NATIONAL ECONOMIC FORUM

Driving Sustainable Development: Analysing India's Ethanol Blended Petrol (EBP) Programme

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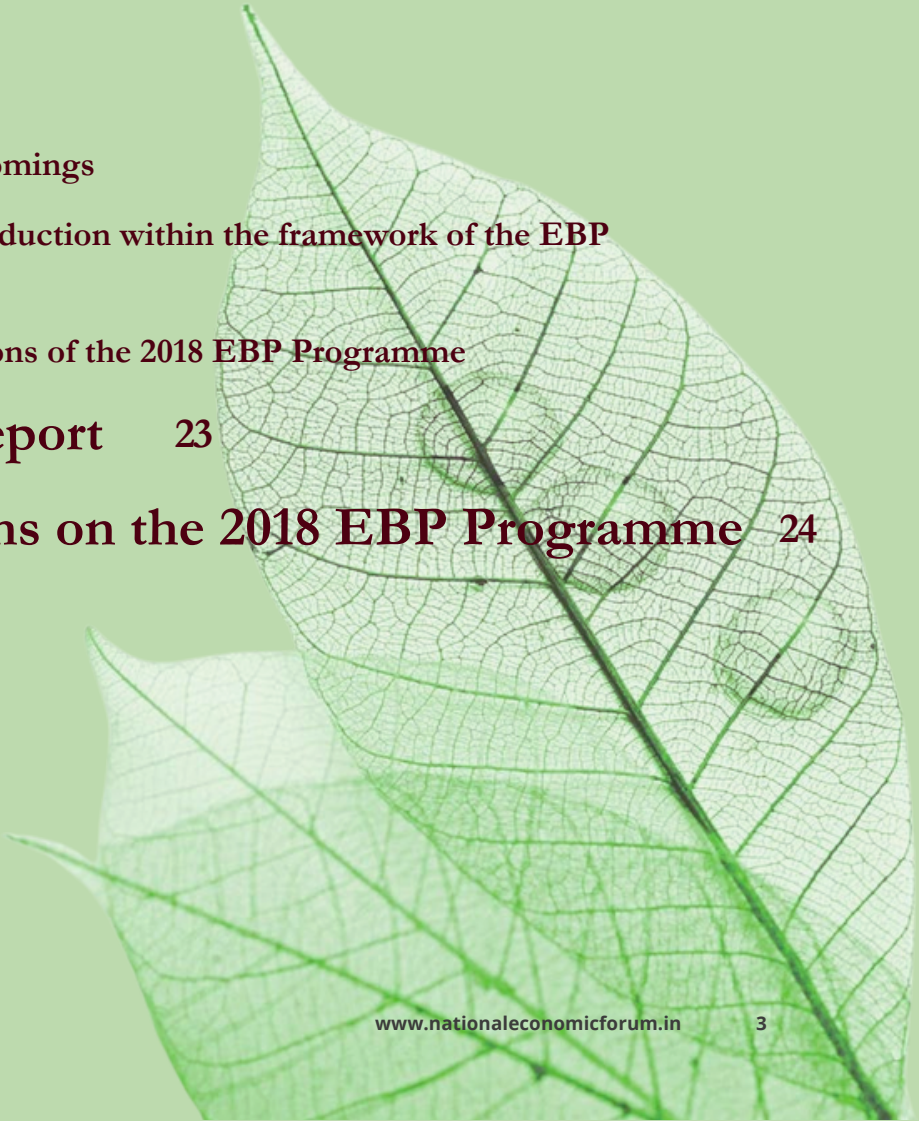


Abstract

The 2018 Ethanol Blended Petrol (EBP) programme is a strategic policy framework that aims to enhance ethanol availability in the Indian market and boost its blending ratio in petrol. The National Policy on Biofuels, established in 2009, set a target of blending 20% ethanol with petrol by 2017. In contrast, the 2018 Ethanol Blended Petrol (EBP) initiative aimed for a 10% ethanol blending target (E10) by 2022 and 20% (E20) by 2030. However, last year in February, the Union Cabinet tweaked the National Policy on Biofuels - 2018 to move the date by which OMCs in India must increase the ratio of ethanol in petrol to 20% from 2030 to 2025 (IEA, 2023). The ethanol blending rate currently stands at 12%. Differential pricing and incentives for 2G ethanol over 1G ethanol were also suggested by the 2018 EBP Programme.

Taxes and inter-state control on the trade and shipping of molasses and non-potable ethanol by various Indian states, together with their set aside allotment, continue to impede the EBP programme's execution. The paper delves into the key features, contemporary challenges, and conducts a critical analysis of EBP. It also compares EBP with the ethanol blending policies of leading nations and proposes certain remedies to do-away with the shortcomings. In-toto, this paper sheds light on India's progress towards achieving its E20 target by 2025, an ambitious milestone set to bolster the groundwork for transitioning to a predominantly ethanol-based economy.

Introduction

The Indian economy holds the third position worldwide in terms of purchasing power parity (PPP), with an economy size of USD 14.17 trillion. India's consumption of 5.3% of the world's primary commercial energy places it third globally in energy utilisation, following only the USA and China (Das, 2019); also, by the late 2030s, it is anticipated that it will emerge as the leading market for energy growth and is projected to represent 15% of the global demand for crude oil by 2040 (Das, 2018). In FY23, India's crude oil imports amounted to approximately USD 110.46 billion, supporting a consumption of over 49.6 million tonnes (MT). For a clearer perspective, 85% of the demand for crude oil is fulfilled by imports, while domestic production caters to the remaining 15%. To address these concerns, a goal had been set to achieve a 10% reduction in crude oil imports by 2022. This objective has been accompanied by the implementation of various policy interventions, including the EBP programme. As crude oil imports continue to escalate, there has been a growing emphasis on ethanol production for blending with petrol. This emphasis was evident when India launched the Global Biofuel Alliance during the G20 Summit, New Delhi, 2023, and more recently at the second edition of the India Energy Week in 2024.

Ethanol blending with petrol commenced in 2001 through a pilot project initiated in the states of Maharashtra and Uttar Pradesh (U.P.). Following the success of the pilot projects, the government mandated a 5% blending requirement in nine additional states in 2002 (Pohit, et al., 2014). In 2003 and 2004, ethanol supplies were affected by severe drought conditions, necessitating the import of 447 million litres of ethanol from Brazil in 2004 to fulfil the blending target. In the year 2005, India emerged as the primary purchaser of Brazilian ethanol. In 2006, the 5% blending target was expanded to encompass 20 states and eight union territories (UTs). Between 2007 and 2009, petrol was blended with only 2% ethanol. Subsequently, the blending percentage fluctuated: it was 0.66% in 2012-13, 1.53% in 2013-14, 2.33% in 2014-15, 3.51% in 2015-16, 2.06% in 2016-17, and 4.22% in 2017-18 (Choudhary, 2019). Albeit, the Motor Spirits and Diesel Oil (Taxation of Sales) Act, 2005 as amended in 2013, required a 5% ethanol blending with petrol, this target was not attained due to flawed policy measures. Under the EBP Programme, the National Policy on Biofuels - 2018 envisioned a tentative target of 20% ethanol blending in petrol (E20) by 2030 (Gazette of India, 2018). Following that, last year in February, the Union Cabinet tweaked the National Policy on Biofuels - 2018 to move the date by which Oil Marketing Companies (OMCs) in India must increase the ratio of ethanol in petrol to 20% from 2030 to 2025 (IEA, 2023). The introduction of the 18% Goods and Services Tax (GST) on ethanol, with effect from July 01, 2017, negatively affected the EBP programme (Das, 2020). This tax rate on ethanol was reduced to 5% on July 27, 2018, in a bid to encourage sugar mills to supply larger quantities of ethanol to OMCs, thereby aiding in meeting blending targets and supporting the EBP programme.

