Heat Pump Choices

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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
- 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 on slide 4)
- 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 five means that for every one kilowatt (1kW) of electricity used, 5kW of heat is produced
- 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 £10,000 over 7 years)
- 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 - Hard to Heat Homes

- For a move to non fossil fuels industry recommends hybrid heat pumps (wait for slide 11)
- 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
- 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)
- May require a heat meter for RHI payments
- 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)

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Heat Pump - 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

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Heat Pump - 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 paster on a wall. https://arcthermalproducts.co.uk/product-category/indoor-heating/living-spaces-heating/

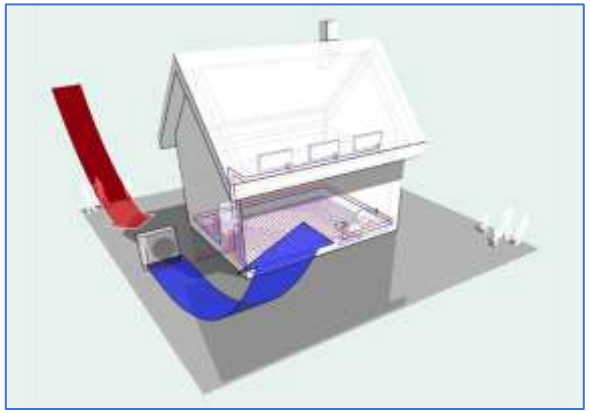
Heat Pump Types

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

Cambridge Carbon Footprint
OPEN eco HOMES
RETROFITWORKS BUILDING EFFICIENCY TOGETHER
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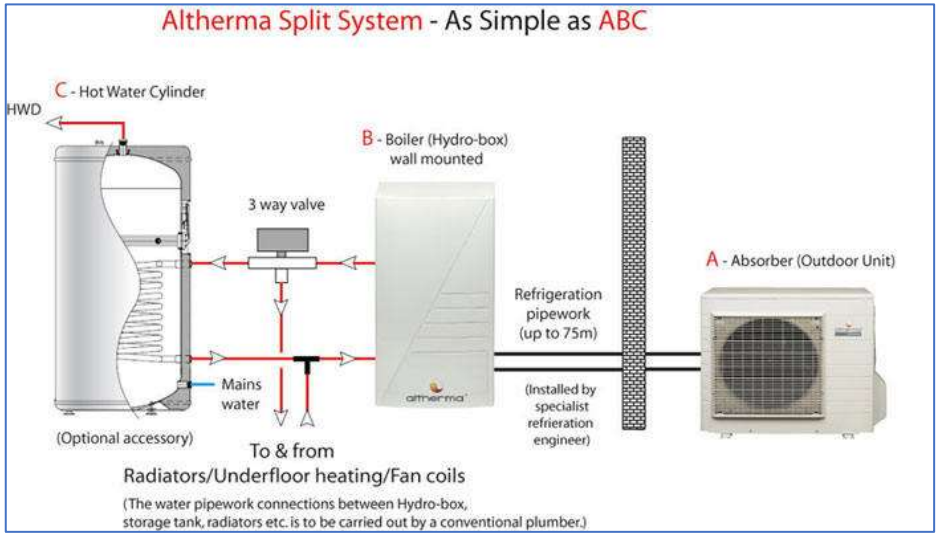
Air Source Heat Pump

- **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 required (in some conservation areas)
- **How long will it last?**
  - Heat pump can run for 20 to 25 years

Monoblock Unit



Split block Unit

Air Source Heat Pump

Benefits

- Reduce CO_2 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^{O}C
- Heat Pumps typically heat water to 45^{O}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

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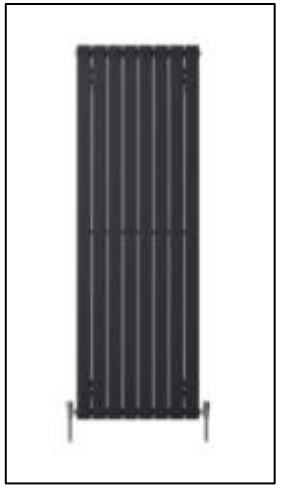
Hybrid Source Heat Pump

