

India Bioethanol Market By Feedstock (Starch Based, Sugar Based, Cellulose Based, Others), By Fuel Generation (First Generation, Second Generation, Third Generation), By Fuel Blend (E5, E10, E15 TO E70, E75 TO E85, Others), By Application (Fuel & Fuel Additives, Industrial Solvents, Disinfectant, Personal Care, Beverages, Others), By Region, Competition, Forecast and Opportunities, 2020-2030F

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Abstracts

India Bioethanol Market achieved the total volume of 3.5 Billion Litres in 2024 and is expected to reach 5.14 Billion Litres by 2030 with a CAGR of 6.82% during the forecast period. Bioethanol, primarily sourced from biomass, serves as a blending agent in gasoline, enhancing fuel cleanliness and reducing reliance on fossil fuels. Its main application is in blended fuels for vehicles, but it is also utilized as a solvent and in chemical synthesis. The Indian bioethanol market has seen considerable growth in recent years, fueled by the country's commitment to renewable energy, lowering greenhouse gas emissions, and ensuring energy security.

As of May 2024, India has successfully reached a 15% blending of ethanol in petrol. The Indian government has set ambitious biofuel targets, seeking to achieve a 20% ethanol blending by 2025 as part of the National Biofuel Policy, which encompasses a range of production and procurement incentives. The focus on the Ethanol Blending Program (EBP) has spurred increased investments in the sector. India's diverse agricultural landscape provides a robust supply of feedstock, including sugarcane, corn, and biomass residues, with the sugar industry playing a pivotal role in ethanol production. The surplus sugarcane production has led to a rise in ethanol extraction from molasses.

Innovations in production technologies, particularly second-generation bioethanol from lignocellulosic biomass, are gaining traction, which could diversify feedstock sources and enhance efficiency. However, challenges remain, such as the need for improved supply chain logistics and infrastructure, as well as the impact of feedstock price volatility on production costs and profitability. Scaling up second-generation bioethanol production will require substantial investment and technological know-how.

Despite these challenges, the bioethanol market in India offers significant opportunities, driven by a growing emphasis on renewable energy. With ongoing government support, rising investments, and advancing technologies, the market is poised for sustained growth, contributing positively to the country's energy landscape and environmental objectives.

Key Market Drivers

Government Policies and Regulations

Government policies and regulations are pivotal in advancing the bioethanol market in India. The National Biofuel Policy establishes clear targets for ethanol blending in petrol, aiming for a 20% blend by 2025, which generates a defined market demand and encourages investment in production facilities. The Ethanol Blended Petrol (EBP) Programme has been implemented nationwide, with the exception of the Union Territories of Andaman and Nicobar Islands and Lakshadweep, where oil marketing companies (OMCs) sell petrol blended with 10% ethanol. This policy provides a comprehensive framework for the development, production, and utilization of biofuels, facilitating a shift towards sustainable energy sources.

The Pradhan Mantri JI-VAN Yojana supports the establishment of commercially viable integrated bioethanol projects, focusing on second-generation (2G) technology and the utilization of waste and cellulosic biomass. In August 2024, the Government of India approved an extension of the modified Pradhan Mantri JI-VAN (Jaiv Indhan- Vatavaran Anukool Fasal Awasesh Nivaran) Yojana for an additional five years, extending its duration until 2028-29. The government also indicated plans to explore the long-term impact of ethanol blending for aviation turbine fuel (ATF) in the near future. The modified scheme encompasses advanced biofuels derived from lignocellulosic feedstocks, including agricultural and forestry residues, industrial waste, synthesis gas, and algae. Additionally, "bolt-on" plants and "brownfield projects" are now eligible, allowing them to leverage existing expertise to enhance their viability.

Furthermore, it supports the advancement of biofuel technologies and aligns with the Make in India initiative, contributing to India's ambitious target of achieving net-zero greenhouse gas emissions by 2070. These subsidies are designed to offset production costs, enhancing the competitiveness of bioethanol against fossil fuels. The Goods and Services Tax (GST) on ethanol has been significantly reduced from

18% to 5%, making it more accessible to consumers. Furthermore, there is a differential pricing structure for ethanol based on the raw materials used in its production. Policies that promote the cultivation of biofuel feedstocks, such as sugarcane, provide farmers with additional income opportunities, potentially including price guarantees or minimum support prices for these crops.

