What are wind power, solar power, hydropower, and more...
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I HAVE THE POWER!

Have you ever wondered how you are able to walk, run or play? You need energy to do all this. Energy is the ability to do work. Energy can neither be created nor destroyed, but it can be converted from one form to another.

Move it, hold it!

There are many forms of energy. A cricket ball moving in the air can break a windowpane if it strikes it. The energy contained in the ball due to its motion is called ‘kinetic’ energy. A brick on top of a building can hurt you if it falls on you from that height. The energy it has due to its position (in this case, height) is called ‘potential’ energy.

There are many other forms of energy, including electrical energy, chemical energy, biochemical energy, electrochemical energy, and nuclear energy.
Renewable energy: the new thing in town

Just like you need energy to work, machines, cars, microwaves, light bulbs, and televisions also need energy to run. This energy can come from two sources. Non-renewable sources, like coal and petroleum, are formed from the buried remains of living creatures, or fossils. They are limited in nature and will finish one day. Renewable energy sources like the sun, water, and wind will last forever.

Energy that comes from renewable sources can be used again and again without the fear that we will ever run out of them.

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Fossil fuels like coal and petroleum were formed millions of years ago, even before the time of dinosaurs!
The Power of the Sun

On a sunny day, have you ever used a magnifying glass to burn paper? That’s solar energy in action! Energy from the sun can be used for heating and producing electricity.

Catch the sun

If a house is built in the right manner, the sunlight and heat entering it can reduce the use of electricity for lighting and heating. Even the ancient Greeks knew this, and built their houses such that they received the sun’s heat in winter. This reduced the need for firewood to keep the house warm!

And have you seen buildings with black panels on their rooftops? Those are solar collectors that can heat water for bathing. Similarly, solar cells, also called photovoltaic cells, can convert sunlight into electricity. This electricity can directly run electric lights, or it can be stored in batteries so that it can be used after the sun has set.
Solar power can be used to produce electricity, heat water, and even cook food!

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Satellites and space stations that are sent into outer space are all powered by solar cells.

What are solar power plants?

Solar thermal power plants use the sun’s energy to heat fluids. This, in turn, can be used to produce steam. The steam is used to run a turbine, which moves a generator to produce electricity.
Air in motion is called wind. It has energy that can be used to do work. Ancient Egyptians used wind to sail ships, and the Dutch used windmills to grind grains, pump water, and cut wood at sawmills.

**Working with the wind**

Windmills use the energy of the wind directly to run a machine, for instance, to turn a grindstone. A wind turbine, on the other hand, uses the energy of the wind to make electricity!

A wind turbine has blades. The wind turns these blades, which spin a generator mounted on the same shaft. This produces electricity.

*A wind turbine is quite the opposite of a fan. A fan needs electricity to move its blades that generate wind!**
Does wind grow on farms?

At a wind farm several wind turbines are placed together to produce large amounts of electricity. They are usually found near sea coasts and in other large, open spaces, where the wind is strong. Wind farms built on the sea are called offshore wind farms.

Germany ranks first in wind power installations, followed by the United States, Spain, and India.

The largest wind turbine is being placed in the North Sea. Its blades measure 126 metres. That’s way bigger than the length of a football field!

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The rotor of a large wind turbine is 126 metres wide. Compare that to the eighty-metre-wingspan of an Airbus A380!
**RUNNING ON WATER**

Human beings have been using the power of water for thousands of years to turn a paddle wheel to grind grain. Today, water is the most commonly used renewable energy source to generate electricity.

**Waterfall to electricity!**

Hydropower, or hydroelectricity, is generated from water. A hydropower plant is usually constructed in the mountains, where fast-flowing rivers are diverted (partly) into reservoirs from which water is allowed to flow in a controlled manner through turbines. The turbines spin a generator that produces electricity. The water, after passing through the turbines, flows back into the river.

*When water falls from a height, it spins the blades of a turbine.*
The higher the water’s fall, the more is its potential energy and, hence, the more its power.

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Norway produces more than 99 per cent of its electricity from hydropower!

New Zealand uses hydropower for 75 per cent of its electricity.

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**Damning water**

Hydropower is a clean source of energy. Although hydropower does not release any harmful products, dams are mostly built in forestland. Trees are cut, and many animals and, sometimes, humans lose their homes.
The energy contained in matter like wood, agro-residues (wastes, including wheat straws, rice husks, and so on, that come from farms), cattle dung, and even garbage is called biomass energy.

