



## World Biofuels Day 2024

**For Prelims:** Biofuels, Types of Biofuels, [Ethanol Blending Program \(EBP\)](#), [National Policy on Biofuels](#), Differential Ethanol Pricing.

**For Mains:** Ethanol, Ethanol Blending Program: Significance, Challenges, Government Policies and Way Forward.

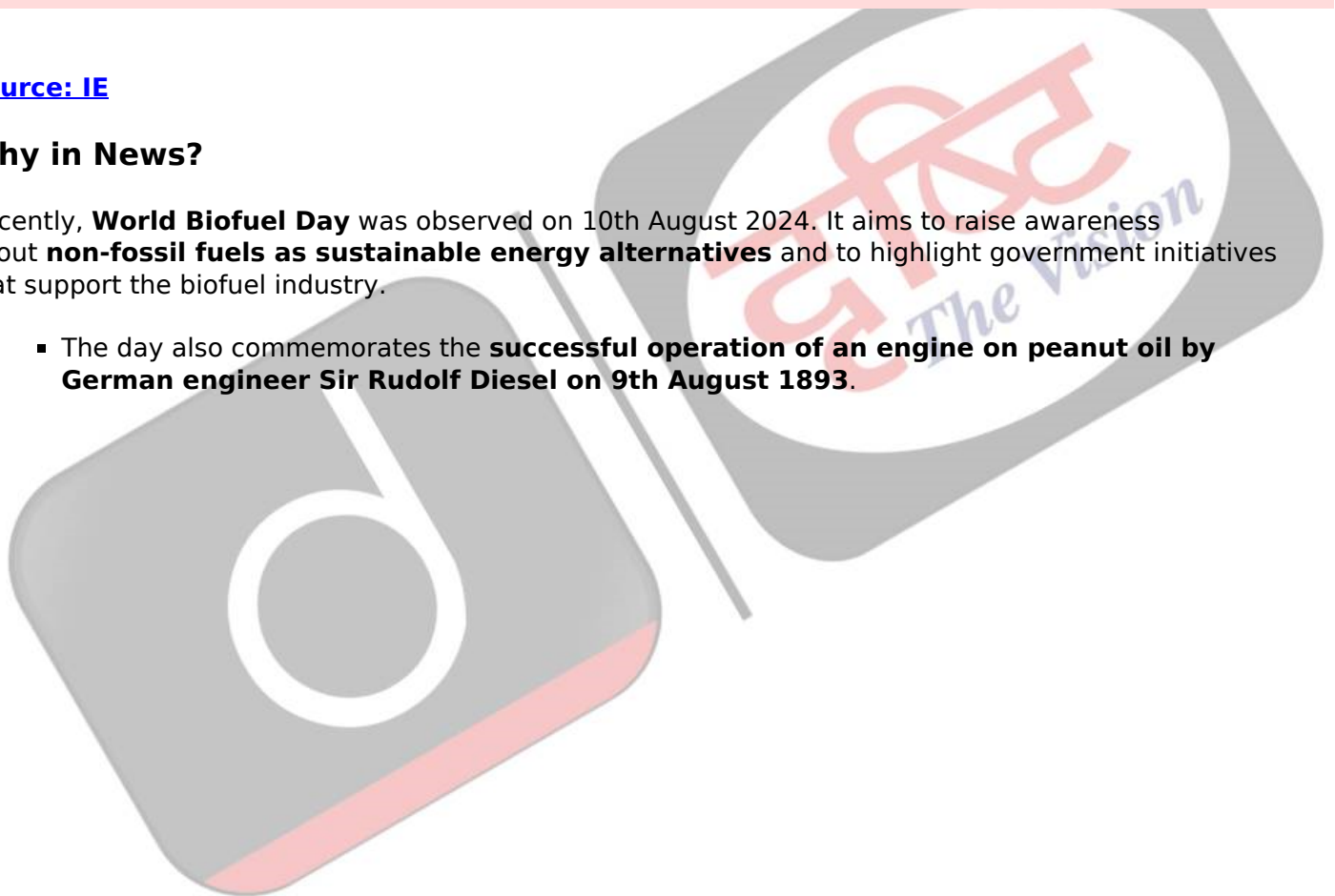
[Source: IE](#)

### Why in News?

Recently, **World Biofuel Day** was observed on 10th August 2024. It aims to raise awareness about **non-fossil fuels as sustainable energy alternatives** and to highlight government initiatives that support the biofuel industry.

