



Mechanical	Force acts upon an object
Electrical	Electric current flow
Heat	Temperature difference between objects
Radiation	Electromagnetic waves or sound

Energy pathways

Change in thermal energy = mass X specific heat capacity X temperature change

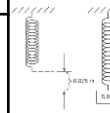
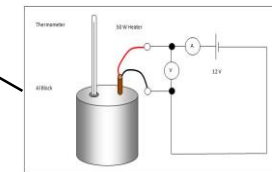
$$\Delta E = m \times c \times \Delta \theta$$

Specific Heat Capacity	Energy needed to raise 1kg of substance by 1°C	Depends on: mass of substance, what the substance is and energy put into the system.
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HIGHER: efficiency can be increased using machines.

$$\text{Efficiency} = \frac{\text{Useful power output}}{\text{Total power input}}$$

$$\text{Efficiency} = \frac{\text{Useful output energy transfer}}{\text{Total input energy transfer}}$$



Energy stores and changes

AQA ENERGY – part 1

Energy Conservation and Dissipation

Efficiency

How much energy is usefully transferred

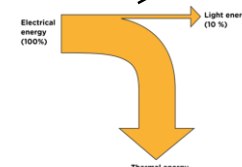
Dissipate	To scatter in all directions or to use wastefully	When energy is 'wasted', it dissipates into the surroundings as internal (thermal) energy.
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Ways to reduce 'wasted' energy	Energy transferred usefully	Insulation, streamline design, lubrication of moving parts.
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Principle of conservation of energy	The amount of energy always stays the same.	Energy cannot be created or destroyed, only changed from one store to another.
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Closed system	No change in total energy in system
Open system	Energy can dissipate



HIGHER: When an object is moved, energy is transferred by doing work.

$$\text{Work done} = \text{Force} \times \text{distance moved}$$

Frictional forces cause energy to be transferred as thermal energy. This is wasted.

Reducing friction - using wheels, applying lubrication. Reducing air resistance – travelling slowly, streamlining.

Kinetic energy	Energy stored by a moving object	$\frac{1}{2} \times \text{mass} \times (\text{speed})^2$ $\frac{1}{2} mv^2$
Elastic Potential energy	Energy stored in a stretched spring, elastic band	$\frac{1}{2} \times \text{spring constant} \times (\text{extension})^2$ $\frac{1}{2} ke^2$ (Assuming the limit of proportionality has not been exceeded)
Gravitational Potential energy	Energy gained by an object raised above the ground	Mass X gravitational field strength X height mgh

System	An object or group of objects that interact together	EG: Kettle boiling water.
Energy stores	Kinetic, chemical, internal (thermal), gravitational potential, elastic potential, magnetic, electrostatic, nuclear	Energy is gained or lost from the object or device.
Ways to transfer energy	Light, sound, electricity, thermal, kinetic are ways to transfer from one store to another store of energy.	EG: electrical energy transfers chemical energy into thermal energy to heat water up.
Unit	Joules (J)	

Work	Doing work transfers energy from one store to another	By applying a force to move an object the energy store is changed.	Work done = Force X distance moved $W = Fs$
Power	The rate of energy transfer	1 Joule of energy per second = 1 watt of power	Power = energy transfer ÷ time $P = E \div t$ Power = work done ÷ time, $P = W \div t$

	Units
Specific Heat Capacity	Joules per Kilogram degree Celsius (J/Kg°C)
Temperature change	Degrees Celsius (°C)
Work done	Joules (J)
Force	Newton (N)
Distance moved	Metre (m)
Power	Watts (W)
Time	Seconds (s)

Useful energy	Energy transferred and used
Wasted energy	Dissipated energy, stored less usefully

Prefix	Multiple	Standard form
Kilo	1000	10^3
Mega	1000 000	10^6
Giga	100 000 000	10^9

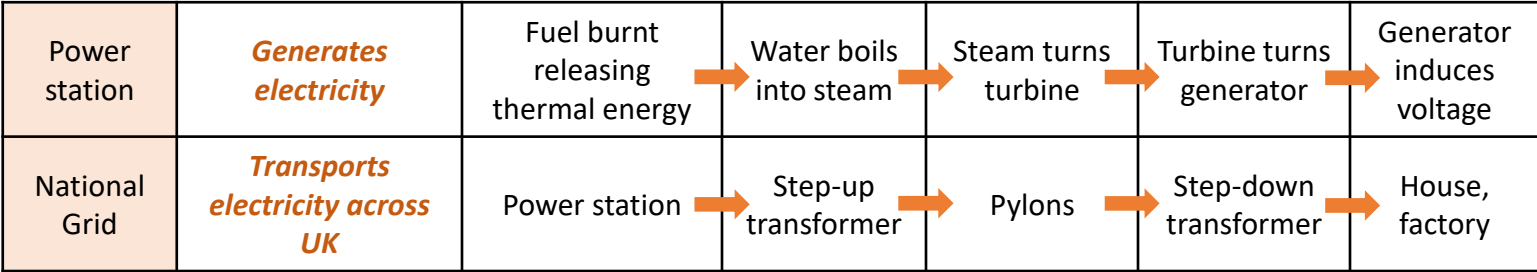
	Units
Energy (KE, EPE, GPE, thermal)	Joules (J)
Velocity	Metres per second (m/s)
Spring constant	Newton per metre (N/m)
Extension	Metres (m)
Mass	Kilogram (Kg)
Gravitational field strength	Newton per kilogram (N/Kg)
Height	Metres (m)



