KNOWLEDGE ORGANISER
BIG IDEA: ENERGY
TOPIC: ENERGY RESOURCES

Key Word	Definition
Energy resource	Something with stored energy that can be released in a useful way.
Non-renewable	An energy resource that cannot be replenished and will be used up.
Renewable	An energy resource that can be replenished and will not run out. Examples are solar, wind, waves, geothermal and biomass.
Fossil fuels	Non-renewable energy resources formed from the remains of ancient plants or animals. Examples are coal, crude oil and natural gas.

Fossil fuels

Crude oil, coal and gas are **fossil fuels**. They were formed over millions of years, from the remains of dead organisms:
•coal was formed from dead trees and other plant material
•crude oil and gas were formed from dead marine organisms

Energy from the burning fuel is used to boil water. The steam turns **turbines**, and these turn electrical **generators**. Unfortunately, the use of fossil fuels releases pollution, including:
•carbon dioxide, which is a **greenhouse gas** and increases **global warming**
•sulfur dioxide and nitrogen oxides, which cause **acid rain**

Geothermal energy

The hot rocks beneath the Earth's surface heat water, and this may rise to the surface naturally as hot water and steam. Here the steam can be used to drive turbines and electricity generators.

Advantages
•Geothermal energy is a renewable energy resource.
•There are no fuel costs and no harmful polluting gases are produced.
•The hot water and steam can be used to heat buildings directly.

Disadvantages
•Most parts of the world do not have suitable areas where geothermal energy can be exploited.

Solar energy

The Sun is a renewable energy resource.

Solar cells
A **solar cell** is a device that converts light energy directly into electrical energy. Some pocket calculators use solar cells, and you may have seen large panels of solar cells on house roofs.

Solar heating
Do not confuse solar cells with **solar panels**, which use energy from the Sun to heat up water. These may also be put onto house roofs so that they can absorb the Sun's energy.

Advantages
•Solar energy is a renewable energy resource.
•There are no fuel costs and no harmful polluting gases are produced.
•Solar cells can provide electricity in remote locations where there is no mains electricity.

Disadvantages
•Solar cells are expensive and inefficient, so the cost of their electricity is high.
•Solar cells do not work at night and not as well when it is cloudy.

Wind energy

The wind is produced as a result of large movements of air, driven by energy from the Sun. This means that the **kinetic energy** in wind is a renewable energy resource.

Wind turbines
They have huge blades mounted on a tall tower. The blades are connected to a generator. As the wind blows, it transfers some of its kinetic energy to the blades, which turn and drive the generator.

Advantages
•Wind is a renewable energy resource. There are no fuel costs and no harmful polluting gases are produced.

Disadvantages
•Wind farms are noisy and may spoil the view for people living near them.
•The amount of electricity generated depends on the strength of the wind. If there is no wind, there is no electricity.

Waves
The water in the sea rises and falls because of waves on the surface. Wave machines use the kinetic energy in this movement to drive electricity generators.

Tides
A tidal barrage is a barrier built over a river estuary to make use of the kinetic energy in the moving water. The barrage contains electricity generators, which are driven by the water rushing through tubes in the barrage.

Hydroelectric power
The water usually comes from behind a dam built across a river valley. The water high up behind the dam has a lot of **gravitational potential energy**. This is transferred to kinetic energy as the water rushes down through tubes inside the dam. The moving water drives electrical generators, which may be built inside the dam.

Advantages
•Water power in its various forms is a renewable energy resource.
•There are no fuel costs and no harmful polluting gases are produced.
•Tidal barrages and hydroelectric power stations are very reliable and can be easily switched on.

Disadvantages
•It has been difficult to scale up the designs for wave machines to produce large amounts of electricity.
•Tidal barrages destroy the habitats of estuary species, including wading birds.
•Dams flood farmland and push people from their homes.
•The rotting vegetation underwater releases methane, which is a **greenhouse gas**.

Nuclear fuels

The main nuclear fuels are uranium and plutonium. In a nuclear power station, the energy released is used to boil water. The expanding steam spins turbines, which then drive generators to produce electricity.

Advantages
•Unlike fossil fuels, nuclear fuels do not produce carbon dioxide or sulfur dioxide.

Disadvantages
•Like the fossil fuels, nuclear fuels are non-renewable energy resources. They will run out one day if we keep on using them.
•If there is an accident, large amounts of **radioactive** material could be released into the environment. In addition, nuclear waste remains dangerously radioactive and harmful to health for thousands of years. It must be stored safely.