- 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

ASHP Emitter

ASHP Emitter

Sunamp Water Heater

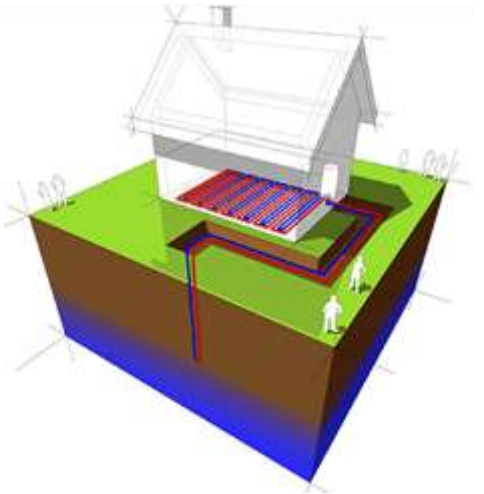


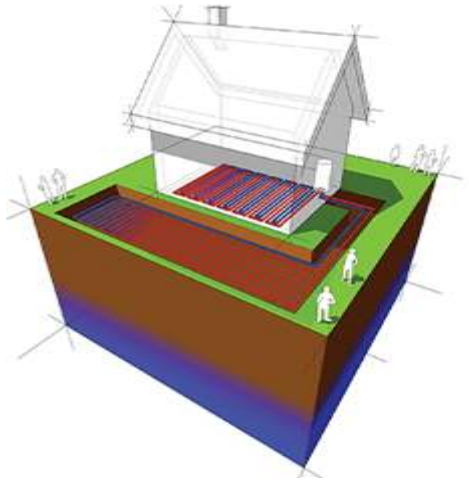
ASHP Emitter

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^{O}C to 12^{O}C in the UK depending on location).
- A mixture of water and inhibiter 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.





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Water Source Heat Pump (WSHP)

Closed loop systems

- Comprised of sealed pipes filled with fluid (antifreeze)
- They are submerged below
- 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

Thank you for listening

Any Questions

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Heat Pump Choices

Michael Goodhart’s photos


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27
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DAIKIN
altherma

Heat Pump Choices

Anne Miller's Slides:

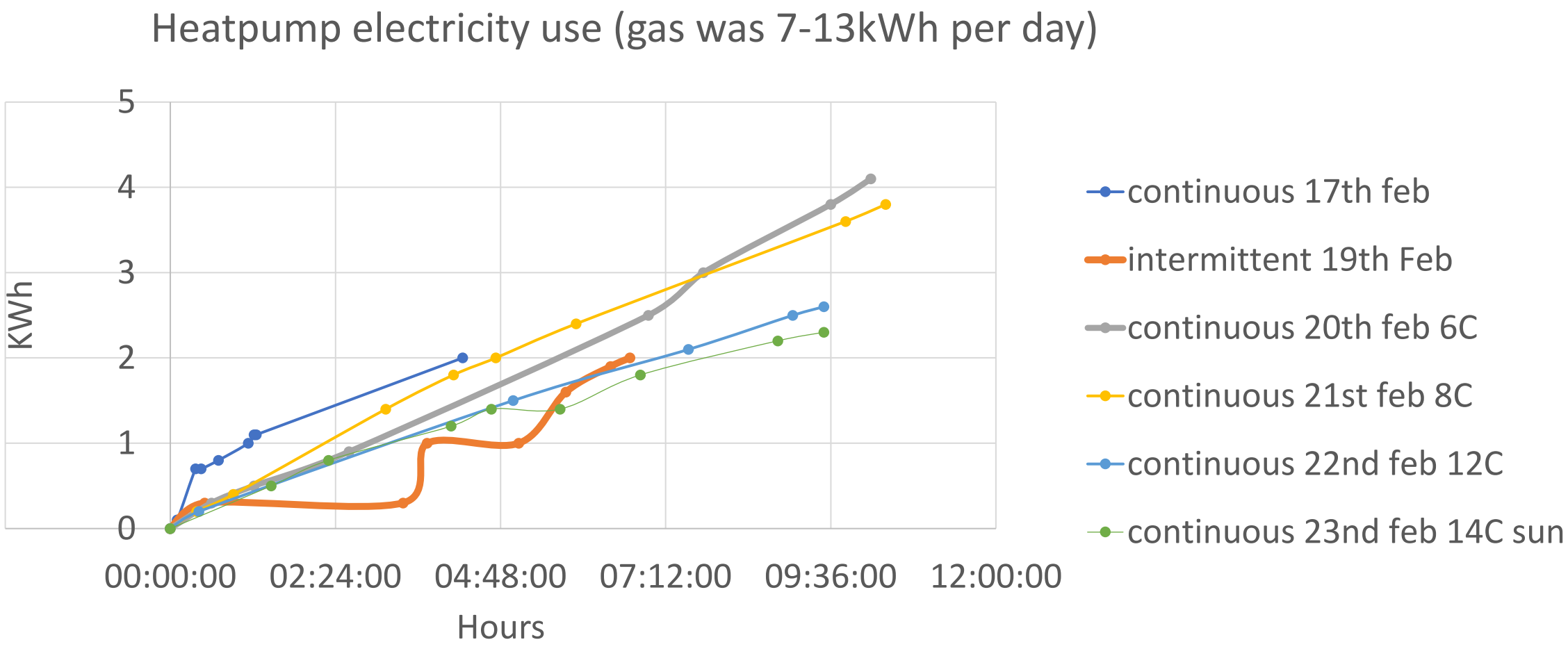
Air-Air heatpump/ air conditioner

Hitachi RAK 25PSE
From Anglian Energy Solutions
Heat output 3.2KW
Seasonal COP 5.1
Refrigerant R32
£2250 installed.

