

Non-Conventional Energy Sources

Topic Covered

- **NON-CONVENTIONAL ENERGY SOURCES:**
Wind, Solar, Tidal, Ocean, and Geothermal sources of
- Energy, fuel cell, Magneto Hydro Dynamic (MHD) system.

Non conventional energy source

 **Introduction to Energy**

 **Types of Energy Sources**

 **Solar Energy**

 **Wind Energy**

 **Tidal Energy**

 **Hydro Energy**

 **Biomass Energy**

 **Geothermal Energy**

Definition of Energy: Energy can be defined as the ability
(or) capacity to do work

The different forms of energy:

Energy can be obtained in number of way. It may be in the form of

- (1) Chemical energy - due to chemical reaction
- (2) Electrical energy - due to flow of electron
- (3) Heat energy - due to thermal vibration
- (4) Light energy - due to radiation of light
- (5) Mechanical energy – due to moving parts
- (6) Nuclear energy - due to nuclear reaction

The SI unit of energy is Joule (or) N/m.

Law of conservation of energy

According to law of conservation of energy, Energy can neither be created nor destroyed. But, one form of energy can be converted to another form.

Example:

- A battery generates electrons from chemical reactions, which are used to make electrical energy.
- A heater convert electrical energy into heat energy.
- The human leg converts the chemical energy stored in the muscles into mechanical energy when you pedal a bicycle.

Category of energy resource

On the basis of availability, the energy resources are broadly categories as,

- Primary energy resources
- Secondary energy resources

Primary energy: All energy originates from natural sources such as coal, solar, wind, hydro are called primary energy resources.

Secondary energy: The energy converted from primary energy sources. For example, the solar energy can be converted into electricity

Types of Energy sources

1. Conventional energy sources (or) Non-renewable energy sources
2. Non-Conventional energy sources (or) Renewable energy sources

(1) Conventional energy (or) Non-renewable energy

Conventional (or) Non-renewable energy sources are those, which cannot be replaced continuously.

- Generally, non-renewable energy sources **come out of the ground** as liquids, gases and solids.

Examples: The *conventional (or) Non-renewable energy sources* are Oil, Coal, Petroleum and natural gas, Nuclear energy

Non-Conventional energy (or) Renewable energy

Renewable energy is a source of energy that can never be exhausted and can be replaced continuously

We can obtain renewable energy from the sun, from the water, from the wind, from crop residues and waste

The types of Non-conventional (or) Renewable energies are

Solar energy

Wind energy

Biomass energy

Geothermal

Tidal energy

Hydro energy

Biofuels

Wave Power

Solar energy

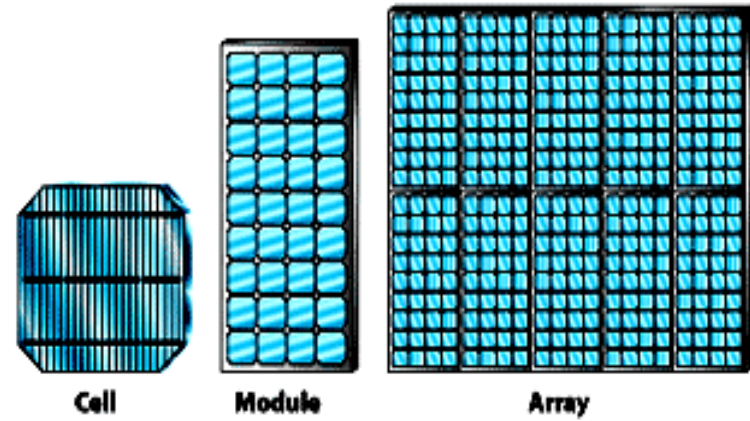


Solar energy comes from the light of the sun, which means it is a renewable source of energy. We can use the sun light to create pollution free electricity

