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INDUSTRY OUTLOOK

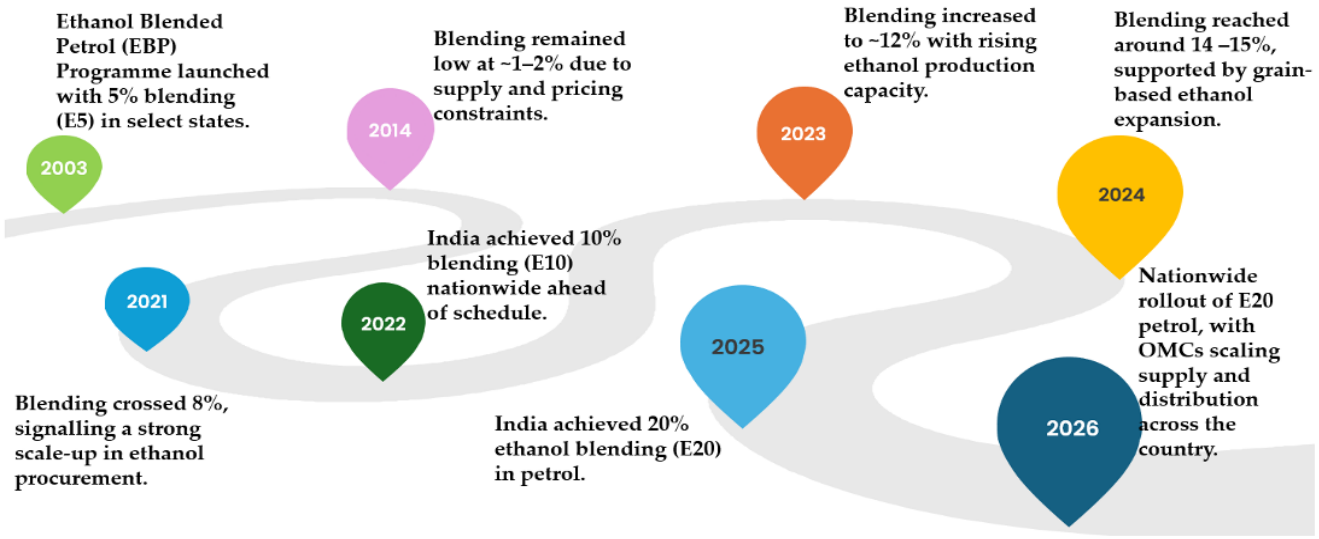
E20 AND BEYOND: THE EXPANDING ROLE OF INDIA'S ETHANOL BLENDED PETROL

22 May 2026

Evolution of the Ethanol Blending Programme

India's Ethanol Blending Petrol (EBP) Programme, implemented under the framework of the National Policy on Biofuels, has successfully achieved 20% ethanol blending (E20) ahead of the revised 2025-26 timeline. With blending targets largely met, the strategic focus is transitioning towards ensuring stable supply, optimising installed capacity, diversifying feedstock sources, and preparing for potential higher blending scenarios such as E30 and E100.

