



IEA-Advanced Motor Fuels ANNUAL REPORT 2021

India

India

Drivers & Policies

India is home to around 18% of the world's population and uses 6% of the world's primary energy, which is projected to increase to 11% by 2040. It is the third largest oil consumer in the world after the United States and China, however, per capita energy consumption is amongst the lowest in the world at 0.6 tons of oil equivalent (toe) as compared to the global average of 1.79 toe per capita, or one-third of the world average. India's energy consumption growth is projected to be the highest among major economies during 2017 to 2040. India's primary energy consumption fell by 5.9% in 2020, the first fall in consumption this century due to the Covid-19 pandemic. Primary energy grows strongly in all scenarios, more than doubling the energy consumed between 2018 and 2050. Average growth per year is in the band of 2.5%-3.0%. As result of strong growth, India accounts for 35% of the increase in global primary energy consumption, 2018-2050, in the Business-as-usual (BAU) scenario.

An initiative started in 2016 to provide universal clean energy access to every household led to approximately 69% increase in LPG consumption in 2021, as compared to 2014. India is also targeting an increased share of gas in its primary energy mix from the current 6% to 15%.

Currently, India imports approximately 85% of its petroleum product requirement. Growing concern about the import dependence for fuel requirement in tandem with environmental pollution issues has driven the need for alternative fuels. India plans to reduce import dependency in the oil and gas sectors by adopting a five-pronged strategy, which includes increasing domestic production, adopting biofuels and renewables, energy efficiency norms, improving refinery processes and demand substitution.

Since 2014, the Indian government has undertaken multiple interventions to promote biofuels through structured programs such as the Ethanol Blended Petrol (EBP) program, Biodiesel Blending in diesel, and SATAT (Sustainable Alternative Towards Affordable Transport), an initiative for promotion of Compressed Biogas (CBG). India introduced a National Policy on Biofuels-2018 in June 2018 which envisages achieving 20% blending of ethanol in petrol and 5% blending of biodiesel in diesel by 2030. However, the government has decided to ramp up ethanol production to achieve the ambitious target of 20% blending of ethanol in petrol by 2025 itself.

The major feature of the policy is categorization of biofuels as "basic biofuels" (e.g., first generation "1G" ethanol, biodiesel, etc.) and "advanced biofuels" (e.g., 2G ethanol, drop-in fuels, etc.) to expand the scope of raw material for ethanol production.

Advanced Motor Fuels Statistics

India's primary energy mix is dominated by fossil fuels and that will continue to be the case in the near future. Presently, oil and gas account for around 35% of India's energy consumption; this is expected to come down to 31% by 2040. However, from existing levels, absolute consumption is expected to double for oil and triple for gas. Energy demand across the transport sector is the highest across major sectors in terms of end usage.

The Indian government has been promoting and encouraging use of advanced motor fuels in the transport sector. In this endeavor, the blending of biofuels, which are sustainable and have lesser emissions as compared to fossil fuels, is being promoted in petrol, diesel and natural gas. Loans for construction of oil extraction/processing units for production of bio-fuels, their storage and distribution infrastructure and loans to entrepreneurs for setting up CBG plants were classified under priority sector lending by India's Central Bank on September 4, 2020.

Ethanol Blended Petrol (EBP) Program

Under the Ethanol Blended Petrol (EBP) program, oil marketing companies (OMCs) sell petrol blended up to 10% ethanol (E10) depending upon its availability. In order to augment the supply of ethanol for EBP, the Government decided to administer ethanol prices. This, combined with a slew of other measures, such as easing restrictions on the movement of ethanol between states; allowing more sources of feedstocks for production of ethanol, including sugar, sugar cane, sugar syrup, damaged food grain, maize, etc.; addressing state specific issues, and attractive ethanol prices and availability of

molasses in the ecosystem facilitated improvement in the supply of ethanol from 154 million liters during Ethanol supply year (ESY) 2012-13 to around 3.02 billion liters during ESY 2020-21, thereby achieving average blending of 8.1% in petrol during ESY 2020-21. In order to promote the establishment of distilleries in states deficit in ethanol, OMCs have entered into long term off-take agreements with upcoming dedicated ethanol plants in such states. This will help avoid transportation of ethanol over long distances and supply fluctuations to meet the blending requirements.

