Date
20/7/20

# Science & Technology

CLASS-3

Topic - Solar Energy, Wind Energy, Geothermal Energy, Ocean Energy, Other Alternative Energy Source.

## # Solar Energy & its Utilization

Solar Tariff

Saffron Revolution

Target of SE

Govt. Programme / scheme

→ 2010 - Jawaharlal Nehru Solar Energy Mission.

↳ Target - by 2020 - 20,000 MW

(Renamed)

2014/15 → National Solar Mission

↓

by 2020 - 1,00,000 MW / 100 GW

UNFCCC - 1992 - 1994 → establish environment against green house gases.

1995 - COP-I

1996 - COP-II

1997 - COP-III - Kyoto Protocal

⋮

2012 - Expiry period of Kyoto Protocal

→ Kyoto Phase-2 / Post Kyoto

2020

2

2012

2015 — ISA — International Solar Alliance

2020

CoP-21 → Paris

Boost up - growth of Solar Energy

- Most Nation – (30°N – 30°S) - Countries are member of ISA.
- Signatory country – 121
- Ratification – 30 Country.

Developed Country → help → Developing Country
- Technology transfer
- Monetary help.

2018
* Solar wafer - advanced type of PV.
→ Semiconductor material used in multilayering.

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## HCNG (Hydrogen Enriched CNG)

HCNG is a mixture of compressed natural gas (CNG) and some percentage of Hydrogen for heat or energy generation. HCNG which may be used as a fuel of Internal Combustion Engine (ICE) is considered a cleaner source of fuel, more powerful and offers more mileage then even CNG.

Some advantages of HCNG:

→ HCNG reduces emissions of CO up to 70%.
→ Enable up to 5% savings in fuel.

→ Better performance due to higher Octane number.

In 2018, Delhi Government has tied up with Indian oil corporation limited (IOCL) to study the technology and infrastructure needs to induct 50 HCNG buses on a trial basis. IOCL has plans to mix (18-20)% Hydrogen in these buses. Current cost of $H_2$ is more than the cost of Natural Gas. So HCNG's costly than CNG.

## # Renewable Energy Target

| Source | Total Installed Capacity (MW) | 2022 Target (MW) |
|---|---|---|
| Wind Power | 34,046 | 60,000.00 /60GW |
| Solar Power | 21,651 | 100,000.00 /100GW |
| Biomass Power | 8,701 | 10,000.00 /10GW |
| Waste to Power | 138 | 5,000 |
| Small Hydropower | 4,486 | |
| Total | 69.022 | 175,000.00 /175GW |

- SHEP – Small Hydroelectric Plant - <25 MW
  HEP – Hydroelectric Plant - >25 MW

## # Growth of Renewable Energy

| | Commissioned Pipeline (GW) | FY-19 (GW) | FY-20 (GW) | 2022 Total (GW) |
|---|---|---|---|---|
| Solar | 49.49 | 24 | 30 | 113.49 |
| Wind | 46.65 | 10 | 10 | 66.65 |
| Small Hydro | 4.98 | 0.5 | 0.5 | 5.98 |
| Bio Mass | 9.5 | 0.5 | 0.5 | 10.5 |
| Floating solar and offshore wind | 0 | 16 | 15 | 31 |
| Total | 110.62 | 61 | 56 | 227.62 |

# Wind Energy

(High – 30 mt/100 ft)

