



## Year. 9 –PHYSICS

### Renewable and non –renewable energy resources

An energy resource can be used to generate power for human use. There are two categories of energy resource:

- **non-renewable energy resources will eventually run out** – once used they cannot be used again. Examples are fossil fuels (coal, oil, natural gas) and nuclear fuels (uranium, plutonium).
- **Renewable energy resources** can be replaced or regenerated and will never run out. Examples are wind, hydroelectricity and solar power.

Renewable	Non-renewable
Will be replaced over time	Will run out
Less concentrated source of energy	Concentrated source of energy
Initial installation cost high but generally require less maintenance than traditional generators	Lesser installation cost
Clean and non polluting	Produces green house gases like carbon dioxide and oxides of nitrogen and sulphur.
Renewable energy often relies on the weather for its source of power.	It is reliable

#### Choosing the best energy source

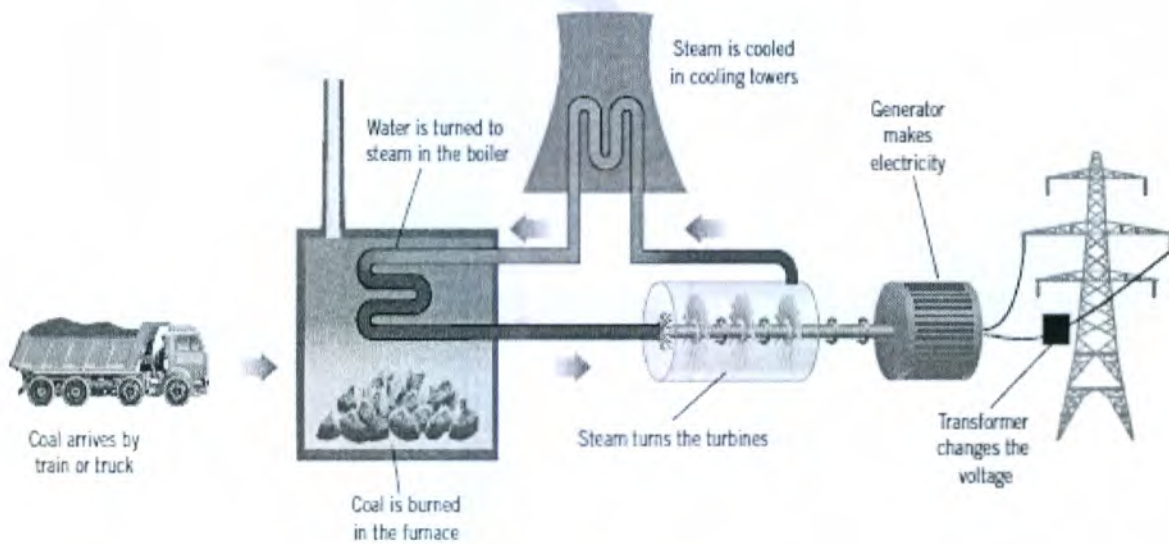
Electricity can be produced from a wide range of different resources. Choosing the best option depends on many factors:

- **efficiency:** how efficiently can electricity be generated from a given energy resource
- **economic costs:** the installation cost and how much will it cost to keep running?
- **environmental impact:** what are the short and long-term impacts, both locally and globally?
- **power output and lifetime:** how much power can be generated and for how long will it run?

