

Heat Pump Choices

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

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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 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 - 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.thinkelectrich heating.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 - 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 - 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



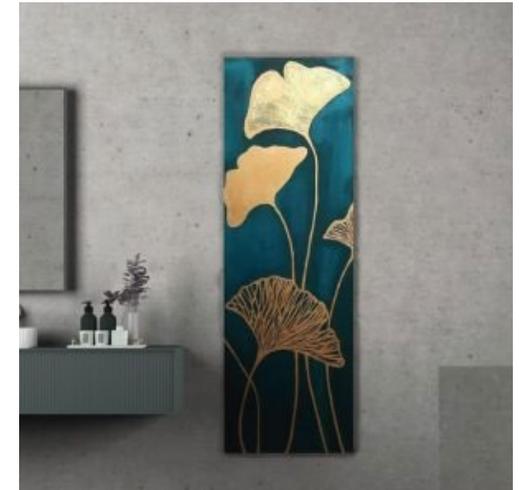
Thermodynamic fluid-filled electric radiator and the IntellyGreen Monitoring and programming Web App solution.



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 - 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.

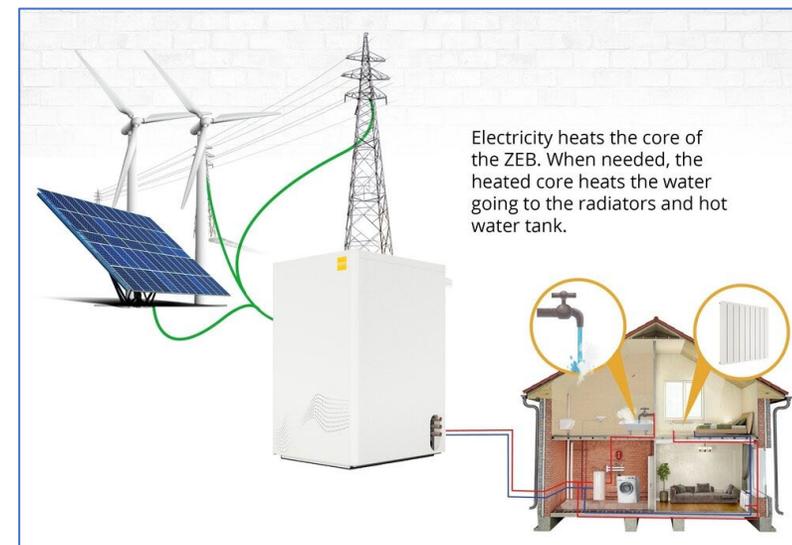
The tepeo Zero Emission Boiler (ZEB) is a low carbon alternative to a gas or oil boiler - it heats your home affordably while lowering your carbon footprint and supporting renewable generation.

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 - 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.



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

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

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.

