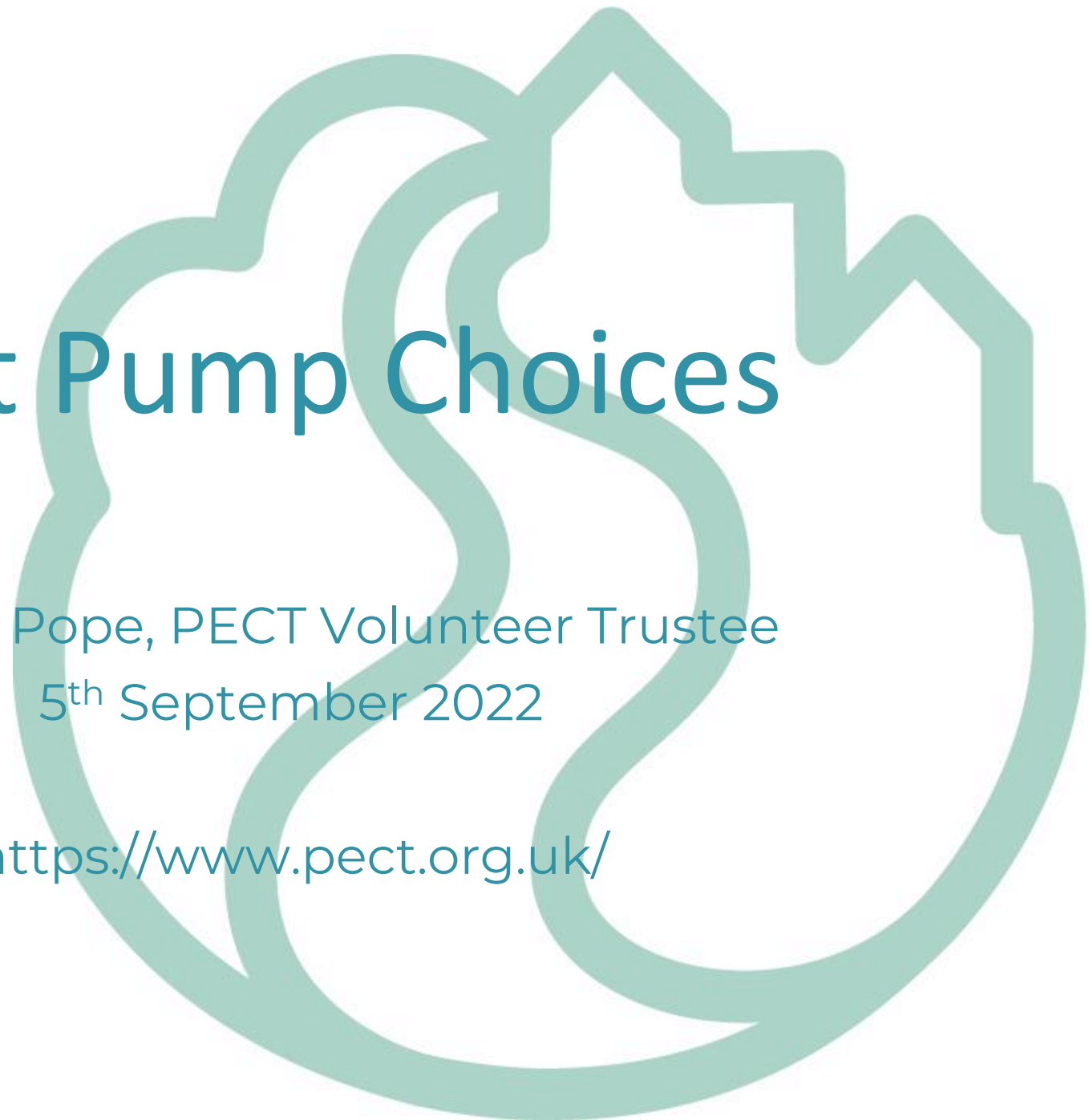




# Heat Pump Choices

Warren Pope, PECT Volunteer Trustee  
5<sup>th</sup> September 2022

<https://www.pect.org.uk/>



# Heat Pump what to look for?

## Who should I use?

- Appoint an installer who is registered with the Micro Generation Certification Scheme (MCS)
- The MCS installer is required to issue and register a heat loss calculation and system design specification to MIS3005
- This specification will give access to the Renewable Heat Incentive (RHI)
- The installation can be subject to audit, if incorrect the installer is subject to a fine
- If the specification is incorrect, and performance under expected any RHI claim will be void