The table on the next page depicts the significant milestones for the EBP programme.

Year	Key Measures Towards the EBP Programme
2001	Ethanol blending with petrol launched in India as a pilot project.
2007	Compulsory 5% ethanol blend with petrol (E5).
2009	Introduction of EBP programme and a proposed target of achieving 20% ethanol blending (E20) by 2017.
2013	The price of ethanol is determined via an open tendering process.
2015	• Excise duty of 12.5% on ethanol is eliminated. • Fixed pricing was reinstated with three price slabs based on distillery-to-depot distance. • OMCs directed to solicit bids for 10% blending with a shortened offer acceptance period to 15 days from 6 months.
2018	• Launch of EBP in 2018. • Proposal set for a 10% ethanol blending (E10) target by 2022, increasing to 20% by 2030.
2022	The target year for the 20% ethanol blending mandate revised from 2030 to 2025.

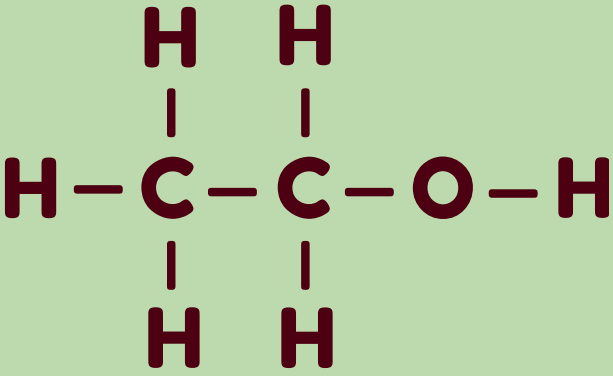
The EBP program holds significant promise for fostering inclusive development in rural India and reducing the nation's crude oil import expenses (Vasandani, 2012). India spent a whopping USD 55 billion to import 185 million metric tons of petroleum in 2021-22 alone (NITI Aayog, 2021). A large share of the imported petroleum is consumed by India's transportation sector. Ergo, realising the target of 20% ethanol blending in petrol could possibly result in the country saving over Rs. 30,000 crore in foreign exchange per annum.

The table presented on the following page highlights the saving of foreign currency, courtesy ethanol blending. The trend in ethanol blended motor spirit saved by Public Sector Undertaking (PSU) OMCs from 2017-2022 shows a significant increase over the years. The ethanol blended (PSU OMCs) in kilolitres (KL) has increased from 1,465,587 in 2017-18 to 4,335,945 in 2021-22. Correspondingly, the blended motor spirit sale (actual) by PSU OMCs in thousand metric tonnes (TMT) has also shown an increasing trend from 25,308 in 2017-18 to 30,654 in 2021-22. The motor spirit saved in TMT due to ethanol blending has also risen from 1,039 in 2017-18 to 3,073 in 2021-22. The data indicates a consistent upward trend in ethanol blending and motor spirit saved by PSU OMCs, reflecting the growth and effectiveness of ethanol blending in saving motor spirit over the years.

Saving of Foreign Currency by Ethanol Blending						
Year	Ethanol blended (PSU OMCs) in KL	Blended Motor Spirit Sale (Actual) PSU OMC in TMT	Motor spirit saved in TMT	Petrol FOB petrol $/bbl	RBI (Rs/$)	Approx total revenue saved (Cr ₹)
1	2	3	4	5	6	7
2017-18	1465587	25308	1039	79.01	67.84	4732
2018-19	1912048	27204	1355	68.53	70.37	5555
2019-20	1705290	24194	1209	46.64	73.86	3539
2020-21	3023401	26456	2143	75.58	73.75	10152
2021-22	**4335945**	**30654**	**3073**	**110.9**	**78**	**22594**
ESY: Ethanol Supply Year (1st December to 30th November); P: Provisional						
Source: PPAC						

The 'Free on Board' (FOB) petrol price and RBI exchange rate have a significant impact on the revenue savings for PSU OMCs. As the FOB petrol price increases, the cost of importing petrol rises, which in turn affects the overall expenditure of PSU OMCs. Similarly, the RBI exchange rate plays a crucial role as it determines the conversion rate of foreign currency to Indian Rupees. Fluctuations in the exchange rate can directly impact the cost of procuring petrol in foreign currency, thereby influencing the revenue savings for PSU OMCs.

The ethanol blending target is also most likely to spur investments in capacity expansion and the construction of additional distilleries (USDA, 2023). The EBP 2018 programme seeks to encourage the utilisation of domestic feedstock for ethanol production, specifically for blending purposes, while also aiming to make a contribution to sustainability efforts. EBP 2018 is closely linked to sugarcane production, as sugarcane serves as the primary raw material for molasses (a thick, dark brown liquid that is produced during the process of making sugar), which in turn is utilised in ethanol production. A reliable EBP program guarantees enduring advantages for sugarcane farmers and offers them an alternative market, particularly during periods of surplus sugarcane production. The aim of the paper is to evaluate the critical aspects, challenges, and shortcomings associated with the implementation of the EBP programme. The paper additionally compares the policy tools utilised in the initiative with those of prominent nations' ethanol blending policies, offering suggestions for improvement. It encompasses policy instruments addressing both demand- and supply-side aspects. The analysis of an array of policy tools, including institutional, technological and financial enabling mechanisms, would empower policymakers to curate suitable strategies for production and consumption of ethanol intended for blending with petrol.



EBP Programmes in Countries across the Globe

Over the last two decades, nations worldwide have enacted a range of policies aimed at advancing ethanol production (Pohit, et al., 2009). Below is a summary of the diverse EBP policies currently in place across various nations:

Canada

The 2010 Renewable Fuels Legislation mandates that fuel producers and importers must incorporate a mandatory 5% blend of ethanol in petrol (Roy, et al., 2012). The regulation included provisions for the establishment of compliance units and allowed for the trading of these units. The law mandated the maintenance and reporting of records to ensure compliance. Ethanol blending in petrol as per the mandate commenced in December, 2010 (Wolinetz et al., 2017). Various provinces enforce their individual ethanol blending requirements, which differ in volume percentages. For instance, British Columbia and Alberta mandate a 5% blend, Saskatchewan enforces 7.5%, Manitoba sets it at 8.5%, and Ontario's requirement stands at 10%. The federal initiative known as ecoENERGY for Biofuels Initiative offered incentives to ethanol manufacturers from 2008 until 2017. Additionally, the ecoAgriculture Biofuels Capital Initiative (ecoABC) aided in the establishment of ethanol projects (Labrie, 2016). A separate federal program, the 2017 'Low Carbon Economy Fund,' provides support for clean emissions and ethanol blending initiatives over a period of five years.

