GEMA
GRAIN ETHANOL MANUFACTURERS ASSOCIATION

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Solutions for Tomorrow

Unlocking ₹35,000 Crore for Farmers

The Untapped Potential of Grain Ethanol

April 2025


Ethanol

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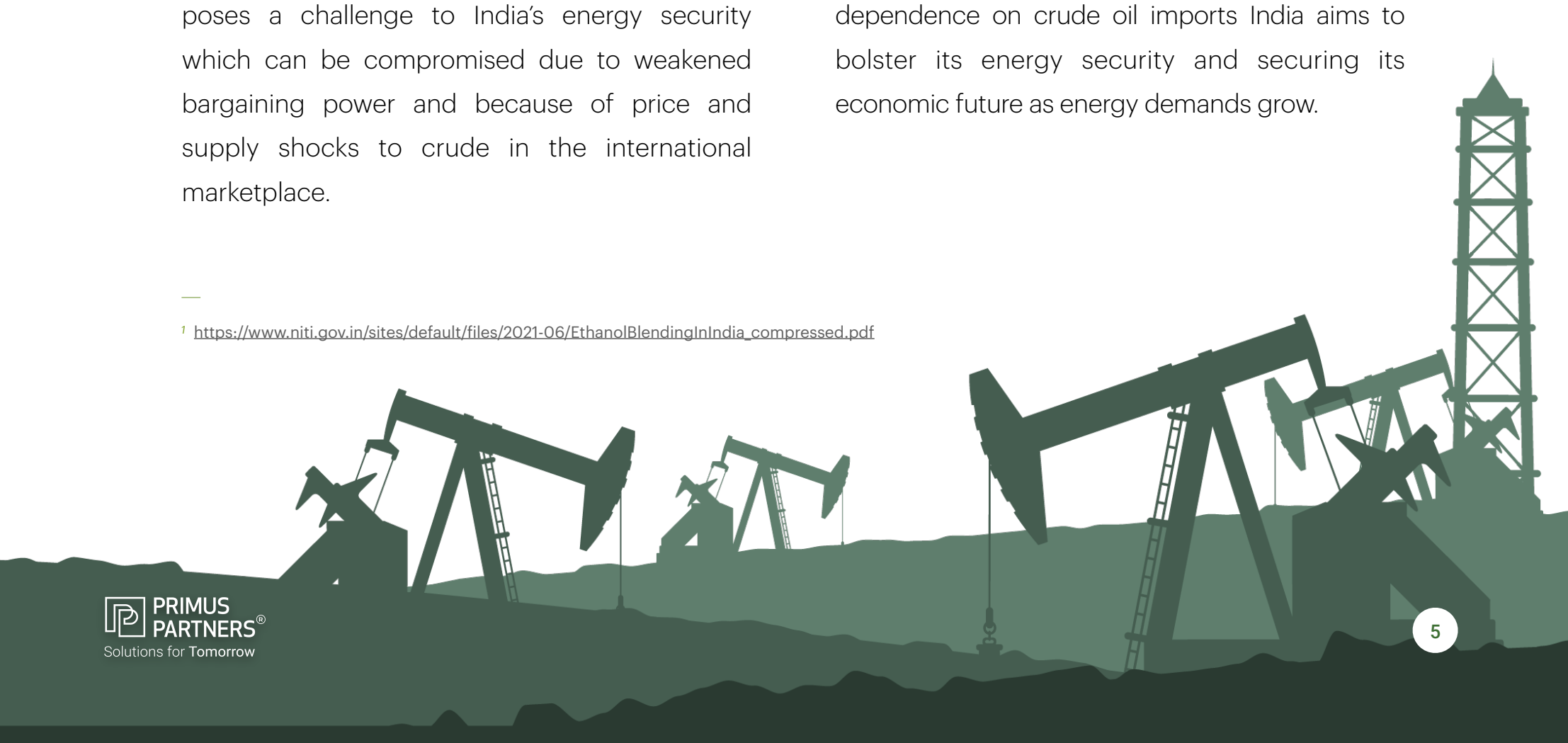
The Triple Mandate: Energy Security, Rural Growth & Climate Action

Reducing Dependence on Oil Imports and Attaining Energy Self-sufficiency

As demand for energy increases, meeting them is getting more challenging in a world that is moving towards decarbonization. India is the world's third-largest energy consumer and has depends heavily on oil imports to meet its energy demands with close to 85 percent of the oil it consumes being imported [1]. This heavy reliance poses a challenge to India's energy security which can be compromised due to weakened bargaining power and because of price and supply shocks to crude in the international marketplace.

This is especially true for a developing nation like India where price fluctuations can slow down economic growth. It is also the cause of a substantial depletion of foreign currency reserves which contributes to a trade deficit leading to devaluation of the currency and can put inflationary pressure on prices. By reducing dependence on crude oil imports India aims to bolster its energy security and securing its economic future as energy demands grow.

