings.

Air Source

Approximate costs and output:

Capacity:		10.5 kW
COP rating		3.8
Capital cost:	~	£10,000 including supply and installation
Annual output:		38,325 kWh
Annualised payback:	~	8 years (at £0.069 per kWh achieved by an oilfired boiler, not including fuel inflation)

Grant funding or the proposed Renewable Heat Incentives should greatly reduce payback.

As well as ground source heat pumps, air source (and water source) heat pumps are also available. These work on the same principle but extract heat from the air using a fan that passes the air through an induction loop assembly compacted in an external wall unit.

Warm exhaust air from building ventilation is a good source of heat. However, air from livestock buildings is very corrosive so the loops and foils within the pump must be made from non-corrosive materials.

Air source heat pumps can also be used in reverse to aid summer cooling.

Belaria air source pump, fan and induction unit

Grant funding

The Rural Development Programme funds larger renewable energy projects via the Regional Development Agencies:

http://www.defra.gov.uk/rural/rdpe/rda.htm

Funding may also be available from the next round of the Bio Energy Capital Grants Scheme:

http://www.bioenergycapitalgrants.org.uk

Micro generation may be funded via the Low Carbon Buildings Programme:

www.lowcarbonbuildings.org.uk

Grant funding may forfeit support from tariffs, so check with the funding body before accepting a grant.

Tax relief

The Enhanced Capital Allowances scheme provides 100% first year tax relief on capital expended on many renewable technologies.

http://www.carbontrust.co.uk/energy/takingaction/eca.htm

Renewable Heat Incentive

Tariffs for renewable heat produced on-site are also being proposed under the Renewable Heat Incentive, even though such heat cannot be exported. The incentive is under consultation until April 2011 when figures will be confirmed. Progress can be monitored at:
http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/renewable_heat/incentive/incentive.aspx

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