USA

The United States stands as the largest ethanol producer globally, predominantly relying on corn as its primary feedstock, which constitutes 80% of global corn production. The 'Energy Independence and Security Act' (EISA), also referred to as the 'Clean Energy Act,' was passed in 2007 with the aim of achieving a 20% reduction in petrol consumption by 2017. It aimed to boost ethanol production and promote energy security. The federal programme known as the 'Renewable Fuel Standard' (RFS) requires an increasing amount of renewable ethanol to be incorporated into transportation fuels each year, following a set threshold (Popp, et al., 2014). RFS-1 was established as a component of the 'Energy Policy Act' in 2005, stipulating a specific ethanol blending requirement. RFS-2, introduced in 2007 as part of the EISA, mandated an annual 9% increase in ethanol blending volumes until 2022 (Sorda, et al., 2010). The revised RFS-2 aimed to incorporate 34 billion litres of ethanol into transportation fuels by 2008, with the target escalating to 136 billion litres by 2022. RFS-2 advocated for 2G ethanol over 1G ethanol, as the latter contributes to the escalation of international corn prices and offers minimal reduction in greenhouse gas emissions (Brown, 2019). Producers engaged in blending ethanol with gasoline received tax incentives under the 'Energy Tax Act' passed in 1978. The 'Volumetric Ethanol Excise Tax Credit' (VEETC), 2004 constituted the largest ethanol subsidy program, enabling corn ethanol suppliers to receive tax incentives of 0.45 USD for every 3.78 litres (gallon) of ethanol blended with petrol (Pohit, et al., 2009).

Argentina

The Biofuels Law 26.093, 2016 mandated a 5% ethanol blend in petrol since 2010, offering tax incentives to ethanol producers and aiding in the reduction of greenhouse gas emissions. Resolution 37/2016 raised the blending ratio to 12% until 2021 (USDAFAS, 2016). Under this policy, tax incentives are granted to ethanol producers on the condition that the ethanol is exclusively utilised for domestic blending purposes (Sorda, et al., 2010). The 'Law 26334/2007', enacted in 2008, permitted sugar mills to participate in the ethanol promotion programme and expedited the production of ethanol from sugarcane (USDAFAS, 2021). The total ethanol production and consumption for 2020 was estimated to be 870 million litres and 880 million litres, respectively. The Tax Reform Law 27430/2017, 2017 imposed a carbon tax on fossil fuels, with an exemption granted to ethanol intended for blending purposes. Argentina possesses 22 ethanol mills, capable of producing 1.85 billion litres of ethanol annually. Among these, 9 distilleries utilise corn, while the remaining 13 mills utilise sugarcane.

Brazil

The nation boasts the most advanced and well-established ethanol blending programme globally (Sorda, et al., 2010). Brazil holds the top position in global sugarcane production and ranks second in global ethanol production, following the USA. Sugarcane serves as the primary raw material for ethanol production in Brazil. In 2018, sugarcane production reached 746 million tonnes, accounting for 39% of global sugarcane output. The 1973 OPEC oil crisis led to the need for widespread ethanol production, prompting the establishment of the national alcohol programme 'Proálcool' (Colares, 2008), which was launched in 1975 with the aim to phase out fossil fuels. The programme demonstrated significant success, as evidenced by key economic indicators such as increases in GDP and employment rates.In 2020, the National Biofuels Policy, commonly referred to as RenovaBio, was put into effect (USDAFAS, 2019). It takes into account the potential advantages of reducing greenhouse gas emissions and aims to establish a decarbonization market where carbon credits can be traded. Trading for decarbonization credits, known as 'CBios', began on the Brazilian stock exchange as of Apr 27, 2020. The policy requires fuel distributors to procure emission reduction certificates, also referred to as 'CBios'. Producers and importers of biofuels have the option to engage in the trading of 'CBios'. The policy aims to reduce carbon emissions by 10% by 2028 and by 43% by 2030, aligning with obligations to meet the goals set by the UNFCCC. The current requirement for ethanol blending in petrol is set at 27%, and the Brazilian market has matured to the extent that nearly all petrol sold contains ethanol, with blending ratios ranging from 18% to 25%. The ethanol production for 2020 was 31.35 billion litres, while consumption was 26.78 billion litres.

Colombia

Law 693, enacted in 2001, mandated a 10% ethanol blend with petrol, offering tax incentives for ethanol blended fuel and

introducing fuel standards. It was designed to bolster revenues for industries associated with palm oil and sugarcane. The introduction of the "Green tax" or "Carbon tax" on fossil fuels occurred through Law 1819, implemented in 2016. Ethanol designated for petrol blending is tax-exempt, a reform initiated in 2002. Import of ethanol has been allowed since 2017, while Decree 1135 mandates new vehicles to support up to an 85% ethanol blend (E85) with petrol (Sorda, et al., 2010).

European Union (EU)

The Common Agricultural Policy (CAP) established in 1962 has played a crucial role in fostering the development of the ethanol industry in the EU. CAP has been instrumental in ensuring fair and accessible supplies of food grains to EU farmers, alongside offering subsidies. The initial European directive, RED I of 2009, outlined objectives for a decade 2010-20, aiming for 20% of energy sourced from renewables in total energy consumption by member countries by the end of 2020. This included a binding sub-target of 10% renewable energy in transportation. The subsequent directive, RED II in 2018, part of the "2030 EU Climate and Energy Framework," set binding targets for the end of 2030, aiming for 32% of renewable energy sources (RES) in total consumption and 14% of RES in transportation (not limited to biofuels). The 'Fuel Quality Directive' required a 6% reduction in carbon intensity (CI) of motor fuels by 2020 compared to 2010 CI levels. The 2030 EU Climate and Energy Framework established a minimum of 40% reduction in GHG emissions by 2030 compared to 1990 levels, along with a minimum share of 32% renewable energy in total consumption by 2030. The Energy Taxation Directive 2003/96/EC permitted EU member states to implement varying tax rates on ethanol intended for blending. The 2020 EU Climate and Energy package, implemented in 2009, mandated at least a 20% reduction in GHG emissions by 2020 from 1990 levels, as well as a minimum share of 20% renewable energy in total energy consumption by 2020 and a minimum 20% improvement in energy efficiency.

