



Renewable energy



What is it?

Renewable energy broadly encompasses a diverse range of energy sources which have the common attribute of being replenished at the same rate as they are used. Renewable energy sources include solar, wind, wave, tidal, hydro, geothermal and biomass and unlike fossil fuels they are "carbon neutral" that is they produce little or no net carbon dioxide (CO₂). Because of this they

are essential if we are to reduce our greenhouse gas emissions and help address climate change.

Until recently, the UK has been slow to embrace renewable energy sources due to the indigenous supplies of coal, gas and oil. However, we already import half our coal and gas and by 2010 will be a net importer of oil. By 2020 we could be dependent on imported energy for 75% of our needs.

Although the UK is near the bottom of the European league in the current deployment of renewable energy this belies the wealth of our resources. In fact certain areas of the UK are considered to be as rich in renewable energy potential as Saudi Arabia is in oil. For instance, we have the largest wind and wave resources in Europe and if we were to exploit the tidal energy of the Severn estuary this would provide 15% of our national electricity needs.

Sources of Renewable Energy

Most types of renewable energy are produced directly or indirectly from the sun. As such they are secure and inexhaustible and until the industrial revolution in the early 19th century virtually all of our energy came from renewable sources. For instance, oats were a vehicle fuel providing the food energy for horses to provide transport, wood was used to produce fire for cooking and heating and the wind and running water were used to power mills.



Solar power street light

There are three methods of harnessing direct solar energy. **Passive solar design** reduces the heating and artificial light requirements of new developments by incorporating design features that maximize the heating action of the sun through the use of glass and the orientation of the

building. **Solar thermal** systems typically use roof mounted solar collectors to extract the heat of the sun which is used to heat domestic hot water. **Photovoltaics (PV)** use cells made of silicon to convert sunlight into electricity. Solar thermal and PV systems can be retro-fitted to existing dwellings.



Inside a wood chip boiler

Biomass energy is the most diverse and versatile form of renewable energy. It involves plant and animal material that can be used to provide heat, electricity and transport fuels. Below are some examples of how different types of organic matter can be converted to useful energy.

Energy conversion method	Useful energy produced	Feedstock
Combustion (also advanced technologies such as gasification & pyrolysis)	Heat and electricity	Wood, straw and other forestry and agricultural bi-products and energy crops
Anaerobic digestion	Biogas (a mixture of methane and CO ₂) which can be burnt to produce electricity and heat or used as a vehicle fuel	Animal manures, food waste, non woody crops & bio-degradable matter in landfill sites & sewage farms.
Fermentation	Liquid fuels for vehicles	Wheat and sugar beet to produce bioethanol (similar to petrol) or oilseed rape to produce biodiesel



Harvesting willow energy crop

In all of these conversion pathways CO₂ is released into the atmosphere but as all plants photosynthesise sunlight in order to fix carbon and grow, they only release the same amount of CO₂ as they took up when they were growing.



Water power

Hydroelectric power is produced by moving water. The sun causes the evaporation of water which forms as clouds. When it rains the water collects in rivers which run back to the sea. Most large schemes involve the creation of reservoirs and dams which allow the release of water in a controlled fashion when electricity is required. Smaller projects use the natural run of the river and have less control when the power is produced.

Wind is caused by uneven warming of the earth's surface and air movements from warm areas to cooler ones. The energy contained in the wind can be harnessed by a turbine which generates electricity. Wind turbines range from tiny devices mounted on roofs and boats, providing a small amount of power to charge batteries, to small scale stand alone machines providing power for several houses, up to large wind farms which can provide the electricity needs of thousands of dwellings. They can also be located off shore.

Waves are created by the movement of the wind over a large body of water. Wave power devices have been created that either sit on the water surface or are embedded in the cliff face. The latter can be incorporated into sea defence initiatives.

The **tides** of the sea are a result of the gravitational pull of the moon and to a lesser extent the sun. There are several methods of intercepting tidal power and converting it to electricity. A tidal barrage captures water at high tide and

releases it gradually as the tide goes out. Such initiatives involve massive engineering works and huge costs and as a result there are only a few examples worldwide. Other options include marine tidal turbines which resemble underwater wind turbines and ducted devices which sit on the sea floor in the tidal stream.