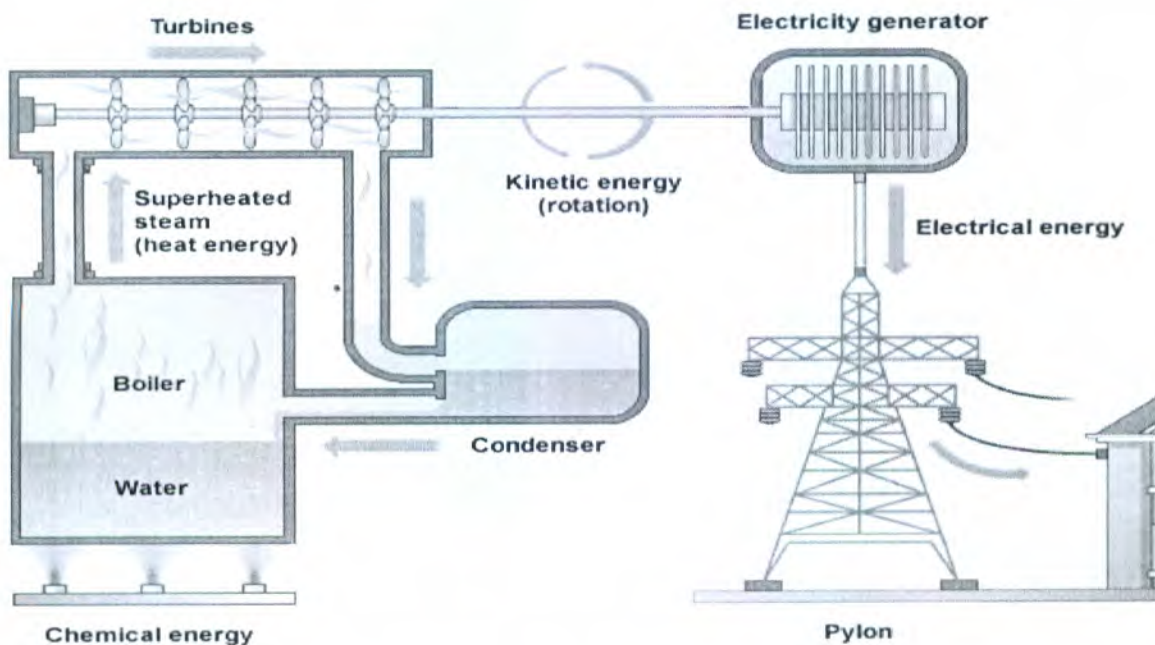
## Thermal power Station

A **thermal power station** is a power station which burns fossil fuel such as coal, natural gas or petroleum to heat water in a boiler to produce steam. The steam at tremendous pressure is directed onto turbines, making them turn. The turbines drive the generator to produce electricity.

A coal-fired power station



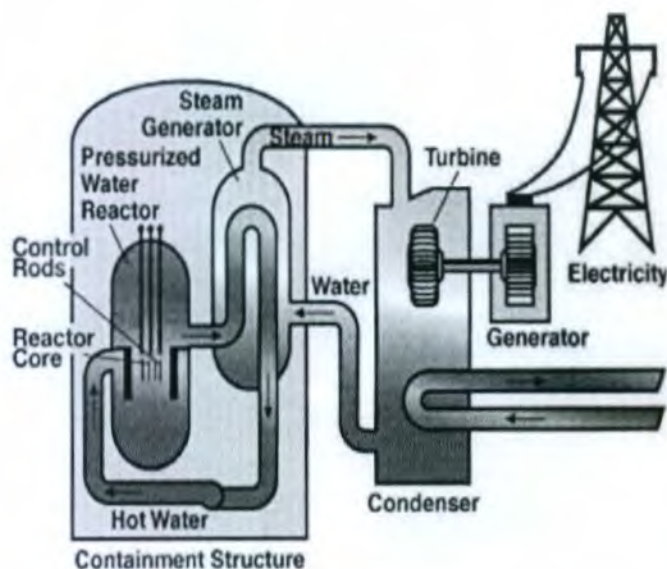
## Energy changes in a thermal power station



Advantages	Disadvantages
Reliable energy source	Release carbon dioxide when burnt
Established fuel supply	produces oxides of sulphur which leads to acid rain
Cheap running cost	Limited fuel left
Easy to store and transport	Large quantities required

### Nuclear power station

A nuclear power station uses the fission of uranium nuclei to generate heat. The process of splitting a nucleus is called nuclear fission. As is typical in all conventional thermal **power stations** the heat is used to generate steam which drives a steam turbine connected to an electric generator which produces electricity.