It’s all gas

Biomass can be burnt to produce steam. This steam is then used to rotate a turbine, which runs a generator that produces electricity.

Special bacteria called anaerobic bacteria can convert organic matter such as dung into methane gas. This gas can be used as a fuel or to make electricity.

Agro-residues can also be turned into a gas called ‘producer gas’ in high-temperature devices called ‘gasifiers’. This gas can be used as a fuel or to make electricity.

Seeds of jatropha and karanj can be burnt to produce eco-friendly bio-diesel, which can be mixed with diesel.

Ethanol is obtained from corn, sugar cane or sweet sorghum. This ethanol can be used as a fuel by mixing it with petroleum.
**Not so clean**

When biomass such as wood, leaves, and cow patties are burnt in the open, it releases smoke and very small particles that pollute the air. Biomass should be burnt in specially designed stoves and furnaces that do not pollute.

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Humans started using biomass energy 300,000 years ago! That was when early humans learnt to use fire to cook food and keep themselves warm.
Do you know how the water of a hot spring gets heated? It is heated by geothermal energy, produced by the heat inside the earth. Yes, that's where nature's boiler room is!

The steam and water under the earth heats up to temperatures over three hundred degrees Celsius. These burst out through cracks in the earth in the form of geysers and hot springs.
E is for Earth, E is for egg
The earth is much like a boiled egg. The earth’s crust is like the thin eggshell; the mantle is like the egg white; and deep in the centre of the earth is the core, just like the egg yolk. The core of the earth is made of hot liquid called magma, which can have a temperature of more than thousand degrees Celsius!

It gets hot inside
Deep under the earth, rocks and water absorb heat from the magma. Wells are drilled into the earth, and hot water is pumped up to the surface. The steam from the hot water is used to turn turbines, which produce electricity.

Geothermal energy can also be used where there is no water under the surface. There, cold water is pumped into the earth. The sizzling hot rocks underneath heat the water, which is pumped up to turn turbines!
A WAVE OF POWER

A tide is the rise and fall in the sea level, usually occurring twice a day. It is caused by the pull of the moon on the earth, and partly by the attraction of the sun and the rotation of the earth itself. Tides can be used to produce electricity.

Making waves

Dams, or barrages, are constructed to use the energy of tides. Incoming tides are let into the dam through a pipe called ‘sluice’. The rushing water can turn a turbine to generate electricity. Outgoing tides can also be used to turn the turbine.

Waves, too, are used to generate electricity. Waves are pushed inside a chamber, which causes the water to bob up and down. This forces out the air inside through holes at the top of the chamber. The air turns a turbine, which spins a generator to produce electricity.
Spring tides occur when the sun and the moon are in line with the earth.

The earth's ocean waters rise and fall according to the pull exerted by the moon and partly by the sun.

Neap tides occur when the moon is at an angle of ninety degrees from the sun and the earth.

**The flip side**

Tidal power is clean and renewable, but it can be obtained only for ten hours a day, when there are tides in the sea.

Barrages often change the flow of water and destroy the natural homes of water animals and plants.

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One of the oldest tidal mills was unearthed in Ireland at the Nendrum monastery in 1999. The mills date back to AD 619 and were used to grind grain!
According to scientists, 50 per cent of the world's energy will come from renewable sources by 2040.

Fossil fuels are a form of stored solar energy. They are composed of decayed plants and animals, which originally got their energy from the sun!

Enough sunlight falls on the earth's surface each minute to meet the world energy demand for an entire year.

About 97 per cent of the electricity produced by renewable energy sources comes from hydropower.

Albert Einstein was awarded the Nobel Prize in 1921 for his work on photovoltaics.

Geothermal electricity was generated for the first time in Larderello, Italy, in 1904.
THIS IS A GREEN BOOK
What are wind power, solar power, hydropower, and more...

Experts say that soon there won’t be any coal, diesel, petrol, and natural gas on earth. How will our machines run then? Don’t worry. Scientists are working around the clock to develop sources of energy that are clean as well as renewable. Find out how green technology can power the world.

Other books in this series:
What are ecosystems, biomes, ecotones, and more...
What are pollution, smoke, smog, and more...
What are bacteria, viruses, fungi, and more...
What are volcanoes, earthquakes, avalanches, and more...
What are landfills, vermicomposting, recycling, and more...