Table 1. Trend in ethanol procurement under EBP program

Ethanol Blending Petrol Program					
Particulars	Ethanol Supply Year (Dec to Nov)				
	2016-17	2017-18	2018-19	2019-20	2020-21
Ethanol procured by PSU OMCs* (in million liters)	665	1505	1886	1730	3023
National average blending (in percentage)	2.0%	4.2%	5.0%	5.0%	8.1%

* Public Sector OMCs, i.e. Indian Oil Corporation Ltd. (IOCL), Bharat Petroleum Corporation Ltd. (BPCL) and Hindustan Petroleum Corporation Ltd. (HPCL)

2G Ethanol Program

The government of India has notified the “Pradhan Mantri JI-VAN (Jaiv Indhan-Vatavaran Anukoolfasalawashesh Nivaran) Yojana,” which will provide financial assistance of approximately USD 300 million for the period from 2018-19 to 2023-24 for supporting commercial projects as well as demonstration projects for 2G ethanol projects. India’s government has allowed procurement of ethanol produced from other non-food feedstock besides molasses, like cellulosic and lignocellulosic materials. The 2G feedstocks include agri-residues such as rice and wheat straw, cane trash, corn cobs and stover, cotton stalk, bagasse, and empty fruit bunches (EFB). In furtherance of this decision, oil public sector units (PSU) have planned to set up 2G ethanol bio-refineries in various parts of the country. Projects at Bhatinda (Punjab), Panipat (Haryana), Bargarh (Odisha) and Numaligarh (Assam) are in advance stages of construction and are likely to be made operational in 2022 and 2023.

Biodiesel

In June 2017, the government allowed direct sale of biodiesel (B-100) for blending with high speed diesel to all consumers, in accordance with the specified blending limits and the standards specified by the Bureau of Indian Standards. “Guidelines for sale of Biodiesel for blending with High Speed Diesel for transportation purposes 2019” were notified on May 1 2019. To augment the supplies of biodiesel and tap potential sources of biodiesel produced from used cooking oil (UCO), public sector OMCs, under guidance of Ministry of Petroleum and Natural Gas (MoPNG), are regularly floating Expression of Interest (EoI) for procurement of Biodiesel produced from Used Cooking Oil (UCO) to meet biodiesel requirements for blending.

Compressed Biogas (CBG)

As part of an initiative under the National Policy on Biofuels 2018, the Sustainable Alternative Towards Affordable Transportation (SATAT) initiative was launched in October 2018 for promoting use of CBG along with Natural Gas. Under this initiative, oil and gas marketing companies (OGMCs) are inviting EoIs from potential investors/entrepreneurs to procure CBG for further selling to automotive and commercial customers.

Under this initiative, various enablers have been provided for development of the CBG sector. Compressed Biogas projects have been included under Priority Sector Lending by Reserve Bank of India. MoPNG has issued policy guidelines for the co-mingling of CBG with Natural Gas in the City Gas Distribution (CGD) network.

As of January 2022, OGMCs have issued 3,134 LoIs to potential entrepreneurs. Supply of CBG has been initiated from 17 CBG plants through 27 Retail Outlets. Compressed Biogas is also being supplied to industrial customers, and CBG injection in the CGD network has begun.

Research and Demonstration Focus

The Centre for High Technology (CHT), PSU OMC's research and development units under MoPNG, Department of Biotechnology (DBT) and the Council of Scientific and Industrial Research – Indian Institute of Petroleum (CSIR-IIP), Dehradun are working on a program to support R&D pertaining to energy biosciences in the country through various schemes and with major emphasis on advanced biofuels. The DBT-ICT center based in Mumbai has developed lignocelluloses technology that is demonstrated at demo scale and is now being used for establishment of commercial plants.