The promotion of cooperative farming and production models enables smallholder farmers to collaborate in bioethanol production, thereby enhancing economic viability and community engagement. In August 2024, the Union government announced a significant policy change, allowing sugar mills to utilize cane juice or syrup for ethanol production in the upcoming Ethanol Supply Year (ESY) 2024-25, starting November 1, 2024. This new policy also permits the use of B-Heavy and C-Heavy molasses for ethanol production and authorizes distilleries to acquire up to 2.3 million metric tons of rice from the Food Corporation of India specifically for this purpose, aimed at boosting ethanol output and supporting blending strategies.

Stable and consistent policies foster a predictable business environment that attracts investment. Investors are more inclined to allocate resources to bioethanol projects when they can count on long-term government support. The government is also positioned to adapt its policies in response to market dynamics and technological progress, ensuring that the bioethanol sector remains competitive and aligned with national objectives. By establishing clear targets, offering financial incentives, supporting infrastructure development, and encouraging innovation, the government cultivates a favorable environment for investment and growth. These initiatives not only advance the bioethanol sector but also contribute to broader goals such as energy security, rural development, and environmental sustainability.

Agricultural Surplus Utilization

India cultivates a variety of crops, including sugarcane, corn, and other agricultural residues. Surplus yields from these crops can be efficiently converted into bioethanol, preventing waste of excess agricultural output. Sugarcane is particularly significant, with approximately 5 million hectares dedicated to its cultivation. Traditionally, sugar serves as the primary feedstock for bioethanol production. The diversity of available feedstocks, encompassing both food and non-food crops, provides flexibility in production and can help stabilize supply chains.

Converting surplus agricultural products into bioethanol enables farmers to diversify their income streams, which is especially advantageous during periods of low market prices for food crops. The demand for feedstocks in bioethanol production can stabilize prices for farmers, ensuring a reliable market for their surplus. Utilizing agricultural surplus for bioethanol production reduces waste and encourages sustainable agricultural practices, aligning with environmental objectives and improving resource efficiency. This approach fosters a circular economy, reintegrating agricultural

by-products into the economic system.

The bioethanol sector also creates job opportunities in rural areas, spanning farming, processing, and distribution, thus supporting local economies. As the industry expands, it promotes skill development in agricultural practices, processing technologies, and biofuel production techniques.

Government initiatives like the Pradhan Mantri JI-VAN (Jaiv Indhan- Vatavaran Anukool Fasal Awasesh Nivaran) Yojana encourage the cultivation of biofuel feedstocks, motivating farmers to produce more raw materials for bioethanol, thereby strengthening the supply chain. This scheme aims to enhance farmers' incomes from agricultural residues, address environmental pollution, generate local employment, and improve India's energy security and self-reliance.

By utilizing agricultural surplus for bioethanol production, India can significantly lower greenhouse gas emissions compared to fossil fuels, reinforcing its environmental commitments. The availability of surplus agricultural products also enables the scaling up of bioethanol production to meet increasing domestic energy demands and potential export opportunities. Overall, leveraging agricultural surplus for bioethanol production is a key market driver that benefits farmers, supports rural development, and promotes environmental sustainability. By capitalizing on excess agricultural output, India can enhance its bioethanol production capacity, minimize waste, and strengthen its energy security, making it an essential component of the country's renewable energy strategy.

Key Market Challenges

High Capital Costs

High capital costs present a significant obstacle for the bioethanol market in India. Setting up production facilities, such as distilleries and storage units, requires substantial initial investment, which can discourage new entrants and small-scale producers from entering the market. The implementation of advanced technologies for efficient bioethanol production also entails significant expenses for equipment and machinery. Additionally, high operational costs encompassing labor, utilities, and maintenance can pressure profitability, especially for new facilities that have not yet reached optimal production levels. Variations in the prices of raw materials like sugarcane and corn further complicate financial planning, impacting overall production costs.

Securing funding for bioethanol projects poses a challenge, particularly for small and medium enterprises (SMEs), as many financial institutions view the bioethanol sector as high-risk, leading to reluctance in providing loans. Furthermore, the volatility of bioethanol prices introduces uncertainty for investors, making it challenging to project returns and justify the significant upfront capital investment.

Compliance with government regulations and quality standards can also increase

operational costs, necessitating further investment in monitoring and compliance systems. Smaller producers often find it difficult to achieve economies of scale, which limits their ability to distribute high capital costs across larger outputs and negatively affects their competitiveness. To address these challenges, targeted government policies, innovative financing solutions, and strategic partnerships may be required to lower entry barriers and strengthen the bioethanol industry. By finding methods to reduce capital costs, India can enhance its bioethanol production capacity and further its renewable energy objectives.