Height from surface

speed required – 8 km/hr

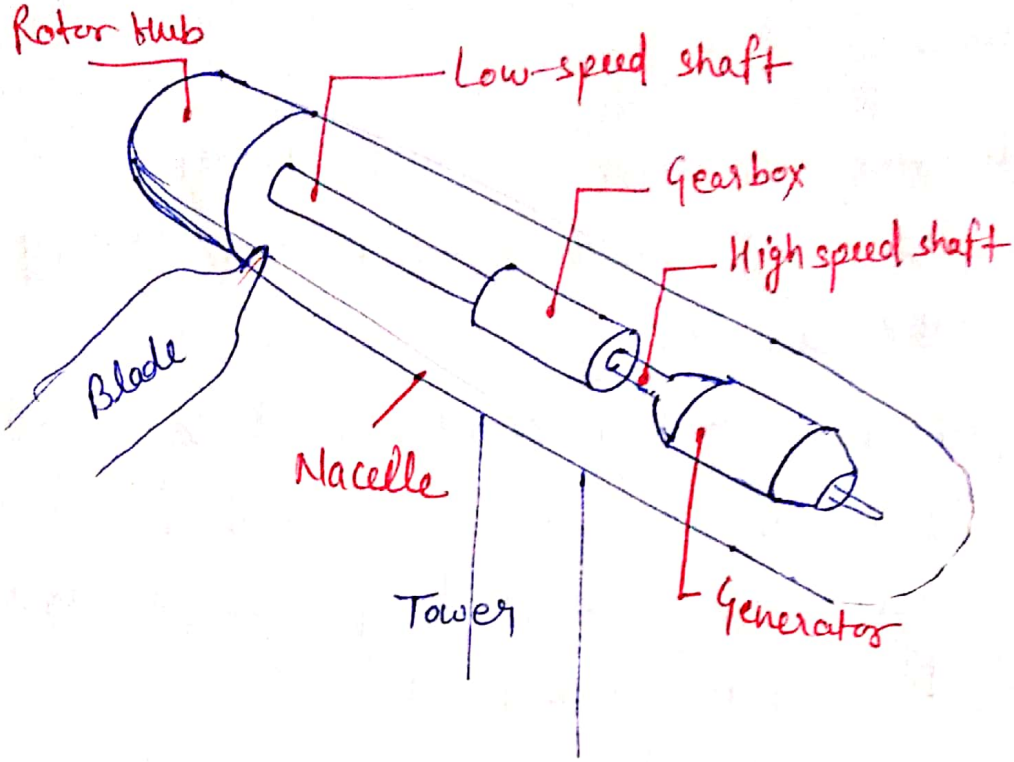
→ Now a day's wind turbine is capable to utilise wind into electricity generation.

→ It is a specific property of blade which is developed with specific aerodynamic shape and other performance - enhancing equipement.

→ To take advantage of faster and less turbulent winds, they need to be mounted at 100 feet (30 meters) or more above ground.

→ When blowing wind turns the wing, it will utilize to generate electricity with the help of generator those attached with this.

→ At this low speed of rotation, generator can not produce any meaningful electricity. So before connecting to the generator the speed of shaft is increased in a gearbox. The gearbox uses a planetary gear set arrangement to increase the high speed ratio (upto 1:90)




→ In 1986, the development of wind power in India began with the first windfarms being set up in coastal areas of Maharashtra (Ratnagiri), Gujarat (Okha) and Tamilnadu (Tuticorin) with 55 Kilowatts Vestas wind turbines.

→ India, TamilNadu is a leading state for wind energy generation. The maximum wind power capacity among Indian states is that of TamilNadu, with around 29 percent of India's total wind power capacity.

# Geo thermal Energy

→ The heat from the Earth generates another renewable (that is clean and sustainable) form of energy called geothermal energy.

→ At a depth of more than 80 km, heat is available normally. In certain location at a depth of 300 mt - 3000 mt have also presented of geothermal energy. ie. called as geothermal field.

→ Worlds first geothermal power plant setup in Larderello (Italy), 1911.

→ There are three type of Geothermal Power Plant setup world wide:-

1. Dry Steam Power Plant
2. Flash Steam Power Plant — Geothermally heated water (Temp - over 350 fahrenheit)
3. Binary Cycle Power Plant - Geothermally heated water (temp Up-to - 100 fahrenheit)

## 1: Dry steam Power Plant.

→ Dry steam plants are most common types of geothermal power plants, accounting for about half of the installed geothermal plants.

→ They work by piping hot steam from underground reservoirs directly into turbines from geothermal reservoirs, which power the generators to provide electricity.

## 2. flash steam Power Plant

flash steam plants take high-pressure hot water from deep inside the earth and converted it to steam to drive generator turbines.

When the steam cools, it condense to water and is injected back into the ground to be used again.

Most geothermal power plants are flash steam plants.

According to Indian Energy Portal, India has a geothermal potential of 10,000 megawatts. The Tattapani (Himachal Pradesh) geothermal field is

the most promising geothermal resource in central India. More than 300 sites of geothermal energy sources are identified in India.

=> There are seven geothermal provinces in India

1. the Himalayan,
2. West Coast
3. Cambay,
4. Son - Narmada - Tapi (Sonata),
5. Godavary
6. Mahanadi

# Ocean Energy

→ 70 percent of Earth's surface is covered by ocean and hence they are the world's largest solar collectors.

→ Ocean is also became a source of energy generation in modern, prospective.

→ Thermal energy from the sun's heat and mechanical energy from the tides and waves are the reason of energy produced by ocean.

