

Environment Class 18

30th March, 2024 at 9:00 AM

HYDROPOWER (09:09 AM)

- Hydropower is one of the oldest and most widely used sources of **harnessing** the energy of flowing or falling water.
- They are of many types:
- a) Run-off River Hydropower:**
 - This generates electricity without significantly altering the flow of the river.
 - It includes a small diversion of the river flows through a canal to a turbine which drives a generator.
- b) Storage Hydropower:**
 - This involves the construction of a dam across a river to store water in the reservoir.
 - The electricity is generated by releasing water from the reservoir through turbines.
- c) Pumped Hydrostorage:**
 - During low electricity demand, excess electricity is used to pump water from the lower reservoir to the upper reservoir.
 - When demand is high the water is released to produce electricity.
 - In India, hydroelectric power projects are categorized based on installed capacity
 - For Example, the installed capacity of up to **100kW is called Micro Hydropower.**
 - 100kW - 2 MW: Mini Hydropower**
 - 2MW -25 MW is a small Hydropower.**
 - More than 25 MW is called a large hydropower project**
 - Meg HPP** has a capacity of more than 500 MW
 - Benefits of HP:**
 - Renewable energy source
 - No emission of greenhouse gases (for small hydropower it is **negligible**)
 - Very high efficiency (80 to 90 percent)
 - Storage capability:** ^{capability} ~~capacity~~ In the case of large projects, storage ~~capacity~~ allows better management of water resources which can help in flood mitigation, water supply for irrigation, and providing a means of balancing the grid, especially in regions with fluctuating power demand.
 - Challenges:** (In case of large hydro power projects)
 - It alters the **river hydrology** by obstructing the natural flow
 - It leads to **loss of biodiversity** by submerging large areas also **dams can obstruct the migration route of aquatic organisms**
 - Dams trap sediments which **degrade water quality** and reduce reservoir capacity.
 - Lack of sediments leads to **loss of fertility** of soil downstream.
 - The decomposition of organic material in submerged forests can **release methane.**
 - The immense weight of water in a large reservoir can induce **seismic activities.**
 - Displacement of local communities leads to **socio-economic and cultural disruption.**

OCEAN ENERGY (09:39 AM)

- There are four ways to utilise ocean energy:
- a) **Tidal Energy:**
 - Produced by ocean water during the rise and fall of tides.
 - In India, the **Gulf of Cambay, Gulf of Kutch, Andaman and Nicobar** have high potential.
- b) **Wave Energy:**
 - Using the kinetic energy of ocean waves to move a turbine to produce electricity.
 - As per **MNRE**, India is estimated to have 12.5 GW of tidal power capacity and 41.5 GW of wave power capacity (Hardly any work has done on Tidal and Wave energy because cost is high and efficiency is 20 to 25 percent.)
- c) **Current energy:**
 - Ocean currents are fairly constant in both speed and flow
- d) **Ocean thermal energy:** conversion (OTEC):
 - It **harnesses** the temperature difference between ocean surface water and deep ocean water.
 - It can be used to produce electricity and desalinate ocean water, warm surface water is pumped through an evaporator containing a **working fluid**.
 - Vaporised fluid drives the turbine and is turned back to liquid in a condenser cooled with cold ocean water ~~pumped~~ ^{pumped} from deeper into the ocean.
 - If it uses sea water as a working fluid we can also produce fresh water.

GEOTHERMAL (09:59 AM)

- It harnesses the heat from the earth to **generate electricity** and **for direct heating purposes**.
- The source of geothermal energy is the internal high temperature of the earth which is the residual heat from planet formation and decay of radioactive material.
- Heat from the core naturally flows towards the surface and is conducted through the earth's crust in some areas, particularly along tectonic plate boundaries heat is closer to the surface and can be easily harnessed.
- There can be a few types of geothermal systems
- i. **Hydrothermal Reservoir:** The most common and ^{easiest} ~~easier~~ to use and ^{this involves} naturally occurring stream of hot water.
- ii. **Enhanced Geothermal System:** engineers can create reservoirs by injecting water into hot rock, and fracturing it to create pathways for water to circulate and heat up.
- As per the **geological survey of India**, there are seven geothermal provinces in India.
- **Himalayan Geothermal Province:**
 - **Puga Valley, Manikarnika** -> Godavari (This includes parts of AP, Rajamundry traps are known for Geothermal potential.)
 - **Sohana, Haryana** -> **Chhumthang in Leh**.
- **West Coast Geothermal Province** Parts of **Gujarat** and Maharashtra
- **Cambay in Gujarat** -> **Peninsular India** (This includes patches in Karnataka, Maharashtra and Tamil Nadu.)
- **Son, Narmada and Tapi (SONATA)**
- **Godavari:** Rajahmundry traps
- **Peninsular India:** This includes patches in Karnataka, Maharashtra and Tamil Nadu
- **Challenges:**
 - Geothermal energy is location-specific and can involve high **upfront costs**.
 - There can be environmental concerns such as the release of CO₂ and SO₂.
 - It can induce seismic activities.

INDIAS ENERGY BASKET (10:18 AM)

- Total installed capacity: 430 GW.
- Fossil fuel contribution is 56 per cent out of which lignite and coal contribute 50 percent of the total.
- Solar contribution is 17 per cent, wind 10.5 per cent, small hydropower 1.2 percent, large hydropower 11 per cent, and nuclear is 1.7 percent.
- **Renewable purchase obligations:** portions
- Discoms are required to include certain portions of renewable energy supply under the Electricity Act 2003 and National Tariff Policy 2006. (this will be fixed by State power regulators that how much to procure)
- **Renewable energy certificates:** one certificate
- It is a market-based instrument to promote renewable sources of energy. It is equivalent to 1 MW hour of electricity injected into the grid from renewable energy sources
- These certificates are tradeable on two power exchanges Indian Energy Exchange and the Power Exchange of India Limited India
- The regulator for this market mechanism is CERC.