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				

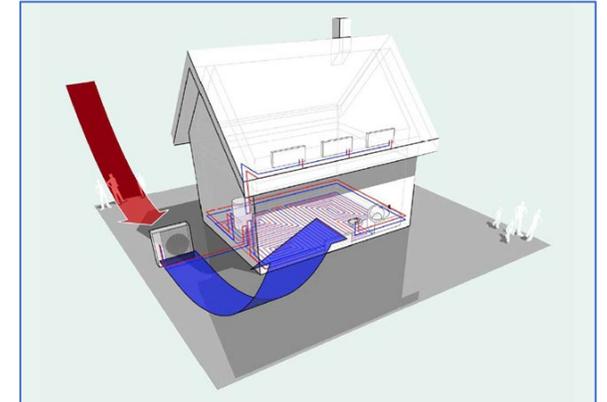
Air Source Heat Pump

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

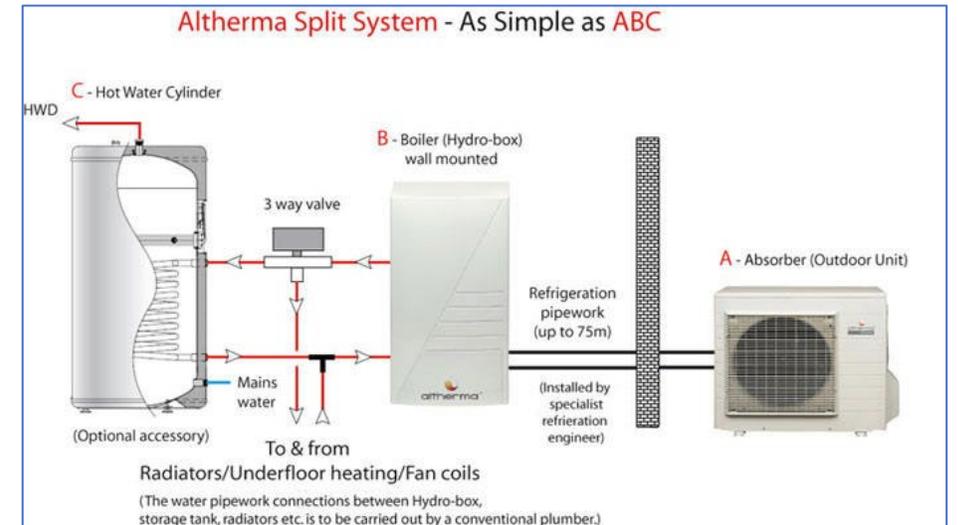


Air Source Heat Pump

- **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

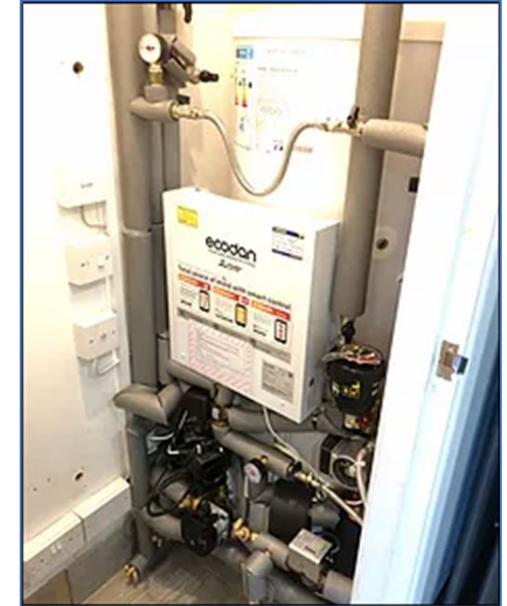
Air Source Heat Pump

Benefits

- Reduce CO₂ 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

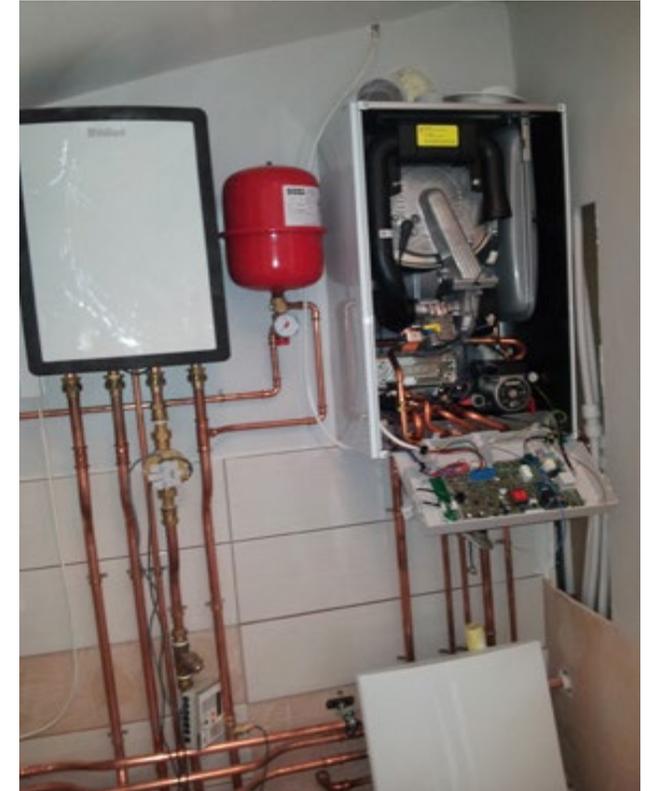
- Air Source Heat Pump: approximately 2m x 2m ideally 2m x 3m around 2m high
- Ground Source Heat Pump: 2m x 2m (Depending on equipment selection)



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

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



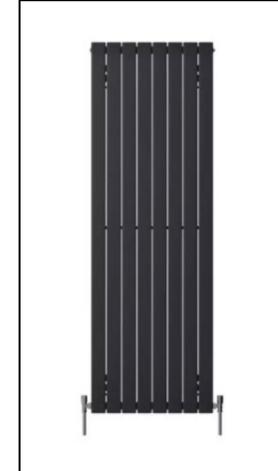
ASHP Emitter



ASHP Emitter



Sunamp Water Heater

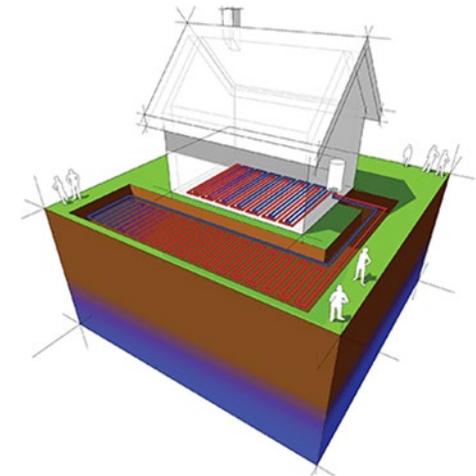
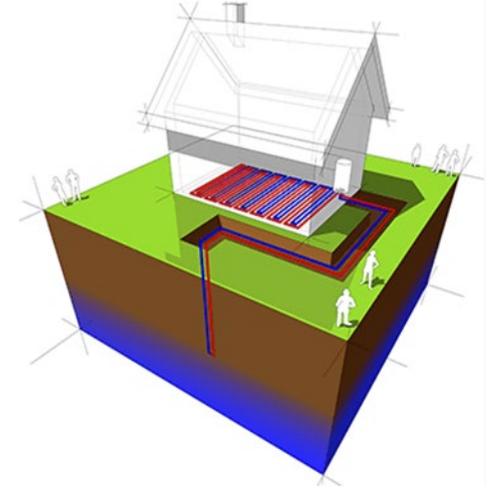


ASHP Emitter

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°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
- 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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<https://retrofitworks.co.uk/schemes/eastern-new-energy/>

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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

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 includes:

- 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.