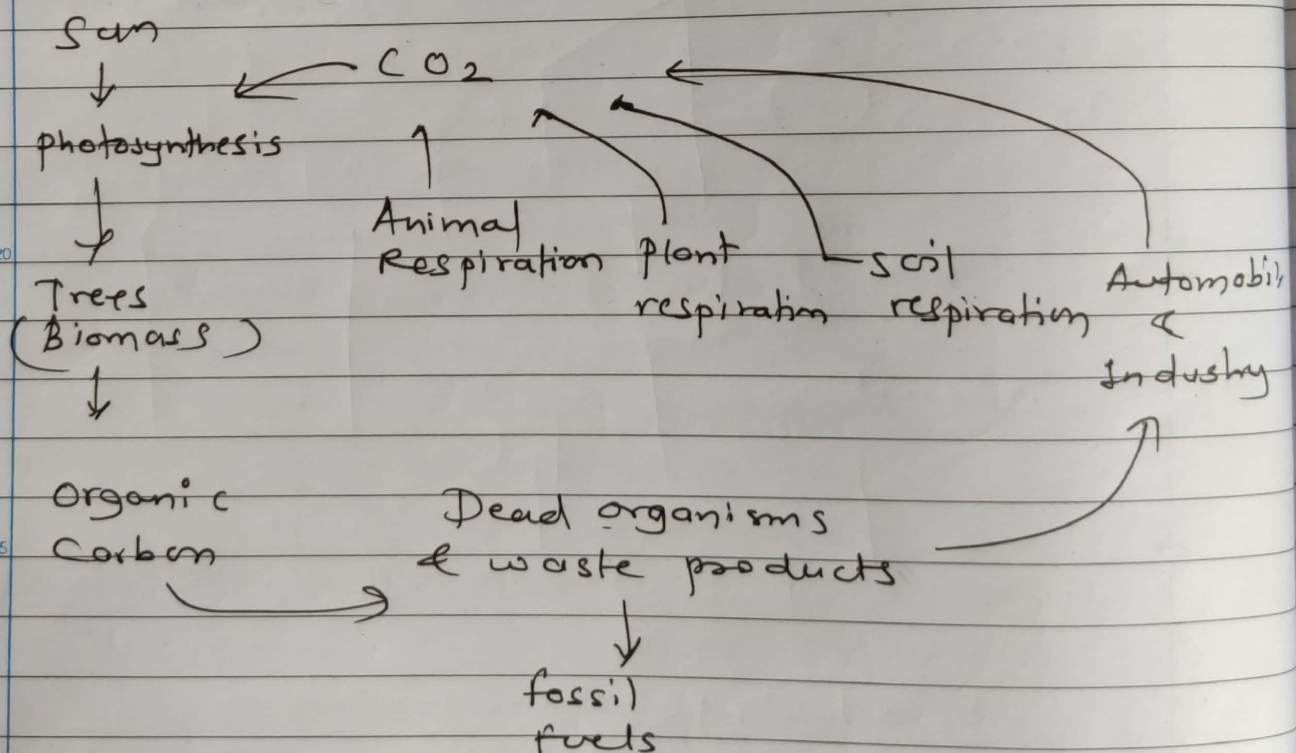


* Biomass energy :
Biomass is a renewable organic material that comes from plants & animals. Biomass contains stored chemical energy from Sun. Plants produce biomass through photosynthesis.

sis.
Biomass can be burnt directly for heat or converted to renewable liquid & gaseous fuels through various processes.

Plants by photosynthesis absorb environmental CO_2 & convert it as plant biomass. Thus bio-energy produced from plants can give viable option for generation of power.

Plants collect & store CO_2 for photosynthesis.



Biomass energy cycle.

II Utilization:

① Bio-fuels: It mainly consist of bio-ethanol, bio-diesel & hydro-treated vegetable oil (HVO). These fuels are used for transportation of vehicles.

Bio-ethanol is produced from fermentation of sugar, Bio-diesel is produced from etherification of plants. Biodiesel is treated with hydrogen to produce hydro-treated vegetable oil.

② Heat & Power: Heat & power is generated by plant material like wood, grasses etc.

③ Bio-gas: It is generated by having anaerobic digestion of biological materials. It consist of hydro-carbon & different compounds like methane, CO_2 etc.