- The day also commemorates the **successful operation of an engine on peanut oil by German engineer Sir Rudolf Diesel on 9th August 1893.**

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# ETHANOL AS A FUEL

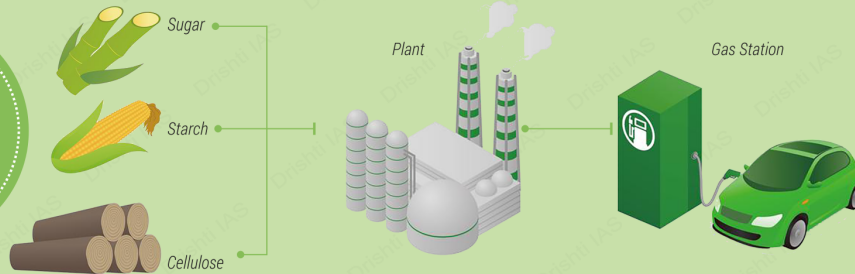
## About Ethanol

- One of the principal biofuels
- Also called ethyl alcohol (C<sub>2</sub>H<sub>5</sub>OH)

## Produced

- Naturally by fermentation of sugar (or corn, rice etc)
- By petrochemical processes (ethylene hydration)

World Biofuel Day is celebrated on 10 August to raise awareness about the importance of non-fossil fuels.



## Ethanol Blending

Blending ethanol with petrol to burn less fossil fuel while running vehicles.

### Blending Target

- 20% ethanol blending in petrol (E20) by 2025

Currently, ethanol makes up 10% of the petrol used in vehicles.

### Significance

- Reduce oil imports
- Equivalent efficiency at a lower cost than petrol
- Burns completely and cleaner than petrol
- Ethanol produced from farm residue to boost farmers' income

### Challenges in Success

- High land requirement for sugarcane (+ consequent food prices issue)
- High water requirement of biofuel crops

### Related Initiatives

- Roadmap for Ethanol Blending in India (Report by NITI Aayog) (2021)
- E100 Pilot Project (Network for production and distribution of ethanol) (2021)
- Pradhan Mantri JI-VAN Yojana (to boost 2G ethanol projects) (2019)
- The National Policy on Biofuels (2018)

