

# I Renewables – how do they work?

## Find out about

- ✓ how renewable energy sources work
- ✓ how much UK electricity is generated from renewable sources



In the UK, placing PV panels on all south-facing roofs could provide 5 kWh per person per day



The Nant y Moch dam is part of a hydroelectric scheme in Wales. The power output from this scheme is 55 MW.

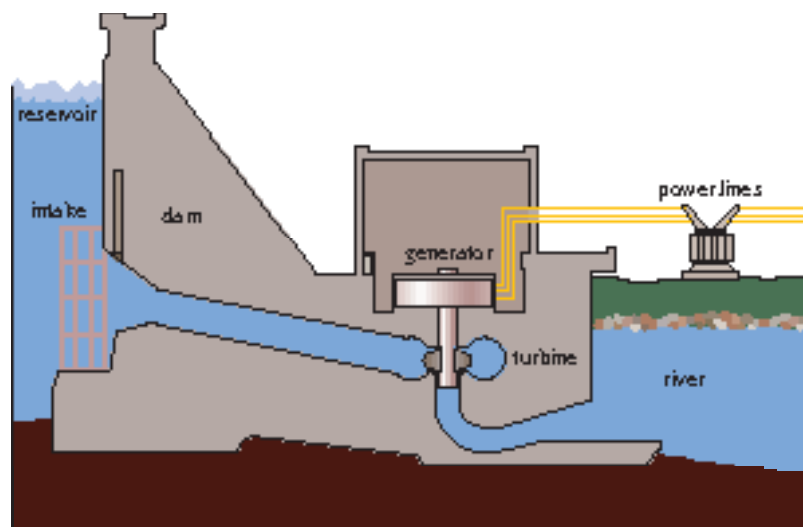
A renewable energy source is one that can be used without running out. We already use some renewable energy sources in the UK. Should we use more?

## Solar power

In the UK, electromagnetic radiation from the Sun provides an average of about 100 W of solar power per square metre of ground. Solar thermal panels use the Sun's radiation to heat water or buildings directly. Covering all south-facing roofs in the UK with thermal solar panels could provide about 13 kWh per person per day. A different kind of solar panel uses the Sun's radiation to generate a voltage; these are called photovoltaic (PV) panels.

## Hydroelectric power

Water heated by the Sun evaporates, and then falls as rain. Rain falling on high ground can be stored behind a dam and used to turn turbines in a hydroelectric power station as it flows downhill. The UK gets about 0.2 kWh per person per day from hydroelectric power. If more schemes were built this could rise to 1.5 kWh.



Water from the reservoir turns turbines, which turn the generator.

## Wind power

Wind energy can be used to turn a turbine, which drives an electricity generator. In the UK, a land-based collection of wind turbines (a wind farm) has an average output of 2 W per square metre. Wind farms covering the windiest 10% of the country could provide about 20 kWh per person per day. Wind farms built all around the coast of the UK could provide a further 48 kWh but there are major costs and engineering challenges when building at sea.

## Power from waves and tides

The pull of gravity between the Earth and Moon affects the oceans. As the Moon orbits the Earth, and the Earth rotates, tides rise and fall. Ocean currents are driven by heating from the Sun and by Earth's rotation. Wind, currents, and tides combine to produce waves.

Water movement due to tides and waves can drive turbines. As the UK is surrounded by sea, tidal power could provide up to 11 kWh per person per day. There is a tidal energy convertor in Strangford Lough and the government has proposed building a tidal power station in the Severn Estuary.

## Biofuels

Biofuels are renewable because they can be replaced quickly. Some biofuels could replace petroleum fuels for transport and all could be burned in thermal power stations. At best, biofuels could provide a total of 7 kWh per person per day in the UK.



Miscanthus grass is grown for fuel. In the UK each square metre of crop yields about 0.2 W electricity.



A Pelamis generator uses **wave power** to produce electricity. Pelamis machines along 500 km of Britain's Atlantic coast could produce 4 kWh per person per day.



Winds are driven by temperature differences in the atmosphere and by the Earth's rotation. The Whitelee wind farm near Glasgow will cover 55 km<sup>2</sup>.

## Key words

- ✓ renewable
- ✓ solar power
- ✓ thermal
- ✓ hydroelectric
- ✓ wind farm
- ✓ wave power
- ✓ tidal power

## Questions

- 1 A student says 'All our energy comes from the Sun.' Explain how this is true for the renewable energy sources mentioned on these pages.
- 2 List the drawbacks of each renewable resource.
- 3 What would be the maximum total energy in kWh per person per day that we could get from renewable sources in the UK? Suggest reasons why, in practice, the amount is likely to be much less.