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Report Highlights:

Post estimates India's ethanol production in calendar year (CY) 2025 to reach 10.5 billion liters (BL), marking a 46 percent increase over 2024 due to improved feedstock availability and favorable monsoon conditions. Ethanol consumption is projected to rise to 11.4 BL with 9.7 BL allocated to fuel ethanol. Despite the remarkable growth, Post forecasts the annual nationwide average blend rate for CY 2025 at 19.3 percent, slightly below the E20 target due to regional shortages in feedstocks and logistics constraints. Industrial ethanol imports are forecast to rise 30 percent to 1 BL in 2025, primarily from the United States, to meet demand from beverage, medicinal, and industrial sectors. India's biodiesel production is forecast at 718 million liters in 2025, a 60 percent increase over 2024. However, the national blend rate is expected to reach 0.7 percent, far from the 5 percent target for 2030 due to feedstock constraints.

THIS REPORT CONTAINS ASSESSMENTS OF COMMODITY AND TRADE ISSUES MADE BY USDA STAFF AND NOT NECESSARILY STATEMENTS OF OFFICIAL U.S. GOVERNMENT POLICY

I. Executive Summary

FAS New Delhi projects India's average ethanol blending rate will reach 19.3 percent for the 2024-2025 calendar year. This is based on the increased availability of feedstock for ethanol production such as sugarcane syrup, B-heavy molasses, damaged food grains, surplus rice from the Food Corporation of India (FCI), and corn. Earlier this year, the Indian government officially announced the achievement of 17.9 percent for the 2024/25 ethanol supply year (ESY) which runs from November to October.[1] Following this, the Ministry of Petroleum and Natural Gas (MOPNG) announced that India achieved a blend rate of 19.6 percent and is considering a new target beyond E20.[2] This milestone marks a significant step in India's Ethanol Blending with Petrol Program (EBP), which has advanced rapidly since the E12 target was reached ahead of schedule in April 2023. The increased availability of the aforementioned feedstocks has contributed substantially to these gains.

India's longstanding position as one of the top sugarcane producers in the world, alongside Brazil, facilitated the significant production of ethanol from sugarcane. However, over the past two seasons, sugarcane output has diminished due to unpredictable monsoons and pest issues. Consequently, sugar production for the 2024/25 marketing year (MY), which runs from October to September, is projected to decrease by five percent. To safeguard domestic food security, the Indian government limited ethanol production from sugar derivatives until last year. At the same time, the use of broken rice was prohibited due to dwindling food stocks. For calendar year 2024, the restrictions are estimated to result in a 20 percent reduction in ethanol feedstock availability compared to the previous year. With the sugar restrictions, there was an increased reliance on grain feedstocks in 2024. Post expects this trend will continue into 2025.

For the 2024/25 ESY, the Indian government approved 5.2 million metric tons (MMT) of FCI rice for ethanol production. Between November 2024 to March 2025, only 0.25 MMT of FCI rice has been utilized for ethanol production, while there has been enhanced support for corn cultivation through minimum support prices and contracted procurement, further facilitating the shift from grain to fuel. This diversification strategy, bolstered by continuous investments, is expected to alleviate future feedstock shocks. Nevertheless, as of April 2025, only 2.11 billion liters (BL) of ethanol have been contracted, compared to the necessary 8.25 BL for fuel blending, indicating a potential 58 percent shortfall from the same timeframe in the previous ESY. However, Post anticipates that this shortfall will be addressed primarily through grain feedstocks throughout the current year.

India's ethanol production capacity was reported at 16 BL as of March 2025. To sustain the national E20 target, a capacity of 17 BL is required, assuming 80 percent plant efficiency. This

[1] [1] Press Information Bureau, Release ID: 2113234

[2] "India looking at increasing ethanol blending with petrol to over 20%: Hardeep Singh Puri". The Hindu. Published on February 26, 2025

would demand an additional 7 million hectares of cultivated feedstock area, which remains a key policy challenge. The ban on ethanol imports for fuel blending further constrains the availability of alternatives, reinforcing the urgency for accelerated capacity expansion.

To date, India's biofuel strategy has delivered notable benefits. The EBP reportedly reduced gasoline consumption by over 5 BL in ESY 2022/2023, saving substantial foreign exchange and cutting carbon emissions by 10.8 MMT. These outcomes reinforce the program's central role in achieving India's nationally determined contributions (NDCs) under the Paris Agreement. Additionally, India's leadership in global clean energy diplomacy has expanded with the launch of the Global Biofuel Alliance (GBA) in September 2023, in collaboration with the United States and Brazil. With 27 countries and 12 organizations now participating, the alliance underscores India's role in driving international coordination for sustainable fuel adoption. Relatedly, Prime Minister Narendra Modi's 2025 visit to Washington marked a renewed commitment by India and the United States to strengthen their strategic partnership, particularly in the areas of energy security, innovation, and emerging technologies.[3]

On the other hand, India's biodiesel sector remains in an early stage of growth. The 5 percent on-road blending target by 2030 remains unchanged. Biodiesel production is forecast to rise to 574 ML in 2025, up from 358 ML in 2024. However, the national average blend rate is projected at just 0.7 percent. Primary feedstocks—used cooking oil (UCO), animal fats, non-edible oils, and palm stearin—remain limited in supply, and despite the Repurpose Used Cooking Oil (RUCO) initiative, feedstock collection remains inefficient and fragmented. While more than 80 certified biodiesel plants exist, their utilization rates are low due to unreliable input supply chains.

India is also exploring long-term bioenergy strategies across the transportation and power sectors. In the electric transportation space, in comparison to the last Indian fiscal year (IFY), which runs from April to March, vehicle registrations rose by more than 6 percent during the 2024/25 IFY. This growth is bolstered by national incentives, various schemes, and the enhancement of public charging infrastructure. Additionally, the government has mandated that all vehicles produced after April 1, 2025, must comply with E20 standards to alleviate consumer concerns and align with blending policy objectives.

At the same time, India is making significant investments in renewable energy to boost energy security, reduce fossil fuel dependence, and achieve climate targets. Renewable electricity generation has grown substantially, from 205,608 Gigawatt-hour (GWh) in IFY 2014/15 to 370,320 GWh in 2023/24, reflecting a compound annual growth rate of 6.76 percent. This growth is driven by ambitious policies such as the National Solar Mission, state incentives, and supportive regulations from the Ministry of New and Renewable Energy (MNRE), encouraging both public and private sector participation. Solar energy, in particular, has expanded rapidly due to lower technology costs, improved efficiency, and government programs like PM-KUSUM and

[3] https://www.whitehouse.gov/briefings-statements/2025/02/united-states-india-joint-leaders-statement/

the Pradhan Mantri Rooftop Solar Scheme. These initiatives aim to reduce carbon emissions, create jobs, enhance rural energy access, and drive technological progress in the power sector. Notably, the government has doubled its IFY 2025/26 allocation to the National Green Hydrogen Mission, reaching INR 6 billion, to scale up domestic production and reduce industrial emissions. Simultaneously, India's National Bioenergy Program (2021–2026) and the Pradhan Mantri JI-VAN Yojana continue to provide fiscal and technical support for second-generation bioethanol and biogas projects.

Lastly, on the aviation front, India has set ambitious blending targets for its Sustainable Aviation Fuel (SAF) program. The country aims to achieve a blending target of 1 percent by 2027, 2 percent by 2028, and 5 percent by 2030 for international flights. In support of these goals, Indian airlines have begun conducting trial flights using blends of SAF combined with traditional Aviation Turbine Fuel, marking an important step toward mainstream adoption. While these targets are ambitious, SAF remains significantly more expensive than traditional jet fuel—typically 3 to 5 times higher in cost. The biggest challenge is the high capital required to establish SAF production facilities, especially in early development stages. Despite these barriers, Indian airlines have begun trial flights using SAF with traditional Aviation Turbine Fuel. Strategic partnerships like the one between Airbus and the Indian Institute of Petroleum are expected to accelerate cost reduction and supply readiness.

