

Sustainable Development



Important Aspects

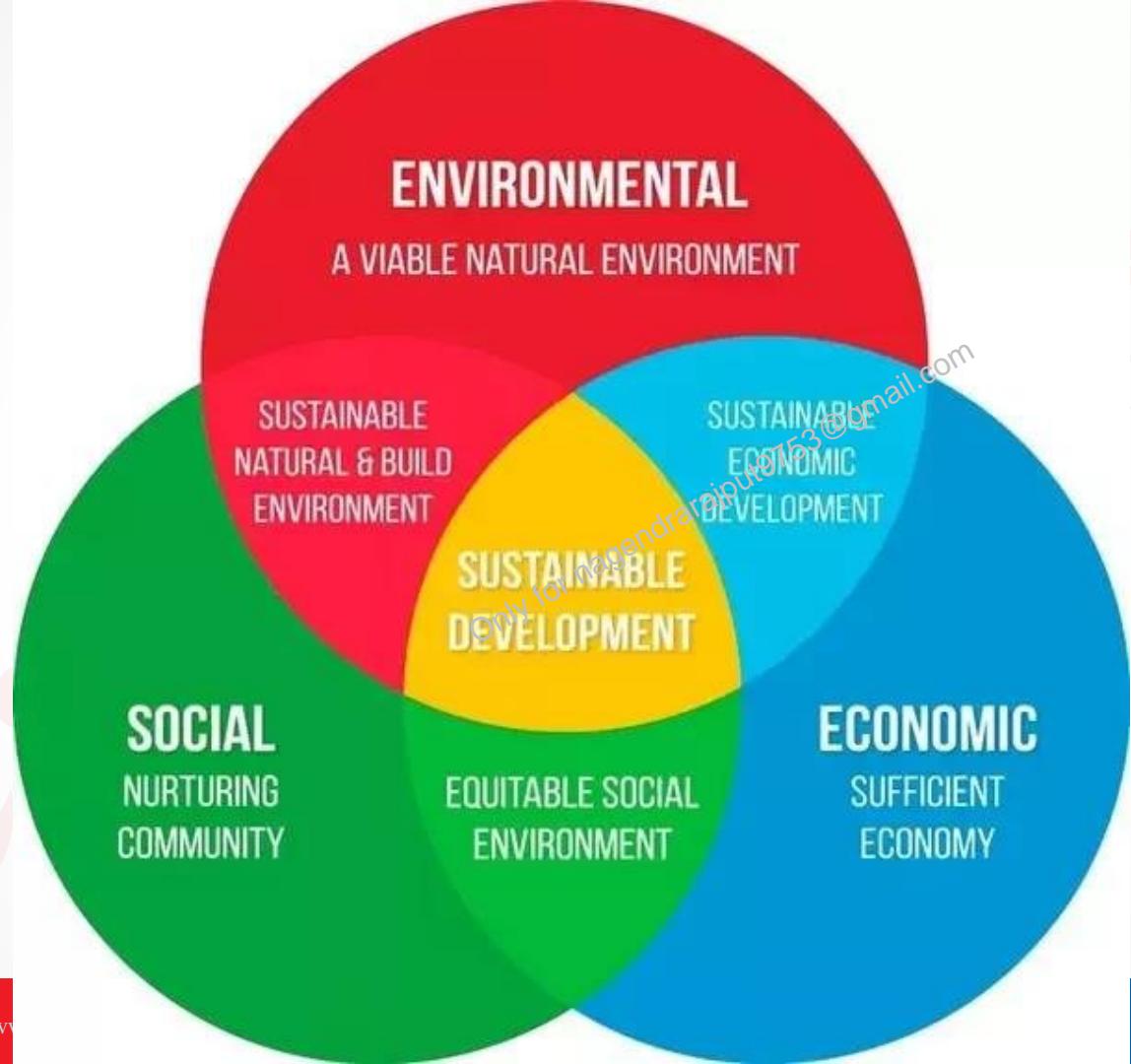
- Forest Conservation
- Energy Conservation
- Water Conservation
- Sustainable Agriculture
- Environmental Impact Assessment
- Important concepts
 - Circular Economy
 - Green GDP
 - Natural Capital Accounting
- Important Environmental Legislations

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Meaning

- Definition
- Evolution of the term
- Sustainable Development Goals
- Important conferences

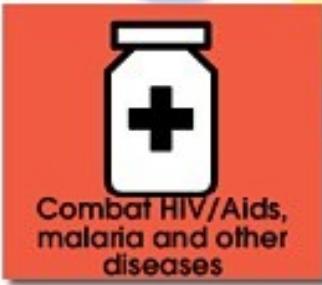
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VISION
IAS



2015 MILLENIUM DEVELOPMENT GOALS





SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

1 NO
POVERTY



2 ZERO
HUNGER



3 GOOD HEALTH
AND WELL-BEING



4 QUALITY
EDUCATION



5 GENDER
EQUALITY



6 CLEAN WATER
AND SANITATION



7 AFFORDABLE AND
CLEAN ENERGY



8 DECENT WORK AND
ECONOMIC GROWTH



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



10 REDUCED
INEQUALITIES



11 SUSTAINABLE CITIES
AND COMMUNITIES



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



13 CLIMATE
ACTION



14 LIFE
BELOW WATER



15 LIFE
ON LAND



16 PEACE, JUSTICE
AND STRONG
INSTITUTIONS

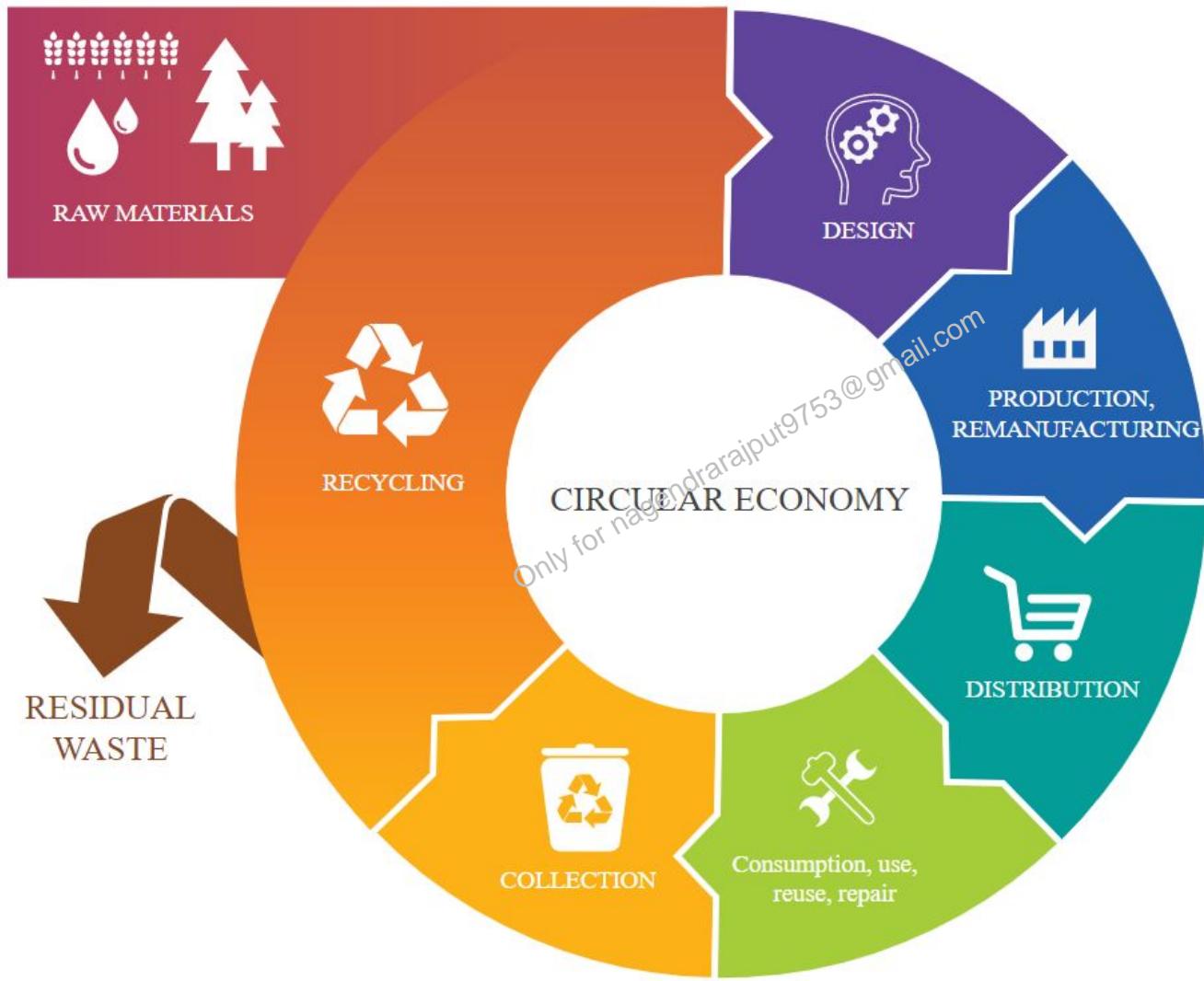


17 PARTNERSHIPS
FOR THE GOALS



SUSTAINABLE
DEVELOPMENT
GOALS





What is Rio+20 Conference, often mentioned in the news?

- (a) It is the United Nations Conference on Sustainable Development
- (b) It is a Ministerial Meeting of the World Trade Organization
- (c) It is a Conference of the Intergovernmental Panel on Climate Change
- (d) It is a Conference of the Member Countries of the Convention on Biological Diversity

Consider the following statements :

1. The Sustainable Development Goals were first proposed in 1972 by a global think tank called the 'Club of Rome'.
2. The Sustainable Development Goals have to be achieved by 2030.

Which of the statements given above
is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2016

With reference to 'Agenda 21', sometimes seen in the news, consider the following statements :

1. It is a global action plan for sustainable development.
2. It originated in the World Summit on Sustainable Development held in Johannesburg in 2002.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2016

The term “sixth mass extinction/sixth extinction” is often mentioned in the news in the context of the discussion of

- (a) Widespread monoculture practices in agriculture and large-scale commercial farming with indiscriminate use of chemicals in many parts of the world that may result in the loss of good native ecosystems.
- (b) Fears of a possible collision of a meteorite with the Earth in the near future in the manner it happened 65 million years ago that caused the mass extinction of many species including those of dinosaurs.

(c) Large scale cultivation of genetically modified crops in many parts of the world and promoting their cultivation in other parts of the world which may cause the disappearance of good native crop plants and the loss of food biodiversity.

2018

(d) Mankind's over-exploitation/misuse of natural resources, fragmentation/loss of natural habitats, destruction of ecosystems, pollution and global climate change.

The Partnership for Action on Green Economy (PAGE), a UN mechanism to assist countries transition towards greener and more inclusive economies, emerged at

- (a) The Earth Summit on Sustainable Development 2002, Johannesburg
- (b) The United Nations Conference on Sustainable Development 2012, Rio de Janeiro
- (c) The United Nations Framework Convention on Climate Change 2015, Paris
- (d) The World Sustainable Development Summit 2016, New Delhi

'R2 Code of Practices' constitutes a tool available for promoting the adoption of

- (a) environmentally responsible practices in electronics recycling industry
- (b) ecological management of 'Wetlands of International Importance' under the Ramsar Convention
- (c) sustainable practices in the cultivation of agricultural crops in degraded lands
- (d) 'Environmental Impact Assessment' in the exploitation of natural resources

2021

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Energy Conservation

- PAT scheme (Perform, Achieve and Trade)
 - a flagship programme of Bureau of Energy Efficiency under the National Mission for Enhanced Energy Efficiency (NMEEE).
 - market-based mechanism to further accelerate as well as incentivize energy efficiency
 - Energy Savings Certificates (ES Certs)
 - through two power exchanges - Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL).
 - 13 energy-intensive sectors: Thermal power plants (TPP), cement, aluminum, iron and steel, pulp and paper, fertilizer, chlor-alkali, petroleum refineries, petrochemicals, distribution companies, railways, textile and commercial buildings (hotels and airports).