Internal unit

External unit

About half to one third the energy use of our gas central heating Little or no benefit from intermittent operation.



Comparison: Air to Air heat pumps, vs Air to Water

Advantages

- ~ Twice the efficiency of air-water heat pumps
- ~ ¼ the initial price of air-water
- Can be used as an air conditioner

Disadvantages

- One room
- No RHI
- No domestic hot water
- No heat storage

Reference Information

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

Hybrid Heat Pump Setup

- A hybrid system is a purpose built combined heat pump with oil or gas boiler from the same manufacturer.
- In this set up, the heat pump can run all or most of the time and the gas or oil boiler tops it up.
- A bivalent system is when any heat pump is paired with any gas or oil boiler and combined via a buffer tank.
- The heat pump will run as much as possible when it can meet demand.
- When the outside temperature drops below a certain point the heat pump will switch off and the oil boiler will fire. (They will do not run at the same time.)
- When sizing cylinder, hot water consumption is typically 25 litres per person per day

No. of Bedrooms	No. of Bathrooms	Cylinder Size in Litres
1	1	120 litres minimum
2	1	150 litres minimum
3	Up to 2	180 litres minimum
4	2	210 litres minimum
5 and up	2 and up	300 litres minimum

Hybrid Heat Pump

Most typical Hybrid Heat Pump combinations

Daikin	Vaillant	Grant	Firebird
5kW or 8kW Altherma heat pump	aroTHERM heat pump 5, 8, 11 and 15kW	17kW Aerona R32 heat pump	7.5-16kW Enviroair heat pump
33kW gas boiler or can use a third party gas boiler	Vaillant gas boiler or existing third party gas or oil boiler	VortexAir Blue Flame oil boiler	Envirogreen oil boiler

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Heat Pump Manufacturers

- Worcester Bosch
- Vaillant
- Ideal
- Baxi
- Viessman
- Vokera
- Mitsubishi
- Samsung
- Daikin
- Nibe
- LG
- Grant
- Panasonic

Mitsubishi Coastal Protection Models (-BS)
Monoblock
PUHZ-(H)W50-140VHA(2)/YHA2-BS

Split Range
PUHZ-SW50-120VKA/YHA-BS

Further Information

- MCS – Certification body for renewable energy products and installation www.mcscertified.com
- HPA – Heat Pump Association, for installers, manufacturers etc, website has a consumer page with more technical detail www.heatpumps.org.uk
- GSHPA – Ground Source Heat Pump Association www.gshp.org.uk/
- Renewable Heat Incentive – Administered by Ofgem www.ofgem.gov.uk/domestic-rhi
- Domestic RHI Calculator: 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

Eastern New Energy Project

RetrofitWorks is a partner in the Eastern New Energy (ENE) project, a collaborative research project led by the University of East London with the aim to build a stronger Local Energy and Low Carbon Economy in the East of England. The Eastern New Energy project is part-funded by the European Regional Development Fund (ERDF).

What Support is available?

The project is designed to help local enterprises (private and social) and other organisations across the region understand and remove the barriers that we all face in rapidly decarbonising our communities, buildings, transport, and lives. It covers the counties of Hertfordshire, Cambridgeshire, Norfolk, Suffolk, Rutland and parts of Lincolnshire and Essex.

For SME companies we can help you with the following:

- Develop and commercialise your low carbon products, technologies and services.
- Grow and develop your business – and take advantage of rapidly growing 'green' market sectors.
- Retrofit affordable low/zero carbon homes.

The Eastern New Energy team can support the development of your product or service, our support incudes:

- Do you need help understanding and identifying business opportunities for your business in low carbon growth market sectors?
- We can help you with finding and meeting new customers (and retaining existing ones) as low carbon considerations become increasingly important to them.
- Helping with demonstrations of products and services.
- Developing and implementing a low carbon marketing and communications strategy for your business.
- Finding complementary businesses with whom you can collaborate.

Working with you to improve the retrofit supply chain to:

- We can help introduce new products and services for retrofit.
- Identify retrofit packages, introduce new technologies and approaches to reducing energy use, in housing, maximising decarbonisation and minimising cost.
- Facilitate demonstrations of these retrofit packages.

The focus wherever possible will be on using innovative approaches and techniques (such as smart energy systems, high performance insulation materials, digital controls, etc) – combined with use of standard measures as part of an innovative approach.

All of the business support services and workshops we provide in the ENE project are free.