Kempley Home Energy Café Report

Saturday October 29th Kempley Village Hall

Don't Panic

This report has all the papers from café but not in the order they were presented

See the Contents overleaf - Dip into it as you see fit

Draft 22nd November 2022

This is a draft – its not in any sense complete

Additional material will be added over time

Thanks to everyone who presented, attended and contributed

Thanks for the support and publicity given to the meeting by Kempley Village Hall Committee, Kempley Parish Council, Transition Newent, The Forest Climate Action Group and Windcross Magazine.

Kempley Home Energy Café Report
Enabling Decision Making and Advocacy

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Enabling Decision Making and Advocacy

Introduction

The background to this meeting included:

- The increase in energy prices is forcing people to evaluate their home energy
- This aligns well with actions that need to be taken to address climate change
- Our rural setting, where many people are not on mains gas, creates a greater awareness of the home energy issues. The 'new boiler challenge' arises often in this situation.
- We also know that our interventions are on a financial scale from no or low cost – to insulation – and then to the expensive issues like new boilers and renewables

- If you want to know how something works sharing experiences with locals who have the technology is a good way of finding out what can be done. We tried to encourage conversations to build those links.

Aim The main aim was to discuss home energy and ways that people could consider saving costs in the short and long term. This was an interactive meeting where the participants were encouraged to share and discuss their experience so that after the meeting, they would share their learning with their friends and family.

Part 1

1.1 Reasons to Act - Decision Making – Overview of Key Points

Change – the speed of technology change – Efficiency

We are living through the early years of a renewable energy revolution. Technology change is happening fast so that what seemed futuristic even 5 years ago are now practical options for everyone. The efficiency of all sorts of technologies are also changing very fast – LED's are 10 times more effective than older filament light bulbs and cheaper run and new solar panels generate twice as much as panels from 10 years ago.

Priorities – what should you do first?

In considering the near term future – the next 5 years – choices made now can help break into new opportunities. In terms of priorities:

1. In the short terms the no cost & low cost options provide a host of things that can be done quickly
2. If you have more money, insulation is the next most cost effective step
3. Next, solar PV can help break into the renewable technologies, the more effective use of electricity (batteries), non-fossil fuel space heating (air source heat pumps) and using your house to fuel the electric car.
4. Other technologies and capital investment may well be appropriate to meet specific needs.

Costs

The sharply rising cost of energy has focussed everyone's attention to the issues surrounding home energy and cost remains the key issues for most people in relation to decision making. Section 1.4 below focuses on the cost elements of decision making, on capital investment and running costs and the arguments that affect this, as well as tariffs and grants. Part 2 of this report ranges from those measures that costing nothing or very little through to major items of capital investment.

Climate change

Climate change *is happening,* and every form of media makes this obvious daily. At COP27 Antonio Guterres the UN General Secretary made it very clear – '*We are on a highway to climate hell with our foot still on the accelerator.'* Read his speech here

Housing in the UK is responsible for 20% of the UK's carbon emissions which is why domestic fossil fuel use will remain on Government agenda for many years to come. Many early adopters of renewable energy have made their choices based on want to mitigate climate change. The Ukraine war have shown us what energy security should be like, and how a dependency on fossil fuels is leaving us very exposed to their fluctuating prices. High temperatures such as the 40C days of 2022 are also making us aware of the need to have cool parts of our houses.

Major prompts for decision making

In the rural setting where many people are not on mains gas the need to change the boiler is a major issue which most homeowners are only too well aware. The fossil fuel options have changed over the years and renewables such as air source heat pumps are providing another option; hydrogen may well enter the scene in years to come. New extensions or refurbishments also provide significant opportunities to modify, upgrade or renew energy systems. (Section 1.3 covers this)

Acting before the event – Having the Choice of Options

It has been very easy to take home energy for granted, our heating systems have often evolved in an ad hoc way and as time passes, they can become increasingly outdated. There is a practical reality of future proofing your home in that it is better to take action *before* it is needed e.g. the boiler breaks down – when you have the choice of options. When things break down there is often an urgency to take action which means your choices are limited.

