India's Ethanol Revolution: Progress & Challenges

This editorial is based on “India’s ethanol conundrum” which was published in The Hindu on 20/12/2023. The article discusses the challenges and opportunities of India’s ethanol blending programme, which aims to reduce the country’s dependence on fossil fuels and promote renewable energy sources.

For Prelims: COP28, National Agricultural Cooperative Marketing Federation of India (NAFED), **Ethanol Blending Program (EBP),** National Policy on Biofuels, Differential Ethanol Pricing, Interest Subvention Scheme.

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

As more than 100 countries at COP28 in Dubai **pledged the tripling of global** renewable energy **capacity by 2030**, India faces a tightrope walk with regard to its ethanol blending target. While Ethanol Blended Petrol (EBP) increased from 1.6% in 2013-14 to 11.8% in 2022-23, the 20% target by 2025 has run into trouble with low sugar stocks in 2022-23 and the impending shortfall in sugarcane production this year. As evident from Minister of Consumer Affairs, the government is looking at a major transition towards grain-based ethanol for meeting the target.

The recent authorisation of the National Agricultural Cooperative Marketing Federation of India (NAFED) and the **National Cooperative Consumers’ Federation of India (NCCF)** to procure maize (corn) for supplying ethanol distilleries indicates emphasis on this transition and will boost an organised maize-feed supply chain for ethanol. This, however, risks creating more challenges for the economy.

What is Ethanol?

- **Ethanol:** Ethanol is an organic compound which is a clear, **colorless liquid** that is **flammable** and has a characteristic odour.
    - **Production**: It can be **produced through the fermentation of sugars by yeas**t, a process that is used in the production of alcoholic beverages. It can also be synthesized through chemical processes, such as hydration of ethylene.
    - **Uses:**
        - **Beverages**: Ethanol is the type of alcohol found in alcoholic beverages. It is consumed socially in various forms, such as beer, wine, and spirits.
        - **Fuel:** It is used as a biofuel and is often mixed with gasoline to produce ethanol-blended fuels.
        - **Industrial Solvent:** Due to its ability to dissolve a wide range of substances, ethanol is used as a solvent in the manufacturing of pharmaceuticals, perfumes, and other products.
        - **Medical and Laboratory Uses**: Ethanol is used as an antiseptic, disinfectant, and

a preservative in medical and laboratory settings.
- **Chemical Feedstock:** It serves as a feedstock for the production of various chemicals.