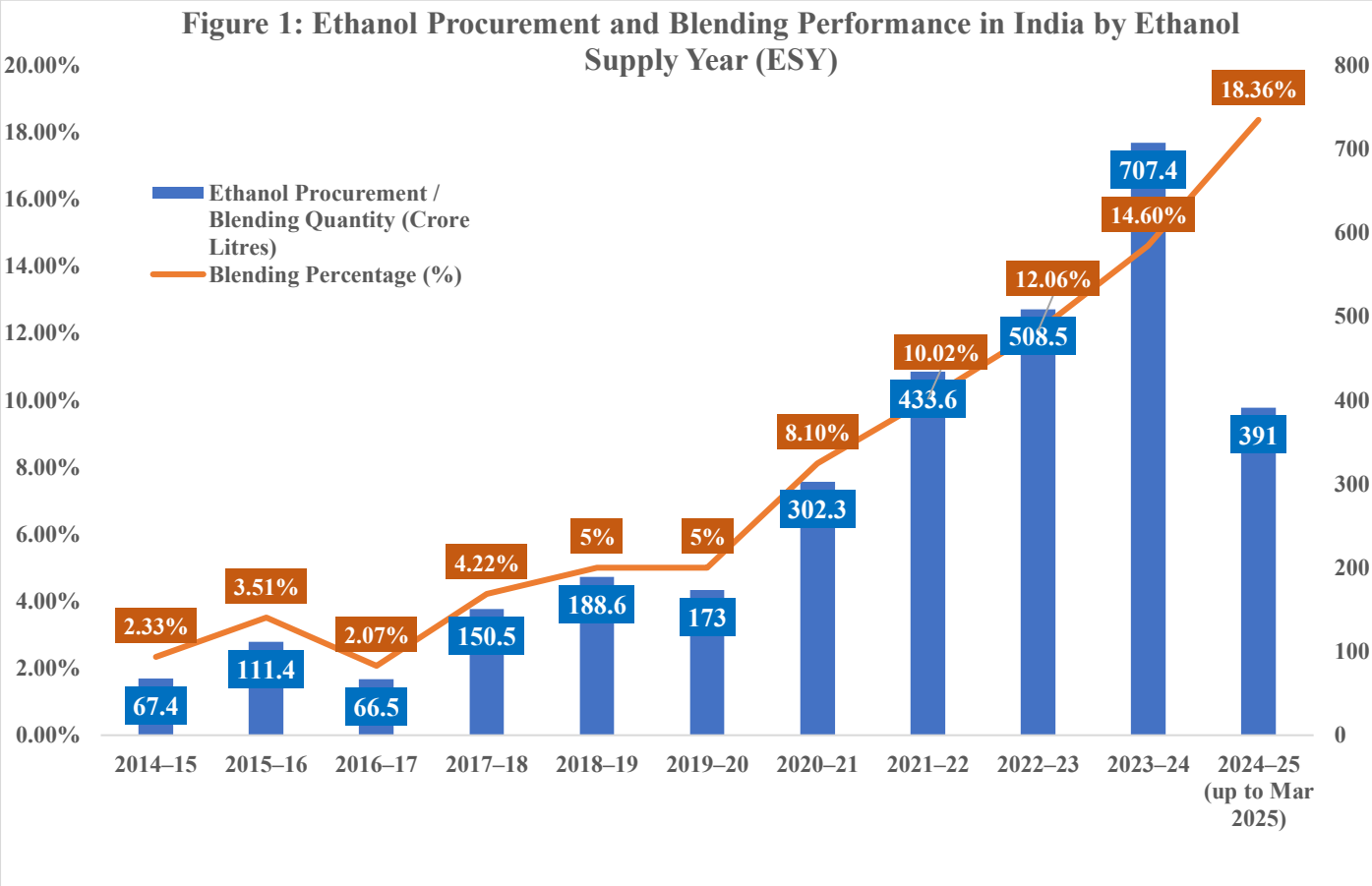
India's ethanol blending trajectory has accelerated significantly over the past decade. As shown in the figure below:



At its core, the programme seeks to address three macroeconomic imperatives: reducing crude oil import dependence, stabilising domestic sugar inventories, and augmenting rural incomes. India imports nearly 85% of its crude oil requirement, exposing the economy to exchange rate volatility and geopolitical supply disruptions. Ethanol blending directly substitutes a portion of petrol demand, generating measurable foreign exchange savings while contributing to carbon emission reduction commitments.

Installed Capacity and Demand Alignment

India's ethanol procurement expanded more than tenfold from 67.4 crore litres in ESY 2014-15 to 707.4 crore litres in ESY 2023-24, driving the blending rate from 2.33% to 14.6%. Despite procurement moderating to 391 crore litres in ESY 2024-25 (up to March 2025), the blending ratio has risen further to 18.36%, indicating improved blending efficiency and policy momentum toward the E20 target. The long-term trend in the figure below shows a structural shift in India's biofuel strategy, with ethanol blending moving from a pilot-level programme (below 5%) to a large-scale energy transition tool approaching the E20 target.



Source: MoPNG

Ethanol blending in India remained relatively stagnant around 4-5% between ESY 2017-18 and 2019-20 despite rising procurement, indicating early-stage supply and distribution constraints before the programme accelerated post-2020. The sharp increase in procurement after ESY 2020-21, i.e., from 302.3 crore litres to 707.4 crore litres by ESY 2023-24, highlights the impact of policy support, higher administered prices, and expanded feedstock diversification under the EBP. The most rapid growth phase occurred between ESY 2020-21 and ESY 2023-24, when blending levels nearly doubled from 8.1% to 14.6%, reflecting improved distillation capacity and stronger participation from sugar mills.

The E20 blending requires ~1,016 crore litres (≈10.16 billion litres) of ethanol annually. Including other uses, total ethanol demand is estimated at ~1,350 crore litres (≈13.5 billion litres). To meet this demand, ~1,700 crore litres of production capacity would be required, assuming 80% plant efficiency, whereas industry estimates suggest that India's installed ethanol production capacity has reached close to 20 billion litres annually, with an additional 4 billion litres expected to come online in the near term as ongoing distillery expansion projects are completed.[1] In contrast, the ethanol requirement for achieving the nationwide E20 blending mandate is estimated at approximately 11-12 billion litres per year for the current ESY beginning in November 2025.

This implies that the country could soon possess 24 billion litres of installed capacity against a demand of roughly 11 billion litres, creating a potential surplus capacity of nearly 100% above the current blending requirement.

Such a gap between capacity and demand raises two possible interpretations:

1. The government may be preparing the supply base for future higher blending targets such as E30 or beyond.
2. The industry could face a phase of suboptimal capacity utilisation, which may affect the financial viability of recently commissioned distilleries and investments made under the ethanol expansion push.

