Business Guide Factsheets
Ref. No 89

Heat Pumps

Heat pumps are an efficient way to heat buildings, and are widely used in Scandinavia. They are about three times more efficient than electric storage heaters. Even at low temperatures, air, ground and water can contain useful heat.

Summary

- A heat pump moves heat from one place to another. Naturally, heat flows from places with a higher temperature to those with a lower temperature. Heat pumps, however, are able to reverse the natural flow of heat, using a relatively small amount of drive energy.

- Heat pumps work on the same principle as a fridge. Whereas a fridge moves heat from the inside to the outside of the fridge, heat pumps transfer heat from a natural heat source to the inside of a building. By applying a little more energy, a heat pump can raise the temperature of this heat energy to the level required.

- There are three heat sources:

  Ground source heat pumps (GSHP) get their heat from ground below the frost line.
  Air source heat pumps (ASHP) get their heat from the outdoor air.
  Water source heat pumps (WSHP) get their heat from water, usually groundwater.

Site requirements

GSHPs are the commonest type. Typically, a cold fluid at about 5°C is circulated around a network of plastic pipe buried outside in the ground. As the fluid passes through the pipe it absorbs heat energy from the surrounding earth. The fluid returns to the heat pump slightly warmer than it left. The heat pump upgrades the heat to a higher level of 40 to 50°C to provide heating. GSHPs require coils or loops to be buried in the ground, either in horizontal trenches (cheaper option) or vertical boreholes (where space is a limiting factor).

Electric ASHPs use the difference between outdoor and indoor air temperatures to heat buildings. Even at very low temperatures, a heat pump is able to extract heat from outside air. The outdoor unit of an ASHP contains coils filled with refrigerant, which absorb heat from the outside air. The refrigerant is much cooler than the outside air and is therefore able to absorb heat.

An ASHP typically runs at slightly lower efficiency than a ground source heat pump. However, their major advantage is the fact that they do not require any outside space. An ASHP is simply attached to the outside of the building. Compared to GSHPs, this significantly reduces the installation costs.

WSHPs require a source of water, usually a well or borehole. If a suitable source is available they are cheaper than GSHPs and work more effectively. The principle is the same as for a ground source. A sealed loop of pipe containing a water/anti-freeze mixture that circulates through it, transfers heat from the water body to a heat exchanger in the heat pump unit.

Planning requirements

Seek advice of the local authority planning department at an early stage. Planning permission may be required as, excepting air source pumps, the process requires "engineering operations" to be undertaken.

Archaeology:
Works undertaken will require the excavation of trenches or deep boreholes and it may be that archaeological remains exist on the development site. Contact your local authority's planning department at an early stage.

Borehole:
As consent may be required from SEPA, contact your local office at an early stage. Care must be exercised to prevent contamination of the borehole itself and of the groundwater.

Specification

Heat pumps operate best when connected to a low-temperature distribution system such as under-floor heating or low-temperature radiators. Conventional radiators require water at a higher temperature (~60^{o}C), and heat pumps are not recommended for hot water e.g. for showers etc. It is also essential that the building being heated be very well insulated.

The system needs to properly sized to be efficient. This requires information about the seasonal heating load e.g. energy bills over a whole year. A typical system might be 7-8kW, though this could be higher for larger buildings or exceptional heating demands.

Capital & Installation costs

System type	Ground coil costs	Heat pump costs	Total system costs
	(£/kW)	(£/kW)	(£/kW)
Horizontal	250-350	350-650	600-1000
Vertical	450-600	350-650	800-1250

A typical 7kW system may cost between £5000 - £9000 installed. Installing underfloor heating will add to the costs, and additional insulation will usually be necessary. Water source heat pumps will be cheaper to install, provided that no new boreholes or pipes are necessary.

Operations & Maintenance Costs

Once the system is installed the maintenance requirement is low and the costs are correspondingly low.

Savings

Once installed, heat pumps have low running costs. They are most cost-effective where they replace electric or oil heating, and where the building is very well insulated.

Sources of Funding

Scottish Communities and Householder's Renewable Initiative:
The Energy Savings Trust (EST) and Highlands & Islands Community Energy Company run the Scottish Communities and Householder's Renewable Initiative (SCHRI). Householders can receive up to 30 per cent of the total cost of their project up to a limit of £4,000. Community schemes can receive a maximum grant of £10,000 for a feasibility study and a maximum grant of £100,000 for a capital project. Contact: www.est.org.uk/schri/ or call 0800 138 8858.

Loan Action Scotland:
Loan Action Scotland is funded by the Scottish Executive through the Scottish Energy Efficiency Office in support of Action Energy. Loans may be advanced against a range of energy saving measures to enable companies to take action to reduce their energy bills.

The scheme provides interest free loans of £5,000 to £50,000. Loans can have a repayment period of up to five years. The loans are available to companies based in Scotland, with up to 250 employees. Companies must be able to demonstrate that the actions proposed will deliver the energy efficiency benefits claimed. See: www.energy-efficiency.org/howto/help/loan/index.html

Tax Incentive

Enhanced capital allowances (ECA) Scheme:
The aim is to encourage businesses to invest in low carbon technologies, and so reduce UK carbon emissions. Heat pumps are included as energy saving plant and machinery. The ECA scheme is an integral part of the Climate Change Levy Programme, and was introduced by the Finance Act of 2001. Sponsoring organisations are the Treasury, DEFRA and The Carbon Trust.

Enhanced Capital Allowances (ECAs) enable a business to claim 100% first-year capital allowances on their spending on qualifying plant and machinery. All businesses that are subject to UK taxation are eligible, regardless of size, industrial or commercial sector or location.
See: http://www.hmrc.gov.uk/capital_allowances/eca-guidance-pt1.htm

Advice

Energy Savings Trust (EST) business advisers can help small to medium sized businesses make best use of the many energy and resource efficiency schemes provided by the Trust and other government funded organisations. They can also help access tax incentives and interest free loans to help finance improvements.

EST advisers can help you access:

- Free and impartial information and advice.
- Free on-site energy, waste and water audits.
- Practical guides and best practice literature.
- Low carbon, clean fuel and renewable technologies.
- Relevant training and seminars.

Contact: **0845 458 5040**