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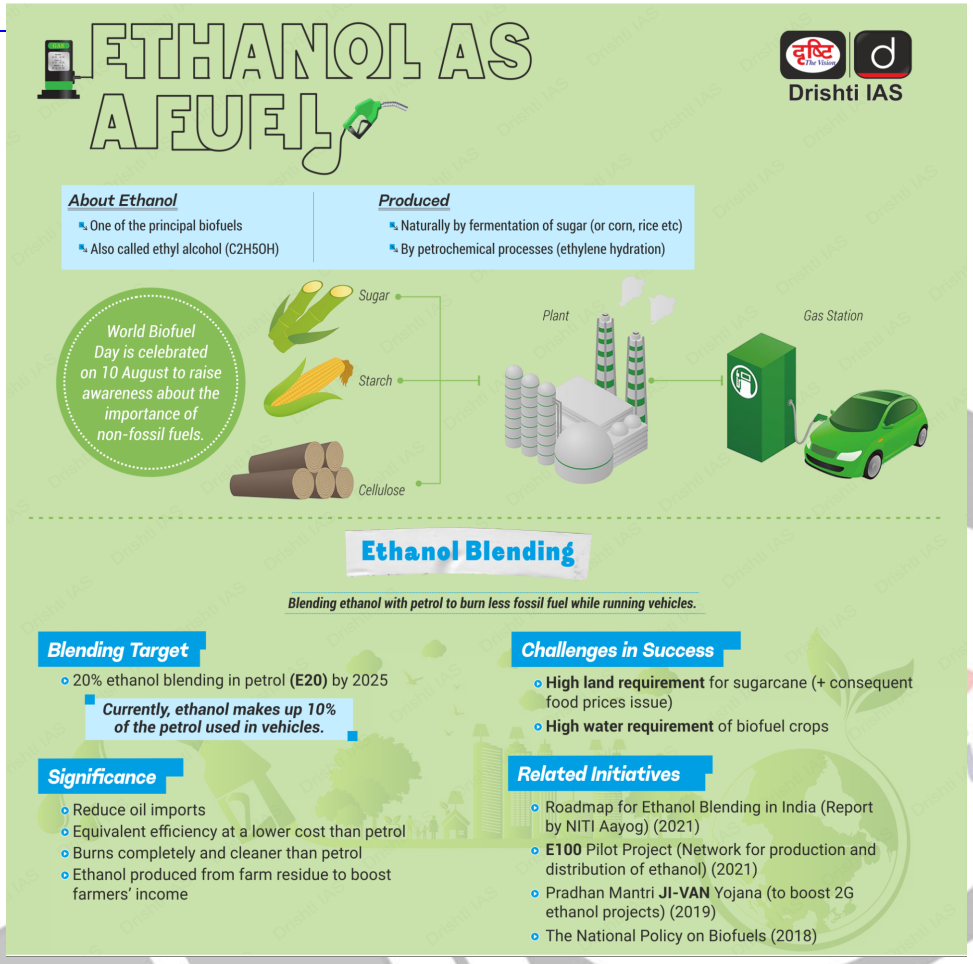
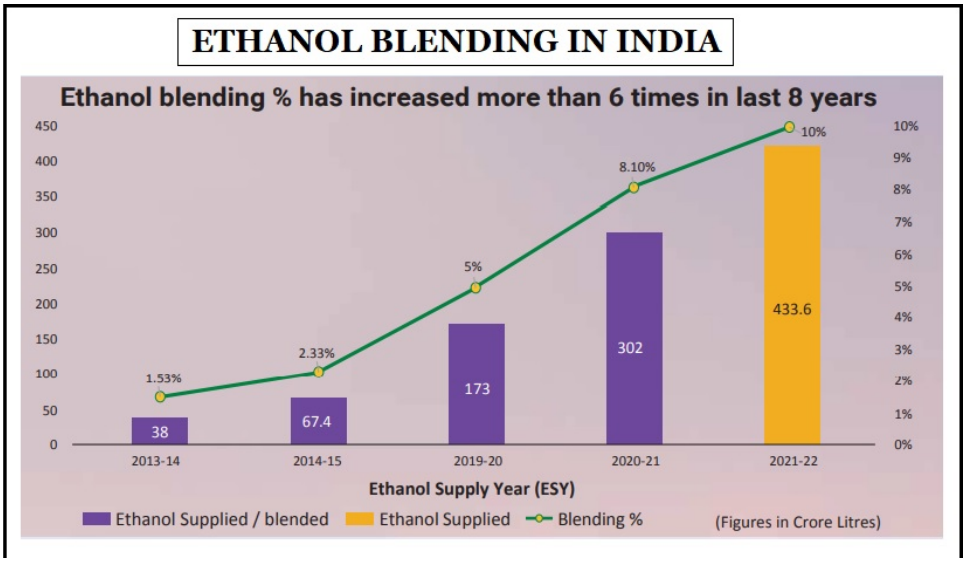


What is Ethanol Blending Program (EBP)?