## Ideal Site Requirements

- Well insulated home (Will talk about hard to heat homes later)
- Accessible outside ground space to install collector (Ideally so a ladder is not required for servicing)
- Indoor space for hot water store
- Electricity and water connections
- With Ground Source Heat Pump (GSHP) A borehole can cost between £4,000 - £6,000 in addition to the cost of the heat pump for the borehole

# Heat Pump what to look for?

## How efficient is a Heat Pump

- The efficiency level is measured according to its **Coefficient Of Performance (COP)**
- This indicates the amount of usable energy extracted from the air compared to how much electricity is used to power the pump
- A COP of four means that for every one kilowatt (1kW) of electricity used, 4kW of heat is produced
- Will I notice a change in how I heat my house

## Benefits

- Reduce CO2 emissions
- Can lower energy bills
- MIS3005 design required to claim RHI (Renewable Heat Incentive) (Up to £7,000 quarterly over 7 years)

**NOTE:** The RHI scheme will remain open to applications until 31 March 2022

Ground source heat pump piping system has an estimated lifespan of 50-100 years

The Heat Pump will last for 20 –25 years

# Heat Pump – Boiler Upgrade Scheme?

## Boiler Upgrade Scheme

- Will run for 3 years starting April 2022, a budget of £450 million has been allocated to the scheme.
- Will supply approx. 90,000 total grants, target is 600,000 heat pumps every year (until 2028).
- The property requires a valid Energy Performance Certificate (EPC) dated within the last ten years.
- Property must either be an existing building or a custom-made one.
- New builds are not be eligible for the Clean Heat Grant.
- Homes are required to get their needs assessed and provide at least one quote from a certified installer to qualify for grant.
- The property owner must apply for the voucher
- The installer will have the lead in redeeming the voucher.
- Installers must be MCS certified.
- The EPC must have no recommendations for loft and cavity wall insulation.

# Heat Pump – Boiler Upgrade Scheme

## Boiler Upgrade Scheme

Will run for 3 years starting April 2022, a budget of £450 million has been allocated to the scheme.

Will supply approx. 90,000 total grants, target is 600,000 heat pumps every year (until 2028).

The property requires a valid Energy Performance Certificate (EPC) dated within the last ten years.

Property must either be an existing building or a custom-made one.

New builds are not eligible for the Clean Heat Grant.

Homes are required to get their needs assessed and provide at least one quote from a certified installer to qualify for grant.

The property owner must apply for the voucher

The installer will have the lead in redeeming the voucher.

Installers must be MCS certified.

The EPC must have no recommendations for loft and cavity wall insulation.

# Heat Pump - Hard to Heat Homes

- A hybrid system will reduce carbon emissions but may leave the home cooler than preferred
- Hybrid systems may not always produce the efficiency required for RHI payments, so having a formal contract linked to the specification in place is important
- The heat pump must have a minimum SPF (Seasonal Performance Factor) of 2.5
- SPF is a measure of the operating performance of an electric heat pump heating system over a year
- $$\text{SPF} = \frac{\text{Total heat energy output per annum (kWh)}}{\text{Total input electricity per annum (kWh)}}$$
- A heat pump with an SPF of 2.5 will on average deliver 2.5kWh of heat for every 1kWh of electricity it uses
- Heat Pumps cannot be used with Micro bore pipe work (8mm Dia), May require modification to existing pipework (bigger diameter)
- Heat pumps can be used in conjunction with thermal stores such as Sunamp (resembles a small fridge) <https://www.thinkelectricheating.co.uk/>
- Solar Thermal can also be built into the system (May require a cylinder)