### Energy changes:

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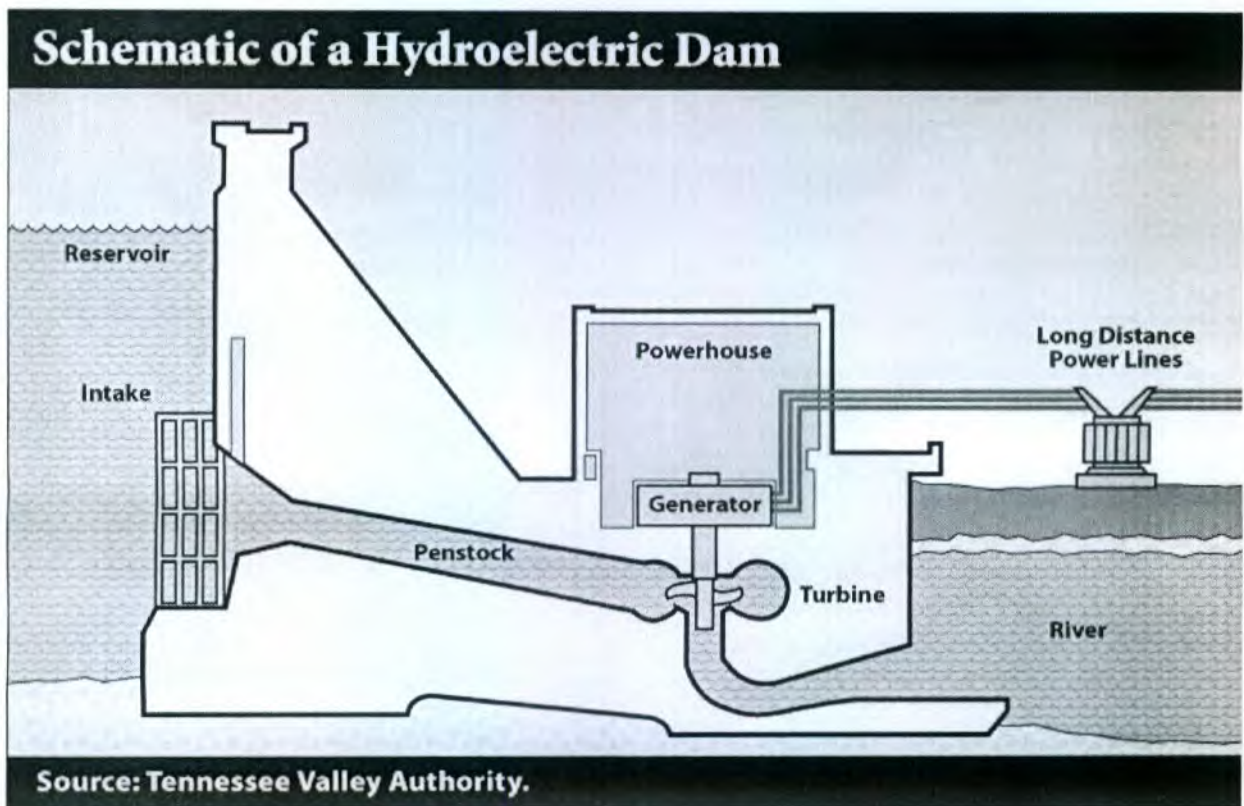
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Advantages	Disadvantages
Little waste produced	Waste produced can cause cancer
Little fuel required	Cost of building and commissioning nuclear power station is high
No smoke/carbon-dioxide produced	<b>Nuclear accidents</b> can spread 'radiation product particles' over a wide area,
Reliable energy sources	
We can <b>control the output</b> from a nuclear power station to fit our needs	