Acceleration of the E20 Rollout

India's EBP has progressed rapidly over the past decade, culminating in the achievement of 20% ethanol blending in petrol (E20), significantly ahead of the original timeline of 2025-26. While this milestone demonstrates strong policy execution and industry participation, the current supply-demand dynamics in the ethanol sector raise questions regarding capacity utilisation and future market absorption.

The surge in capacity was largely driven by strong policy incentives, including soft loans, assured procurement by oil marketing companies (OMCs), and price support mechanisms designed to encourage ethanol production from both sugar-based and grain-based feedstocks. These measures were critical to scaling the sector quickly to meet national targets aimed at reducing crude oil imports and lowering carbon emissions. However, once the E20 target has been achieved, the next phase of the programme requires a recalibration of supply planning, demand creation, and vehicle ecosystem readiness to ensure sustained utilisation of the expanded ethanol capacity.

Another notable aspect of India's ethanol strategy has been the speed of the transition from lower blends to E20 fuel. Historically, India moved gradually from E5 to E10 blending during the 2000s and early 2010s, but the shift from E10 to E20 occurred within roughly three years following the 2021 roadmap for ethanol blending.[2]

This acceleration was influenced partly by energy security considerations. India is the world's third-largest importer of crude oil, and the push for ethanol blending aims to reduce reliance on imported petroleum products while supporting domestic agricultural markets. Achieving E20 blending earlier than planned was therefore seen as a strategic step to diversify the country's fuel mix and mitigate vulnerabilities arising from global oil market volatility and geopolitical disruptions.

However, rapid implementation has also raised concerns within the automotive ecosystem. Some stakeholders have pointed out that a sudden shift in fuel composition may pose compatibility challenges for older vehicles, which were not originally designed to operate on higher ethanol blends. Reports have also indicated potential variations in fuel efficiency when using E20 fuel in certain vehicles.[3] India's E20 petrol rollout has become the only fuel option at nearly 90,000 fuel stations, replacing earlier blends like E5 and E10. The government acknowledges a possible marginal decline in fuel efficiency in older vehicles using E20. Automakers have given mixed guidance about compatibility, especially for vehicles manufactured before 2020. Industry bodies later clarified that E20 may reduce mileage by around 2-4% but does not pose safety risks.[4] These factors highlight the importance of ensuring that vehicle technology, fuel distribution systems, and consumer awareness evolve alongside fuel policy changes.

India has formally notified fuel specifications for higher ethanol-blended petrol variants, including E22, E25, E27 and E30, creating a regulatory framework for the next phase of the country's ethanol blending programme [5] [6].

In a notification dated May 15, 2026, the Bureau of Indian Standards (BIS) said it had established standard IS 19850:2026 for "*E22, E25, E27 and E30 Fuel, Admixture of Anhydrous Ethanol and Motor Gasoline for Usage in Positive Ignition Engine Powered Vehicles*." The standards define specifications for higher ethanol-petrol blends intended for use in petrol-powered vehicles and come as the government expands its biofuel roadmap beyond the existing E20 blending target.

The notification marks the latest regulatory step in India's broader effort to increase ethanol use in transportation fuels. The Centre has repeatedly said higher ethanol blending can help reduce crude oil imports, support domestic agriculture and lower vehicular emissions.
India accelerated its ethanol blending programme in recent years after advancing the target for 20 % ethanol blending in petrol from 2030 to the ethanol supply year 2025-26.
India is actively exploring 100% ethanol blending (E100) to reduce its 87% oil import dependency, with Union Minister Nitin Gadkari advocating that India should achieve energy self-reliance. While India achieved 20% blending (E20) ahead of schedule, moving to 100% requires transitioning to flex-fuel engines, as current vehicles cannot handle pure ethanol.

Key Considerations for 100% Ethanol Blending (E100)

Infrastructure & Vehicles: Shifting to E100 requires widespread adoption of flex-fuel engines designed to handle the corrosive nature of high-ethanol fuel on rubber and plastic components.

Supply Challenges: While India is pushing for second-generation ethanol from agricultural waste, relying on sugarcane poses water-intensity issues and may impact food prices.

Economic Impact: Ethanol production requires policy support to compete with petrol prices, although it offers significant savings in foreign exchange. Goal Alignment: The push is driven by the need to become self-reliant in energy and turn farmers into "*energy providers*" [7].

While the ambition for 100% exists, India is currently scaling up via E20 (20% blend) and planning to move towards E85 (85% blend) before reaching 100%[8].

International Comparison: Brazil's Gradual Ethanol Transition

India's rapid transition to E20 stands in contrast to the historical experience of Brazil, widely regarded as the global leader in ethanol-based transportation fuels[9]. Brazil's ethanol programme began with the Proálcool (National Alcohol Program) launched in 1975, which promoted ethanol production and blending in response to the global oil crisis. Over several decades, Brazil gradually increased the ethanol share in gasoline, supported by strong policy incentives and the parallel development of ethanol-compatible vehicles.

The ethanol blending mandate in Brazil historically fluctuated between approximately 10% and 27% depending on supply conditions, eventually stabilising around E25 before being raised to E27 in 2015.

