A buyer's guide to heat pumps

To find out more about installing a heat pump call 0300 123 1234 or visit energysavingtrust.org.uk

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What are heat pumps?

Heat pumps extract available heat from a natural source such as the ground or air and release it in another location at a higher temperature. Heat pumps can be used to heat your home or hot water.

There are different types of heat pumps that can take heat from the ground, the air or from water – known as ground source, air source and water source respectively. Heat pumps have some impact on the environment as they need electricity to run (just like your fridge requires electricity to operate) but the heat they extract is from a renewable source.

How do heat pumps work?

Heat naturally flows from a warmer place to a cooler place. However, heat pumps use a special fluid that constantly evaporates and condenses in a closed circuit controlled by valves and a compressor in order to reverse this natural process. In heating applications, heat is removed from ambient air or from water, soil or bedrock using a heat 'collection loop' and delivered to where it is needed, usually into the heating and hot water systems of the house.

Heat pumps need electricity to run but they use less electrical energy than the heat energy they generate.

This makes them much more efficient than other electrical heating options. Typically you only need one unit of electricity to deliver three or more units of heat with a well designed heat pump system. Because heat pumps need electricity to run there will still be some resulting carbon dioxide emissions, although these can be lower than for other heating systems.

What are the key benefits of heat pumps?

Heat pumps are well established in other EU countries and are becoming more popular in the UK. As well as the lower running costs and reduced carbon dioxide emissions heat pumps have other benefits:

Integration

Heat pumps can be incorporated into many UK homes. They are ideally suited to newer highly insulated properties and are not always suitable for flats. Once installed and connected to the heating and hot water circuits they are fully automatic. Heat pumps are also easily integrated with solar hot water systems to provide a comprehensive heating and hot water system.

Versatility

The collection loop for ground source heat pumps can be installed horizontally or vertically into the ground. Water source heat pumps need a source of water such as a lake, river or stream and air source heat pumps simply need unrestricted access to outside air. There is, therefore, a type of heat pump suitable for almost every type of house.

What are the main issues relating to heat pumps?

Whilst heat pumps are becoming more popular, they require a different approach to heating your home than traditional central heating systems.

Because heat is produced at a lower temperature, it is necessary to use larger heating surfaces; this could be under floor heating or by increasing radiator sizes. The Heat Emmitter Guide issued by the Microgeneration Certification Scheme (MCS) will help you to understand this, however your installer should be able to advise you in detail.

As the air in your home is being heated more gently, it is imperative that insulation and draught proofing levels are to current standards.

Heat pumps operate most efficiently when they are maintaining room temperatures rather than trying to heat them from cold; this could mean that you need to operate your new heating system 24 hours a day in order to get the most cost effective performance. This can be difficult to accept as it may seem to be counter–intuitive. Your installer should be able to advise you on this for your home.

Installing ground loops or vertical bore holes does require some disruption to your garden; the soil from a ground loop trench must be piled next to the trench ready for back–filling.

Ground source heat pump units are about the size of a fridge–freezer, and the position of your current boiler, if you have one, may not be appropriate for its location.

Is a heat pump suitable for my home?

Heat pumps can be integrated into most heating systems and are more cost effective in some homes than others. Before choosing to install a heat pump you should consider:

Energy efficiency first

Make sure you improve the energy efficiency of your home first. Focus on improving insulation and tackling draughts. Heat pumps are most efficient when used in highly insulated buildings.

Your current heating system

Heat pumps are most likely to save money and carbon dioxide when they are used to replace electric, LPG or coal heating systems, however they should reduce carbon dioxide emissions when replacing any other fossil fuelled heating system. Heat pumps work better with slow response, low temperature heating systems such as under–floor heating rather than conventional wet radiator systems. But low temperature heating systems work better in buildings with a high 'thermal mass'. If your home heats up and cools down quickly, a low temperature heating system is unlikely to provide the heating you require and a heat pump may not be the best option for your home.

To find out more call free on 0300 123 1234.

Choosing a heat collection system
Most domestic systems use either a ground source or an air source system. Ground source heat pumps require a borehole or a trench for heat collection. A loop buried in a trench can need a lot of ground space: usually around 100–200 metres is required (depending on the type of ground loop) for a typical domestic installation. If you do not have enough land for a large trench you can use a borehole but this tends to be more expensive to install – this will require a depth of around 80–100 metres in total for a typical domestic installation. This doesn't have to be a single borehole, it can be a number of shallow boreholes which together total 100 metres.

