FOREST RESOURCE

Dr. Prasenjit Adak

Forest Resource

- A forest , a biotic community with predominance of trees is an important Renewable natural resource.
- Types of forest
  - Very dense – above 70%
  - Moderately dense – 41 – 70%
  - Open forest – 10 – 40%
- 33% should be forest
- 24.39% in India
- Average annual growth:
  - 1990-2000: 0.22%
  - 2000-2010: 0.46%
  - 2010-2020: 0.38%

Functions of forests

- Commercial use
  - Timber, pulpwood
  - Raw materials: oil, bamboo, cotton, jute, rubber, gum, fibers etc.
  - Edible products: Fruits, condiments, spices, Beverages, fodder
  - Manure, fuel wood
  - Medicines
  - Minerals
  - Employment opportunity
  - Recreation: Tourism

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Functions of forests

- Environmental functions
  - Regulation of hydrological cycles
  - Produces oxygen
  - Soil conservation
  - Pollutants moderators
  - Driving energy flow and nutrient cycle
  - Wild life habitat
  - Reducing Greenhouse gas

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Over-exploitation of forests (Deforestation)

- Causes
  - Extensive wood cutting and logging
  - Deforestation due to road construction
  - Clearing forest for agriculture
  - Overgrazing
  - Mining activities
  - Big hydropower projects
  - Forest fire

Over-exploitation of forests (Deforestation)

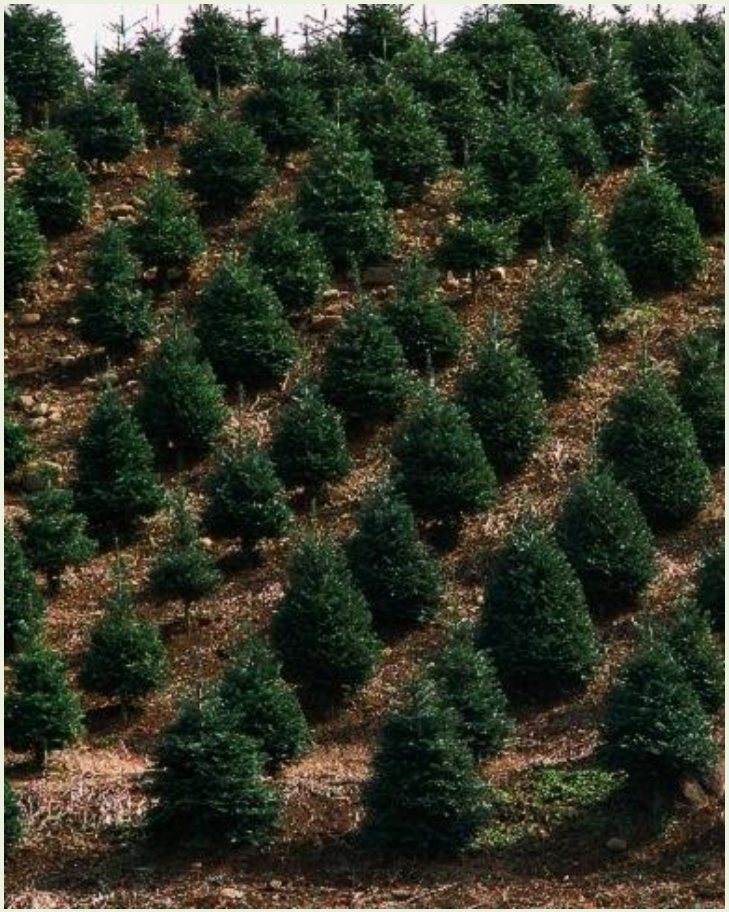
- Effects
  - Threatens the existence of wildlife species
  - Biodiversity is lost
  - Hydrological cycle gets affected
  - Soil erosion and loss of soil fertility
  - Siltation of river and lakes
  - May lead to landside
  - Global warming
  - Flood
  - Loss of revenue
  - Socio-economic problems: Relocation, threat to culture and tradition