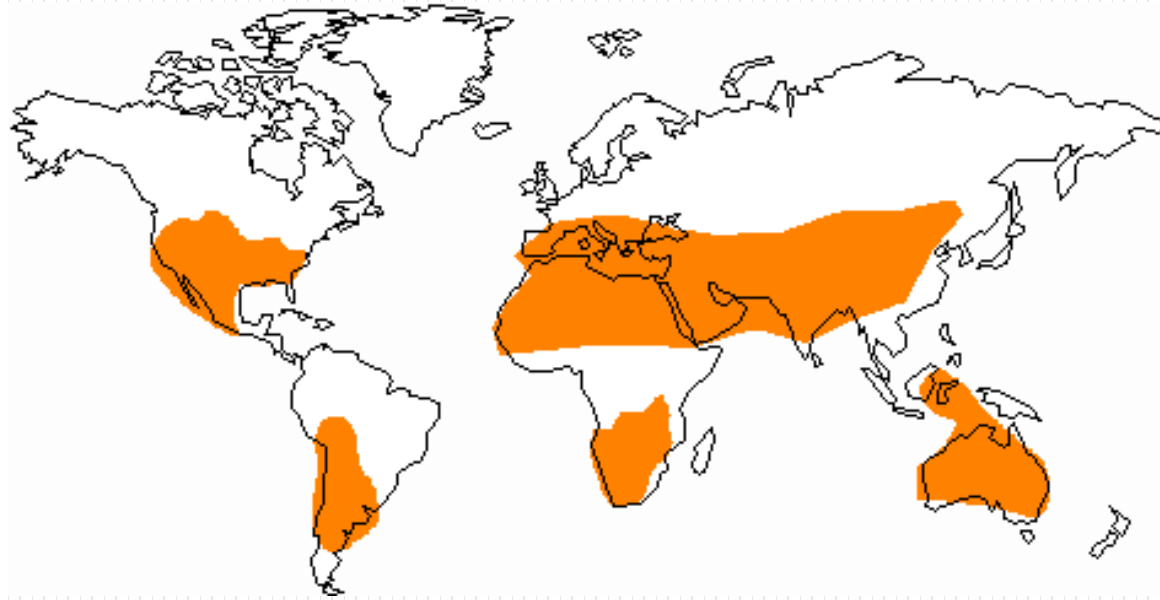
The solar cell is the system used to convert the sunlight energy into electrical energy



Solar collectors



Areas of the world with high Solar radiation



- The basic resource for all solar energy systems is the sun.
- Knowledge of the *quantity and quality* of solar energy available at a *specific location* is of prime importance for the design of any solar energy system

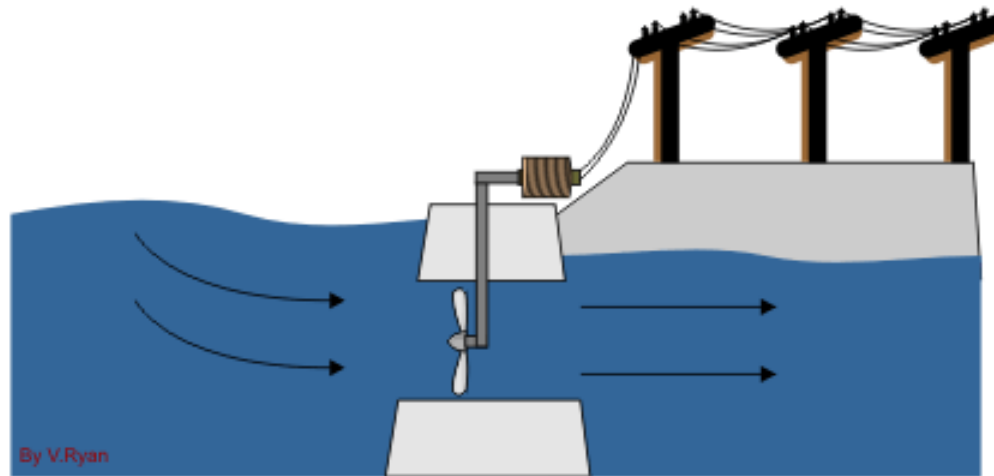
- Although the solar radiation is relatively constant outside the earth's atmosphere, *local climate influences* can cause wide variations in *available radiation* on the earth's surface from site to site.
- In addition, the relative *motion of the sun* with respect to the earth will *allow surfaces with different orientations* to intercept different amounts of solar energy.
- It is the primary task of the solar energy system designer to determine the *amount, quality and timing of the solar energy available at the site* selected for installing a solar energy conversion system.