II. Policy and Programs

A. Renewable Energy and Greenhouse Gas (GHG) Emissions: India is investing heavily in renewable energy as part of its broader strategy to enhance energy security, reduce dependence on fossil fuels, and meet its climate goals. This commitment is evident in the country's sustained growth in electricity generation from renewable sources, which include solar, wind, hydro, biomass, and small hydro power projects. See Table 1 and 2. As a result, the gross generation of electricity from renewables has seen a substantial increase, rising from 205,608 Giga Watt-hour (GWh) in Indian fiscal year (IFY) 2014/15 to 370,320 GWh in IFY 2023/24, as illustrated in Figure 1. This marks a compound annual growth rate (CAGR) of 6.76 percent over the ten-year period.[4]

[4] Press Information Bureau. Release ID: 2116510

Table 1. India: Installed Generation Capacity (GW) as of April 30, 2024

Category	Wind Power	Solar Power	BM Power/ Bagasse Cogeneration	Waste to Energy	Small Hydro Power	Total
Installed Generation Capacity	50	105	11	0.8	5	171
% Share of Total	29	61	6	0.5	3	N/A

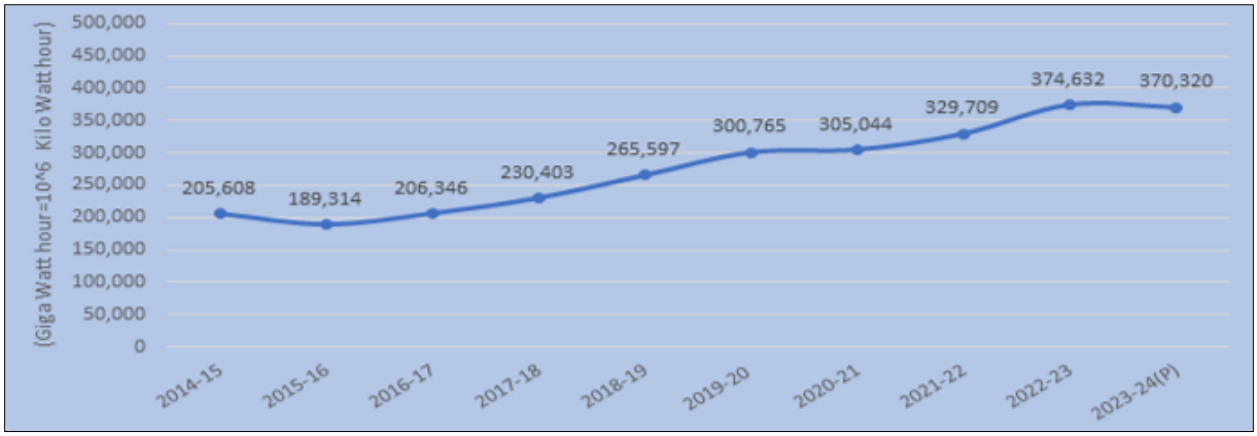
Source: Ministry of Power, New, and Renewable Energy (MNRE), Government of India.

Table 2. India: Installed Capacity of Renewables (In Gigawatts)

Renewable Energy	Wind Power	Solar Power	Small Hydro Power	Biomass (Bagasse) Cogeneration	Biomass (non-bagasse) Cogeneration	Waste to Power	Waste to Energy (off-grid)	Large Hydro Power	Total
Total (GW)	51	110.8	5.1	9.8	0.9	0.3	0.5	47.9	226.8

Source: Ministry of Power, New, and Renewable Energy (MNRE), Government of India. Note: All figures as on May 31, 2025.

Figure 1. Gross Generation of Electricity from Renewable Sources of Energy



Source: Ministry of Statistics and Programme Implementation, Government of India

Renewable Energy Policy Mandates: Overall, India's renewable energy sector has been driven by ambitious national and state policy initiatives, including the National Solar Mission and regulatory framework by the Ministry of New and Renewable Energy (MNRE) and various other sub-national incentives that promote investment and innovation. Consequently, the country has emerged as one of the largest markets for solar and wind energy, with significant contributions from both public and private sectors. In particular, solar energy has witnessed exponential growth due to reduced technology costs, improved efficiency, and government-backed schemes such as the Farmer Energy Security and Upliftment Campaign Scheme (PM-KUSUM) and the Pradhan Mantri Rooftop Solar Scheme by MNRE. The transition to cleaner energy is designed

not only to lower carbon emissions but also to generate jobs, enhance energy access in rural communities, and promote technological innovation throughout the power sector.

Bioenergy Policy Initiatives: India is undergoing an energy transition, aiming to source 50 percent of its installed electricity capacity from non-fossil fuel sources by 2030 and to achieve net-zero emissions by 2070. According to MNRE, India is already at 46 percent of installed electricity using non-fossil fuel.[5] To meet its 50 percent target and strengthen energy self-reliance, the country is focusing on optimally using domestic renewable resources, including modern bioenergy. To promote this sector, MNRE launched the National Bioenergy Programme (2021–2026) with a budget of INR 8.6 billion (Bn). Since 2018, MNRE has supported energy recovery from urban, industrial, and agricultural waste. Under new guidelines (2021–2026), financial assistance is available for large biogas, bio compressed natural gas (CNG), and power projects (excluding municipal solid waste). India's Sustainable Alternative Towards Affordable Transportation (SATAT) initiative, led by the Ministry of Petroleum and Natural Gas (MOPNG), targets the production of 15 MMT of compressed biogas (CBG) from 5,000 plants to be used in vehicles, industries, and households. Biomass power, using agricultural residues, animal waste, and dedicated crops, plays a key role in India's renewable energy mix.

Greenhouse Gas Emissions: India is transitioning from the Perform, Achieve, and Trade (PAT) scheme to the Indian Carbon Market (ICM) by 2026, marking a major shift in its climate strategy. The current ICM is valued at $1.2 billion and is projected to grow to $50 billion by 2030, positioning India as a major player in global carbon markets. The 2024/25 Union Budget confirmed plans to move from PAT to ICM, introducing the Carbon Credit Trading Scheme to replace Energy Saving Certificates. The move aligns with global climate developments, including the outcomes of COP29 and Article 6 of the Paris Agreement, which promote international carbon trading through a United Nations supervised market mechanism. The government has also approved new project categories for carbon trading under Article 6.2 of the Paris Agreement, including clean cooking with renewable energy for public and public private partnership projects. India is also aiming for 450 GW of renewable energy by 2030 and targeting a 45 percent reduction in emissions intensity by 2030, with 50 percent of electricity from non-fossil sources.

India is home to approximately 17 percent of the global population and is estimated to have contributed approximately 4 percent to the cumulative global greenhouse gas (GHG) emissions between 1850 to 2019. To further guide its long-term climate ambitions, India has developed the Long-Term Low Emission Development Strategy (LT-LEDS), which outlines seven major strategic transitions aimed at achieving sustainable growth while addressing climate challenges. Reinforcing its commitment, India's Fourth Biennial Update Report, published on January 12,

[5] India's Renewable Energy Capacity Hits New Milestone: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2073038#:~:text=According%20to%20the%20Central%20Electricity,leadership%20on%20the%20global%20stage

2024, highlighted a 7.93 percent drop in GHG emissions in 2020 compared to 2019, reflecting significant strides toward a low-carbon and climate-resilient future.[6]

Green Hydrogen Programs: The India government doubled funding in its Union Budget for IFY 2025/26 for the National Green Hydrogen Mission to INR 6 BN, compared to IFY 2024/25.[7] India's hydrogen demand was 6 MMT in 2020 and is projected to grow nearly five-fold to 28 MMT by 2050—80 percent of which is expected to be green hydrogen. Costs are also expected to drop by 50 percent by 2030. To promote green hydrogen's use in transport, the MNRE released guidelines on February 14, 2024, for pilot projects. As of March 25, 2025, MNRE approved five projects involving 37 public and commercial vehicles (buses and trucks) and nine hydrogen refueling stations. India's first green hydrogen plant, set up by one of the state-owned corporations, is expected to produce 4.3 MMT and contribute to the national target of 5 MMT by 2030. Plans are also underway to allocate funds for developing port infrastructure to support hydrogen production.

B. Policy and Program Mandates Aimed at Biofuels - Ethanol, Biodiesel, and Sustainable Aviation Fuel

India's 2018 National Policy on Biofuels marked a pivotal moment in the country's efforts to promote alternative energy sources. Designed to cut down on fossil fuel dependence, support sustainable growth, and tackle environmental challenges, the policy created a robust framework that has remained influential. It significantly boosted the ethanol industry, which had previously struggled under less effective initiatives. A key driver of this progress has been the Ethanol Blending with Petrol (EBP) Program, which has expanded ethanol production using feedstocks such as sugarcane juice, B- and C-heavy molasses, broken rice, damaged grains, and corn. Oil Marketing Companies (OMCs) are responsible for the nationwide ethanol blending, excluding union territories.[8]

The 2018 National Biofuels Policy outlines India's goals for increasing ethanol blending in gasoline, aiming to boost renewable fuel usage. The initial targets set by the policy aimed to elevate the ethanol blending rate in petrol to 20 percent (E-20) from the previous 5 percent by the Indian Ethanol Supply Year (ESY) 2030, which runs from November to December. In May 2022, the Indian government expedited the national E-20 mandate, moving the target date from 2030 to 2025, with the goal of increasing ethanol production capacity in India from 7 billion liters (BL) in 2021 to 15 BL in 2025. This February, the government announced that it had achieved the E-20 target ahead of the November 2025 deadline. According to industry sources,

[6] Press Information Bureau, Release ID: 2092311
[7] "Budget 2025: Green hydrogen allocation rises 100 per cent to Rs 600 cr". Economic Times, Published on February 1, 2025.
[8] OMCs in India – three public OMCs, namely - Indian Oil Corporation Limited (IOCL), Bharat Petroleum Corporation Limited (BPCL), Hindustan Petroleum Corporation Limited (HPCL); and two privately owned OMCs - Reliance Industries (RIL) and Nayara (Essar) Oil

there is an expectation that India will increase the target to E30 by 2030. Additionally, sources noted that approximately 18,000 retail outlets in India are currently equipped to supply E20 fuel. However, limitations in storage capacity and distribution infrastructure are likely to hinder the broader adoption of the fuel type.