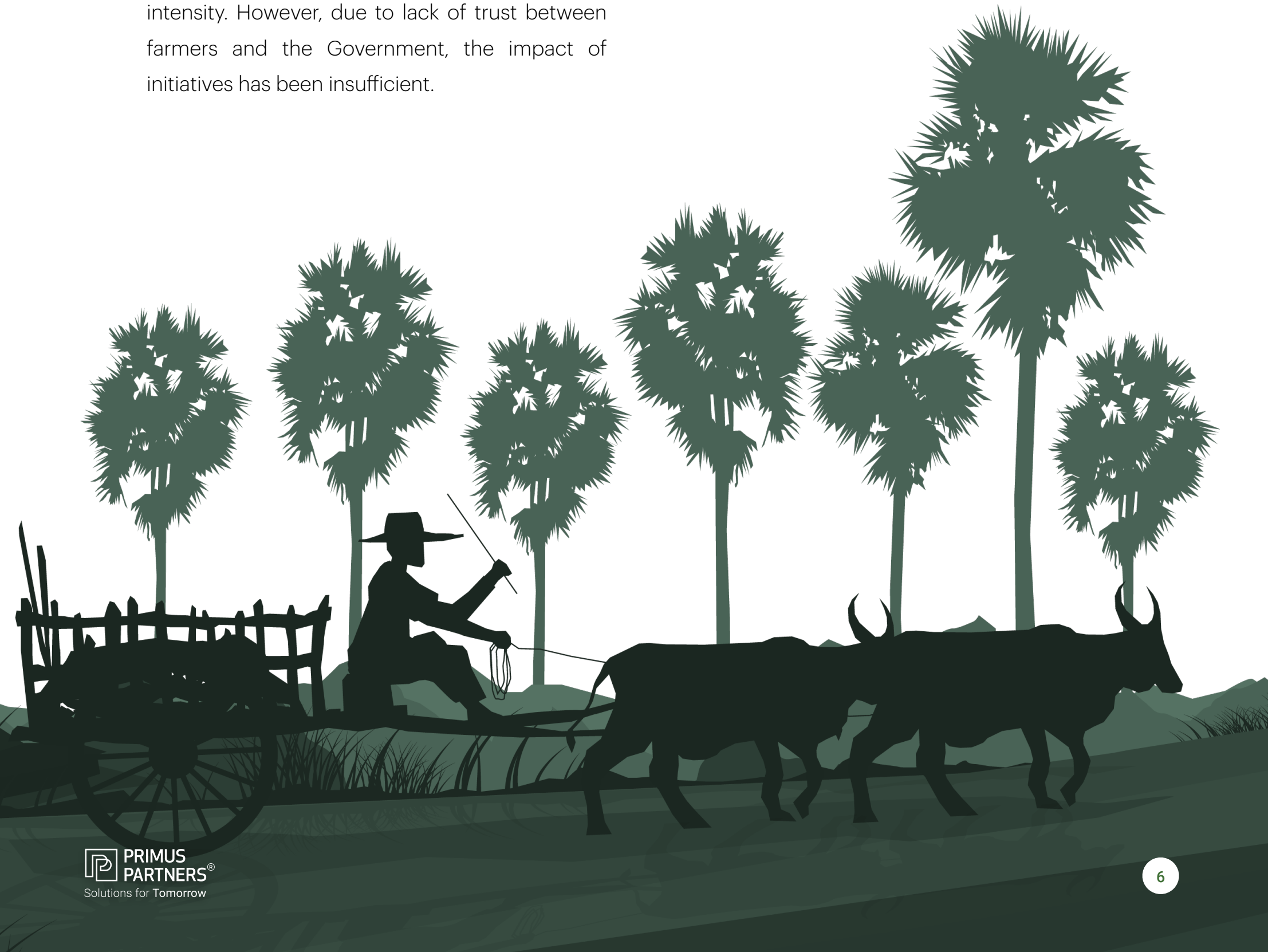
[1] https://www.niti.gov.in/sites/default/files/2021-06/EthanolBlendingInIndia_compressed.pdf



Improving Farmer Welfare and Fostering Rural Development

Being a developing nation, India still has a sizeable population that resides in rural areas and are engaged in farming. India has been trying to bring increased welfare to farmers for quite a few years with limited success. The Doubling Farmer's Income (DFI) committee set up in 2016 gave its recommendations for achieving the target by 2022 however, those targets were not met the Government pushed the goal posts further back. The recommendation from the DFI committee included increased market access, increasing crop productivity and diversity, cropping intensity. However, due to lack of trust between farmers and the Government, the impact of initiatives has been insufficient.

Income in rural areas is well below their counterparts in urban areas due to lack of employment opportunities. This leads to mass migration to urban centres which then become overcrowded and lead to proliferation of slums. The Government aims to increase the **economic wellbeing of farmers, thereby uplifting them.** The Government also wants to **invigorate the rural economy and enable job creation by attracting industries and investment in rural capacity building.**



Reducing Carbon Emissions and Environmental Impact

As India moves along its development path it does not have the luxury of burning fossil fuels as freely as nations that developed earlier on did. The threat of climate change is looming over the world and more **environmentally friendly solutions to aid rapid growth are the need of the hour.** India also has a major air pollution problem, especially in urban areas where vehicular pollution and industrial fumes drastically reduce air quality.

