

### India (Reprinted from 2017)

#### ***Drivers and Policies***

At \$2.5 trillion (US), India's economy is currently the seventh largest in the world. The International Monetary Fund forecasts that India will grow at 7.4% in fiscal year (FY) 2018–2019. The demand for energy is growing rapidly, especially in the transport sector. Domestic crude oil production, however, can meet only about 17.9% of the demand; the remainder must come from imported crude.

The government intends to reduce the import bill by 10% by 2022 and has prepared a roadmap to reduce import dependency in the oil and gas sector. India's five-phase strategy includes (1) increasing domestic production, (2) adopting biofuels and renewables, (3) adopting energy-efficiency norms, (4) improving refinery processes, and (5) substituting demand. This plan envisages a strategic role for biofuels. India enacted a national policy for biofuels in 2009. Since 2014, the government has undertaken multiple interventions to promote biofuels through structured programmes, such as the Ethanol Blended Petrol (EBP) Programme and the Bio-diesel Blending Programme. A target of 20% blending of ethanol in petrol and 5% blending of biodiesel in diesel is proposed by 2030.

Hydrocarbon fuels, along with greenhouse gas (GHG) emissions, have adversely affected the environment. To reduce GHG emissions and improve air quality, India introduced the Bharat Stage (BS) norms — emission control standards based on European regulations — in 2000. BS IV (equivalent to Euro 4) norms have been applicable in India since April 1, 2017, and the government is committed to implementing BS VI (equivalent to Euro 6) norms at the national level on April 1, 2020, directly leapfrogging from BS IV norms to BS VI norms, with India's refineries investing approximately \$44 billion (US). Diesel sulphur content was reduced from 10,000 parts per million (ppm) in 1996 to a maximum of 50 ppm in 2017. The proposed BS VI regulation will reduce diesel sulphur to a maximum of 10 ppm, enabling the introduction of advanced emission control technologies, including diesel particulate filters and selective catalyst reduction systems, which will be needed to meet BS VI emission standards.

#### ***Advanced Motor Fuels Statistics***

India expects to double its consumption of petroleum and become the third largest consumer in the world by 2030. Energy demand is highest across the transport sector. As vehicle ownership expands so will the demand for

petroleum products. It is estimated that the demand for diesel and petrol will increase from 80.4 million metric tons (Mt) and 26.1 million Mt, respectively, in the years 2017–2018 to 110 million Mt and 31.1 million Mt by the years 2021–2022, respectively, if the present situation prevails. Consumption of all petro products combined together has increased from 148.1 million Mt in FY 2011–2012 to 203 million Mt in FY 2017–2018 at a CAGR of 5.4% (depicted in Figure 1), while net import has increased from 126.1 million Mt in FY 2011–2012 to 188.1 million Mt at a CAGR of 7%.

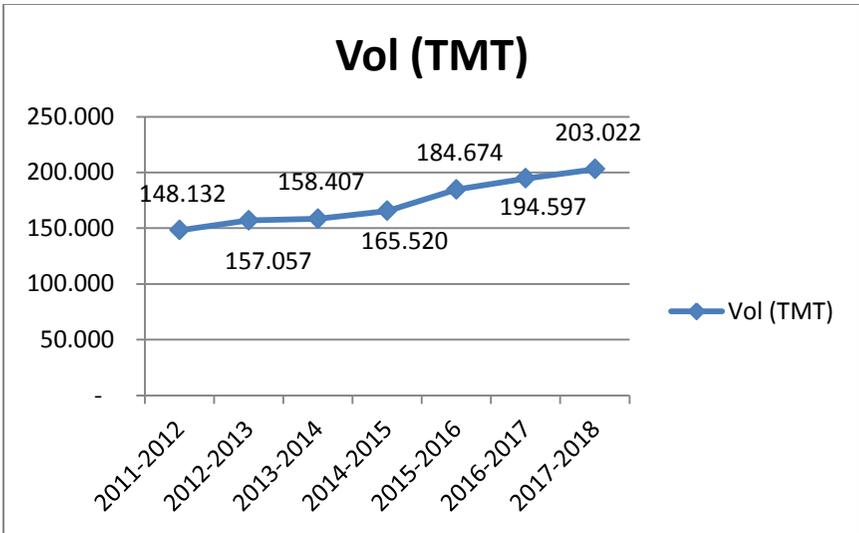


Fig. 1 Consumption of Petroleum Product  
 Note: Data for 2017–2018 is actually for April–December 2017 and extrapolated for FY 2017–2018 to facilitate the comparison.  
 Source: PPAC website [ppac.org.in](http://ppac.org.in)

**Details on Advanced Motor Fuels**

The government has been promoting and encouraging production and use of (1) ethanol derived from sugar molasses and/or second generation (2G) biofuels (e.g., biomass, agricultural waste) for blending with petrol and (2) biodiesel derived from inedible oils, tree-borne oil seeds, and oil waste for blending with diesel.

***Ethanol-blended Petrol Programme***

Under the Ethanol Blended Petrol (EBP) Programme, oil marketing companies (OMCs) sell petrol blended with ethanol up to 10% depending on availability. Supplies were not forthcoming until 2013–2014. To augment

the supply of ethanol for EBP, on December 10, 2014, the government decided to administer ethanol prices. This decision, along with other measures, such as an excise duty waiver addressing state-specific issues and availability of molasses in the ecosystem, facilitated improving the supply of ethanol from 154 million L during 2012–2013 to 1,110 million L during 2015–2016, thereby achieving 3.5% blending in petrol. For the ethanol supply year 2016–2017, about 665.1 million L of ethanol could be procured due to lower sugarcane production in the country.