## What are Biofuels?

### About:

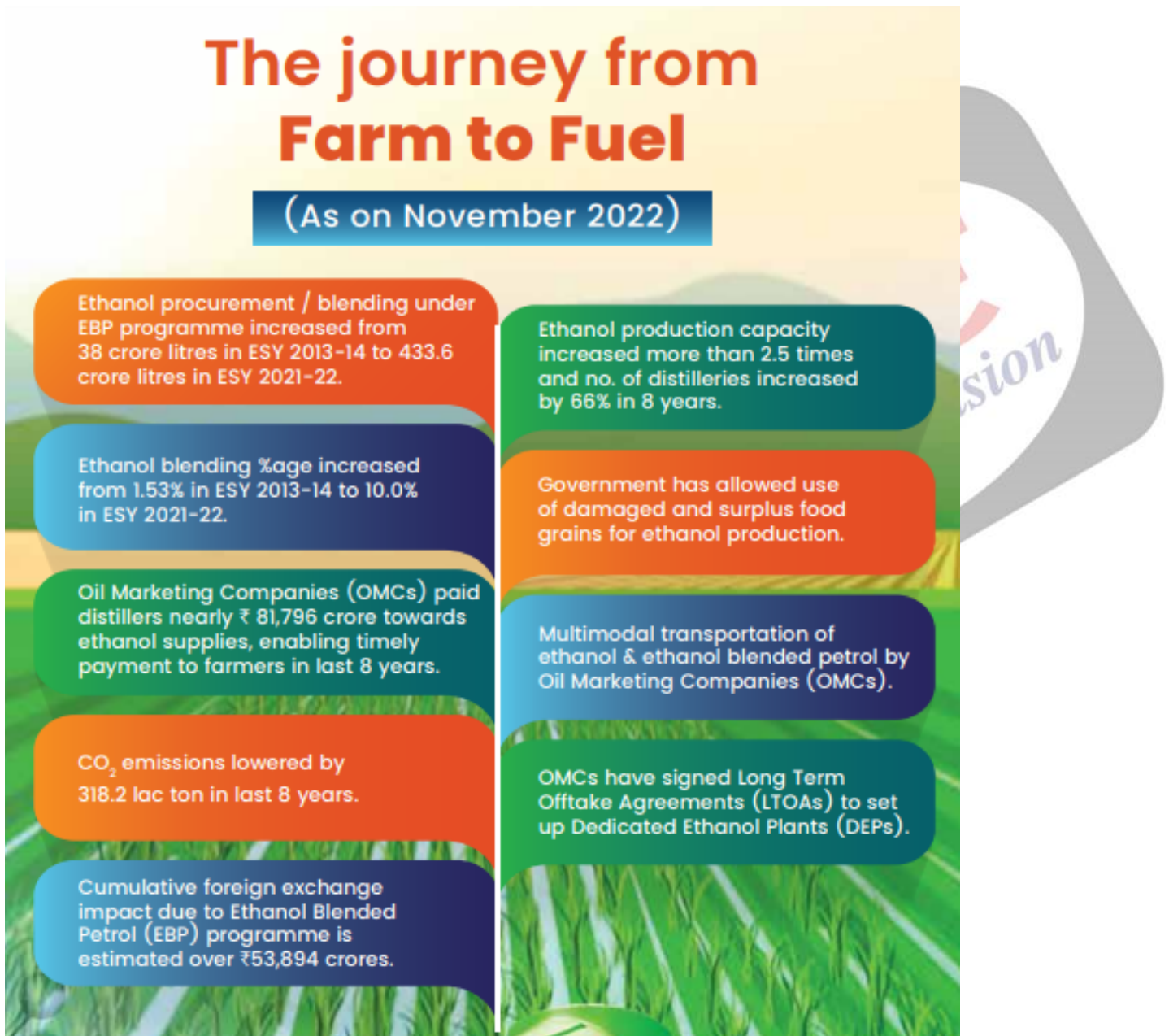
- Biofuels are the fuel derived from the **biomass of plants or animal wastes**.
- It is commonly produced from **corn, sugarcane and animal waste like cow dung**.
- These come under renewable sources of energy.

### Most Common Biofuels:

- Ethanol:** It is produced by **fermentation of crop residues** such as corn and sugarcane. After fermentation, the **ethanol is mixed with petroleum**, diluting it and reducing emissions.
  - The most common blend is **Ethanol-10**, which contains **10% ethanol**.
  - Ethanol used in fuel is 99.9% pure alcohol, while 96% extra neutral alcohol is used in potable liquor and 94% rectified spirit is found in paints, cosmetics, pharmaceuticals, and other industrial products.**
- Biodiesel:** It is a renewable, biodegradable fuel made from used **cooking oil, recycled restaurant grease, yellow grease, or animal fats**.
  - Its production involves **burning the oil or fat with alcohol** in the presence of a **catalyst**.