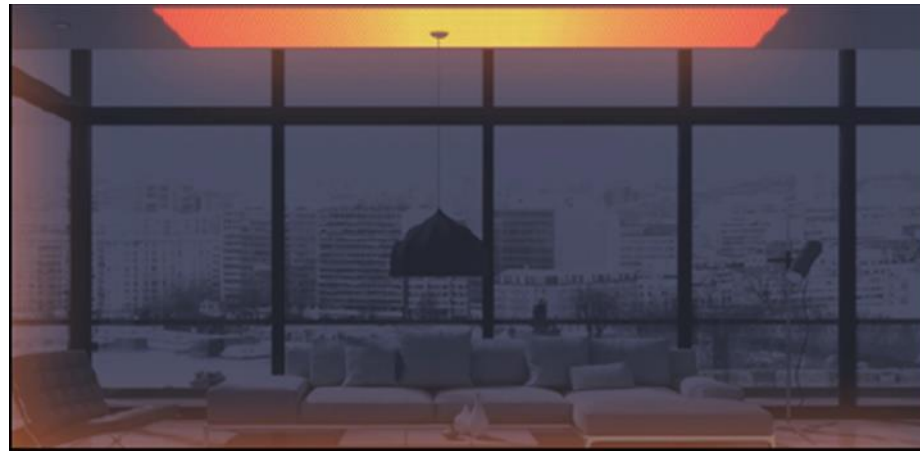
## Heat Pump or an alternative - Hard to Heat Homes

### Secondary heating could be considered such as;

Laminaheat Powerboard, a heated fabric sheet that can be incorporated into ceilings, walls and floors and be over plastered or covered, a product new to the market.

The product offers an even range of heat through a property, either embedded in the ceiling, under floor or within the wall plaster.

<http://www.laminaheat.com/en/#funktionsweise>



# Heat Pump or an alternative - Hard to Heat Homes

## Secondary heating could be considered such as;

Infrared Heaters, can be used to replace gas or coal fires, the radiated infrared waves directly heat the thermal mass within a room (including the ceiling, walls, floor, furniture and occupants).

These objects store the energy and gradually release it back into the room in the form of heat. They come as a flat panel, or a mesh that can be underfloor or embedded into plaster on a wall. <https://arcthermalproducts.co.uk/product-category/indoor-heating/living-spaces-heating/>





# Heat Pump or an alternative - Hard to Heat Homes



Premium Aluminium Electric Radiators  
Fully controllable revolutionary LCD touchscreen thermostat programmer  
State of the art electronic thermostat accurate to  $\pm 0.1^\circ\text{C}$   
Built-in WiFi with intuitive and easy to use app based data analysis software  
Real-time energy consumption monitoring  
Energy tariff optimisation  
Open window detection sensor  
Presence detection with wide range motion sensor  
Weekly Timer Control, programmable to the minute



Thermodynamic fluid-filled electric radiator and the IntellyGreen Monitoring and programming Web App solution.

1 Waterloo Close, Thetford, Norfolk, IP4 2ZD. 020 3916 0000

<https://creativeradiators.co.uk/>

<https://intelligentheat.co.uk/electric-radiators-and-towel-rails/isense-wifi-electric-radiators/>



# Heat Pump or an alternative - Hard to Heat Homes

The initial models are regular/system boiler which means they requires your home to have a separate hot water tank. We plan to develop a “combi” replacement version in 2022 which will not require a hot water tank.

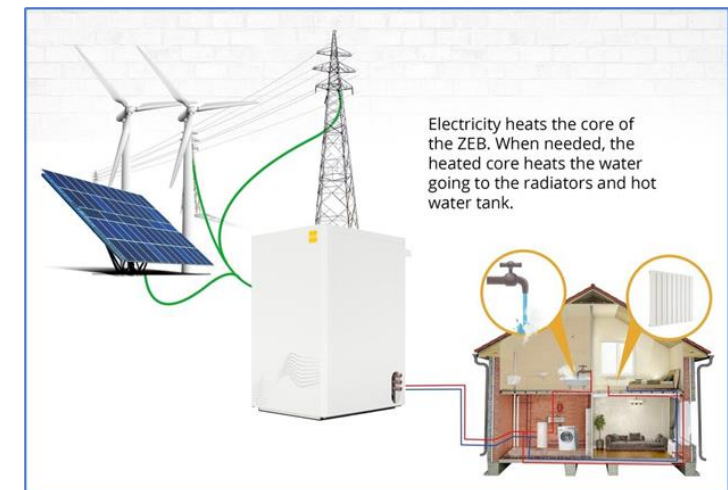
The tepeo Zero Emission Boiler (ZEB) is a low carbon alternative to a gas or oil boiler - it heats your home affordably while lowering your carbon footprint and supporting renewable generation.