India is undertaking several initiatives with respect to the greater use of hydrogen in the energy mix. The first pilot of using H-CNG (Hydrogen fuel mixed with Compressed Natural Gas) as transportation fuel was started at Rajghat Bus Depot, New Delhi. Under this pilot, 50 buses in Delhi operated on a blended H-CNG mixture. The results were encouraging in fuel economy improvement and emission reductions. The MoPNG has further directed the OGMCs to introduce Green Hydrogen in the refineries at various locations as a feedstock. The pilot projects for setting up Green Hydrogen plants in the refineries are being planned.

An ambitious R&D project under the aegis of MoPNG is being done by Indian Oil Corporation Limited (IOCL) at a cost of USD 18.3 million. It is the first scientific project in India to address all aspects of the value chain of hydrogen-based mobility. IOCL R&D will use 15 indigenously manufactured/integrated hydrogen fuel cell buses to conduct a 20,000 kms field trial in Delhi NCR. Four demo units of hydrogen production units amounting to 1 ton per day will also be set up. Of these, three plants will be based on renewable sources (biomass gasification, reforming CBG and solar PV-based electrolysis) to produce green hydrogen. Trial of the first set of two fuel buses using this Green Hydrogen is expected to begin by the end of year 2022. An anaerobic gas fermentation technology will convert CO₂ into acetic acid, and aerobic fermentation technology will convert acetic acid into highly valuable Omega 3-fatty acids (DHAs) and bio-diesel. This value chain makes the overall process economically feasible. Studies are in advanced stages at the IOCL R&D center to install the world's first pilot plant with capacity of 10 kg/day CO₂. IOCL is also setting up an ethanol production plant to produce around 128 KL per day of ethanol using gas fermentation technology from pressure swing absorption off gases at Panipat Refinery.

In aviation, the first flight using 25% biojet fuel between Dehradun to Delhi was operated by Spice Jet on August 27, 2018. Biojet fuel used in the flight was developed by laboratory in CSIR-IIP, Dehradun, using *Jatropha* seeds. After the flight's success, the Government of India decided to set up demonstration plants for the future growth of Bio-ATF in the country.

Currently, efforts are focused on the development of cost-effective and efficient enzymes for 2G bioethanol refineries, development of value-added products by lignin valorization, commercial production of biojet fuel, compressed biogas from biomass, foodwaste and municipal solid waste, and cost effective biofuels from industrial waste gases.

Outlook

The outlook for biofuels in India will remain promising considering the thrust of the Government on promoting biofuels and advanced biofuels as "environment friendly" fuels.

Ethanol procurement by PSU OMCs reached 3,023 million liters of ethanol in ESY 2020-21. OMCs achieved a blending percentage of 8.1% during ESY 2020-21. As the demand for petrol rises, the demand for ethanol is bound to increase, year on year, with projected requirement for 10% blending, or 3.11 MMTPA (approximately 4 billion liters annually). Retailing of E100 fuel has commenced on a pilot basis at three retail outlets in Pune, Maharashtra. Based on the response of these pilot retail outlets, further expansion is planned.

The SATAT initiative will help reduce India's dependence on fossil fuels and increase the share of gas in primary energy consumption. This initiative will help integrate the vast retail network of companies with upcoming CBG projects. It has the potential to replace more than 50% of gas imports.

These highlighted initiatives have already started creating impact in the biofuel industry in India. Major developments in the advanced biofuel sector in terms of deployment in transport sector, investments, project establishment and enhanced R&D are expected in the coming years.

Additional Information Sources

- www.ppac.org.in for data on fossil fuels production, consumption, Import & Export
- www.mnre.gov.in for data on R&D projects
- <https://www.siamindia.com> for data on automotive industry
- www.dbtindia.nic.in
- www.iocl.com for data on R&D projects
- 1-BP Outlook 2020, India.