As a developing nation, India also has a **large part of the population that are extremely vulnerable to climate change**, this is especially true for the vast number of agricultural workers whose livelihood can be severely compromised adverse weather patterns affecting crop production. India aims to **reduce carbon emissions by 50 percent by 2030 and achieve net zero by 2070.**

02

Ethanol as a Strategic Lever: Reducing Imports, Uplifting Farmers, and Cutting Emissions

To combat these issues India has started taking steps toward securing its energy future by embracing sustainable practices like ethanol blending. Ethanol is generated by processing grain and sugarcane. It can be mixed with petrol, cutting down on fossil fuel imports and reducing harmful carbon emissions that contribute to climate change and public health issues. As on March 2024, only 2 percent of road transport used biofuels like ethanol. Promoting the use of ethanol blending presents India with a promising opportunity to reduce its dependence on imported oil while addressing environmental concerns. Domestically produced ethanol can play a pivotal role in helping India meet the increasing demand for energy and aligns with various national level goals India is trying to achieve like “Make in India”, generating employment, and helping double farmer’s income.

Ethanol blending supports the three goals of the Government.

Firstly, the Ethanol Blended Petroleum (EBP) Programme will **aid in curbing imports of fossil fuels leading to lower crude oil import bills and attaining self-reliance for domestic energy needs**. Oil is the largest item in India's trade deficit, reducing dependence on oil imports will lead to significant drop in trade deficit. Through the proliferation of the EBP India can also partially insulate itself from price shocks in the international markets and placing it in a stronger position geopolitically. It also secures India's energy future in an increasingly volatile geo-political landscape where war and diseases can hamper trade leaving millions vulnerable and slow down economic growth.

The second objective that the EBP programme is addressing is **increased farmer welfare and rural development.** By creating a new market for maize, the EBP is helping farmers get better prices for their produce, the minimum support price for maize has gone up from Rs. 1850 per quintal in 2020 to Rs. 2225 in 2024-25. [2] Maize is also a more resilient crop to weather effects, making a more secure crop for farmers to grow. The capacity building initiatives under the EBP programme also helped in securing Rs. 30,000 crores worth of capital investment in rural areas due to the establishment of distilleries and supporting infrastructure. This is helping to create a value chain in the rural areas helping farmers gain buyers for their produce and generate employment in allied sectors in the area. Through this the EBP can help arrest out migration as well.

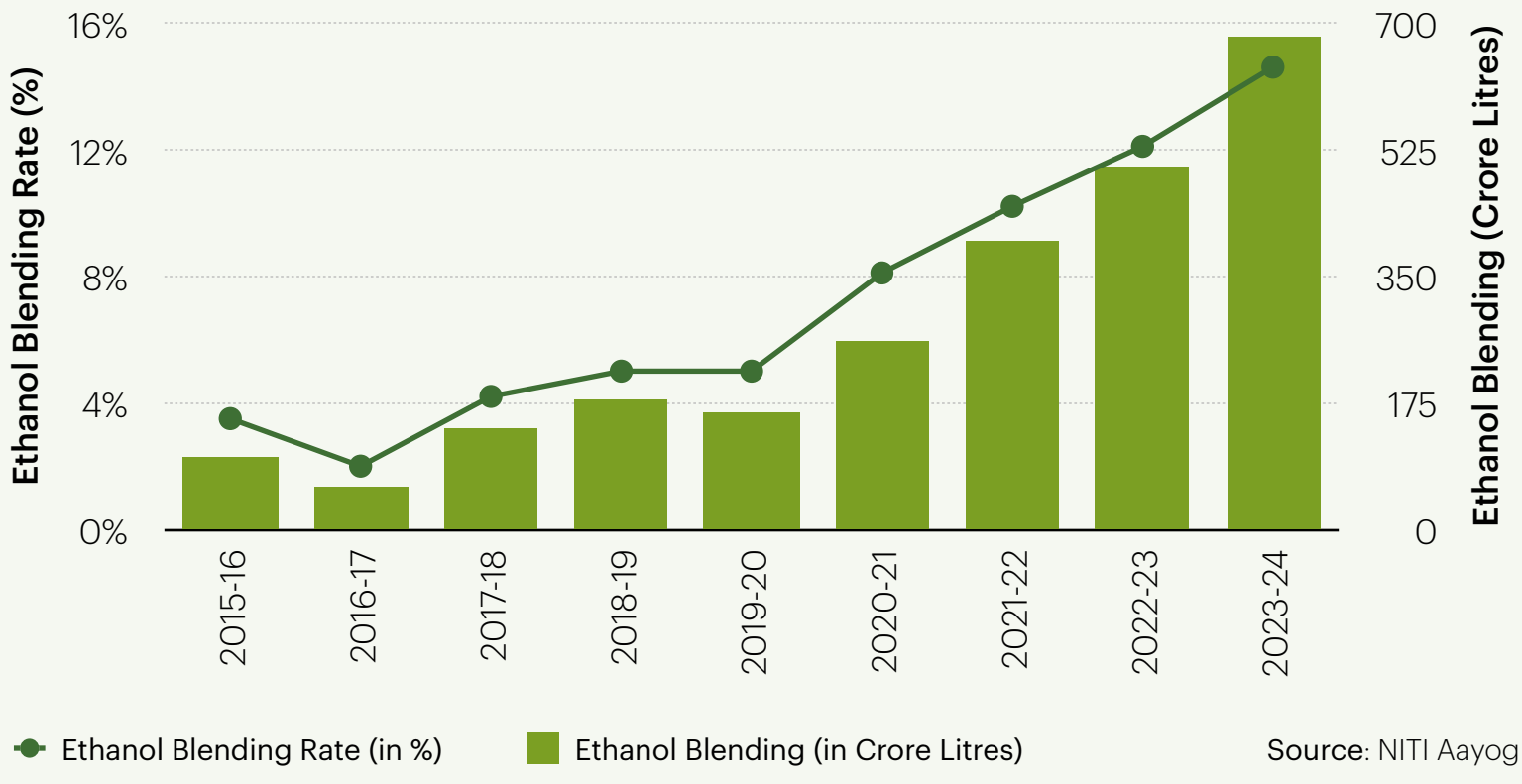
[2] https://upag.gov.in/dash-reports/mipmspstatement?rtab=Prices&rtype=reports