Over-exploitation of forests (Deforestation)

- Control
  - Mining activities should be prohibited in protected forests
  - Cutting of trees should follow massive plantation
  - Environmental laws and legal provisions must be strictly followed
  - Social forestry, agro-forestry, recreational forestry, extension forestry
  - Public awareness
  - Participation in forest conservation programs

Control of deforestation

- Control
  - Reforestation
    - Reforestation is the reestablishment of forest cover, either naturally or artificially in a deforested area.
  - Afforestation
    - Afforestation is the establishment of a forest or stand of trees in an area where there was no forest.

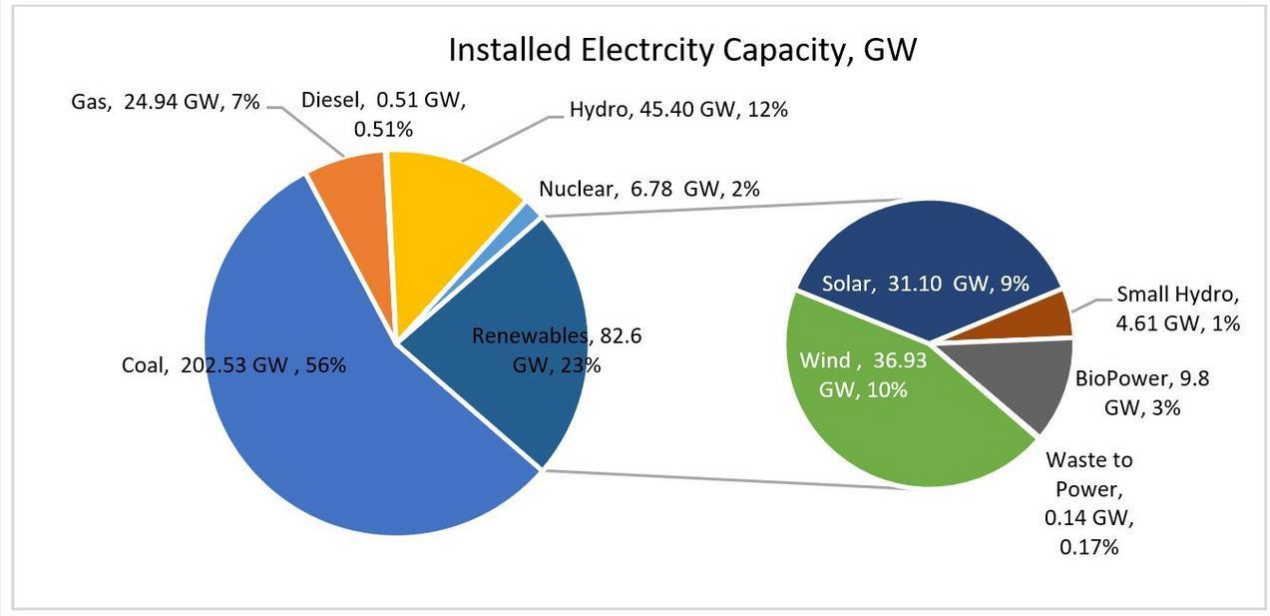


ENERGY RESOURCE

Dr. Prasenjit Adak

Energy resource

- What is energy: Capacity to do work
- Source of energy: Sun
- Energy sources in India:



Renewable and non-renewable energy

- Non-renewable
  - Sources: Coal, oil, natural gas, nuclear energy
  - Problems
    - Leakage during transportation – water pollution
    - Accidental fire – air pollution
    - Refinery waste – solid waste, salt, grease, cleaning of oil tankers
    - Vehicular emission
- Renewable
  - Solar energy, wind energy, hydro-power, Tidal energy, Ocean thermal energy, Geo thermal energy, biomass energy, biogas, biofuel, hydrogen fuel