There are three forms of electricity generations from sea:-

1. Tidal Energy
2. Wave Energy
3. Ocean thermal Energy.

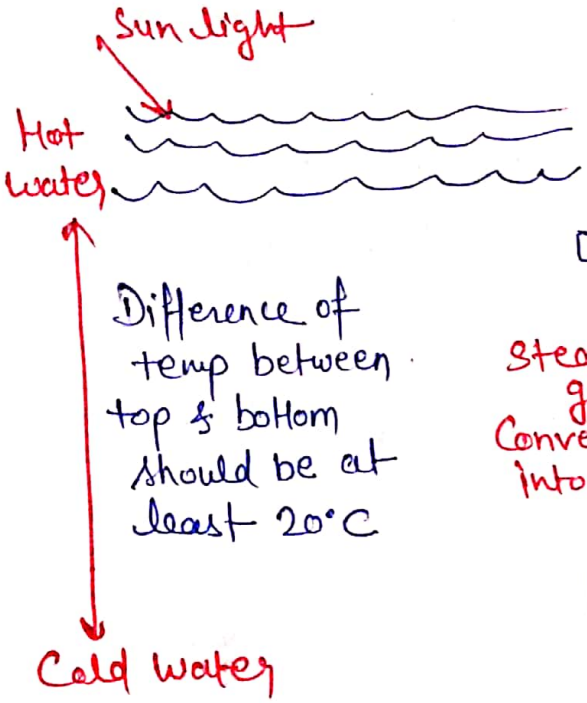
## Wave Energy

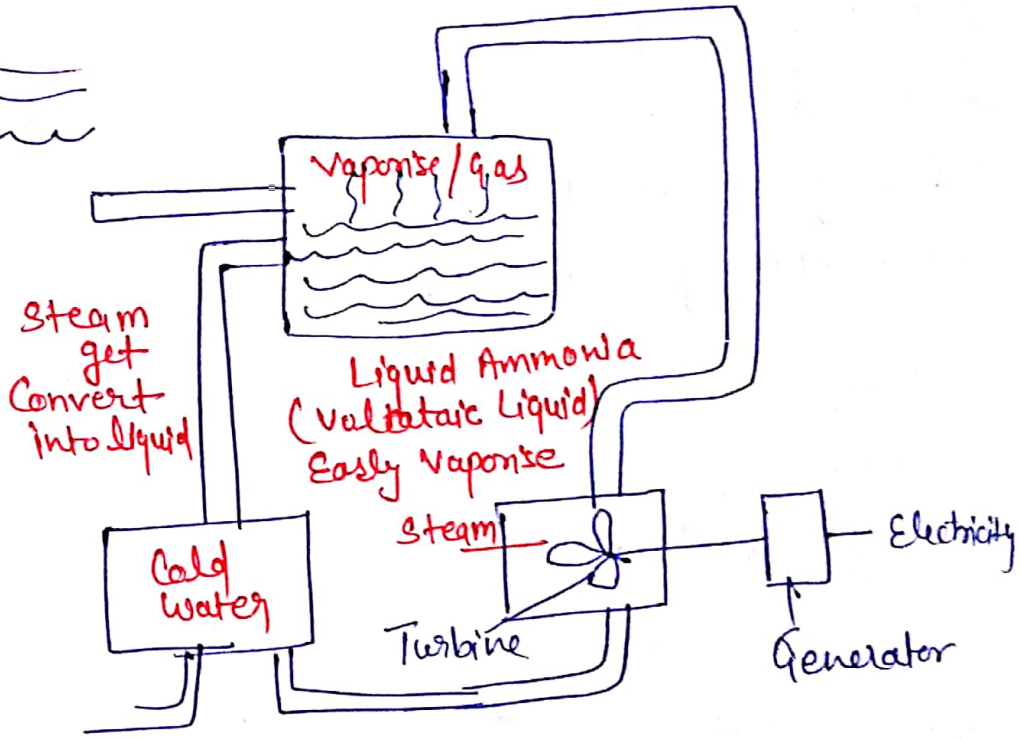
In this type of ocean energy generation, turbine, installed inside the ocean and they will move during the effect of ocean current.

This mechanical energy of turbine will convert into electricity with the help of dynamo.

(10) # Ocean thermal Energy

The surface water of ocean is heated more by Sun's heat, than the deep ocean water. The temperature difference thus created results in thermal energy.