Germany

In 2015, Germany became the first EU member-state to adopt ethanol targets centred on reducing GHG emissions, transitioning away from volume-based metrics. The nation has established a goal to reduce GHG emissions from transport fuel by 6% by the year 2025 (Giuntoli, 2018). The Common Agricultural Policy (CAP) provided significant support to the German ethanol industry by including a mandate requiring a 2.8% ethanol blend in petrol from 2009-14 (Kaup et al., 2013). In 2017, Germany implemented a goal of 0.05% of energy consumption from ethanol in the transportation sector, subsequently raised to 0.5% to be reached by 2025. It also embraced the EU Indirect Land Use Change (ILUC) Directive in 2009, which required the exclusion of ethanol feedstock from carbon-rich and protected areas (Sorda, et al., 2010).

China

China ranks fourth globally in terms of ethanol production. In 2019, the ethanol

blending rate in gasoline was 2.4%, with the country primarily relying on corn as feedstock (Hao et al., 2018). The 'Medium and Long-Term Development Plan for Renewable Energy' enacted in 2007 mandated that the proportion of renewable energy in the primary energy composition reach 15% by 2020. In 2017, a nationwide target of blending 10% ethanol (E10) with petrol by 2020 was established. However, it was suspended in 2020 due to a decline in corn stocks associated with a rise in corn prices.

Indonesia

The 2007 National Energy Policy (KEN) has established a goal of incorporating 23% renewable energy into the overall energy consumption mix by 2025, with a further aim of reaching 31% by 2050 (USDAFAS, 2019). Despite the existence of the ethanol blending mandate, challenges persisted within the ethanol sector due to shortages in raw materials and a lack of commercial incentives.

Philippines

The Republic Act of 2006 (RA9367) was formulated to reduce reliance on imported petroleum products, curb the emission of harmful gases, and boost rural income (Kumar, et al., 2013). The existing blending mandate requires a 10% ethanol blend in petrol. Additionally, the sale of raw material feedstocks like sugarcane and corn utilised in ethanol production is VAT exempt.

Thailand

The 2015 'Alternative Energy Development Plan' (AEDP) policy set an ambitious goal of achieving 30% renewable energy in the overall energy consumption from 2018-37. Sugarcane and molasses serve as feedstocks for ethanol production, with importation of feedstock prohibited. Tax incentives are granted to "gasohol" blends compared to petrol, with the incentives increasing proportionally with the blending ratio. Gasohol consumption represented 97% of total petrol consumption. The nation has committed to reducing GHG emissions by 110-140 million tonnes as part of its obligation to the United Nations Framework Convention on Climate Change (UNFCCC) (Prasertsri, et al., 2023).

India's 2009 EBP Programme

The EBP programme was initiated in 2009 to encourage ethanol usage for blending, enhance energy security, and establish a comprehensive ethanol ecosystem for the following decade. It included a voluntary target of blending 20% ethanol with petrol by 2017. The aim of the EBP 2009 was to ensure a consistent ethanol supply to meet demand year-round. The salient features of EBP 2009 are listed below:

- Financial incentives were initiated for plants utilised in the production of both 1G and 2G feedstock.
- Focus was directed towards research for the production of 2G ethanol utilising non-food feedstock, agricultural residues, and forest waste.
- The surplus ethanol remaining after blending with petrol was stored by the Oil Marketing Companies (OMCs).
- The mandated ethanol blending percentage in petrol was regularly reviewed according to its market availability.
- The responsibility for storing and distributing ethanol was assigned to OMCs.
- The policy allowed for the import and export of ethanol as deemed necessary by the National Biofuel Coordination Committee (NBCC).
- The policy envisioned 100% Foreign Direct Investment (FDI) in the ethanol industry in India, permitted solely for domestic purposes. However, investments in plantations were restricted from FDI.

An Assessment of Previous Research Journals on Ethanol Blending Frameworks in India

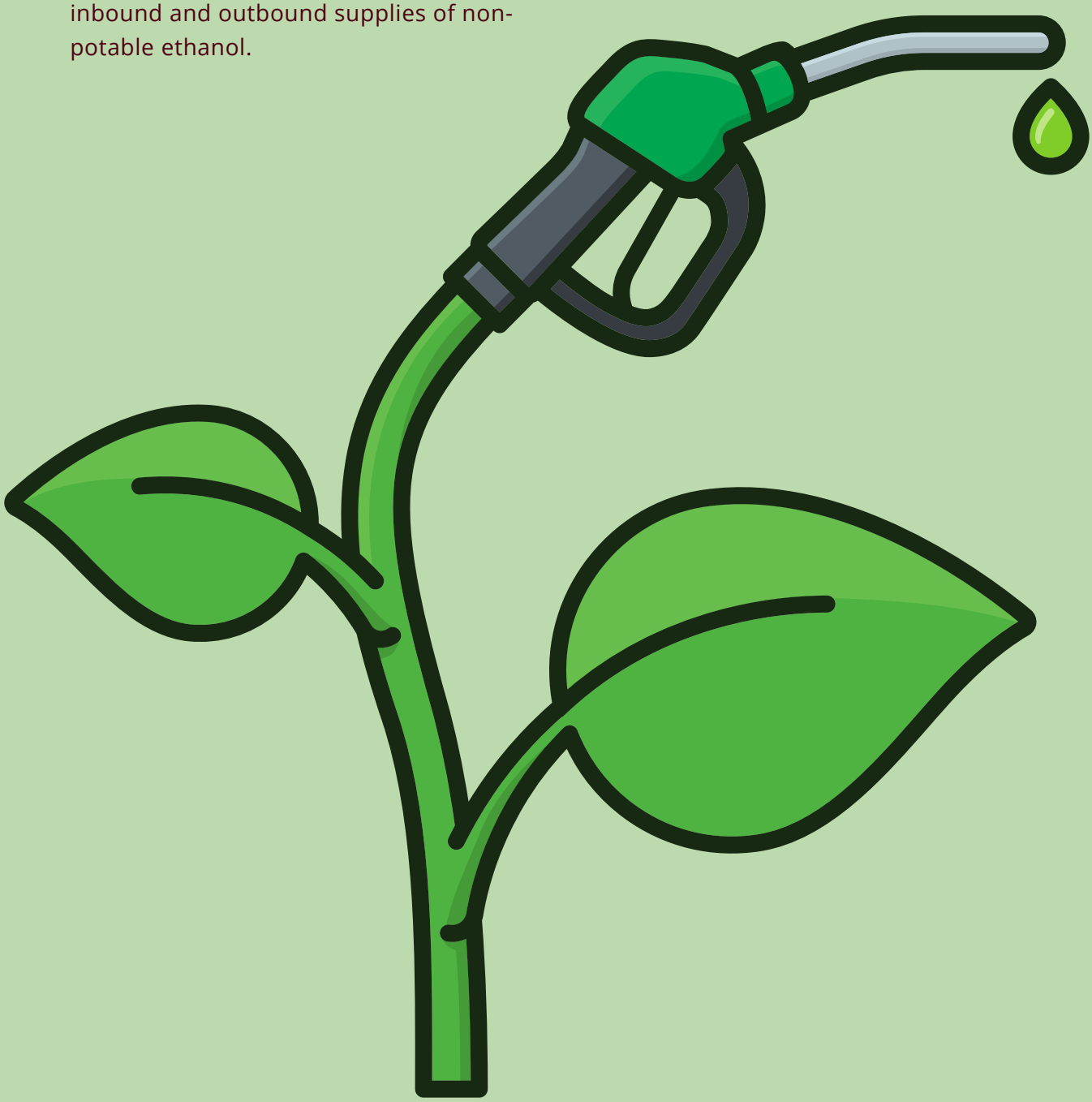
The EBP 2009 assessed the availability of domestic ethanol for the blending program but did not address ethanol imports and exports (Sujata et al., 2017). Another research inquiry into EBP 2009 uncovered that the ethanol framework favoured the supply side over other aspects (Basavaraj et al., 2012). Furthermore, another study explored the utilisation of fallow lands for sugarcane cultivation, but it overlooked the potential of using forest or agricultural waste as feedstock for ethanol production (Arjune, 2017). Other studies highlighted the importance of enhancing energy security through the EBP programme, yet they failed to address the current limitations on the interstate transportation of molasses and ethanol (Gunatilake et al., 2011; Gunatilake, 2011). Another paper concerning EBP delved into ethanol pricing for blending, yet it omitted discussion on the elevated GST imposed on molasses (Saini et al., 2010).

