4. India’s First Bamboo Based Bio Ethanol Refinery - Environment

World’s largest bamboo-based ethanol plant getting pick of the north east’s grass. India has launched its first bamboo-based bio-ethanol refinery in Assam, a major step for energy self-reliance using Second-Generation (2G) biofuel technology. This project supports India's goal of 20% ethanol blending in petrol and boosts the Northeast's economy by utilizing its vast bamboo resources.

Context - A Milestone in India's Green Energy Transition

Prime Minister Narendra Modi inaugurated India’s first bio-ethanol refinery that uses bamboo as its primary feedstock, located in Assam. This launch is a significant step towards achieving energy self-reliance (*Atmanirbhar Bharat* in energy). The foundation stone for a new Polypropylene unit was also laid at the same refinery complex.

About Bioethanol and Polypropylene

Bioethanol - It is a renewable fuel produced by fermenting biomass such as sugarcane, corn, bamboo, or other plant materials. Its primary application is as a biofuel additive to petrol, which helps reduce carbon emissions and decrease dependence on imported fossil fuels. A Bio-refinery is an industrial plant that converts biomass into a spectrum of products including energy, biofuels, biochemicals, and other biomaterials.

Polypropylene - It is a synthetic resin (a type of plastic) created through the polymerization of propylene.

Key Properties - It is valued for being lightweight, durable, waterproof, and resistant to corrosion. It is also recyclable.

Common Applications - It is widely used in packaging, textiles, pipes, automotive parts, electronic appliances, and medical devices.

Key Features of the Assam Bio-Ethanol Plant

Nature - This is India’s first-of-its-kind bio-refinery using bamboo as the main raw material.

Location - Golaghat district, Assam.

Objective - To produce bio-ethanol as a renewable, alternative, and eco-friendly fuel source.

Raw Material - The plant will process five lakh tonnes of green bamboo annually, sourced from Assam, Arunachal Pradesh, and other northeastern states.

Ownership - It is a joint venture between Numaligarh Refinery Limited (NRL) and two Finnish companies, Fortum and Chempolis OY.

Bamboo in India - A Key Resource

Area and Diversity - India possesses the largest area under bamboo cultivation in the world, covering approximately 13.96 million hectares.

Species Richness - In terms of the number of species, India ranks second globally after China, with 136 different bamboo species.

Annual Production - The country produces around 14.6 million tonnes of bamboo each year.

Suitability for Biofuel - Bamboo is a lignocellulosic biomass, meaning it's a non-food, woody grass. Its cellulose and hemicellulose content can be broken down (hydrolyzed) into sugars, which are then fermented into ethanol. This makes it an ideal feedstock for Second-Generation (2G) Bioethanol, as its use does not create a conflict with food crops.

Significance of the Project

Renewable Energy Boost - This plant leverages the abundant natural bamboo reserves of Assam and the Northeast to produce clean energy.

Economic Impact - It will encourage bamboo cultivation as a cash crop and support allied industries, generating significant employment opportunities in the region.

Strategic Importance - The project directly supports India’s goal of achieving 20% ethanol blending in petrol by 2025, which helps reduce the nation's carbon footprint.

Regional Development - It integrates India's energy independence goals with the expansion of medical and transport infrastructure in Assam.

Government Initiatives Promoting Biofuels

National Policy on Biofuels (2018) - This policy, amended in 2022, advanced the target for 20% ethanol blending in petrol to the Ethanol Supply Year (ESY) 2025-26, up from the original target of 2030. It expanded the list of permissible feedstocks to include sugarcane juice, sugar beet, cassava, and damaged or rotten food grains unfit for human consumption.

Ethanol Blended Petrol (EBP) Programme - Under this program, India successfully achieved its **20% ethanol blending target in 2025**, five years ahead of schedule.

Repurpose Cooking Oil (RUCO) Initiative - This project focuses on collecting used cooking oil from restaurants and kitchens and converting it into biodiesel.

Classification of Biofuels by Generation

First-Generation (1G) -

Feedstock - Edible food crops (sugarcane, corn, wheat, soybean oil).

Limitation - Creates a "Food vs. Fuel" conflict, threatening food security.

Second-Generation (2G) -

Feedstock - Non-edible biomass (crop residues like rice husk, forest residues like bamboo).

Advantage - Avoids food security issues and utilizes waste materials.

Third-Generation (3G) -

Feedstock - Microorganisms like algae.

Advantage - Very high yield per hectare and does not compete for agricultural land. Still in the R&D phase.

Fourth-Generation (4G) -

Feedstock - Genetically engineered algae and microbes.

Technology - Integrates carbon capture with biofuel production, making it potentially carbon-neutral or even carbon-negative. Highly futuristic.

India's Global Standing in the Energy Sector

1. **Biofuels -** 3rd largest producer globally.
2. **LNG (Liquefied Natural Gas) -** 4th largest terminal capacity in the world.
3. **Refining Capacity -** 4th largest globally.
4. **Refined Petroleum Exports -** 7th largest exporter.

Source - https - //www.thehindu.com/news/national/assam/worlds-largest-bamboo-based-ethanol-plant-getting-pick-of-the-north-easts-grass/article70057359.ece