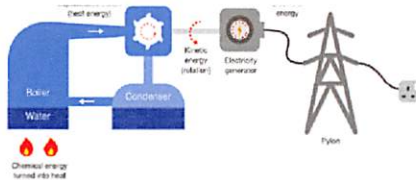


AQA Design & Technology 8552
Unit 2: Energy, Materials, Systems and Devices
2.1 Energy Generation and Storage

1. Energy Generation

Power can be generated from renewable and non-renewable sources. Non-renewable power is generated from fossil fuels.

Most electricity is created by rotating a turbine which turns a generator. Fossil fuels are burnt to create heat which superheats the water. The steam rotates the turbine which is linked to the generator to supply the electricity.



1.1 Fossil Fuels – Most electricity in the UK comes from burning Fossil Fuels such as **Coal, Gas and Oil**. Fossil fuels are **finite** resources and **cannot be replaced** as they run out. Burning fossil fuels creates carbon dioxide and is not environmentally friendly and contributes to **global warming**.

1.2 Fracking – Shale gas is trapped within the earth's crust. Fracking is the process which removes it so it can then be burnt to create electricity. It involves drilling the earth's crust and sending high pressure water, sand and chemical mixtures into the rock to release the gas.



3. Nuclear Power

Nuclear power is highly controversial. The process harnesses a nuclear reaction to create heat to power the turbines.

- | | |
|--|--|
| <ul style="list-style-type: none"> • Clean • Efficient | <ul style="list-style-type: none"> • High start up costs • Radioactive waste which is very dangerous to all living things. • Nuclear waste stays radioactive for millions of years and is stored underground. |
|--|--|

2. Renewable Energy

Energy that comes from the planet's non-finite resources is renewable. It includes



2.1 Wind Power

- | | |
|---|---|
| <ul style="list-style-type: none"> • Low cost • Produce More power in winter when demand is higher. | <ul style="list-style-type: none"> • Do not create power when not enough wind or it is too windy. • Harmful to wildlife • Ugly |
|---|---|

2.2 Solar Energy

- | | |
|---|--|
| <ul style="list-style-type: none"> • Low maintenance costs. • Improvements in technology mean the efficiency is always improving. | <ul style="list-style-type: none"> • Only produce energy during daytime. • Production is less in winter. |
|---|--|

2.3 Tidal Energy

- | | |
|---|--|
| <ul style="list-style-type: none"> • Predictable and consistent. | <ul style="list-style-type: none"> • Machinery has to be located some distance from land making repair and maintenance difficult. |
|---|--|

2.4 Hydro Electric Power

- | | |
|---|---|
| <ul style="list-style-type: none"> • Very reliable | <ul style="list-style-type: none"> • High set up costs both financially and environmentally. |
|---|---|

2.5 Bio Fuel

- | | |
|--|--|
| <ul style="list-style-type: none"> • Carbon Neutral – They absorb the CO2 whilst growing and produce similar amounts when burnt for energy. | <ul style="list-style-type: none"> • Vast amounts of land and water needed to produce the crops which contribute to food shortages in developing countries. |
|--|--|

4. Energy Storage

Most mechanical power is stored by using tension or compression. Coiled springs used in clocks, watches and wind up toys store physical energy from the winding process which is then released slowly through cogs, gears and other mechanisms.

4.1 Pneumatics – A form of compression is used to store gas or air under pressure. They are commonly used to controlling production lines. They are accurate, efficient and low maintenance.

4.2 Hydraulics – Very similar to Pneumatics but uses a liquid, most commonly Oil. Extremely powerful and used in manufacturing industrial applications.

Both systems will use a compressor which pump the air or liquid into a storage tank to hold it until it is needed.

4.3 Kinetic Energy – any object in motion has kinetic energy. Objects not in motion store potential energy which is converted to kinetic energy when a force is applied to the object such as gravity.

4.4 Batteries – Electrical power can be stored in batteries. Battery technology has vastly improved alongside the power consumption of modern electronic devices helping save valuable finite resources.

Alkaline batteries are more efficient than traditional acid based batteries and hold their charge well.

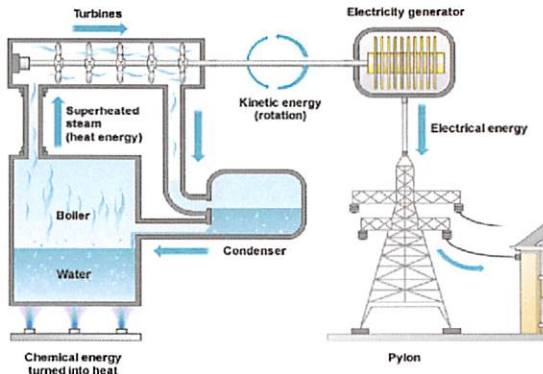
Rechargeable batteries are capable of being charged and discharged thousands of times reducing the resources needed. The time it takes for rechargeable batteries to reach full charge has also improved in recent years making their use much more convenient.