Since 2020, efforts have been directed at expanding ethanol production from various feedstocks, including first, second, and third-generation biofuels. The government launched the Pradhan Mantri JI-VAkN Yojana to accelerate second-generation ethanol production, offering viability gap funding for such projects. In August 2024, the Union Cabinet, led by Prime Minister Shri Narendra Modi, approved an updated version of the Pradhan Mantri JI-VAN Yojana to align with recent advancements in biofuel technology and encourage greater investment in the sector. The revised scheme extends its implementation period by five years, now running through 2028-29, and broadens its coverage to include advanced biofuels derived from lignocellulosic sources such as agricultural and forestry residues, industrial waste, synthesis gas, and algae. Additionally, in May 2021, India amended the Sugarcane Control Order, enabling independent ethanol plants to boost production. The amendment also ensures quality control by regulating the sugar and ethanol industries and limiting procurement to formal sources for better oversight and consumer protection. The government also allocates from their budget some financial assistance to the sugar mills to support the augmentation of ethanol production capacity. For IFY 2025/26, the allocation will stay consistent with that of the IFY 2024/25. See Table 3.

Table 3. Indian Government Budget Allocation-Sugar Industry (USD million/INR billion)

Allocation	**IFY 2023/24**	**IFY 2024/25**		**IFY 2025/26**	**Percent Change**
	Realized Outlays	**Initial Budget**	**Revised Budget**	**Budget**	
Scheme for extending financial assistance to sugar mills to enhance and augment ethanol production capacity	INR 4 billion	INR 4.5 billion	INR 6 billion	INR 6 billion	0

Source: Notes on Demands for Grants, 2025-20256, Department of Food and Public Distribution.
Note: Percent change depicted for IFY 2025/26 with initial budget estimate over the IFY 2024/25 revised budget estimate.

To encourage the establishment of ethanol production plants in the country, several Ethanol Interest Subvention Schemes were introduced between 2018 and 2022. Additionally, on March 6, 2025, the Indian government notified a new scheme for converting the existing sugarcane-based plants of Cooperative Sugar Mills into multi-feed ethanol plants.[9] Under the 2018 National Biofuels Policy, India promotes using various feedstocks—like molasses, broken rice, damaged grains, and corn—for ethanol production. To reach the E-20 target by 2024/25, the government encouraged sugar mills to divert excess sugar for ethanol, which was effective during years of high sugarcane output. However, due to low sucrose output during the sugar marketing year (MY) 2023/24, ethanol production from sugarcane was limited to 2.37 million metric tons (MMT), down by 45 percent compared to the previous MY. There was a temporary boost in B-heavy molasses use due to a surplus in MY 2023/24. Yet, broken rice use was halted due to low supply and high prices, leading OMCs to raise purchase prices for damaged grains and corn to meet the demand.

For MY 2024/25, Post estimates sugar production at 28 MMT, which is a 5 percent drop from MY 2023/24, due to the considerable impact of El Nino weather conditions and depleted groundwater availability for irrigation (Refer: India Sugar Annual - IN2025-0027). However, higher ending-stocks from the previous season and continued restrictions on exports are expected to balance the sugar to ethanol conversion, despite an estimated low sugar output and cane production. Furthermore, the government has authorized the procurement of 2.3 MMT of rice from the Food Corporation of India (FCI) for distilleries specifically for ethanol production. Additionally, the use of corn for ethanol is being encouraged by maintaining the corn-based ethanol price at INR 71.86 per liter, higher than ethanol made from all other feedstocks. See Table 4. Market contacts predict that the ethanol procurement prices will be raised further for the ESY 2025/26.

Relatedly, for the current 2025/26 sugar MY, the Cabinet Committee on Economic Affairs (CCAP) has set the Fair and Remunerative Price (FRP) for sugarcane at $4.17 per quintal (INR 355 per quintal), based on a 10.25 percent recovery rate, which is 4 percent higher than MY 2024/25. According to industry sources, the increase in the FRP, combined with a favorable 2024 southwest monsoon and incentives under the EBP, is expected to lead to an increase in sugarcane acreage, thereby enhancing the availability of molasses for fuel ethanol production. Likewise, the subsequent increase in corn price is also to augment the ethanol availability.

[9] Press Information Bureau, Release ID: 2110936

Table 4: Ethanol Price by Feedstock for ESY 2022/23, 2023/24 and 2024/25 (INR per Liter)

Feedstock	ESY 2022/23	ESY 2023/24	ESY 2024/25
Sugarcane Juice/Sugar Syrup/Sugar	65.61	65.61	65.61
B-Heavy Molasses	60.73	60.73	60.73
C-Heavy Molasses	49.41	56.28	57.97
Damaged Food Grains	55.54	64	64
Corn	-	66	71.86
Surplus Rice (from Food Corporation of India)	58.50	58.50	58.50

Source: MoPNG

Biodiesel Mandates and Programs: India has set an ambitious goal to achieve a 5 percent biodiesel blending rate for on-road use by 2030, requiring an estimated 4.5 BL annually. However, unlike ethanol, India's biodiesel initiatives have not achieved similar success, falling short of their intended impact. The current national average blend rate has only made an incremental change from 0.06 percent in IFY 2022/23 to 0.5 percent in IFY 2024/25.[10] As of September 4, 2024, the Indian Oil Corporation Limited (IOCL) has led the sector by blending 232.4 million liters (ML) of biodiesel with conventional diesel, achieving a 0.49 percent blending ratio—higher than the 0.43 percent achieved by other OMCs.[11] India's biodiesel production draws from feedstocks such as animal fats, non-edible oils, used cooking oil (UCO), and imported palm oil and palm stearin. However, progress has been limited due to restrictions on feedstock imports and the lack of a cost-effective, large-scale UCO collection system. These challenges notwithstanding, India's UCO market—one of the largest globally—is expanding, growing from 3.2 MMT in 2023 to 3.4 MMT in 2024, with projections reaching 4.5 MMT by 2030.

Sustainable Aviation Fuel (SAF) Initiatives: On February 4, 2025, India launched its SAF Alliance to accelerate the adoption of SAF across the country and to foster collaborative efforts towards achieving India's climate goals. The initiative represents a significant step in efforts to reduce aviation emissions, with ambitious targets of 1 percent SAF blend by 2027, 2 percent by 2028, and 5 percent by 2030. This applies to international flights and aligns with the global Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) framework aimed at reducing aviation emissions. Indian airlines have started trial flights using SAF mixed with conventional Aviation Turbine Fuel, and several local companies are actively developing

[10] "Raw Material, Subsidy Key For 5% Biodiesel Blend By 2030: Report". Business World, Published on March 13, 2025.

[11] "Indian Oil hits impressive biodiesel blending ratio, sets new benchmark by blending 23.24 crore litres of biodiesel''. Economic Times, Published on September 4, 2024.

SAF technologies. While SAF use is not yet mandatory, industry experts expect regulations to be introduced once production scales up.

Flex Fuel Vehicles (FFVs) and Electric Vehicles (EVS) Goals: The Indian government, under its "Make in India" initiative, is pushing for local manufacturing of Flex Fuel Vehicles (FFVs) and Electric Vehicles (EVs) to strengthen the automotive sector and tackle environmentally induced air quality issues. In late 2022, FFVs and E20-compliant vehicles were launched to run on ethanol-petrol blends, encouraging the use of biofuels in transport and supporting global efforts to cut fossil fuel use and fight climate change. The Indian government anticipates several benefits from these initiatives —reduced oil imports, enhanced energy security, and lower carbon emissions. However, there are also some anticipated drawbacks as well. Ethanol has less energy than petrol, which can reduce fuel efficiency. Also, higher ethanol blends may cause faster wear on engines and corrosion of components, especially in vehicles not designed for E20 fuel. This can raise maintenance costs for consumers and affect long-term vehicle performance.

Although there are anticipated challenges in the FFV sector, India's EV market is forecasted to experience significant growth, achieving a compound annual growth rate (CAGR) of 43 percent and reaching 932,000 units by 2030. Notably, a substantial portion—approximately 61 percent—of this demand is expected to stem from electric SUVs. In 2024, however, EV sales were still relatively low at 107,000 units, compared to 4.3 million total car sales, including sedans and SUVs. Currently, EV's make up nearly 8 percent of India's entire vehicle fleet. However, a major shift is expected in 2025, with more EV launches than petrol or diesel vehicles. Sales of three-wheelers in the EV category were the highest in IFY 2024/25, followed by two-wheelers and four-wheelers, whereas in the previous year two-wheelers topped the list. In 2025, of the 28 new vehicle models planned, 18 will be electric—far higher than the 4–5 EV models launched annually in recent years and more than the total launches in 2023 (11) and 2024 (15). Further, automakers in India are invested in supporting this shift. Maruti Suzuki plans to install fast-charging stations every 5–10 km in the top 100 cities ahead of its first EV launch next IFY. Hyundai, forecasting EVs to account for 15–20 percent of its sales in India by 2030 (up from 2 percent in 2024), is also scaling up efforts. The company has begun local battery pack assembly, partnered with a domestic supplier for battery cells, and plans to install 600 fast chargers along key highways by 2030. Additionally, there are important government incentives, such as a reduced 5 percent goods and services tax (GST) on EVs, and new product offerings from automakers are expected to further accelerate adoption. Battery technology, especially Solid-State Lithium-Ion batteries, is expected to play a transformative role, reducing energy consumption and production costs while setting new global efficiency standards. Ultimately, India's proactive promotions of both ethanol blended fuel and EVs, are still in the nascent stages. As such, the interaction and long-term impact of these parallel strategies remain uncertain as it is still too early to assess their full implications on national fuel pool demand.