The third aspect that the EBP addresses for the Government comes from the fact that **ethanol burns cleaner than crude, releasing lower emissions** and in turn leading to better environmental outcomes. Crude is predominantly used by the transport sector and by replacing gasoline with ethanol will have a sizeable impact on vehicular emissions. India has multiple cities that appear on the most polluted list in the world. North India has a chronic air pollution problem in the winter and most of India's electricity is generated using coal powered powerplants. With energy demands only slated to grow in the future and the loom threat of climate change the need for more environmentally friendly energy sources is imperative.

It also supports the Government's waste-to-wealth mission by using damaged foodgrains reducing wastage. The use of maize in the programme also promotes crop diversity and can lead to a shift towards less water utilisation in farming.

The EBP programme has over the last decade has had a remarkable impact by saving ₹1,08,655 crore in foreign exchange, reducing CO2 emissions by 557 lakh metric tons, and leading to substitution of 185 lakh metric tons of crude oil. It has also had a significant economic impact, with OMCs disbursing ₹1,45,930 crore to distillers and ₹87,558 crore to farmers. [3]

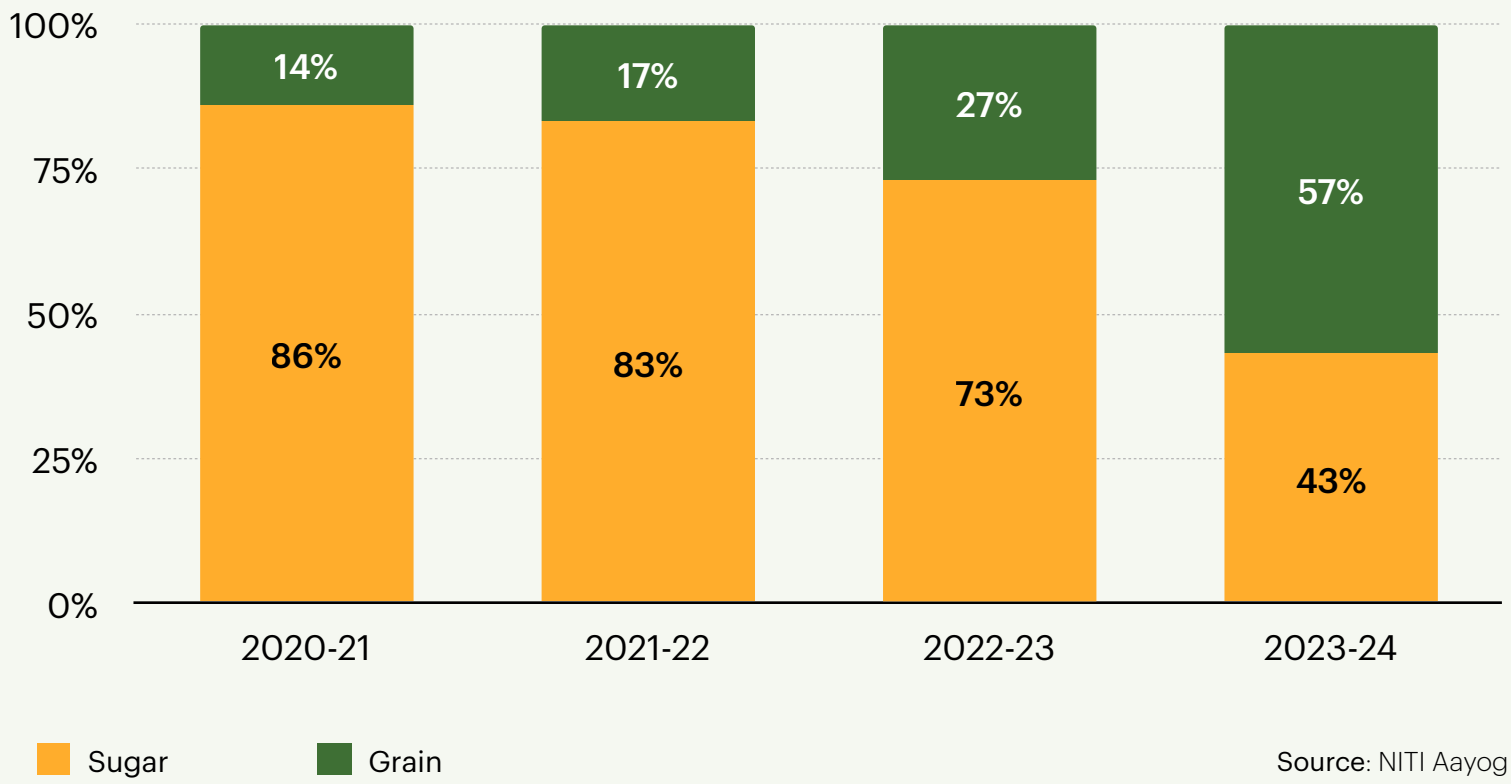
Fig. 1 Ethanol Blending in Petrol



Source: NITI Aayog

[3] https://pib.gov.in/PressNoteDetails.aspx?NoteId=153363&ModuleId=3&reg=3&lang=1

Fig. 2 **Shift in Feedstock used from 2020-2024**
(as % of total Ethanol Production)



Source: NITI Aayog

The introduction of diverse feedstock like B heavy molasses, approval to utilise surplus FCI rice in October 2020, the approval of maize in November 2020, and interest subvention schemes to incentivise capacity building for grain-based distilleries have been a shot in the arm for the previously fledgeling program.

