

Air source heat pumps

Low-cost, electric powered space heating

Air-source heat pumps can provide fairly low-cost space heating for well insulated homes that have well managed ventilation.



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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 are more common, they 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 3 to 4, meaning for 1kWh of electricity you will get 3 to 4 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?

A well-insulated home with high standards of air-tightness is important because heat pumps are most effective in homes which warm up quickly and keep the heat in and so require little energy to maintain a temperature once it's been reached. So if your home isn't already energy efficient then you need to make sure it is before installing a heat pump.

Heat pumps operate most efficiently when the temperature difference between the pump unit and the heat distribution system is small. Consequently, they produce heat at a lower temperature than a conventional central heating system so a larger area is required for the heat distribution - bigger radiators in other words, so some of your existing radiators may need replacing. Underfloor heating is ideal, but large, heat-pump specific radiators can also be used. Heat pumps also work more efficiently when the temperature demands on the system are gradual rather than sudden, and so need to be controlled differently to traditional central heating systems.

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.



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

If you're connected to mains gas which is cheaper than electricity for each unit supplied, you will need to make sure your home is well insulated, because the heat pump will need to work efficiently to save you money.

Because in the UK we now produce most of our electric from low-carbon sources, a heat pump that works efficiently is likely to be the lowest carbon form of heating for your home.

And bear in mind that while the heat pump itself doesn't take up a lot of space, they need to be positioned somewhere outside with adequate air flow. An air source heat pump contains a fan so makes a low background noise, so you'll need to consider your neighbours when deciding where to put it.

Cost & savings

The typical cost of installing an air source heat pump unit is £6,500–£10,000 depending on the size of the property it needs to heat. On top of this, works may be required to upgrade the heat distribution system, for example larger radiators to help distribute the heat. Remember if you want your heat pump to operate efficiently you need to insulate your home well.

The running costs 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 (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've installed your heat pump you'll be eligible for Renewable Heat Incentive payments which could amount to payments of £800–£1,300 per year. The Government has recently announced plans to replace the RHI with a future heat pump voucher scheme offering householders £5,000 towards the installation cost.

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.

You can earn an income from the Renewable Heat Incentive if you install an air or ground source heat pump, solar hot water or biomass. If you're in our area (Bristol, Bath, Dorset, South Gloucestershire, Somerset and Wiltshire), and want advice about what eligible renewable technology would be right for you get in touch. We can help you with your application.

Integration with other renewables

Although air source heat pumps can meet the heating and hot water needs of an average household, you could combine heat pumps with other technologies to maximise your carbon savings and minimise your energy bills. For example, solar PV could be used to generate the electricity that powers the heat pump, and if this was coupled with a battery, stored power from the PV panels during the day could heat hot water for baths and showers at night.



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



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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.



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