Financial Supports Programs: While the India government doesn't give direct EV subsidies to state governments through its Union budget, it does support consumers through national schemes

led by the Ministry of Heavy Industries (MHI).[12] Through phase II of Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India (FAME India) (2019–2024), INR 15 BN were allocated to promote two, three, and, four wheeler EVs, electric buses, and charging stations. Under Prime Minister e-Drrive Scheme (PM E-Drive) and Prime Minister e-Bus Service (PM e-Bus Sewa) in 2024, INR 143 BN has been allocated for an upgrade in infrastructure including the installation of charging stations to deploy 38,000 electric buses. There are also several production linked incentive schemes to boost the domestic production of batteries and related technologies in the automobile and auto-component industry.

C. Environmental Sustainability and Certification

A major driver in India's work towards achieving its renewable energy goals is environmental sustainability, as the country continues to face significant environmental and public health issues, including high particulate matter (PM) pollution and harmful air toxins from vehicle emissions in many cities. India has shown a commitment to increase the share of renewable energy in its energy mix, aiming to meet a substantial portion of its energy needs from renewable sources by 2030. Specifically, energy security and climate change mitigation are central objectives of India's National Biofuels Policy. The country recognizes ethanol as a clean, renewable fuel that burns more efficiently than petrol, leading to lower particulate matter (PM 2.5 and 10) and air toxins in vehicle emissions. The roadmap report for ethanol blending in India (2020-2025) indicates that blending 20 percent ethanol with petrol could reduce carbon monoxide emissions by 30 percent in four-wheelers and 50 percent in two-wheelers. However, some scientists and environmentalists raise concerns about the efficacy of the EBP program, suggesting that the positive effects may be offset by the harmful chemicals released during biofuel production. These environmental advocates argue that the production processes may cause more environmental damage, while industrialists claim that many factories struggle to implement pollution control measures due to escalating production and labor costs. Currently, all ethanol production facilities and distilleries are categorized as red by the Central Pollution Control Board (CPCB), with pollution scores ranging from 75 to 80.

International Collaboration and Commitments: In 2024, India hosted the World Biogas Association (WBA), showcasing its potential in the biogas sector. The event aimed to create a framework for accelerating growth in the biogas industry, drawing global attention to bioenergy ahead of the G20 and COP29. At India Energy Week 2025, the WBA engaged with key stakeholders, including government officials, industry leaders, and biogas plant operators, to discuss biogas's role in India's energy transition and sustainable development. India's goal of building 5,000 large-scale biomethane (Compressed biogas or CBG) plants by 2030 has positioned the country as a key market for WBA's biogas solutions.

[12] Press Information Bureau. Release ID: 2082747

During India's G20 presidency in 2023, the Global Biofuel Alliance (GBA) was established, bringing together 19 countries, including India, Brazil, and the United States. This strategic initiative focuses on promoting the global use of sustainable biofuels, particularly in the transportation sector. Key objectives include sharing technical expertise and evaluating the international biofuel market to support wider adoption and innovation in biofuel technologies. In October 2024, India and the GBA signed a host country agreement to establish the GBA Secretariat in India, under the United Nations Privileges & Immunities Act. The Secretariat includes both Indian and international personnel, enabling the alliance to effectively pursue its goals. GBA aims to tackle key issues such as feedstock availability, policy development, biomass supply chain efficiency, and investment in biofuel production, including clean cooking initiatives. Since its launch, the alliance has rapidly grown, expanding to 27 member countries and 12 international organizations within a year.

Prior to this, India actively engaged in international collaboration to advance bioenergy initiatives. In April 2022, India and Brazil partnered to promote ethanol production, culminating in the launch of the "Center of Excellence on Ethanol" in January 2023. This initiative, supported by the Society of Indian Automobile Manufacturers and the Brazilian Sugarcane industry, aims to enhance efficient ethanol production from sugarcane and molasses. In March 2025, a delegation from the collaborative group visited Brazil to study advanced practices in ethanol production and usage, to understand flex-fuel and hybrid-flex vehicle manufacturing and explored fuel distribution systems and sugarcane technology centers. Key points included the impact of feedstock choices and agricultural practices on carbon reduction, and the need for international standards and certifications to acknowledge the sustainability of raw materials.

Lastly, India's MNRE International Relations Division is working with various stakeholders to promote cooperation in new and renewable energy. MNRE has signed several agreements, including memorandum of understandings, and implementation agreements, and organized bilateral, multilateral, and Joint Working Group (JWG) meetings. India also collaborates under frameworks like SAARC, ASEAN, BRICS, and IBSA. Additionally, the MNRE partners with international funding agencies such as the World Bank, New Development Bank, Asian Development Bank, United Nations Development Programs, and others to support renewable energy projects in the country.

D. Trade Policy

During Prime Minister Narendra Modi's visit to Washington DC in 2025, India and the U.S. reaffirmed their strong commitment to deepening bilateral cooperation in trade, energy security, innovation, and technology. The newly launched U.S.-India COMPACT (Catalyzing Opportunities for Military Partnership, Accelerated Commerce & Technology) and TRUST (Transforming the Relationship Utilizing Strategic Technology) initiatives focus on structured collaboration in energy and other key areas to ensure a sustainable and secure energy future. Both nations emphasized energy security as fundamental to economic growth, restarting the

U.S.-India Energy Security Partnership dialogue. The cooperation aims to ensure availability of energy through enhanced hydrocarbon production and trade in crude oil, petroleum products, natural gas, and ethane. Through this collaboration, the U.S. will seek to be a major supplier of energy resources to India. The two countries are expected to support expanding strategic oil reserves and endorse India's full membership in the International Energy Agency to strengthen global energy governance. Relatedly, India aims to increase natural gas share in its energy mix from 6 percent to 15 percent. There are also goals related to e-fuel production in India to reduce emissions in aviation, shipping, and heavy industries. At the same time, work is happening to advance the integration of India's ethanol blending and SAF mandates through policy support and international partnerships. There is also a focus on the development of biofuel clusters, decentralized production, biomass hubs, and digital tracking systems to improve efficiency and compliance. Relatedly, innovation in feedstock processing is expected to enhance, alongside aligning biofuel certification with global standards to boost export potential.

Import Policies: India does not allow the import of biofuels for blending with domestic fuel supplies. This applies to fuel ethanol and biodiesel. Relatedly, products under the following Harmonized System (HS) codes: 220710, 220720, 271020, and 382600 require an import license. This includes undenatured ethyl alcohol (HS 220710) with an alcohol content of 80 percent or more, all strengths of denatured ethyl alcohol (HS 220720), petroleum oil containing up to 30 percent biodiesel (HS 271020), as well as pure biodiesel and biodiesel blends with more than 30 percent biodiesel content (both classified under HS 382600). The import duties on both denatured and undenatured ethanol have remained unchanged since April 2023, as indicated in Table 5. Similarly, biodiesel import duties have stayed the same since 2022, as shown in Table 6.

Table 5. India: Ethanol Import Duty (Percent ad valorem on Customs Insurance, and Freight [CIF] Value)

ITC HS Tariff Number	Total Import duty
Ethyl alcohol and other spirits, denatured, of any strength; denatured ethanol; and denatured spirits [2207 2000]	Basic customs duty (BCD) on denatured ethanol for manufacture of excisable goods is zero percent. However, denatured spirits assessed five percent duty for all goods except above. *
Undenatured Ethanol [2207 1000] of an alcoholic strength by volume of 80 percent or higher	150 percent (SWS of 10 percent on BCD exempted; State excise/value added tax as applicable).

Source: Central Board of Indirect Taxes and Customs (Updated as of May 1, 2024).
Note: If the importer follows the procedure set out in the Customs Rules, 2017 (import of goods at concessional rate of duty), the central excise duty is a fixed amount and not a percentage on price.*****Ethyl alcohol supplied to OMCs for blending with gasoline will be assessed a five percent Integrated Goods and Service Tax.

Table 6. India: Biodiesel Import Duty (percent ad valorem on CIF value)

ITC HS Tariff Number	Total Import duty
Biodiesel and mixtures thereof, not containing or containing less than 70 percent by weight of petroleum oils and oils obtained from Bituminous minerals (greater than B30 to B100) [3826 0000]	10 percent BCD per KG
Petroleum oil and oils obtained from Bituminous minerals (other than crude), containing by weight more than 70 percent or more of petroleum oils, contain biodiesel, other than waste oils (B1-B30), [2710 2000] *	5 percent BCD per KG
Automotive diesel fuel, containing biodiesel, conforming to standard IS 1460 (2710 2010)	2.5 percent BCD per KG

Source: CBIC (Updated as of May 1, 2023). *For the purposes of the sub-headings of 2710, the term "biodiesel" means mono-alkyl esters of fatty acids of a kind used as a fuel, derived from animal, vegetable or microbial fats and oils, whether or not used.