Production has skyrocketed, with grain at the forefront of the revolution. The Government had envisioned a 50-50 split between grain and sugar; however, grains ethanol has exceeded expectations. In ESY 23-24 grain overtook sugar as the major feedstock and within grain, maize has become the highest contributor.

While ethanol blending is not a new technology and has been around since the 1980's, the first pilot blending programme in India was initiated in 2001. In the recent past, the Government has pushed the programme to new heights with some key reforms, even revising the 20 percent blended petrol target that was to be achieved by 2030 to 2025.

One of the key reforms that has allowed this to happen has been the introduction of grain-based ethanol.

03

Fuel from Fields:
Why Grain-based Ethanol is the Future?

Grain ethanol, particularly maize-based ethanol, is the global standard for ethanol production due to its high starch content. The US, the largest producer of ethanol, has a well-established infrastructure for maize farming, processing, and ethanol production, making it a cost-effective and efficient option. Also, Ethanol production from maize demonstrates a positive energy balance, meaning the process of producing ethanol fuel consumes less energy than the amount of energy contained in the fuel itself. The Government of India is also aligning itself with these with global best practices.

Secondly, India has a massive grain surplus. India is a net exporter of rice. In the year 2023-24, net exports of rice equalled 164 lakh tonnes (or 12 percent of production).[4] Currently, the buffer stocks of rice with FCI exceed the stocking norms and has done so for the past five years.[5] This is an indicator that production of rice exceeds its production, and this rice is lying dormant in FCI warehouses across India, beyond the mandated surplus.

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[4] https://agriexchange.apeda.gov.in/

[5] https://sansad.in/getFile/annex/266/AU2436_GhjTyM.pdf?source=pqars Questions answered in Rajya Sabha on 17th December 2024. As on 1st April, actual rice stock in the Central Pool equalled 301.57 LMT while the stocking norm was 135.80 LMT.

In addition, out of the three major feedstock (sugar, rice, maize), maize is the least water intensive, making it more environmentally friendly. Maize uses 2.57 kilolitres of water for 1 litre of ethanol compared to 3 kilolitres used by sugarcane and rice has best ethanol conversion ratio amongst the three. Maize is also the second most efficient feedstock when it comes to ethanol conversion only behind rice. The promotion of grains for utilization in ethanol production can help the country diversify its crop pattern, reduce dependence on one particular feedstock and move to more environmentally friendly crops for ethanol production as well as making use of the over production of rice which would otherwise go to waste.

Type of Feedstock	Quantity of Ethanol per Metric Ton of Feedstock
Sugarcane Juice	70 Litres
B Molasses	300 Litres
C Molasses	225 Litres
Damaged Foodgrains (Broken Rice)	400 Litres
Rice	450 Litres
Maize	380 Litres

Source: Roadmap for Ethanol Blending in India 2020-25, NITI Aayog

> ***The EBP programme has made India a global leader in the Biofuels sector and green energy. It has increased India's soft power on the global stage and has benefited the domestic agrarian economy immensely. The government needs to continue the good work it has been doing over the last few years to ensure the sector flourishes.***
>
> **Mr. Vaibhav Dange**
> Public Policy Expert on Green Energy;

Finally, Agronomists believe that maize is a crop that can easily grow across multiple agroclimatic zones and land topographies. Thus, providing farmers with a more resilient crop leading to more secure livelihoods and also allowing for production to be scaled up more easily. However, the country was not able to generate required amounts of maize in a short span of time to support the current needs of the program. To ensure diversity in feedstock and availability the Government also periodically allows grains like broken and surplus rice to be used in ethanol production. This is another big advantage of grain ethanol. Using broken rice and surplus rice which would have gone to waste, by using to produce ethanol it instead creates value and supports the waste-to-wealth mission of the Government.

