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EDITORIAL ANALYSIS

Rethinking E20 — India's Ethanol Mandate, Climate Trade-offs, and the Food-Fuel Tension

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GS PAPERS

Rethinking E20 — India's Ethanol Mandate, Climate Trade-offs, and the Food-Fuel Tension

Down to Earth 1 April 2026 GS3

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INTERVIEW ANGLE

"India's E20 ethanol mandate becomes mandatory from April 1, 2026. Down to Earth's analysis finds mixed climate benefits and rising food-versus-fuel tensions. Was this the right policy at the right time?"

WHY IN NEWS

From April 1, 2026, E20 (20% ethanol-blended petrol) became mandatory across India under the National Biofuel Policy's phased blending roadmap. India crossed the E10 target two years ahead of schedule in 2022-23 and has progressively increased blending to reach E20. DTE's exclusive analysis finds the mandate achieves some energy security goals but raises significant concerns about emission profiles, food security, and second-order agricultural impacts.

WHAT E20 MEANS — THE BLENDING PROGRAMME

India's ethanol blending programme (EBP) has been one of the signature energy transition policies of the past decade:

YEAR	BLENDING LEVEL	KEY MILESTONE
2013-14	~1.5%	Blending programme restarts after previous failures
2020-21	~8.0%	Accelerated post-National Biofuel Policy 2018
2022-23	~10.2%	E10 target achieved — 2 years ahead of 2025 schedule
2025-26	~15.5%	Progressive ramp-up
April 2026	**20% (E20)**	Mandatory — petrol sold at all pumps must be E20

The programme's stated goals:

1. Reduce crude oil import bill (India's oil import cost: ~$150 billion/year)
2. Provide additional income to sugarcane and maize farmers
3. Reduce vehicular carbon emissions
4. Support India's NDC commitment under Paris Agreement

THE DTE ANALYSIS — WHAT THE DATA SHOWS

Claim 1: "E20 Reduces Emissions" — Partially True

The conventional argument for ethanol blending is that it displaces fossil petrol, reducing net carbon emissions because the carbon released on combustion was recently absorbed by the crop (sugar cane, maize, rice) during growth.

DTE's finding: This is true for CO_2 on a life-cycle basis (Well-to-Wheel analysis). However:

- **NOx (Nitrogen Oxides) emissions increase** with higher ethanol blends. Ethanol combustion at E20 levels raises NOx emissions by 8-12% compared to pure petrol in standard engines — contributing to urban air pollution and smog formation.
- **Acetaldehyde emissions increase** — acetaldehyde is a Tier 1 carcinogen. India's Bharat Stage (BS) emission norms do not yet have specific limits for acetaldehyde from ethanol blends.
- **Older vehicles (pre-BS-VI):** E20 can cause rubber seal degradation, fuel system corrosion, and engine performance issues in older vehicles — disproportionately affecting lower-income users who cannot afford newer vehicles.

Net assessment: E20 reduces greenhouse gas (CO_2) emissions but increases local air pollutants (NOx, acetaldehyde) — a trade-off that urban air quality policy must account for.

Claim 2: "E20 Helps Farmers" — Complicates Food Security

India's ethanol primarily comes from sugarcane (>80% of supply). Diverting sugarcane molasses and juice to ethanol production has:

- **Kept sugar prices elevated:** Less sugar in the market → higher retail prices → food inflation
- **Encouraged sugarcane monoculture** in water-stressed states (Maharashtra, Karnataka, Uttar Pradesh) — a water-intensive crop in regions already facing groundwater depletion
- **Diverted maize to ethanol:** FCI's maize procurement for ethanol supply created upward pressure on poultry feed costs, raising chicken and egg prices

The food-versus-fuel tension: India allocates significant sugarcane for ethanol at a time when food price inflation has been a persistent macroeconomic concern. The government has periodically restricted ethanol supply to stabilise sugar prices — creating supply uncertainty that undermines the energy security argument.

The 2G Ethanol Gap

DTE's key constructive recommendation: India's ethanol programme should prioritise scaling up **Second-Generation (2G) ethanol** — produced from crop residues (paddy straw, wheat straw, sugarcane bagasse, corn cobs) rather than food crops.

2G ethanol advantages:

- No food-vs-fuel tension (uses agricultural waste)
- Addresses the paddy straw burning problem (farmers in Punjab/Haryana burn residue — a major air quality crisis every October-November)
- Better carbon reduction profile (lignocellulosic biomass has higher carbon intensity savings)

Current 2G status: India has very limited 2G ethanol capacity (only 1-2 commercial-scale plants operational as of 2026). The entire E20 mandate is being met primarily through 1G (food crop-based) ethanol.