Seasonality and Geographical Variations

Seasonality and geographical variations present substantial challenges for the bioethanol market in India, affecting crop availability, production consistency, pricing stability, and operational efficiency. The industry heavily relies on agricultural crops like sugarcane and corn, which are subject to seasonal fluctuations. This dependence can result in inconsistent raw material availability, disrupting production schedules and capacity.

Different crops have varying harvest timelines, complicating supply chain management and leading to cycles of surplus and shortage. Additionally, the cultivation of biofuel feedstocks tends to be concentrated in specific regions, such as Uttar Pradesh and Maharashtra for sugarcane, which can create vulnerabilities in regional supply chains. Infrastructure disparities across regions can hinder transportation and logistics efficiency, making it difficult to move feedstocks and finished products to market. Furthermore, unpredictable weather conditions, such as droughts or heavy rainfall, can negatively impact crop yields, leading to fluctuations in feedstock availability for bioethanol production.

These seasonal and geographical factors can also contribute to price volatility in raw materials. Surplus periods may depress prices, while shortages can cause spikes, complicating financial forecasting and planning. The capacity to process raw materials efficiently can differ by location, affecting overall production capacity and responsiveness to market demands. Moreover, government support for bioethanol can vary by region, influencing investment decisions and the viability of operations. By addressing these challenges, India can strengthen the resilience of its bioethanol sector and align it more effectively with renewable energy objectives.

Key Market Trends

Ethanol Blending in Aviation Fuels

Ethanol blending in aviation fuels is an emerging trend within India's biofuels market. The aviation sector faces increasing pressure to lower its carbon emissions, and ethanol, as a renewable fuel, presents a viable solution for achieving sustainability targets and meeting regulatory emission reduction requirements. The government has established a strategy for integrating sustainable aviation fuel into the Indian aviation

industry, which includes blending 1% of aviation turbine fuel with SAF by 2027 and increasing that to 2% for international flights in 2028. The Indian government has actively supported the promotion of biofuels, including ethanol, across various sectors, extending this encouragement to aviation by fostering research and development for ethanol blending. India's commitments under international agreements like the Paris Agreement further align with the push for cleaner aviation fuels.

Collaboration among airlines, fuel producers, and government agencies is increasing as they work together to explore and implement ethanol blending in aviation fuels. For instance, in May 2024, Dubai-based SAF One collaborated with Bengaluru-based GPS Renewables to co-develop a plant capable of producing 20 to 30 million liters of bioethanol annually using lignocellulosic waste feedstock.

Ongoing research into blending ratios and the development of compatible engines are crucial for successfully incorporating ethanol into aviation fuels. Technological advancements are enabling more efficient utilization of ethanol in this sector.

Consumer and stakeholder interest in sustainable travel options is growing. Airlines that adopt greener fuels, such as ethanol blends, can improve their brand image and attract environmentally conscious passengers. As technology continues to advance and government support remains strong, this trend could significantly contribute to reducing the carbon footprint of air travel in India and beyond. By adopting ethanol blending, the aviation industry can play a vital role in fostering a sustainable future while reaping economic benefits from local fuel production.

Segmental Insights

Feedstock Insights

Based on Feedstock, the Sugar Based emerged as the dominating segment in the Indian market for Bioethanol during the forecast period. India boasts a robust sugar industry with extensive infrastructure for the cultivation, processing, and distribution of sugarcane and molasses. This established framework facilitates the efficient production of bioethanol. Sugarcane's high sugar content allows for easy conversion into ethanol through fermentation, resulting in superior ethanol yields compared to starch or cellulose feedstocks, thereby enhancing its economic viability.

The Indian government has introduced various policies and incentives to promote bioethanol production from sugarcane, including price guarantees and subsidies for farmers. These measures encourage investment in the sugarcane bioethanol sector. Additionally, by-products like molasses are often used for ethanol production, maximizing resource utilization and contributing to waste reduction, thus enhancing sustainability.

The sugarcane industry also offers significant income opportunities for farmers, especially in rural regions, fostering a strong interest in bioethanol production. Furthermore, sugarcane thrives in India's climate, particularly in states like Uttar

Pradesh and Maharashtra, where growing conditions are optimal, ensuring a reliable supply. These factors create a conducive environment for the ongoing expansion of bioethanol production from sugarcane, establishing it as a crucial element of India's renewable energy strategy.