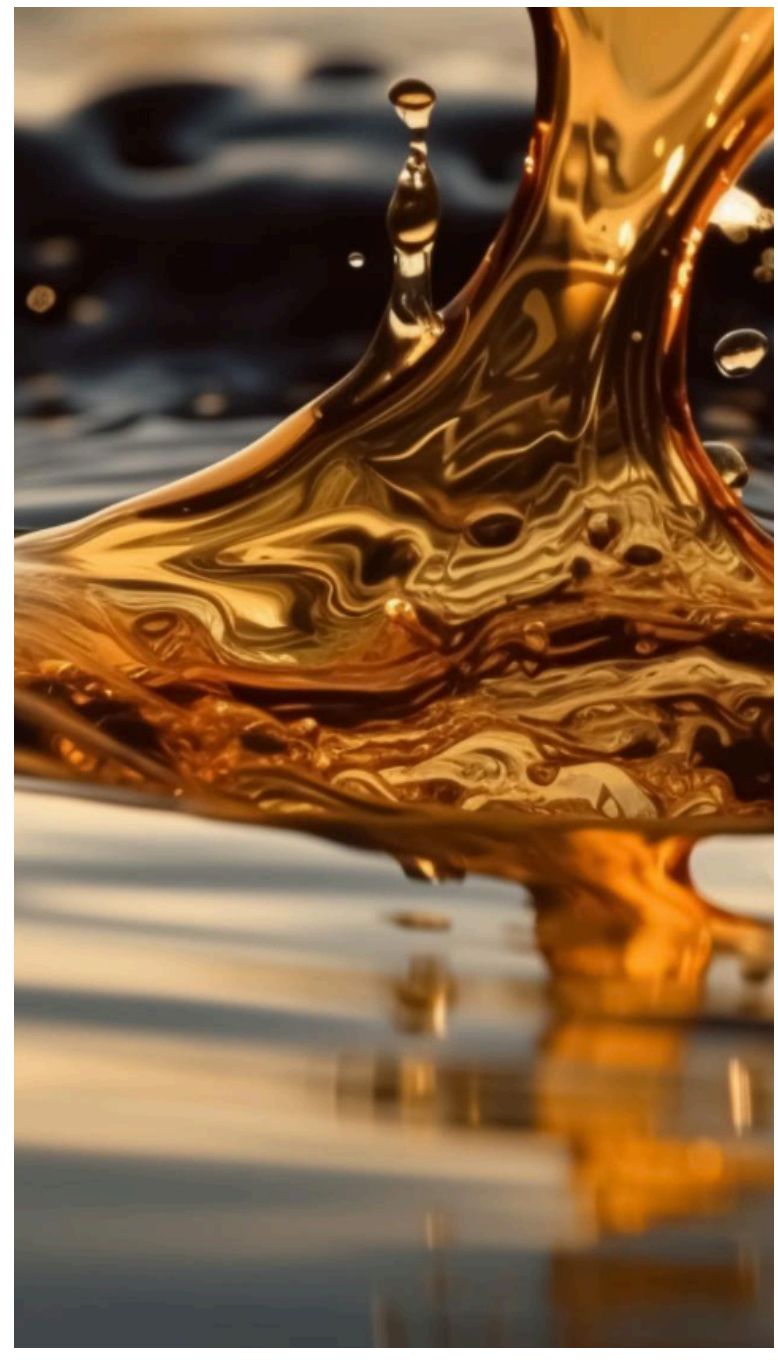
04

Where We Stand:
India's Ethanol Journey So Far

The Ethanol Blended Petrol (EBP) Programme has been in effect since 2003, evolving a target of 20 percent ethanol blending in petrol by 2025, brought forward from the original target of 20 percent by 2030. The target of 10 percent ethanol blending in petrol was achieved five months ahead of schedule, i.e., by June 2022. [6]

The supply of ethanol blended petrol for public sector OMCs has jumped from 3,413 crore litre during Ethanol Supply Year (ESY) 2019-20 to an estimated 4,828 crore litre during ESY 2023-24, with a concurrent increase in ethanol blending percentage from 5 percent to 14.60 percent in ESY 2023-24. [7] The rate reached a remarkable 19.6 percent for January 2025. [8]

Since ESY 2013-14 and up to ESY 2023-24 (as on 30th September 2024), ethanol blending in petrol has resulted in approximate savings of more than Rs. 1,08,655 crore of foreign exchange, net CO2 reduction of about 557 lakh metric tonnes [9] and crude oil substitution of approximately 185 lakh metric tonnes.[10]



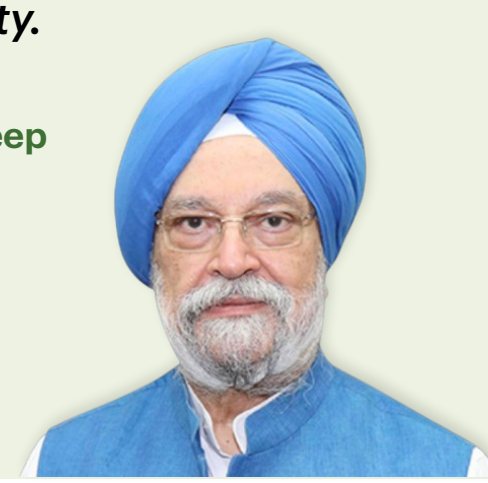
6 https://pib.gov.in/PressReleseDetailm.aspx?PRID=2078518&reg=3&lang=1
7 RAJYA SABHA UNSTARRED QUESTION NO-1559 dated 9th December 2024
8 https://www.thehindubusinessline.com/economy/ethanol-blending-with-petrol-at-record-196-in-january-2025/article69232849.ece

Since ESY 2013-14 and up to ESY 2023-24 (as on 30th September 2024), ethanol blending in petrol has resulted in approximate savings of more than Rs. 1,08,655 crore of foreign exchange, net CO2 reduction of about 557 lakh metric tonnes [9] and crude oil substitution of approximately 185 lakh metric tonnes. [10]

Since 2019, the number of retail outlets selling ethanol-blended petrol has also seen a steady increase. In 2019, ethanol-blended petrol was sold from 43,168 of all OMC retail outlets but in 2024, this has increased to include all OMC retail outlets. [11]