The Programme's Pitfalls

- The policy aimed for a 20% ethanol blend in petrol by 2017. However, this target was not met by the specified year. Back then, only 12% ethanol blending with petrol was accomplished. This shortfall is attributed to the restrictions imposed by different states on the movement and sale of molasses and non-potable ethanol.

- EBP 2009 did not succeed in guaranteeing a consistent minimum supply of ethanol to meet demand at all times.

- The Industries Development and Regulation Amendment Act (IDRAA) of 1951, revised in 2016, stipulated that only the central government had the authority to impose taxes and regulations on non-potable ethanol. However, this provision has not been enforced by the states. The amendment empowered state governments solely to impose taxes on potable ethanol intended for human consumption. Despite this, various states continued in imposing duties on both inbound and outbound supplies of non-potable ethanol.
- Some states require sugar mill suppliers to secure a 'No-Objection Certificate' (NOC) from their excise departments for the interstate transportation of non-potable ethanol. This requirement has posed as a barrier to the EBP programme.



India's 2018 EBP Programme

The EBP 2018, effective from May 16th, 2018, outlines a vision for ethanol usage across various sectors of the economy for the next decade. It delineates a comprehensive strategy and approach to ethanol development, leveraging financial, technological, and institutional interventions. The primary objective of EBP 2018 is to ensure a sustainable ethanol supply over the next ten years and to expand the blending targets for ethanol in petrol. Building upon the achievements of the previous EBP in 2009, EBP 2018 aims to further enhance ethanol utilisation in the transportation sector in the coming years. It employs a three-tier strategy to facilitate ethanol production. Its salient features include:

- The policy expanded the range of raw materials permissible for ethanol production, allowing for the utilisation of sweet sorghum, sugarcane juice, corn, sugar beet, and spoiled grains.
- The proposal suggested increased tax benefits and a higher purchase price for 2G ethanol compared to 1G ethanol.
- It suggested establishing a viability funding scheme aimed at 2G bio-refineries specifically geared towards ethanol production.
- It suggested placing greater emphasis on researching new feedstocks for advanced ethanol generation and improving conversion technologies.
- The NBCC was designated to oversee the advancement of the ethanol programmes.
- The policy suggested allowing 100% Foreign Direct Investment (FDI) through the automatic approval process in the ethanol sector, applicable for domestic purposes.
- Suggested entering into Ethanol Purchase Agreements (EPAs) between OMCs and 2G ethanol suppliers to guarantee a steady supply of 2G ethanol.
- The policy proposed various measures, including Viability Gap Funding (VGF), differential purchase prices for 2G ethanol suppliers compared to 1G ethanol suppliers, depreciation benefits on plant expenditure for ethanol production, and increased funding for the establishment of 2G bio-refineries.
- The responsibility for storing and distributing ethanol has been assigned to OMCs.

The table on the next page provides information on the ethanol blended with petrol by three major oil companies in India, namely the Indian Oil Corporation Ltd (IOCL), the Bharat Petroleum Corporation Ltd (BPCL), and the Hindustan Petroleum Corporation Ltd (HPCL). The total ethanol blending by the three CPSEs (IOCL, BPCL, HPCL) has shown a significant increase from 2017-18 to 2022-23, both in terms of crores of litres and percentage of blending. The percentage of ethanol blending has consistently increased, indicating a positive trend towards ethanol-blended petrol usage. The ESY data also reflects an increasing trend in ethanol blending, with a notable rise in the total crores of litres blended and the percentage of blending. The data, thus, suggests a positive shift towards ethanol blending in petrol, which aligns with environmental and energy sustainability goals.

Ethanol Blended with Petrol							
Company Name	**Unit**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23 (P)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
As per Financial Year-wise							
IOCL	Crores Litres	40.3	79.8	74.9	93.33	136.1	**202.26**
	%	2.67	4.96	4.44	5.96	7.97	**10.57**
BPCL	Crores Litres	19.54	49.96	45.72	59.51	97.3	**143.1**
	%	1.99	4.79	4.17	5.86	8.68	**10.59**
HPCL	Crores Litres	19.3	53.5	46.1	58.84	95.03	**129.6**
	%	2.11	5.5	4.9	6.19	9.03	**10.59**
Total CPSEs	**Crores Litres**	**79.14**	**183.26**	**166.72**	**211.68**	**328.43**	**474.96**
	%	**2.33**	**5.05**	**4.5**	**6**	**8.46**	**10.58**
As per Ethanol Suppy Year (ESY) Year-wise							
IOCL	Crores Litres	67.61	84.89	78.02	128.96	184.64	**138.35**
	%	4.3	5	5.1	8	10.02	**11.75**
BPCL	Crores Litres	37.56	51.98	45.6	87.07	130.42	**94.88**
	%	3.7	4.7	4.7	8	10	**11.72**
HPCL	Crores Litres	45.34	54.34	46.91	86.28	118.54	**87.01**
	%	4.8	5.3	5.1	8.36	10.04	**11.75**
Total CPSEs	**Crores Litres**	**150.51**	**191.2**	**170.53**	**302.32**	**433.6**	**320.24**
	%	**4.2**	**5**	**5**	**8.1**	**10.02**	**11.74**
ESY: Ethanol Supply Year (1st December to 30th November). P: Provisional							
Note: From ESY 22-23, ESY has been changed to 1st Nov to 31st Oct and ESY 22-23 is for the period of Dec'22 to Oct'23. Data for the ESY 2022-23 is upto June, 2023.							
Source: Oil Companies							

Navigating the Compliance Maze

India's compliance regime for ethanol blending is multi-layered and evolving. By continuously strengthening regulations, monitoring systems, and enforcement mechanisms, the government strives to ensure a smooth transition to higher ethanol blends while safeguarding environmental and safety concerns. Effective compliance will remain crucial to realizing the full potential of ethanol blending in achieving India's energy security and sustainability goals. India's ambitious journey towards 20% ethanol blending in petrol (E20) by 2025 hinges on a robust compliance system. This intricate network involves oil companies, government agencies, and independent bodies meticulously ensuring the quality and safety of ethanol-blended petrol (EBP) throughout its lifecycle. Let's embark on a guided exploration of this multi-layered compliance machinery.