## Hydroelectric power station

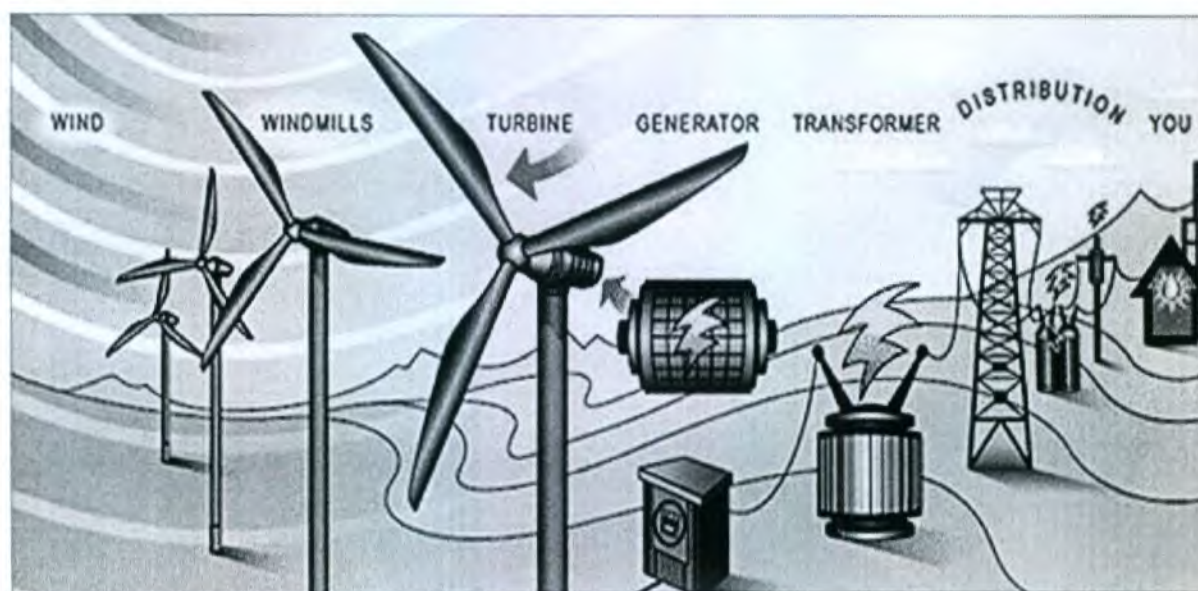
Hydroelectric power stations use the kinetic energy of moving water. But the water comes from behind a dam built across a river valley. The water high up behind the dam contains **gravitational potential energy**. This is transferred to kinetic energy as the water rushes down through tubes inside the dam onto the turbine. The moving turbine drives electrical generator which may be built inside the dam.



Advantages	Disadvantages
No smoke/carbon-dioxide produced	Hilly area required to built dam (site specific)
Reliable energy sources, long life time	Expensive to build
Quick start up time	Disrupts aquatic life and ecosystem
No fuel required and less maintenance cost	Construction of dam floods the region
Dams can be used for irrigation of farms and for water tourism	Depends on rain, less water less production

## Wind power station

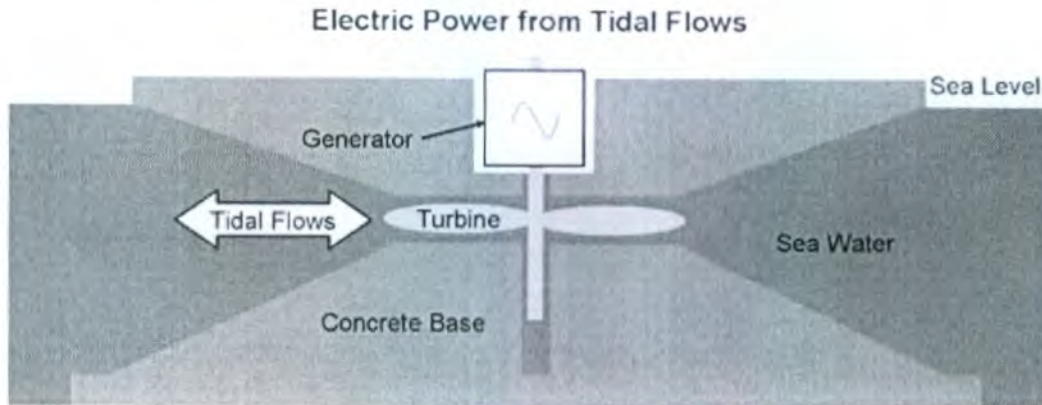
**Wind turbines** have large blades that capture the kinetic energy of the wind. This kinetic energy directly turns a turbine and generates electricity.