Alternatively, an air source heat pump doesn't need any of these ground works and may therefore be appropriate for a wider range of properties. Capital costs are generally lower too, although system efficiency will also be lower.

Disruption and mess
Digging trenches or boreholes is a dirty job and can be disruptive to you and to your neighbours. Bear in mind that a trench will disrupt the appearance of your garden and this may take some time to recover, although there should be no need to excavate the ground loop once installation is complete.

Get connected
Heat pumps need high electrical currents to start up. Check that your electrical supply is up to the job by speaking to your electricity supplier about any limitations at your point of supply. Your installer should be able to advise on this. Some heat pumps are available with a "soft start" option to minimise this effect.
A heat pump system should be connected to its own circuit breaker in the fuse board.

Planning Permission
Heat pumps are listed under Permitted Development; meaning you don't need to get Planning Permission before installing. However, air source heat pumps may require Planning Permission in some circumstances. The full list of conditions can be found in the The Town and Country Planning (General Permitted Development) (Amendment) (England) Order 2011. If you live in a National Park, Area of Outstanding Natural Beauty, Conservation Area, Listed Building, or other protected area you should seek the view of your local Planning Authority before installing an air source heat pumps. You may also need Listed Building Consent to install a ground source heat pump within the grounds of a Listed Building.

Types of heat collection systems

Ground source heat pumps
Use buried lengths of plastic pipe either in a borehole or a horizontal trench. The pipe is filled with a water/antifreeze mixture which circulates through the pipe absorbing heat from the ground. Horizontal trenches dug to a depth of 1–2 metres can cost less but need more land than boreholes. Using coiled piping

(known as a slinky) reduces the amount of land needed. The design of the system will determine the overall length of collection loop required to meet the building's needs; this will be dependent upon the building design and the geology of the site. The borehole method involves drilling to the required depth and will benefit from the higher ground temperatures compared with a horizontal trench although installation costs will be greater.

Water source heat pumps
Use the same heat collection system but are immersed in a lake or other body of water.

In both cases once your ground source heat pump is installed there should be nothing visible above ground.

Air source heat pumps
Use air as the source of ambient heat energy. They do not rely on a collection system and simply extract the heat from the source at the point of use. Air source heat pumps can be fitted outside a house where there is unrestricted air flow and will perform better at warmer air temperatures.

Integrating with existing heating systems

Heat pumps are most efficient if they provide heat over a long period of time to a heating circuit that runs at a lower temperature (usually around 35–55°C) than conventional systems. To benefit from this lower temperature output your home will need to be reasonably 'air tight' and well insulated. The Energy Saving Trust can offer you free advice on how best to insulate your home as well as tell you about any assistance available for energy efficiency measures, call **0300 123 1234**.

Heat pump systems can be particularly effective when used to run under-floor heating. This will allow the pump to work at a consistent level over a period of time and to provide sufficient heat while operating at a lower temperature.

If necessary you can use a secondary heating source to raise the temperature in some rooms such as the living room or throughout your home. This could be done by using a conventional central heating system or individual room heaters. You should be aware that the use of a secondary heating system may affect your eligibility for the Renewable Heat Incentive, and you should check this prior to installation if you intend to apply for RHI payments. A wood pellet stove or traditional log burner would do this without adding to your carbon footprint.

It is important that the installer sizes the heat pump to match the building's heat demand. Over sizing or under sizing the heat pump can increase running costs and reduce operating efficiency. This will mean the pump may be prevented from operating continuously resulting in more energy intensive 'stop-start' heating, which will in turn increase running costs. Speak to your installer about sizing and ask them to explain how they have identified the size you will need.

Heat pumps can be combined with a solar hot water; it can also be used to top up the ground temperature to increase system efficiency. However, you may still need additional top-up heating from, for example an immersion heater to heat the hot water to the required temperature of 60degrees centigrade for at least one hour each day.

To find out more call free on 0300 123 1234 or visit energysavingtrust.org.uk

Heat pump efficiencies

Heat pumps give out more energy (heat) than they use (electricity), sometimes much more. If a heat pump has a 'coefficient of performance' (CoP) of four, this means that at, a given point in time it is generating four units of heat energy for every unit of electrical energy used. However the average system efficiency of the whole system over the year, including any top-up electricity for water heating will be less than the quoted CoP.

Good quality domestic heat pump installations designed in line with the new MCS standards (MIS3005) can have a system efficiency of over 300%. The Energy Saving Trust heat pump field trials showed that in a sample of existing installations monitored in the UK a typical ground source system has an efficiency of 250%, and air source systems efficiency is 220%.