Export Policies: In 2025, the Indian government is maintaining a 50 percent export duty on two key biofuel feedstocks—B-heavy and C-heavy molasses—the same rate as the previous year. This policy is intended to ensure sufficient availability of feedstocks for domestic ethanol production. The export duty was raised from zero to 50 percent in January 2024. Before the hike in duty, the country was one of the world's largest molasses exporter.

III. Ethanol

Table 7. India: Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)

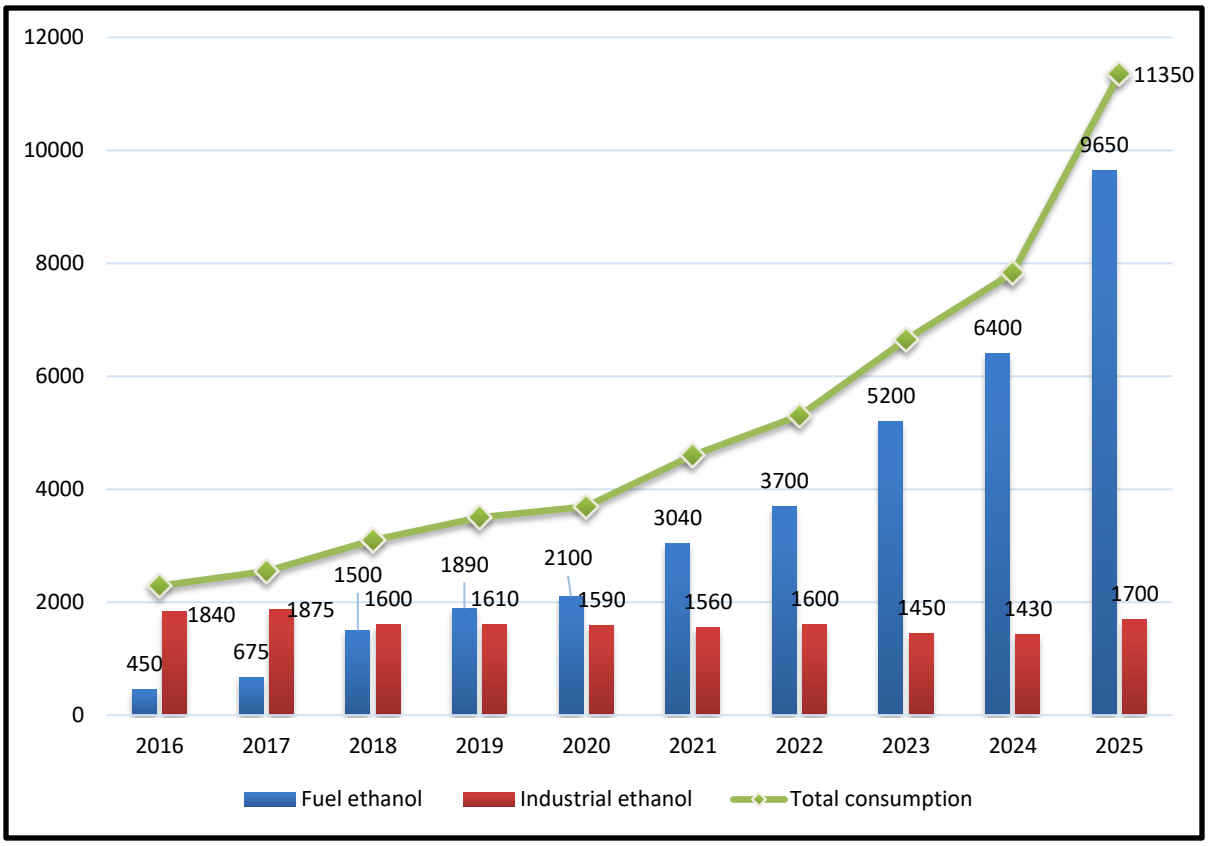
Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025f**
Beginning Stocks	61	128	150	200	112	190	102	100	214	258
Fuel Begin Stocks	20	20	50	50	80	100	60	10	70	150
Production	2,061	1,991	2,672	2,792	3,232	3,999	5,118	6,486	7,197	10,500
Fuel Production	450	705	1,500	1,920	2,120	3,000	3,650	5,260	6,480	9,700
Imports	432	722	607	670	669	600	289	410	767	1,000
Fuel Imports	0	0	0	0	0	0	0	0	0	0
Exports	136	141	129	50	133	87	109	132	90	100
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	2,290	2,550	3,100	3,500	3,690	4,600	5,300	6,650	7,830	11,350
Fuel Consumption	450	675	1,500	1,890	2,100	3,040	3,700	5,200	6,400	9,650
Ending Stocks	128	150	200	112	190	102	100	214	258	308
Fuel Ending Stocks	20	50	50	80	100	60	10	70	150	200
Refineries Producing Fuel Ethanol (Million Liters)										
Number of Refineries	161	161	166	170	220	231	252	263	270	1212
Nameplate Capacity	2,210	2,215	2,300	3,000	3,500	4,300	5,700	10,820	16,150	20,000
Capacity Use (%)	20.4%	31.8%	65.2%	64.0%	60.6%	69.8%	64.0%	48.6%	40.1%	48.5%
Co-product Production (1,000 MT)										
DDGs	0	0	0	0	0	0	0	10	2,492	3,283
Corn oil	0	0	0	0	0	0	0	1	231	305
Bagasse	97,485	79,176	118,784	99,942	126,976	139,264	135,168	131,072	132,259	135,000
Feedstock Use for Fuel Ethanol (1,000 MT)										
Corn kernel	0	0	0	0	0	0	0	32	7,961	10,490
Molasses (C-heavy)	2,075	3,245	5,500	4,500	1,200	785	800	600	2,701	507
Molasses (B-heavy)	0	0	750	2,271	3,550	5,150	6,079	9,250	5,060	4,333
Sugarcane syrup	0	0	0	1,951	5,263	9,200	10,800	15,000	3,539	17,105
Damaged food grains	0	0	350	603	1,600	2,000	1,759	2,100	4,064	4,000
Rice	0	0	0	0	118	395	1,125	1,890	25	5,200
Market Penetration (Million Liters)										
Fuel Ethanol Use	450	675	1,500	1,890	2,100	3,040	3,700	5,200	6,400	9,650
Gasoline Pool	32,994	37,098	40,367	42,496	40,741	37,926	41,831	45,427	48,400	50,100
Blend Rate (%)	1.4%	1.8%	3.7%	4.4%	5.2%	8.0%	8.8%	11.4%	13.2%	19.3%

Source: FAS New Delhi Research and historical data series, industry sources, and official government trade data as compiled and reported by Trade Data Monitor, LLC.
f =Year 2025 is projected; # Excess rice supplied by the Food Corporation of India (FCI); * Leftover sugarcane residue after juice extraction.
Note: Bagasse is calculated based on the range of 25 to 30 percent of Post's total annual sugarcane production estimate. See Sugar Annual | IN2025-0027.
Note: For ethanol imports originating from the United States, data used is from U.S. Census Bureau. HS codes include (a) denatured, fuel 2207.20.0010, (b) ethanol denatured, other 2207.20.0090, (c) ethanol undenatured, fuel 2207.10.6010 and (d) ethanol undenatured, other 2207.10.6090.
Note: Post updated the methodology for calculating the gasoline pool to reflect India's motor spirit consumption which includes pure gasoline and ethanol for fuel use. The downward revisions in the gasoline pool estimates also reflect a move away from International Energy Agency (IEA) data projections that Post sees as less accurate.

Consumption: India's overall ethanol consumption is projected to increase by nearly 45 percent, reaching 11.4 billion liters by 2025. As shown in Table 7, most of this consumption will continue to be in the form of fuel ethanol, which has been the trend since 2019. It is estimated that fuel ethanol consumption will hit 9.7 billion liters this year. This growth is largely fueled by the government's initiative to enhance ethanol blending in order to fulfill its E-20 mandate by 2025. Post forecasts the country to reach 19.3 percent blending rate for the 2025 calendar year. According to MoPNG's Petroleum Planning & Analysis Cell (PPAC) India reached the target of 17.9 percent in February 2025 and will reach the 20 percent blend rate ahead of the November 2025 deadline for the ESY. The difference between MoPNG and Post's blending rate is attributed to Post's calculation of total gasoline pool which includes blended ethanol (gasoline and all additives including any biocomponents and biofuels). According to industry sources, India has already reached the target of E20 in March 2025 and there is an expectation that India will set a new target of E30 by 2030. Industry sources also indicate that it is technically difficult for all Indian states to achieve the blending rate of E20 due to regional feedstock and logistics constraints. On a similar note, sources suggested that it is possible to reach the target based on total feedstock availability nationwide, which may not be regionally realized in the actual consumption of fuel.