Geothermal energy taps into the heat generated in the Earth's core. Reservoirs of water trapped deep underground are heated by molten rock (called the mantle) and this heat can be accessed by drilling bore holes into the reservoir. The steam produced can be used to drive turbines and produce electricity or the hot water can be used in community heating schemes such as the project heating Southampton's town centre.

Heat pumps utilise solar energy stored in the ground, water or air and work like a fridge in reverse, extracting heat from where it's cold and transporting it to where it's warm. The heat pump raises the extracted heat to a useful temperature with a compressor. This requires a separate source of electricity so heat pumps are not truly renewable but do provide very efficient heating with every unit of electricity resulting in three to four units of heat.

Support for renewables

The UK energy pie is made up of three roughly equal segments: heat, electricity and transport fuels. Currently about 5% of our electricity is sourced from renewable sources and this should rise to 10% by 2010 and 20% by 2020 under a support mechanism called the Renewables Obligation. This forces electricity suppliers to source a certain percentage of their electricity supply each year from renewable sources. You can buy green electricity from your electricity provider but green tariffs tend to be slightly more expensive.

A similar mechanism for transport fuels (Renewable Transport Fuels Obligation) will come into force in 2008 and this requires 5% of all fuel sold on UK forecourts to come from renewable sources by 2010. There are currently no targets for renewable heat.

Pro and cons of renewable energy

Although renewable sources are unlikely to supply our entire energy needs they have many distinct advantages that make them an essential part of the future energy mix. However, achieving their potential will involve several key challenges.



Pros

- ✓ Low carbon energy sources and produce less pollution than fossil fuels
- ✓ Provide local jobs particularly in rural areas
- ✓ Locally sourced energy therefore enhance security of supply
- ✓ Will strengthen energy dispersal network
- ✓ Make people think about energy

Cons

- ✗ Many renewables such as wind and solar are intermittent
- ✗ Can be visually intrusive and fail to get planning
- ✗ Non competitive without incentives
- ✗ Require changes in infrastructure
- ✗ Often viewed as new technology

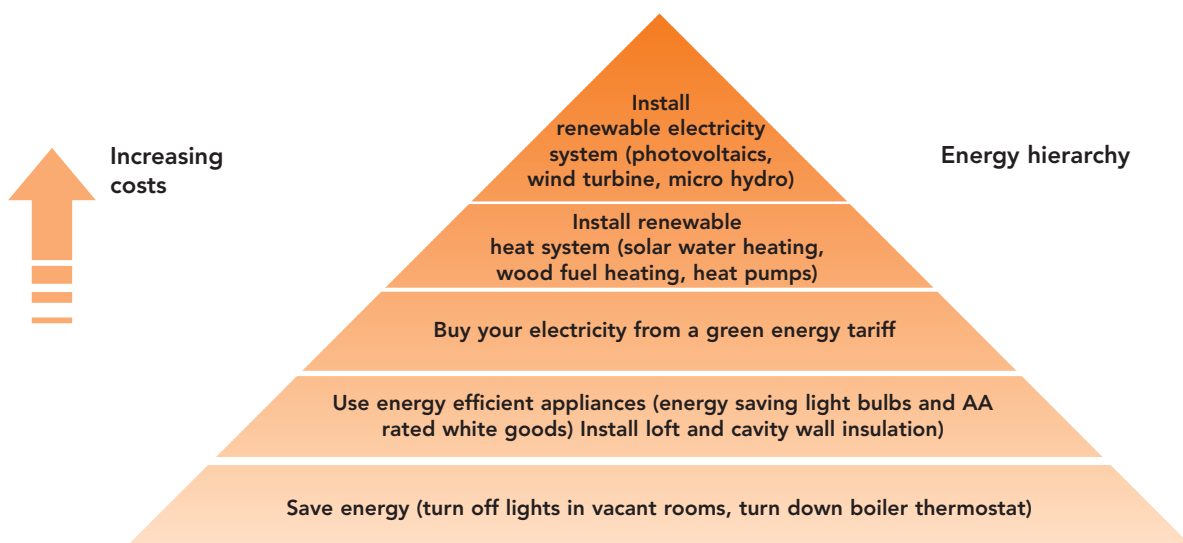
With regards to the intermittency of renewables various recent studies suggest that the national grid already operates with enough back up to manage the loss of a large power station. Furthermore, up to 20% of our power needs can be met by intermittent sources without the need for significant additional back up. (See articles and papers produced by the Environmental Change Institute www.eci.ox.ac.uk/research/energy/renewable.php).