Tidal energy



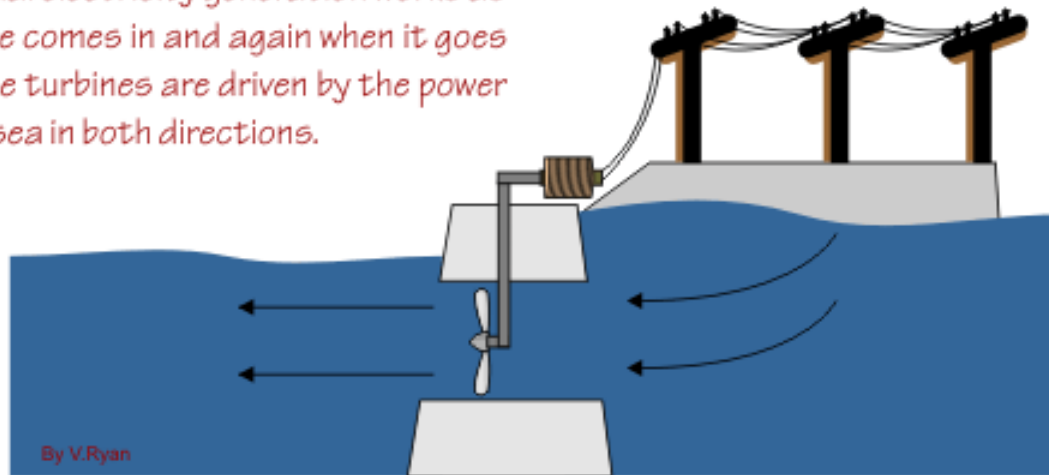
Tidal energy is the energy due to the water waves created in the ocean. The tidal energy is also called hydropower.

- It is a hydropower due to raise and fall of water wave in ocean. The raise and fall of water wave is due to the gravitational forces of the moon and sun as well as the revolution of the earth
- The raising and falling *waves* are used to *rotate the turbines* and hence the electricity is produced.



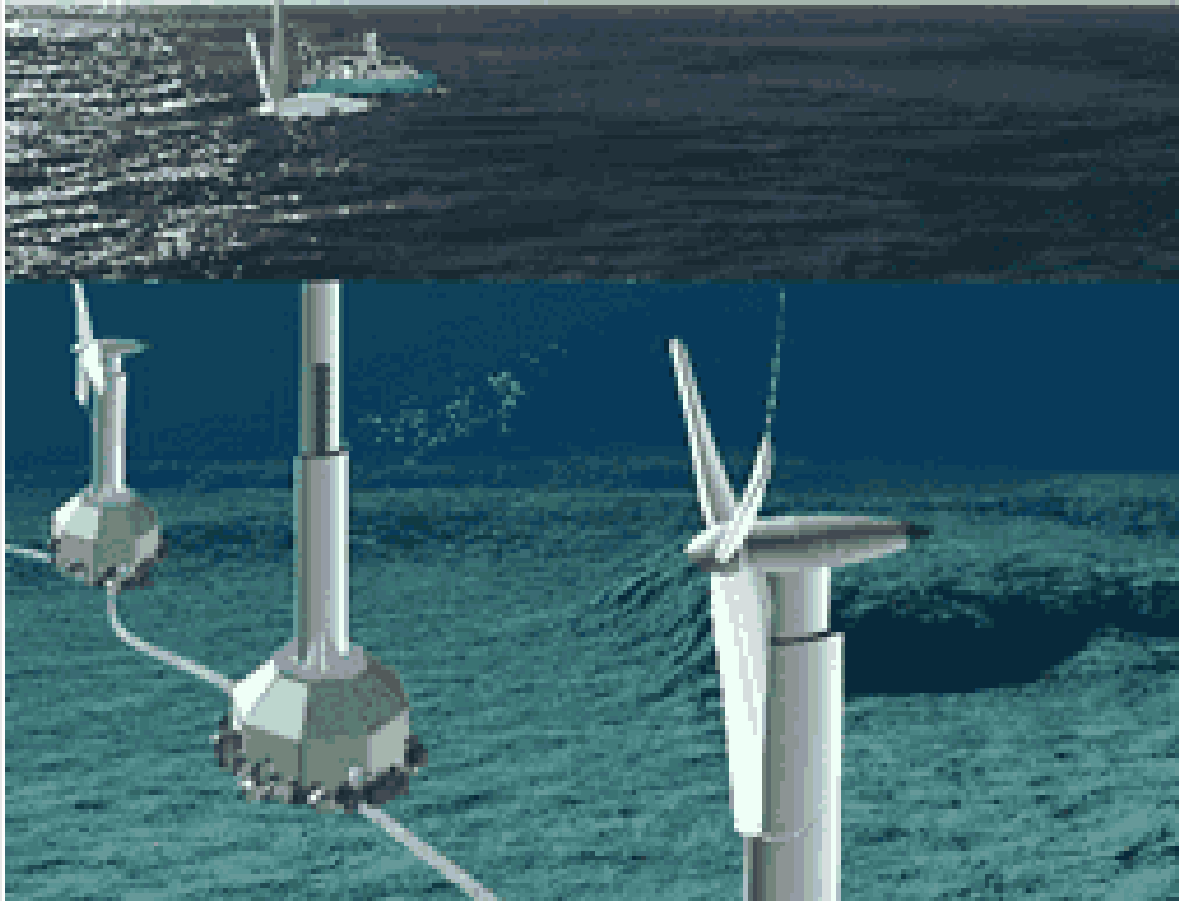
TIDE COMING IN

This tidal electricity generation works as the tide comes in and again when it goes out. The turbines are driven by the power of the sea in both directions.



