# AIR SOURCE HEAT PUMPS (ASHP)

*Information Service, Centre for Alternative Technology, Machynlleth, Powys, SY20 9AZ.*
*Tel: 0845 3308373 or 01654 705989 Fax: 01654 702782 e-mail: info@cat.org.uk*
*Web site: www.cat.org.uk/information*

**Introduction**

An air-source heat pump (ASHP) is the opposite of an air-conditioning unit. Instead of taking heat from a building and 'pumping' it outside, it takes heat from the outside air and uses it to heat a house.

**Will it reduce my carbon emissions?**

Heat pumps use electricity, and in the UK most of our electricity is generated by fossil fuel or nuclear power stations. In addition to carbon dioxide ($CO_2$) emissions, these power stations give off other pollutants. Even with a well-specified heat pump, $CO_2$ savings over the best gas or oil boiler can be small. However, as more renewable electricity generation (such as wind power) is added to the UK grid, emissions should reduce. The key thing is to maximise the efficiency of the heat pump - to find out how, read on.

**How much will an ASHP cost?**

The installation cost of an ASHP should be less than a ground-source heat pump, as boreholes or trenches are not needed. However, running costs are likely to be higher, as air is a poorer heat source. Installation costs vary depending on the size of your house and how well-insulated it is, but will be several thousand pounds. The best thing to do is get actual quotes from a few potential installers to compare.

Running costs also depend on how well-insulated your house is, and if a backup is needed (especially for hot water). To make the heat pump really effective you'll want a low temperature heating system, like underfloor heating (as explained below). This is simple to specify for a new build, but can be pricey for existing homes – the likely cost is £2,000. Existing homes will also need insulation their levels maximised.

See our sheet on the proposed Renewable Heat Incentive (RHI) to see how this will affect the economics of heat pumps.

**How can I compare heat pumps?**

Efficiency is measured with the 'coefficient of performance' (COP). When operating with a COP of 3, a heat pump produces 3 units of heat energy for each unit of electricity used. The COP will reduce as the gap between the source and delivery temperatures increases. The delivery temperature is that required by central heating: underfloor heating can run at 35°C, large radiators need about 50°C, and standard radiators run at about 75°C.

For ASHPs, the COP gets worse as outdoor temperatures drop. The ASHP will then use more electricity to keep the house warm. Properly installed ground source heat pumps don't have this problem – the temperature underground is almost constant. Producing domestic hot water (at 60°C) also reduces the COP. Some systems will use an electric immersion to 'top up' to 60°C, which means more electricity use and higher costs.

All these factors mean that the high COPs quoted in brochures may be rarely achieved. When comparing quoted COPs, check the background figures. Does it include domestic hot water? What source temperature is it based on? And what delivery temperature?

Ask installers for performance figures that reflect winter air temperatures, such as the following figures for the COPs of two Worcester Bosch air-to-water heat pumps at various outdoor and delivery temperatures:

| Temperature | | Heat pump COP | |
|---|---|---|---|
| **Inlet** | **Delivery** | **7kW** | **9.5kW** |
| -7°C | 35°C | 2.3 | 2.5 |
| 2°C | 35°C | 3.0 | 3.3 |
| 7°C | 35°C | 3.4 | 3.8 |
| 7°C | 45°C | 2.8 | 3.0 |

*Source: www.worcester-bosch.co.uk*

It may be best to size a heat pump to meet 90% of your heating demand, and have a backup option for additional space heating in very cold weather – a wood-fired room heater may be appropriate for this.

Once you have figures for likely electricity consumption from potential ASHP suppliers, you'll be able to check the likely cost of meeting this consumption, by using online calculators that compare electricity tariffs.

Some ASHPs are air-to-air rather than air-to-water. However, warm air heating systems are not common in the UK, and are difficult to install into existing buildings because of the ductwork required - so again, evaluation of the costs will be necessary.

Ground source heat pumps (GSHP) can use some cheap night-rate electricity to reduce running costs. However, as the night air is very cold, running an ASHP on night-rate electricity is unlikely to be effective. GSHPs may have other advantages: for example, as the equipment is all indoors or below ground, it is not exposed to the elements and should last longer. For more, see our free sheet on *Ground Source Heat Pumps.*

**How are installed AHSPs performing?**

In spring 2010, the Energy Saving Trust is to publish the results of UK field trials of heat pumps. Unfortunately, until then there is very little data on how systems actually perform here. For example, in damp, cold climates (like ours!) frost can build up overnight on the external part of an air-source heat pump, and an energy-intensive defrosting cycle needs to be used.

The Fraunhofer Institute for Sustainable Energy (ISE) has published a survey of heat pumps in Germany. They found that ASHPs in new buildings achieved an average COP of 3.0, while those added to existing buildings had an average COP of 2.6 (very few of the existing homes had underfloor heating).

**Are they noisy?**

There will be some noise - check technical literature on manufacturers' websites for figures. Noise levels are quoted in decibels, dB(A), which can be hard to evaluate - the decibel scale is not linear, and distance and location will affect perception of the noise.

Worcester Bosch quote a figure of 65db for the noise level at 1 metre from their unit. By comparison, normal conversation may be at a noise level of 50db, a busy office about 60db, and a busy street about 70db.

As the external part of an ASHP is basically the same as an air conditioning unit, you could listen to examples of these. However, there is considerable variation - don't judge all ASHPs by the noisiest air conditioner.

**Will I need planning permission?**

Potential noise is the key reason why ASHPs are not a 'permitted development', while ground-source heat pumps and wood or fossil-fuel boilers usually are. At present you will need to apply for planning permission and show that noise will not be a problem.

**Will it also provide air conditioning?**

Air conditioning should not be necessary in the UK, as passive (unpowered) ventilation and cooling can be used instead. See our *'Keeping Cool in Summer'* information sheet for advice on avoiding overheating.

**What other heating options do I have?**

Modern wood pellet or 'batch' log boilers are very efficient, and (especially in old houses) might be a better option than a heat pump. It's certainly worth investigating both to compare. See our *Wood-fuelled Home* information sheet for further advice.

**Further Information**

Our **residential course** programme includes some on heat pumps.
*Web: www.cat.org.uk/shortcourses*
*Tel: 01654 704952*

We can give in-depth advice on a particular project though **CAT Consultancy**
*consultancy@cat.org.uk or 01654 705991*

**CAT Mail Order** stock many books about energy conservation & renewable energy *http://store.cat.org.uk or 01654 705959*.

**Contacts**

**Microgeneration Certification Scheme**
*Tel: 020 7090 1082*
*Web: www.microgenerationcertification.org*
Lists installers accredited for the new Renewable Heat Incentive.

**Energy Saving Trust**
*Tel: 0800 512 012; web: www.est.org.uk*
Can give details of local support for energy conservation measures or heating systems.