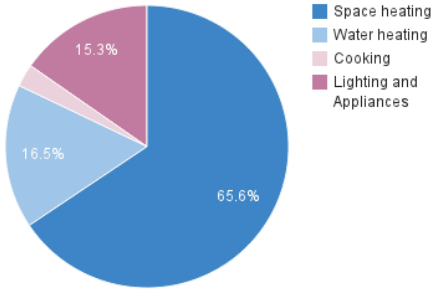
1.2 Home Energy: Reviewing & measuring energy in the home

Paul Kinnaird
email paul@kinnaird.org

What do we use are home energy for?

Source Carbon Brief Housing average use energy report UK Government

Space heating	65.6%	Water Heating	16.5%
Lighting and appliances	15.3%	Cooking	2.6%



There are now a host of ways of measuring home energy usage that can guide where best investments can be made. Knowing the cost of all the energy types available helps the decision making around such major spends such as the need for insulation, changing the boiler, fitting renewables or moving house!

Energy Rating of your house & summary of homes energy performance

You can find the energy rating of your house at this Government website – by law you'll need this if you sell your house.

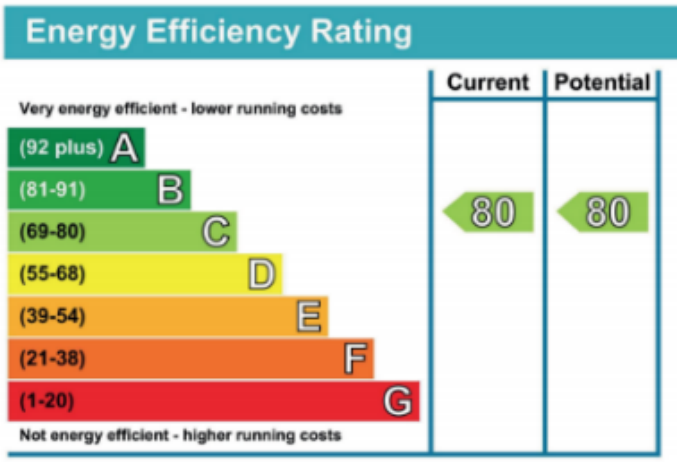


Table 1 An example of a summary of the main elements of a home energy performance related features provides a breakdown of the different elements of your house you need to think about.

Element	Description	Energy efficiency
Walls	Solid brick, as built, no insulation (assumed)	One star
Roof	Pitched, 100mm of loft insulation	Three stars
Floor	Suspended, no insultation (assumed)	None
Windows	Single glazed	One star
Main heating	Boiler & radiators, mains gas	Four stars
Main heating controls	Programmed no economy thermostat	One star
Secondary heating	None	None
Hot water	From main system – no cylinder thermostat	Two stars
Lighting	Low energy lighting in 7% of outlets	One star

Measuring the energy in the home

If you want to understand and control the energy used at home, it is really helpful to measure the amount used. In addition to the information on your electricity bills there are now a number of devices for measuring how much energy you home uses including, Smart Meters, Energy Monitors, Energy Reader for appliances, Digital Thermometers and Infrared Cameras.

Electricity Bills

The utility supplier measures this at the meter to bill the correct amount. The detail needed to reduce your energy is more than the Direct Debit each month. It is helpful to know how many kilowatt hours kWh (units) is used daily, and which appliances use the most. 5 years ago, gas for domestic use was 4-5 p/kWh and now it is capped at 10.3 p/kWh - Electricity was 12p/kWh - now it is capped at 34p/kWh. This could have been much more.

Table 2 Comparisons of costs per unit of energy = 1 kWh – kilowatt hour

Natural gas	10.3p	capped by UK Gov
Electricity	34p	capped by UK Gov [BUT with PV & Battery & Tesla tariff it can be 10.3! – See costs, tariffs
LPG	9.2p	(7.08 kWh per litre) or 13.7p in a 47kg bottle
Heating oil	7.8p	(11.8 kWh per litre) - can vary enormously throughout the year
Diesel	17p	(10.6 kWh per litre)
Petrol	17p	(9.61 kWh per litre)
Logs	12p	(£460 for 1.6 CuM – 1 tonne – kiln dried = 3806 kWh) (often 'free' in rural areas from gardens)

There are a variety of ways you can measure the energy use of your house and appliances including:

Smart Meters https://www.gov.uk/guidance/smart-meters-how-they-work Provided by your supplier. Smart meters: a guide for households This has links to many other aspects of smart meters

Energy meters – independent – e.g. OWL The 'switch' off test enables you to see how much individual appliances are contributing to your overall energy consumption.