It provides the same heating service (heated water to any set temperature between 35-80°C) as a gas or oil boiler with reduced emissions  
It's powered by electricity and works like a battery to store heat efficiently until it is needed.

The ZEB's smart tech charges the core with energy at the cheapest and greenest times of day ready for when you need it. It uses flexible tariff's - known as time-of-use - to do this. Most energy providers offer one or more tariffs of this sort.

<https://tepeo.com/thezeb>

630 Wharfedale Rd, Winnersh, Wokingham RG41 5TP



# Heat Pump or an alternative - Hard to Heat Homes

Made from Warmstone a patented solid storage material that is made from a combination of recycled and natural materials.

It uses cheaper night time electricity to heat the solid core of the Caldera. The stored heat is used to provide a supply of hot water and heating to the home when needed.

## Heat Pump or a Heat Battery?

If you live in a house that uses heating oil or LPG, has solid walls (built pre-1930) and normal radiators, then you may be better to consider a heat battery. Currently advertised at £12,000.



The Heat Battery consists of a block of Warmstone that is heated by electrical elements that are similar to those used in a oven or kettle. Heat is discharged via a heat exchanger to produce hot water.

Using highly efficient insulation is reported to result in over 90% of the energy being recoverable as heat for your home.

In the UK today there are three electricity suppliers offering 5p/kWh off-peak tariffs – making the electrification of heat an affordable option.

In addition, you can store and use electricity from your own solar PV panels to reduce or eliminate your hot water bills during the summer months. 7kW of additional PV can be fed directly to the unit without restrictions.

<https://www.caldera.co.uk/>

Caldera Heat Batteries Limited, 7 Brunel Way, Segensworth East, Fareham, Hampshire, PO15 5TX

# Heat Pump Types

Air Source Heat Pump		Ground Source Heat Pump		Hybrid Heat Pump	Water Source Heat Pump
Air to Air	Air to Water	Ground Coil (Slinky)	Bore hole	Air/Ground to water	Water to Water
Split Unit or Monoblock		Monoblock		Gas/Oil Boiler	
High Temp	Low Temp				

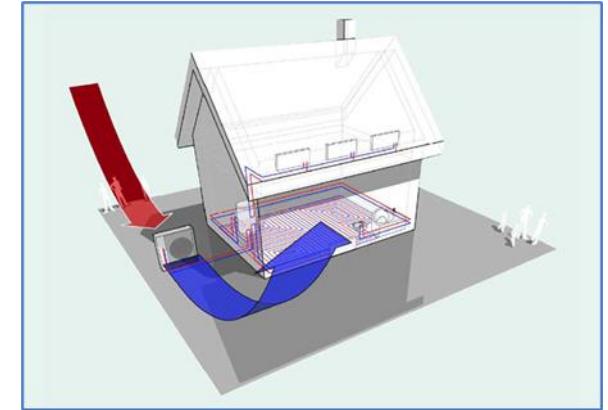
# Air Source Heat Pump

## How do they work?

- Heat from the air is absorbed at low temperature into a fluid.
- The fluid is then compressed which increases its temperature.
- This higher temperature heat to the heating and hot water cylinder.
- Up to 4 times more efficient than non-renewable heating solutions.
- Air Source Heat Pumps provide more heat for less energy use.