TIDE GOING OUT

Turbine rotation due to Tidal



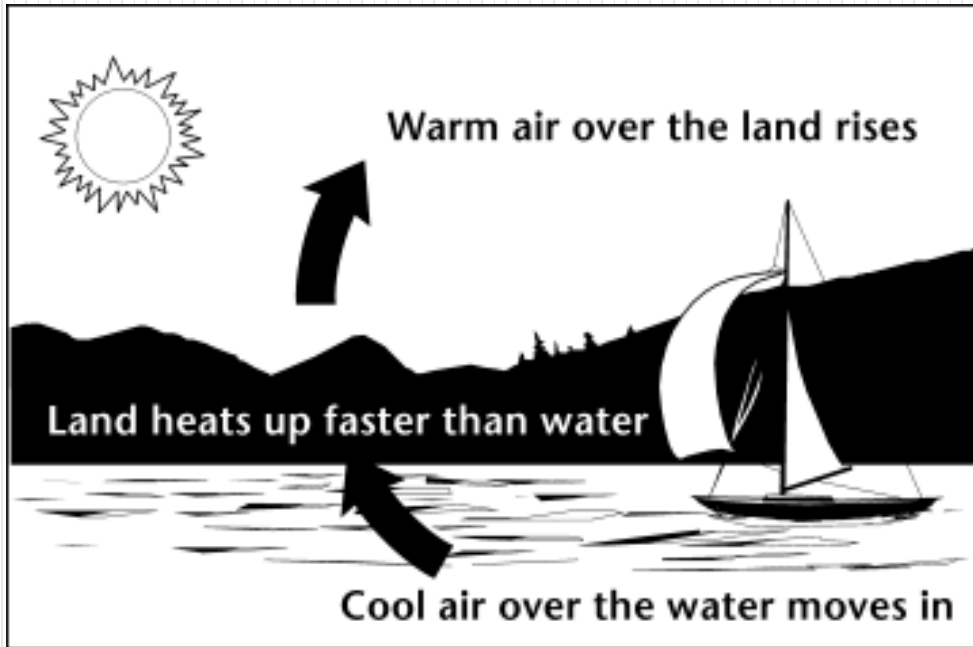
Wind energy



Wind energy is the kinetic energy associated with the movement of atmospheric air

- Wind energy systems convert kinetic energy to more useful forms of power.
- Wind energy systems for irrigation and milling have been in use since ancient times
- From beginning of the 20th century it is being used to generate electric power.

- Wind is simple air in motion.
- wind is caused by the *uneven heating* of the earth's surface by the sun.
- During the day, the *air above the land heats up more quickly than the air over water.*
- The *warm air* over the land *expands* and rises, and the heavier, cooler air rushes in to take its place, *creating winds.*
- This winds are used to rotate *turbine blades* which *spins the generator* to produce electricity