Energy Reader for appliances These plugs enable you to monitor the usage of individual appliances – see link

Digital Thermometer This link provides reviews of the 10 best room thermometers

Infrared Camera for domestic energy audits – see this YouTube explanation of how this works Linton Parish Council have an infrared camera which they rent to residents – and they have had good uptake from residents – contact Heather Pealing heather@pealing.me.uk

Air tightness testing This test will show you how well sealed your house is relative to drafts – it is now standard on all new houses. See here for link and explanation

Energy installer audits Many installation companies also offer domestic energy audits.

Appliance electricity cost

The approximate costs of various electrical appliances are shown in Table 3 (below) produced by the Centre for Sustainable Energy. Armed with this information it can guide behaviour in the 'no and low cost' actions we take. Some appliances are notoriously expensive to run e.g. tumble driers. Others like electric blankets are much cheaper to run than say space heating bedrooms.

You can check the **cost of using different electrical appliances** at this Citizen's Advice website Link lots of websites – this Center for Sustainable Energy one is good - link Website link For some appliances we've only listed the cost for either an hour (column 2) or ten minutes (column 3). This is because no one boils a kettle for an hour at a time or puts on the fridge for 10 minutes.

Table 3 Costs of appliance use

Appliance (with average power rating)	Cost per hour	Cost per 10 mins
Electric shower (9000 W)	£3.06	51p
Immersion heater (3000 W)	£1.02	-
Kettle (3000 W)	-	17p
Tumble Dryer (2500 W)	85p	14p
Electric heater (2500 W)	85p	14p
Oven (2100 W)**	71p	-
Washing machine (2100 W)	71p	-
Oil-filled radiator (2000 W)	68p	11p
Hairdryer (2000 W)	-	11p
Hob (2000 W)	61p	10p
Grill (1500 W)	51p	9p
Iron (1500 W)	51p	9p
Toaster (1000 W)	-	6p
Microwave (1000 W)	34p	6p
Electric mower (1000 W)	34p	6p
Vacuum cleaner (900 W)	31p	5p
Dehumidifier (500 W)	17p	-
Towel rail (450 W)	15p	-
Plasma TV (350 W)	12p	2p
Fridge-freezer (300 W)**	10p	-
Freezer (150 W)**	5p	-
Fridge (150 W)**	5p	-
Heating blanket (150 W)	5p	1p
Desktop computer (140 W)	5p	1p
Games console (120 W)	4p	1p
LCD TV (120 W)	4p	1p

Laptop (50 W)	2p	-
TV box (40 W)	1p	-
DVD player (40 W)	1p	-
Extractor fan (20 W)	1p	-
Broadband router (10 W)	1p	-

1.3 Major Prompts for makng decisions on Home Energy

Bob Earll bob@bobearll.co.uk

There are number of major prompts and events that can have major implications for home energy use. These include moving house, needing a new boiler or major rebuilding, refurbishment, extensions etc. These can provide significant opportunities to review, upgrade or renew energy systems.

The new home

This move often means that reviewing your new home's energy operation is timely (see section 1.2 above).

Major rebuilding, refurbishment, extensions – new builds

These major capital expenditures often provide the opportunity to upgrade and replace existing systems, the examples below – and you may well have direct experience show the sort of thing that is possible

- Extension to the house – new underfloor heating system installed
- Gutting the insides of an old 3 storey house – enabling dry lining and new insultation and ducting for heat exchange system.

The Building Sense initiative in Herefordshire is looking enhancing the understanding of retrofit and energy.