#### ***Second Generation Ethanol Programme***

Oil PSUs are also working to set up 12 2G ethanol bio-refineries in 11 states to boost production of ethanol. The estimated investment for the bio-refineries is \$1,550 million (US). These bio-refineries will produce around 300–350 million L of ethanol annually, thus contributing significantly towards the EBP. Hindustan Petroleum Corporation Ltd. (HPCL) is constructing the first 2G ethanol bio-refinery in India at Bathinda (Punjab) for which the foundation stone-laying ceremony was held on December 25, 2016, with an estimated annual production capacity of 34 million L of ethanol. Oil PSUs have completed a detailed feasibility report (DFR) for the first few 2G bio-ethanol plants, and oil PSUs are now seeking environmental clearance for their projects.

#### ***Biodiesel***

In June 2017, the government allowed the 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. From April 2017 to November 2017, the biodiesel quantity procured by OMCs was 43.55 million L vis-à-vis 34.91 million L procured during the same period in 2016 (i.e., an increase of 24%).

#### ***Research and Demonstration Focus***

The Centre for High Technology (CHT) under MoPNG and Department of Biotechnology (DBT) are working on the programmes to support research and development (R&D) pertaining to energy biosciences in the country with major emphasis on advanced biofuels. Efforts are being made to support the R&D towards development of cost-effective, next-generation biofuels like algae biodiesel, cellulosic ethanol, bio-butanol, and bio-hydrogen. DBT has established four bioenergy centres to strengthen the research base in biofuels and to promote translation of process and technologies from research to scale-up and commercialization. Various technologies, including cellulosic ethanol, have been developed. Lignocelluloses technology is being demonstrated at a pilot scale.

Recently, Bharat Petroleum Corporate R&D Centre completed a project with CSIRO, Australia and Indian Institute of Petroleum, Dehradun for the production of di-methyl ether (DME) from stranded natural gas. Natural gas is first converted into synthesis gas (syngas), which is then converted into DME. The project focuses on developing modular reactor configuration and catalyst for direct conversion of syngas to DME. As part of the program, BPCL Corporate R&D Centre has developed a novel catalyst for direct conversion of syngas to DME. The project also led to the development of an efficient tubular reactor configuration for carrying out exothermic gas solid reactions such as syngas conversion to DME. The concept has been demonstrated in laboratory scale. Further development towards commercialization, in terms of scale up of catalyst to commercial scale and fabrication of a pilot-scale reactor system, is underway.

The IOC-DBT Advanced Bio-Energy Centre has recently commissioned the first integrated pilot plant in India for conversion of Ligno-cellulosic biomass to ethanol with technological support from the National Renewable Energy Laboratory. The pilot plant can process 5 kg/hour biomass and a variety of feedstock.

With regard to drop-in fuels, few technologies have been developed on the laboratory/demonstration scale to yield advanced biofuels, such as 2G ethanol, drop-in fuels, and bio-CNG, by companies/organizations such as IOCL, HPCL, M/s Praj Industries, M/s Shell, DBT-ICT, and more. Indian investors are assessing the commercial viability of such plants for ramping up the existing technologies to commercial scale.

## **Outlook**

The outlook for biofuels in India will remain promising, considering the government's decision to promote biofuels and advance biofuels as environmentally friendly fuels. From the view of EBP, the ongoing sugar year will see improved cane production/crushing (more than 22% over last year), resulting in higher molasses availability, which can be converted to alcohol/ethanol. With the continuation of the government's policy to administer prices of ethanol for EBP, India has approved an enhanced ex-mill ethanol price of \$0.63 (US) per liter for 2017–2018. Additionally, Goods and Service Tax and transportation will be paid to the suppliers. Against the tendered ethanol demand of 3.13 billion L during 2017–2018, PSU OMCs have allocated 1.39 billion L, which is an all-time high in a single ethanol supply year. As the demand for petrol rises, the demand for ethanol will increase annually. Considering, estimated petrol consumption of

31.1 MMTPA during 2021–2022, the ethanol requirement for 10% blending will be 3.11 MMTPA (4 billion L per year).

A National Policy on Biofuels – 2018 is being formulated. This policy looks at the future for biofuels. It reinforces ongoing biofuels supplies by increasing domestic production, setting up 2G bio-refineries, developing new feedstock and conversion technologies for biofuels, and creating a suitable environment for biofuels and its integration with the main fuels. To invigorate the present EBP, address environmental issues caused due to burning of biomass, and provide remuneration to farmers for agriculture residues, in 2014 the government allowed procurement of ethanol produced from other non-food feedstock besides molasses, like cellulosic and lignocelluloses materials, including petrochemicals, subject to meeting the relevant BIS standards. Pursuant to the aforesaid decision, oil PSUs have decided to set up 12 2G ethanol bio-refineries in 11 states across the country. These bio-refineries will yield around 300–350 million L of ethanol per year and are expected to be set up with an investment of about \$1.56 billion (US).

Bio-CNG is also being looked as next major development in the alternate fuel segment. Indian Oil Corporation, one of the government oil companies, has entered into a Memorandum of Understanding with State Government of Punjab for setting up 400 biomass to bio-CNG plants in the next 5 years. These initiatives may be a precursor to biofuel schemes that the government may announce in coming years to provide an impetus to the Indian Biofuel Programme.

#### ***Additional Information Sources***

- [www.ppac.org.in](http://www.ppac.org.in) for data on fossil fuels production, consumption, import and export
- [www.mnre.gov.in](http://www.mnre.gov.in) for data on R&D projects
- [www.siamindia.com](http://www.siamindia.com) for data on automotive industry
- India Economic Survey 2018
- [www.fame-india.gov.in](http://www.fame-india.gov.in)
- India Biofuel policy 2009
- [www.dbtindia.nic.in](http://www.dbtindia.nic.in)
- [www.indianoil.com](http://www.indianoil.com)