Windmill

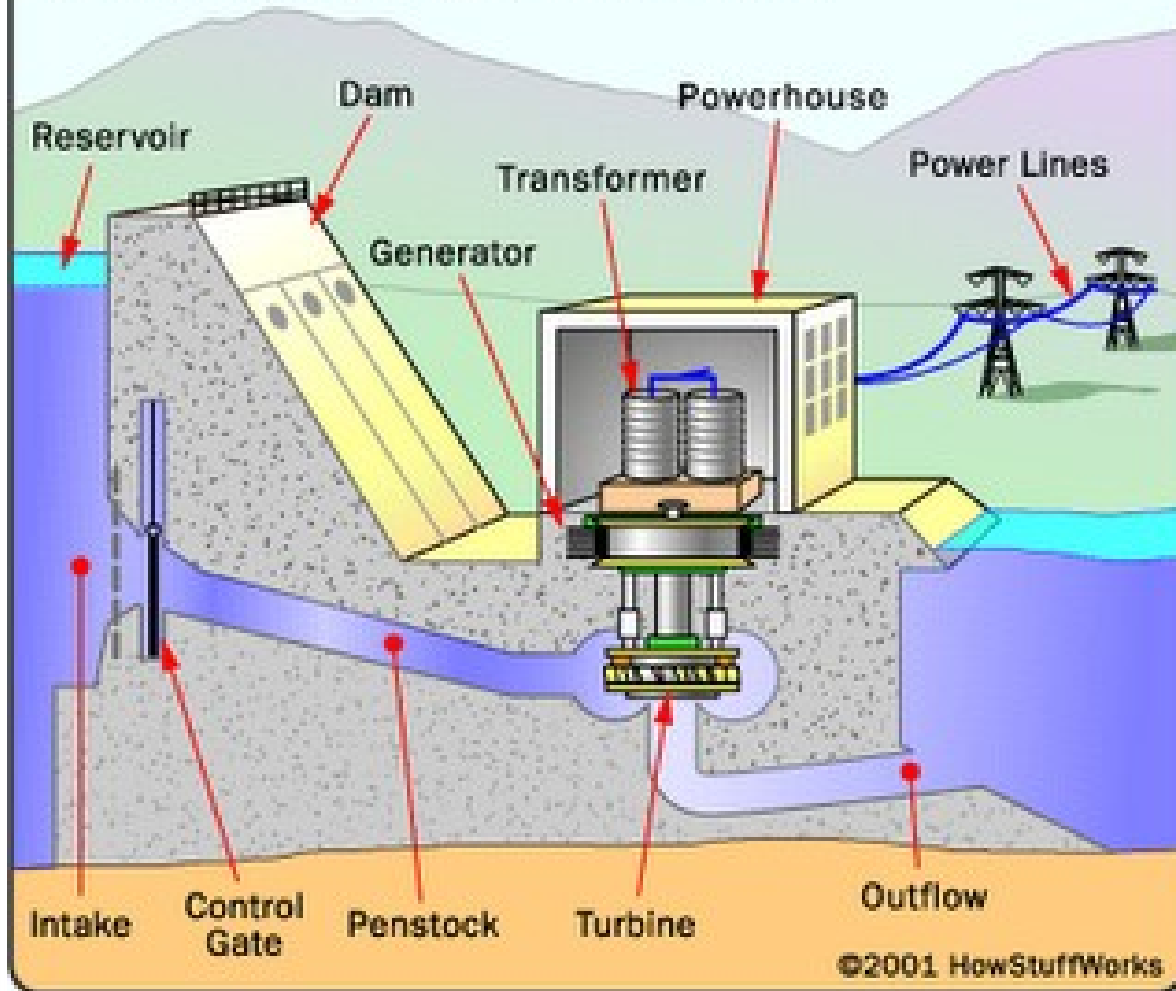
Hydro energy



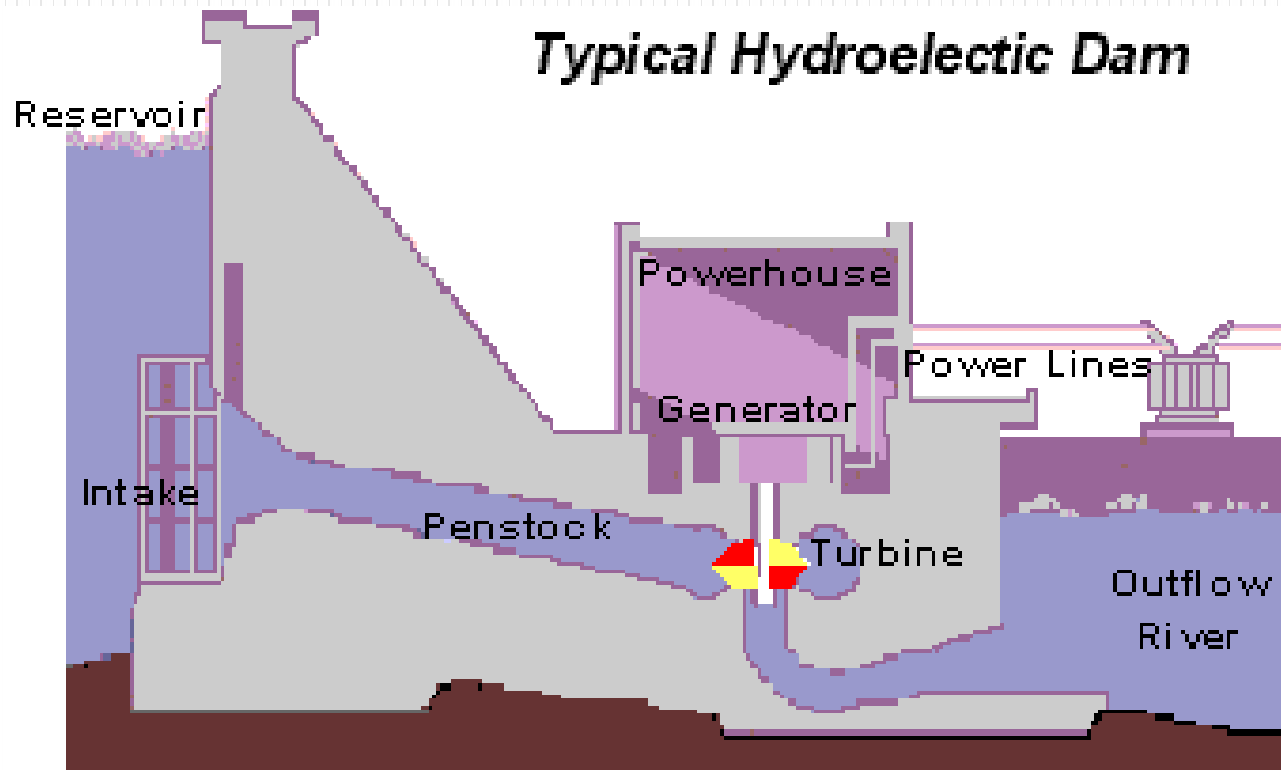
Hydro energy is derived from flowing water in rivers, water streams in mountains or from man-made installations where water flows from a high-level reservoir down through a tunnel and away from the dam.