Today, Brazil's transport fuel system is supported by a mature ecosystem in which:

- Standard gasoline contains 27% ethanol (E27).
- A large share of the vehicle fleet consists of flex-fuel vehicles capable of running on both gasoline blends and pure ethanol (E100).
- Ethanol adoption evolved gradually over four decades, allowing vehicle technology, infrastructure, and agricultural supply chains to develop in parallel.

This gradual approach enabled Brazil to integrate ethanol into its energy mix without causing major disruptions in the automotive or fuel supply ecosystem.

Structural Composition of Ethanol Supply

From a supply-side perspective, ethanol production capacity has expanded multifold over the past decade. Distillery capacity, once concentrated largely in sugarcane-rich states, has been broadened through policy incentives that support grain-based distillation, interest subvention schemes, and long-term offtake agreements with OMCs.

India's ethanol supply currently derives from three major streams:

- C-heavy molasses - Traditional by-product of sugar production.
- B-heavy molasses/sugarcane juice - Diverts a portion of cane away from crystallised sugar production toward ethanol.
- Grain-based ethanol - Primarily maize and surplus rice (including FCI stocks).

Table 1: Quantity of Ethanol Produced and Supplied to OMCs (Crore Litres)

Feedstock	ESY 2019-20	ESY 2020-21	ESY 2021-22	ESY 2022-23	ESY 2023-24	ESY 2024-25 *(as on 28.2.2025)*
C-Heavy Molasses	74.12	38.9	10.06	5.6	57.56	2.63
B-Heavy Molasses	68.14	183	249.43	235.3	148.81	21.69
Sugarcane Juice / Sugar Syrup / Sugar	14.83	39	80.26	128.4	63.9	116.16
Damaged Food Grain (DFG)	15.94	39.3	22.59	31.9	115.62	18.95
Maize	0	0	0	31.5	286.47	119.45
FCI Rice	0	2.2	45.75	73.7	0.13	0
Total	**173.03**	**302.4**	**408.09**	**506.4**	**672.49**	**278.88**

Source: GoI, Ministry of Consumer Affairs, Food and Public Distribution, Department of Food and Public Distribution. Lok Sabha Unstarred Question No. 2761, Annexure, 06 August 2025

Ethanol production in India is carried out by distilleries that supply ethanol primarily for blending with petrol under the EBP Programme, along with other industrial uses. The quantity of ethanol procured is determined by demand from public sector Oil Marketing Companies (OMCs), and there are no inter-state restrictions on ethanol supply, allowing distilleries to supply across the country, depending on procurement requirements.

In addition to existing capacity, the government has supported the expansion of ethanol production through the Ethanol Interest Subvention Scheme, aimed at augmenting distillation capacity under the EBP programme. Under this initiative, 38 new distilleries across several states are expected to be commissioned, with a projected additional annual production capacity of about 169 crore litres. Major capacity additions are anticipated in states such as Maharashtra, Madhya Pradesh, Karnataka, Gujarat, and Rajasthan, which are emerging as key hubs for ethanol production[10].

During the ESY 2024-25, ethanol blending continued to expand across Indian states. Between November 2024 and March 2025, India blended 391 crore litres of ethanol under the EBP Programme, achieving an average blending rate of 18.36% in petrol sales, as per data from the Ministry of Petroleum and Natural Gas (MoPNG).

The expansion of ethanol blending has also generated notable macroeconomic benefits by lowering India's dependence on imported crude oil. Over the last eleven years (2014-15 to 2024-25), ethanol blending by Oil Marketing Companies (OMCs) has saved more than ₹1.44 lakh crore in foreign exchange, substituted around 245 lakh metric tonnes of crude oil, and reduced carbon emissions by nearly 736 lakh metric tonnes, equivalent to planting about 30 crore trees. At the same time, ₹1.96 lakh crore has been paid to distilleries, fueling the expansion of the biofuel industry, while ₹1.18 lakh crore has gone directly to farmers, boosting rural incomes and strengthening the agricultural economy. The environmental impact of this shift has also been significant, with 698 lakh tonnes of CO_2 emissions reduced due to the adoption of cleaner fuel.

Iran - US/Israel War

Rising geopolitical tensions around the Strait of Hormuz, a critical artery through which nearly 20-30% of the world's traded crude oil passes is following recent scuffles involving Israel and the United States have once again pushed global crude prices upward, highlighting the fragility of international energy supply chains. For India, this situation opens a window of opportunity to cushion the impact of crude shocks by strengthening its domestic ethanol ecosystem and focusing inward. Higher global crude prices often encourage major producers to divert a larger share of sugarcane toward ethanol production at the expense of sugar, which could tighten global sugar supplies and improve the prospects for Indian sugar exports.