- The EBP is an initiative by the Government of India to promote the use of ethanol, a renewable and environment-friendly fuel, in petrol.
- The program **aims to reduce the import of fuels** from other countries, conserve foreign exchange, and increase value addition in the sugar industry.
- The target of **10% ethanol blending set in the 'Roadmap for Ethanol Blending in India 2020-25'** for Ethanol Supply Year (ESY) 2021-22 has already been achieved and Public Sector Oil Marketing Companies (OMCs) have **started selling E20 (20% ethanol blended) petrol** across the country.
    - Further, the National Policy on Biofuels – 2018 targets 20% blending of ethanol in petrol by ESY 2025-26.
- Ethanol is mainly produced from a **by-product of the sugar industry**, namely molasses, but other raw materials like sugarcane juice, sugar, sugar syrup, and damaged food grains can also be used.
    - The Government has taken various steps to facilitate the procurement and supply of ethanol under the EBP, such as fixing remunerative prices, simplifying the procedure, waiving excise duty, and extending financial assistance.
- Due to effective Government policies, the supply of ethanol to OMCs has **increased by more than 13 times** in ESY 2022-23 from ESY 2013-14.
    - The blending percentage has also increased from 1.53% in ESY 2013-14 to targeted 12% in ESY 2022-23.



What is the Significance of Ethanol Blending in Fuels?

- **Reducing Fossil Fuel Dependence:** India imports most of its oil, which makes it vulnerable to fluctuations in global markets and geopolitical risks. By using ethanol, India **can reduce its oil imports and increase its energy self-reliance.**
- **Protecting the Environment:** Ethanol burns cleaner than gasoline, which means it produces less harmful emissions that cause air pollution and climate change. By using ethanol, India can improve its air quality and meet its climate goals.
    - According to a study by the Indian Institute of Science, Bangalore, blending **ethanol with petrol can reduce the carbon monoxide emissions by 30-50%** and hydrocarbon emissions by 20%.
- **Supporting Farmers:** Ethanol production requires agricultural inputs, such as sugarcane or corn. By using ethanol, India can create a **new demand for these crops**, which can boost the income and livelihood of farmers and rural communities.
- **Enhancing Energy Security:** Ethanol is a domestic and diverse source of energy, which can reduce India's dependence on a single and foreign source of energy. By using ethanol, India can increase its energy security and resilience.
- **Generating Economic Benefits**: Ethanol blending can stimulate the growth of the ethanol industry, which can create new jobs, investments, and innovations. It can also help India develop a more sustainable and modern energy system.
    - Ethanol blending can **save the country USD 4 billion per annum,** i.e., Rs. 30,000 cr.
- **Enhanced Vehicular Performance:** Ethanol has **a higher** octane rating **than gasoline**, which means that it can improve the engine performance and reduce the knocking tendency.

What are the Limitations of Ethanol Blending?

- **Feedstock Availability and Cost:** Ethanol production **requires a large amount of biomass,** such as sugarcane, corn, or lignocellulosic materials, which may compete with food, feed, or other uses. The availability and cost of these feedstocks may vary depending on the season, weather, market, and policy conditions.
- **Conflict with Food Security:** The use of corn for ethanol production come directly in conflict with food security.
    - In the case of sugarcane, **ethanol is produced by processing the molasses (C-heavy/B-heavy)** and constitutes minimal trade-off with the sugar output.
    - The **B-heavy molasses path produces less sugar** compared to the C-heavy one, but both produce sugar and ethanol simultaneously from sugarcane.
    - But **using corn for producing ethanol directly reduces its use as food** or livestock feed.
        - It not only diverts grain to fuel use, but also links food prices directly with crude oil prices through the demand side.

- **Conversion Efficiency and Yield**: Ethanol production involves several steps, such as pretreatment, hydrolysis, fermentation, and distillation, which may have different efficiencies and yields depending on the type and quality of the feedstock, the process technology, and the operating 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 requires adequate infrastructure and distribution systems to transport, store, and deliver the feedstock and the fuel to the end-users. This may involve high capital and operating costs, as well as 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 Performan**ce: Ethanol production requires compatible and efficient vehicles that can run on ethanol-blended fuels or pure ethanol. This may **require modifications or adaptations in the engine, fuel system, and emission control devices** of the vehicles, as well as changes in the driving behavior and maintenance practices of the drivers.
    - 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.

