

Air source heat pumps

Low-cost, electric powered space heating

Air-source heat pumps can provide fairly low-cost space heating for homes which are not connected to the gas grid, or for very well insulated new-build homes.



Air source heat pumps are a kind of renewable energy technology that take the warmth from the air outside (even when it's freezing) and use it to heat the home. You can get other heat pumps that do the same thing using the warmth in the ground and in water, but air source heat pumps are suitable for a wider range of properties. Because the air (or ground, or water) is heated by the sun, the energy that heat pumps produce is still classed as 'renewable', even though the pump itself is powered by electricity which may or may not have a renewable source.

There are two types of air source heat pump. Air-to-water systems heat water which is then circulated around the home via radiators or an underfloor heating system. They can also be used to heat water in a storage tank for the bathroom or kitchen. Air-to-air systems typically use fans to circulate warm air around the home and cannot be used to heat water.

How do they work?

Air source heat pumps use the same type of technology that keeps your fridge cold, but in reverse. A liquid refrigerant that has a very low boiling point is pumped on a loop between two heat exchangers. This refrigerant takes on heat energy from the outside ambient air temperature and turns into a gas as it warms up. This gas is then compressed back into a liquid, which increases

its temperature further. The warm refrigerant then goes through a heat exchanger, which transfers the warmth to a separate body of water for circulating round the central heating system. During the final stage the liquid refrigerant goes through an expansion valve reducing the pressure and temperature and the cycle repeats.

Coefficient of Performance or COP is why heat pumps are a useful technology: if you put 1kWh of energy into a system you will get more than 1kWh of heat energy out. Typically a heat pump has a maximum CoP of 2 or 3, meaning for 1kWh of electricity you will get 2 or 3 kWh's of heat. The actual ratio of 'electricity in' to 'heat out' will change over the course of the year.

Is my property suitable?

Heat pumps make most financial sense in properties which are off the gas grid and which therefore use expensive fuels like electricity, oil, LPG or coal for space heating. If you're connected to mains gas, then *economically* you'll probably be better off with gas central heating.

A well-insulated home with high standards of air-tightness is also preferable, although improving the general energy efficiency of your home will help – as reducing your heating needs will enable you to run a smaller and cheaper heat pump. This is because heat pumps are most effective in homes which warm up quickly, keep the heat in and so require little energy to maintain a temperature once it has been reached.

Heat pumps operate more efficiently when the temperature difference between the heat pump unit and the heat distribution system is smaller. Consequently, they produce heat at a lower temperature than a conventional central heating system and so a larger area is required for the heat distribution. Underfloor heating is ideal but large heat-pump



Make sure your home is well insulated before you invest in a heat pump

specific radiators can also be used. Heat pumps also work more efficiently when there are gradual rather than sudden temperature demands on the system and so need to be controlled differently to traditional central heating systems.

Finally, bear in mind that whilst the unit itself doesn't take up a lot of space, they need to be positioned somewhere outside with adequate air flow.

Cost & savings

The cost of installing an air source heat pump unit is around £6,000–£8,000 and will depend on the size of the property it needs to heat. On top of this you might have any additional works required to upgrade the heat distribution system. Generally speaking installing a heat pump is not especially disruptive work, though you may want to carry out this work at the same time as other home renovations.

The running costs of an installed system will vary depending on the size and insulation levels of your home, what type of distribution system you have and the room temperature you want, as well as the CoP of the system (as mentioned above).

The type of fuel you're currently using will determine how much you save on your annual fuel bill. Based on a 4-bedroom detached home, potential yearly savings are:

System being replaced	Old (G-rated)	New (A-rated)
Gas boiler	£560–£650	£105–£110
Oil boiler	£930–£1,100	£285–£330
LPG boiler	£1,365–£1,610	£565–£660
Night storage heater	£1,065–£1,315	£695–£815
Coal	£540–£665	n/a

Figures from Energy Saving Trust

What's more, once you have installed your heat pump you will be eligible for payments of between £1,341 and £1,586 per year under the Renewable Heat Incentive.

- Maintenance costs for air source heat pumps are low.
- They are reliable, work automatically and most will operate for 20 years or more. Your installer should advise on any maintenance required, such as an annual check by you and a service every few years by a professional.

Integration with other renewables

- Although air source heat pumps can meet the heating and hot water needs of an average household, there may be some cases – e.g. in an older home that cannot be insulated to a suitable standard – where a back-up supplementary system may be required. This could be a traditional form of heating, or another renewable technology, for example solar hot water or wood pellet stove. Solar thermal may meet your domestic hot water needs during summer removing the need to run the heat pump at all, and saving you money.

- You could also look at supplying the electricity through a renewable source. For instance a wind turbine provides more generation during winter when you require heating, rather than solar panels which produce more energy in the summer. However, with the emergence of ever improving battery storage options means there is now the potential to store this generated electricity for use at a later point, to power the heat pump at a time when the solar panels or wind turbine are not generating. Although there is an upfront cost, this could drastically decrease (and at certain times eliminate) the running costs of a heat pump and greatly improve a property's environmental impact.



More information

For more technical information see the website of the Heat Pump Association www.heatpumps.org.uk

And to find approved installers, see the website of the Microgeneration Certification Scheme (MCS) www.microgenerationcertification.org

See also our factsheets on how to cost-effectively control heat pumps (coming soon), battery storage and Renewable Heat Incentive downloadable from www.cse.org.uk/resources/category:advice-leaflets



St James Court,
St James Parade,
Bristol BS1 3LH

0117 934 1400
www.cse.org.uk
info@cse.org.uk

Charity: 298740
Founded: 1979

The Centre for Sustainable Energy is a national charity that helps people change the way they think and act on energy.

Our Home Energy Team offers free advice on domestic energy use to people in Bristol, Somerset, Wiltshire, South Gloucestershire and Dorset.



Contact us:

PHONE 0800 082 2234
EMAIL home.energy@cse.org.uk
WEB www.cse.org.uk/loveyourhome
FACEBOOK EnergySavingAdvice
TWITTER @cse_homeenergy