What does a heat pump need to provide heating?

There are three main parts to any heat pump system:

- A heat source and the means of extracting heat e.g. a ground loop.
- A circuit of fluid in the heat pump and a power source.
- A heat distribution system in the home e.g. the under-floor heating system.

How is the heat generated?

The central component of a heat pump is the compressor. This is usually driven by an electric motor, although gas engine driven compressors are also available. As heat is absorbed from the heat source the 'working' circulating fluid evaporates changing from liquid to gas. This vapour is then compressed causing it to heat up. The heat from this process is absorbed via a 'heat exchanger' into your home's heating system which means the vapour loses its heat and condenses back into a liquid. This is then circulated through the heat source once more.

A heat pump can also be used for cooling with the addition of a valve to reverse the direction of the working fluid.

Costs, funding and savings

The cost of a professionally installed heat pump system can vary significantly so it is important to do as much research as possible. This should include obtaining at least three quotes from certified installers.

Typical costs range from £9,000 to £17,000 for a ground source or £6,000 to £10,000 for an air source system, not including the cost of the heat distribution system.

The running cost will depend very much on the size, insulation levels and heating pattern of the house. For a typical three bedroom semi-detached house with reasonable insulation levels, the annual cost of providing space and water heating with a ground source heat pump would be around £750, or £850 for an air source system. This is based on current electricity prices and a standard tariff. Using an Economy 10 or Economy 7 tariff may give slightly lower running costs depending on the heating pattern, the control strategy and the thermal performance of the building.

At current fuel prices, these running costs are unlikely to deliver financial savings compared to most gas systems. Savings are likely to be

more favourable when replacing a coal, oil, LPG, or electric heating system, although the payback period will still be long.

Purchase and installation costs can be quite high when compared to other home heating options so make sure you obtain full quotations from manufacturers and installers. In particular, drilling the bore or digging the trench can be costly. Make sure you know exactly what any quote covers before going ahead.

There are plans to introduce a domestic Renewable Heat Incentive (RHI) scheme in 2013 for heat generating technologies. Owners of eligible heat technologies are likely to be paid an annual sum to reflect the amount of renewable heat they have used. Until then the Renewable Heat Premium Payment (RHPP) is available, making one off contributions to the installation costs of qualifying heat pumps. Successful applicants for RHPP will receive £1,250 towards the cost of a ground source heat pump, or £850 towards the cost of an air source heat pump. It is not yet clear whether recipients of RHPP will also qualify for RHI payments. In most cases, renewable heating systems which are not the primary heating source for the whole dwelling will not be eligible for RHPP. For the latest information on RHI and RHPP visit energysavingtrust.org.uk the MCS, or DECC website.

Maintenance

Heat pump systems typically come with a 10 year warranty. You can expect them to operate for 20 years or more, however they do require regular scheduled maintenance. A yearly check by you and a more detailed check by a professional installer every 3–5 years should be sufficient. The installer should leave written details of any maintenance checks you should undertake to ensure everything is working properly. Consult with your supplier for exact maintenance requirements before you commit to installing a heat pump.

Local impact

Ground source heat pump installations are generally unobtrusive and extremely quiet in operation. Usually, the only system noise is from the small circulation pump which, if audible at all, should be no louder than a modern central heating pump. Ground collectors are buried so they are not visible. Usually the heat pump will be installed in a cupboard area, so that it is out of sight as well.

Air source heat pumps require the installation of a unit outside of the dwelling. This unit contains fans which move air across the heat exchanger; these will generate some noise which may be obtrusive if located close to neighbours, especially if near to opening windows.

How to find installers and products

When you buy a renewable energy technology, there are currently two industry led and Government approved schemes that you should check that your installer is a member of. They are the Microgeneration Certification Scheme (MCS), and Renewable Energy Association Ltd (REAL) Assurance scheme. The MCS scheme will cover any technical related issues while the REAL Assurance Scheme covers all contractual related disputes, including deposit protection and workmanship guarantees. In addition, MCS also certifies renewables products as so look out for the MCS logo. We recommend getting at least three quotes from installers before proceeding with any work.

Microgeneration Certification Scheme

The Microgeneration Certification Scheme (or MCS), exists to ensure that installers install to the highest quality every time, using MCS certified products that have met rigorous testing standards. All MCS approved products will come with a guarantee for a set period of time, which your MCS approved installer should clearly explain to you. To check that your installer is MCS certified, you can search for them on the MCS website or call the Energy Saving Trust for free advice on 0300 123 1234. For more information about the scheme, go to microgenerationcertification.org

REAL Assurance Scheme

All MCS certified installers must belong to an Office of Fair Trading-backed consumer code-of-conduct programme, and the REAL Assurance Scheme is currently the only one available. The scheme covers general business standards, such as protection against excessive deposit payments and workmanship warranties, which installers must always explain to consumers both in writing and verbally.