Using renewable energy will need to increase to meet demand.

Transport	<i>Petrol, diesel, kerosene produced from oil</i>	Used in cars, trains and planes.
Heating	<i>Gas and electricity</i>	Used in buildings.
Electricity	<i>Most generated by fossil fuels</i>	Used to power most devices.

Power station – NB: You need to understand the principle behind generating electricity. An energy resource is burnt to make steam to drive a turbine which drives the generator.



Renewable energy makes up about 20% of energy consumption.

Fossil fuel reserves are running out.

Energy demand is increasing as population increases.

Non-renewable energy resource	<i>These will run out. It is a finite reserve. It cannot be replenished.</i>	e.g. Fossil fuels (coal, oil and gas) and nuclear fuels.
Renewable energy resource	<i>These will never run out. It is an infinite reserve. It can be replenished.</i>	e.g. Solar, Tides, Waves, Wind, Geothermal, Biomass, Hydroelectric

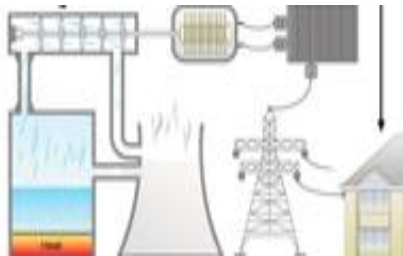
Using fuels

Energy resources

Global Energy Resources

AQA ENERGY – part 2

National Grid



Energy resource	<i>How it works</i>	Uses	Positive	Negative
Fossil Fuels (coal, oil and gas)	<i>Burnt to release thermal energy used to turn water into steam to turn turbines</i>	Generating electricity, heating and transport	Provides most of the UK energy. Large reserves. Cheap to extract. Used in transport, heating and making electricity. Easy to transport.	Non-renewable. Burning coal and oil releases sulfur dioxide. When mixed with rain makes acid rain. Acid rain damages building and kills plants. Burning fossil fuels releases carbon dioxide which contributes to global warming. Serious environmental damage if oil spilt.
Nuclear	<i>Nuclear fission process</i>	Generating electricity	No greenhouse gases produced. Lots of energy produced from small amounts of fuel.	Non-renewable. Dangers of radioactive materials being released into air or water. Nuclear sites need high levels of security. Start up costs and decommission costs very expensive. Toxic waste needs careful storing.
Biofuel	<i>Plant matter burnt to release thermal energy</i>	Transport and generating electricity	Renewable. As plants grow, they remove carbon dioxide. They are 'carbon neutral'.	Large areas of land needed to grow fuel crops. Habitats destroyed and food not grown. Emits carbon dioxide when burnt thus adding to greenhouse gases and global warming.
Tides	<i>Every day tides rise and fall, so generation of electricity can be predicted</i>	Generating electricity	Renewable. Predictable due to consistency of tides. No greenhouse gases produced.	Expensive to set up. A dam like structure is built across an estuary, altering habitats and causing problems for ships and boats.
Waves	<i>Up and down motion turns turbines</i>	Generating electricity	Renewable. No waste products.	Can be unreliable depends on wave output as large waves can stop the pistons working.
Hydroelectric	<i>Falling water spins a turbine</i>	Generating electricity	Renewable. No waste products.	Habitats destroyed when dam is built.
Wind	<i>Movement causes turbine to spin which turns a generator</i>	Generating electricity	Renewable. No waste products.	Unreliable – wind varies. Visual and noise pollution. Dangerous to migrating birds.
Solar	<i>Directly heats objects in solar panels or sunlight captured in photovoltaic cells</i>	Generating electricity and some heating	Renewable. No waste products.	Making and installing solar panels expensive. Unreliable due to light intensity.
Geothermal	<i>Hot rocks under the ground heats water to produce steam to turn turbine</i>	Generating electricity and heating	Renewable. Clean. No greenhouse gases produced.	Limited to a small number of countries. Geothermal power stations can cause earthquake tremors.