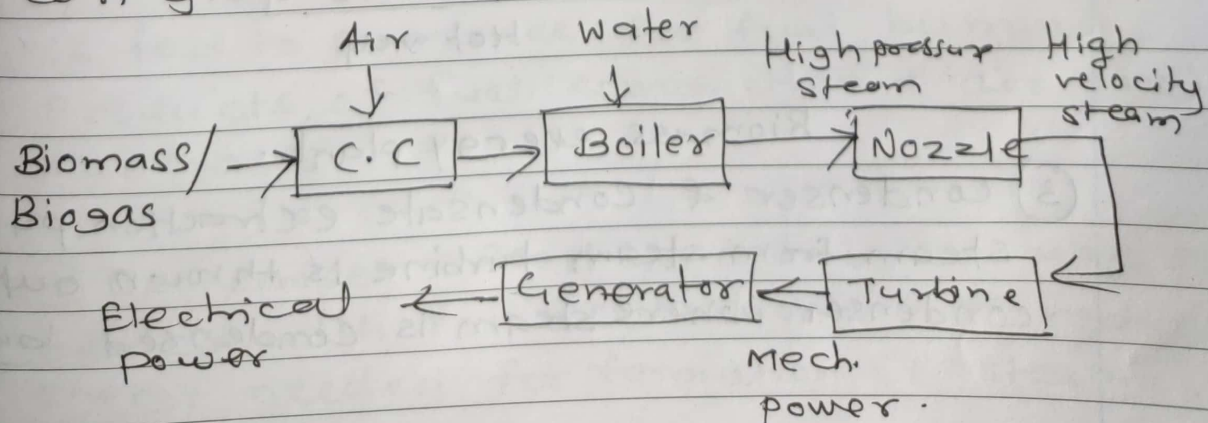
III Characteristics of Biomass resource.

① High energy yield & low cost of processing

② Low green house gas emission.

③ They can sustain extreme & variable environment.

④ Easy to plant, low water requirement & can grow on any type of soil.

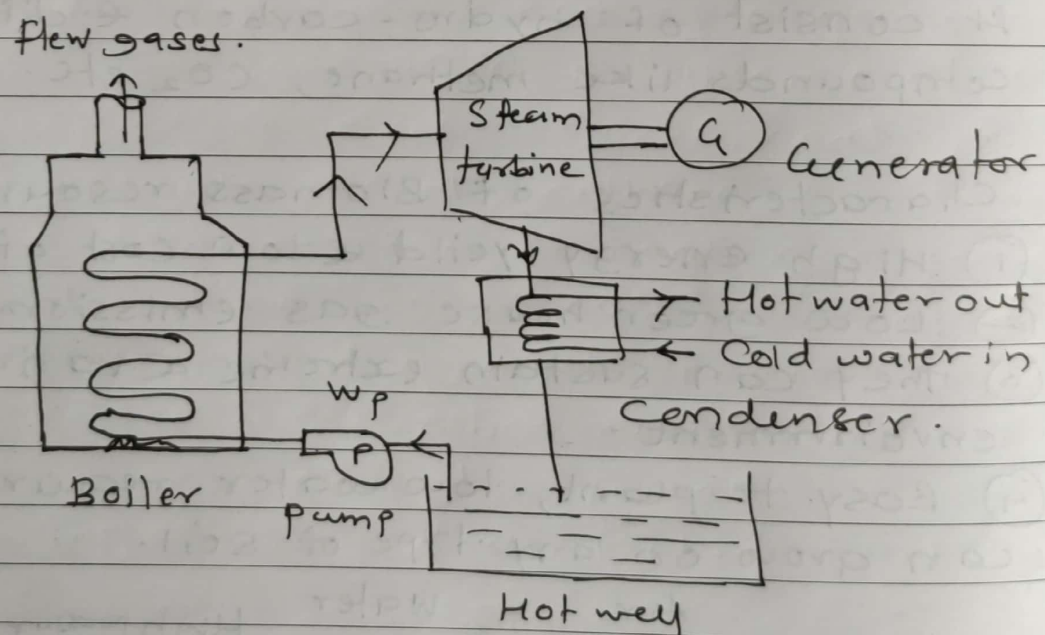


IV Components :

① Boiler : It consists of water tubes, boiler shell & super heater. Feed water is supplied from economiser which is converted into wet steam in water tube. Steam is generated at high pressure in boiler.