Related to industrial ethanol consumption, Post has adjusted estimates in Table 7 from 2016 until 2024. Post observes that with the rise in total ethanol consumption, industrial ethanol consumption has been inconsistent, as illustrated in Figure 2. Despite the growing population, income, and increased demand in food and beverage industry, industrial ethanol consumption fell in 2023 and 2024. This is largely due to the conversion of ethanol for fuel use which has grown over the year to meet the E20 target and the government's commitment towards cleaner energy and fuel. However, Post expects India's industrial ethanol consumption to bounce back in the current year as the country has already imported a record volume of U.S. industrial ethanol.

Figure 2: Industrial and Fuel Ethanol Consumption (2016-2025) (In Million Liters)



Source: FAS New Delhi Research

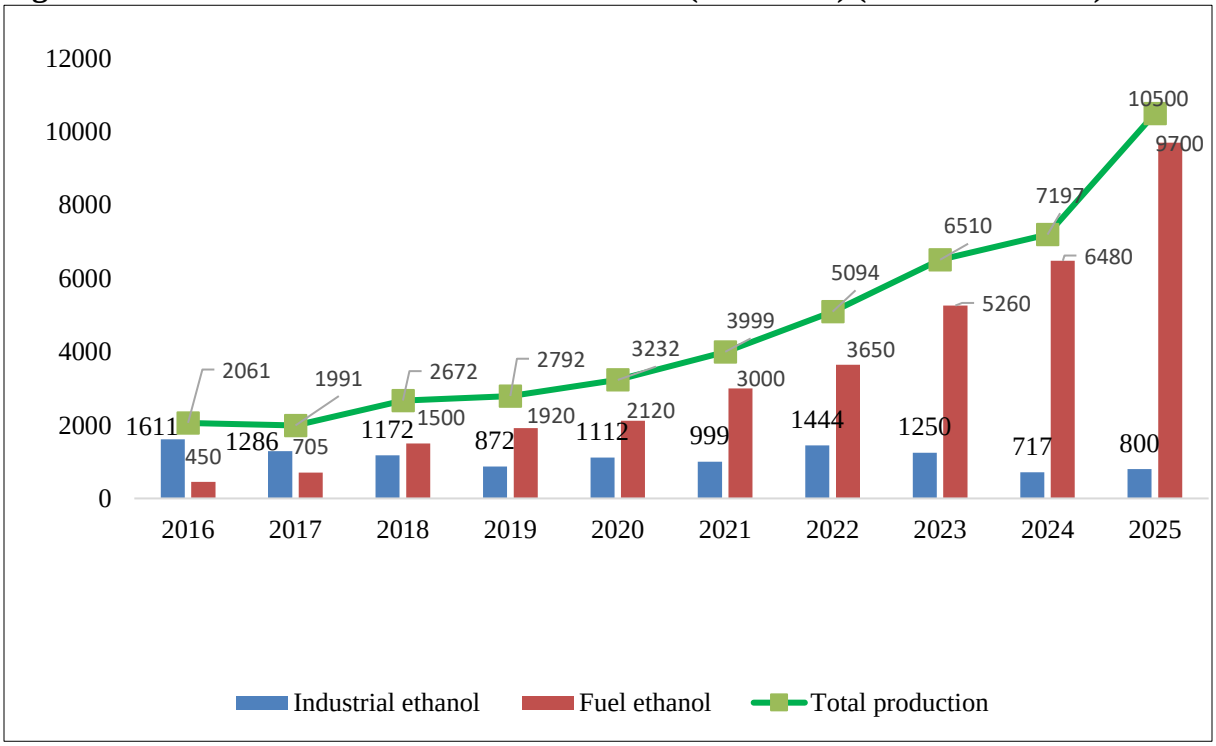
India's overall fuel consumption for light-duty vehicles has risen and is projected to continue increasing in the future. At present, among the 81,529 OMC outlets, 15,600 retail locations are offering E20 ethanol blended options nationwide. Additionally, MoPNG announced the launch of E100 fuel at over 400 retail outlets in India.[13] Under the EBP program, the fuel ethanol supply increased by 24 percent from 2023 to 2024 and it is expected to increase by 38 percent by the end of the current year. Despite the automobile industry's proactive approach to offering vehicles for E20 fuel, vehicles that are practically E20 compliant are still a matter of concern for the consumers. India has a strong consumer base for two-wheelers with the highest sales of 19 million units compared to any other vehicle type during the Indian Fiscal Year (IFY) which runs from April through March (2024-25). However, two-wheeler consumers have raised the concern of ethanol blended fuel evaporating rapidly when exposed to sunlight. Furthermore, four-wheeler consumers complain about reduced efficiency as the vehicles are supposedly not fully or practically E20 compliant. Relatedly, according to the Ministry of Consumer Affairs, Food & Public Distribution, vehicles that use E20 fuel tend to have a small drop in fuel efficiency compared to those running on gasoline. On March 12, 2025, the Indian government mandated

[13] Press Information Bureau. Release ID: 2050907

that all vehicles manufactured from April 1, 2025, must be E20 certified. This initiative aims to tackle compliance issues and decrease carbon emissions.[14]

Production: For 2025, Post estimates total annual ethanol production for fuel and industrial use at 10.5 BL, a 46 percent increase from the previous year. See Table 7. This includes 9.7 BL of fuel ethanol which is an increase of 50 percent from 2024. Although Post projects a rise in overall ethanol production, the estimate includes a reduction in industrial ethanol output as a result of the diversion for fuel use, as illustrated in Figure 3. However, Post anticipates industrial ethanol production will see a slight increase in 2025, reaching approximately 800 thousand liters.

Figure 3: Industrial and Fuel Ethanol Production (2016-2025) (In Million Liters)



Source: FAS New Delhi Research

As highlighted above, the bulk of production is directed towards fuel ethanol, aligning with the country's target of an E20 ethanol blend rate by 2025. This year's increased production estimate is driven by expectations of favorable sugarcane yields, thanks to improved water availability resulting from the 2024 southwest monsoon (Refer: India Sugar Annual - IN2025-0027). In addition, the government has lifted the restrictions on converting molasses for ethanol, which were in place last year due to low sugar supplies. The proactive promotion and planting of corn for ethanol is also anticipated to boost production levels. Moreover, the government has increased the total allocation of FCI rice for ethanol to 5.2 million metric tons (MMT) for the current ethanol supply year (ESY), up from just 0.25 MMT in 2024.[15] This decision, however,

[14] ibid, page number 5
[15] "Centre approves additional 2.8 million tonnes of FCI rice for ethanol production". Down To Earth, Published on May 12, 2025.

raised concerns about the implications of utilizing essential food grains for industrial uses. It should be noted that from November 2024 to March 2025, only 0.25 MMT of FCI rice has been reported for ethanol production.[16]

Under the "Feedstock Use for Fuel Ethanol" section in Table 7, the conversion of ethanol derived from corn, FCI rice, and sugar syrup is anticipated to rise in 2025. This increase is attributed to a successful production year for these three crops, driven by favorable weather conditions. Given that the three aforementioned feedstocks are being primarily diverted for fuel ethanol, industry sources indicate the shares of B and C heavy molasses will be used more for the production of industrial ethanol in 2025.

The number of distilleries, both molasses and grain based, increased exponentially over the year due to government policies and schemes as explained in Section I. Under the ethanol interest subvention schemes announced by the Government, 1,212 projects have been approved, including 590 molasses-based, 474 grain-based, and 148 dual-feed distilleries. Molasses-based distillery capacity is projected to increase by 26 percent reaching 9.0 BL. Grain-based distillery capacity is expected to grow by over 60 percent reaching 7.0 BL. Dual-feedstock capacity is anticipated to reach 1.3 BL. In 2024, based on the number of increased refineries, the government projected ethanol capacity at 12.8 BL. However, Post estimated the maximum ethanol capacity at 16.2 BL to reflect the industry's calculation of capacity utilization as shown in Table 7. Similarly, in 2025, the government schemes support a projection of 17.3 BL, yet Post estimates the nameplate capacity to reach 20.0 BL due to the increase in the number of refineries.

To boost ethanol production, the Cabinet Committee on Economic Affairs (CCEA) has set ethanol procurement prices for feedstocks as noted in Table 8. For 2025, the CCEA has increased the price of C heavy molasses from INR 56.58 per litre to INR 57.97 per litre for the current ESY.[17] Prices for other feedstocks remain the same. Corn has the highest ethanol procurement price at INR 71.86 per liter. Additionally, corn yields more ethanol than FCI rice, followed by B heavy molasses. Consequently, the current incentive for grain-based ethanol surpasses that of molasses-based ethanol. To achieve the E20 target, the government has been promoting corn production since the latter part of 2023. As a result, the average price of corn in India has surged from INR 14,500 per metric ton to INR 24,500 per metric ton. With the increase in grain ethanol production, its co-products like Distiller's Dried Grains with Soluble (DDGs) from rice and corn are also rising.