Setting the Stage for Compliance

The journey begins with OMCs like HPCL and IndianOil. They procure ethanol from authorized producers, adhering to the Long Term Ethanol Procurement Policy (LTEPP) and conducting stringent quality checks to ensure it meets Bureau of Indian Standards (BIS) specifications. They then craft meticulous blend plans, allocating specific ethanol percentages for different regions. Meanwhile, the Department of Food and Public Distribution (DFPD) keeps a watchful eye on ethanol production through online systems like Electronic Project Management System (EPMS), conducting rigorous audits and inspections to uphold quality standards. Bureau of Indian Standards (BIS), the guardian of quality, develops and updates EBP specifications, conducting surprise checks at blending facilities and retail outlets to ensure adherence.

From Blending to Distribution: Maintaining Purity and Accuracy

OMCs are the custodians of EBP quality. They maintain dedicated storage facilities for pure ethanol and EBP blends, meticulously following BIS guidelines during the blending process. Every drop is accounted for, with detailed records documenting blending ratios and distribution across retail outlets. BIS remains ever vigilant, conducting random sample analyses and facility inspections to verify consistent quality throughout the supply chain.

Enforcing Compliance: Guaranteeing Accountability and Responsibility

The Ministry of Petroleum and Natural Gas (MoPNG) wields the oversight baton. It closely reviews compliance reports submitted by OMCs and BIS, acting swiftly with penalties and corrective actions for non-compliance. Pollution Control Boards (PCBs) join the fray, monitoring vehicle emissions and fuel quality at retail outlets. They hold vehicles exceeding emission norms accountable, imposing strict penalties. Additionally, the Central Motor Vehicle Rules lay down the law for vehicle emissions using EBP blends. The Ministry of Road Transport and Highways of India (MoRTH) has established additional safety standards for EBP based on AIS 171, ensuring safe handling and transportation. OMCs may even enlist independent auditors to scrutinise their practices and fuel quality.

Taxation Policy

The Indian government has implemented a comprehensive set of taxation policies to incentivize the use of ethanol as a renewable fuel and reduce the nation's reliance on imported oil. One of the key measures include a reduced Goods and Services Tax (GST) rate, which was lowered from 18% to 5% in 2018 for ethanol intended for blending under the Ethanol Blended Petrol Programme (EBP). This reduction has enhanced affordability for oil marketing companies (OMCs), fostering wider adoption of ethanol blending.

Additionally, excise duty exemption has been granted to ethanol produced from sugarcane juice, rendering this feedstock economically viable and promoting its increased use in ethanol production. Income tax deductions for ethanol producers contribute to improved profitability, further encouraging industry growth. Notably, the government has introduced extra tax incentives for 'green' ethanol derived from non-food feedstocks, emphasising sustainability.

In conjunction with these tax concessions, the government has implemented other policies to promote the use of ethanol, such as:

- Mandatory ethanol blending: The government has mandated that all petrol sold in India must be blended with at least 10% ethanol. This mandatory blending has ensured a steady demand for ethanol and has provided a stable market for ethanol producers.
- Public procurement policy: The ministry has also implemented a public procurement policy that gives preference to ethanol produced from non-food feedstocks. This policy has helped to promote the development of new ethanol production technologies and encourage the use of sustainable feedstocks.

The Indian government's taxation policies for ethanol have been successful in promoting the use of ethanol as a renewable fuel and reducing the country's dependence on imported oil. The government's continued support for ethanol is expected to further promote the development of the ethanol industry and increase the use of ethanol in India.

Here are some additional details about the taxation policies for ethanol in India:

- The GST rate of 5% on ethanol meant for blending under the EBP is applicable to all types of ethanol, including ethanol produced from sugarcane juice, molasses, and other feedstocks.
- The excise duty exemption on ethanol produced from sugarcane juice is applicable to all ethanol producers, regardless of their production capacity.
- The income tax deductions on profits from ethanol production are available to all ethanol producers who meet certain eligibility criteria.
- The additional tax incentives for 'green' ethanol are applicable to ethanol produced from non-food feedstocks that meet certain sustainability criteria.

Furthermore, the government's commitment to supporting ethanol is evident in the allocation of substantial funds for the Ethanol Blended Petrol (EBP) Programme. The allocated financial outlay for the EBP from 2018-19 to 2023-24 is Rs. 1969.50 crore, underscoring the significance of promoting ethanol as a renewable fuel. The continual review and updating of taxation policies reflect the government's responsiveness to developments in the ethanol industry and alignment with environmental and energy objectives. Overall, these measures are contributing to the successful advancement of the ethanol sector in India.

Price Mechanism: A Look at Government-Regulated Pricing for Ethanol in India

India's ambitious journey towards 20% ethanol blending in petrol (EBP) by 2030 relies heavily on a well-defined and dynamic pricing mechanism for ethanol. Unlike fossil fuels, whose prices are determined by international market forces, ethanol pricing in India falls under the purview of the government, aiming to balance producer profitability, consumer affordability, and overall program sustainability. Let's explore the intricacies of this regulated system.

Minimum Support Price (MSP) for Ethanol

To ensure adequate ethanol production and incentivize farmers, the government sets a Minimum Support Price (MSP) for sugarcane, the primary feedstock for ethanol production. This MSP acts as a safety net for farmers, guaranteeing a minimum purchase price for their produce irrespective of market fluctuations. The Ministry of Food and Public Distribution (DFPD) announces the MSP annually, considering factors like production costs, farmer income, and ethanol demand.

Bridging the Gap: Administered Price Mechanism (APM) for Ethanol Blending

To ensure smooth implementation of the

blending program and manage price volatility, the government employs an Administered Price Mechanism (APM) for ethanol used in blending. Under this system, the oil marketing companies (OMCs) procure ethanol at a fixed price determined by the Ministry of Petroleum and Natural Gas (MoPNG). This fixed price, currently set at a premium over the cost of production, incentivizes ethanol production while guaranteeing a stable market for producers.

Balancing the Scales: Blending Price Mechanism (BPM)

The final piece of the pricing puzzle is the Blending Price Mechanism (BPM). This mechanism determines the maximum retail price of EBP at petrol pumps. MoPNG revises the BPM periodically based on the cost of ethanol, crude oil prices, and other relevant factors. The aim is to maintain a balance between affordability for consumers and profitability for OMCs.

E20 & Vehicles

In 2023, India initiated a pilot project to introduce E20 blended petrol in 32 selected cities. However, industry experts from India's automotive sector expressed concerns regarding the lack of consumer awareness about its potential impact on vehicles. Ethanol-blended petrol can reduce fuel efficiency by 6-7% and increase maintenance costs for vehicle owners, aspects often overlooked amidst discussions focusing on the fiscal and environmental benefits of ethanol blending. E20 has the potential to decrease the country's oil import costs, enhance energy security and self-sufficiency, reduce carbon emissions, improve air quality, boost farmers' income by utilising damaged food grains, and create employment opportunities while attracting greater investments.

