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Opinion

The E20 Ethanol Vision: Fuel for India's Future, or a Glass Half Empty?

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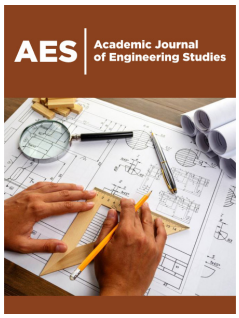

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Introduction

India is on the cusp of a quiet energy revolution. By 2025, every liter of petrol sold at your neighborhood pump could contain up to 20% ethanol. The government's E20 programme, driven by NITI Aayog's roadmap, promises to cut oil imports, support distressed farmers, and lower tailpipe emissions. Brazil did it. The United States subsidized it. Now India wants to leapfrog.

But beneath the glossy headlines lies a more complex story—one of ageing engines sucking up corrosive fuel, groundwater running dry in sugarcane belts, and a delicate trade-off between feeding the nation and fueling its cars.

Why Ethanol, and Why Now?

India imports nearly 85% of its crude oil. Every rupee saved on oil is a rupee that stays inside the country. Ethanol, derived from sugarcane molasses, maize, or surplus rice, is an oxygenated, high-octane additive that replaces toxic compounds like Methyl Tertiary-Butyl Ether (MTBE). It burns cleaner, reducing carbon monoxide and hydrocarbons.

But there are less obvious reasons. By 2025, India will need roughly 1,200 crore liters of ethanol annually. That translates to assured procurement from thousands of distilleries and a steady income stream for sugarcane and maize farmers. The NITI Aayog report projects that by 2030, the ethanol push could generate over ₹1.5 lakh crore in investment and support five lakh farmers indirectly.

For a government that has made *Atmanirbhar Bharat* a creed, ethanol looks like a triple win: energy security, rural income, and climate action.

The Global Lesson: Not All Ethanol is Equal

Brazil, the undisputed leader, blends up to 27% anhydrous ethanol and sells pure Hydrous Ethanol (E100) at pumps. Their secret? Sugarcane grown on vast, rain-fed land, and a fleet of Flex-Fuel Vehicles (FFVs) that can handle any blend. The United States, by contrast, relies on maize ethanol—heavily subsidized, energy-intensive, and mired in the food-versus-fuel debate.

Europe remains cautious, capping blends at E10 and insisting on strict sustainability criteria. Thailand is slowly walking the E20 path with cassava and molasses.

India's challenge is uniquely severe. Unlike Brazil, India's sugarcane belt lies in water-stressed Maharashtra, Karnataka, and Tamil Nadu. Unlike the US, India cannot afford large-scale maize diversion without spiking poultry and cattle feed prices.

The Engine under the Bonnet: Old vs New

Here is the first reality check. A brand-new car sold after April 2023—with E20-ready fuel lines, coated injectors, and adaptive ECU—will run just fine on E20. But over 30% of India's two-wheelers and older cars were built when E5 or E10 was the norm.

For those ageing engines, E20 is trouble. Ethanol absorbs water, corrodes brass and copper components, swells rubber seals, and leans out the air-fuel mixture. Cold starts become harder. Fuel economy drops by 3-6%. Some owners may face voided warranties and expensive repairs. The government has resisted mandatory retrofitting or scrappage. That is a quiet ticking bomb.

Water, Land, and the Food Plate

Sugarcane—India's primary ethanol source—is a thirsty crop. Producing one liter of ethanol from sugarcane juice can consume over 2,500 liters of water, much of it drawn from rapidly depleting groundwater. In Punjab and Haryana, rice diverted for ethanol is less egregious because the water has already been used for paddy. But in Maharashtra's sugar cooperatives, farmers are drilling deeper every year.

Maize, often touted as an alternative, brings its own problem: competition with animal feed. India's poultry sector, already reeling from price volatility, cannot afford a sudden ethanol-driven maize price spike.

The food security question is uncomfortable but unavoidable. Any large-scale diversion of food crops to fuel will hit the poor hardest—through higher prices for eggs, chicken, and edible oils.

The Carbon Calculus: Not as Green as it Seems

On paper, E20 from sugarcane can reduce lifecycle CO_2 emissions by 30-40% compared to petrol. That is real climate action. But the fine print matters. If new sugarcane plantations replace forests or grasslands, land-use change emissions can wipe out the entire benefit. Fertilizer use, diesel for farm machinery, and coal-fired distilleries also add to the carbon debt.

