

Environment Class 17

29th March, 2024 at 9:00 AM

NATIONAL SOLAR MISSION (09:07 AM)

- The target was to achieve **100 GW** of installed solar energy capacity by 2022.
- It has been revised to **300 GW by 2030**.

PM SURYODAYA YOJANA

- The centre will subsidize the cost of setting up a rooftop solar system for households that consume less than **300 units** of electricity per month.
- The target is to install rooftop solar panels on **1 crore houses**.
- The household can become a supplier of electricity to the power grid if solar energy supply is more than demand.
- **Net metering** is required to record energy flow in both directions and at the end of the billing period net energy use is calculated

PM KUSUM YOJANA

- **It has three components:**
- Installation of stand-alone solar-powered agricultural pumps.
- Solarization of grid-connected agricultural pumps.
- 10 GW of solar capacity through the installation of small solar power plants with individual capacity up to 2 MW.

SURYA MITRA

- It is a **skill development program** considering the opportunities for employment in growing solar energy power.

INTERNATIONAL SOLAR ALLIANCE

- On the sidelines of the **Paris Agreement 2015**, COP 21, India and France conceptualized the International Solar Alliance.
- It is headquartered in **Gurugram Haryana**.
- All UN members can become part of this alliance.
- It is guided by the Towards 1000s strategy: which aims to mobilise 1000 billion dollars of investment in Solar Energy by 2030 in developing nations.

ONE WORLD ONE SUN ONE GRID (09:33 AM)

- At the first assembly of ISA in 2018, the PM announced this initiative.
- It aims to connect different regional grids with common grids, that will be used to transfer renewable energy power, particularly solar energy.
- It was officially launched at COP26 of UNFCCC.
- **It aims to be implemented in three phases:**
- 1. Interconnection of Middle East, South Asia, and South East Asia.
- 2. This grid is getting interconnected with the African Power grid.
- 3. Global Interconnection

WIND ENERGY (09:40 AM)

- There are two types of Wind Turbines:
- **1. Horizontal Axis Wind Turbine:** The design and installation are complex, they require larger space and depend upon wind direction but they have a higher power coefficient.
- **2. Vertical Axis Wind Turbines:** They are simpler and movement is not dependent upon wind direction but has a lower power coefficient.
- **Challenges:**
- **Intermittency:** Only efficient/functional when strong winds are blowing.
- High initial cost.
- Offshore wind turbines can adversely affect aquatic ecosystem
- **Govt Schemes:**
- **National Wind-Solar Hybrid Policy 2018:**
- For efficient use of land, and transmission infrastructure, to reduce variability in renewable power generation, and to achieve better grid stability.
- **National Offshore-Wind Energy Policy 2015:**
- To promote spatial planning and management of Maritime Renewable Energy Resources in India's EEZ by boosting indigenization.

HYDROGEN AS FUEL (10:04 AM)

- Hydrogen is a great energy source with very high energy density, clean burning, water vapour as the end product, and energy.
- It is also a reliable source of energy, unlike solar or wind.
- Even though hydrogen is the most abundant element in the universe, on Earth and in the atmosphere, it is not available in free form, which allows industrial extraction.
- Different methods of production are used for hydrogen and all these production methods are assigned a color.
- Green Hydrogen:
- It is produced through the electrolysis of water using renewable energy sources solar, wind, tidal, etc.
- Green hydrogen does not produce greenhouse gases during production.
- If we use nuclear energy for electrolysis, we can call it pink or purple hydrogen.
- Grey Hydrogen
- This uses a process called Steam-Methane Reforming.
- $\text{CH}_4 + \text{H}_2\text{O (steam)} = \text{CO} + 3\text{H}_2$
- $\text{CO} + \text{H}_2\text{O} = \text{CO}_2 + \text{H}_2$
- Brown Hydrogen:
- This uses a method called coal gasification.
- It involves the oxidation of coal to produce syngas.
- This follows the water gas shift reaction
- This process generates a large amount of CO_2 and coal tar.
- It has certain benefits: even low-quality coal can be made into syngas and some of the byproducts have utility in industrial processes.
- Turquoise Hydrogen
- It uses a process called methane pyrolysis.
- Environment friendliness depends upon the energy source.
- Blue hydrogen:
- This is similar to grey and brown hydrogen but includes the capture of carbon dioxide.