To achieve the E20 target by 2025, approximately 1,016 crore litres of ethanol is required and the total demand for ethanol is estimated to be approximately 1,350 crore litres. To meet this requirement, an ethanol production capacity of approximately 1,700 crore litres need to be established by 2025, if one is to assume that plants are operating at 80 percent efficiency. [12]

> ***India's ethanol story is one of enormous grit and perseverance. From just 1.5 percent target from 2005-14, we have moved from 1.5 percent to 10 percent blending during 2014-22.***
>
> ***It is a unique initiative which combines energy security, environmental well-being and rural prosperity.***
>
> **Shri Hardeep Singh Puri**
>
> Minister for Petroleum & Natural Gas



In January 2025, the Government of India reduced the reserve price of FCI rice under the Open Market Sale Scheme (OMSS) by Rs 550 per quintal, now equalling Rs. 2,250 for States and ethanol producers. State governments and State-run corporations can purchase up to 12 lakh tonnes and ethanol distilleries can buy up to 24 lakh tonnes of rice. This measure was taken with the aim to boost sales and aid food security measures across the country.

9 RAJYA SABHA UNSTARRED QUESTION NO-142

10 LOK SABHA UNSTARRED QUESTION No. 2874 dated 12th December 2024

11 RAJYA SABHA UNSTARRED QUESTION NO – 765 dated 12th December 2024

12 https://pib.gov.in/PressNoteDetails.aspx?NoteId=153363&ModuleId=3&reg=3&lang=1

05

From Grain to Gold: The Ethanol Opportunity

The NITI Aayog estimated 1,016 crore litres of ethanol would be needed to achieve 20 percent blending by 2025 meaning that total demand for ethanol for all uses will be around 1,350 crore litres. The total ethanol industry was valued at Rs. 53,790 crores in 2023. It is expected to grow at a compound annual growth rate of 8.84 percent and could reach Rs. 90,600 crores by 2029. [13]

With 98 percent of road transportation in India utilising fossil fuels and only 2 percent utilising biofuels means that there is still a vast scope to expand the ethanol blending in fuel. As capacities are enhanced and the Government pushing the automotive industry to bring in flex fuel cars that can accommodate a higher threshold of blended fuel the need for ethanol is only going to rise.

13 https://www.outlookbusiness.com/news/ethanol-market-in-india-set-to-hit-new-highs-news-416813

The NITI Aayog estimates gasoline demand to reach 5,785 crore litres annually by 2030. Ethanol blended fuel can help significantly reduce emissions from the rise in vehicles. The Government hopes to reach 30 percent blending by 2030 [14], this would require approximately 1,735.5 crore litres of ethanol for blending leading to annual emissions reduction of 347.1 lakh tons and 197.85 lakh tons from grain ethanol alone. [15]

The total foreign exchange savings on crude oil imports, thanks to EBP, from 2014-21, were Rs. 26,509 crores.

From 2021 - 2024, once grain ethanol capacities were enhanced, India has achieved an average of yearly saving of Rs. 26,521 crores.

The Government estimates that at 20 percent blending the saving would be Rs. 45,000 crores annually. [16] Even if the blending rate continues at 20%, the savings that would accrue between 2025-2030 would be Rs. 2.25 lakh crores. Of this total savings, assuming the current 57% contribution of grain ethanol, forex savings thanks to grain ethanol could total Rs. 1.28 lakh crores. This is a conservative estimate, and the savings will probably be much higher than this.

Forex Savings on Crude Import (2025 to 2030)

Grain		Grain + Sugar	
2025 onwards	2025 - 2030	2025 onwards	2025 - 2030
Annual Savings at 20%	**Cumulative Savings** at 20%	**Annual Savings** at 20%	**Cumulative Savings** at 20%
25,650 INR Crore	1,28,250 INR Crore	45,000 INR Crore	2,25,000 INR Crore

14 https://economictimes.indiatimes.com/industry/renewables/ethanol-blending-program-saved-rs-24300-crore-foreign-exchange-in-2022-23-hardeep-puri/articleshow/106536867.cms?from=mdr

15 Using government estimates of 20,000 tons of emissions saved per crore litre of ethanol and 1735.5 crore litre requirement as per authors calculations.

16

India has big plans for ethanol, it led the creation of the Global Biofuels Alliance (GBA) during its G20 presidency which brings together the biggest and producers and consumers of biofuels. The objective of GBA is to accelerate development, deployment, and adoption of biofuels establishing them as cornerstone of the energy transition while driving job creation and economic growth. India is also entering into a technology and knowledge share partnership with Brazil which has a more mature ethanol blending programme and stands as the second largest producer of ethanol. India plans to learn from Brazil's experience to enter a new phase of biofuels, expanding into alternative aviation fuel and 2G feedstock.

> ***The launch of the Global Biofuels Alliance marks a watershed moment in our quest towards sustainability and clean energy.***
>
> Hon'ble
> Prime Minister
> **Shri Narendra Modi**

These partnerships should help India develop a more conducive ecosystem for promotion and adoption of ethanol. With these strategic partnerships India intends to become a global hub for green energy and a leader in sustainable fuels. [17]

According to Government estimates 2025 onwards, approximately 165 Lakh Metric Tons of surplus grain annually will be used to produce ethanol resulting in payments exceeding Rs. 35,000 crores to farmers. [18]

17 https://www.business-standard.com/industry/news/india-in-talks-with-brazil-for-tech-partnership-to-expand-ethanol-usage-124011600543_1.html

18 https://mopng.gov.in/files/TableManagements/IPNG-Statistics-Report_2023-24_Final.pdf

06

Ethanol's Roadblocks: Rising Costs, Falling Margins & Feedstock Pressure

While the grain ethanol is slowly gaining prominence amongst the producers in the industry, there are a few challenges that the industry is facing and need to be addressed.