Energy Conservation

- Market Transformation for Energy Efficiency (MTEE)
 - aims for accelerating the shift to energy efficient appliances in designated sectors through incentives and innovative business models.
 - Bachat Lamp Yojna (BLY): The programme was developed for replacement of inefficient bulbs with Compact Fluorescent Lamps (CFLs)
- Energy Efficiency Financing Platform (EEFP)
 - to provide a platform to interact with Financial Institutions (FIs) and project developers for implementation of energy efficiency projects
- Framework for Energy Efficient Economic Development (FEEED)
 - was designed for development of fiscal instruments to promote energy efficiency. The objective was to provide the comfort to concerned stakeholders through implementation of Energy Efficiency schemes such as Partial Risk Sharing Facility (PRSF)

Alternative Energy



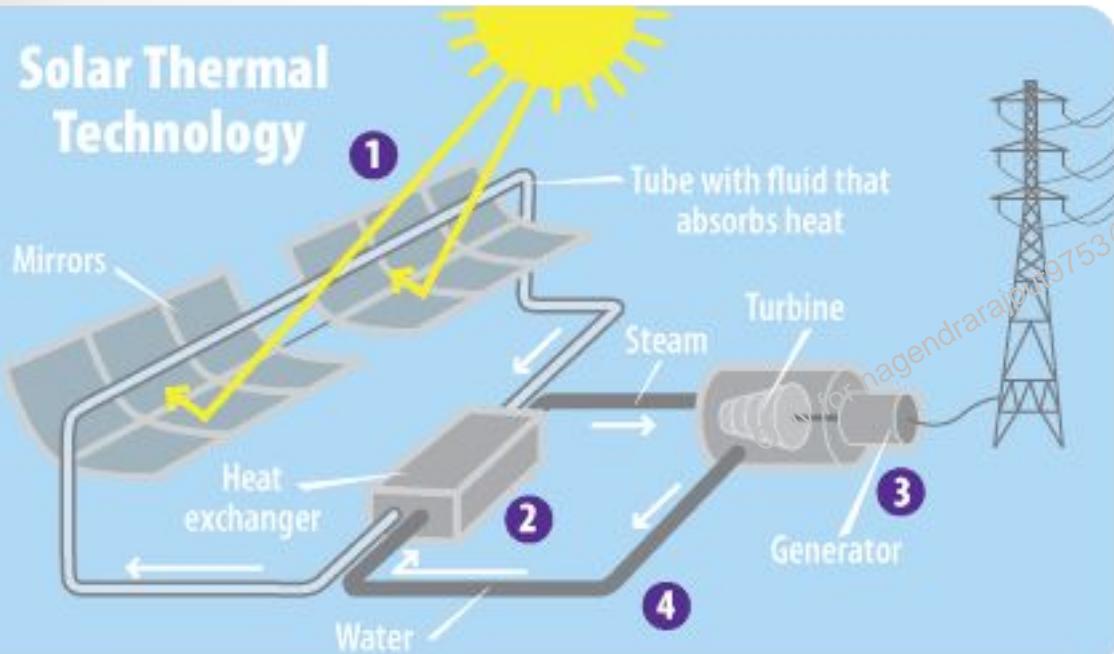
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Sources

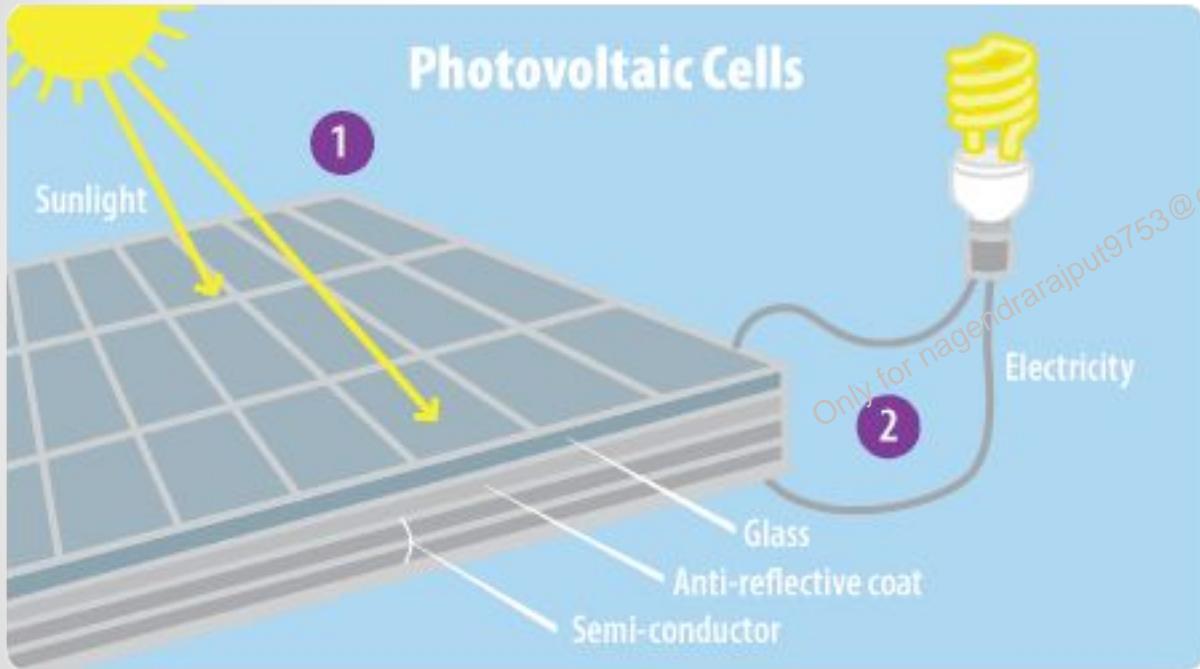
- Conventional
 - Non-Renewable: Fossil Fuel – Coal, Petroleum, Natural Gas
 - Renewable: Non-fossil fuel above the ground: Fire wood, Cattle dung, Wood Charcoal
- Non-Conventional
 - Non-Renewable: Nuclear
 - Renewable: Solar, Wind, Tidal, geothermal, Biofuel, Hydro power, Hydrogen
- Alternative: Any source of energy which is not fossil fuel based.

Solar Energy

Solar Thermal Technology



Solar Energy

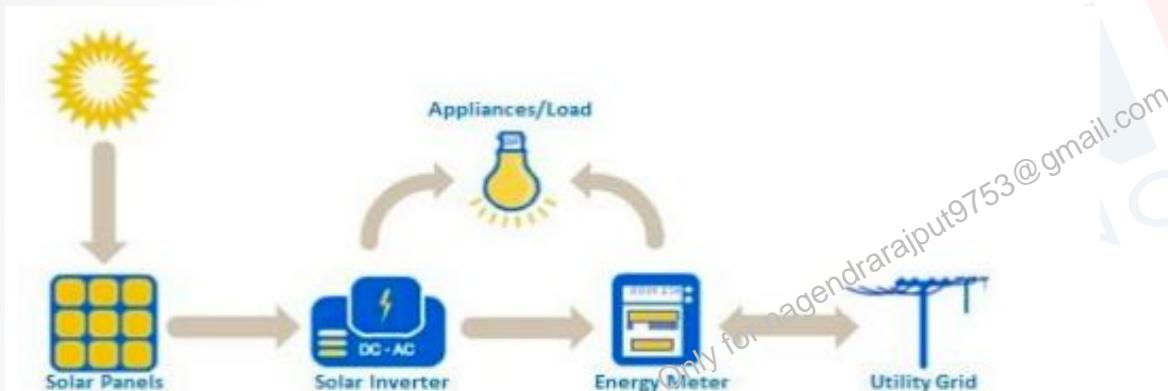


Solar Energy

- National Solar Mission:
 - 100 GW by 2022 (installed capacity 57 GW by May 2022), 300 GW by 2030
- Schemes:
 - Pradhan Mantri Suryoday Yojana
 - Solar Parks and Ultra mega solar power projects
 - PM KUSUM
 - Suryamitra Programme
 - Atal Jyoti Yojana
 - Renewable Purchase Obligations

Solar Energy

- Grid connected solar rooftop scheme (40 GW)



- Net Metering: records the energy flow in both the directions and at the end of billing period net energy used is calculated.
- Suryamitra: to develop the skills of youth, considering the opportunities for employment in the growing Solar Energy Power Project's installation, operation & maintenance in India and abroad.
 - By National Institute of Solar Energy under MNRE

Solar Energy

- Pradhan Mantri Suryoday Yojana: the Centre will bear the entire cost of setting up rooftop solar systems for households that consume less than 300 units of electricity per month.
 - target of installing rooftop solar on 1 crore houses
- Atal Jyoti Yojana: to illuminate dark regions through establishment of solar street lights.
 - It is a sub scheme under off -grid and decentralized solar application scheme
- PM KUSUM:
 - Component A: 10,000 MW of solar capacity through installation of small Solar Power Plants of individual plants of capacity upto 2 MW.
 - Component B: Installation of 20 lakh standalone Solar Powered Agriculture Pumps.
 - Component C: Solarisation of 15 Lakh Grid-connected Agriculture Pumps.

Solar Energy

- Challenges:

- Domestic manufacturing capabilities
- Net-metering limits on rooftop solar schemes
- Intermittent supply
- Lack of Power storage
- Land acquisition issues
- High cost of installation

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Solar Energy

- International solar alliance:
 - a joint effort by India and France to mobilize efforts against climate change
 - Headquarter in Gurgaon
 - conceptualized on the sidelines of the 21st Conference of Parties (COP21) to the UNFCCC held in Paris in 2015.
 - all member states of the United Nations are now eligible to join the ISA
 - is guided by its 'Towards 1000' strategy which aims to mobilise USD 1,000 billion of investments in solar energy solutions by 2030
 - to help member countries with particular focus on Least Developed Countries (LDCs) and the Small Island Developing States (SIDS)
- One Sun One World One Grid (OSOWOG) initiative
 - was put Prime Minister Shri Narendra Modi, at the First Assembly of the ISA in October 2018.
 - aims to connect different regional grids through a common grid that will be used to transfer renewable energy power and, thus, realize the potential of renewable energy sources, especially solar energy.
 - Was launched , during the 'Accelerating Innovation and Clean Technology Deployment' event at the World Leaders Summit held on 2 November 2021 during COP26.
 - launch of the 'One Sun Declaration' as approved by the Fourth Assembly of the ISA.

Solar Energy

Geographical reach of the envisioned Interconnected grid



Far West which would cover the Middle East and the African Region.

India at the fulcrum

Far East which would include countries like Myanmar, Vietnam, Thailand, Lao, Cambodia etc.

Phases



Phase I

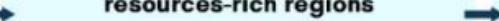
Interconnection of Middle East-South Asia-South East Asia (MESASEA)

- Indian Grid interconnection with the **MESASEA** grids to share solar and other renewable energy



Phase II

Interconnection of Solar and other Renewable Energy resources-rich regions



- **MESASEA** grid getting interconnected with **the African power pools** to share solar and other renewable energy power of the countries located in solar and renewable energy-rich areas.

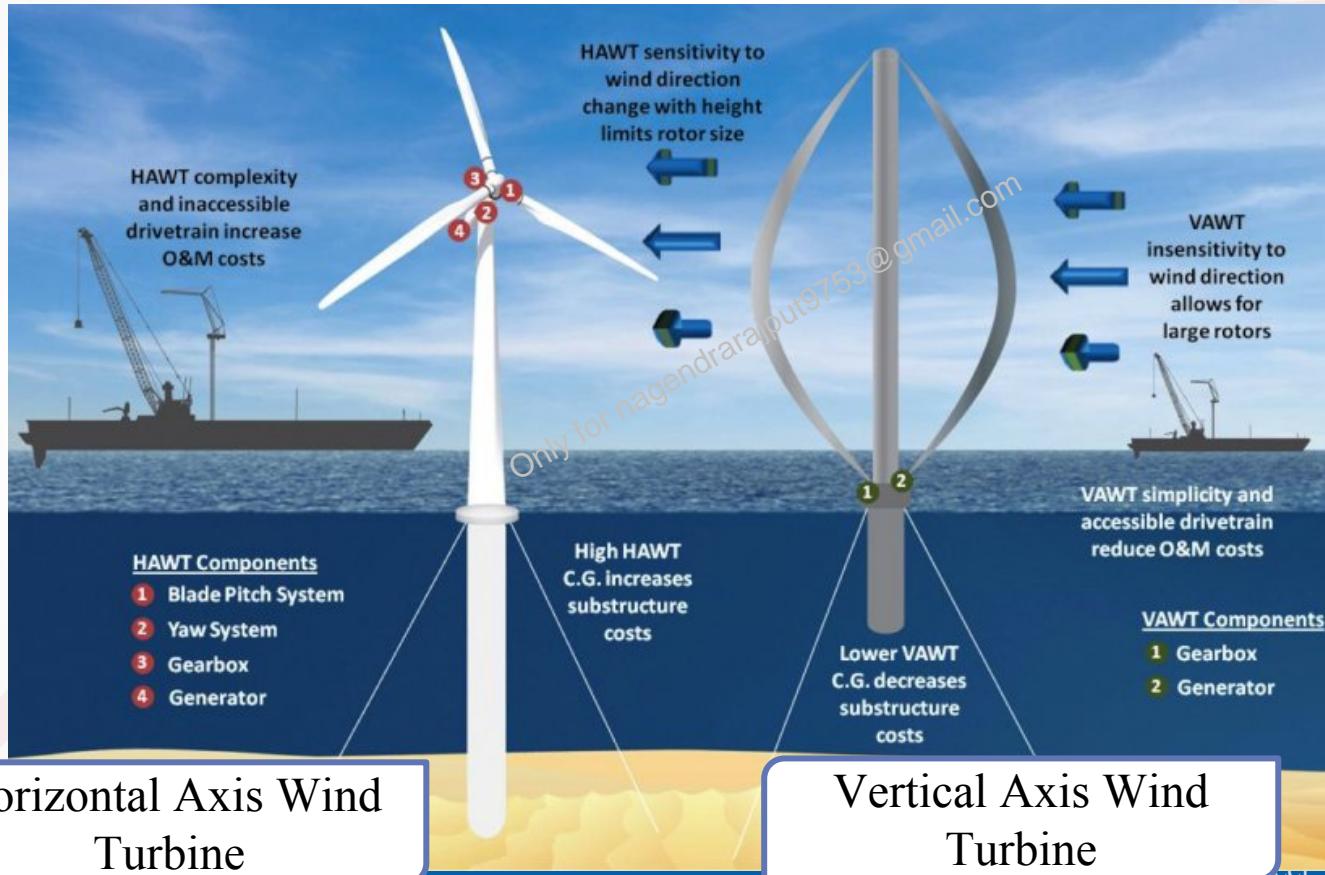


Phase III

Global interconnection

- To achieve the One Sun One World One Grid vision.