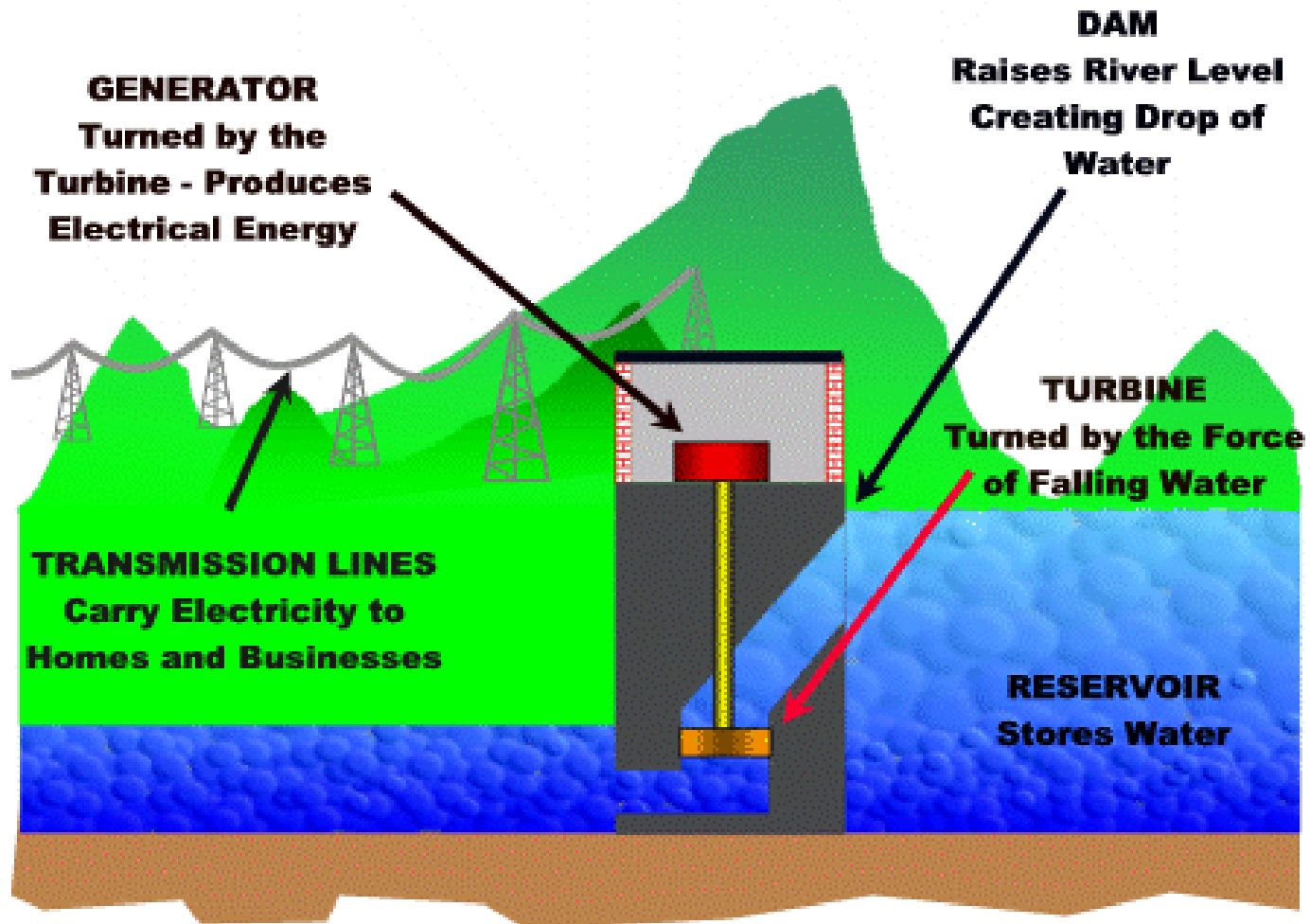
- A *dam is built to trap water*, usually in a valley where there is an existing lake.
- Water is allowed to flow through *tunnels* in the dam, to turn turbines and thus drive generators and the electricity is produced