4.5 Disposal of Batteries – Batteries must be disposed of correctly as they contain toxic electro chemicals. If placed in the normal bin and they end up in land fill sites, it will degrade over time and release harmful chemicals and metals into the soil and water.

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Energy Types

1. Fossil Fuels – Non-renewable energy

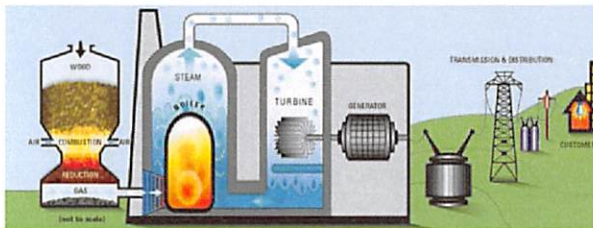


In a thermal power station fuel such as coal, oil or gas is burned in a furnace to produce heat - chemical to heat energy.

- this heat is used to change water into steam in the boiler.
- the steam drives the turbine - heat to kinetic energy
- this drives the generator to produce electricity - kinetic to electrical energy.

Some experts believe that fossil fuels will run out in our lifetime.

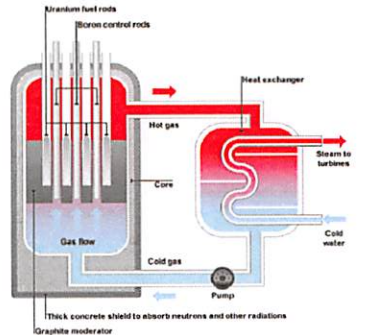
Energy Types 2. Biomass Energy – Renewable Energy



Biomass is an industry term for getting energy by burning wood, and other organic matter. Burning biomass releases carbon emissions, but has been classed as a renewable energy source in the EU and UN legal frameworks, because plant stocks can be replaced with new growth.

Energy Types

3. Nuclear Energy – Renewable energy



The main nuclear fuels are **uranium** and **plutonium**. In a nuclear power station nuclear fuel undergoes a controlled chain reaction in the reactor to produce heat - nuclear to heat energy.

- heat is used to change water into steam in the boiler.
- the steam drives the turbine (heat to kinetic energy)
- this drives the generator to produce electricity - kinetic to electrical energy.

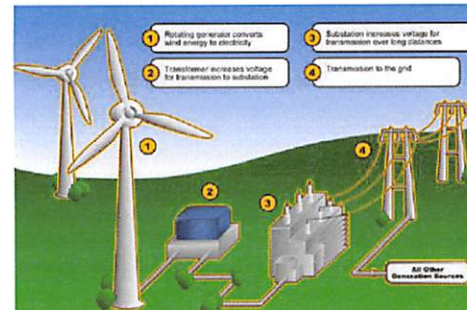
Energy Types

8. Batteries

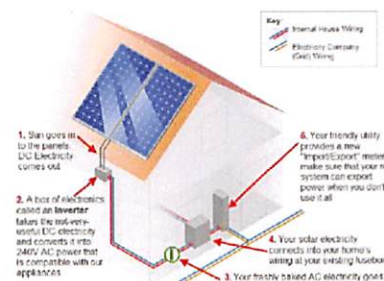
Alkaline batteries are the most common type of domestic batteries, they are disposable but contain chemicals that are bad for the environment. Fortunately more and more battery recycling banks are appearing now where most of the battery can be reused. **Rechargeable batteries** are better for the environment and more economical in the long run (High initial purchase price). Their lifespan decreases with every charge.

Energy Types

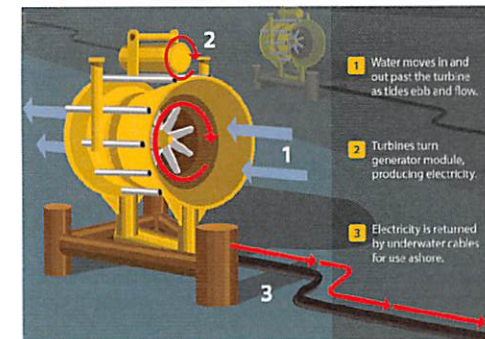
4. Wind Energy – Renewable Energy



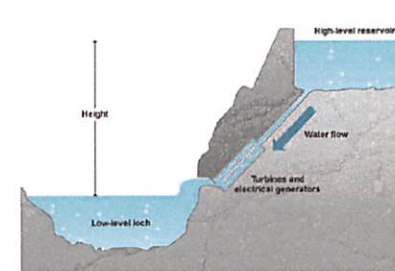
5. Solar Energy – Renewable Energy



6. Tidal Energy – Renewable Energy



7. Hydroelectricity – Renewable Energy



- In a hydroelectric power station water is stored behind a dam in a reservoir. This water has gravitational potential energy.
- The water runs down pipes (potential to kinetic energy) to turn the turbine
- The turbine is connected to a generator to produce electricity (kinetic to electrical energy).