Wind Energy



Wind Energy



Off Shore and On
Shore

Wind Energy

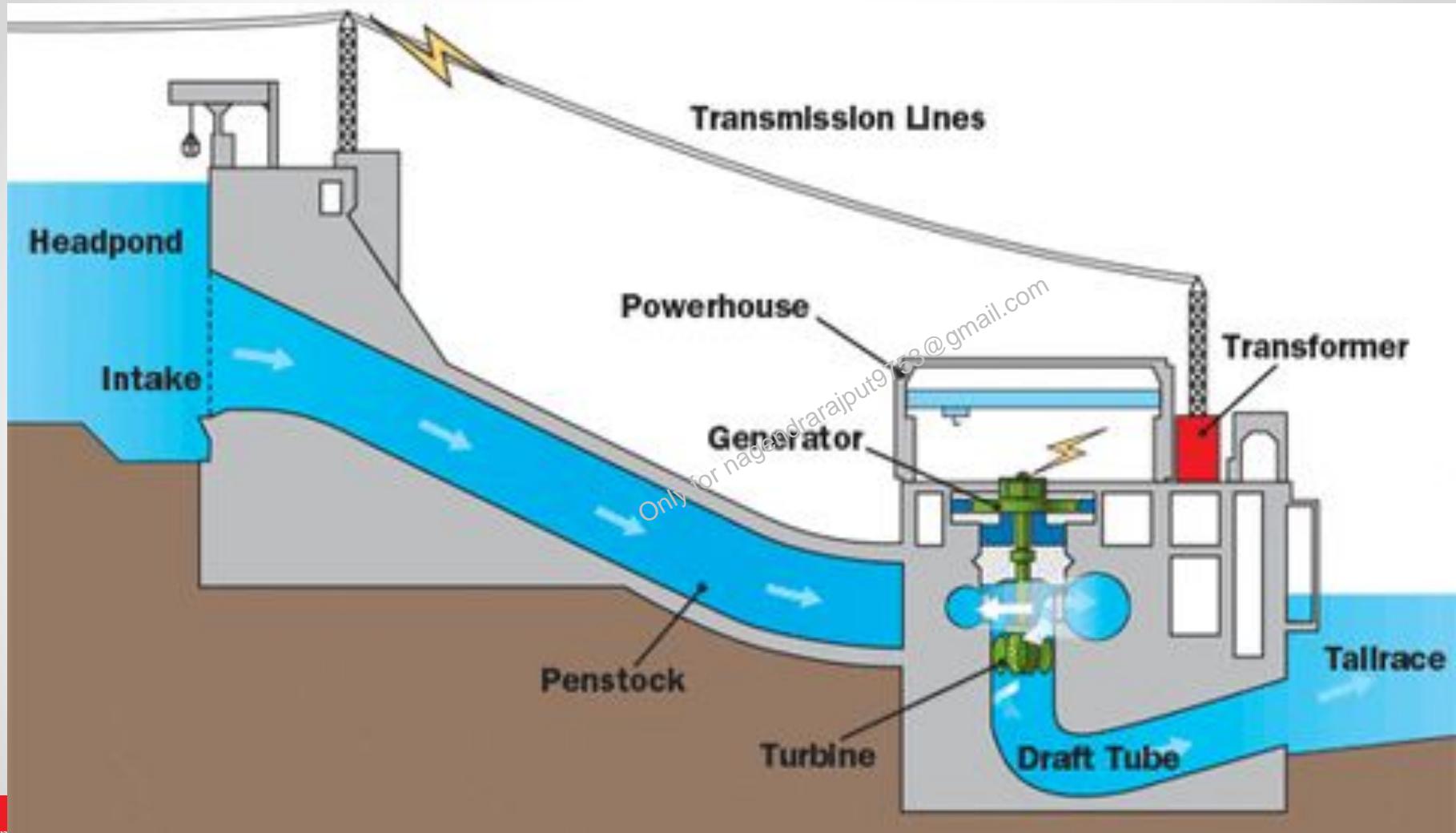
- The design and installation of a horizontal axis wind turbine is complex, they require larger space, more expensive and are dependent on wind direction but they have higher power coefficient.
- Wind turbines typically produce alternating current (AC) electricity.
- The electricity produced by a wind turbine is an alternating current because the wind can blow at different speeds and in different directions, causing the turbine's blades to rotate at varying speeds.
- Challenges:
 - Intermittency: wind does not always blow at a constant speed which can make it challenging to integrate wind energy into the grid.
 - High upfront costs
 - Land use: Wind turbines require a large amount of land
 - Environmental impacts: potential impact on birds and other wildlife.
 - Public opposition: to the construction of wind turbines, either due to aesthetic concerns or concerns about the impact on the local community.

Wind Energy

- India has the 4th largest wind power capacity in the world.
- According MNRE the total potential for wind energy in India is estimated to be 302 GW, with a technically feasible potential of 147 GW.
- Target till 2022:
 - Total: 175 GW
 - Solar: 100 GW
 - Wind: 60 GW
- Target till 2030
 - Total: 500 GW
 - Solar: 300 GW
 - Wind: 140 GW

Wind Energy

- National Wind – Solar Hybrid Policy, 2018
 - for efficient utilization of the transmission infrastructure and land.
 - to reduce the variability in renewable power generation and to achieve better grid stability.
- National Offshore Wind Energy Policy, 2015
 - Promoting spatial planning and management of maritime renewable energy resources in India's EEZ through suitable incentives.
 - Boosting the indigenisation.
 - Creating skilled manpower and employment
 - Enabling the development of Project EPC and Operation & Maintenance with regard to the offshore wind industry.
 - Developing coastal infrastructure and supply chain
- The Wind Energy Tariff Policy: provides incentives for the development of wind energy in India, including feed-in tariffs and tax incentives.



Hydro Power

- Benefits of Large Hydro power:
 - Clean Energy: Though many experts highlight the carbon footprint of such projects as an issue.
 - Irrigation
 - Drinking Water supply
 - Controlling floods and droughts
- Issues Large Hydro Projects
 - Habitat loss
 - Biodiversity loss
 - Flooding of Large areas
 - Loss of forest
 - Alteration of ecosystems
 - Erosion of riverbanks
 - Social and cultural Impact
 - Economic impact
- In India, large Hydropower Projects have been declared as Renewable Energy source for RPO requirements.

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Ocean Energy

- Tidal
- Wave
- Current
- Ocean thermal

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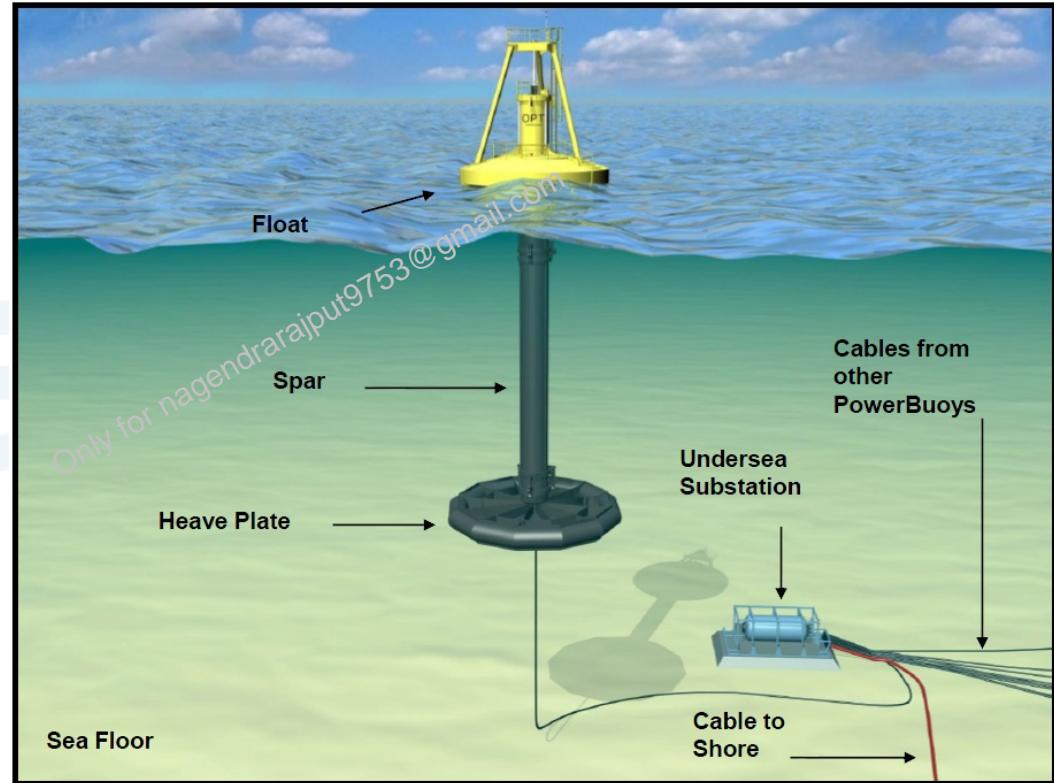
Ocean Energy Types

- Tidal Energy
 - produced by the surge of ocean waters during the rise and fall of tides.
 - Gulf of Cambay, Gulf of Kutch in Gujarat, A&N islands
- Challenges:
 - High upfront cost
 - Low energy conversion efficiency
 - R&D
 - Identifying locations



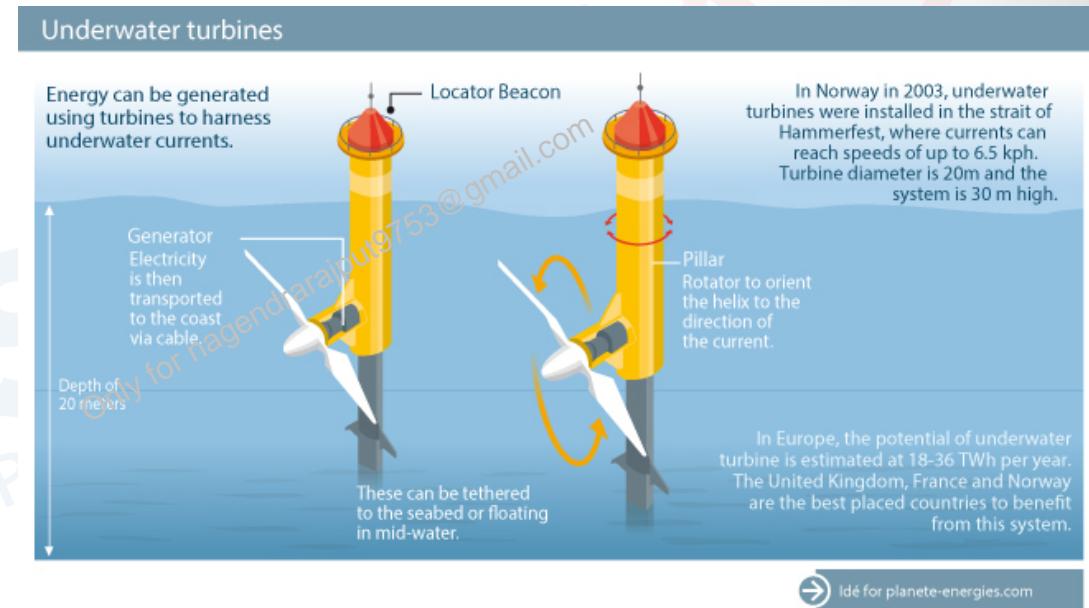
Ocean Energy Types

- Wave Energy:
 - Using Kinetic Energy of Ocean waves to produce electricity
- India is estimated to have a potential of around 54 gigawatts (GW) of ocean energy – tidal power (12.45 GW) and wave power (41.3 GW)



Ocean Energy Types

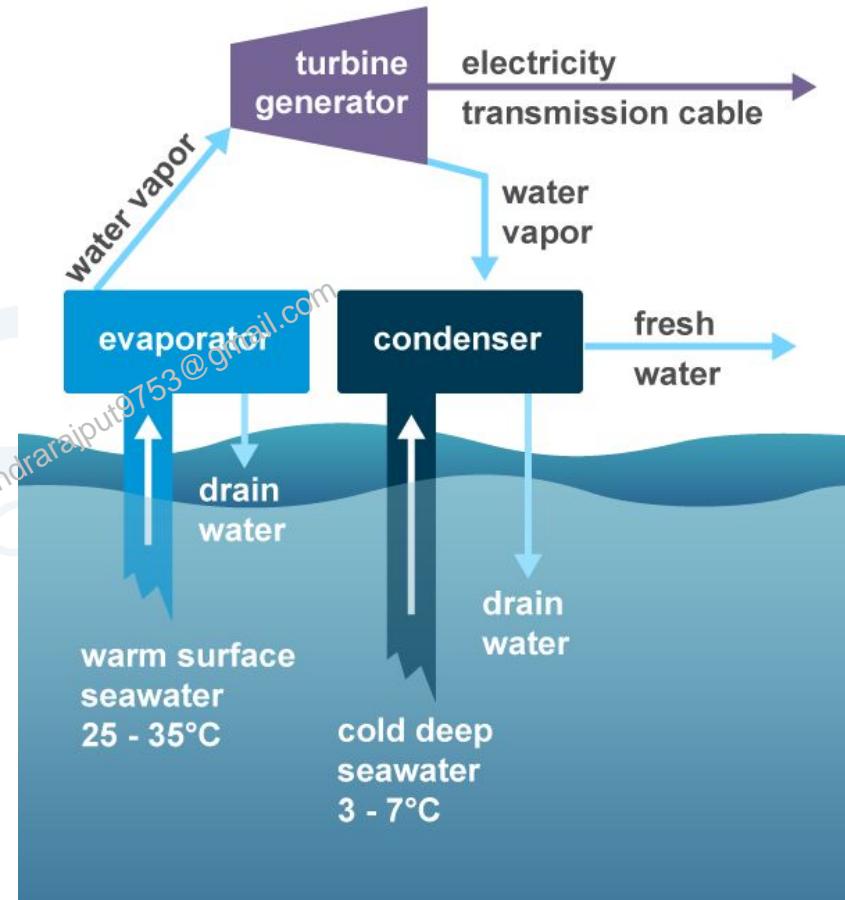
- Ocean Current Energy
 - ocean currents are fairly constant in both speed and flow and carry large amounts of energy
 - Electricity is produced from the ocean currents by coupling a generator to the turbine and power is transmitted back to shore via subsea cable.



