HEAT PUMP PROS & CONS

Right: Vaillant's aroTHERM split is a Quiet Mark-approved, low-noise air source heat pump that's available in a wide range of outputs

Below right: Slinky horizontal collector pipework being laid in trenches as part of a Kensa ground source heat pump installation

We look at the main heat pump options, along with the key factors that will help you decide if this efficient tech suits your project

Heat pumps are a modern, low-carbon space heating and hot water solution. They take warmth from low-grade sources (the air, ground or water), compress it to boost temperatures, and then distribute it around the home. Crucially, heat pumps produce more energy than the electricity required to run them – making them an appealing choice for a range of projects and households.

What makes heat pumps efficient?

Heat pumps work on the same principle as a refrigerator, but in reverse. Energy is taken from the ground, air or water in a collector fluid known as a refrigerant. It's then passed into the heat pump's compressor, which pressurises the fluid into a gas and, in doing so, increases its temperature. This gas then passes through a heat exchanger, which extracts the warmth for use in your home's central heating and hot water system (you'll need a cylinder).

For each unit of electrical power used to run your heat pump, you'll get more than one unit of heat output. The ratio of heat energy produced versus electrical energy consumed is known as the Coefficient of Performance (COP). Manufacturers generally quote a Seasonal Coefficient of Performance (SCOP) of four or more. This measure is designed to reflect performance across a whole heating season, although it is determined under lab-controlled conditions.

The exact performance of your heat pump system will depend on a range of factors. These include the type of heat pump, collector design, insulation levels in your home, whether you're using radiators or underfloor heating, ratio of space heating versus hot water demand, and more.

Using current energy price caps as a starting point (6.89p/kWh for gas; 27.35p/kWh for electricity), a heat pump system would need to achieve a SCOP of around 3.65 to deliver similar running costs to a mains gas condensing boiler (operating at 92% efficiency). So, at current prices you may not save much on your energy bills versus mains gas. Thanks to the proliferation of green electricity tariffs, however, you can expect to significantly cut your household's carbon footprint with a heat pump.

Air source heat pumps

These are the most common type of heat pump installed in UK homes. They're typically specified as air-to-water systems that output to central heating and domestic hot water (although air-to-air versions are also available).

One of the key benefits of an air source heat pump (ASHP) is that it's easier to install than ground or water source versions. There are two key options: monobloc (where all the magic happens in an outdoor unit) and split (a combined indoor-outdoor design). Either way, the pump needs a convenient site outside offering a good flow of air.

Good-quality modern ASHPs are low-noise (look for the Quiet Mark seal of approval) and provide good efficiency in use. Because it takes energy from the air, an ASHP won't be quite as efficient in the coldest parts of winter (ie peak heating season) as it is in autumn or spring. But, in a house insulated to modern Building Regs standards, the running costs for a well-designed system should be similar to using a mains gas boiler.

Budget-wise, as a rough guide, budget £10,000-£14,000 to fit an air source heat pump in a well-insulated three-bedroom property. ASHPs are currently eligible for a £5,000 grant voucher under the government's Boiler Upgrade Scheme (BUS). Visit **www.self-build.co.uk/ashp** for more on this tech.

Ground source heat pumps

Dig down a metre or so into the earth, and you'll find the ground reaches very stable temperatures – around 12°C in the UK (depending on where you are in the country). This makes it a predictable source of energy year-round.

Properly designed and installed, a ground source heat pumps (GSHP) should therefore deliver slightly better efficiency than an equivalent ASHP – potentially in excess of 400%. "You can generally expect your GSHP to operate in the same ballpark as the manufacturer's quoted SCOP, plus or minus 5%-10% from year to year," says Andy Howley from Hex Energy.

Getting the collector loop right is key to ensuring your ground source heat pump runs efficiently. If you've got enough land, it's usually most cost-effective to install horizontal collectors – for a coiled slinky design, you'll typically need around 10m of trench for each kW of heat output, with 5m between trenches. A vertical borehole can be used where space is tight or you want to preserve a mature landscaping scheme, but this is more expensive to install. Visit **www.self-build.co.uk/gshp** to find out more about GSHP system design.

The cost of fitting a GSHP depends on a range of factors, not the least of which is the collector type. Depending on the size of your house, you can expect to pay anything from £20,000-£35,000 for fully-commissioned horizontal trenched systems. Budget another 40%-60% on top for installs using boreholes. GSHPs are eligible for a £6,000 grant under the BUS.

Above: NIBE's S1155 is an intelligent inverter-driven GSHP, available with smart home accessories for an efficient, easy-to-control living environment

Water source heat pumps

A water source heat pump (WSHP) takes its energy from a body of water – such as a stream, river or lake. The temperature of this heat source should be better than either the ground or the air during peak heating season. Plus, the rate of heat recharge where the warmth is collected is likely to be more efficient than with a GSHP.

So, all things being equal, it should perform even better than a ground or air source heat pump. The sticking point is that relatively few homes or building plots have a convenient body of water nearby.

WSHP collectors can be either closed loop or open loop. The former is common for small-scale applications, such as streams and modest rivers. The latter is designed to take water from a lake or aquifer, extract some of its heat and then return the water to its source.

As WSHP are still quite rare in the UK, it's difficult to give indicative costs. Each installation must be bespoke-priced depending on the water source, as well as the usual considerations such as insulation levels, emitter type etc. That said, it can be an attractive alternative to ground source systems in the right circumstances. WSHPs are also eligible for the same £6,000 subsidy under the BUS. Log on to **www.self-build.co.uk/wshp** for more on how this tech works.

PREPARING FOR A HEAT PUMP

INSULATION & DRAUGHTPROOFING A poorly-insulated, leaky house isn't likely to be a good fit for a heat pump, which performs best when delivering consistent low-grade warmth. If you're self building you can design-in good energy performance from the get-go. If you're renovating, you'll need to look closely at whether you make can cost-effective upgrades to insulation and airtightness.

EMITTERS The large surface area of underfloor heating (UFH) makes it an ideal partner for the low flow temperatures heat pump systems deliver. Again, this tech is easier to install into a new build home, although retrofit systems that require minimal build-up of floor height are available. Don't rule out a heat pump if you can't install UFH: radiator-based distribution can still be effective, though you may need to upgrade to larger panels.

PIPEWORK In many houses, the existing space heating network will be suitable for a heat pump. However, if you have microbore pipework (12mm diameter or less), it will add significant resistance to the rate of flow, which affects a heat pump's ability to efficiently deliver the required output. One way around this is to install a more powerful circulation pump, but this will require extra power – lowering efficiency.

HOT WATER Heat pumps have to work harder to produce high-temp water, so if your household has a high hot water demand this could impact on running costs. You'll need a slightly larger cylinder than you would with a boiler, because you'll be storing the water at a lower temperature (around 45°C-50°C rather than 60°C+).

USAGE Living with a heat pump is different to running your house off a boiler. So, for efficient results, you may need to change your habits – don't simply use it like the old on/off system you might be used to. Talk this through with your installer and ask them to design and programme the controls to suit your lifestyle.

CONTACTS

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