[Note: Alternative sources of energy = Non-fossil fuel sources]

Non-renewable resources

- Coal
  - Types of coal
    - Anthracite: The highest rank of coal. It is a hard, brittle, and black lustrous coal, often referred to as hard coal, containing a high percentage of fixed carbon and a low percentage of volatile matter.
    - Bituminous: Bituminous coal is a middle rank coal between subbituminous and anthracite. Bituminous usually has a high heating (Btu) value and is the most common type of coal used in electricity generation in the United States. Bituminous coal appears shiny and smooth when you first see it, but look closer and you may see it has layers.
    - Subbituminous: Subbituminous coal is black in color and dull (not shiny), and has a higher heating value than lignite.
    - Lignite: Lignite coal, aka brown coal, is the lowest grade coal with the least concentration of carbon.
    - Also, there is peat. Peat is not actually coal, but rather the precursor to coal. Peat is a soft organic material consisting of partly decayed plant and, in some cases, deposited mineral matter. When peat is placed under high pressure and heat, it becomes coal.

Non-renewable resources

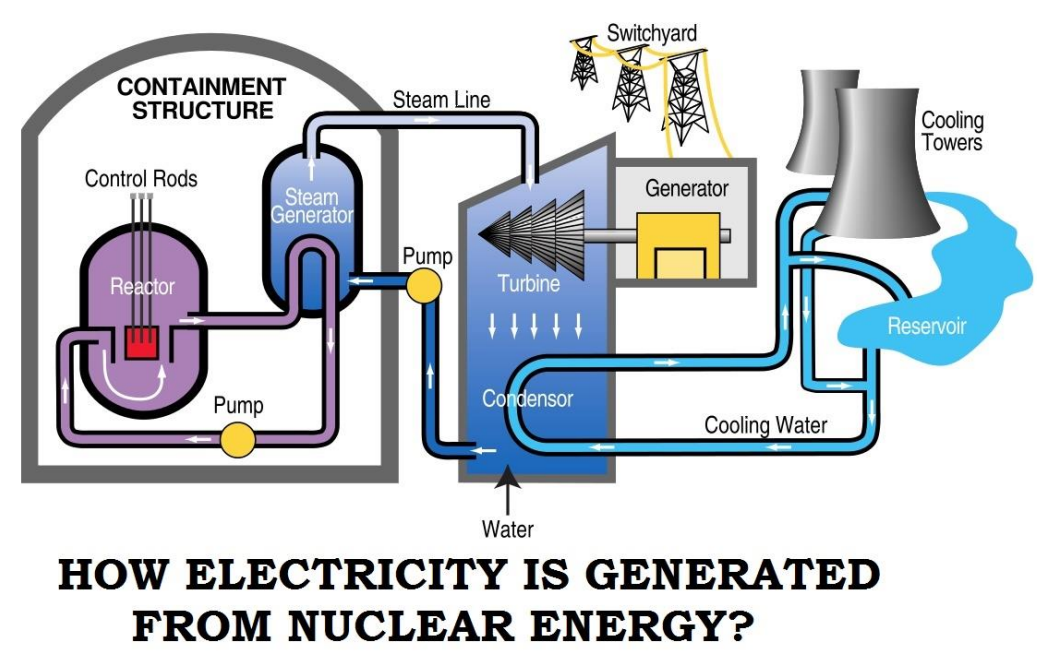
- Petroleum
  - Organization of Petroleum Exporting Countries (OPEC) consists of 13 countries and having 67% of worlds petroleum reserve.
  - Petroleum is a complex mixture of alkane hydrocarbons.
  - It is purified and refined by the process of fractional distillation.
  - Petroleum is a cleaner fuel as compared to coal.
  - Petroleum products
    - Petroleum gas, kerosene, petrol, diesel, lubricating oil, paraffin, wax, asphalt, plastic etc.
  - Liquefied Petroleum Gas: mainly composed of butane, other being propane and ethane.