Experts also highlight that vehicles consuming E20 fuel may have higher fuel consumption compared to unblended petrol due to ethanol's lower calorific value.

Moreover, all components of the fuel system that come into contact with the fuel may require modification to ensure compatibility with E20 fuel, as ethanol has a lower calorific value than petrol. Industry experts caution that operating E10-compliant vehicles with E20 fuel could lead to corrosion of certain engine components, potentially necessitating part replacements during the vehicle's lifecycle.

The Programme's Shortcomings

- The policy permits OMCs to engage in contractual negotiations with 2G ethanol suppliers for a 15-year ethanol supply agreement, while excluding 1G ethanol suppliers, which is seen as an out of place policy. Given that India is one of the largest producers of molasses, the policy policy should have allowed OMCs to sign EPAs with 1G ethanol suppliers as well.
- The policy suggests different pricing and fiscal incentives for 2G ethanol compared to 1G ethanol, produced from molasses, which is considered regressive. The primary contribution to the EBP program

comes from 1G ethanol (molasses-based). If the various measures aimed at boosting 2G ethanol were also applied to 1G ethanol, it could significantly enhance the EBP programme, given the proven effectiveness of 1G ethanol in recent years.

- EBP 2018 recommends prohibiting the import and export of ethanol, which is viewed as regressive. Since India has struggled to meet blending targets, it would have been beneficial to allow interim ethanol imports to address the shortage of domestic ethanol intended for blending.
- EBP 2018 permitted ethanol production from various sources including sugarcane juice, corn, cassava, spoiled potatoes, sugar beet, sweet sorghum, etc. However, this policy aspect should be revised to limit the use of food grains as ethanol feedstock, ensuring an ample food supply for those in need and controlling food price inflation. It's noteworthy that certain countries have ethanol policies restricting the use of food crops for ethanol production (Shrestha et al., 2019).

Ethanol and molasses production within the framework of the EBP Programme

Ethanol is categorised into 1G and 2G based on the feedstock used. 1G ethanol is produced through sugar fermentation from sources like sugarcane, sweet sorghum, sugar beet, molasses, wheat, and corn. In contrast, 2G ethanol is derived from lignocellulosic residues such as bagasse, straw, pellets, tops, wood residue, forestry waste, agricultural waste, etc (Purohit et al., 2015).

India ranks second globally in sugarcane production, with an annual domestic sugar demand of 30 million tonnes. Ethanol production from sugarcane is carried out through three methods: sugarcane juice, B-molasses, and C-molasses. B-molasses refers to ethanol produced directly from sugarcane juice and contains fermentable sugars. C-molasses refers to ethanol produced from sugarcane juice after the sugar has been completely removed. Molasses, utilised for ethanol generation, is the thick, viscous brown byproduct liquid obtained when sugarcane juice is used to produce sugar.

Over the past five years, the growth of ethanol as a biofuel sector has significantly benefited the sugar industry. Utilising sugar for ethanol production has improved the financial standing of sugar mills by expediting payments, reducing working capital requirements, and minimising funds tied up in surplus sugar. During the 2021-22 period, sugar mills and distilleries generated approximately ₹18,000 crore in revenue from ethanol sales, facilitating the timely settlement of farmers' cane dues. The ethanol production capacity of molasses and sugar-based distilleries has reached 605 crore litres per annum, with ongoing efforts to achieve the target of 20% blending by 2025 under the EBP programme. In the upcoming season, the diversion of sugar to ethanol is projected to

increase from 35 million tonnes to 50 million tonnes, generating approximately ₹25,000 crores in revenue for sugar mills (PIB, 2022).

The majority of ethanol production in India occurs through the C-molasses route. From one tonne of sugarcane, 106 kg of sugar, 45 kg of molasses, and 11 litres of ethanol are generated. In 2023, the leading sugarcane-producing states were U.P. (177.43 million tonnes), Maharashtra (113.37 million tonnes), Karnataka (56.45 million tonnes), Gujarat (17.44 million tonnes), Andhra Pradesh and Telangana combined (15 million tonnes), Tamil Nadu (14.53 million tonnes), Bihar (13.97 million tonnes), Haryana (8.75 million tonnes), Punjab (7.51 million tonnes), and Uttarakhand (3.52 million tonnes).

The annual ethanol supply to the Oil Marketing Companies (OMCs) for blending purposes amounted to 38 crore litres in 2013-14, 67.41 crore litres in 2014-15, 11.4 crore litres in 2015-16, 66.51 crore litres in 2016-17, 150.5 crore litres in 2017-18, 188.55 crore litres in 2018-19, 173.05 crore litres in 2019-20, 302 crore litres in 2020-21, 433.66 crore litres in 2021-22, and 559.08 crore litres in 2022-23 (IndianExpress, 2023). The increased procurement price of ethanol and higher sugarcane production in 2017-18 led to an increased supply of ethanol for that year (Das, 2020).

Previously, only C-molasses was allowed as a raw material for ethanol production. However, in 2018, the government authorised the use of sugarcane juice and B-molasses for ethanol production. The government has set a higher procurement price for ethanol produced from sugarcane juice at ₹59.1 per litre compared to ₹47.5 for B-molasses and ₹43.7 for C-molasses. This initiative would enable sugar factory owners to redirect sugarcane juice towards ethanol production during seasons of surplus sugarcane production.

The ethanol supply under the EBP Programme has risen from 38 crore litres in ESY 2013-14 to 173 crore litres in ESY 2019-20, leading to an increase in the blend percentage from 1.53% to 5.00% respectively. Moreover, the allocation for the ongoing ESY (2020-21) has increased to 332 crore litres, marking a 91% increase compared to the ethanol supplies received during the preceding ESY (2019-20)(NITI Aayog, 2021).

In conclusion, India's sugarcane industry plays a pivotal role in both the production of sugar and ethanol. The ethanol sector has seen significant growth over the past few years, benefiting the sugar industry financially and contributing to timely payments to farmers.

Challenges and Implications of the 2018 EBP Programme

- In 2016, the Indian government made amendments to 'The Industries (Development and Regulation) Amendment Act, 1951', introducing changes that allowed states to levy taxes solely on potable alcohol (liquor). This amendment also granted exclusive authority to the central government for imposing levies on de-natured ethanol (non-potable alcohol). Despite these changes, many states have not complied, persisting in imposing taxes and regulating the interstate transportation of ethanol. As of 2017, Gujarat imposes the highest tax on inbound ethanol supplies at ₹3 per litre, with Delhi, Haryana, and Punjab at ₹2 per litre. Madhya Pradesh and Maharashtra both impose the highest taxes on outbound ethanol supplies, set at ₹1.5 per litre for 2017. Uttar Pradesh, the largest ethanol producer, adds an additional ₹0.15 per litre as a denaturant fee and licence fee for both inbound and outbound ethanol. These measures have discouraged sugar mill owners from supplying ethanol to OMCs for blending with petrol, adversely affecting the EBP programme.