Additionally, high freight costs and uncertain times for Brazilian sugar shipments to Asian markets could further support India. Domestically, the rise in crude prices may also prompt the government to accelerate supportive measures for the ethanol sector, including expediting the issuance of the C2 tender for 150 crore litres of ethanol supply, revising ethanol procurement prices, and addressing existing anomalies in ethanol allocation.[11] Amid the ongoing conflict in West Asia that is disrupting global energy supply chains, the Indian government has taken steps to secure domestic fuel availability. With crude oil prices remaining volatile due to uncertainty surrounding shipments through the Strait of Hormuz, New Delhi has invoked provisions of the Essential Commodities Act (EC Act) to regulate the supply and distribution of natural gas, ensuring that priority sectors continue to receive adequate fuel. Additionally, the Ministry of Petroleum and Natural Gas has introduced a 25-day interval between LPG bookings to discourage hoarding and prevent black-marketing.

Challenges of Blending

Falling Mileage

One of the most practical concerns with ethanol blending is vehicle compatibility. Most vehicles currently on Indian roads were designed for E10 fuel (10% ethanol). When higher blends like E20 are used in vehicles not designed for them, several issues may arise:

- Corrosion of engine components because ethanol absorbs moisture.
- Degradation of rubber and plastic fuel system parts.
- Lower fuel efficiency, since ethanol has lower calorific value than petrol.
- Engine knocking or performance issues in older vehicles.

Automobile manufacturers have begun producing E20-compliant vehicles, but millions of older vehicles will remain on roads for years. This creates a transition challenge, as both fuel suppliers and vehicle manufacturers must adapt simultaneously. Ethanol is hygroscopic in nature, meaning it tends to absorb moisture from the atmosphere. If a vehicle remains unused for extended periods, this property can lead to water accumulation in the fuel system, potentially causing rusting in fuel tanks, blockages in fuel lines, and degradation of certain rubber or plastic components. To address these issues, automobile manufacturers have begun introducing component upgrades. For instance, Maruti Suzuki has introduced upgrade kits costing around ₹6,000[12], while certain models from Hyundai Motor Company, including Creta, may require replacement of components such as fuel injectors, pumps, tanks, and carburetor floats, which can raise costs to ₹14,000 or more, with total installation expenses potentially reaching ₹35,000. In some cases, manufacturers may not provide warranty coverage for damage caused by ethanol exposure to components originally designed only for E10 fuel.[13]

Although newer BS-VI-compliant vehicles are increasingly being designed to accommodate higher ethanol blends, the large stock of legacy vehicles on Indian roads continues to pose a transition challenge.

Also, ethanol contains significantly lower energy content than petrol, around 24 MJ per liter compared with roughly 34 MJ per liter for petrol, implying nearly 30% lower energy density.[14] This raises concerns about a potential decline in fuel efficiency. However, according to NITI Aayog, the actual mileage impact from E20 fuel is expected to be relatively modest, with fuel efficiency declining by 1–2% for four-wheelers and about 6–7% for larger vehicles.[15] Despite this, consumer apprehension persists as even a marginal drop in mileage can translate into higher effective fuel costs when retail fuel prices remain unchanged.

Pricing Distortion: Ethanol Sold at Petrol-Equivalent Prices

Another criticism of the ethanol programme is related to fuel pricing and consumer economics. Even though ethanol is generally cheaper to produce than petrol, consumers often pay nearly the same retail price for ethanol-blended petrol. This creates several issues:

- Lower energy content: Ethanol provides about 30-35% less energy than petrol, meaning vehicles travel fewer kilometres (kms) per litre.
- Consumers effectively pay more per km when ethanol blending increases, but prices remain unchanged.
- Hidden cross-subsidy: Consumers may unknowingly subsidise ethanol procurement and the sugar industry.

However, critics argue that the pricing structure lacks transparency and may reduce public acceptance of higher ethanol blends.

Water and Environmental Stress

The environmental implications of India's ethanol expansion extend beyond fuel substitution and raise important concerns regarding water use, cropping patterns, and ecological sustainability. Ethanol production in India is still largely dependent on sugarcane-based feedstocks, a crop known for its intensive water requirements. Estimates suggest that producing one litre of ethanol from sugarcane can require roughly 2,000-3,000 litres of water, considering irrigation needs and processing requirements. This places significant pressure on groundwater resources, particularly in states such as Maharashtra and Karnataka where sugarcane cultivation has expanded rapidly despite recurring droughts and declining water tables. The environmental footprint is further compounded by the process of distillation, as ethanol plants generate large volumes of spent wash and wastewater, which can cause soil and water pollution if not properly treated through zero-liquid-discharge or bio-treatment systems.

The government has attempted to diversify feed stocks to reduce dependence on sugarcane. Ethanol can also be produced from maize, damaged rice, rice husk, wheat husk, and bagasse, along with emerging second-generation biofuel technologies that use agricultural residues. However, several of these inputs remain linked to the food security debate. For instance, maize and rice are staple or feed crops, and their diversion toward ethanol production raises concerns about potential impacts on food prices and availability. This is one reason why some policymakers remain cautious about relying heavily on corn-based ethanol, despite its wider use in countries like the United States.