Challenge #1

While the market price of maize has increased, standing at about Rs 23-24 per kg, the price of maize-based ethanol has remained at Rs 71.86 per litre. The procurement price of maize produced ethanol has not changed to reflect the increase in market price and the MSP. [19]

Challenge #2

The prices of by-products like Distiller's Dried Grains with Soluble (DDGS) are also falling due to oversupply. This has impacted the profitability of the distilleries, putting them at risk of becoming financially unviable without price revisions and process optimizations. [20]

[19] https://thesecretariat.in/article/india-s-ethanol-blending-programme-faces-serious-challenges
[20] https://www.financialexpress.com/business/industry-the-future-of-indias-ethanol-industry-opportunities-and-challenges-in-achieving-20-blending-by-2025-3701387/

Challenge #3

While maize production has increased, it is still insufficient for the meet the demands of the growing industry.

Challenge #4

Ethanol producers face competition from various industries for feed stock crops. Maize, for example, also plays an important role in industries like poultry and starch, Rice on the other hand is also an important food crop and export crop in India. [21]

PM Modiji initiative - "Ethanol Blending program (EBP)" is a great step forward by the GOI to ensure India's future energy security, rural development, increasing farmer's income manifold and reducing carbon footprint in the environment.

In the last two years, Grain Ethanol Industry has grown and become the largest contributor to the EBP of India.

Still, India being a Grain surplus country - the Grain Ethanol Industry requires timely support from Government of India with right policy initiatives and direction to grow and thrive in the future.

Mr. Abhinav Singhal
Treasurer, Grain Ethanol Manufacturers' Association (GEMA)

[21] https://www.theindiaforum.in/public-policy/challenges-meeting-ethanol-fuel-blending-target-2025-26

07

Fixing the Fundamentals: Solutions for Feedstock, Pricing & Market Linkages

In order to unlock the full potential of grain ethanol blending the Government needs to ensure the following:

Promote maize production in India to ensure feedstock availability and controlling rising maize prices

Maize is a crucial feedstock for ethanol production, and ensuring its availability is key to achieving blending targets. Rising maize prices make ethanol production costlier and less competitive. Without intervention, volatility in maize prices could discourage investment in ethanol production. To ensure that there is maize availability India needs to incentivize farmers to shift to maize by providing high-yield seeds, fertilizers, and irrigation infrastructure. FPOs should get assistance to buy basic infrastructure such as drying units.

Introduce a more dynamic pricing for grain ethanol

At present the pricing mechanism for grain ethanol is determined by Oil Marketing Companies in India. In the last ESY, despite an increase in price of maize, the procurement price for grain ethanol remained the same leading to losses for the grain ethanol industry. This also dampens the entrepreneurial spirit of the nascent industry. The Government needs to ensure that prices move as per variations in the input costs.

Provide uninterrupted supply of damaged, broken and surplus FCI rice

Until maize production scales up, ethanol production requires an alternative feedstock. Damaged and surplus FCI rice provides a viable interim solution. Instead of allowing broken rice to deteriorate in storage, channelling it towards ethanol production ensures better resource utilization. The Government should establish clear, predictable policies regarding the use of surplus rice for ethanol production. The Government must set a fair procurement price that balances cost-effectiveness for distillers while maintaining reasonable FCI stock levels. A well-defined allocation process for surplus rice to distilleries will prevent supply bottlenecks and ensures ethanol production continues uninterrupted, supporting India's biofuel goals.

Provide support for expanding the market for domestic Distiller's Dried Grains with Solubles (DDGS)

DDGS is a protein-rich by-product of grain ethanol production and a cost-effective substitute for maize in animal feed, reducing reliance on maize. Developing a strong domestic market for DDGS will help secure revenue stream distillers, making ethanol production more economically viable. Import substitution through domestically produced DDGS will strengthen India's animal feed supply chain increasing self-reliance and provide insulation from global market fluctuations.

To achieve this, the government must incentivise the animal feed industry to purchase domestically produced DDGS by offering subsidies or tax benefits to feed manufacturers that use domestic DDGS in their formulations. Further, protecting the domestic DDGS market through tariffs on foreign DDGS will encourage local consumption. The Government can also consider banning the import of foreign DDGS to strengthen domestic DDGS market linkages between the grain ethanol and animal feed industries.

About Grain Ethanol Manufacturers' Association (GEMA)

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GEMA is an association of All India Grain Ethanol Manufacturers, with 120+ member units who are owners of grain-based distilleries from across the nation who have come together to serve as a proactive business solution provider through continuous interaction with constituent members and various government agencies. It stands for harmonious relationship, quality, industrial development, Government-Society partnership and to enhance the quality, technology, and productivity of the distillery/ethanol industry on the whole.

About Primus Partners

www.primuspartners.in info@primuspartners.in

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India **United States of America** **United Arab Emirates** **Kingdom of Saudi Arabia**

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