Inside a Hydropower Plant



Typical Hydroelectric Dam

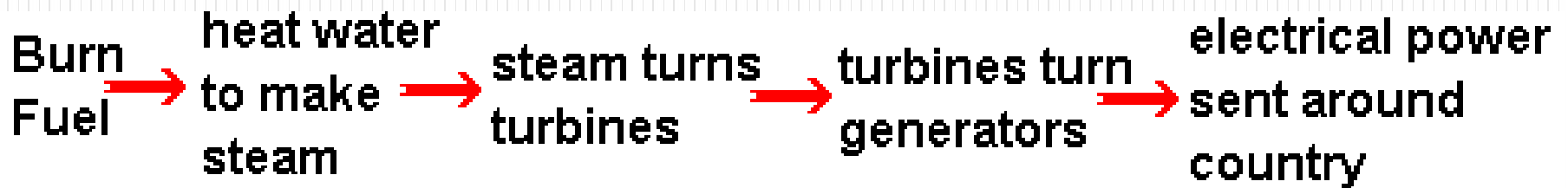




Biomass energy



Biomass energy (or) bioenergy, is the energy stored in non-fossil organic materials such as wood, straw, vegetable oils and wastes from the forest, agricultural and industrial sectors.



Types of Biomass



Wood



Crops



Garbage



Landfill Gas



Alcohol Fuels

Jatropha

- Biodiesel from Jatropha
- Seeds of the Jatropha nut is crushed and oil is extracted
- The oil is processed and refined to form bio-diesel.

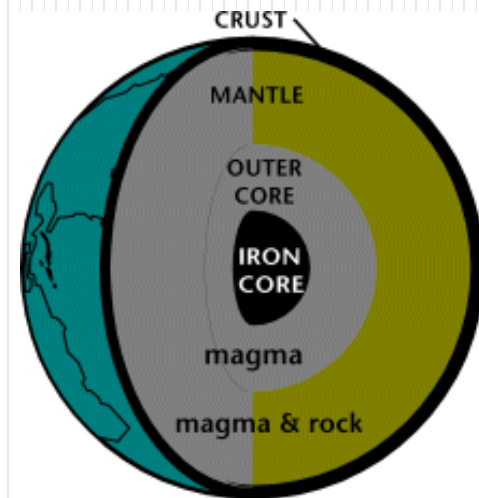
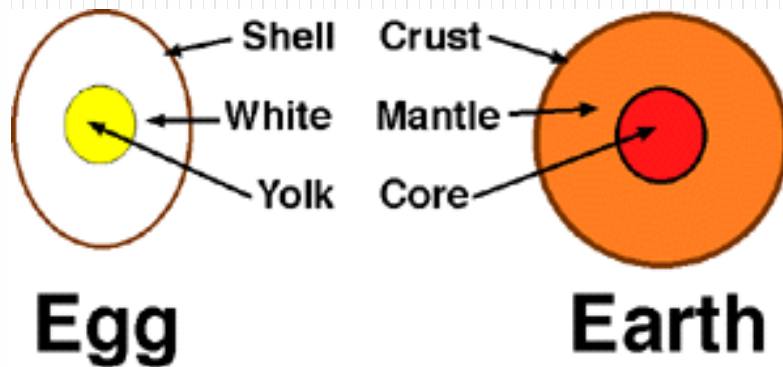


Geothermal energy



The word **geothermal** comes from the Greek words *geo* (earth) and *therme* (heat). So, geothermal energy is heat from within the earth. We can use the steam and hot water produced inside the earth to heat buildings or generate electricity.

The earth can be compared with egg. The outer layer of the earth is called crust and the center layer is called Mantle and inner layer is called Core (Iron).