The water-intensive crops such as sugarcane and paddy are already associated with groundwater depletion in states like Punjab and Haryana, where decades of paddy-wheat cultivation have contributed to falling water tables and early signs of land degradation and desertification risks. Similar concerns arise when ethanol demand incentivises the expansion of sugarcane in semi-arid regions, potentially exacerbating ecological stress.

Globally, countries have begun adjusting agricultural strategies to conserve water resources. For example, China has increasingly reduced domestic rice cultivation in water-stressed regions and relied more on imports from countries such as India and Bangladesh, partly to protect its limited freshwater reserves. Such shifts highlight the broader tension between agricultural production, water sustainability, and industrial uses of crops.

Recognising these environmental constraints, policymakers and researchers have begun exploring alternative biofuel pathways. These include bamboo-based biomass in northeastern states like Assam, where bamboo is technically a fast-growing grass that requires relatively less water and can be harvested without strict forestry penalties. Similarly, advanced technologies are experimenting with engineered algae capable of producing bioenergy or electricity, offering a potential future pathway that does not rely on arable land or food crops.

Taken together, these factors underscore why the environmental sustainability of ethanol production remains a subject of ongoing debate. While ethanol blending offers clear benefits in terms of reducing fossil fuel dependence and supporting rural incomes, its long-term viability depends on balancing energy goals with water conservation, sustainable cropping patterns, and responsible waste management in the biofuel industry.

Response To Concerns on Blending of Ethanol in Petrol - Misplaced Fears?

India's ethanol blending programme is positioned as a key pillar of the country's clean energy transition and energy security strategy. Biofuels and natural gas are considered "bridge fuels" that support India's commitment to achieving Net Zero emissions by 2070 under its Nationally Determined Contributions (NDCs). According to a NITI Aayog study, sugarcane-based ethanol reduces greenhouse gas emissions by about 65% and maize-based ethanol by nearly 50% compared to petrol.

The programme has also generated significant economic benefits for rural India. Increased ethanol production has improved farmer incomes, reduced sugarcane payment arrears, strengthened maize cultivation, and redirected money previously spent on crude oil imports toward Indian farmers [16] [17].

Concerns regarding mileage, engine performance, and vehicle life were anticipated years ago and examined by an Inter-Ministerial Committee under NITI Aayog, supported by studies from Indian Oil Corporation (IOCL), Automotive Research Association of India (ARAI), and the Society of Indian Automobile Manufacturers (SIAM).

The government states that E20 fuel offers several performance benefits. Ethanol has a higher-octane rating (around 108.5 compared to petrol's 84.4), which improves anti-knocking properties and supports modern high-compression engines. Petrol sold in India earlier had a Research Octane Number (RON) of 88, which increased to 91 under BS-VI norms and has further improved to about 95 with E20 blending. E20 vehicles are said to provide better acceleration, smoother ride quality, and nearly 30% lower carbon emissions compared to E10 fuel. Ethanol's cooling properties also improve engine efficiency by lowering intake temperatures and increasing air-fuel mixture density.

The government rejects claims of a drastic reduction in mileage due to E20 fuel. It argues that fuel efficiency depends on several factors, such as driving habits, tyre pressure, vehicle maintenance, air filter condition, and air-conditioning usage. Discussions with SIAM and vehicle manufacturers reportedly indicate only marginal efficiency drops, if any, in E10 vehicles. Several manufacturers had already introduced E20-compatible vehicles as early as 2009.

The Ministry argues that reverting to unblended petrol (E0) would reverse gains in pollution control and energy transition. The roadmap for E20 adoption has been publicly available since 2021, allowing over four years for improvements in vehicle technology, fuel supply chains, and ecosystem readiness.

International experience is also cited in support of ethanol blending. Brazil has been successfully operating on E27 fuel for years using vehicles from global manufacturers such as Toyota, Honda, and Hyundai. Indian authorities maintain that E20 standards are backed by BIS specifications and Automotive Industry Standards. Most compatibility concerns are limited to older vehicles, where some rubber components or gaskets may wear faster and require inexpensive replacement during routine servicing, possibly once during the vehicle's lifetime.

On pricing concerns, the government clarified that ethanol is no longer cheaper than petrol, unlike when NITI Aayog prepared its 2020-21 report. The average procurement cost of ethanol in 2024-25 is about ₹71.32 per litre, including transport and GST. Prices of ethanol produced

from C-heavy molasses and maize have risen substantially in recent years. Despite higher ethanol procurement costs, the government continues the blending programme due to its benefits for energy security, farmer incomes, and environmental sustainability.

The Ministry also dismissed claims that vehicle insurance becomes invalid with E20 fuel use, calling such fears baseless and driven by misinformation. Insurance companies have clarified that E20 usage does not affect vehicle insurance validity in India. Automobile manufacturers and authorised service centres remain available to assist vehicle owners with tuning or component replacement if required.

Regarding plans beyond E20, the government stated that no decision had been taken. Any move beyond 20% blending will require extensive consultation with automakers, ethanol producers, oil companies, feedstock suppliers, and research agencies. The current roadmap commits to E20 implementation until 31 October 2026, after which future decisions will depend on recommendations from the Inter-Ministerial Committee and stakeholder consultations.