FOREST (10:51 AM)

- **Forest:** Forest is an area dominated by trees.
- **Forest cover:** All patches of land with tree canopy density > 10 percent and an area of more than 1 hectare irrespective of ownership, species of trees, or land use.
- **Canopy Density:** It refers to the proportion of an area in the ground, that is covered by the crown of trees, and is expressed as a percentage of total area.
- Based on canopy density we can further divide forests:
- **Very Dense Forest:** >70 percent canopy density
- **Moderately Dense Forest:** 40-70 percent canopy density
- **Open Forests:** 10-40 percent canopy density.
- **Recorded Forest Area:** All lands notified as forest under any government act or rules,
- **Deemed Forest:** These are land tracts that appear to be a forest but are not notified by the state government.
- **Tree cover:** All patches of trees less than 1 hectare outside recorded forest area. irrespective of canopy density.
- **Trees outside forest:** Any tree outside the recorded forest area, irrespective of patch size, thus tree cover is a subset of the tree outside the forest.

→ Forests are best case study for economic excellence. (Essay)

Q: Discuss the significance of forest ecosystem from ecological conservation perspective as well as from human development.

INDIAN FOREST SURVEY REPORT 2021 (11:20 AM)

- Forest survey report is released by forest survey of India biennially
 - It is released every two years. → Findings are -
 - The total forest cover is **7,13,789 sq. km.**
 - **21.71 percent** of the geographical forest area.
 - Very Dense Forest: 3.04 percent
 - Moderately Dense Forest: 9.33 percent
 - Open Forest: 9.34 percent
- increasing forest
- **The top 5 states in total forest cover are:**
 - 1. Madhya Pradesh
 - 2. Arunachal Pradesh
 - 3. Chattisgarh
 - 4. Odisha
 - 5. Maharashtra
- MACOM
- **The top 5 states by percentage of state geographic area under forest cover are:**
 - 1. Mizoram
 - 2. Arunachal Pradesh
 - 3. Meghalaya
 - 4. Manipur
 - 5. Nagaland
- tree outside forest and
- The state with maximum tree cover is **Maharashtra.**
 - **The top 5 states/UTs in Mangrove cover are:**
 - 1. West Bengal
 - 2. Gujarat
 - 3. Andaman and the Nicobar Islands
 - 4. Andhra Pradesh
 - 5. Maharashtra
- WG AAM
- **State with the highest bamboo-bearing area:** Madhya Pradesh
 - ~~No~~ forest fires were detected highest in Odisha, MP, and Chattisgarh.
 - In terms of forest types, **Tropical Dry Deciduous Forest** has the highest percentage followed by **Tropical Moist deciduous forest**, **plantation forest**, and **Tropical Semi-Evergreen Forest.**
 - At the global level, Russia followed by Brazil, Canada, the US and China have the highest forest cover. **India is in 10th position.**

LEGAL MECHANISM TO PROTECT FOREST (11:36 AM)

• 1. Indian Forest Act, 1927.

- It established a framework for **Forest Administration and Management**^{of forest} and it provided for the demarcation of **reserved forests, protected forests, and village forests**.
- **Reserved forests** are the **most restricted forest** constituted by the **state government**.
- **Local people** are prohibited unless specifically allowed by a **forest officer**.
- **Protected forests** have a low level of protection, **local people** will be allowed.
- However, certain activities such as collecting **major forest produce** can be banned.
- **Village forests** are areas where a village community resides, within a reserved forest.
- The act recognizes the rights of local communities such as rights of Access, Use, and Transit.
- It provided for the regulation and control of forest produce which includes **both Timber and Non-Timber products**. ^{It outlined the procedure of extraction, transportation and sell of forest produce.}
- The act listed various offences like the felling of trees, encroachment, and hunting and prescribed penalties for them.
- It provided for mapping and survey of forests and records of rights and privileges.
- **In the amendment in 2017**, bamboo growing in **non-forest areas** waived off the requirement of permission for its **felling**.

• 2. Forest Conservation Act 1980 (11:53 AM)

- This act requires prior approval from the **central government** for the diversion of forest land for non-forest purposes.
- It mandates compensatory afforestation. ^{i.e.}
- If **forest land** is diverted for nonforest purposes an equivalent area of non-forest land has to be afforested or reforested. ^{under MoECC}
- The act established the **Forest Advisory Committee**^{exemptions}, which advises the union govt. on matters of forest conservation and diversion of forest land.
- The act provides ^{exceptions} for certain categories such as projects related to defense, national security, and public utility.
- It recognizes the **involvement of the local community** in forest conservation and management.

• 3. Compensatory Afforestation Act 2016¹⁹⁹⁶ ^{vs UOI}

- Supreme Court in ¹⁹⁹⁶ **2002, TN Godavarman** ^{for} case has ordered the creation of Compensatory Afforestation Fund Management and Planning Authority Fund. ^{to provide proper institutional fund}
- In 2016, the government enacted the **Compensatory Afforestation Fund Act** which established a two-tier mechanism:
- **National Fund and the State Fund under Public Accounts** of India and States.
- The net Present Economic Value of the Forest will be calculated, 10 percent of the contribution will go to the National Fund, and 90 percent to the State Fund.
- **National Compensatory Afforestation Fund, State Compensatory Afforestation Fund** under respective Public Accounts.
- The National Fund will receive 10 percent and the State will receive the remaining 90 percent.

The topic for the next class: Water Conservation, Sustainable Agriculture