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StrettonClimateCare
Solutions for a Sustainable Future

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Heat Pumps – a beginners' guide

In Shropshire considerable carbon emissions come from the central heating systems in our homes. But things are changing. From 2025 no new build properties will be allowed to have natural gas piped in so there is now a lot of interest in heat pumps. Although these pumps at present only take up around 1% of the market for domestic heating in the U.K., they are becoming ever more popular as they can provide a fossil free source of heating.

So what is a heat pump and how do they work?

Heat pumps have been in existence for 150 years and are most commonly found in fridges and freezers. As the name suggests, they pump heat from one source to another, are exceptionally reliable and should have a much longer life expectancy than a combustion boiler. They absorb heat from water, the ground or the air and transfer this low-grade heat to a refrigerant gas through a heat exchanger. The gas is compressed which increases its temperature and as it passes through a second heat exchanger the heat is transferred into the water that circulates through your heating system. The gas then goes into an expansion vessel where it condenses, cools and is ready to begin the whole process again. Air source heat pumps will still work when air temperatures drop below freezing (absolute zero is−273.15 °C) and are very energy efficient. They do require some electricity to run them; however for every unit of electricity used, an air source heat pump will produce around four units of heat. Ground source heat pumps are slightly more efficient as the low grade heat from the ground is more consistent but installation costs are greater.

Gas and oil boilers produce hot water at between 60 and 70 degrees for radiators. Heat pumps however run most efficiently at between 40 to 50 degrees. They are most suited for underfloor heating systems in very well insulated homes, however where necessary, increasing the size of existing radiators overcomes this lower heat output. A skilfully designed heat pump system will work perfectly adequately in many homes and the technology is improving all the time. They will provide hot water as well as heating so if changing from a combi boiler a hot water tank is necessary.

Although the carbon savings and running costs and are greatest when converting from solid fuel, oil or LPG there are still savings to be made when converting from gas to heat pump heating but how much will depend on the level of insulation and the unit cost of your existing heating fuel and electricity supply.

With renewable electricity, heat pumps provide a fossil free heating system and at present are eligible for the **Government Boiler Upgrade Scheme (BUS) worth £7,500**. These grants should cover most if not all of the installation costs.

The grant can be used for Air Source, Ground Source, Water Source and Air to Air Heat Pumps, Heat Batteries and biomass boilers. see
https://www.gov.uk/government/news/families-to-get-more-choice-over-home-upgrades

https://energysavingtrust.org.uk/grants-and-loans/boiler-upgrade-scheme/

Questions to consider before installing an Air Source Heat Pump.

Heat Pump technology is complex, far more so than a conventional gas or oil boiler and the ordinary customer must be confident that any potential installer really knows their subject and will guarantee an installation will perform satisfactorily.

1. *How well insulated is your home?* Installing any form of heating in a poorly insulated home means a lot of the heat is lost through the fabric of the building. Knowing the EPC (Energy Performance Certificate) rating is a good start. An EPC of A is excellent, G is very poor. Because heat pumps work at a lower water temperature than a conventional gas or oil boiler they will take longer to heat any property. Where insulation is poor, impossible to improve or simply not cost effective, it is sometimes suggested by installers that a hybrid system is fitted where heating is topped up with a traditional gas or oil boiler. High Output Heat pumps are however increasingly available where adequate insulation is a problem. They often have two compressors and are a little more expensive to run.
   It is a myth that heat pumps won't work in a poorly insulated home. They will but will have to work harder and cost more to run. Improving the insulation will make the home more comfortable and cheaper to heat. If the heat pump is installed first as part of a retrofitting project, with insulation improvements planned later, be careful not to initially oversize both heat pump and radiators.

2 *Does your home have micro bore radiator pipes?* Some installers suggest these may not carry sufficient water round the radiators for the heat to be disbursed, though with a skilfully designed system this can usually be overcome. A second circulation pump may sometimes be necessary.