Reluctance by OMCs

Oil Marketing Companies (OMCs) have been reluctant to procure ethanol, affecting the progress of the ethanol blending programme. Although OMCs initially committed to lifting about 700 crore litres of ethanol from sugar and 125 crore litres from grain-based distillers, government advice to curb purchases due to concerns over a potential sugar shortage reduced the contracted quantity to around 560 crore litres. Actual offtake has been slower still, with only about 197 crore litres lifted between November 1, 2023, and March 17, 2024, roughly one-third of the annual target. Industry officials have noted that both the contracted volumes and the pace of lifting are lower than last year, while the petroleum ministry attributes the slower procurement, partly to storage constraints and maintenance work at some facilities, though it remains hopeful that the blending target will be met.[18]

When ethanol blending was at 5% in 2018-19 (see figure 1), crude oil imports were 226 mt, meeting about 87.4% of the total requirement. Despite blending rising to almost 20%, imports were 226 mt (until Feb), with imports dependence still rising to 90%. This indicates that the higher blending has not reduced reliance on imported crude due to faster rate of oil consumption.

Table 2: Rise in Import dependence		
Year	**Imports**	**Import dependency**
	'000 tonnes	Per cent
2018-19	2,26,498	83.8
2019-20	2,26,955	84.9
2020-21	1,96,461	84
2021-22	2,12,382	85.6
2022-23	2,32,700	87.3
2023-24	2,34,262	87.8
2024-25	2,43,225	88.3
2025-26*	2,26,995	89
*Until February 2026; Source: PPAC		

Government Initiatives

The government promotes the EBP programme through policy frameworks (National Biofuel Policy), financial incentives (interest subvention schemes), tax reductions, infrastructure development, and guaranteed procurement by oil companies. Substantial financial flows, i.e., over ₹1.4 lakh crore to farmers and large foreign exchange savings, demonstrate the economic and environmental importance of the programme.

Table 3		
Initiative / Policy	**Key Features**	**Objective / Impact**
Ethanol Blended Petrol (EBP) Programme (2003)	Introduced blending of ethanol with petrol; blending increased from **1.53% in 2014 to 20% in 2025**, achieving the target ahead of the 2025–26 deadline.	Reduce dependence on crude oil imports, promote cleaner fuel, and support the domestic biofuel sector.
National Policy on Biofuels (2018)	Expanded feedstock base beyond molasses to include **sugarcane juice, corn, rotten potatoes, and other agricultural inputs**; allowed use of **surplus FCI grains** for ethanol production.	Diversify ethanol sources, manage surplus food stocks, and create additional income opportunities for farmers.
Administered Pricing Mechanism	The government introduced **fixed ethanol procurement prices** for Oil Marketing Companies (OMCs).	Ensure stable and remunerative returns for ethanol producers and encourage capacity expansion.
Financial Support and Interest Subvention Schemes	Interest subvention and capital assistance provided for setting up **molasses- and grain-based distilleries**.	Increase ethanol production capacity and promote private investment in the biofuel sector.
GST Reduction on Ethanol for EBP	GST on ethanol supplied for blending has been reduced from **18% to 5%**.	Improve cost efficiency and encourage ethanol supply to the EBP programme.

Long-Term Offtake Agreements (LTOAs)	OMCs sign long-term agreements with ethanol producers for procurement.	Provide **assured demand and revenue stability** for ethanol manufacturers.
Pradhan Mantri JI-VAN Yojana	Promotes **second-generation (2G) ethanol production** using agricultural residues such as rice straw.	Reduce crop residue burning and promote advanced biofuel technologies.
Vehicle and Fuel Infrastructure Development	Introduction of **E20 fuel norms**, draft rules for **E100 vehicles**, and deployment of **E20 fuel at over 17,000 retail outlets**.	Support the transition to higher ethanol blending and ensure vehicle compatibility.
Ethanol Blending Roadmap (2020–25)	Strategic roadmap outlining policies and steps to achieve higher ethanol blending targets.	Provide a structured pathway for achieving the **20% blending target**.
Global Biofuels Alliance (GBA)	India-led international initiative to promote cooperation on biofuel technologies and standards.	Strengthening global collaboration and accelerating biofuel adoption worldwide.