1. Wind blows...
2. across tall windmills...
3. to turn the blades of huge turbines...
4. which spin generators to create electricity.
5. A transformer increases the voltage to send electricity over...
6. distribution lines. Then local transformers reduce the voltage...
7. for you to use.

Advantages	Disadvantages
No smoke/carbon-dioxide produced, clean energy	Considered to be noisy and eyesore
Wind farms require space in open areas, but the land beneath them can also be used for farming at the same time	Kills migrating birds.
Only cost is for building turbines	Possible only in windy areas and dependant on wind
Wind turbines are great resources to generate electricity in remote areas	Turbines can be destroyed by severe storms

## Tidal power station

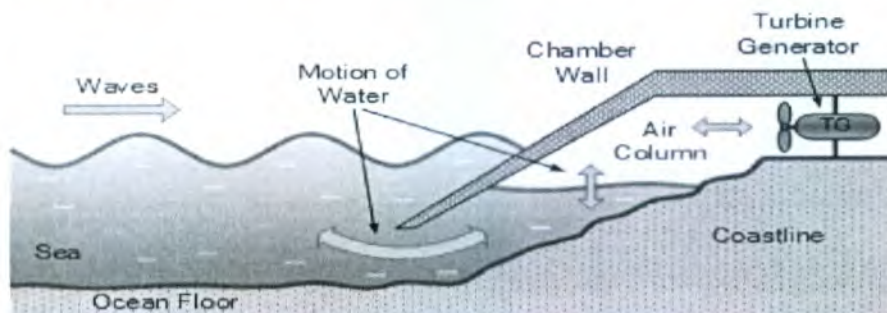


**Tidal power** involves harnessing the kinetic energy of tidal waters. The tide is the twice-daily and fall of the ocean's surface due to the gravitational pull of the Moon and, to a lesser extent, Sun. Tidal power involves building a dam across a river estuary. Water is only able to flow in and out of the estuary through turbines in the dam.

Advantages	Disadvantages
High power output	Only few suitable locations
Predictable power source	Expensive to build
Low running cost , no fuel required	Destroys habitats
Long lifetime	Tidal range varies
No greenhouse gases produced	Usually the places where tidal energy is produced are far away from places where it is consumed. Transmission is expensive and difficult.

Energy changes: \_\_\_\_\_

## Wave power stations



The up and down motion of the waves can provide energy for those countries which have a coastline. The wave generators change the vertical motion of the waves into the rotary motion necessary for the electricity generation.

Advantages	Disadvantages
Energy is free, no fuel required	The device needs to be strong and weather resistant
Can produce great deal of energy	Waves can be big or small so always may not be able to produce electricity
Only cost is for building power stations, not expensive to run and maintain	Needs to find a way to transmit electricity from sea to land
No greenhouse gases produced	Some devices can produce a lot of noise and takes up a lot of space
	Devices are expensive

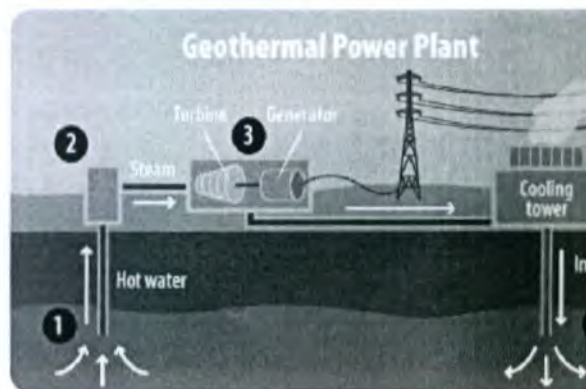
### Geothermal energy

Geothermal energy is the heat from the Earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma.