HOW TO USE HYDROGEN (10:58 AM)

- There are two methods:
- **i. Hydrogen Combustion Engine:**
- It works by burning hydrogen in a combustion chamber similar to how petrol or diesel engine operates.
- It requires air for combustion.
- Hydrogen is ignited in the presence of oxygen which leads to high temperature and high-pressure explosion
- This explosion forces a piston in the engine to move, converting the energy of the explosion into mechanical work moving vehicles or powering a generator.
- **ii. Fuel Cell**
- Fuel cells generate electricity through an electrochemical process similar to batteries but with a continuous supply of fuels.
- The most common type is a proton exchange membrane fuel cell.
- In a fuel cell, there is an anode, where hydrogen molecules are split into electrons and protons through a catalyst.
- A polymer electrolyte membrane allows protons to pass through but electrons are forced through an external circuit to the cathode (oxygen side).
- Where electron combines and form H_2O in the process, an electrical current is produced which can be used to do work.
- Fuel cells have very high efficiency (more than 80 percent).

CHALLENGES IN HYDROGEN AS A SOURCE OF ENERGY

- About 95 percent of hydrogen produced is through steam methane reforming and coal gasification.
- Green hydrogen production is a cleaner method but is very expensive and accounts for less than 5 percent of hydrogen production on a global scale.
- Hydrogen is used to be stored at high pressure in transportation which requires energy-expensive infrastructure
- Another storage can be cryogenic (minus 250 degrees Celsius), this is very costly and energy-intensive.
- Moving hydrogen whether by pipeline road or other methods is challenging and expensive.
- Fuel cells are very expensive due to the use of catalysts like platinum.
- Hydrogen combustion engines are less efficient and contribute to NO_x emissions.
- Hydrogen is highly flammable it's also the smallest and lightest molecule making it prone to leaks.

- **The government of India has announced the National Green Hydrogen Mission with the following Objectives:**
- 5 million metric tons of Green Hydrogen Production Capacity by 2030.
- 125 GW of electricity using green hydrogen.
- Reduction in fossil fuel import over 1 lakh crore rupees.
- 50 million metric tons of reduction of greenhouse gases.
- The mission has a financial incentive mechanism called Strategic Intervention for Green Hydrogen Transition Program.

BIOFUELS

- Biomass is converted to energy through various processes including direct burning, and chemical or biological conversion to a liquid or gaseous fuel.
- Biomass-based energy is considered renewable as inherent energy comes from the sun and it can regrow in a relatively short time.

TYPES OF BIOFUELS

- **Bioethanol:** It is made from the **fermenting and distillation** of crops that are high in carbohydrates such as corn wheat, and sugar cane among others.
- It is often used as an additive to Petrol which reduces CO₂ emission.
- **Biodiesel:**
- It is made from vegetable oil and animal fats.
- It can be used as an additive to diesel fuel in vehicles.
- **Biogas:**
- It is produced by anaerobic digestion of organic matter such as agricultural waste or manure.
- **Bioethanol:**
- Made from wood, organic waste, etc.

GENERATIONS OF BIOFUEL

- **1st Gen Biofuels:** Made from feedstock such as Corn, Wheat, and Sugarcane, among others.
- **2nd Gen Biofuels:** These are made from nonfood feedstock such as agricultural waste, and rotting crops.
- **3rd Gen Biofuels:** Made from seaweed, algae, and others.
- **4th Gen:** This includes genetic engineering to enhance the growth of algae and regeneration which can help further in biofuel production.

NATIONAL POLICY ON BIOFUEL 2018

- It divides biofuel into two categories **basic and advanced**.
- The viability gap funding scheme for ethanol refineries.
- **MSP for nonedible oil.**
- the target of 20 percent blending of ethanol in petrol and 5 percent biodiesel in diesel by 2025.
- It is implemented by the **National Biofuels Coordination Committee** under the Ministry of Petroleum and Natural Gas.
- Export of biofuel will generally not be permitted except with the approval of NBCC.

Topic for the Next Class: Biofuel Continued