# Modern Prospective of other Energy Sources

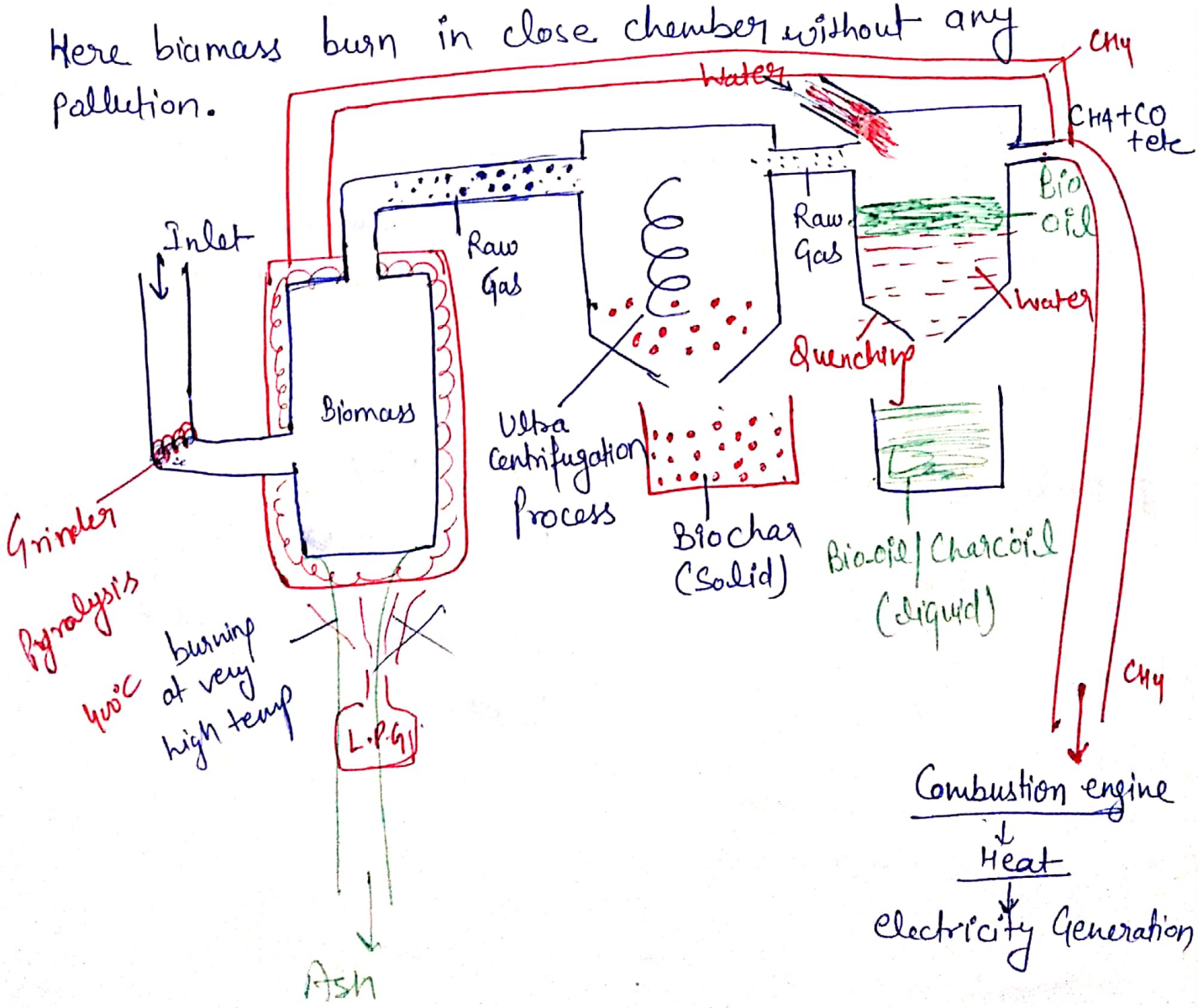
1. => Biomass Gasification
2. => fuel cell & Microbial fuel cell

## Biomass Gasification

eg - • Rice husk
• Baggase
• Coir

} Burn Biomass } — Pollution.

It is a sustainable method of burning the biomass. Here biomass burn in close chamber without any pollution.



## Biochar & Flyash

{ Residual Part Left after burning of coal

+ve effect [Bric & Cement] - fire Resistant wall ]

↓

Replace the demand of Portland Cement

-ve effect → Black Carbon — GHGs — ↑ temp of Env.