Non-renewable resources

- Natural gas
  - Natural gas is the cleanest fossil fuel.
  - composed of 95% methane, small amount of propane and ethane.
  - It has been formed by decomposing remains of dead plants and animals.
  - It has high calorific value (about 50 KJ/g)
  - Compressed Natural Gas (CNG): It is used as an alternative to petrol and diesel in many cities including Delhi.
  - Synthetic Natural Gas (SNG): It is a mixture of carbon monoxide and hydrogen. Low grade coal is first transformed into synthetic gas, then into methane by catalytic conversion.

Nuclear energy

- Types of nuclear reactions
  - Fission: Splitting of large nucleus into smaller nuclei.
  - Fusion: Joining of small nuclei into a large nucleus.
- Elements used in nuclear energy production: Uranium, Thorium, Plutonium
- Advantages:
  - Less fuel offers more energy.
  - The cost of nuclear fuel is only 20% of the cost of energy generated.
  - The production of electric energy is continuous (almost 90% of annual time).
- Disadvantages:
  - Risk of unexpected event or nuclear accidents.
  - Difficulty in the management of nuclear waste.
  - Nuclear plants have a limited life.



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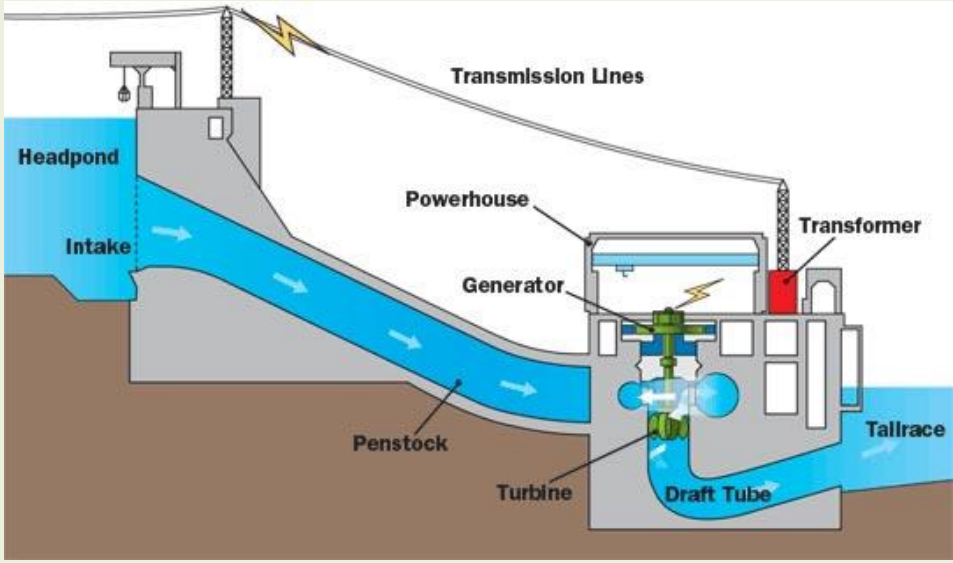
Hydro-electric energy

- The potential energy in the water stored in dams is converted into electrical energy by releasing the water flow and rotating the turbine
- Advantages
  - Low operating and maintenance cost
  - Non-polluting
  - Reliable
  - Flexible
  - Safe
- Disadvantages
  - High setup cost
  - Affects fish population
  - Limited reservoirs
  - Affected by draught
  - Probable seismic activity