3. *Where will the unit be placed?* Ideally, though not essential, it needs to be on a south (ish) facing outside wall as the surrounding air will be possible be warmer and must, because of planning regulations be at least 1 meter inside the property boundary. The fans do make some noise (40-50 decibels at 1 metre distance) so must be sited with consideration to neighbours (50 decibels is roughly equal to the level of indoor conversation). With listed buildings there are additional restrictions. Heat pumps do not usually require a planning application as they are permitted development if they pass an assessment mainly about noise set out in MCS 020. In Conservation Areas the heat pump will require a planning application if it is fronting a highway. The installer will make

this assessment for you . Listed building consent may be required within the curtilage of a listed building. Full details are in

https://www.legislation.gov.uk/uksi/2015/596/schedule/2/part/14/crossheading/class-g-installation-or-alteration-etc-of-air-source-heat-pumps-on-domestic-premises/paragraph/G.2/made

4. *Do you have a hot water tank?* Heat pumps require a hot water tank and small houses with a combi-boiler may not have room for one. The tank can if necessary be loft mounted.

5. *Is your existing heating system adequate?* Because the flow temperatures to radiators is lower than with oil and gas boilers, correct sizing of radiators is essential for the system to disperse sufficient heat. Doubling the size of certain radiators is often recommended.

Now to some questions to ask a potential installer.

How do you choose an installer before inviting a quotation? Ask around to see who locally has a heat pump installation. They will love to show it off, especially if it is satisfactory. Can you find any which are not satisfactory and discover why not? Get at least three quotes and carefully note how the installer proposes to overcome any difficulties your existing system may present. The lowest quote may not necessarily be the best. Also consider any future additional costs if for example the installer suggests leaving existing radiator sizes and waiting for a heating season to see if the house is warm enough! The problem with this approach is that it could cause the heat pump to work less efficiently.

1. *Is the company MCS accredited (micro generation certificate scheme)?* In order to take advantages of Government Grants, both the product and the installation company must be certified under the Microgeneration Certification Scheme (MCS).

2. *How many air source heat pumps have the company installed?* In order to build up suitable experience, a company needs to have installed this complicated technology over a number of years.

3. *Can the installer explain which heat pump they would choose for your installation and why?* This discussion can bring to light any difference in what your installer believes are your priorities and what you consider them to be. It will also help reassure you that your installer knows what he is talking about.

4. *What is lowest ambient temperature the proposed heat pump will cope with and what will the installer do to ensure it provides adequate heat below this level?* This will help you understand exactly how much of your heating the installer is planning your heat pump to supply on its own and how much it will need boosting with electricity.

For your information the design temperatures specified in Microgeneration Installation Standard: MIS 3005 for different areas of the UK are as follows:-

Belfast: -1.2C Birmingham: -3.4C Cardiff: -3.9C Edinburgh: -1.8C
Glasgow: -3.9C London: -1.8C Manchester: -2.2C Plymouth: -1.2C

Also what is the Coefficient of performance (COP) of the heat pump? A COP of 4 means that for every unit of electricity used the heat pump will produce 4 unts of heat.

5. *How will the system deal with hot water pasteurisation or the "legionella" issue?* Legionella bacteria can breed in water with temperatures between 25C and 45C and if particles of water containing the bacteria are breathed in, when having a shower for example, it can cause illness. The bacteria will however die within a few minutes if exposed to temperatures over 60C. The domestic hot water therefore has to be raised above this temperature at least once a week to ensure the bacteria has no chance of surviving. Is this automatic with the proposed installation?

6. *What warranty is offered?* The heat pump units will come with a manufacturer's guarantee and the system should separately be guaranteed by the installer. Make sure that warranty includes a guarantee that the system will adequately heat to a satisfactory level all the rooms in your home and the hot water. This is usually 20 degrees for living rooms and 18 for other rooms. Domestic hot water needs to be able to reach 60 degrees though is usually kept lower. Is a condition of the warranty that the system is serviced annually? The manufacturers warranty often requires that the heat pump is serviced annually. Can the installer offer a maintenance contract?