## Biochar

→ Residual Part left after burning of biomass

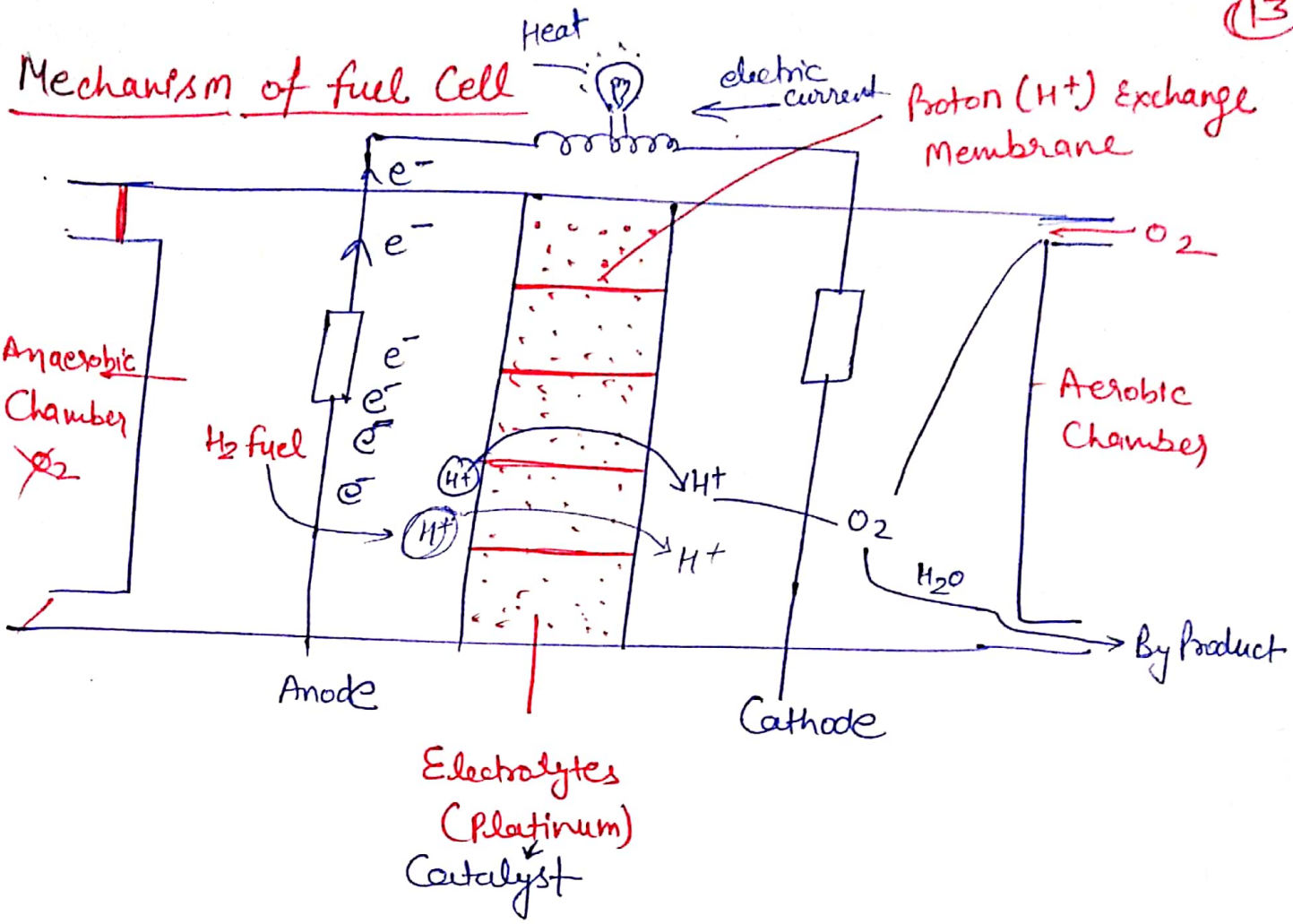
→ Importance of Biochar

- Richest source of phosphorus Compound (Good fertilizer)
- Mixing of biochar in soil reduces leaching process. so application of water as a irrigation & chemical uses will be minimize.

## # Fuelcell & Microbial fuel cells (MFCs)

| Battery | fuelcell / $H_2$ fuel cell |
|---|---|
| → Chemical | → $H_2$ fuel as a source of energy |
| → Charge - Discharge | → Small - Large (at every level) |
| → applicable for small size of electronic devices | → DC |
| → DC | |

## Mechanism of fuel Cell




## Electrolysis

$$H_2O \xrightarrow{\text{e-current}} H^+ + OH^-$$

$$H_2 \xrightarrow{\text{Platinum}} H^+ + e^-$$

## Mechanism of Microbial