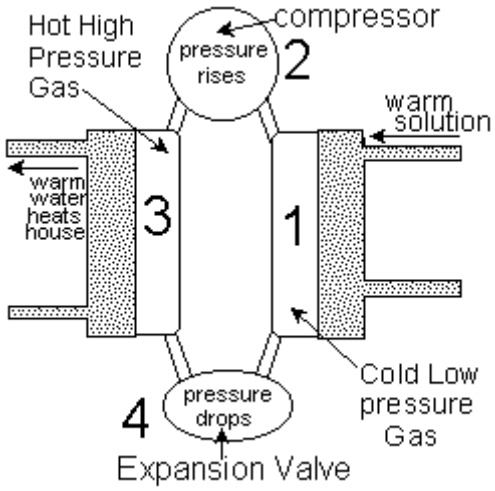
Air Source Heat Pumps

Heat pumps can be used to provide heat and cooling to buildings or rooms. Using this technology it is possible to recover heat from most sources (even those that have what appear to be very low temperatures) and pump that heat to another location e.g. removing heat from inside your fridge and dissipating it through the heat-exchanger grill at the back.

How do heat pumps work?

The vapour compression cycle (electric) heat pump is a closed system around which a refrigerant flows. A heat pump works by a fluid (gas or liquid) being passed through coils or matrix of the source, i.e. water, the ground or air (1). As this fluid is a couple of degrees cooler than the source, it will gradually warm up. The slightly warmer fluid is then passed through an evaporator and this slight temperature increase is transferred to a refrigerant in the internal system. The refrigerant boils at a lower temperature (around -40°C) so turns into a gas. It is then drawn into a compressor which increases the pressure and the temperature of the gas (2). In the condenser, the heat is then transferred to heating and water system (3). With the heat energy gone the refrigerant turns back into a liquid and passes through the expansion valve, reducing the temperature and pressure (4).

Because of their high efficiency, heat pumps use around a third less electricity for heating than other forms of electrical heating. This, in-turn, means two thirds less carbon dioxide emissions. But, unlike oil or gas, electrically-driven heat pumps can be made carbon dioxide-free by the purchase of electricity via a *green tariff* (See advice sheet No1) or the generation of electricity on-site by a renewable technology such as wind or sun.



Air-source systems

Air source heat pumps (ASHPs) are suited to domestic properties where ground source heat pumps (GSHP) are not suitable. ASPHs are designed to work effectively at ambient temperatures and can even extract heat from air at temperatures of minus 15C. They can even provide cooling in the summer. There are two basic types: ‘air-to-air’ and ‘air to water’. Air-to-air systems have an external unit which extracts low-grade heat from the air and an internal unit which circulates the warmer air by convection. Air-to-water systems have a similar external unit but the heat is transmitted within the home by a conventional wet central heating system

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Cornwall Energy Efficiency Advice Centre, South Crofty House, 1 South Crofty, Tolvaddon Energy Park, Camborne, Cornwall, TR14 0HX.
Telephone - Advice: 0800 512012. Office: 01209 614975

or underfloor heating. Typically, a 3kW unit will use 1kW of electricity to provide 3kW of heat.

Grants

At the moment the Low Carbon Buildings Programme does not fund air-source heat pumps.

Costs for typical UK house heating

The initial purchase costs of an air source heat pump system will be less than that for a conventional oil or gas fired boiler. Running costs are low since for every 3kW of heat provided, a heat pump will consume around 1kW of electricity. Costs for more conventional fuels are set to rise in the future. The cost of a heat pump system will vary according to the size and energy efficiency of the property but a typical domestic-sized air-source system might be expected to cost in the region of £1,600 to £2000 for a 3kW 'air-to-air' system and £3,800 for an 'air-to-water' system and upwards according to size. VAT is payable at 5% not 17.5%.

Size of System

The better insulated your house, the smaller the pump required - and the less money it will cost. The heating requirement for most UK homes is around 6 to 8 kW. A normal-sized home which obtained building regulations approval after April 1st 2002 should only require around 4-5 kW.

Heat pump installation

Most heat pumps are easier to install than gas or oil boilers. Installation time is usually about a half a day, with the minimum of disruption.

Domestic Hot Water (DHW)

It is not usual to supply domestic hot water with an 'air-to-air' heat pump but is more usual with the 'air-to-water' systems.

Underfloor, radiators or air heating

Existing radiators can be used with a heat pump system but it is not ideal. The maximum flow temperature that most pumps provide is generally 50°C and so some rooms may need larger radiators than with a fossil fuel boiler. If you are planning to use radiators then you will need to select a pump with a higher output than that recommended for underfloor heating.
Air-to-air is popular in North America and Scandinavia, and can be used effectively in the UK, especially if cooling is required.