THE POLICY ARCHITECTURE — NATIONAL BIOFUEL POLICY 2018 AND ITS GAPS

National Biofuel Policy 2018 (revised 2022):

- Sets blending targets: E20 by 2025 (met 2026), E20 sustained thereafter
- Promotes 2G ethanol through viability gap funding
- Creates a dedicated ethanol supply year (December to November)
- Fixes indicative ex-distillery prices for ethanol

What the policy lacks:

- No mandatory 2G minimum within the blending target (all 20% can be 1G)
- No binding agricultural water use limits for sugarcane ethanol production
- No independent lifecycle emission assessment framework (India relies on global databases rather than India-specific data)
- No vehicle modification support for owners of pre-2019 vehicles affected by E20 compatibility issues

THE DTE PRESCRIPTION

Down to Earth argues India's E20 mandate is the right direction but incomplete execution:

1. **Set a 2G minimum floor:** At least 5% of the E20 blend (i.e., 5 percentage points of the 20%) must come from 2G sources by 2028.
2. **Update BS emission norms for ethanol blends:** Specifically limit acetaldehyde and NOx from high-ethanol vehicles.

3. **Create a food security safeguard mechanism:** Automatically redirect ethanol supply to food when sugar prices exceed a threshold — but make the trigger rules transparent and pre-announced, not ad hoc.
4. **Subsidise 2G plant investment:** Viability gap funding for cellulosic ethanol plants processing paddy straw from Punjab/Haryana.

UPSC RELEVANCE

National Biofuel Policy 2018; E20; EBP (Ethanol Blending Programme); 1G vs 2G ethanol; BS-VI; NOx; acetaldehyde; NITI Aayog's Ethanol Roadmap.

MAINS GS-3:

"India's ethanol blending programme — evaluate the energy security benefits against the food security risks and environmental trade-offs."

ESSAY:

"Biofuels — a bridge fuel or a bridge to nowhere?"

INTERVIEW:

"India achieved E20 blending. Does this make India energy-secure, or has it just shifted the dependency from oil to food crops?"

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INDIA'S ETHANOL BLENDING PROGRAMME (EBP):

National Biofuel Policy: 2018 (amended 2022); Nodal Ministry: MoPNG (Ministry of Petroleum and Natural Gas)

E20 mandatory: April 1, 2026

E10 achieved: 2022-23 (2 years ahead of 2025 target)

Primary feedstock: Sugarcane (>80% of supply); also maize, damaged food grains

Oil import saving (E20): ~Rs 35,000-40,000 crore/year (estimated at current crude prices)

Farmer income: ~Rs 80,000 crore generated annually from ethanol supply (govt estimate)

1G VS 2G ETHANOL:

1G (First Generation): Made from food crops (sugarcane, maize, rice) — food-vs-fuel tension

2G (Second Generation): Made from crop residue (paddy straw, wheat straw, bagasse) — no food conflict

2G advantage: Addresses paddy straw burning (Punjab/Haryana October-November air crisis)

India's 2G capacity: Very limited (1-2 commercial plants as of 2026)

EMISSION TRADE-OFFS:

CO_2: E20 reduces lifecycle CO_2 compared to pure petrol (net carbon benefit)

NOx: Increases 8-12% with E20 vs pure petrol — worsens urban air quality

Acetaldehyde (carcinogen): Increases with ethanol combustion; BS norms currently lack E20-specific limits

FOOD SECURITY CONCERN:

Sugarcane for ethanol reduces market sugar supply → higher prices

Maize for ethanol raises poultry feed costs → higher egg/chicken prices

Government has periodically restricted ethanol production to stabilise food prices

OTHER RELEVANT FACTS:

Bharat Stage VI (BS-VI): Current emission norms for new vehicles (since April 2020)

India crude oil import: ~85% dependence; ~4.6 million barrels/day

Brazil model: 27.5% ethanol blending (E27) — mostly sugarcane; largest biofuel programme globally

US: E10 standard (10% blending); corn-based

> Pradhan Mantri JI-VAN Yojana (2019): Viability gap funding for 2G ethanol plants — underfunded

Sources: Down to Earth , MoPNG , PIB , NITI Aayog Ethanol Roadmap

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