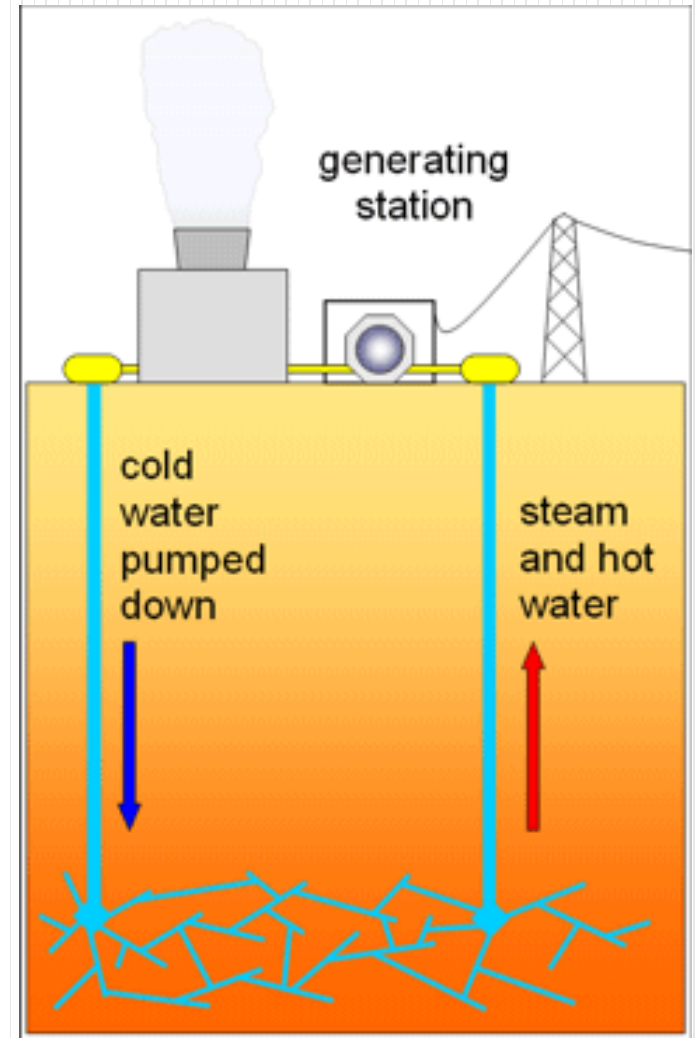


THE EARTH'S INTERIOR

- Below the crust of the earth, the top layer of the *mantle* is a *hot liquid rock* called magma.
- The crust of the earth floats on this liquid magma mantle.

- For every *100 meters* you go below ground, the temperature of the rock increases about *3 degrees Celsius*.
- So, if you went about *10,000 feet below ground*, the temperature of the rock would be hot enough to *boil water*.
- Deep under the surface, water *close to the hot rock* can reach temperatures of more than *148°C*.

- This is hotter than boiling water (100°C). It doesn't turn into steam because it is not in contact with the air.
- When this *hot water* comes up through a crack in the earth, we call it a hot spring and it is used to *rotate the turbines and the electricity is produced*.





- The most active *geothermal resources* are usually *found* along major plate boundaries where *earthquakes and volcanoes* are concentrated.
- Most of the geothermal activity in the world occurs in an area called the *Ring of Fire*.

BIOFUEL

Plants use photosynthesis to grow and produce biomass.

Also known as biomatter, biomass can be used directly as fuel or to produce liquid biofuel.

Agriculturally produced biomass fuels, such as biodiesel, ethanol and bagasse (often a by-product of sugar cane cultivation) can be burned in internal combustion engines or boilers.

Typically biofuel is burned to release its stored chemical energy. Research into more efficient methods of converting biofuels and other fuels into electricity utilizing fuel cells is an area of very active work.

LIQUID BIOFUEL



- Liquid biofuel is usually either a bioalcohol such as ethanol fuel or a bio-oil such as biodiesel and straight vegetable oil.
- Biodiesel can be used in modern diesel vehicles with little or no modification to the engine and can be made from waste and virgin vegetable and animal oil and fats (lipids).

Virgin vegetable oils can be used in modified diesel engines. In fact the Diesel engine was originally designed to run on vegetable oil rather than fossil fuel. A major benefit of biodiesel is lower emissions. The use of biodiesel reduces emission of carbon monoxide and other hydrocarbons by 20 to 40%.

Advantage of Non-conventional (or) Renewable energy resources

1. It is fact that the consumption of conventional sources of energy has caused more environmental damage than any other human activity.
1. The use of fossil fuels such as oil and coal produce high concentration harmful gases in the atmosphere and creates so many problems such as Ozone depletion and global warming.
1. The Non-conventional energy sources, such as the sun and wind, can never be exhausted and therefore are called renewable. They cause fewer emissions and are available locally.