What are the Steps taken by the Government to Boost Ethanol Blending?

- **Differential Ethanol Pricing**: The government has fixed different prices for ethanol derived from C heavy molasses, B heavy molasses, sugarcane juice/sugar/sugar syrup, and damaged food grains or rice.
    - The prices are revised annually by the Cabinet Committee on Economic Affairs (CCEA) based on various factors such as cost of production, availability, and demand.
    - The differential pricing policy has resulted in increased supply of ethanol for the Ethanol Blended Petrol (EBP) programme and helped achieve 20% ethanol blending in petrol by 2025.
- **Interest Subvention Scheme**: With a view to enhance the ethanol production capacity in the country to achieve the blending targets set under EBP Programme, the Government has notified various ethanol interest subvention schemes from July 2018 to April 2022.
    - Under these ethanol interest subvention schemes, Government is **facilitating entrepreneurs to set up new distilleries (molasses based, grain-based and dual-feed based) or expansion of existing distilleries** (molasses based, grain-based and dual-feed based) throughout the country.
        - **Interest subvention @ 6% per annum or 50% of rate of interest charged by banks/financial institutions**, whichever is lower, on the loans to be extended by banks/financial institutions is being borne by the Central Government for five years including one-year moratorium.
- **Tax relief**: Lower taxes are levied on E10 and E20 blends compared to unblended petrol, making them more cost-competitive for consumers.
    - Lower excise duty and GST rates for ethanol compared to petrol.
- **Incentives for E20-compatible vehicles**: Tax benefits and other incentives are being considered for manufacturers and buyers of vehicles compatible with higher ethanol blends.

What Steps can be Taken Further to Boost Ethanol Program?

- **Production Boost:**
    - **Diversify Feedstock:** Encourage production from non-food sources like cellulosic biomass, waste paper, and agricultural residues. This reduces competition with food security and utilizes waste.
    - **Support 2G and 3G Biofuels**: Invest in research and development for second and third-generation ethanol production technologies, which use non-edible resources.
    - **Expand Production Capacity**: Incentivize setting up new ethanol distilleries and

modernize existing ones through financial assistance and streamlined bureaucratic processes.
    - **Promote Regional Production:** Focus on establishing distilleries closer to fuel depots to minimize transportation costs and optimize logistics.
- **Policy and Market Mechanisms:**
    - **Raise Blending Mandate:** Gradually increase the mandatory ethanol blending percentage beyond the current target of 20% by 2025. This creates a guaranteed market for ethanol producers.
    - **Long-term Contracts:** Offer fixed-price contracts with oil marketing companies to encourage stable investment in ethanol production.
    - **Support Research and Development:** Invest in research on optimizing blending ratios, addressing engine compatibility issues, and developing efficient conversion technologies.
- **Technological Advancement:**
    - **Upgrade Infrastructure:** Invest in storage and transportation infrastructure for ethanol to ensure efficient supply chain management.
    - **Vehicle Compatibility:** Work with automobile manufacturers to develop engines and vehicles compatible with higher ethanol blends.
    - **Quality Control:** Implement stringent quality standards for ethanol production and blending to ensure fuel performance and vehicle safety.
- **Public Awareness and Education:**
    - **Create Awareness Campaigns**: Educate consumers about the benefits of ethanol blending, dispel myths about its impact on vehicles, and encourage its adoption.
    - **Transparency and Labeling:** Ensure clear labeling of ethanol blended fuels at petrol stations to inform consumers about their choice.

Conclusion

India has made significant progress in its Ethanol Blending Program. This achievement in the course of last 8-10 years has not only **augmented India's energy security but also translated into a forex impact of over Rs.41,500 crores, reduced Green House Gas (GHG) emissions of 27 lakh Metric Tonne (MT)** and also led to the expeditious payment of over Rs.40,600 crores to farmers.

Drishti Mains Question

Discuss the significance of India's Ethanol Blending Program in achieving energy security, reducing fossil fuel dependence, and mitigating 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)