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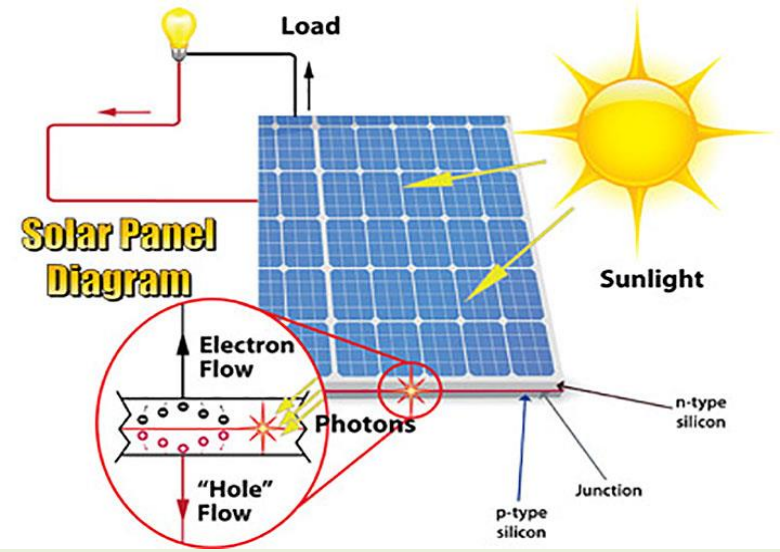
Solar energy

- 1 hour solar energy can be used for 1 year
- Uses of solar energy
  - Solar heating of home (sunspace)
  - Solar water heating, solar cooker, solar furnace
  - Solar desalination system
- Photovoltaic energy: Silicon -> PV cells -> PV modules -> PV array -> solar panel
- Advantages
  - Easy to install
  - No pollution, no noise
  - Can be installed anywhere
- Disadvantages
  - Doesn't work when light is not available
  - Requires energy storage device
  - Low efficiency
  - Damage easily



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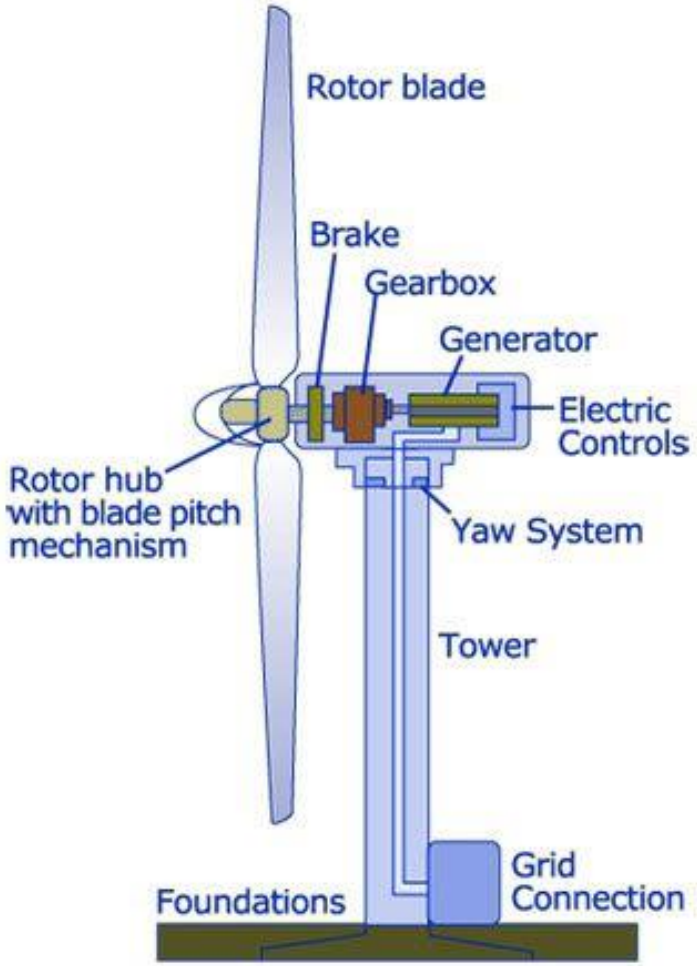
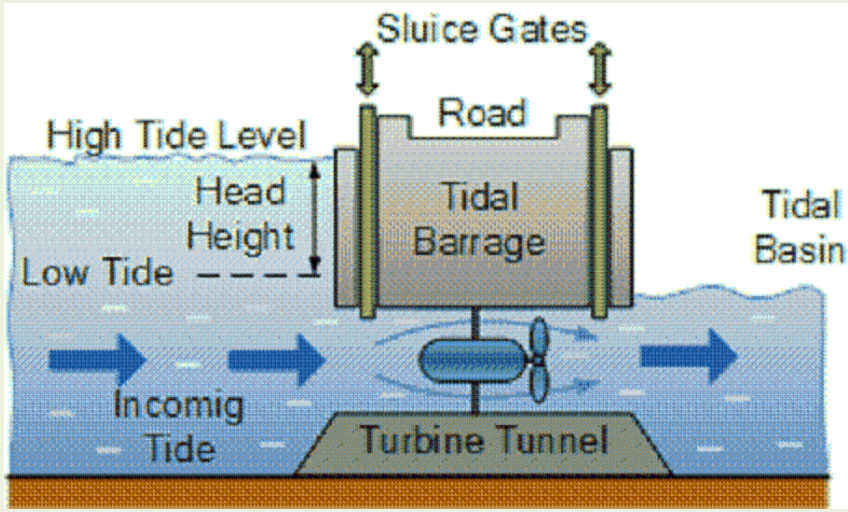
Wind energy

