India's Ethanol Revolution Driven by Grains – Explained

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Ethanol Revolution Latest News

- India's ethanol blending programme has undergone a major shift, with grain-based ethanol, especially from maize, surpassing sugarcane-based production for the first time, marking a structural change in the country's biofuel strategy.

Evolution of India's Ethanol Blending Programme

- India's **ethanol blending programme (EBP)**, launched to reduce crude oil imports and support sugarcane farmers, has undergone a remarkable transformation.
- Initially conceived to enable sugar mills to generate additional revenue and make timely payments to cane growers, the programme has evolved into a **multi-feedstock ethanol industry** powered largely by grains, especially **maize and rice**.
- This shift marks a major structural change in India's biofuel policy. What began as a sugarcane-linked project is now driven by **grain-based distilleries**, which have received over **Rs. 40,000 crore in investments**, reshaping the dynamics of rural industry, fuel policy, and agricultural markets.

Sugarcane as the Foundation

- Ethanol production in India began through the **fermentation of sucrose** from molasses, a by-product of sugarcane processing.
- Until 2017-18, sugar mills mainly used **C-heavy molasses**, the final by-product of sugar extraction.
- However, the introduction of higher procurement prices for ethanol made from **B-heavy molasses** and **direct cane juice or syrup** encouraged mills to divert cane from sugar production to ethanol.
- Between **2013-14 and 2018-19**, ethanol supplies to oil marketing companies (OMCs) surged from **38 crore litres to nearly 189 crore litres**, raising the average blending rate from **1.6% to 4.9%**.
- The policy was hailed as a success in stabilising the sugar sector, especially during periods of price volatility and excess production.

The Shift from Sugar to Grain

- Starting from the **2018-19 fiscal year**, the government allowed ethanol production from grains such as **maize, rice, and damaged foodgrains**, setting differential ex-distillery prices for each.
- Initially, this was meant to help sugar mills operate their distilleries year-round by using grains during the **off-season (May-October)**.
- However, with attractive pricing and flexible feedstock regulations, **standalone grain-based ethanol plants** began proliferating across India, particularly in **Punjab, Haryana, Bihar, Andhra Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Rajasthan, and Chhattisgarh**.
- By **2023-24**, this transition became strikingly visible. Out of the **672.49 crore litres** of ethanol supplied to OMCs, only **270.27 crore litres (40.2%)** came from sugarcane-based sources, while **402.22 crore litres (59.8%)** were grain-based, mostly maize and broken rice.

Maize Becomes the Mainstay

- The current **2024-25 ethanol supply year** reflects the dominance of grains. Out of the **920 crore litres** likely to be procured, about **620 crore litres** are expected to come from grain-based sources, with **maize contributing nearly 420 crore litres**.
- Two main factors explain this shift:
- **Reduced Sugarcane Availability:** Droughts in 2023-24 and 2024-25 hit sugarcane production, prompting the government to restrict ethanol derived from cane juice and B-heavy molasses to safeguard sugar supplies for domestic consumption.
    - Sugar diverted for ethanol fell from **45 lakh tonnes in 2022-23** to **24-35 lakh tonnes** in the subsequent two years.
    - Sugar production declined from **359 lakh tonnes (2021-22)** to an estimated **261 lakh tonnes (2024-25)**.
- **Pricing Advantage:** Ethanol from maize fetches **Rs. 71.86 per litre**, compared to Rs. 57.97 from C-heavy molasses, Rs. 60.73 from B-heavy, and Rs. 65.61 from cane juice/syrup. This made **maize ethanol more lucrative** for distillers.

Growth, Capacity and Policy Implications

- For **2025–26**, OMCs invited tenders for **1,050 crore litres** of ethanol to achieve the **20% blending target**, but received offers totalling **1,776 crore litres**, far exceeding requirements. Of this, **1,304 crore litres** were from grain-based sources, mainly maize and FCI rice.
- Currently, India has **499 operational distilleries** with a combined production capacity of **1,822 crore litres annually**.
- The massive expansion, driven by private and cooperative investment, shows the sector's potential but also raises policy challenges.

Challenges and Sustainability Concerns

- **Excess Production Capacity**
    - With ethanol demand capped by blending limits (20% being the technical ceiling for current vehicles), the sector faces a looming **oversupply risk**. Balancing production capacity and consumption will require strategic planning to avoid price distortions.
- **The Food vs. Fuel Debate**
    - India's ethanol policy now faces the global dilemma of diverting **food grains for fuel**. Producing 420 crore litres of ethanol from maize consumes about **11 million tonnes of grain**, roughly **26% of India's total maize output (42 mt)**.
    - Since maize is a critical input for **poultry, dairy, and livestock feed**, rising ethanol demand could pressure feed costs and food inflation.
    - Similarly, ethanol from rice depends on **surplus stocks held by the Food Corporation of India (FCI)**, which may not persist every year.
- **Environmental Considerations**
    - While ethanol is a cleaner-burning fuel that reduces greenhouse gas emissions, **large-scale grain diversion** raises sustainability concerns related to **water use, land allocation, and fertiliser intensity**, particularly in maize cultivation.

Government's Future Strategy

- To ensure balance, the government is likely to adopt a **dual-feedstock policy**, encouraging both sugarcane and grain-based ethanol while closely monitoring the food security implications.
- Efforts are also underway to develop **second-generation (2G) biofuels** using agricultural residues like paddy straw, which could help achieve **the 20% blending target by 2025-26** sustainably.
- The government's continued focus on ethanol reflects its **commitment to energy transition**, rural income diversification, and **reducing crude oil imports**, which cost over **$160 billion annually**.

Source: IE