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Ocean Thermal Energy Conversion

- by harnessing the temperature differences (thermal gradients) between ocean surface waters and deep ocean waters.
- temperature difference can be used to produce electricity and to desalinate ocean water.
- Warm surface water is pumped through an evaporator containing a working fluid.
- The vaporized fluid drives a turbine/generator.
- The vaporized fluid is turned back to a liquid in a condenser cooled with cold ocean water pumped from deeper in the ocean.
- OTEC systems using seawater as the working fluid can use the condensed water to produce desalinated water

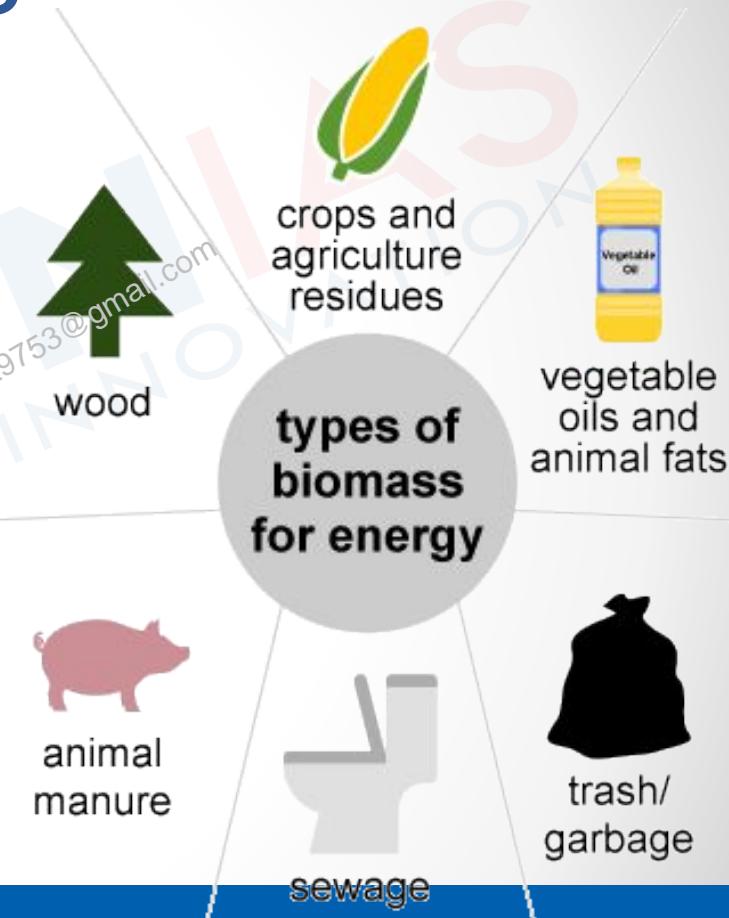


Biofuels

- Biomass is converted to energy through various processes, including:
 - Direct combustion (burning) to produce heat
 - Thermochemical conversion to produce solid, gaseous, and liquid fuels
 - Chemical conversion to produce liquid fuels
 - Biological conversion to produce liquid and gaseous fuels
- Why Renewable: its inherent energy comes from the sun and because it can regrow in a relatively short time.

Types:

- Bioethanol:
 - made from fermenting and distilling crops that are high in carbohydrates, such as corn, wheat, and sugarcane.
 - It is often used as a gasoline additive to reduce emissions.
- Biomethanol,
 - also known as wood alcohol or methyl alcohol,
 - is a type of biofuel that is made from renewable raw materials, such as wood, agricultural waste, and other organic matter.



Biofuels

- **Biodiesel:**
 - made from vegetable oils, animal fats, or recycled cooking grease.
 - It can be used as a substitute for diesel fuel in vehicles.
- **Biogas:**
 - produced by the anaerobic digestion of organic matter, such as agricultural waste or manure.
 - It can be used as a substitute for natural gas to generate electricity or heat.
- **Algal biofuels:**
 - Algal biofuels are made from microalgae, which are tiny aquatic organisms that can be grown using sunlight and nutrients.
 - They can be used to produce biofuels such as bioethanol and biodiesel.
- **Biobutanol:**
 - Biobutanol is a type of biofuel that is made through the fermentation of crops such as corn, sugarcane, and wheat.
 - It can be used as a gasoline additive or as a substitute for gasoline.

Generation of Biofuels

- **First-generation**
 - biofuels are made from feedstocks such as sugarcane, corn, wheat, and other crops that are used for food or animal feed.
 - These biofuels are produced through processes such as fermentation and distillation. Examples of first-generation biofuels include bioethanol, biodiesel, and biogas.
- **Second-generation**
 - are made from non-food feedstocks such as agricultural waste, forestry residues, and algae. These biofuels are produced through processes such as thermochemical conversion and biochemical conversion.
 - Examples of second-generation biofuels include biomethanol, biobutanol, and advanced biofuels made from algae.
- **Third-generation biofuels**
 - made from feedstocks such as seaweed, algae, and microorganisms, and
 - they are produced using advanced technologies such as synthetic biology.
 - Third-generation biofuels have the potential to be more sustainable and efficient than first- and second-generation biofuels, but they are not yet widely available.

National Policy on Biofuel, 2018

- Two categories: Basic and Advanced
- target of 20% blending of ethanol in petrol and 5% blending of biodiesel in diesel is proposed by 2030. (now 2025)
- MSP for non-edible oil
- viability gap funding scheme for 2G ethanol Bio refineries
- Ministry of Petroleum & Natural Gas: Overall coordinator
 - National Biofuels Coordination Committee (NBCC) chaired by minister

National Policy on Biofuel, 2018

Amendment 2022:

- A target of 20% blending of ethanol in petrol is proposed by Ethanol Supply Year (ESY) 2025-26.
- An indicative target of 5% blending of biodiesel in diesel /direct sale of biodiesel is proposed by 2030.
- Role of Ministry of Consumer Affairs, Food & Public Distribution: to provide suitable financial incentives for setting up of 1G ethanol distilleries from various feed stocks
- export of biofuels will generally not be permitted except approval of NBCC
 - When there is surplus of biofuels
 - Very high price resulting in poor sales
 - In case of emergencies

The scope of the Policy encompasses following categories of fuels as “Biofuels” which can be used as transportation fuel or in stationery applications:—

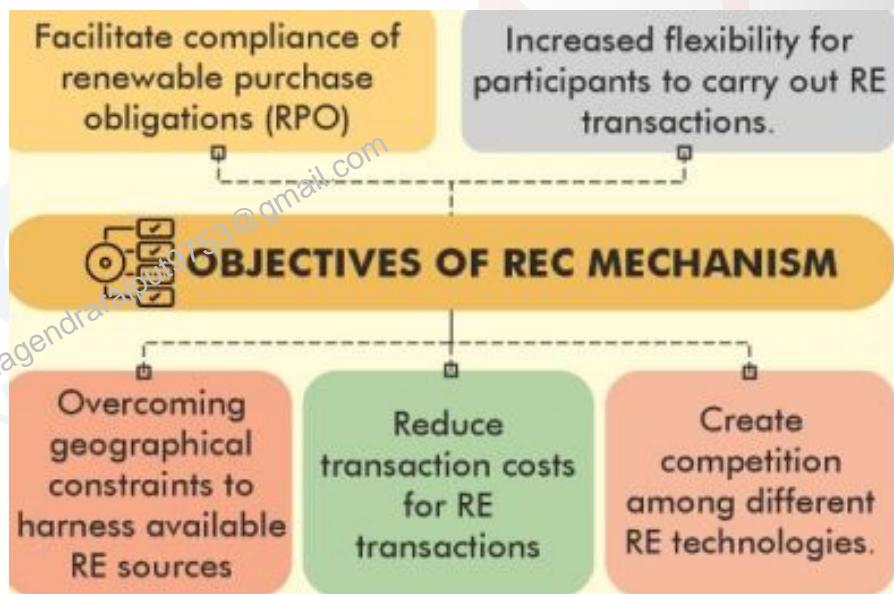
- i. ‘bioethanol’: ethanol produced from biomass such as sugar containing materials, like sugar cane, sugar beet, sweet sorghum etc.; starch containing materials such as corn, cassava, rotten potatoes, algae etc.; and, cellulosic materials such as bagasse, wood waste, agricultural and forestry residues or other renewable resources like industrial waste;
- ii. ‘biodiesel’: a methyl or ethyl ester of fatty acids produced from non-edible vegetable oils, acid oil, used cooking oil or animal fat and bio-oil;
- iii. ‘Advanced biofuels’: Fuels which are (1) produced from lignocellulosic feedstocks (i.e. agricultural and forestry residues, e.g. rice & wheat straw/corn cobs & stover/bagasse, woody biomass), non-food crops (i.e. grasses, algae), or industrial waste and residue streams, (2) having low CO₂ emission or high GHG reduction and do not compete with food crops for land use. Fuels such as Second Generation (2G) Ethanol, Drop-in fuels, algae based 3G biofuels, bio-CNG, bio-methanol, Di Methyl Ether (DME) derived from bio-methanol, bio-hydrogen, drop in fuels with MSW as the source / feedstock material will qualify as “Advanced Biofuels”.
- iv. ‘drop-in fuels’: Any liquid fuel produced from Biomass, agri-residues, wastes such as Municipal Solid Wastes (MSW), Plastic wastes, Industrial wastes etc. which meets the Indian standards for MS, HSD and Jet fuel, in pure or blended form, for its subsequent utilization in vehicles without any modifications in the engine systems and can utilize existing petroleum distribution system.
- v. ‘bio-CNG’: Purified form of bio-Gas whose composition & energy potential is similar to that of fossil based natural gas and is produced from agricultural residues, animal dung, food waste, MSW and Sewage water.

Renewable Purchase Obligations

- DISCOMs are required to have certain proportion of clean energy supplies
- Under the Electricity Act 2003 and the National Tariff Policy 2006
- Fixed by state power regulators
- RPOs are categorized as Solar and Non Solar RPO.

Renewable Energy Certificates

- market-based instrument to promote renewable sources of energy
- equivalent to 1 MWh of electricity injected into the grid from renewable energy sources
- traded on two power exchanges – Indian Energy Exchange (IEX) and Power Exchange of India (PXIL)
- contained between the 'floor price' (minimum price) and 'forbearance price' (maximum price) specified by the **Central Electricity Regulatory Commission** (CERC).
- distribution companies, Open Access consumer, Captive Power Plants (CPPs) are eligible of purchasing the REC.



Hydrogen

- Benefits of Hydrogen as source of Energy:
 - Renewability: Use of Water
 - High Energy Density
 - Clean burning
 - Efficiency: Fuel cells can be 80% efficient
- Challenges:
 - Production
 - Storage and Transportation
 - Cost
 - Safety
 - Lack of Infrastructure

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Hydrogen Color Spectrum based on source

	Terminology	Technology	Feedstock/ Electricity source	GHG footprint*
PRODUCTION VIA ELECTRICITY	Green Hydrogen		Wind Solar Hydro Geothermal Tidal	
	Purple/Pink Hydrogen	Electrolysis	Nuclear	Minimal
	Yellow Hydrogen		Mixed-origin grid energy	Medium
PRODUCTION VIA FOSSIL FUELS	Blue Hydrogen	Natural gas reforming Gasification + CCUS	Natural gas coal	Low
	Turquoise Hydrogen	Pyrolysis	Natural gas	Solid carbon (by-product)
	Grey Hydrogen	Natural gas reforming		Medium
	Brown Hydrogen		Brown coal (lignite)	
	Black Hydrogen	Gasification	Black coal	High

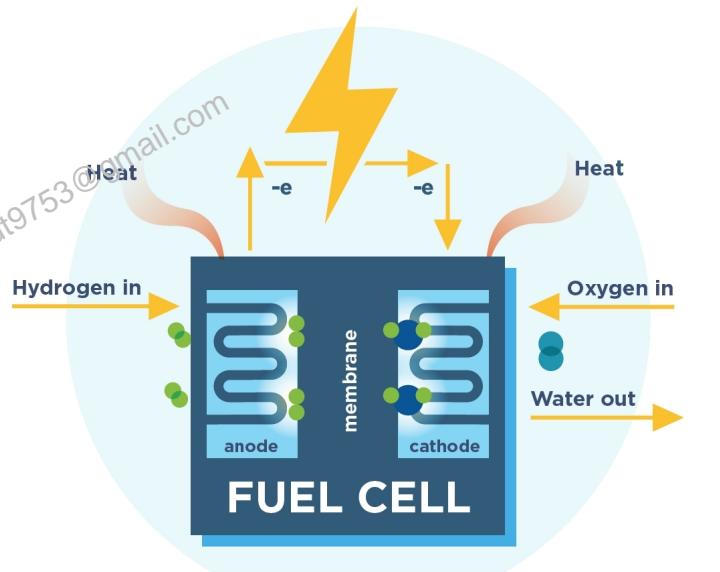
* GHG footprint given as a general guide but it is accepted that each category can be higher in some cases.