### Significance:

- **Environmental Benefits:** Biofuels are crucial for **environmental sustainability** as they can help alleviate some of the negative impacts of fossil fuel use, such as **greenhouse gas emissions** and **resource depletion** and they also offer **improved waste management solutions**.
- **Energy Security:** India, the **world's third-largest crude oil consumer, imports over 85% of its oil**. With rising energy demand and heavy reliance on imports, biofuels can help **improve energy security**.
- **Economic Benefits:** Biofuels can **cut India's oil imports and import bill**, while also **boosting farm incomes** and **addressing surplus production of crops like corn and sugarcane**.
- **Abundant Availability:** Biofuels can be produced from a variety of sources, including crops, waste, and algae.



## What are the Government Initiatives and Policies on Biofuels?

- **National Policy on Biofuel, 2018:** It aims to reduce import dependence by promoting fuel blending with bioethanol, biodiesel, and bio-CNG.
  - Key elements include the **Ethanol Blending Programme (EBP)**, production of **second-generation ethanol** (derived from forest and agricultural residues), increasing **local fuel additive production** under the **"Make in India"** program,

and **R&D in feedstock.**

- In May 2022, the policy was amended to **advance the 20% ethanol blending target** from 2030 to **2025-26.**

▪ **Reduced GST on Ethanol:**

- To encourage ethanol blending, the government **lowered** the **Goods and Services Tax (GST)** rate on ethanol used for blending under the **Ethanol Blended Petrol (EBP) Programme** from **18% to 5%.**

▪ **Pradhan Mantri JI-VAN Yojana, 2019:**

- It aims to boost **Second Generation (2G) ethanol** production from **cellulosic and lignocellulosic** sources, including petrochemical routes, by offering financial support.
- **Lignocellulosic biomass (or LC biomass)** refers to plant biomass that is composed of **cellulose, hemicellulose, and lignin.** For examples cereal straw, bagasse, forest residues, and **purpose-grown energy crops such as vegetative grasses.**
- The government has approved an **extension** of the scheme's implementation timeline by **5 years,** now running until **2028-29.**

▪ **GOBAR (Galvanizing Organic Bio-Agro Resources) DHAN Scheme, 2018:**

- It focuses on **managing and converting cattle dung and solid waste** in farms to useful compost, biogas and bio-CNG, thus **keeping villages clean and increasing the income of rural households.**

- It was launched under the **Swachh Bharat Mission (Gramin).**

▪ **Repurpose Used Cooking Oil (RUCO):**

- It was launched by the **Food Safety and Standards Authority of India (FSSAI)** and aims for an ecosystem that will **enable the collection and conversion of used cooking oil to biodiesel.**

▪ **Global Biofuels Alliance (GBA): It is a multi-stakeholder alliance to facilitate international cooperation and promote the use of sustainable biofuels.**

- It was formally **launched in 2023 by India** along with the leaders of the USA, Brazil, Italy, Argentina, Singapore, Bangladesh, Mauritius and the UAE on the sidelines of the **G20 Summit** in New Delhi.
- Additionally, it aims to **facilitate global biofuel trade** and provide technical support for national biofuel programs.

**Note:**

- The **first 2G ethanol project** was inaugurated in Panipat, Haryana in 2022.
- **Ethanol blending** increased from 38 crore liters in 2013-14 to over 500 crore liters in 2022-23.
  - **Blending percentage** rose from 1.53% to **12.06%**, reaching **15.83% in July 2024.**
- Oil Marketing Companies (OMCs) aim for a **20% ethanol blending target** by the end of Ethanol Supply Year (ESY) 2025-26, requiring approximately 1,100 crore litres of ethanol.
- A total of 1,750 crore litres of **ethanol distillation capacity** is needed to meet blending requirements.

## Generations of Biofuels

### First Generation

- Derived from edible plants grown on arable land.
- Ethanol and butanol produced via yeast fermentation.
- Crops include wheat, sugar cane, and oily seeds.
- Attributed as a potential reason for recent spike in food prices.
- Net energy negative.