New builds can open up a huge array of possibilities so that the homes energy system can be designed from scratch including:

- Passive houses which have the highest standards of insulation and draft proofing can substantially reduce the space heating bills of the house. They often come with heat exchange and ventilation systems built in.
- The orientation of the house to catch the sun and optimise '**passive solar gain'** is also a major opportunity from new build.
- Modern life's appliances and electric cars still need lots of electricity so solar panels are an important component of new builds

The New Boiler

In our rural setting our houses are not on mains gas which means that deciding on how to heat our homes for space heating is a major and expensive decision. In our Kempley Climate conversations this issue came up all the time. Everyone gives this a great deal of thought usually relating to the age of their boiler and costs. The fossil fuel options have changed over the years and renewables such as air source heat pumps are providing another option; hydrogen may well enter the scene in years to

come. Personally we have used logs, coal, oil and now air source heat pumps in the 40 years living in Kempley.

Key points to consider

1. **Heating appliance (boilers) – fuel and type**

There are two main types of heating appliance that are used in our rural setting:

i) **Fossil fuels – LPG, Calor, heating oil, solid fuel, wood chip** Conventional heating. Older boilers are relatively inefficient and there can be massive spikes in fuel cost depending on world events. These boilers have a high carbon footprint. Even in a rural environment the *day to day work* involved with using logs is prohibitive.

ii) **Heat Pumps** (air source or ground source) are seen to be much more environmentally friendly, especially as mains electricity is using more renewable energy. Heat pumps are a fundamentally different way of heating a home - they rely on maintaining a relatively level background heat rather than the 'heat up and cool down cycle' of conventional heating.
Other points
- Heat pump running costs can be offset by installing solar panels.
- There are Government grants encouraging their installation (Boiler upgrade scheme BUS) which can help reduce the installation costs.
- The need to alter radiator systems with ASHPs is over-stated
- In this context, warm water underfloor heating brings extra benefit.

Government bans on gas boilers – the Government have suggested they would like to ban new gas boilers in *new* homes by 2025 and in *existing* homes by 2035, but as with much in Government policy application these targets are being watered down

Table 4 The Energy Efficiency of heating appliances varies enormously (from different sources)

Open fire	20%	
Wood burning stove	80%	
Electric night storage heaters	38%	
Gas/Oil boilers	50%	
Gas/Oil condensing boilers	80%+	The most modern boilers are much more efficient
Air source heat pump	300-400%	There is **a multiplier effect** using heat pumps
Ground source heat pump.	400%	

Heat pumps are a very efficient way of using electricity for space heating.

1.4 Costs - Incentives and Grants

Mike Floyd *mrfloyd.home@gmail.com*

Introduction

Money is at the heart of the way we decide what to do. One way of thinking about what we spend ranges from low cost steps through to bigger investments such as insulation and then the investment in more expensive energy sources and devices. If you find yourself in trouble with

paying your energy bills you really should contact your provider as soon as possible because they must respond to your issues and they funds at their disposal to assist.

Capital costs – Investment and Running Costs

Current cash investments give low return. Simple low cost energy investments i.e. insulation, draught exclusion will reduce running costs. Larger capital investments on ASHPs, PVs, EVs etc can give returns exceeding **10% through reduced running costs.** Another way of rationalising this expenditure is that if you have the money, investment now is a way of saving money on running costs long term.

Adding value to your house: I recently asked the estate agent selling my house with it recently installed solar PV, air-source heat pump and EV charging (cost £20K) about the value added to the house of having made this investment. He said £50K! That is a very considerable return on investment.

Beware 'what's the payback period question?' (Return on Investment - RoI) Whilst this can be a useful question, you need to put this into context. Who asks you what the payback period is for your new car, conservatory or expensive holiday? Nobody. One seldom gets asked this even though the sums of money involved are very similar. This is an example of *framing* arguments against climate action, and renewables.