Expert

Hydrogen

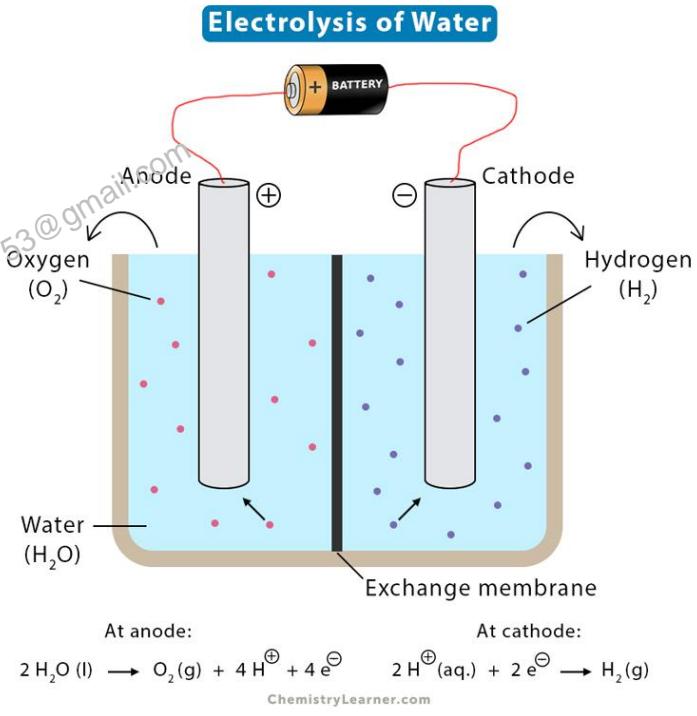
- Fuel cells:

- uses the chemical energy of hydrogen or other fuels to cleanly and efficiently produce electricity.
- hydrogen is the fuel, the only products are electricity, water, and heat.
- can provide power for systems as large as a utility power station and as small as a laptop computer.
- they do not run down or need recharging.
- They produce electricity and heat as long as fuel is supplied
- All batteries: negative electrode (anode) and a positive electrode (or cathode)—sandwiched around an electrolyte.
- hydrogen, is fed to the anode, and air is fed to the cathode.



Hydrogen

- National Green Hydrogen Mission:
 - green hydrogen production capacity: 5 Million Metric Tonne per annum
 - with an addition of about 125 GW
 - Rs. 8 lakh crore investments
 - 6 lakh jobs
 - reduction in fossil fuel imports over Rs. 1 lakh crore
 - Abatement of nearly 50 MMT of annual greenhouse gas emissions

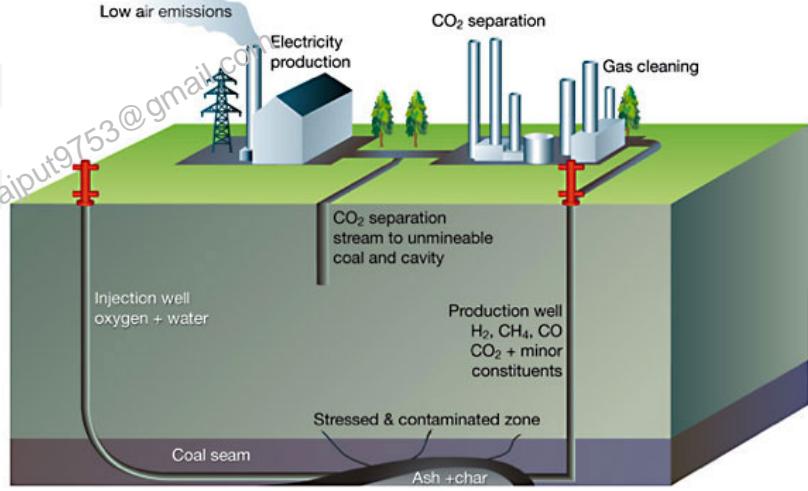


Hydrogen

- National Green Hydrogen Mission:
 - creation of export opportunities for Green Hydrogen and its derivatives
 - Decarbonisation of industrial, mobility and energy sectors
 - development of indigenous manufacturing capabilities
 - development of cutting-edge technologies
 - Under the Strategic Interventions for Green Hydrogen Transition Programme (SIGHT), two distinct financial incentive mechanisms – targeting domestic manufacturing of electrolyzers and production of Green Hydrogen – will be provided under the Mission.
 - a public-private partnership framework for R&D (Strategic Hydrogen Innovation Partnership – SHIP) will be facilitated
 - A coordinated skill development programme will also be undertaken under the Mission.
 - Under MNRE

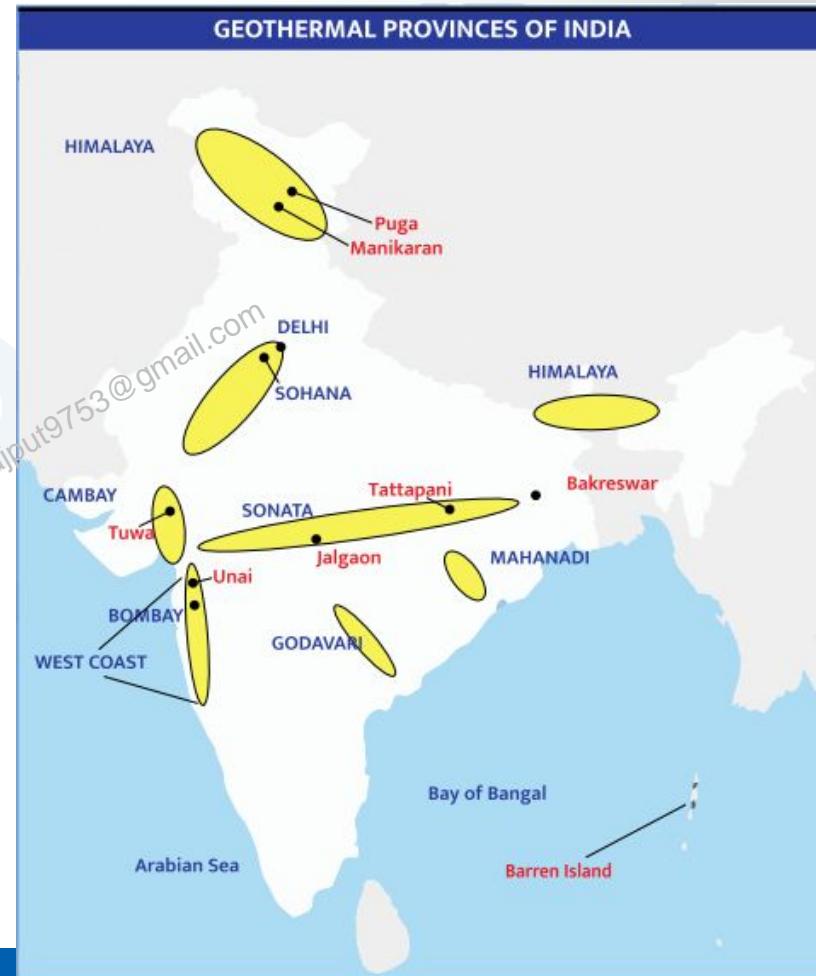
Coal Gasification

- Gasification of coal is a process in which coal is partially oxidized by air, oxygen, steam or carbon dioxide under controlled conditions to produce a fuel gas. (Syn Gas – $\text{CO} + \text{H}_2 + \text{CO}_2, \text{CH}_4$)
- The hydrogen obtained from coal gasification can be used for various purposes such as
 - making ammonia, powering a hydrogen economy, or upgrading fossil fuels.
- The by-products of coal gas manufacture included
 - coke, coal tar, sulfur and ammonia; all useful products.
 - Dyes, medicines, including sulfa drugs, saccharin and many organic compounds are therefore derived from coal gas.



Geothermal

- India's first-ever geothermal field development project in Leh
- thermal energy generated and stored inside the Earth's crust.
- electricity generated from the heat source within the earth's crust.
- 7 geothermal provinces in India:
 - Himalayas - Ladakh, Manikaran, Tapoban
 - Sohana - Haryana, Rajasthan
 - West coast – Maharashtra
 - Cambay – Khambet
 - Son-Narmada-Tapi (SONATA) - Tatapani, Anhoni-Samoni
 - Godavari – Manuguru
 - Mahanadi – Bakreshwar



➤ Installed Generation Capacity (Fuel wise) as on 31.12.2023 :

	Category	Installed Generation Capacity (MW)	% Share in Total
Fossil Fuel	Coal	2,07,776	48.5%
	Lignite	6,620	1.5%
	Gas	25,038	5.8%
	Diesel	589	0.1%
	Total Fossil Fuel :	2,40,023	56.0%

India's Energy Production

Non-Fossil Fuel	RES (Incl. Hydro)	1,80,796	42.2%
	Hydro	46,910	11.0%
	Wind, Solar & Other RE	1,33,886	31.3%
	Wind	44,736	10.4%
	Solar	73,318	17.1%
	BM Power/Cogen.	10,262	2.4%
	Waste to Energy	583	0.1%
	Small Hydro Power	4,987	1.2%
	Nuclear	7,480	1.7%
Total Non-Fossil Fuel :		1,88,276	44.0%

➤ **Installed Generation Capacity (Sector wise) as on 31.12.2023 :**

Sector	Installed Generation Capacity (MW)	% Share in Total
Central Sector	1,02,275	23.9%
State Sector	1,06,333	24.8%
Private Sector	2,19,691	51.3%
Total Installed Capacity	4,28,299	100.0%

India's Energy Production

With reference to technologies for solar power production, consider the following statements :

1. 'Photovoltaics' is a technology that generates electricity by direct conversion of light into electricity, while 'Solar Thermal' is a technology that utilizes the Sun's rays to generate heat which is further used in electricity generation process.
2. Photovoltaics generates Alternating Current (AC), while Solar Thermal generates Direct Current (DC).
3. India has manufacturing base for Solar Thermal technology, but not for Photovoltaics.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1, 2 and 3
- (d) None

2014

Biomass gasification is considered to be one of the sustainable solutions to the power crisis in India. In this context, which of the following statements is/are correct?

1. Coconut shells, groundnut shells and rice husk can be used in biomass gasification.
2. The combustible gases generated from biomass gasification consist of hydrogen and carbon dioxide only.
3. The combustible gases generated from biomass gasification can be used for direct heat generation but not in internal combustion engines.

Select the correct answer using the codes given below :

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2012

With reference to 'fuel cells' in which hydrogen-rich fuel and oxygen are used to generate electricity, consider the following statements :

1. If pure hydrogen is used as a fuel, the fuel cell emits heat and water as by-products.
2. Fuel cells can be used for powering buildings and not for small devices like laptop computers.
3. Fuel cells produce electricity in the form of Alternating Current (AC).

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2015

- 'Net metering' is sometimes seen in the news in the context of promoting the
- (a) production and use of solar energy by the households/consumers
 - (b) use of piped natural gas in the kitchens of households
 - (c) installation of CNG kits in motor-cars
 - (d) installation of water meters in urban households

It is possible to produce algae based biofuels, but what is/are the likely limitation(s) of developing countries in promoting this industry ?

1. Production of algae based biofuels is possible in seas only and not on continents.
2. Setting up and engineering the algae based biofuel production requires high level of expertise/technology until the construction is completed.
3. Economically viable production necessitates the setting up of large scale facilities which may raise ecological and social concerns.

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

2017

In the context of proposals to the use of hydrogen-enriched CNG (H-CNG) as fuel for buses in public transport, consider the following statements :

1. The main advantage of the use of H-CNG is the elimination of carbon monoxide emissions.
2. H-CNG as fuel reduces carbon dioxide and hydrocarbon emissions.
3. Hydrogen up to one-fifth by volume can be blended with CNG as fuel for buses.
4. H-CNG makes the fuel less expensive than CNG.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 4 only
- (d) 1, 2, 3 and 4

2019

According to India's National Policy on Biofuels, which of the following can be used as raw materials for the production of biofuels ?