Second-Generation (2G) Ethanol—made from rice straw, cotton stalk, or corn stover—offers a far cleaner alternative. It uses agricultural residue that would otherwise be burnt, releasing smoke and particulates. India's 2G plants in Panipat, Bathinda, and Bargarh are running, but high capital costs, enzyme prices, and biomass logistics remain hurdles. The government's viability gap funding and GST reduction to 5% are steps forward, but not yet a leap.

A Calibrated Strategy for India

No single feedstock or policy will work across India's diverse agro-ecological zones. A one-size-fits-all E20 mandate is a recipe for distortion.

Instead, India needs a state-wise, feedstock-wise, vehicle-wise calibrated approach:

A. Feedstock Prioritization: Use only surplus rice (from FCI stocks) and C-molasses as low-hanging fruit. Cap sugarcane juice-based ethanol to avoid further groundwater stress. Promote maize only in rainfed areas (Madhya Pradesh, Rajasthan) and post-feed demand.

B. Aggressive 2G Push: Offer higher prices for 2G ethanol (₹65-70 per litre vs ~ ₹60 for 1G). Create biomass aggregation hubs. Mandate enzyme localisation.

C. Vehicle Segmentation: Mandate retrofitting of fuel systems for commercial vehicles older than 10 years. Provide subsidised kits for two-wheelers. Keep E10 available for older fleets in parallel.

D. Water-Smart Feedstock R&D: Scale up sweet sorghum (1,200L water per litre ethanol) and explore agave, cactus, and even algae for 3G ethanol.

E. Food Security Guardrails: Legally cap 1G food-based ethanol (Sugarcane Juice, Maize Grain, Rice) at 30% of total ethanol demand. Publish monthly food-versus-fuel use data in the public domain.

The Road to 2030

NITI Aayog's projections are ambitious: 20% blending by 2025, rising to 25-30% by 2030. The investment is substantial—₹1.5 lakh crore in distillery capacity, supply chains, and vehicle upgrades. The benefits, if managed well, are equally large: reduced import bills, lower farm distress, and cleaner air in cities like Delhi and Mumbai.

But the risks of a poorly executed policy are also high: degraded aquifers, higher food prices, damaged engines, and a public backlash that could set back biofuels by a decade.

India does not need to copy Brazil or the US. It needs to invent its own model—one that acknowledges water scarcity, protects food security, and phases in high blends without punishing the common citizen.

Ethanol is not a magic bullet. But as part of a diversified strategy that includes electric vehicles, public transport reform, and energy efficiency, it can be a powerful scalpel. Precise, calibrated, and used with care.

The writer is Professor, Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar, Gujarat. Views are personal.

Side Bar

What is 2G ethanol?

A. Made from rice straw, cotton stalk, corn stover, sugarcane trash.

B. Converts agricultural residue that is otherwise burnt (causing smog).

C. India has 3 operational plants; 12 more planned.

D. Challenges: High capital cost, enzyme price, biomass collection logistics.

What should India do?

A. Cap sugarcane juice-based ethanol to protect groundwater.

B. Mandate retrofitting kits for older two-wheelers & commercial vehicles.

C. Publish monthly food vs fuel feedstock data.

D. Price 2G ethanol higher (₹70/L) to incentivize investment.

E. Keep E10 available for incompatible vehicles until 2028.

Graphics

Water Consumption per Liter of Ethanol (Liters)

A. Sugarcane Juice: ■■■■■■■■■■■■■■■■■■■■■■■■■■ 2,500L

B. Maize Grain: ■■■■■■■■■■■■ 1,200L

C. Molasses: ■ 0L (waste product)

D. 2G (Rice Straw): ■ 15L (process only)

Lifecycle CO_2 reduction compared to petrol (%)

A. 2G ethanol: ■■■■■■■■■■■■■■■■ 70%

B. Sugarcane E20: ■■■■■■■■ 35%

C. Maize E20: ■■■■ 18%

Data sources: NITI Aayog (2021, 2023 reports), Ministry of Petroleum & Natural Gas, ICAR, ICCT, ARAI, SAE India, Nature Sustainability (2021), FCI, SIAM.