This thermal energy comes from the decay of radioactive elements, such as uranium, in rocks under the ground.

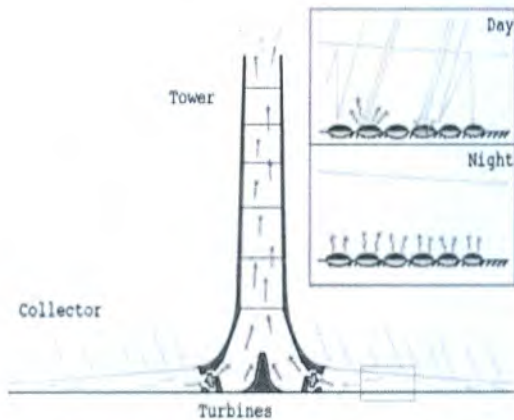
In some areas, where the hot rocks are near the surface, hot water and steam rise to the surface. This creates features such as steam vents, geysers and hot springs.

A geothermal power plant uses steam and hot water that rise to the Earth's surface to drive a turbine and generate electricity.



Advantages	Disadvantages
no fuel required	Very few locations
Reliable energy source which do not depend on climate	Expensive to build
24 hour production, long life time	Construction can cause land instability
Once the well is drilled and power plant is built electricity production cost is less	Can emit some gases like hydrogen sulphide and ammonia that can be irritating
No green house gases produced	Large amount of cooling water required depending on the type of the plant

## Solar power stations



A solar power plant consists of a chimney, a collector area and wind turbines. The air inside the collector heats up due to the greenhouse effect. The light hot air rises up through the chimney, rotating the turbines which are placed in the chimney. The turbines are connected to an electrical generator which produces electricity.

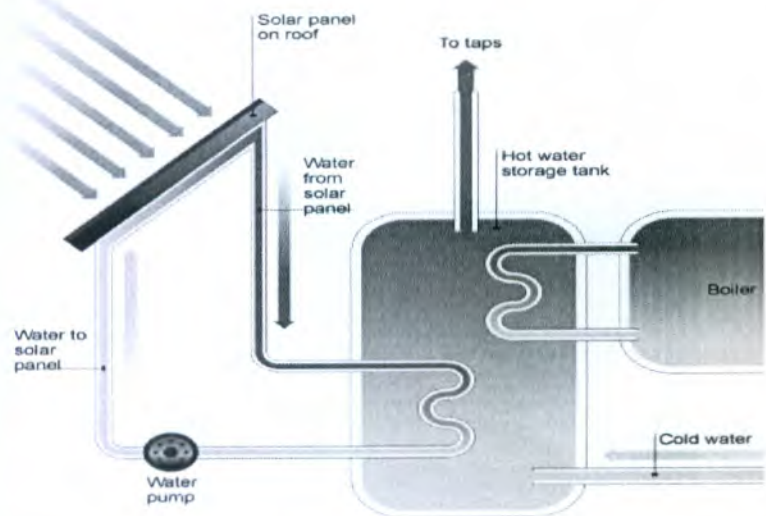
### Solar cells

Solar cells are devices that convert light energy directly into electrical energy. You may have seen small solar cells in calculators. Larger arrays of solar cells are used to power road signs in remote areas, and even larger arrays are used to power satellites in orbit around Earth.



### Solar panel

Solar panels do not generate electricity, but rather they heat up water. They are often located on the roofs of buildings where they can receive heat energy directly from the sun.



Advantages	Disadvantages
Pollution free	Capital cost high
After the installation cost, the cost of energy production is quite low	Dependant on climate and location
Less maintenance required	Large area required