## Site requirements

- Well insulated home, Outside space for heat pump (Floor or Wall mounted)
- Indoor space for hot water store, Electricity and water connection



# Air Source Heat Pump

## How do loud are they?

Everyday sounds	Ave sound in decibels (dB)
Normal breathing	10
Ticking Watch	20
Soft Whisper	30
Quiet Library	40
Refrigerator hum	40
Moderate rainfall	50
Normal Conversation	60
Air conditioner	60



kW Rating	4.8kW	8.3kW	11kW	14kW
At 1m dB	45	48	53	53
Low noise mode dB	40	42	46	46



# Air Source Heat Pump – Planning Rules

- Air Source Heat Pump and Planning Permission: From 1 December 2011, the installation of an air source heat pump on domestic premises was considered to be permitted development, therefore not requiring an application for planning permission, this is so long as ALL the limits and conditions listed below are met.
- These permitted development rights apply to the installation, alteration or replacement of an air source heat pump on a house or block of flats, or within the curtilage (garden or grounds) of a house or block of flats, including on a building within that curtilage. A block of flats must consist wholly of flats (e.g. should not also contain commercial premises).
- Development is permitted only if the air source heat pump installation complies with the Microgeneration Certification Scheme Planning Standards (MCS 020) or equivalent standards.
- The volume of the air source heat pump's outdoor compressor unit (including housing) must not exceed 0.6 cubic metres.
- Only the first installation of an air source heat pump would be permitted development, and only if there is no existing wind turbine on a building or within the curtilage of that property. Additional wind turbines or air source heat pumps at the same property requires an application for planning permission.
- All parts of the air source heat pump must be at least one metre from the property boundary.

# Air Source Heat Pump – Planning Rules

- Installations on pitched roofs are not permitted development (and would require planning permission). If installed on a flat roof all parts of the air source heat pump must be at least one metre from the external edge of that roof.
- Permitted development rights do not apply for installations within the curtilage of a Listed Building or within a site designated as a Scheduled Monument.
- On land within a Conservation Area or World Heritage Site the air source heat pump must not be installed on a wall or roof which fronts a highway or be nearer to any highway which bounds the property than any part of the building.
- On land that is not within a Conservation Area or World Heritage Site, the air source heat pump must not be installed on a wall if that wall fronts a highway, and any part of that wall is above the level of the ground storey.
- In addition, the following conditions must also be met. The air source heat pump must be:
  - Used solely for heating purposes.
  - Removed as soon as reasonably practicable when it is no longer needed for microgeneration.
  - Sited, so far as is practicable, to minimise its effect on the external appearance of the building and its effect on the amenity of the area.
- A noise level output of 45dBA will give you almost total flexibility on where you site your heat pump.

# Air Source Heat Pump – Temperature Vs Performance

A heat pump with a CoP of 4, with and an outdoor temperature of 8.3 °C, a heat pump could achieve around 3.8 CoP.

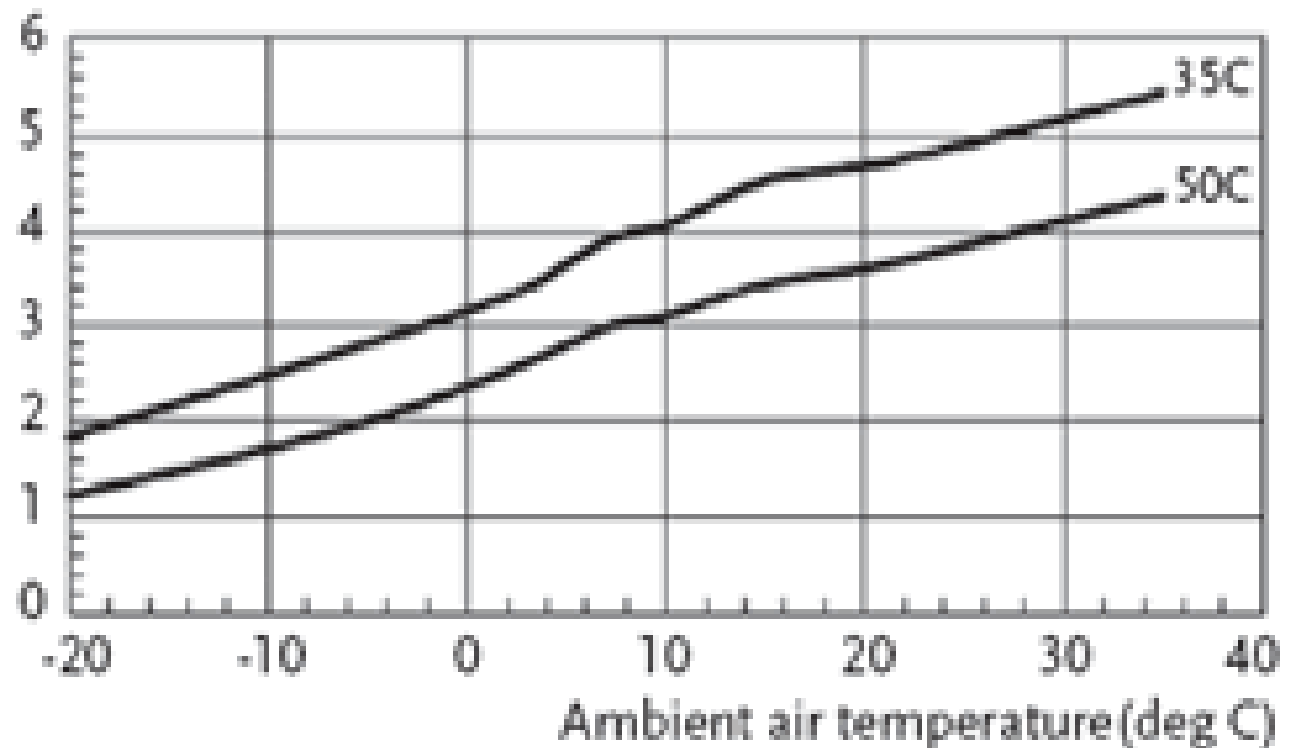
Alternatively if the temperature drops to around -8.3 °C, the heat pump efficiency could drop to approximately 2.3 CoP.