Box 1: Report of NITI Aayog on Roadmap for Ethanol Blending in India 2020-25

Report Highlights

The NITI Aayog released a report on 'Roadmap for Ethanol Blending in India 2020-25' in June 2021. The report suggests: (i) an annual roadmap for production and supply of ethanol till 2025-26, and (ii) systems for country wide marketing of ethanol. Note that the National Policy on Biofuels, 2018 was notified in June 2018, which aimed at achieving 20% blending of ethanol in petrol by 2030. In December 2020, the deadline to achieve the ethanol blending target was revised to 2025. Key observations and recommendations include:

- **Fuel ethanol demand projection:** The report estimates that India's requirement of ethanol for petrol blending will increase from 173 crore litres in 2019-20 to 1,016 crore litres in 2025-26. To meet this demand, the ethanol production capacity will have to be increased from 684 crore litres in 2019-20 to 1,500 crore litres in 2025-26. This includes production capacity of: (i) 740 crore litres of grain-based ethanol, and (ii) 760 crore sugar-based ethanol. The report recommended that to enable roll out across India, ethanol may be supplied from surplus to deficit states based on the requirements. This will ensure uniform availability of ethanol blends in the country.
- **Ethanol blending roadmap:** The report recommends that the Ministry of Petroleum and Natural Gas should notify a plan for availability of E10 fuel (blend of 10% ethanol and 90% petrol) by April 2022. Further, the Ministry should notify a plan for continued availability of the fuel for older vehicles. Fuel blended with 20% ethanol (E20) should be launched in phased manner from April 2023 to ensure

availability of E20 by 2025. The roll out of higher ethanol blends may be done in phased manner, starting with the states with surplus production of ethanol.

- **Expediting regulatory clearances:** Ethanol production plants need environmental clearances for new projects and expansion of existing projects. The report recommends certain measures to expedite regulatory clearances for ethanol production such as expediting the issuing of consent to establish distilleries by state governments. Further, a single window system may be formulated by the Department for Promotion of Industry and Internal Trade to accord speedy clearances. This would facilitate speedy clearances for new projects and expansion of current projects for ethanol production.
- **Ethanol pricing and environmental impact:** In 2018-19, the government introduced a differential pricing policy wherein higher rates were offered to sugar mills for ethanol production from B-heavy molasses (an intermediate product) and sugarcane juice. This incentivizes sugarcane-based ethanol production. One litre of ethanol from sugar requires about 2,860 litres of water. In view of the need for water conservation, the report recommended that suitable incentives should be used to (i) source ethanol from less water intensive crops, and (ii) promote production from maize and second-generation sources.
- **Ethanol compatible vehicles:** The Committee highlights that in order to use higher ethanol blends, vehicles need to be designed holistically to prevent engine failure and low fuel economy. Flex Fuel vehicles, though proven, would cost more than normal petrol vehicles. To ensure production of ethanol blended petrol compatible vehicles in the future, the Committee recommended that: (i) E20 material compliant and E10 engine tuned vehicles may be rolled out across the country from April 2023, and (ii) vehicles with E20 tuned engines can be rolled out from April 2025.
- **Unrestricted movement of denatured ethanol:** The report noted that ethanol used for blending purpose is denatured ethanol (unfit for human consumption). It further noted that state governments are empowered to legislate, control, and levy taxes and duties on liquor meant for human consumption. The report recommended that movement of denatured ethanol across India should not be under control of states. It may be controlled only by the central government to ensure unrestricted movement across India.

E100: The Future

Going forward, India's EBP programme requires a coherent, long-term strategy that goes beyond the current E20 target. To be sure, India has made significant progress in accelerating ethanol blending, driven by concerns over rising crude oil imports, energy insecurity, and environmental degradation. But the next phase of the programme must focus on sustainability, affordability, and technological preparedness. A calibrated, phased transition is essential so that automobile manufacturers, fuel retailers, farmers, and consumers can gradually adapt to higher ethanol blends without major economic or technical disruptions.

A key challenge remains the pricing and market competitiveness of E20 fuel. Unless ethanol-blended petrol is priced lower or at least competitively with conventional petrol, consumer adoption may remain limited despite government mandates. Fiscal incentives, tax rationalisation, and targeted subsidies during the transition period could help create stronger demand for ethanol-compatible vehicles and fuels. Simultaneously, consumers should retain the flexibility to choose among different fuel blends, as this would ease concerns regarding vehicle compatibility, mileage efficiency, and long-term engine performance.

Building public confidence through awareness campaigns and transparent fuel-efficiency data will also be critical. The government must also articulate a clear roadmap for future targets such as E30, E50, or even E100 fuels. Such policy clarity would encourage long-term investments in flex-fuel vehicle technology, refinery infrastructure, and advanced biofuel production. Brazil's successful flex-fuel programme demonstrates that sustained policy support, stable pricing mechanisms, and infrastructure readiness are crucial for scaling ethanol adoption. India can draw important lessons from such international experiences while adopting - and, more importantly, adapting - them to domestic realities. However, the expansion of ethanol production should not come at the cost of food security or excessive water consumption.

Currently, a large share of India's ethanol is produced from sugarcane, a highly water-intensive crop. Therefore, future policy must increasingly promote second-generation biofuels derived from agricultural residues, municipal waste, and non-food biomass. Greater investment in research, innovation, and rural bio-refineries can diversify feedstocks while generating additional income opportunities for farmers. If implemented strategically, the EBP programme could significantly reduce India's dependence on imported crude oil, lower carbon emissions, strengthen rural economies, and advance the broader goal of energy self-reliance. This is a tall order and requires coordinated, concerted measures with a sense of urgency from all stakeholders. Difficult, yes, but by no means undoable.

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