1. Cassava
2. Damaged wheat grains
3. Groundnut seeds
4. Horse gram
5. Rotten potatoes
6. Sugar beet

Select the correct answer using the code given below :

- (a) 1, 2, 5 and 6 only
- (b) 1, 3, 4 and 6 only
- (c) 2, 3, 4 and 5 only
- (d) 1, 2, 3, 4, 5 and 6

2020

Consider the following statements :

1. Gujarat has the largest solar park in India.
2. Kerala has a fully solar powered International Airport.
3. Goa has the largest floating solar photovoltaic project in India.

Which of the statements given above is/are correct ?

- (a) 1 and 2
- (b) 2 only
- (c) 1 and 3
- (d) 3 only

2022

Consider the following heavy industries :

- 1. Fertilizer plants**
- 2. Oil refineries**
- 3. Steel plants**

Green hydrogen is expected to play a significant role in decarbonizing how many of the above industries?

- (a) Only one**
- (b) Only two**
- (c) All three**
- (d) None**

2023

With reference to green hydrogen, consider the following statements :

1. It can be used directly as a fuel for internal combustion.
2. It can be blended with natural gas and used as fuel for heat or power generation.
3. It can be used in the Hydrogen fuel cell to run vehicles.

How many of the above statements are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

2023

Afforestation

- Significance of Forest as an ecosystem
- Forest Conservation
 - At Global Scale : REDD and REDD+
 - At National Scale

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Very Dense Forest



Moderately Dense Forest



Open Forest



Mangroves

With reference to 'Forest Carbon Partnership Facility', which of the following statements is/are correct?

1. It is a global partnership of governments, businesses, civil society and indigenous peoples.
2. It provides financial aid to universities, individual scientists and institutions involved in scientific forestry research to develop eco-friendly and climate adaptation technologies for sustainable forest management.
3. It assists the countries in their 'REDD+' (Reducing Emissions from Deforestation and Forest Degradation+) efforts by providing them with financial and technical assistance.

Select the correct answer using the code given below.

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2015

2016

Which of the following best describes/
describe the aim of 'Green India
Mission' of the Government of India?

1. Incorporating environmental benefits and costs into the Union and State Budgets thereby implementing the 'green accounting'
2. Launching the second green revolution to enhance agricultural output so as to ensure food security to one and all in the future
3. Restoring and enhancing forest cover and responding to climate change by a combination of adaptation and mitigation measures

Select the correct answer using the code given below.

- (a) 1 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

Which of the following statements is/are correct?

Proper design and effective implementation of UN-REDD+ Programme can significantly contribute to

1. protection of biodiversity
2. resilience of forest ecosystems
3. poverty reduction

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

2016

Consider the following statements :

1. The definition of “Critical Wildlife Habitat” is incorporated in the Forest Rights Act, 2006.
2. For the first time in India, Baigas have been given Habitat Rights.
3. Union Ministry of Environment, Forest and Climate Change officially decides and declares Habitat Rights for Primitive and Vulnerable Tribal Groups in any part of India.

2018

Which of the statements given above is/are correct ?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

Consider the following statements :

1. As per law, the Compensatory Afforestation Fund Management and Planning Authority exists at both National and State levels.
2. People's participation is mandatory in the compensatory afforestation programmes carried out under the Compensatory Afforestation Fund Act, 2016.

2019

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

With reference to the 'New York Declaration on Forests', which of the following statements are correct?

1. It was first endorsed at the United Nations Climate Summit in 2014.
2. It endorses a global timeline to end the loss of forests.
3. It is a legally binding international declaration.
4. It is endorsed by governments, big companies and indigenous communities.
5. India was one of the signatories at its inception.

Select the correct answer using the code given below.

- (a) 1, 2 and 4
- (b) 1, 3 and 5
- (c) 3 and 4
- (d) 2 and 5

2021

At the national level, which ministry is the nodal agency to ensure effective implementation of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006?

- (a) Ministry of Environment, Forest and Climate Change
- (b) Ministry of Panchayati Raj
- (c) Ministry of Rural Development
- (d) Ministry of Tribal Affairs

2022

The “Miyawaki method” is well known for the :

- (a) Promotion of commercial farming in arid and semi-arid areas
- (b) Development of gardens using genetically modified flora
- (c) Creation of mini forests in urban areas
- (d) Harvesting wind energy on coastal areas and on sea surfaces

Consider the following States :

1. Chhattisgarh
2. Madhya Pradesh
3. Maharashtra
4. Odisha

With reference to the States mentioned above, in terms of percentage of forest cover to the total area of State, which one of the following is the correct ascending order?

- (a) 2-3-1-4
- (b) 2-3-4-1
- (c) 3-2-4-1
- (d) 3-2-1-4

2019

Consider the following statements :

1. As per recent amendment to the Indian Forest Act, 1927, forest dwellers have the right to fell the bamboos grown on forest areas.

2. As per the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, bamboo is a minor forest produce.

3. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 allows ownership of minor forest produce to forest dwellers.

Which of the statements given above is/are correct?

2019

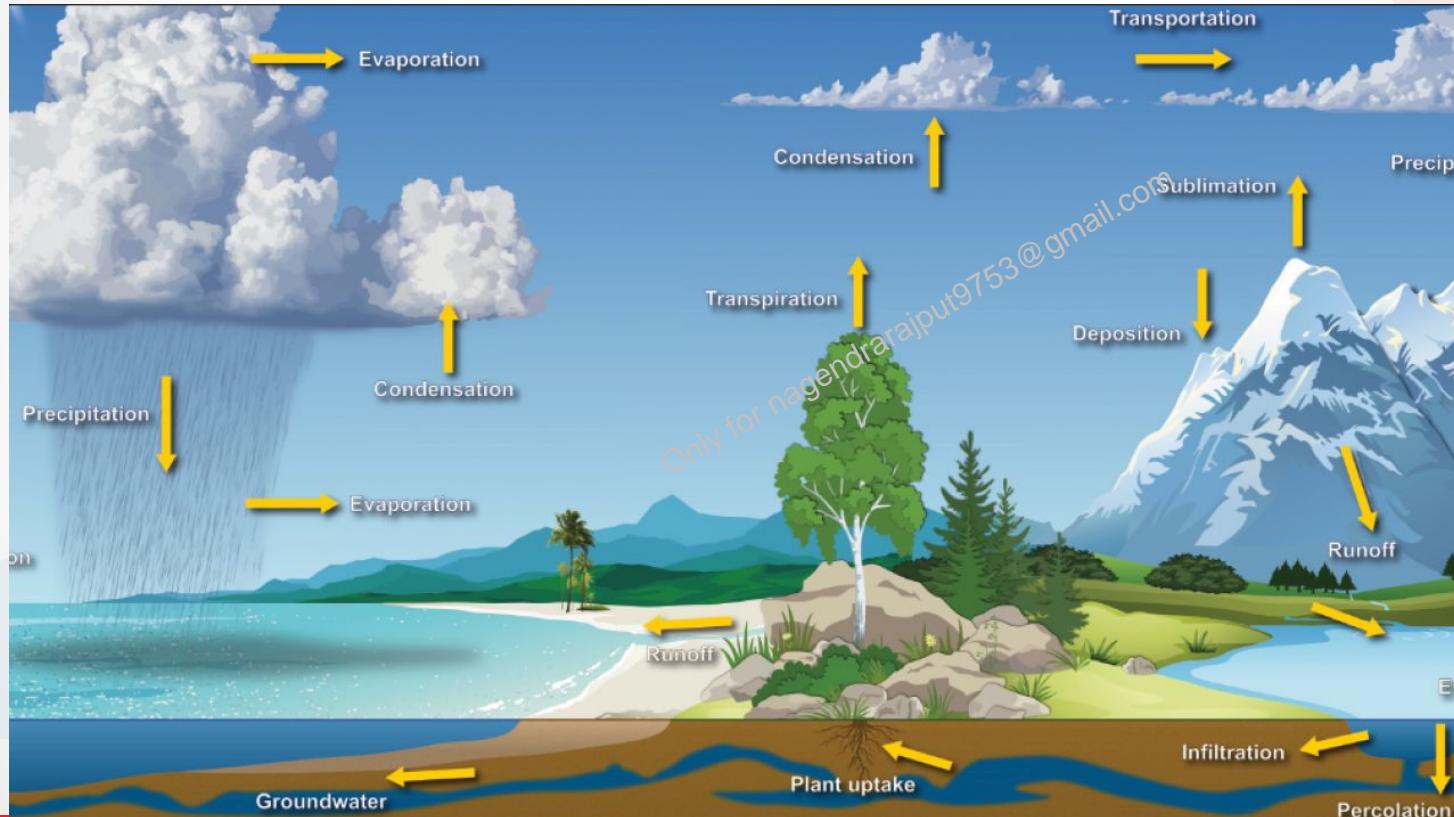
(a) 1 and 2 only

(b) 2 and 3 only

(c) 3 only

(d) 1, 2 and 3

Water Conservation



Water Conservation

Water source	Water volume, in cubic miles	Water volume, in cubic kilometers	Percent of freshwater	Percent of total water
Oceans, Seas, & Bays	321,000,000	1,338,000,000	--	96.54
Ice caps, Glaciers, & Permanent Snow	5,773,000	24,064,000	68.7	1.74
Groundwater	5,614,000	23,400,000	--	1.69
Fresh	2,526,000	10,530,000	30.1	0.76
Saline	3,088,000	12,870,000	--	0.93
Soil Moisture	3,959	16,500	0.05	0.001
Ground Ice & Permafrost	71,970	300,000	0.86	0.022
Lakes	42,320	176,400	--	0.013
Fresh	21,830	91,000	0.26	0.007
Saline	20,490	85,400	--	0.006
Atmosphere	3,095	12,900	0.04	0.001
Swamp Water	2,752	11,470	0.03	0.0008
Rivers	509	2,120	0.006	0.0002
Biological Water	269	1,120	0.003	0.0001

Water Conservation

Source of Fresh Water	Percentage
Ice Caps, Glaciers and Permanent snow	68.66%
Ground Water	30.1%
Ground Ice and Permafrost	0.86%
Lakes	0.26%
Soil Moisture	0.05%
Atomosphere	0.04%
Swamp Water	0.03%
Rivers	0.006%
Biological Water	0.003%

Water Conservation

- Annual per-capita water availability
 - < 1700 cubic meters: water stressed
 - < 1000 cubic meters water scarce
- India
 - 18% of the world's population, but only 4% of its water resources.
 - Per capita availability: 1486 cubic meters in 2021
 - Largest use of groundwater resources
 - 25% of global groundwater extraction
 - Agriculture (90%)
- Impact
 - Lowering Groundwater Table
 - Increase in concentration of contaminant
 - Cost of extraction
 - Land subsidence
 - Salt water intrusion in coastal areas

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Water Conservation

- Challenges
 - Monsoon variability and inadequate rainfall
 - Continuing increase in demand because of rising population, industrial activity
 - Agricultural policies: MSP regime, water intensive crops, free subsidy on electricity
 - Growing concretization
 - Sand mining
 - Hard rock terrain in southern states
- Government Initiatives:
 - National Water Policy 2012
 - Pradhan Mantri Krishi Sinchayee Yojana
 - Per drop more crop
 - Watershed development
 - Neeranchal Watershed development
 - Atal Bhujal Yojana
 - Jal Jeevan Mission
 - Jal Shakti Abhiyaan
 - Guidelines for groundwater regulation

Water Conservation

- **Government Institutions**
 - Central Water Commission
 - Central Ground Water Board
 - Central Ground Water Authority
- **Step Forward**
 - Preventing misuse in agriculture: Irrigation techniques – Crop diversification, drip irrigation
 - Artificial Recharge Techniques
 - Monitoring
 - Watershed Development
 - Rainwater Harvesting

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Water Conservation

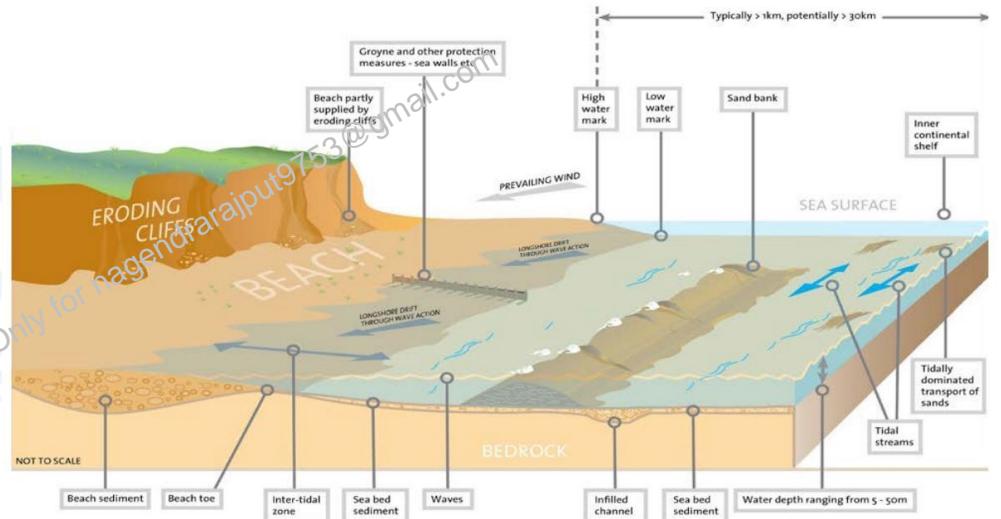
- **National Water Policy, 2012:**

- need for a national water framework law
- Except basic necessities water be treated as economic good so as to promote its conservation and efficient use.
- Ecological needs of the river
- Adaptation strategies in view of climate change
- Water Audits
- Setting up of Water Regulatory Authority
- Reuse and Recycle
- Water Users Associations should be given statutory powers to collect and retain a portion of water charges
- Removal of large disparity in stipulations for water supply
- community participation
- grants to the States to update technology