The graph on the right hand side is from a CIBSE journal.

The COP is listed on vertical axis.

The lines represent a low temperature and high temperature heat pump (the 35 and 50 is the output temperature).

Coefficient of performance (incl. power input to pump)



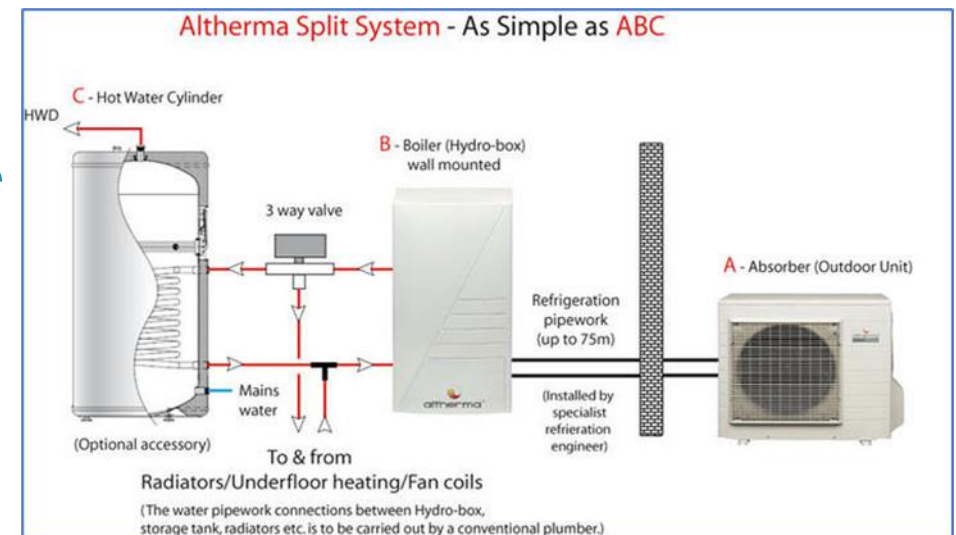
# Air Source Heat Pump

## Things to consider

- Monobloc or Split unit (Split can be £4,000 to £6,000 additional cost)
- Under floor or radiators (Radiators and pipework may need to be upgraded)
- Must have heat loss calculation to size system
- MIS3005 design required to claim RHI (Renewable Heat Incentive)
- Planning permission may be required (in some conservation areas)

## How long will it last?

- Heat pump can run for 20 to 25 years



# Air Source Heat Pump

## Benefits

- Reduce CO<sub>2</sub> emissions, Can lower energy bills
- Can attract RHI payments (Potentially £7000 to £10,000 over 7 years)
- New models are very quiet