- Molasses intended for the production of potable alcohol (liquor) is not subject to GST, whereas a 28% GST rate applies to molasses used for non-potable alcohol production. Uttar Pradesh, the leading molasses producer, has enforced a 12% quota allocation policy. This policy mandates sugarcane mill owners to sell 12% of their molasses yield to alcohol producers. This policy presents a challenge to achieving the blending targets set forth in the EBP 2018. It deprives sugar factory owners of significant revenue they could have earned by selling their 12% molasses allocation in the commodities market. Additionally, sugar mill owners encounter difficulties in obtaining permissions from the excise department to sell the remaining "free molasses" after the deduction of the 12% reserved for liquor producers.

- Due to stringent waste release standards set by the Central Pollution Control Board (CPCB), new licences for establishing sugarcane distilleries in Uttar Pradesh (U.P.) are now restricted. This limitation, combined with insufficient distillation capacity in U.P., has resulted in losses for sugarcane cultivators and sugar mill owners. Furthermore, this action is viewed as regressive within the framework of the EBP programme. Restrictions on the import and export of ethanol impede economic efficiency and reduce domestic ethanol consumption intended for blending purposes.

- The imposition of taxes and inter-state restrictions on the sale and movement of non-potable ethanol and molasses by various states impedes free trade. Greater liberation of the reservation on the ultimate use allotment of molasses and ethanol is necessary, allowing their prices to be largely determined by the market.

The Rangarajan Report

The movement of molasses between Indian states is restricted in most cases (Khatri et al., 2016). Some states have implemented quotas concerning the final use of molasses and ethanol. These actions have hindered free trade and led to artificially depressed prices. The Rangarajan report centred on the deregulation of the sugar industry, offering precise policy suggestions aimed at enhancing efficiency and encouraging higher investments (Rangarajan, 2012).

One significant recommendation put forth by the Rangarajan committee was the elimination of taxes and limitations imposed by certain states on the interstate transportation of molasses and non-potable ethanol. It also proposed allowing market forces to determine molasses prices and abolishing quotas tied to the final utilisation of molasses and ethanol. Implementation of the Rangarajan committee's recommendations would greatly support the EBP programme.

Recommendations on the 2018 EBP Programme

- The distillation capacity for converting molasses to ethanol, particularly in Uttar Pradesh, needs to be gradually increased. Financial incentives such as subsidies, a five-year moratorium on interest payments, excise duty waivers, soft loans, tax incentives, and zero import duty on machinery should be provided to sugarcane distilleries. There should be a heightened focus on enhancing the production of 1G ethanol from molasses, and necessary amendments to EBP 2018 should be incorporated accordingly. A robust 1G ethanol industry based on molasses would complement the fluctuating sugar industry. Presently, under EBP 2018, there is a bias towards achieving blending targets through 2G ethanol at the expense of 1G ethanol; OMCs are investing ₹100 billion in constructing five 2G ethanol plants. Establishing a 2G ethanol plant in India entails an investment of Rs. 1000 crores, whereas setting up a 1G plant costs Rs. 100 crores (Pathak, 2021). The yearly capacity for producing 2G Ethanol ranges from 0.375 million litres to 1.125 million litres. Exporting 2G ethanol is not permitted, and it must be compulsorily supplied to the OMCs (Ministry of Petroleum and Natural Gas, 2019). In 2022, the inaugural 2G ethanol biorefinery, spanning 35 acres, commenced operations in Haryana. With an annual capacity to process 0.2 million tonnes of agricultural waste, it yields 30 million litres of ethanol. Moreover, it promises to mitigate pollution from stubble burning and eliminate 320,000 tonnes of CO_2 emissions annually. This refinery is anticipated to save ₹550-₹600 million annually on imported crude oil. Notably, it possesses the versatility to process various agricultural residues such as corn cobs, wheat straw, and rice straw. Expanding the higher support prices allocated to 2G ethanol under the EBP 2018 to encompass 1G ethanol is imperative. The consistent production of 1G ethanol from molasses warrants vigorous encouragement. Encouraging OMCs to enter into long-term agreements (EPAs) with 1G ethanol suppliers, akin to those with 2G ethanol suppliers, would bolster the 1G ethanol industry.

- Complete deregulation of molasses sales is a necessary step. It is essential to put into effect the recommendations outlined in the Rangarajan Report (Rangarajan, 2012). The market should have full control over determining the prices of molasses, and the interstate movement restrictions on molasses imposed by certain states should be eliminated. Additionally, the designated end-use allocations for molasses and ethanol need to be revoked. Taxes levied by specific states on inbound and outbound ethanol supplies should be eliminated promptly, as they discourage interstate movement and impede the EBP scheme. It's crucial for the central government to intervene and address the taxation and regulation of interstate movement of non-potable ethanol by certain states.

- Allowing ethanol imports from other countries as needed and incorporating the necessary amendments to EBP 2018 is essential. This would address the shortfall in domestic ethanol, stimulate employment at local bio-refineries, and bolster the EBP programme. Promotion of flex-fuel vehicles capable of handling higher ethanol blends should be encouraged through reductions in vehicle registration fees and road taxes. Non-governmental organisations (NGOs) and other institutions should be incentivized to raise awareness among farming communities about the advantages of molasses and its potential for 1G ethanol production.

If put into action, the aforementioned suggestions would greatly bolster the ethanol and molasses industry, fostering the establishment of integrated plants for ethanol production from molasses. These plants have the potential to evolve into rural energy hubs. Additionally, they would promote efficiency, attract investments in the ethanol industry, generate employment, and elevate incomes in rural areas.

Conclusion

Removing restrictions on the movement of molasses and ethanol across states, abolishing ultimate-use allocations and quota policies, and allowing market-driven pricing would facilitate the attainment of the EBP programme's goal of achieving a blending mandate of 20% by 2025.
The compliance mechanism of ethanol blending in India is a multi-layered system involving various stakeholders. Continuous strengthening of this system through improved regulations, robust enforcement, and technological advancements will be crucial to achieving the ambitious E20 target and realizing the full potential of this clean and sustainable fuel.

The success of India's ambitious ethanol blending program hinges on a robust compliance mechanism to ensure quality, safety, and adherence to the prescribed regulations. This mechanism involves a coordinated effort across various government agencies, OMCs, ethanol producers, and consumers.

This comprehensive explanation delves deeper into the specific roles and responsibilities of each participant in the compliance scheme. It also acknowledges the challenges and potential areas for improvement, providing a holistic understanding of how India is ensuring responsible and sustainable implementation of its ethanol blending program.

Government-regulated pricing for ethanol in India plays a vital role in steering the country towards energy security and environmental sustainability. By setting minimum prices, regulating blending costs, and adjusting retail prices dynamically, the government strives to create a win-win situation for all stakeholders. While challenges remain, the system's adaptability and focus on affordability hold immense promise for the success of India's ambitious ethanol blending program.

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