Scaling up of Ethanol Blending

Mains: *GS III | Environment*

Why in News?

India reached its 20% ethanol blending in petrol (E20) target in 2025–26, five years ahead of its original 2030 goal.

What is ethanol blending?

- Ethanol is an ***alcohol-based fuel produced from crops*** or plant residues and mixed with petrol to power vehicles.
- It helps lower vehicle emissions, reduce crude oil imports, and support domestic agriculture
- Ethanol is produced from crops and biomass like sugarcane, maize, surplus foodgrains, and agricultural waste. Blends are labeled by the percentage of ethanol by volume
    - **E10** - 10% ethanol and 90% petrol.
    - **E20** - 20% ethanol and 80% petrol. India achieved its 20% blending target ahead of schedule in 2025–26.
- **Higher blends (E27, E85) -** Used in flex-fuel vehicles or countries like Brazil, which mandates E27 as a standard blend.
- **Current status -** India launched the Ethanol Blended Petrol (EBP) programme in **2003** with a **5%** blend across nine states and four Union Territories, facing thin, sugar-dependent supplies for its first decade.
- Administered pricing, assured procurement by Oil Marketing Companies (OMCs), and the **National Policy on Biofuels, 2018** which opened the door to maize and surplus foodgrains helped raise blending from roughly 5% in 2019–20 to 20% in 2025–26.
- **Heavy shift to rice -** Food Corporation of India (FCI) rice entered the ethanol mix in 2020–21 at under 1% of supply, rose to 13.5% by ESY25 (despite a near-halt in 2023–24).
- It accounts for 44% of ESY27 allocations. Allocations from damaged foodgrains also jumped 164% over ESY26, raising concerns over storage-related quality losses.
- **Rapid rise of maize-** Maize's share grew from 6% in ESY23 to 47% in ESY27.
- Maize is also the backbone of poultry feed and increasingly used in dairy feed and starch, mandi prices have climbed to around Rs.2,800 per quintal well above the Rs.2,400 Minimum Support Price (MSP).
- Either distilleries bid prices even higher passing costs onto poultry farmers and milk consumers or they fall short of supply commitments, putting E20 targets at risk.

What are the fiscal and environmental costs of rice-based ethanol?

- **Heavy Fiscal Burden on the Exchequer -** Rice allocations for ethanol rose from 3.11 MMT in ESY25 to an initial estimate of 7.2 MMT in ESY27.
- While the latest ESY27 allocation of 483.8 crore litres of rice-based ethanol (159.9 crore litres from damaged rice and 323.9 crore litres from surplus rice) implies roughly 11.2 MMT of rice

(at conversion factors of 2.5 and 2.22 kg per litre, respectively).

- FCI sells rice to distilleries at Rs.23.20/kg, which is 47% below its economic cost of Rs.43.91/kg.
- Adding roughly Rs.10/kg in power and fertilizer subsidies in the Punjab–Haryana belt brings the real economic cost to nearly Rs.53.91/kg.
- At an average conversion rate of 2.75 kg of rice per litre of ethanol, each litre embodies about Rs.148 in public expenditure, whereas OMCs pay only Rs.60.32/litre meaning OMCs receive an indirect subsidy of Rs.87.93/litre, translating to a fiscal cost of over Rs.35,800 crore across 11.2 MMT of rice.
- **Severe Water Footprint and Methane Emissions -** According to data shared by the Petroleum Ministry in Parliament (March 2026), rice is the most water-intensive ethanol feedstock.
- At 2.75 kg of rice per litre of ethanol and 4,000 litres of irrigation water per kg of rice, every litre of rice-based ethanol embodies 11,000 litres of irrigation water or a potential water footprint of 44.8 billion cubic metres for 11.2 MMT of rice.
- Flooded paddy fields also emit methane (estimated at 5 tonnes CO_2e per hectare in the Punjab–Haryana belt), whereas rainfed kharif maize requires roughly one-fifth as much irrigation water and generates far lower methane emissions.

Comparing feedstock pathways

Dimension	First-Generation (1G) Crops (Rice, Maize, Sugarcane)	Second-Generation (2G) & Third-Generation (3G) Options
Raw Material	Foodgrains (rice, maize) and sugarcane/molasses	Crop residues (such as paddy straw), industrial waste (2G), and seaweed/algae (3G)
Food & Feed Competition	High—competes directly with human food staples, poultry/dairy feed, and sugar supply	Minimal to none—seaweed requires no farmland, fertilizer, or freshwater irrigation
Water & Climate Impact	Rice carries a heavy groundwater footprint and high methane emissions	Lower strain on land and water once scaled, though 2G plants remain few and 3G yields are not yet commercially viable
Policy & Scaling Status	Drives current E20 blending, but vulnerable to weather shocks and price spikes	Backed by **PM JI-VAN Yojana** (extended to **2028–29**), but commercial rollout needs faster scaling and R&D

What are the key challenges in sustaining E20?

- **Food and Feed Security for a Massive Population -** Feeding roughly 1.48 billion people alongside one of the world's largest livestock populations means food and feed availability cannot be compromised for fuel targets.
- **Ad Hoc Policy Adjustments -** Switching feedstocks abruptly based on annual harvest fluctuations creates price volatility for poultry/dairy farmers and uncertainty for ethanol producers.
- **Slow Commercialization of Non-Food Alternatives -** Despite support under the Pradhan Mantri Jaiv Indhan-Vatavaran Anukool Fasal Awashesh Nivaran (PM JI-VAN) Yojana (extended to 2028–29), 2G plants remain limited.
- It leaving paddy straw still burnt in fields rather than converted into fuel while 3G seaweed options require further R&D to achieve commercial viability.

What is the way forward?

- Guide procurement prices and allocations through a comprehensive study of feedstock supply, water and carbon costs, and food/feed impacts, benchmarked against the landed cost of imported ethanol rather than ad hoc adjustments.
- Replace a rigid target with a dynamic **E15–E20** range governed by pre-announced triggers tied to sugar output, grain stocks, and maize prices allowing blending to ease in deficit years and expand in surplus ones, with ethanol imports acting as a safety valve.
- Expand crop-residue and waste-based 2G biorefineries under **PM JI-VAN** while investing in targeted research and coastal pilot biorefineries for third-generation seaweed ethanol that competes with neither food nor groundwater.

Reference

Indian Express | Fuel be ethanol-blended