## How much internal space is generally required

- Air Source Heat Pump: approximately 2m x 2m ideally 2m x 3m around 2m high
- Ground Source Heat Pump: 2m x 2m (Depending on equipment selection)



ASHP Water Cylinder Busy Energy Ltd

# Hybrid Source Heat Pump

- The hybrid system can use any type of boiler system, including gas, oil and liquid petroleum gas (LPG), the two devices are linked by a smart switch to a Heat Pump
- A sensor outside detects the external temperature which at a pre-set minus temp will turn the Heat pump off and boiler on
- Gas boilers typically heat water to 80°C
- Heat Pumps typically heat water to 45°C
- Heat Pumps, same as the boiler are connected to emitters (To normal people these are radiators or underfloor heating,)
- Heat Pump & Boiler emitters will often have a different surface area (Boiler emitters being smaller)
- If the system keeps the smaller surface area, it runs the risk of under heating when using the heat pump, so secondary heating is recommended

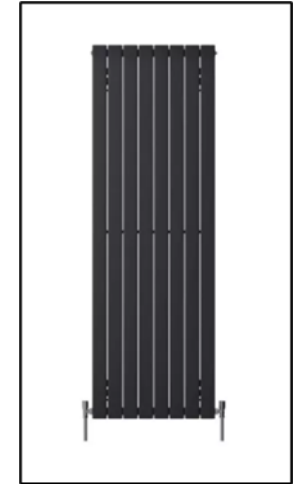


Picture from PHAM news 2015



# Alternative to Heat Pumps

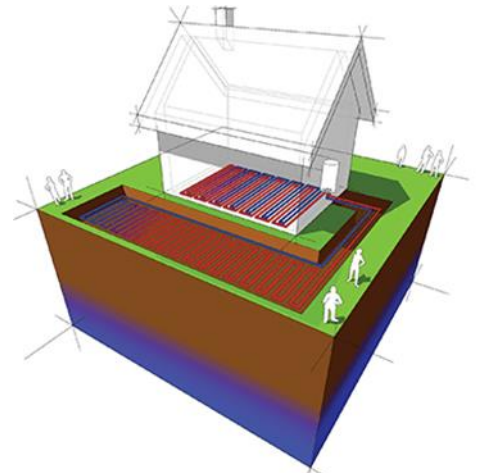
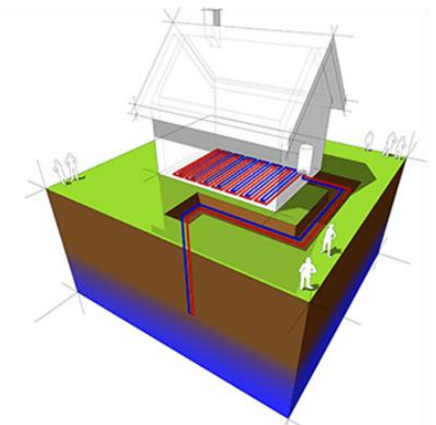
- When the outside temperature drops to set temperature the boiler will turn on, the heat pump turns off
- A combi boiler is a practical choice for the boiler component of a hybrid system, as it dispenses with the need for a hot water cylinder
- If no combi boiler, retaining the cylinder for Domestic Hot Water (DHW) from the fossil fuel boiler is important
- The Sunamp thermal store can be used with some heat pumps



# Ground Source Heat Pump

## How do they work?

- At depths of 1m and more, the ground temperature does not deviate very much from the average summer/winter surface temperatures (around 9°C to 12°C in the UK depending on location).
- A mixture of water and inhibitor anti-freeze is pumped around a ground loop (or borehole) to absorb the latent heat.
- The heat then passes over a refrigerant, turning the liquid into a gas, which is compressed to increase its temperature.
- This then passes over a second heat exchanger to transfer the heat into the heating circuit and cylinder to provide hot water.