Grants

Boiler Upgrade Scheme (BUS) – available for Air and Ground source Heat pump installations via registered mcs* installers who can access a grant of £5000 for customers who qualify. (mcs - Micro generation certification scheme see www.mcscetified.com)

Smart Export Guarantee (SEG) – available via energy suppliers who participate in scheme will pay for Photovoltaic exports to the grid directly to home generators, rates vary according to scheme/provider. Best currently is Octopus Tesla scheme paying around 11p/kWh exported

VAT - Currently 0% on renewable generating schemes and insulation

ECO4 Grant Scheme - Available for low-income households who qualify if energy rating of property **is** in range D-G. Will pay for Boiler upgrades insulation etc.

Insulation Grants - Available from some local authorities and some energy suppliers to households that meet their criteria.

Tariffs

From October 2022 tariffs were frozen by Govt

34.0p/kWh inc VAT - Electricity	46p Daily standing charge
10.3p/kWh inc VAT – Gas	28p Daily standing charge

Many providers offer lower rates in fixed rate deals. Octopus for example offers three different schemes for import/export for customers with PV, Battery storage and Electric vehicles. Octopus is currently excellent at customer support with helpful advisers at the end of the phone!

Suppliers There is a difference between suppliers that generate their own electricity from renewable sources and those that get their green energy through the trading schemes. Ecotricity generate from their electricity from their own installations.

Part 2 Ways to Act – Ideas and Technologies

2.1 No and Low Cost Actions to Reduce Your Energy Consumption

Heather Pealing heather@pealing.me.uk

There are **lots** of ideas, tips and advice on the web about easy low cost ways to save energy by making small changes to the way you live.

Don't be put off by the idea that many suggestions are not new: you may have been doing them for years, but continuously developing technology and materials mean that it is very likely you can still improve the energy efficiency of your home.

These are the areas you will need to think about:

Energy Efficiency

- Turning down your thermostat (but not below 18°C).
- Energy monitoring – smart meter (allows you to access variable tariffs), energy monitor plug.
- Lights – inside and outside, LEDs, timers, sensors, smart plugs, clean windows, clear window ledges.
- Hot Water – quantity in kettle and pans, length of shower, eco shower head, lagged pipes and tank.
- Cooking – using microwave, air fryer, slow cooker, wonderbag, batch cooking, full oven, pan lids.
- Appliances – standby modes, smart plugs, energy ratings of new appliances, solar chargers.

Keeping Warm

- Clothing – layering, types of fabric.
- Personal heating – water bottles, microwaveable heat pads, electric blankets and heated clothing.
- Activity levels – keeping moving.
- Heating controls to only heat the rooms you are using – manual or smart thermostatic valves.
- Draught proofing – adding extra or missing sections, replacing worn sections.

Useful websites to get you started:

https://energysavingtrust.org.uk/hub/quick-tips-to-save-energy/ A great independent website with lots of useful advice about saving energy throughout your home. This link takes you to the quick and easy tips page, but it's worth exploring the site further.
https://energysavingtrust.org.uk/advice/draught-proofing/ This link will take you directly to the draught proofing section.

https://www.cse.org.uk/advice/advice-and-support/diy-draught-proofing Another fantastic website packed with information. This link takes you to the page about draught proofing.

https://keepherefordshirewarm.co.uk/advice/energy-101/ 101 energy saving tips from Keep Herefordshire Warm, another website full of help and advice.

https://www.uswitch.com/energy-efficiency/free-energy-saving-tips/ 103 energy saving ideas

https://www.moneysavingexpert.com/utilities/energy-saving-tips/

https://www.wonderbagworld.com A modern hay box cooker that doesn't use any energy to cook once you place food that has been brought up to temperature inside it.

Linton Parish Council has a handheld, easy to use thermal imaging camera that you can hire to help identify the areas of your home in need of extra draught proofing and insulation. Contact Adrian Newton for more information: adrian501newton@btinternet.com

https://www.standard.co.uk/shopping/esbest/fashion/best-heated-jackets-electric-battery-b975715.html A review of some heated jackets. The prices vary, but several options are less than £100.

2.2 Insulation

Vilnis Vesma vilnis@vesma.com
See my talk and question-and-answer session on home energy saving at
http://fodlibdems.org.uk/home-energy

Comfort

Even a small amount of insulation will reduce discomfort, because it will raise the wall, ceiling or floor temperature somewhat.