② Steam Turbine & Generator :-

High pressure superheated steam from boiler expands in turbine to produce mechanical work. This work is used to run generator which converts mechanical energy into electrical energy.



Biomass energy plant.

③ Condenser & Condensate extraction pump :- Steam from steam turbine is thrown out to condenser where steam is condensed by

rejecting heat to circulated cooling water. Condensed steam is called condensate & given to hot well.

④ Feed pump: Condensate from hot well with makeup water is fed back with help of feed pump at boiler pressure to economizer.

⑤ Cooling tower: Cooling water from cooling tower is supplied to condenser & absorbs heat from exhaust steam of steam turbine.

Extra components.

① Blower: Blower draws surrounding air needed for combustion of biomass. This air is supplied to air preheater (C.C)

② Air preheater: It transfer heat to air drawn from surrounding with help of hot flue gases before discharged to atmosphere through chimney. It improves combustion efficiency.

③ Furnance: Heated air from air preheater is fed to furnace for fuel burning. Products of fuel combustion & air are flue gases.

④ Economiser: feed water to boiler tube is heated with help of flue gases. It reduces energy needed for formation of steam.

V Converting biomass to energy :-

(I) Direct Combustion to produce heat :

It is common method to convert biomass to useful energy. All biomass can be burnt directly for heating building & water for industrial process heat & for generating electricity in steam turbine.

(II) Thermochemical conversion of biomass :

It includes pyrolysis & gasification.

Both are thermal decomposition process in which biomass feedstock material are heated in closed, pressurized vessel called gasifier at high temperature.

Pyrolysis, involves heating organic materials to $400-500^{\circ}\text{C}$, in absence of oxygen to produce fuel like charcoal, bio-oil, renewable diesel, methane & hydrogen.

Gasification involves heating organic material at $800-900^{\circ}\text{C}$, with injection of controlled amount of free oxygen to produce CO (carbon monoxide) & hydrogen rich gas called "syngas".

Syngas is used as fuel in diesel vehicle.

(III) Chemical conversion :-

Chemical conversion is called transesterification used for converting vegetable oils, animal fats & greases into fatty acid methyl esters, which is used to produce biodiesel.

Biological Conversion conversion:-
It involves conversion caused by fermenting, which that converts biomass into ethanol & anaerobic digestion to produce renewable natural gases.

Advantages
Disadvantages

} Refer ppt

* Tidal Energy :-

Tidal energy is form of power produced by natural rise & fall of tides caused by gravitational interaction between earth, sun & moon. Tidal current with sufficient energy for harvesting occur when water passes through constriction, causing water to move faster.

Using specially engineered generators in suitable location, tidal energy can be converted into useful forms of power including electricity.

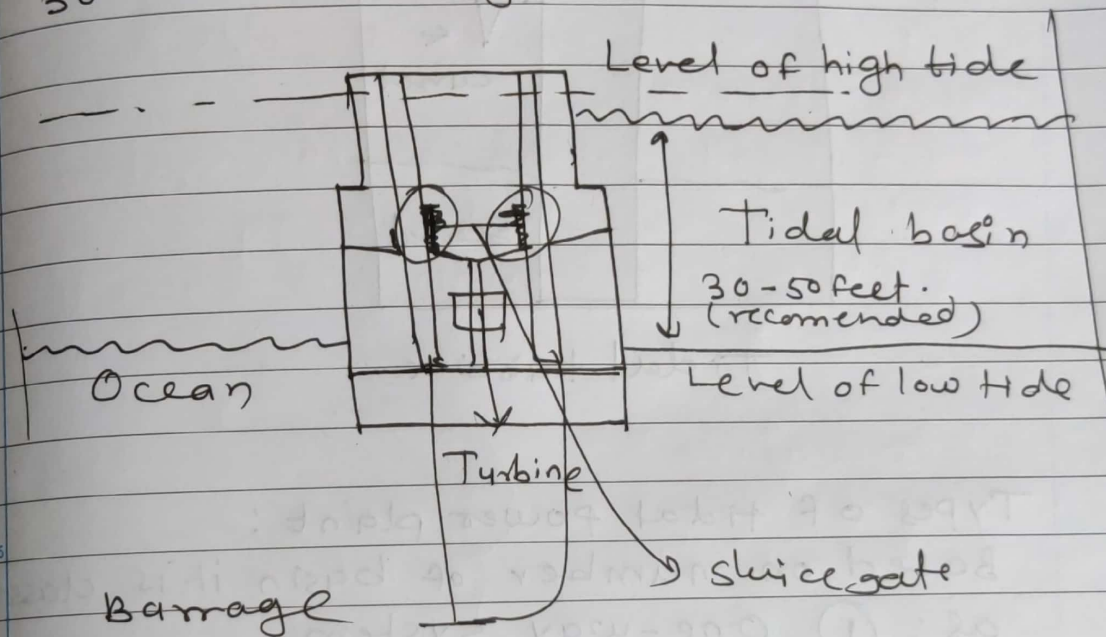
Suitable location for capturing tidal power include those with large difference in tidal range, which is difference in between high tide & low tide.