# Water Source Heat Pump (WSHP)

## Closed loop systems

- Comprised of sealed pipes filled with fluid (antifreeze)
- They are submerged below water
- The fluid flows through the pipes, heated by the water body and returns to the heat pump

## Open loop systems

- Water flows through the pump to extract its heat in an open loop system, before being discharged back to its source
- Can be more efficient than closed loop pumps
- Consent needed from the Environment Agency, for England, Wales, or Scottish Environment Protection Agency (SEPA) in Scotland to discharge the water
- Additional permission may be required to extract the water

## Water hybrid heat pumps

- Require a second heating source running alongside the WSHP system

## Where (Typically)

- Golf clubs, Hotels, larger estate houses



# Heat Pumps in General

## City Science appointed by BEIS to accelerate the uptake of heat pumps via the Heat Pump Ready programme in Cambridgeshire

City Science has been appointed by the Department of Business, Energy & Industrial Strategy (BEIS), to coordinate a consortium to deliver one of a series of the Stream 1, phase 1 projects of the Heat Pump Ready (HPR) Programme, with City Science specifically working in Cambridgeshire.

A key solution for decarbonising heat in homes, heat pumps will be critical in meeting the UK's legally binding commitment to achieve net zero by 2050. The Heat Pump Ready Programme forms part of BEIS' £1 billion Net Zero Innovation Portfolio (NZIP), which aims to accelerate the commercialisation of innovative clean energy technologies and processes through the 2020s and 2030s.

# Heat Pumps in General

In Cambridgeshire, City Science will be understanding the feasibility of high-density heat pump deployment in rural areas. City Science will be working with project partners Cambridgeshire County Council, Fenland District Council, Peterborough Environment City Trust (PECT), Growth Guides and Lendology.

We'll be developing the plan, and gaining an understanding, on how to install a large number of heat pumps in a high-density cluster. The feasibility studies will take a place-based approach by working with local partners, which will help to establish local momentum and generate community interest for heat pumps. Our approach will work closely with users to streamline the customer journey, and we will be investigating innovative financing models that help consumers overcome the large upfront cost of heat pumps.

“Heating in domestic buildings is a major source of carbon emissions and one where we are currently not seeing a decline. To have any chance of reaching the UK’s commitment of Net Zero by 2050, heating within our homes must decarbonise, and a large-scale role out of heat pumps will be necessary to achieve this.

However, we know there are considerable barriers to their adoption by homeowners. With the HPR project, we will be looking to help the government make the transition to net zero affordable and achievable for all, by reducing costs to consumers and minimising barriers to uptake.”

# Heat Pumps in General

ASHP – Air source heat pump

ATA – Air to air

ATW – Air to water

BSRIA – UK Building Services Research and Information Association

CAGR – Compound annual growth rate

CCC – The UK Committee on Climate Change

COP – Coefficient of performance

SCOP – Seasonal Coefficient of Performance

EHPA – European Heat Pump Association

EINA – UK's Energy Innovation Needs Assessment

F-gas – Fluorinated gas

GMI – Global Markets Insights

GSHP – Ground source heat pump

GTW – Ground to water

GWP – Global warming potential

HFC – Hydrofluorocarbons

HVAC – Heating, ventilation, and air conditioning

IEA – International Energy Agency

MCS – Microgeneration Certification Scheme

RHI – Renewable Heat Incentive

WSHP – Water source heat pump

WTW – Water to water



# Further Information

- MCS – Certification body for renewable energy products and installation [www.mcscertified.com](http://www.mcscertified.com)
- HPA – Heat Pump Association, for installers, manufacturers etc, website has a consumer page with more technical detail [www.heatpumps.org.uk](http://www.heatpumps.org.uk)
- GSHPA – Ground Source Heat Pump Association [www.gshp.org.uk/](http://www.gshp.org.uk/)
- Domestic RHI Calculator: [www.renewable-heat-calculator.service.gov.uk/](http://www.renewable-heat-calculator.service.gov.uk/)
- Smart Export Guarantee: <https://www.ofgem.gov.uk/environmental-programmes/smart-export-guarantee-seg/about-smart-export-guarantee-seg>
- Examples of ASHP noise in operation: <https://www.busyenergy.co/affordable-technology>

# Thank you for listening

## Any Questions

Warren Pope, Volunteer Trustee  
PECT  
[warren.pope@btinternet.com](mailto:warren.pope@btinternet.com)



---

01733 568408   info@pect.org.uk   www.pect.org.uk