[16] Food Corporation of India

[17] Press Information Bureau. Release ID: 2097307

Table 8: Ethanol and Distiller's Dried Grains with Soluble in 2024 (January – December)

Feedstocks	Feedstock used (MMT)	Conversion to ethanol (BL)	Ethanol procurement price (INR/Liter)	DDG average price (INR/Kg)
Cane Juice	3,539	0.27	65.61	Nil
B heavy Molasses	5,060	1.52	60.73	Nil
C heavy Molasses	2,701	0.59	57.97	Nil
Damaged Food Grains	4,064	1.02	64	20
Surplus FCI Rice	0.25	0.0013	58.5	20
Corn	7,961	3.03	71.86	15
Total	**23,330**	**6.42**	-	-

Source: FAS New Delhi Research

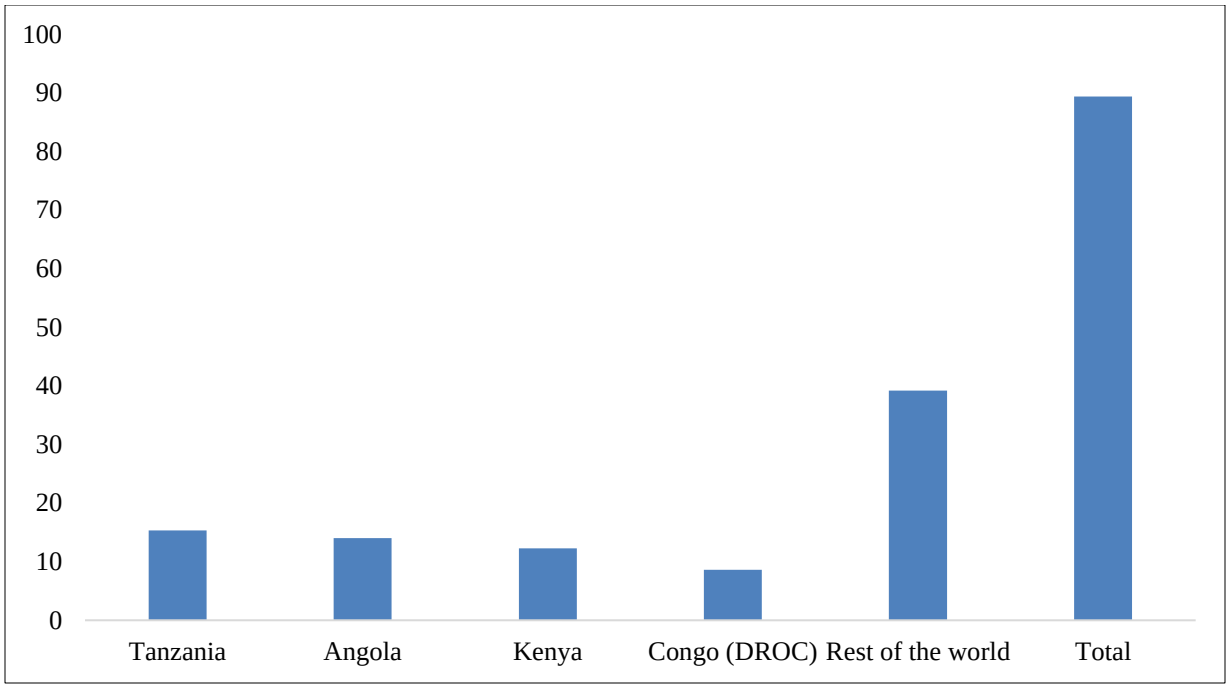
Trade

Imports: India does not allow import of fuel ethanol. Post forecasts India's industrial ethanol imports to increase to 1.0 BL in 2025, almost 30 percent up from the previous year to meet India's medical, industrial, and beverage demand. The country remains a net ethanol importer for all end uses. The U.S. is the largest ethanol supplier of denatured ethanol for medical-grade and industrial ethanol, followed by Brazil. From January 2025 to March 2025, India imported 254 ML of the U.S. ethanol. In 2024, India imported 708 ML of the U.S. ethanol, which is 123 percent more than 2023. In 2022 and 2023, India's ethanol imports from the U.S. reduced due to increasing costs in the supply chain coupled with higher U.S. ethanol prices.

Exports: Post projects exports will reach 100 thousand liters for the current year, reflecting an 11 percent increase compared to 2024. This anticipated growth is attributed to a favorable feedstock production year. Additionally, as the country strives to achieve a 20 percent target by 2025, industry sources forecast that there will be an excess quantity available for export. In 2024, India's undenatured ethanol exports declined by 32 percent due to strong domestic demand in the potable sector and the need to meet fuel conversion requirements. Major importers included Tanzania, Angola, Kenya, and Congo. Refer to Figure 4 for more details. In March 2023, the Indian government clarified that biofuels produced with imported raw materials and exported from special economic zones—whether for fuel or non-fuel purposes—would not be subject to tariff restrictions.

India was one of the world's largest exporters of molasses. However, in January 2024, the country instituted a 50 percent duty fee on molasses exports. This decision was prompted by a year of low sugarcane production and aimed to secure molasses availability for ethanol production. This policy change followed shortly after the restriction on sugar exports, which was mainly intended to convert cane juice to meet the nation's biofuel needs.

Figure 4: India, Ethanol Exports (Thousand Liters), 2024



Source: U.S. Census Bureau, Trade Data Monitor and Ministry of Commerce, Indian government

Revisions to Gasoline Pool: Post has made downward revisions to the gasoline fuel pool estimates compared to last year's estimates. The revisions were made to match the government of India's official data, which incorporates a calculation of India's gasoline pool that accounts for the primary petroleum product of motor spirit consumption and a conversion rate for local gasoline density. Post has observed these estimates to be more accurate and as such have made the aforementioned revisions

IV. Biodiesel

TABLE 9. INDIA BIODIESEL PRODUCTION FROM MULTIPLE FEEDSTOCKS (MILLION LITERS)

Biodiesel (Million Liters)										
Calendar Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025f**
Beginning Stocks	13	13	18	25	23	16	26	22	32	30
Production	158	170	185	230	200	180	185	201	448	718
Imports	3	8	25	7	1	1	1	1	0	0
Exports	42	8	23	54	68	6	4	2	0	0
Consumption	119	165	180	185	140	165	186	190	450	700
Ending Stocks	13	18	25	23	16	26	22	32	30	48
Production Capacity (Million Liters)										
Number of Biorefineries	6	6	6	6	6+	6+	20+	50+	70+	80+
Nameplate Capacity	550	600	650	670	580	520	700	950	1,020	1,200
Capacity Use (%)	28.7%	28.3%	28.5%	34.3%	34.5%	34.6%	26.4%	21.2%	43.9%	59.8%
Feedstock Use (1,000 MT)										
Animal fats	6	6	7	10	6	12	7	10	12	13
Recycled oils (UCO)	55	56	60	70	45	65	65	70	267	457
Other (mostly palm stearin)	90	100	110	140	140	95	105	112	150	217
Market Penetration (Million Liters)										
Biodiesel, On-road use	48	72	83	100	50	10	40	40	350	600
Diesel Pool, On-road use	73,572	75,619	78,960	76,433	67,610	72,185	79,200	85,600	88,112	90,200
Blend Rate (%)	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%	0.4%	0.7%
Diesel Pool	91,965	94,524	98,700	95,541	84,512	81,349	91,226	95,176	96,642	97,704

Source: FAS New Delhi Research and historical data series, and official government trade data as compiled and reported by Trade Data Monitor, LLC. f =Year 2025 is projected; *Indicates theoretical estimate.

Note: Post has updated the methodology for the calculation of the diesel pool based on the government of India's diesel consumption data. The downward revisions in the diesel pool estimates also reflect a move away from International Energy Agency (IEA) data projections that Post sees as less accurate.

Consumption: India's biodiesel consumption is projected to increase by nearly 56 percent, reaching 700 ML by 2025 compared to 2024. In September 2024, Indian Oil Corporation Limited (IOCL), one of the Oil Marketing Companies (OMCs), achieved a significant milestone by blending 230 ML of biodiesel with conventional diesel, resulting in a blending rate of 0.49 percent—surpassing the 0.43 percent rate achieved by other OMCs. Throughout 2024, IOCL maintained an average biodiesel blending rate of 0.73 percent. However, Post estimates that India's national average biodiesel blending rate will rise to 0.6 percent in 2025, a modest increase from the 2024 rate of 0.4 percent. This growth is driven by the rising demand for cleaner fuels in both the transportation and stationary power sectors, along with consumer tax incentives.

Production: Post forecasts India to produce 718 ML of biodiesel in 2025, a 60 percent increase from the previous year's estimate. With India consuming 7.5 BL of diesel each month, the

government has set a goal to achieve a 5 percent biodiesel mix by 2030. Non-edible industrial oils used cooking oil (UCO), animal fats, and tallows, are vital feedstocks for producing biodiesel. Yet, their supply can fluctuate, leading to uneven biodiesel production schedules. To address this, the Food Safety and Standards Authority of India (FSSAI) introduced the Repurpose Used Cooking Oil (RUCO) initiative in 2018, aiming to curb the reusing of oil in food preparation and encourage its conversion into biofuels. India annually utilizes approximately 24 BL of oil, with a significant portion — about 6 percent — being recycled for food use, which poses health risks. The equivalent of 1.8 BL of this used oil could be obtained from the hotel and restaurant sector and converted into 1.3 BL of biodiesel each year. To maintain a consistent and dependable supply of raw materials, the government is backing the establishment of collection centers for UCO and other feedstocks, providing incentives to streamline the collection process through the RUCO to encourage the collection and transformation of UCO into biodiesel.