Tip: even heavy curtains will help

Costs

To cut your heating costs significantly you need substantial insulation. Two important parameters are the *thickness* and *conductivity* of the material you use. For example sheep's wool has nearly double the conductivity of polyisocyanurate foam, so you'd need almost twice the thickness to achieve the same effect.

Practical considerations may dictate your choice of material. Most high-performance insulants are difficult to fit without leaving gaps while materials that can be squeezed and teased into irregular spaces tend to have higher (*i.e.* worse) conductivities.

Tip: don't believe claims for ultra-thin insulation materials and certainly not insulating paint

Condensation

When you insulate a structure, the outermost elements end up very close to ambient temperature. Moisture passing through the material from the indoor air may condense in the structure. You may have prolonged damp on roof timbers in an insulated loft, or in freezing weather ice may form within the outer brick skin of a wall.

Tips: insulate externally; or if insulating internally provide ventilation on the cold side and fit a vapour barrier on the warm side

Ventilation

Bob Earll: Insulation standards have developed and improved on new houses significantly over the last decade and this trend is likely to continue. This trend, including **passive houses**, where draft proofing and insulation are taken to the highest level massively reduce the need for conventional space heating. Passive houses and major refurbishments often **use of heat exchangers** (see section 2.8) to ensure adequate ventilation in the house, avoiding condensation, and so that heat generated by the house is not lost.

Air tightness testing This test will show you how well sealed your house is relative to drafts – it is now standard on all new houses. See here for link and explanation

2.3 Solar PV

Richard Collins & **Bob Earll**

Bob Earll bob@bobearll.co.uk *Solar panels are the gateway into a different way of thinking about home energy* - where you are generating the electricity you use

Solar panels and electricity generation have a number of major benefits which include:

- You can substantially reduce the *running* costs of home electricity consumption
- Used in conjunction with batteries that enable peaks of your domestic use to be met, these savings can increase
- Solar PVs can then be the gateway to use of heat pumps for space heating, again saving running costs
- Solar PV can then be the gateway to charging your electric vehicle – again reducing you dependence on a very price volatile fossil fuels
- Tariff arrangements e.g. with Octopus mean that you can generate income in the summer – when your use electricity use is lower
- There is no doubt of the capital investments beyond insultation solar PV is the next most cost effective investment
- Relative to money in the bank, investment in this technology can produce an annual rate of return of 10% +
- On sale existing solar PV can add significantly to the value of your house

Richard Collins 'Panels generate in DC (Direct Current) we then convert to AC which is used in our houses using a device called an inverter. With improvements in panel technology they have become more efficient and for similar outputs take up considerably less room on roofs than first generation panels. The biggest change has been the improvements and cost reductions in battery storage, this enables the user to safely store their Solar PV generation and use it when the sun is not shining.

There are also export tariffs available for Solar PV however using the electricity that you generate yourself gives you the best bang for your buck. A 4kW PV system will generate between 3,500 – 4,500kWh's of electricity per year which for a domestic customer can help to offset a large proportion of electric usage. With costs for standard solar PV of a 3.68kW inverter and 4kW of panels the capital costs can range from £7,000 with currently no VAT. Your savings will start straight away, and you will get ROI of 6-8 years. If you add batteries the capital costs increase to £12k + with ROI of 10-12 years.

There are other products that can help to make the most of the electric that you generate from the I Boost type of product which diverts excess electricity into your hot water cylinder via the immersion element to the Smart EV chargers which do the same by diverting excess electricity into the car.

We are seeing a huge uptake of battery storage customers, 2 years only 15% of customers would purchase battery storage, the figure today is closer to 85%. It is difficult to become self-sufficient solely through solar, but you can massively reduce your electricity purchases from the grid.
For more information please look at www.caplor.co.uk

2.4 Battery Storage

Tim Rickard & Richard Collins

Richard Collins The average home uses around 8kWh of electricity per day. The capacity of new lithium-ion batteries ranges from around 1kWh up to as much as 15kWh. Ideally, you want a battery that will cover your evening and night-time electricity use, ready to be charged again when the sun comes up. Home-energy storage will reduce the electricity you use from the grid and cut your energy bills, but it will cost upwards of £2,000, so you'll need to make sure your investment is worthwhile. They require minimal maintenance, but they're pricey and may need replacing during the lifetime of a solar PV system.