Sand Mining

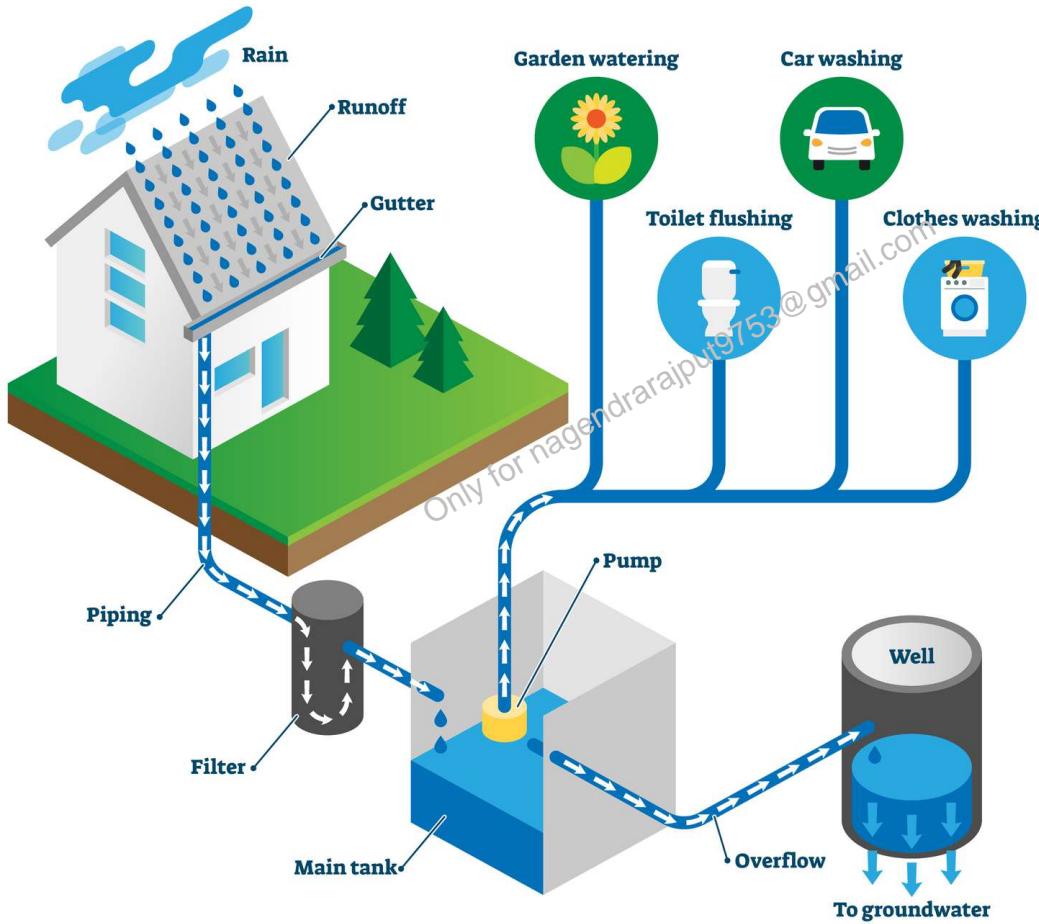
- Sand – a minor mineral as per Mines and Mineral (Development and Regulation) Act, 1957
- Environmental Impact:
 - River course change
 - Bank Erosion
 - Flooding
 - Lowering of Groundwater table
 - Biodiversity loss
- Steps taken:
 - empowers **state governments** to frame rules
 - Districts to have comprehensive mining plan
 - Define the mining and no mining zones: Prefer abandoned stream channels
 - No Riverbed mining in Monsoon
 - Use of technology
 - Annual audit of mining lease
 - Online portal for sale and purchase of sand and river bed material

Figure 1: Key features and processes considered in a coastal impact study for aggregate dredging



Source: (BMAPA and The Crown Estate 2013 p.41)

RAINWATER HARVESTING



If National Water Mission is properly and completely implemented, how will it impact the country?

1. Part of the water needs of urban areas will be met through recycling of wastewater.
2. The water requirements of coastal cities with inadequate alternative sources of water will be met by adopting appropriate technologies that allow for the use of ocean water.
3. All the rivers of Himalayan origin will be linked to the rivers of peninsular India.
4. The expenses incurred by farmers for digging bore-wells and for installing motors and pump-sets to draw ground-water will be completely reimbursed by the Government.

2012

Select the correct answer using the codes given below :

- (a) 1 only
- (b) 1 and 2 only
- (c) 3 and 4 only
- (d) 1, 2, 3 and 4

What is the role of ultraviolet (UV) radiation in the water purification systems?

1. It inactivates/kills the harmful microorganisms in water.
2. It removes all the undesirable odours from the water.
3. It quickens the sedimentation of solid particles, removes turbidity and improves the clarity of water.

2012

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2013

On the planet earth, most of the freshwater exists as ice caps and glaciers. Out of the remaining freshwater, the largest proportion

- (a) is found in atmosphere as moisture and clouds
- (b) is found in freshwater lakes and rivers
- (c) exists as groundwater
- (d) exists as soil moisture

2022

Which one of the following has been constituted under the Environment (Protection) Act, 1986 ?

- (a) Central Water Commission
- (b) Central Ground Water Board
- (c) Central Ground Water Authority
- (d) National Water Development Agency

Which of the following is/are the possible consequence/s of heavy sand mining in riverbeds ?

1. Decreased salinity in the river
 2. Pollution of groundwater
 3. Lowering of the water-table

Select the correct answer using the code given below :

2018

- (a) 1 only
 - (b) 2 and 3 only
 - (c) 1 and 3 only
 - (d) 1, 2 and 3

Consider the following statements :

1. 36% of India's districts are classified as "overexploited" or "critical" by the Central Ground Water Authority (CGWA).
2. CGWA was formed under the Environment (Protection) Act.
3. India has the largest area under groundwater irrigation in the world.

2020

Which of the statements given above is/are correct ?

- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1 and 3 only

With reference to the water on the planet Earth, consider the following statements :

1. The amount of water in the rivers and lakes is more than the amount of groundwater.
2. The amount of water in polar ice caps and glaciers is more than the amount of groundwater.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2021

Consider the following statements :

Statement-I :

According to the United Nations' 'World Water Development Report, 2022', India extracts more than a quarter of the world's groundwater withdrawal each year.

Statement-II :

India needs to extract more than a quarter of the world's groundwater each year to satisfy the drinking water and sanitation needs of almost 18% of world's population living in its territory.

Which one of the following is correct in respect of the above statements?

- (a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I
- (b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I
- (c) Statement-I is correct but Statement-II is incorrect
- (d) Statement-I is incorrect but Statement-II is correct

2023

Sustainable Agriculture

- Issues with Modern Agriculture practices
- How to achieve sustainability in Agriculture
- Steps taken by Government of India
- FAO GIAHS sites



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Sustainable Agriculture

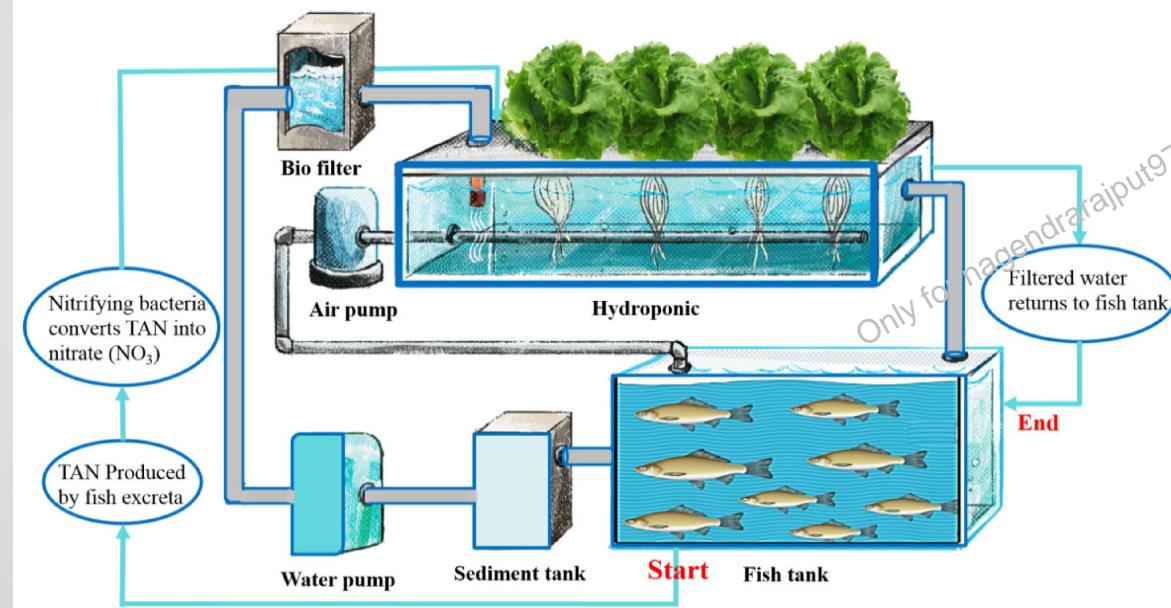


Sustainable Agriculture



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Sustainable Agriculture



Sustainable Agriculture



Sustainable Agriculture



Permaculture

Some Important Acts

- Environment Protection Act, 1986
- NGT Act, 2002

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Coastal Regulation Zone Notification, 2011

Index

CRZ I: Eco-sensitive and intertidal areas

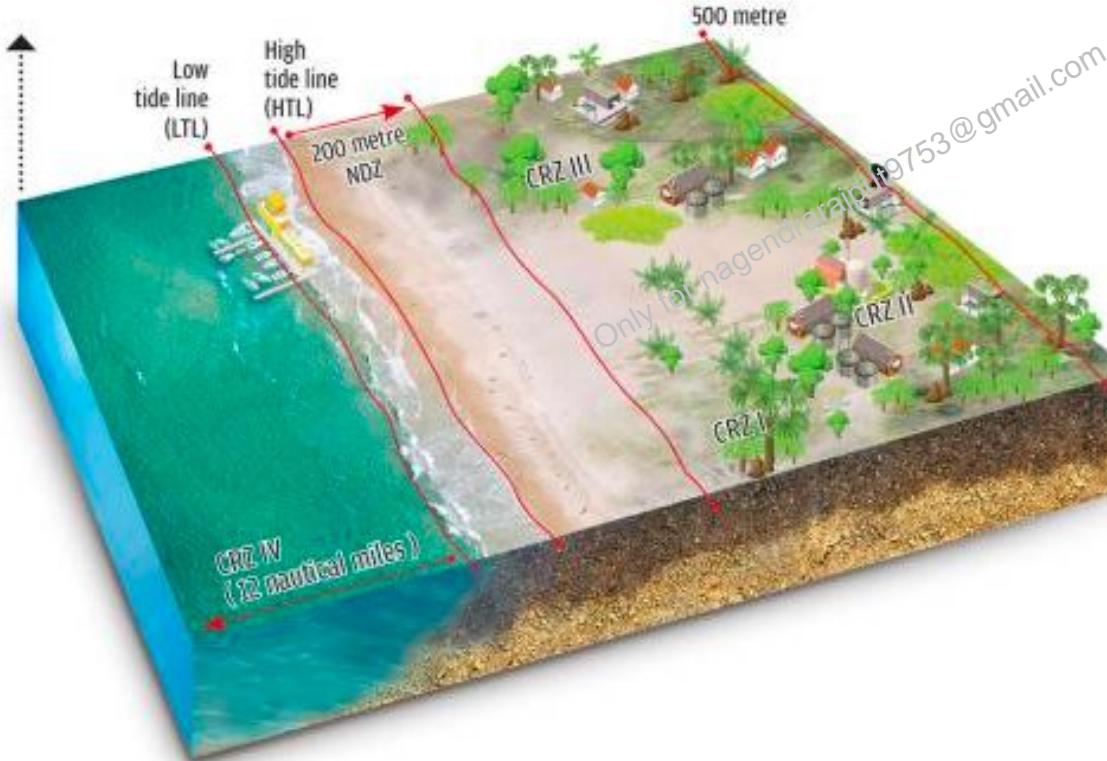
CRZ II: Areas which have been developed up to or close to the shore

CRZ III: Areas that are relatively undisturbed and do not fall under CRZ-I or CRZ-II

CRZ IV: Area between Low Tide Line and 12 nautical miles into the sea/ tidal influenced waterbodies

NDZ: No development zone that extends up to 200 m from High Tide Line towards land in CRZ-III area

Under Environment Protection Act, 1986



Coastal Regulation Zone Notification, 2018



Index

CRZ I A: Eco-sensitive areas

CRZ I B: Inter-tidal areas

CRZ II: Areas which have been developed up to or close to the shore

CRZ III A: CRZ-III areas, where the population density is more than 2,161 sq km as per 2011 Census

CRZ III B: Areas with population density of less than 2,161 per sq km, as per 2011 Census