To check that your installer is a member of the REAL assurance scheme visit realassurance.org.uk or call REAL on 0207 981 0850.

Deposit and Advance Payment Insurance Scheme

All REAL members must provide protection for deposits and advance payments they take from domestic consumers. REAL members have access to insurance known as the 'Deposit and Advance Payment Insurance Scheme'. The scheme is designed to provide protection for payments made before works have begun, just in case the company ceases to trade before they deliver the goods to you. The Deposit and Advance Payment Insurance Scheme has been arranged between REAL and the insurance scheme administrator (QANW). You will not be asked to pay anything for the insurance cover, either to the REAL Assurance Scheme or to the company you're contracting with. The company can register your contract with the scheme administrator and you will receive an insurance policy by post.
For further information on this scheme please visit www.real.qanw.co.uk/consumer-faqs.php or call 01292 268020.

Workmanship Warranties

When you purchase a renewable energy technology, your MCS installer is obliged to provide a workmanship warranty for a minimum of one year. However, typically speaking many companies offer warranties for longer than this. Members of the REAL Assurance Scheme are required to put in place arrangements to ensure that the warranty they provide will be honoured if the company ceases to exist during the warranty period. Under the Deposit and Advance Payment Insurance Scheme consumers are given the opportunity purchase warranty insurance for an additional £35. This insurance provides protection should the company cease to trade and is valid for the period of the installer's original workmanship warranty.

If the installer company has not already provided an insurance backed warranty the Energy Saving Trust recommends that you pay this additional £35 for the workmanship warranty insurance. For more information about this scheme visit real.qanw.co.uk/consumer-IBG-faqs.php, or call 01292 268020.

What should I expect from my installer?

All MCS approved installers should be able to provide a detailed breakdown of the specification and costs of their proposed system. They should:

- visit in person and complete a technical survey before quotation
- comply with the lastest MCS MIS 3005 standards
- provide an estimate of how much heat will be produced by any proposed system
- supply clear, easy to understand and detailed information and advice on how best to use the system and operating instructions
- explain how the system will be installed and if there will be any disruption to your property
- install and set controls and settings to ensure you get the most out of your system
- provide clear and easy to understand information on product and workmanship warranties
- provide a full breakdown of costs in their quote and include the terms and conditions
- not ask for more than a 25% deposit. You also have the right to cancel the contract within seven days with no penalty

To help you make an informed decision we suggest you get as much information as possible from product and installer brochures, which may include background information on performance testing.

Check list:

Before making the decision to go ahead and install a heat pump, we recommend that you use the following check list:

- I have checked how energy efficient my home is and installed any necessary measures to improve insulation. YES/NO
- I have considered my current heating system including heating circuit YES/NO
- I have considered available space for heat pump including garden (ground source heat pump) YES/NO
- I have considered my current fuel use YES/NO
- I have received at least three quotes (however, do not compare installers on cost alone; the cheapest may not be the most appropriate option for you) YES/NO
- I have checked any proposed works with the local authority planning and building control teams YES/NO
- I have chosen an MCS certified installer that uses MCS certified products and is a member of the REAL assurance scheme YES/NO
- I have checked what warranties are on offer – both product and workmanship, including post installation services YES/NO
- I have checked that I have received a briefing from my installer on how to operate and perform basic maintenance checks YES/NO

How the Energy Saving Trust can help

The Energy Saving Trust is a non-profit organisation providing free, impartial advice to help you stop wasting energy and money and help fight climate change. To find out what you can do to generate your own energy visit **energysavingtrust.org.uk** or call us free on **0300 123 1234**.

Our advisors will:

- Give you personalised advice on what's practical for your home.
- Put you in touch with local certified installers.
- Tell you about grants and offers available.

To start generating your own energy visit

Energy Saving Trust
energysavingtrust.org.uk

Microgeneration Certification Scheme
microgenerationcertification.org

REAL Assurance Scheme
realassurance.org.uk

The Heat Pump Association
heatpumps.org.uk

Ground Source Heat Pump Association
gshp.org.uk

All measure costs and savings are correct at time of printing. However financial savings will change as energy prices rise or fall. Please refer to our website for the most recent measure costs and savings.

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