Tim Rickard An energy-storage system, also called a home or solar battery, captures electricity so you can use it at another time. For example, you can store the electricity your solar panels generate during the day and use it at night. Even without solar panels, you may be looking to make use of time-of-use tariffs with a battery. These let you store up electricity while it's cheap (overnight, for example) so you can use it during peak times. They will also provide your home with power in the event of a grid failure.

2.5 Air Source Heat Pumps

Richard Collins For more information please visit www.caplor.co.uk

Most people already have heat pumps in their fridges and freezer. Air and ground source heat pumps work using the same principles. An Air Source Heat Pumps (ASHP) takes heat from the air, it compresses the air, and this generates heat which is could it the medium of hot water to enable you to use this heat to heat your property.

ASHP's are very efficient, you put 1kW of electricity in and on average get 4kW of heat out.
The heat produced is a lower temperature than traditional fossil fuel boilers, traditional boilers would operate at 70-80 degrees C, a heat pump will produce heat around 45 degrees.
As a result of this it is quite normal that radiators may need to be upsized to get the required heat out of the system rather than just rely on the existing radiators so this is a cost which must be taken into account. The systems work best in well insulated properties and due to the lower flow temperatures are well matched with Under Floor Heating.

ASHP's mainly come in 2 parts, an external unit with a fan or fans in it which looks like an air conditioning unit and an internal cylinder which stores hot water. These need to ideally be as close together as possible to prevent efficiency losses, the cylinder is also larger than a standard hot water cylinder, so more room is normally required.

To operate the system it is advised to let the system run on room stats rather than timer controls which many of us would use to run our heating currently, the stats will allow the system to modulate up and down as required and keep the property at the desired temperature.

ASHP's range from £12k + depending on required system size and complexity of installation, there is currently a Grant via the Boiler Upgrade Scheme which will supply £5,000 off the costs of the system.

References
Which https://www.which.co.uk/reviews/ground-and-air-source-heat-pumps/article/ground-source-heat-pumps-explained/ground-source-heat-pump-costs-and-savings-aYYGN4A4NFpB
Their advice on solar and heat pumps is not protected by their usual paywall. A good basic consumer guide
The Great Collaboration – Heat Pumps – website link

2.6 Ground Source Heat Pumps

Tim Rickard timrickard@orpheusmail.co.uk
& **Norman Evans** normanevans888@gmail.com

Two metres below the surface the temperature of the ground is a fairly constant 11-12°C. By using a buried network of fluid-filled pipes connected to a compressor and pump unit, we can capture this warmth and use it as a reliable, renewable heat source.

Some systems work using boreholes (less cost). Others GSHPs use buried pipes known as 'slinkies' in land adjacent to your house; this will require about ½ an acre of land.

The whole system is powered by electricity, and for every kilowatt used to run the system, the output can be as high as 4 kilowatts of heat. Unless your electricity comes from a renewable source, a ground source heat pump still generates carbon emissions, though less than those associated with conventional types of heating, and with no on-site emissions.

It is very important to make sure your home is well insulated as heat pumps operate at a lower temperature than conventional central heating systems. Underfloor heating is ideal but larger radiators can also be used. Installing a typical system cost around £10,000-£18,000, the cost varying considerably depending on the size of the system and any additional work required such as fitting larger radiators or underfloor heating. Heat pumps last around 20 years and require very little maintenance.

2.7 Solar Hot Water – Solar Thermal

Tim Rickard timrickard@orpheusmail.co.uk
Solar water heating, often referred to as 'solar thermal', uses solar panels to absorb the heat of the sun. It works alongside conventional water heating systems, feeding hot water into a storage cylinder or directly into a combination boiler. On warm summer days this can provide all of your hot water, though during winter the output will be much less.

There are four practical things to consider before investing in a solar water heating system.