CRZ IV A: 12 nautical miles from the Low Tide Line towards the sea

CRZ IV B: Tidal influenced waterbodies

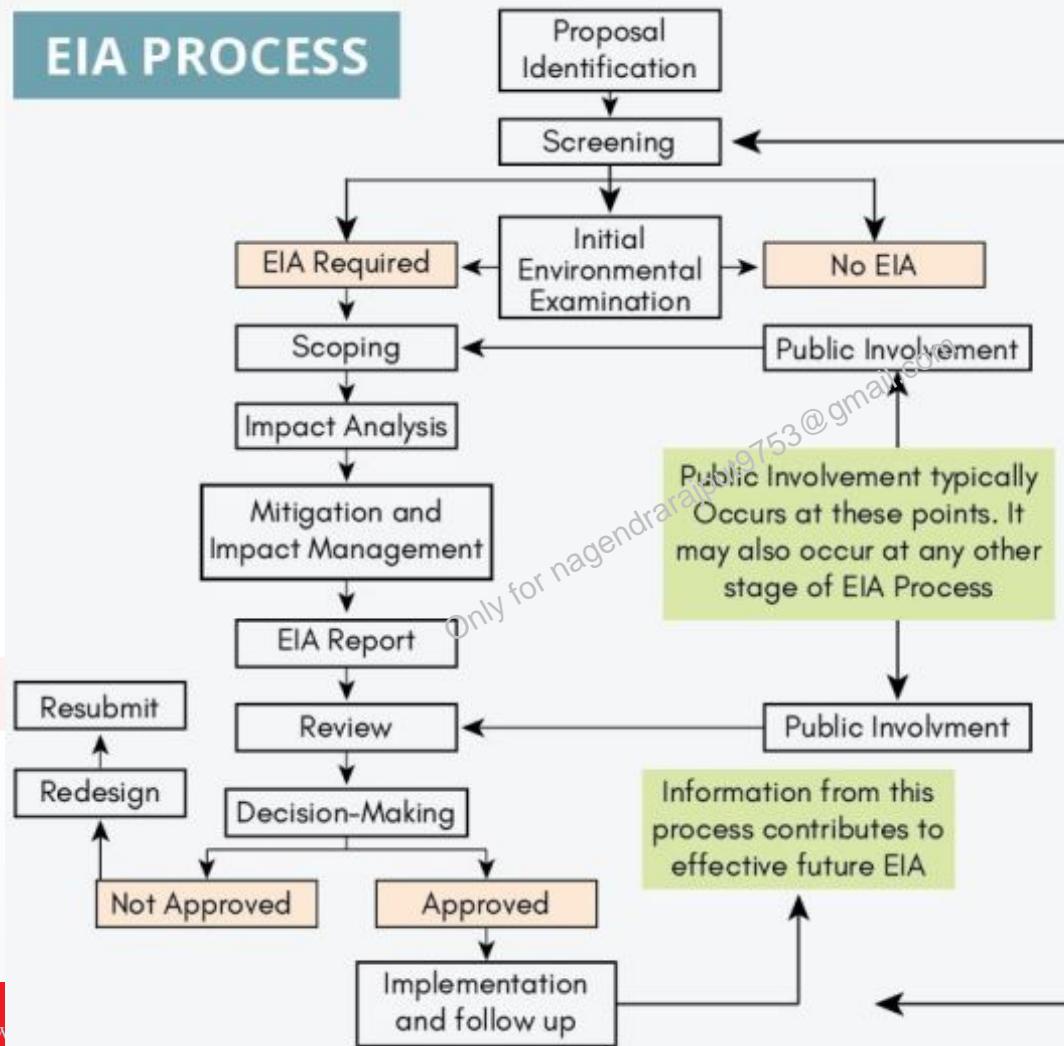
NDZ: 50 metres from High Tide Line in CRZ III A areas, 200 m from HTL in CRZ-III B areas

Environmental Impact Assessment

- Meaning
- Steps
- EIA in India
 - Draft EIA 2020

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EIA PROCESS



Consider the following kinds of organisms :

1. Bacteria.
2. Fungi
3. Flowering plants

2012

Some species of which of the above kinds of organisms are employed as biopesticides?

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Government of India encourages the cultivation of 'sea buckthorn'. What is the importance of this plant?

1. It helps in controlling soil erosion and in preventing desertification.
2. It is a rich source of biodiesel.
3. It has nutritional value and is well-adapted to live in cold areas of high altitudes.
4. Its timber is of great commercial value.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2, 3 and 4 only
- (c) 1 and 3 only
- (d) 1, 2, 3 and 4

2012

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RION INNOVATION

Consider the 'following' agricultural practices :

1. Contour bunding
2. Relay cropping
3. Zero tillage

In the context of global climate change, which of the above helps/help in carbon sequestration/storage in the soil?

- (a) 1 and 2 only
- (b) 3 only
- (c) 1, 2 and 3
- (d) None of them

2012

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2013

With reference to the usefulness of the by-products of sugar industry, which of the following statements is/are correct?

1. Bagasse can be used as biomass fuel for the generation of energy.
2. Molasses can be used as one of the feedstocks for the production of synthetic chemical fertilizers.
3. Molasses can be used for the production of ethanol.

Select the correct answer using the codes given below.

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

IAS
ATION

2013

Consider the following organisms :

1. Agaricus
2. Nostoc
3. Spirogyra

Which of the above is/are used as biofertilizer/biofertilizers?

- (a) 1 and 2
- (b) 2 only
- (c) 2 and 3
- (d) 3 only

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What are the significances of a practical approach to sugarcane production known as 'Sustainable Sugarcane Initiative'?

1. Seed cost is very low in this compared to the conventional method of cultivation.
2. Drip irrigation can be practiced very effectively in this.
3. There is no application of chemical/inorganic fertilizers at all in this.
4. The scope for intercropping is more in this compared to the conventional method of cultivation.

Select the correct answer using the code given below.

- (a) 1 and 3 only
- (b) 1, 2 and 4 only
- (c) 2, 3 and 4 only
- (d) 1, 2, 3 and 4

2014

Consider the following statements :

1. Animal Welfare Board of India is established under the Environment (Protection) Act, 1986.
2. National Tiger Conservation Authority is a statutory body.
3. National Ganga River Basin Authority is chaired by the Prime Minister.

Which of the statements given above is/are correct?

2014

- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1, 2 and 3

2014

With reference to 'Eco-Sensitive Zones', which of the following statements is/are correct?

1. Eco-Sensitive Zones are the areas that are declared under the Wildlife (Protection) Act, 1972.
2. The purpose of the declaration of Eco-Sensitive Zones is to prohibit all kinds of human activities in those zones except agriculture.

Select the correct answer using the code given below.

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2015

What can be the impact of excessive/inappropriate use of nitrogenous fertilizers in agriculture?

1. Proliferation of nitrogen-fixing microorganisms in soil can occur.
2. Increase in the acidity of soil can take place.
3. Leaching of nitrate to the ground-water can occur.

Select the correct answer using the code given below.

- (a) 1 and 3 only
- (b) 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

In a particular region in India, the local people train the roots of living trees into robust bridges across the streams. As the time passes, these bridges become stronger. These unique 'living root bridges' are found in

- (a) Meghalaya
- (b) Himachal Pradesh
- (c) Jharkhand
- (d) Tamil Nadu

2015

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The FAO accords the status of 'Globally Important Agricultural Heritage System (GIAHS)' to traditional agricultural systems. What is the overall goal of this initiative?

1. To provide modern technology, training in modern farming methods and financial support to local communities of identified GIAHS so as to greatly enhance their agricultural productivity
2. To identify and safeguard eco-friendly traditional farm practices and their associated landscapes, agricultural biodiversity and knowledge systems of the local communities
3. To provide Geographical Indication status to all the varieties of agricultural produce in such identified GIAHS

Select the correct answer using the code given below.

- (a) 1 and 3 only
- (b) 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

2016

Which of the following is/are the advantage/advantages of practising drip irrigation?

1. Reduction in weed
2. Reduction in soil salinity
3. Reduction in soil erosion

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 3 only
- (c) 1 and 3 only
- (d) None of the above is an advantage of practising drip irrigation

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2016

Which of the following practices can help in water conservation in agriculture ?

1. Reduced or zero tillage of the land
2. Applying gypsum before irrigating the field
3. Allowing crop residue to remain in the field

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2017

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With reference to the ‘Global Alliance for Climate-Smart Agriculture (GACSA)’, which of the following statements is/are correct ?

1. GACSA is an outcome of the Climate Summit held in Paris in 2015.
2. Membership of GACSA does not create any binding obligations.
3. India was instrumental in the creation of GACSA.

2018

Select the correct answer using the code given below :

- (a) 1 and 3 only
- (b) 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

With reference to the circumstances in Indian agriculture, the concept of “Conservation Agriculture” assumes significance. Which of the following fall under the Conservation Agriculture ?

1. Avoiding the monoculture practices
2. Adopting minimum tillage
3. Avoiding the cultivation of plantation crops
4. Using crop residues to cover soil surface
5. Adopting spatial and temporal crop sequencing/crop rotations

Select the correct answer using the code given below :

- (a) 1, 3 and 4
(b) 2, 3, 4 and 5
(c) 2, 4 and 5
(d) 1, 2, 3 and 5

2018

With reference to agricultural soils, consider the following statements :

1. A high content of organic matter in soil drastically reduces its water holding capacity.
2. Soil does not play any role in the sulphur cycle.
3. Irrigation over a period of time can contribute to the salinization of some agricultural lands.

2018

Which of the statements given above is/are correct ?

- (a) 1 and 2 only
- (b) 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Consider the following statements :

1. Agricultural soils release nitrogen oxides into environment.
2. Cattle release ammonia into environment.
3. Poultry industry releases reactive nitrogen compounds into environment.

Which of the statements given above is/are correct?

- (a) 1 and 3 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1, 2 and 3

2019

Consider the following statements :

The Environment Protection Act, 1986
empowers the Government of India to

1. state the requirement of public participation in the process of environmental protection, and the procedure and manner in which it is sought
2. lay down the standards for emission or discharge of environmental pollutants from various sources

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2019

What is the use of biochar in farming ?

1. Biochar can be used as a part of the growing medium in vertical farming.
2. When biochar is a part of the growing medium, it promotes the growth of nitrogen-fixing microorganisms.
3. When biochar is a part of the growing medium, it enables the growing medium to retain water for longer time.

2020

Which of the statements given above is/are correct ?

- (a) 1 and 2 only
- (b) 2 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

What is/are the advantage/advantages of zero tillage in agriculture ?

1. Sowing of wheat is possible without burning the residue of previous crop.
2. Without the need for nursery of rice saplings, direct planting of paddy seeds in the wet soil is possible.
3. Carbon sequestration in the soil is possible.

2020

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

2020

In the context of India, which of the following is/are considered to be practice(s) of eco-friendly agriculture ?

1. Crop diversification
2. Legume intensification
3. Tensiometer use
4. Vertical farming

Select the correct answer using the code given below :

- (a) 1, 2 and 3 only
- (b) 3 only
- (c) 4 only
- (d) 1, 2, 3 and 4

What are the advantages of fertigation in agriculture ?

1. Controlling the alkalinity of irrigation water is possible.
2. Efficient application of Rock Phosphate and all other phosphatic fertilizers is possible.
3. Increased availability of nutrients to plants is possible.
4. Reduction in the leaching of chemical nutrients is possible.

Select the correct answer using the code given below :

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 1, 3 and 4 only
- (d) 2, 3 and 4 only

2020

How is permaculture farming different from conventional chemical farming?

1. Permaculture farming discourages monocultural practices but in conventional chemical farming, monoculture practices are predominant.
2. Conventional chemical farming can cause increase in soil salinity but the occurrence of such phenomenon is not observed in permaculture farming.
3. Conventional chemical farming is easily possible in semi-arid regions but permaculture farming is not so easily possible in such regions.
4. Practice of mulching is very important in permaculture farming but not necessarily so in conventional chemical farming.

Select the correct answer using the code given below.

- (a) 1 and 3
- (b) 1, 2 and 4
- (c) 4 only
- (d) 2 and 3

2021

In the context of India's preparation for Climate-Smart Agriculture, consider the following statements :

1. The 'Climate-Smart Village' approach in India is a part of a project led by the Climate Change, Agriculture and Food Security (CCAFS), an international research programme.
2. The project of CCAFS is carried out under Consultative Group on International Agricultural Research (CGIAR) headquartered in France.
3. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India is one of the CGIAR's research centres.

Which of the statements given above are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2021

2022

Among the following crops, which one is the most important anthropogenic source of both methane and nitrous oxide ?

- (a) Cotton
- (b) Rice
- (c) Sugarcane
- (d) Wheat

“System of Rice Intensification” of cultivation, in which alternate wetting and drying of rice fields is practised, results in :

1. Reduced seed requirement
2. Reduced methane production
3. Reduced electricity consumption

Select the correct answer using the code given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2022

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With reference to the role of biofilters in Recirculating Aquaculture System, consider the following statements :

1. Biofilters provide waste treatment by removing uneaten fish feed.
2. Biofilters convert ammonia present in fish waste to nitrate.
3. Biofilters increase phosphorus as nutrient for fish in water.

2023

How many of the statements given above are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None