Fuel Generation Insights

Based on Fuel Generation, Second Generation emerged as the fastest growing segment in the Indian market for Bioethanol in 2024. Second-generation bioethanol leverages by-products and waste materials, which helps reduce environmental waste and fosters a circular economy. This strategy minimizes landfill usage and enhances resource efficiency. Producing bioethanol from non-food sources generally results in lower greenhouse gas emissions compared to fossil fuels, aligning with India's commitments to environmental sustainability and climate objectives. Unlike first-generation bioethanol, which relies on food crops, second-generation bioethanol does not compete for arable land or resources essential for food production, thereby addressing food security concerns in a country where agricultural productivity is vital. The Indian government is actively encouraging the use of agricultural residues and non-food feedstocks through various initiatives, including subsidies and incentives aimed at promoting research and investment in second-generation biofuels. These policies increasingly emphasize achieving sustainable development goals, further enhancing the appeal of second-generation bioethanol.

Technological advancements, such as enzymatic hydrolysis and fermentation processes, are making the production of second-generation bioethanol more efficient and cost-effective. For example, in May 2024, Fermbox Bio, a synthetic biology research and manufacturing company, launched EN3ZYME, an innovative enzyme cocktail designed to improve the efficiency and cost-effectiveness of converting pre-treated agricultural residues into fermentable cellulosic sugars, which are essential for producing second-generation ethanol.

With its sustainability advantages, compatibility with food security needs, government backing, technological progress, and diverse feedstock availability, second-generation bioethanol is well-positioned for substantial growth in the coming years. As the market develops, it is expected to play a key role in fulfilling India's energy requirements while supporting environmental sustainability.

Regional Insights

Based on Region, North India emerged as the dominant region in the Indian market for Bioethanol in 2024. North India, especially Uttar Pradesh, is the leading producer of sugarcane in India. Sugarcane is a key raw material for bioethanol production, as both its juice and molasses can be fermented into ethanol. Additionally, North India cultivates other crops like maize and wheat, which can also be used for bioethanol, enhancing the diversity of available feedstock.

The government provides financial support and incentives for bioethanol production, particularly in states with substantial sugarcane farming. This promotes investment from farmers and entrepreneurs in bioethanol facilities. For example, the Uttar Pradesh government has initiated the State BioEnergy Promotion Programme, designed to encourage bioenergy enterprises. This program offers benefits such as capital subsidies, full reimbursement of state GST for ten years, and exemptions from stamp duty on land purchases for establishing these enterprises. Uttar Pradesh also launched its Bioenergy Policy 2022 to enhance the bio-economy and decrease reliance on fossil fuels.

The region boasts a strong network of sugar mills, many of which are capable of producing bioethanol from molasses, a byproduct of sugar production. This established infrastructure reduces the need for new investments and facilitates a smoother transition to bioethanol production. Moreover, North India has a well-developed transportation network that aids in the efficient movement of raw materials like sugarcane to processing facilities and the distribution of finished bioethanol products. As urbanization and industrialization accelerate in North India, the demand for energy is rising. Bioethanol, as a cleaner fuel alternative, is increasingly appealing to both consumers and businesses.

The region is also home to numerous agricultural universities and research institutions focused on biofuels and renewable energy, fostering research, innovation, and the development of advanced bioethanol production technologies. The regulatory environment in North India is generally favorable for biofuel production, characterized by less bureaucratic complexity than in other regions, which encourages investment and the establishment of new bioethanol plants. As India intensifies its efforts toward renewable energy and carbon footprint reduction, North India's importance in the bioethanol sector is expected to grow.

Key Market Players

Balrampur Chini Mills Limited

Praj Industries Limited

India Glycols Limited

Triveni Engineering & Industries Ltd.

Gulshan Polyols Limited

Advanced Enzyme Technologies Limited

Bajaj Hindusthan Sugar Ltd.

Shree Renuka Sugars Ltd.

DCM Shriram Industries Ltd.

HPCL Biofuels Ltd.

Report Scope:

In this report, the India Bioethanol Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

India Bioethanol Market, By Feedstock:

Starch Based

Sugar Based

Cellulose Based

Others

India Bioethanol Market, By Fuel Generation:

First Generation

Second Generation

Third Generation

India Bioethanol Market, By Fuel Blend:

E5

E10

E15 TO E70

E75 TO E85

Others

· India Bioethanol Market, By Application:

Fuel & Fuel Additives

Industrial Solvents

Disinfectant

Personal Care

Beverages

Others

India Bioethanol Market, By Region:

West India

North India

South India

East India

Competitive Landscape

Company Profiles: Detailed analysis of the major companies presents in the India Bioethanol Market.

Available Customizations:

India Bioethanol Market report with the given market data, TechSci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

India Bioethanol Market By Feedstock (Starch Based, Sugar Based, Cellulose Based, Others), By Fuel Generation...

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Detailed analysis and profiling of additional market players (up to five).

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