1. Your roof should face predominantly south. Due south is ideal, but anywhere between south-east and south-west is also likely to be suitable.

2. You'll need between 2 and 5m^2 of roof space with as little shading as possible from buildings, chimneys or trees.
3. You'll also need a compatible hot water storage cylinder.
4. If you have combination or 'combi' boiler which cannot accept pre-heated water directly you will need to install a separate hot water cylinder.

Most domestic solar water heating systems cost somewhere between £2,000-£6,000 while maintenance costs are minimal. According to the Energy Savings Trust and using October 2022's energy prices, this system can save a household **£160 a year** when replacing gas heating, or **£275 a year** when replacing electric immersion heating.

For general, non-commercial advice:

Centre for Sustainable Energy https://www.cse.org.uk/advice but a useful website

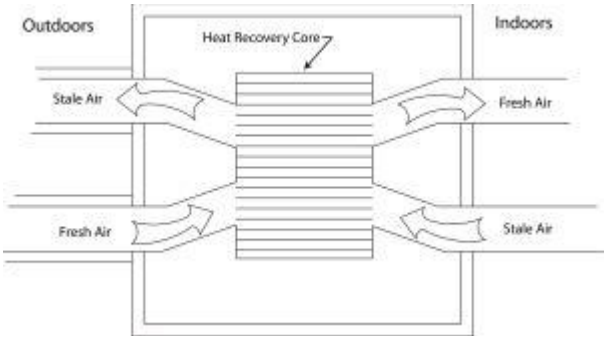
The Severn Wye Energy Agency based in Highnam https://severnwye.org.uk/

Which https://www.which.co.uk/reviews/ground-and-air-source-heat-pumps/article/ground-source-heat-pumps-explained/ground-source-heat-pump-costs-and-savings-aYYGN4A4NFpB
Their advice on solar and heat pumps is not protected by their usual paywall. A good basic consumer guide

2.8 Heat Exchangers – Heat Recovery Systems

Heat Recovery Systems

Choosing an Air-to-Air Exchanger System



One way to minimize air quality and moisture problems in a home, without opening a window, is by the installation of a mechanical ventilation system such as an air-to-air heat exchanger. An air-to-air heat exchanger brings two air streams of different temperatures into thermal contact, transferring heat from the exhausting inside air to incoming outside air during the heating season.

In summer, the heat exchanger can cool and, in some cases, dehumidify the hot outside air passing through it and into the house for ventilation. The air-to-air heat exchanger removes the excess humidity and flushes out odours and pollutants generated indoors.

Generally, heat exchangers are classified by the way the air moves through the unit. In a counter-flow exchanger, hot and cold air streams flow parallel in opposite directions. In a crossflow unit, the air streams flow perpendicular to each other. An axial flow unit uses a large wheel. The air warms

one side of the wheel, which transfers heat to the cold air stream as it slowly turns. A heat pipe unit uses refrigerant to transfer the heat. Other units are available for specialized applications. Small structures, such as houses, generally use counter-flow or crossflow exchangers.

2.9 Installers

Some key points

- There are a growing number of renewable energy installers: many of these also install fossil fuel based systems.
- It is very worthwhile – *essential* - to talk friends and contacts about their experience with the various installers.
- Renewable energy installers are very busy currently
- It is a common user experience that their customer services post installation are not as good as they should be.
- Micro-Generation Certification Scheme MCS – It is worth checking that installers work to this standard and that you get completed certificates upon completion of installation

Some local installers

1. Bavenhill (Ledbury) http://www.bavenhill.co.uk/Renewable-Energy
2. Caplor Energy (Fownhope) https://caplor.co.uk/
3. Earth Save Products / Ecocent https://www.earthsaveproducts.com/products/ecocent/ecocent-energy
4. Eco Engineering https://www.eco-eng.com/
5. Energy Efficiency Centre http://www.efficientenergycentre.co.uk/about-us/
6. GSM (Newent) https://gsmlimited.com/
7. MJS Energy https://mjsenergy.co.uk/
8. Tipsgrove Eco Ltd (Ledbury) https://www.tipsgrove.com/