### Second Generation

- Produced from non-edible crops grown on non-arable land.
- Sources have high lignocellulosic content, which include wood and organic waste.
- Potential to be net energy positive.

### Third Generation

- Produced from algae and other microorganisms.
- Resilient organisms that can be grown from sunlight, CO<sub>2</sub> and brackish water.
- Does not use arable land.
- Fastest growing of all biofuel sources.
- Potentially carbon neutral

### Fourth Generation

- Genetic engineering of organisms for efficient production of biofuels.
- Includes altering lipid characteristics and introducing lipid excretion pathways.
- Aim to be carbon negative by creating artificial carbon sinks.

## What are the Challenges Related to Biofuels?

- **Environmental Issues:** Biofuel production can **strain land and water resources, cause pollution**, and alter cropping patterns.
  - Producing **one litre of ethanol** from sugar **requires about 2,860 litres of water**.
- **Food vs. Fuel Challenge:** There are concerns about **balancing food security with energy security**, depending on the choice of feedstock and production methods for biofuels.
  - The availability and **cost of these feedstocks can fluctuate** based on factors like season, weather, market conditions, and policy changes.
- **Conversion Efficiency and Yield:** Ethanol production involves **pretreatment, hydrolysis, fermentation, and distillation**, with varying **efficiencies and yields** depending on feedstock type, process technology, and conditions.
  - For example, **lignocellulosic biomass**, which is more **abundant and diverse than sugarcane or corn**, requires more intensive and complex pretreatment and hydrolysis to break down the cellulose and hemicellulose into fermentable sugars.
  - The **conversion efficiency and yield of ethanol** also affect the **economic viability and environmental impact** of the production process.
- **Infrastructure and Distribution:** Ethanol production needs **robust infrastructure** for **transporting, storing, and delivering feedstock** and fuel, which can be **costly and face logistical and regulatory** challenges.
  - For example, **ethanol is corrosive and hygroscopic**, which means that it can damage or **contaminate the existing pipelines, tanks, and pumps** that are designed for gasoline or diesel.
- **Vehicle Compatibility and Performance:** Vehicles need **modifications** to run on ethanol-blended fuels or pure ethanol, affecting **engines, fuel systems, and maintenance** practices.
  - For example, Ethanol has a **lower energy density than gasoline**, which means that **more volume of ethanol is needed** to provide the same amount of energy, resulting in **higher transportation and storage costs**.

## Way Forward

- **Production Boost:** Diversify **feedstock by using non-food sources and waste**, support R&D

for advanced biofuels, expand and **modernise production facilities**, and establish distilleries near **fuel depots to reduce costs and enhance logistics**.

- **Policy and Market Mechanisms:** Gradually raise the ethanol blending **mandate beyond 20% by 2025**, establish fixed-price contracts with oil companies to ensure market stability, and **invest in R&D for optimising blending ratios**, engine compatibility, and conversion technologies.
- **Technological Advancement:** Invest in improved **storage and transportation infrastructure**, collaborate with automakers to **develop ethanol-compatible engines**, and enforce strict quality standards for **ethanol to ensure performance and safety**.
- **Public Awareness and Education:** Launch campaigns to **educate consumers on the benefits of ethanol blending**, address misconceptions, and encourage adoption. Ensure **clear labelling of ethanol-blended fuels** at stations to inform choices.

### **Drishti Mains Question**

Discuss the importance of India's Ethanol Blending Program in enhancing energy security, decreasing reliance on fossil fuels, and minimising environmental impact.

## **UPSC Civil Services Examination, Previous Year Questions (PYQ)**

**Q. Given below are the names of four energy crops. Which one of them can be cultivated for ethanol? (2010)**

- (a) Jatropha
- (b) Maize
- (c) Pongamia
- (d) Sunflower

**Ans: (b)**

**Q. According to India's National Policy on Biofuels, which of the following can be used as raw materials for the production of biofuels? (2020)**

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

**Ans: (a)**