

How energy is produced

Conventional power plants

1 Have you ever wondered where the electricity in your house comes from? Read the texts about the different types of power plants and match them with the pictures.



1 Nuclear power plants

About 10% of the world's electric power is produced by nuclear power plants. Nuclear power **requires** little **fuel** and causes much less air **pollution** than other power plants, but it can cause severe health and environmental problems when accidents **occur**, with a consequent release of radioactive material. This type of energy is produced by the **splitting** of atoms of uranium, which **releases** heat. This process – called fission – produces large amounts of **steam**, which is used to turn the **blades of turbines** thus creating energy. The main problems with nuclear power are linked to the location of the power plants, as people are not **willing** to have these plants near their homes, and the disposal of **waste** material, which stays radioactive for centuries.

2 Thermoelectric power plants

They provide about $\frac{1}{3}$ of the world's electricity. These plants burn fossil fuels, such as coal, oil or natural gas, which are all **non-renewable** resources. This means that in the future there will be a limited **supply** of these resources. The main advantage of thermoelectric power plants is that they are **reliable** and can meet the demand in peak periods. Electricity is generated by heating water in a **boiler** to create steam, which is then pressurised and used to turn the blades of giant turbines that produce electricity. These power plants cause environmental pollution because of the combustion of fossil fuels which release carbon dioxide.

3 Hydroelectric power plants

The energy produced by water can be captured and turned into electricity. The use of a **dam** on a river allows hydroelectric power plants to store water in an artificial lake, or reservoir. When released, the force of the water spins the blades of giant turbines, which are connected to a generator producing energy. Hydropower is one of the most important renewable energy resources, because it is reliable, efficient and does not pollute the air. Although it has high initial costs, it is cheap to operate. Unfortunately, it has a great impact on the **environment**, as humans, animals and plants may lose their natural habitats.

2 Read the texts again and decide if the following sentences are true (T) or false (F),

- 1 Nuclear power plants do not produce air pollution at all.
- 2 Accidents in nuclear power plants can have terrible consequences for the environment.
- 3 Nuclear power plants produce biodegradable waste material.
- 4 Thermoelectric power is generated by the combustion of renewable resources.
- 5 Thermoelectric power plants are environmentally friendly.
- 6 Dams are built on rivers to store water.
- 7 The water released from the reservoir flows through the generator.
- 8 The only disadvantage of hydropower is its high initial cost.

Alternative power sources

Read the texts about alternative power sources

Environmental problems such as the **greenhouse effect** and air pollution have led scientists to find alternative power sources which are renewable and less polluting.

SOLAR ENERGY

Sunlight can be directly converted into electricity by solar cells made of silicon. When light strikes the cells, a part of it is absorbed by the semiconductor material. The energy of the absorbed light **knocks** electrons loose, allowing them to flow freely and produce electricity. The process of converting light (photons) into electricity (voltage) is known as the photo-voltaic process (PV). Solar cells are usually combined into panels and grouped into **arrays**. Even if the initial costs can be high, the PV system provides an independent, reliable electrical power source. It can produce energy for more than 15 years and its routine **maintenance** is simple and cheap.

WIND ENERGY

Wind energy is one of the cheapest renewable technologies available today. The wind turns the blades of giant turbines, producing in this way kinetic energy which is then converted into mechanical power and electricity by a generator. The main disadvantage of wind energy is that there are few suitable wind sites where it is possible to have a constant production of electricity.

TIDAL ENERGY

This alternative power source, which is typically used in coastal areas, turns the potential energy of **tides** into electricity. Tidal power generators use rising and falling tides in much the same manner as hydroelectric

power plants. Large underwater turbines are placed in areas with high tidal movements and are designed to capture the kinetic energy of rising and falling tides. The turbines are driven by the power of the sea both when the tide comes in and when it goes out. The problem with tidal power is that only massive increases in tides can produce energy and there are very few places where this occurs. Moreover, the aquatic ecosystem and the **shoreline** can be damaged by the changes in the tidal flow.

GEOTHERMAL ENERGY

In the past, people used **hot springs** for bathing, cooking and heating. Geothermal energy is based on the fact that the Earth is hotter below the surface. The hot water which is stored in the Earth can be brought to the surface and used to drive turbines to produce electricity or it can be **piped** through houses as heat. This energy is cheap and has a low impact on the environment, but there are few sites where it can be extracted at low cost.

BIOMASS ENERGY

Biomass is a renewable energy source deriving from plant material and animal waste. When it is burnt, it releases its chemical energy as heat. Biomass fuels include forest residues (such as dead trees, branches and tree **stumps**), **straw**, **manure** and even municipal solid waste. Biomass energy is a natural process, it is carbon neutral and has low initial costs. It used to be the main source of heating at home in the past and it continues to be highly exploited in the developing world. The main disadvantage of biomass is that it has a smaller potential than other energy sources and requires excellent maintenance skills.

3- Match the words with their definitions.