- One of the earliest renewable energy – sail ships, windmills
- India is the 4th largest producer of wind energy (after China, US and Germany).
- Advantages
  - Unlimited, free, renewable resource
  - Low maintenance cost
  - No pollution
- Disadvantages
  - High setup cost
  - Birds and bats get killed
  - Noise and signal reception problem



Tidal energy

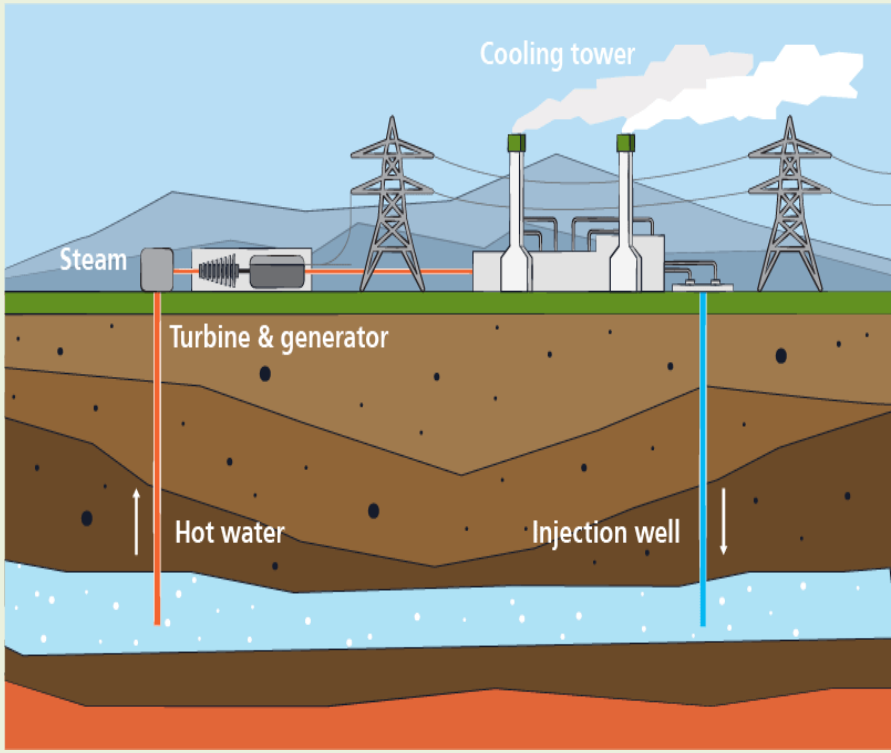
- Tidal power or tidal energy is a form of hydropower that converts the energy obtained from tides into electricity.
- Advantages
  - Tides are more predictable than the wind and the sun
  - Uses less area.
  - No emission of gaseous or particulate pollutants
- Disadvantages
  - Electro-magnetic emission affects the aquatic life.
  - High construction cost