OMCs have been increasingly turning to biodiesel, with a significant uptick in procurement over recent years. In 2024, OMCs sourced approximately 360 ML of biodiesel. Industry reports indicate that biorefineries are also on the rise, boasting over 80 certified biodiesel producers with a combined annual capacity of just 1.2 ML. However, to achieve the anticipated 5 percent blend rate by 2030, a total of 5 BL of biodiesel is necessary. Progress is hindered by supply chain challenges in collecting used cooking oil (UCO). Sources within the industry reveal that Fast-Moving Consumer Goods (FMCGs) are collaborating with biorefineries to streamline the logistics of transforming food waste into biofuel. For instance, U.S. FMCG Humankind has established a memorandum of understanding with a CBG plant in India to enhance biofuel production without disrupting the supply chain. Additionally, Post has observed a notable increase in the procurement of various feedstocks for CBG plants.

Trade: There was no trade of biodiesel in 2024, and Post expects the trend to continue through the current year, considering the import restrictions.

Revisions to Diesel Pool, On-Road Use and Diesel Pool: Post has made revisions to the diesel on-road use estimates compared to last year's estimates. The revisions impact the estimates from 2016 to the 2025 forecast. Post has revised the previous estimates to match the government of India's official data, which incorporates supplied and contracted estimates. Post has observed these estimates to be more accurate and as such have made the aforementioned revisions. Similarly, post has revised down the diesel pool estimates from 2021 onward to match the government of India data which is observed to be more accurate.

V. Advanced Biofuels

Sustainable Aviation Fuel: India has set progressive SAF blending targets of 1 percent by 2027, 2 percent by 2028, and 5 percent by 2030 for international flights, in alignment with the international CORSIA framework aimed at reducing carbon emissions from aviation. In support of these goals, Indian airlines have begun conducting trial flights using blends of SAF combined with traditional Aviation Turbine Fuel, marking an important step toward mainstream adoption.

While these targets are ambitious, SAF remains significantly more expensive than traditional jet fuel—typically 3 to 5 times higher in cost. The biggest challenge is the high capital required to establish SAF production facilities, especially in early development stages. Despite these barriers, Indian airlines have begun trial flights using SAF with traditional Aviation Turbine Fuel. Several domestic companies are actively developing SAF technologies. Aircraft manufacturer Airbus is actively working to scale up the production and adoption of SAF, with current demand largely concentrated in Europe. As part of its global efforts, Airbus has also formed a partnership with the Indian Institute of Petroleum (IIP) in Dehradun, Uttarakhand to support the development and deployment of SAF in India.

According to industry sources, India has a surplus of biomass of over 200 MMT annually along with lipid feedstocks like non-edible oils and animal fats. These can be processed into SAF using HEFA (Hydrotreated Esters and Fatty Acids), which is a certified pathway expected to account for 80 percent of global SAF production over the next five years. HEFA uses waste oils, cooking oil, and fats. Alternatives like AtJ and Fischer-Tropsch (FT), which use agricultural waste and residues, are also being explored. Additionally, SAF can be obtained from large volume of agricultural waste of which there is around 500 MMT produced annually, with 100 MMT being burned and contributing to air pollution. Utilizing this residue for SAF can help reduce both emissions and environmental damage. According to a Deloitte report (October 2024), India could produce 8 to 10 MMT of SAF by 2040, but this would require investments of USD 70–85 billion.[18]

Cellulosic Ethanol: To boost ethanol production and reduce dependence on fossil fuels, the Indian government has launched several initiatives—most notably the Pradhan Mantri JI-VAN Yojana (Jaiv Indhan–Vatavaran Anukool fasal awashesh Nivaran). This scheme offers financial assistance for setting up Second-Generation (2G) bioethanol plants that use cellulosic and lignocellulosic biomass—such as agricultural residue and other non-food feedstocks. Under this scheme, six commercial and four demonstration 2G ethanol plants have been approved. A total of INR 18 BN has been allocated for 12 integrated bioethanol projects. An additional INR 1.5 BN supports 10 demonstration plants, while INR 195 MN is earmarked for establishing a Center for High Technology.

[18] "India can be great producer of SAF; the fuel can help reduce pollution: Airbus official", Economic Times. Published on March 31, 2025.

As part of this national effort, OMCs are investing INR 140 BN to build 12 second-generation bio-refineries. These will convert renewable feedstocks like lignocellulosic biomass into ethanol, significantly expanding India's renewable fuel capacity and supporting sustainability goals. See Table 10. India aims to blend 5–10 BL of cellulosic ethanol into its fuel mix by 2030, a target set under the 2018 National Biofuels Policy. The country produces 120–160 MMT of biomass annually, which could theoretically yield 30 BL of cellulosic ethanol each year.

Additionally, Bio-CNG, a potential by-product of these 2G ethanol plants, adds another dimension to sustainable energy production. With OMCs offering financial guarantees, the commercial viability of Bio-CNG is enhanced. Although technologies to convert waste into fuels and chemicals are still in the early stages, they show promise in solving waste management challenges and producing clean energy. Currently, India's pilot and demonstration-level advanced biofuel plants have a combined production capacity of 32 ML of cellulosic ethanol per year. The Indian Oil Corporation's Panipat Refinery in Haryana, Bharat Petroleum's integrated ethanol refinery in Bargarh, Odisha, Hindustan Petroleum Corporation Limited and Numaligarh Refinery Limited in Assam are all pioneering the development of 2G distilleries that utilizes different feedstocks like crop residue, bamboo, food waste and grain and sugarcane products for ethanol production.

In a significant advancement for both India's dairy and renewable energy sectors, India's largest dairy brand, Amul, has successfully developed bioethanol from acid whey, a byproduct usually discarded during cottage cheese and soft cheese production. Acid whey, a lactose-rich liquid left after cheese production, results in disposal challenges for dairy producers. However, its high sugar content makes it ideal for ethanol fermentation, offering a sustainable solution to waste management and energy production.[19]

Lastly, India's first Polylactic Acid (PLA) plant is being set up in Uttar Pradesh by Balrampur Chini Mills Limited. This industrial bioplastic facility aims to produce PLA and other bioplastic materials, representing a significant shift from the conventional linear consumption model to a manufacturing system rooted in the principles of a circular economy and sustainable climate action. Additionally, PLA and its compounds have the potential to replace a substantial share of India's existing plastic consumption and its various applications.

Table 10. India: Biofuel Research and Development Classification

Fuel	Substitute	Technologies Deployed
Diesel	*Biodiesel, **HDRD (Green Diesel), Bio-based oxygenates (alcohols and ethers)	Esterification, Hydroprocessing, Fermentation, Syngas conversion
Aviation Turbine	**Sustainable Aviation	Hydroprocessing, Sugar conversion,

[19]https://dairydimension-com.cdn.ampproject.org/c/s/dairydimension.com/amul-bioethanol-acid-whey-gcmmf-plant-gujarat/?amp=1

Fuel (ATF)	Fuel (or, Bio-ATF)	alcohol-to-jet, Fischer–Tropsch process
Gasoline (Petrol/Motor Spirit)	*Ethanol (1G), **Ethanol (2G), **Methanol, Green (drop-in) gasoline	Fischer–Tropsch process, Gas Fermentation, Alcohol-to-gasoline, Hydroprocessing, Pyrolysis/Catalytic Cracking
Compressed natural gas (CNG)/piped natural gas (PNG)	*Bio-CNG/Bio-PNG, HCNG, Bio-H2	Waste Fermentation
Marine Fuel/Industrial Fuel Oil	**Green heavy distillate, biomass-derived oils	Hydroprocessing, Pyrolysis/Fluid catalytic cracking, Hydrothermal Liquefaction, MSW-thermochemical processing

VI. Notes on Statistical Data

Conversion Table: Ethanol

Damaged Food Grains – 1 MT = 250 liters
Broken Rice – 1 MT = 440 liters
Sugarcane Juice – 1 MT = 76 liters
B-Heavy Molasses – 1 MT = 300 liters
C-Heavy Molasses – 1 MT = 217 liters
Corn/Maize – 1 MT = 380 liters
Ethanol – 1 MT = 1,270 liters

Ethanol Co-Product Conversion Rates

DDGs production = 0.313 MT per 1 MT of grains
Corn oil production = 0.029 MT per 1 MT of corn

Conversion Table: Biodiesel

Animal Fats – 1 MT = 1,043 liters
Recycled Oils (UCO) – 1 MT = 1,043 liters
Other (mostly palm stearin) – 1 MT = 1,050 liters

Attachments:

No Attachments