* Generation of power:

① Tidal can be harnessed in three ways, tidal streams, barrages & lagoons. However as we are still waiting on tidal energy to become more economical, there are a few alternative ways to capture tidal energy.

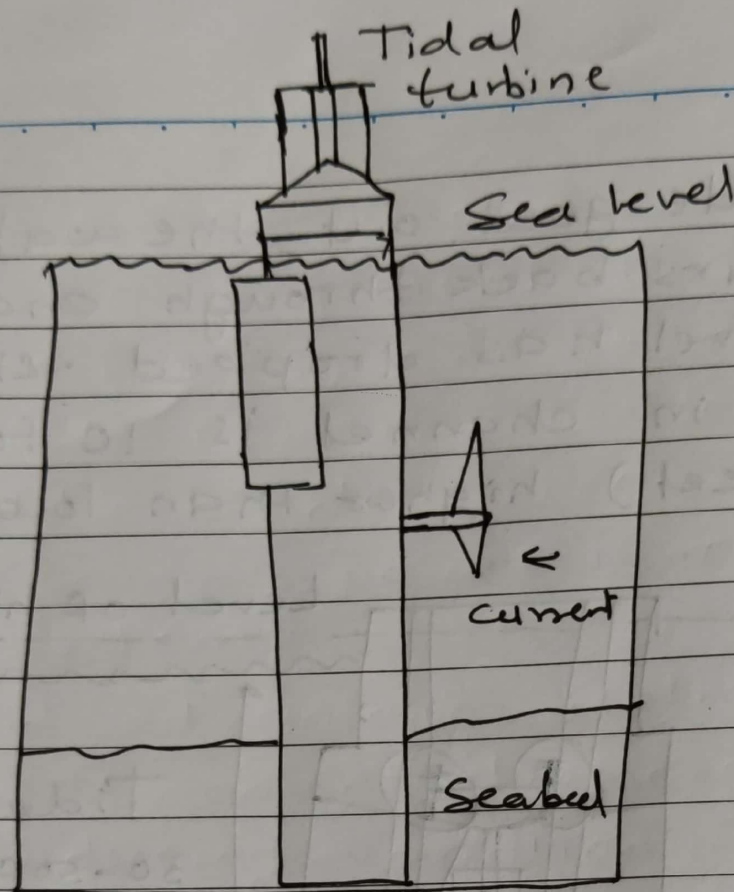
② Best way to capture tidal energy is to place turbine in narrow channel between two land masses. When tide comes in, water rises on one side of channel & pores down channel to other side.

- ③ When tide goes out, the water on higher side pours back through channel where water level has dropped. It is best if high tide in channel is 10 to 15 m (i.e. 30 - 50 feet) higher than low tide.



← flow of water from tidal basin to ocean for generation of power (one way system).

- ④ Tidal turbine are similar to wind turbine in that they have blades that turn a rotor to power generator. They can be placed on sea floor where there is strong tidal flow. Because water is about 800 times denser than air, tidal turbine have to be much sturdier & heavier than wind turbine.



Tidal turbine.

Types of tidal power plant :

Based on number of basin it is classified as ;

- ① One-way system.
- ② Two-way system.

① Single basin one-way cycle :-

This is simplest form of tidal power plant. In this system basin is allowed to get filled during flood tide and during ebb tide, water flows from basin to sea passing through turbine & generates power.

② Double basin type :-

In this arrangement turbine is setup between basins, one basin is intermittently filled tide & other is intermittently drained by ebb tide. Therefore small capacity but continuous power is made available with system.

Main disadvantage of this system is, 50% of potential energy is sacrificed in introducing variation in water level of two basins.

Diagram

Advantages

Disadvantages

Refer
ppt