- Types
  - Tidal stream generator
  - Tidal barrage
  - Dynamic tidal power
  - Tidal lagoon

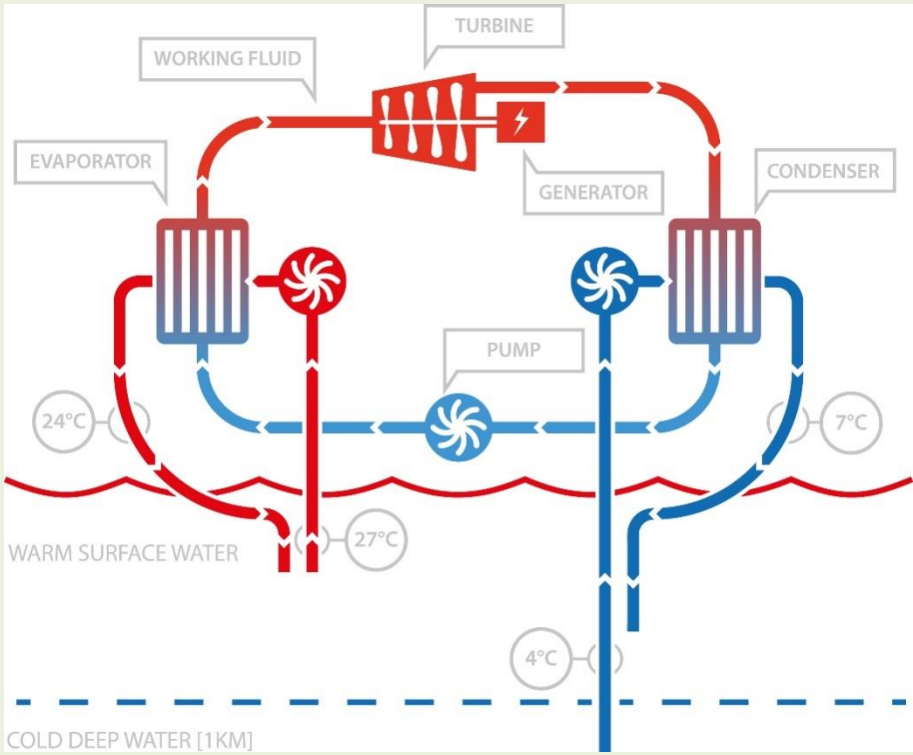
Geo-thermal energy

- The energy harnessed from the hot rocks present inside the earth is called geothermal energy.
- Sometimes natural geysers or artificially drilled holes can be used to released the water vapour underneath the earth surface.
- Advantages
  - No pollutant emission
  - Reliable source of renewable energy
  - Less operating cost
  - Less maintenance cost
- Disadvantages
  - Possibility of emissions of H_2S, CO_2, CH_4 during extraction
  - High Investment Costs