7. *Can the existing the hot water tank be used?* If replacing a combi boiler system, a new hot water tank is necessary. It may be possible to reuse an existing hot water tank but tanks designed for heat pump systems tend to heat up quicker. If using an existing tank does the installer propose an additional heat exchanger to speed this process up? It is unlikely the heat pump will heat both radiators and hot water simultaneously so it is useful to know how long it will take to heat the hot water, usually before heating is required, especially in the winter.

8. *What are the noise levels of the heat pump?*
(They tend to run at between 40 - 50 decibels (quiet conversation level) most of the time though may be nosier during defrost mode. This may influence location.)

9. *What is the cost of the proposed installation?* Will this cost include any necessary upgrading of radiators, additional heat exchangers etc. to overcome possible issues associated with micro bore pipework. Will the hot water tank have an immersion heater? Will the quote include a room and hot water thermostat? Does the system have weather compensation - a small outdoor sensor to adjust the system controls to compensate for changes in outdoor temperature automatically?

10. *If you have solar P.V. how would installer propose to take advantage of any surplus generation?* There are electronic diverters which can be installed to allow surplus generation to be used to power an immersion heater, storage battery or even an electric car charger. before exporting back to the grid. This of course is much more cost effective than running the heat pump throughout the year.

11. *Can the installer roughly predict what the cost saving are likely to be?* Having designed a system for you the installer should be able to provide data to show what the likely running costs will be, though these will depend on how well insulated the property is, how warm you keep it, the price of your current heating fuels, your electricity costs and variable weather conditions.

14. *Are there any low interest loans available?*

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* *Though we are not able to recommend a particular installer we have the details of two contractors who have been interviewed by our Trustees and their work seen. These installers pay us a small commission following any installation referred by us but we do not act as agents for them. We would recommend you obtain at least two and preferably three quotations. If you would like the details of these two installers, please let us know.*

* *If applying for Government grants the property must have an up-to-date EPC.*

* *Since heat pumps tend to run mostly in the evenings and early mornings, look at what tariff rates and times are offered by your electricity supplier. You may wish to change supplier to take advantage of cheaper variable tariff rates.*

* *There is further excellent information available from The Energy Saving Trust and The Centre for Sustainable Energy, Bristol. (CSE)*

https://energysavingtrust.org.uk/advice/air-source-heat-pumps/?gclid=EAIaIQobChMImtilz8Xw7QIVz-3tCh01dw4cEAAYAiAAEgLY8PD_BwE

* *User Guide.* The installer should provide clear instructions for using the heat pump as operation is very different to that of a gas boiler. The following link from The Centre for Sustainable Energy, Bristol. (CSE) is useful. https://www.cse.org.uk/advice/renewable-energy/making-the-most-of-your-air-source-heat-pump

* *What if the installation does not do what you were led to believe it would?* MCS as a quality assurance scheme, is at the centre of a network of organisations set up to advocate consumer protection and to ensure that its members comply with the industry standards which underpin scheme membership. *https://mcscertified.com/complaints-compliance*

"This information is provided in good faith but individual circumstances of the property, use and equipment may vary, as will fuel prices. We cannot take responsibility for the accuracy of this information in these circumstances."

The following link, sponsored by Zero Carbon Shropshire and the Herefordshire Green Network in consultation with Shropshire, Herefordshire and Powis Councils and local voluntary networks leads to a Marches wide data base of suppliers and installers.

https://futurereadyhomes-directory.org.uk/

Caution - Please Read this:

Our Advice Note has been carefully prepared and is, as far as we know, accurate at the date of publication. However, things change very fast in the world of technology and in government schemes. Sometimes parts of Advice Notes become outdated and may not offer best advice very soon after publication. We do our best to keep them up to date with the limited resources we have. Furthermore, our advice may not be appropriate for your particular circumstances. We advise that you get advice from a relevant expert before making changes. We may be able to offer further advice or make suggestions on who to contact if you get in touch with us. We are not technical experts but have many years of offering common sense advice and we recommend you should not rely on our Advice Note alone for making decisions. The national advice centre Energy Savings Trust is a good source of information.

See https://energysavingtrust.org.uk/
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