However, if your house is already energy efficient then you should consider installing renewables although you should be aware that in some cases they will only save a proportion of the energy you require to heat and power your home. In particular most roof mounted wind turbines and photovoltaic systems might produce about 25% of a houses annual electricity requirement.

Energy hierarchy

There are now grants available through the Government's Low Carbon Building Programme to install micro renewable energy systems in your home. Before you consider renewables, remember that you should first try to use less energy through behavioural changes (i.e. turning lights off when you leave a room) and buying energy efficient products (e.g. AA rated fridges and energy saving light bulbs). Many of these no and low cost measures will save you far more energy, money and carbon than a much more expensive investment in micro renewables.

Nevertheless, in certain circumstances such as dwellings off the gas or electricity grid micro renewables really come into their own. For those, relying of mains electricity for their heating needs, incorporating a renewable technology such as a solar water heating system or a heat pump will make economic sense even if the environment is not your main priority. Approximately 6000 houses in north and west Dorset are off the gas grid and as many as 10% of Dorset residents will rely on electricity for their heating. These residents could benefit from installing micro renewables.





Opportunities for renewable energy in Dorset

In 2005 the Bournemouth, Dorset and Poole Renewable Energy Strategy was finalised. The strategy was endorsed by all the local authorities in Dorset as well as 30 local groups and businesses. On the back of this, Dorset County Council employed a part time Renewable Energy Development Officer to co-ordinate the implementation of the strategy with key stakeholders, through the Dorset Energy Group. The group's actions are taken forward by four working groups focussing on planning policy, bioenergy, community and building integrated renewables and energy efficiency. The groups have a core membership of about 60 stakeholders from across the public, private and community sectors.

Renewable development in Dorset

A report called Revision 2010 produced for the Government Office South West in 2005 provided draft targets for renewable electricity generation for each of the seven south west counties (www.oursouthwest.com/revision2010). This suggested that Dorset might be able to achieve 64-84 MW (mega-watts) of generating capacity by 2010, making up 8.4 to 9.9% of Dorset's electricity demand. The target is not technology specific but could be achieved by approximately 30 large wind turbines and



1.8 MW wind turbine

several wood fuelled combined heat and power plants. As a start, there is already approximately 12 MW installed made up from 8.3 MW of landfill gas (White's Pit and Beacon Hill), and 3MW of centralised anaerobic digestion from sewage sludge at Wessex Water sewage treatment sites. There are also a number of small-scale installations across the county. A farm based anaerobic digestion plant fed with maize, grass silage and slurry has received planning permission and is expected

to be fully operational by July 2007. The plant based near Blandford Forum will generate electricity with a capacity of 340 kW (kilowatts). In addition, Dorset County Council has received funding to install renewable projects on 56 buildings managed by the County Council, the six District Councils and a number of village halls. In total this will provide a further 800 kW of renewable energy capacity by 2009.

More information

Renewable Energy Officer	01305 228530	k.lindegaard@dorsetcc.gov.uk
Energy Saving Trust case studies	0845 1207799	www.est.org.uk/myhome
Low Carbon Buildings Programme	0800 9150990	www.lowcarbonbuildings.org.uk
Regen SW	01392 229394	www.regensw.co.uk
Teaching resources	/	www.dti.gov.uk/energy/sources/renewables/renewables-schools/
Dorset Energy Advice Centre	0800 512012	www.deac.co.uk
Dorset Agenda 21	01305 213721	www.dorsetagenda21.org.uk