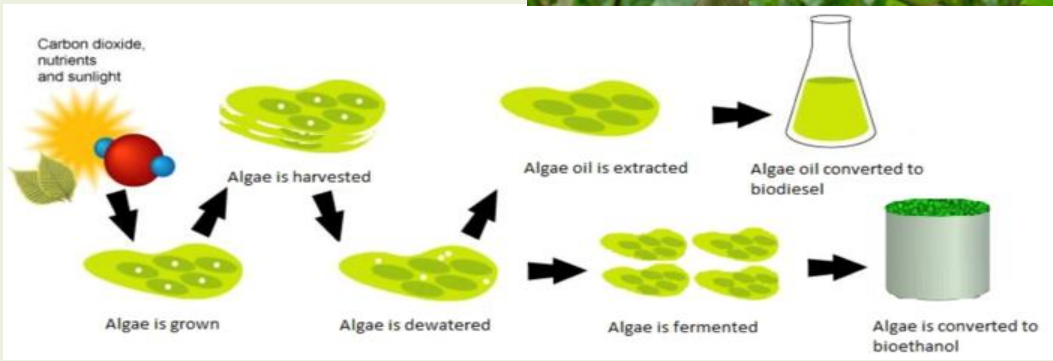
Ocean-thermal energy

- The energy available due to the difference in temperature of water at the surface of tropical oceans and deeper levels is called ocean-thermal energy.
- A difference of at least 20° C is required
- The heat is used to vaporize ammonia and rotate the turbine sing the vapour.
- Advantages
  - Continuous source of energy
  - No pollutant emission
  - Output shows very little seasonal variation
- Disadvantages
  - Capital investment is very high
  - High maintenance cost
  - Low efficiency
  - Pipes could damage coral reefs



Biomass energy

- Log burning is a simple way use biomass energy
- Wood is the largest source of biomass energy. It can also be used in electricity production in wood-based power stations.
- Energy crop
  - An energy crop is a plant grown as a low-cost and low-maintenance harvest used to make biofuels, such as bioethanol, or combusted for its energy content to generate electricity or heat. Example: Jatropha, Sunflower etc.
- Energy trapped inside biomass
- Biofuels
  - Biodiesel
  - Biogas
  - Bio-ethanol
  - Bio-methanol



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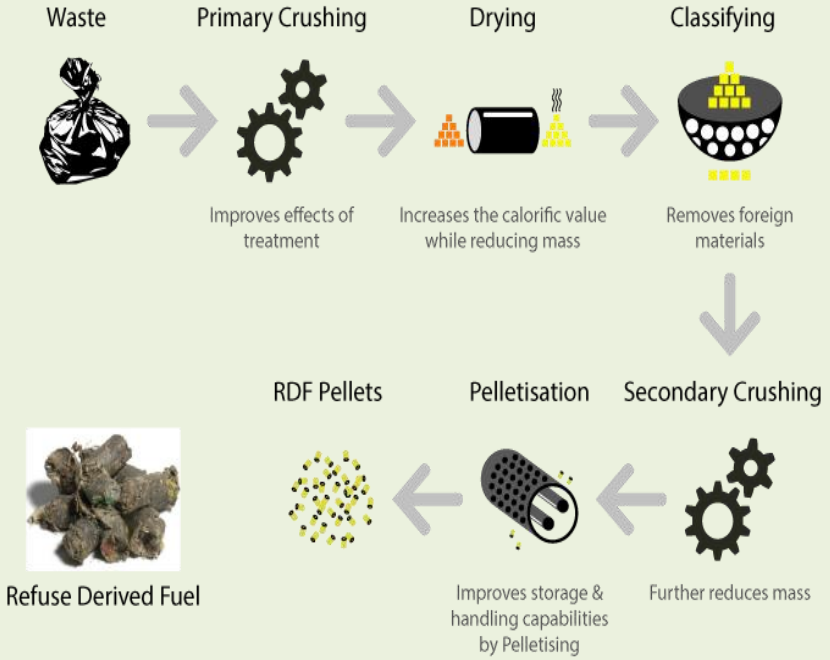
Energy recovery

- Getting energy by burning the waste
- Advantages
  - Reduced number of coal fired power plants
  - Reduced airborne particles
  - Improved air quality
  - Lower fuel bills on transport
  - Longer availability of crude oil
  - Reduction of waste volume (up to 90%)
  - Less requirement of landfill space
- Disadvantages
  - Release of toxic substances
  - Residual ash may contain heavy metal

Refuse Derived Fuel (RDF)

- RDF consists largely of combustible components of such waste, as non recyclable plastics , paper cardboard, labels etc.
- These fractions are separated by different processing steps in order to produce a homogeneous material which can be used as substitute for fossil fuels



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Thank You

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