1 array	a <input type="checkbox"/> a spot where hot water comes up naturally from the ground
2 kinetic	b <input type="checkbox"/> unwanted material left after using
3 tide	c <input type="checkbox"/> a group of things arranged in a particular way
4 hot spring	d <input type="checkbox"/> waste material from animals used as fertiliser
5 to pipe	e <input type="checkbox"/> the process of keeping something in good condition by regularly checking it
6 manure	f <input type="checkbox"/> produced by motion
7 waste	g <input type="checkbox"/> to send a liquid or a gas through a tube
8 maintenance	h <input type="checkbox"/> the regular change in the level of the sea caused by gravitational attraction of the moon and the sun

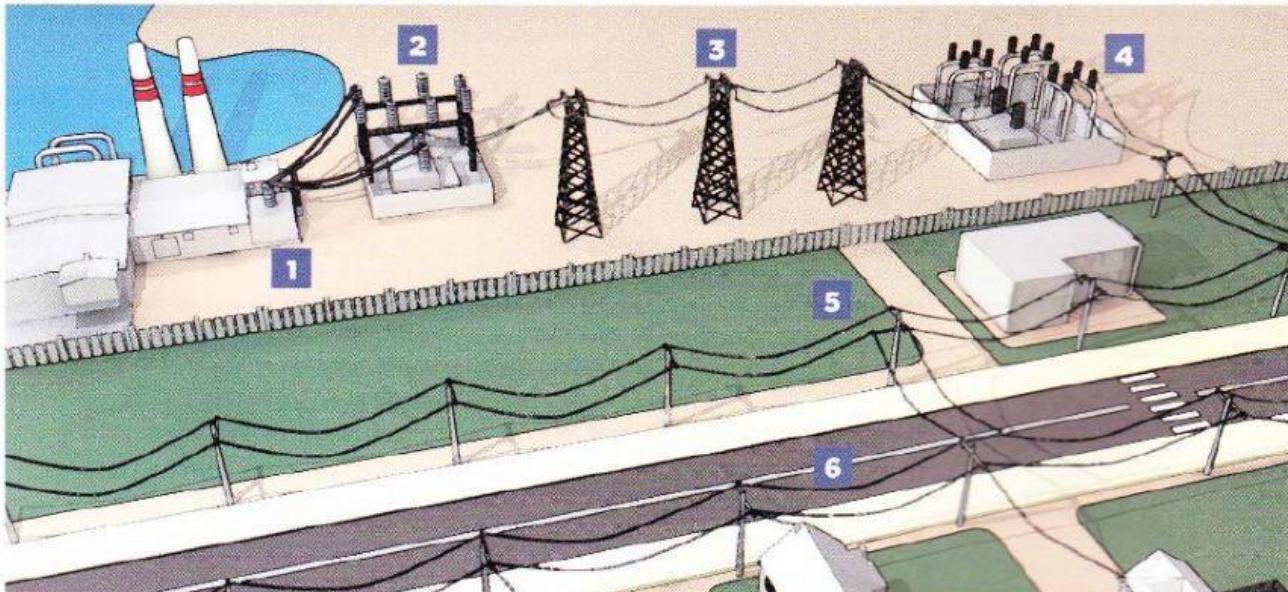
4-7 Read the text about the electrical distribution system and complete it with the words in the box. Then listen and check.

pole demand lower voltages consumers high-voltage
power plants delivery appliances **network** transformer

Electricity distribution is the final stage in the (1) _____ of electricity to end users. In order to be able to use electric power for our daily activities, electricity must be transmitted from the (2) _____ to other areas where it can be distributed to different (3) _____. The electricity generated by power plants is increased or **stepped up** at substations and distributed through (4) _____ transmission lines, in order to minimize energy **losses** and to economise on the material needed for conductors. Transmission lines use voltages as high as 765,000 volts and they are usually connected in a (5) _____. This means that if a station receives an unexpected (6) _____ for electric power, it can call on the other stations to help to meet the demand. Then electrical power is converted from high voltage to (7) _____ thanks to step-down transformers which turn electricity into different power levels. Once it is sent to your neighbourhood, another small (8) _____ mounted on a (9) _____ converts the power to even lower levels to be used at home. The final voltage is between 110 volts – for lights, TVs, and other smaller appliances – and 240 volts for larger (10) _____.

5- Reorder the different stages in the distribution system and match them to the numbers in the picture.

- a Transmission lines carry high-voltage electricity to different substations.
- b Electricity leaves the power plant.
- c Electricity is **stepped down** by transformers.
- d Current at lower voltages is transmitted to homes and offices.
- e The voltage is increased at a step-up station.
- f Power levels are lowered by small transformers mounted on poles.



6- Read the text again and match each sentence with its ending.

1 Power plants generate	a <input type="checkbox"/> convert electricity from high voltage levels to lower levels.
2 Transmission lines are used	b <input type="checkbox"/> in case of an expected demand for electric power.
3 High voltages mean	c <input type="checkbox"/> a reduction in energy losses during transmission.
4 Step-down transformers	d <input type="checkbox"/> power and distribute it to substations.
5 Substations can help each other	e <input type="checkbox"/> can be safely used in businesses and homes.
6 The current transmitted by poles	f <input type="checkbox"/> to distribute high-voltage electricity to a network of substations.