Cooling

Being able to cool a building as well as heat it is one of the major assets of an air source heat pump. The additional installation costs are relatively low. It is possible to provide limited cooling using an underfloor heating system provided the piping is laid with double the density and a control system is installed to take account of the possibility of condensation. This method of cooling is usually regarded as unsuitable for houses because the floor area is too small and the response time too slow. We would also recommend the use of a buffer tank (around £450) if you are considering cooling with a floor. Cooling with radiators is not possible. Cooling with air using fan coils is ideal, and there are some hybrid systems which use underfloor heating in the winter and fan

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coil cooling in the summer connected to the same heat pump.

Buffer Tanks

A purpose-built buffer tank allows for a much wider range of temperatures to be achieved. Buffer tanks also prevent short cycling problems during periods of low heating or cooling demand - perhaps when only a small part of a building needs to be heated or cooled.

Environmental and energy efficiency benefits

Heat pumps are a highly energy efficient method of heating buildings in the UK. There is generally no regular servicing requirement but occasional maintenance may be required. There are no local CO_2 emissions, no flammable fuels or tanks, no flue, no pilot light and no toxic exhaust gases. If electricity to drive the pump is purchased through a green tariff (See information sheet 1 –*Green Electricity*) your energy required for space heating should effectively be CO_2 emission-free.

Alternative Heat Sources

Air is free and widely available, and it is the most common heat source for heat pumps. Air source heat pumps, however, achieve on average 10 to 30% lower seasonal performance factor (SPF) than water/ground-source heat pumps. This is mainly due to the rapid fall in capacity and performance with decreasing outdoor temperature, the relatively high temperature difference in the evaporator and the energy needed for defrosting the evaporator and to operate the fans.

In mild and humid climates, frost will accumulate on the evaporator surface in the temperature range 0 to 6°C, leading to reduced capacity and performance of the heat pump system. Coil defrosting is achieved by reversing the heat pump cycle or by other, less energy-efficient means. Energy consumption increases and the overall coefficient of performance (COP) of the heat pump drops with increasing de-frost frequency. Using demand de-frost control rather than time control can significantly improve overall efficiencies.
There is the possibility of corrosion of the ASHP when in close proximity to the sea so some manufacturers require the ASHP to be at least 1Km away from the coast.

Exhaust (ventilation) air is a common heat source for heat pumps in residential and commercial buildings. The heat pump recovers heat from the ventilation air, and provides water and/or space heating. Continuous operation of the ventilation system is required during the heating season or throughout the year. Some units are also designed to utilise both exhaust air and ambient air. For large buildings exhaust air heat pumps are often used in combination with air-to-air heat recovery units.

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More Information

For air source heat pumps, the government has indicated to Parliament that it will require that neighbours are not exposed to noise levels exceeding 45 decibels. This limit will be reviewed after two years.

Permitted development rights

In England, changes to permitted development rights for renewable technologies introduced on 6th April 2008 have lifted the requirements for planning permission for most microgeneration technologies but as yet this is NOT applicable to ASHPs.

Installers

It is advised that you seek more than one quote from an installer to achieve the best price. Some installers located in Cornwall are:

Company	***Telephone***	***Website***
Capture Energy Ltd	01209 716861	www.capture-energy.co.uk
ECO Heat Pumps	01872 300200	www.ecoheatpumps.co.uk
Earth Energy	01326 310650	www.earthenergy.co.uk
Kensa Heat Pumps	01872 862140	www.kensaengineering.com

Other installers are:

Company	***Telephone***	***Website***
Genvex	0845 260 0123	http://www.genvex.co.uk/genvex-air.asp
Climatherm	0845 257 8950	http://www.climatherm.co.uk/index.htm
British ECO Energy	0845 257 0041	http://www.britishecoenergy.com/page.aspx?id=20
Microgeneration	0845 4348084	www.microgeneration.com
Calorex	01621 856611	http://www.calorex.com/
Dragon DCS (air-to-air) Newquay	08707 669529	http://www.dragondcs.com/air_source_heat_pump_unit.html

We advise that you obtain at least 2 comparable written quotes from different installers and check the VAT discount for renewable technologies has been applied. For more information on VAT discounts, please see: http://customs.hmrc.gov.uk

Other Information

Energy Saving Trust		www.energysavingtrust.org.uk
Cornwall Energy Efficiency Advice Centre	0800 512012	www.cep.org.uk

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