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Report Highlights:

India's average ethanol blending rate in gasoline is expected to reach 5.2 percent, up from 4.5 percent last year. This increase is mostly due to a smaller gasoline-ethanol fuel pool resulting from COVID-19 lockdown measures. Relatively weak domestic demand for sugar and stronger price incentives to divert B-heavy molasses and sugarcane juice for ethanol production will help oil-marketing companies (OMC) procure 1.95 billion liters of fuel ethanol, up from 1.9 billion in 2019. With increased industrial and medical grade ethanol imports during the first quarter, 2020 ethanol imports are estimated at a record 870 million liters, nearly all from the United States. The biodiesel market remains nearly non-existent; plans that were set forth in 2018 to support market development by tapping into India's large supply of used cooking oil (UCO) remain a work in progress.

Section I. Executive Summary

E10 by 2022 is India's aspirational blend goal for fuel ethanol, while there are no similar near-term blend targets for biodiesel. The National Biofuel Policy (2018) remains the central directive governing India's biofuel usage, trade and strategy, which includes a national average goal of E20 for gasoline and B5 for diesel by 2030.

The Ethanol Blending Program (EBP) stipulates ethanol procurement produced directly from B-heavy and C-heavy molasses, sugarcane juice and damaged food grains such as wheat and broken rice. India recently approved using surplus rice as a potential feedstock to produce ethanol. Weak domestic demand for sugar owing to the national lockdown during peak consumption season (March-May), coupled with a stronger financial incentive to convert excess sugar to ethanol should help the OMCs procure upwards of 1.95 billion liters in 2020.

India will likely achieve its highest average fuel ethanol market penetration ever, reaching 5.2 percent in 2020, compared to 4.5 percent last year, not from an increased fuel ethanol supply but rather due to reduced gasoline consumption, estimated 12 percent lower because of restricted movement during the nationwide lockdown.

Fuel and non-fuel ethanol consumption will outgrow domestic production for the sixth consecutive year. In 2020, imports will largely fulfill supply to industrial and potable sectors due to opportunistic buying on account of increased medical grade usage because of the pandemic. The Government of India (GOI) is implementing a new initiative to encourage local sugar mills to divert their surplus sugar stocks towards domestic ethanol production. This will likely displace some ethanol imports and the 2019 import license requirement for importing ethanol (for non-fuel use) is intended to support that new initiative (GAIN 9048). Post estimates between 60-65 percent of domestically produced ethanol in 2020 is used for the EBP, indicating that there is room for imported non-fuel ethanol for at least the next five years. The United States remains largest ethanol supplier to India with exports reaching its highest in a decade. In 2020, ethanol imports are forecast to grow to a record 870 million liters (mostly denatured), the highest in a decade. The United States will remain the largest ethanol supplier, slightly relinquishing market share from other origins.

The biodiesel market penetration in on-road diesel remains negligible, estimated at less than two-tenths of one percent and the reduced diesel usage in 2020 from the nationwide lockdown has had no meaningful impact of the biodiesel market. The GOI is now aiming to develop a consistent UCO supply chain, having discontinued its decade long effort to develop a viable feedstock industry based on jatropha (*Jatropha curcas*), which is grown on rain-fed, non-arable lands. Most biodiesel produced goes to informal sectors via support received through OMC procurement, but demand remains insufficient. Additionally, lack of larger feedstock supplies has prohibited market development. The GOI's 2019 import license requirement continues to apply to biodiesel and will limit purchases to an estimated two million liters in 2020, down 71 percent compared to last year. Meanwhile, India's exports are expected to remain near 60 million liters, or close to a quarter of its total production. Nearly all biodiesel exports go to Europe to capitalize on European Union (EU) incentives provided to waste-based biofuels exporters.

The national lockdown (March 25-May 31, 2020) in response to COVID-19 restricted vehicular movement and fuel usage, but Post does not foresee significant impact on ethanol or biodiesel consumption, because the fuel pool size has no bearing on biofuels use in India, which remains well below any set targets and is determined year to year by available domestic feedstock supply. Ethanol blend targets are determined by tender pricing, which in practice secures only a portion of the aspirational mandate in any given year. For biodiesel, the larger pool size is irrelevant, given that market penetration is marginal and remains largely restricted to disbursed and informal groups at the local level, along with some stationary applications.

With the continued prohibition of fuel ethanol imports and high biodiesel import duties, India's biofuel policy remains focused on utilizing domestic resources, including surplus cane sugar diverted to ethanol production using high sugar price supports. However, this same order of priorities is considered standard for nearly all countries with biofuel programs. Commercial-scale advanced biofuels production such as cellulose-based or intermediate syngas remain unviable despite a decade of support programs.

If India is to meet its long-term blending goals, biofuels and biofuel feedstock imports must remain as a critical source to augment domestic production, especially given the projected growth of the domestic fuel pools, despite the temporary drop in demand because of COVID-19.

Section II. Policy and Programs

A) India's Biofuel Policy 2018

India's 2018 biofuel policy seeks to achieve by 2030 a national average of a 20 percent ethanol blend with gasoline and a five percent blending of biodiesel with conventional diesel. The GOI envisions that the targets will be met through: 1) growth in domestic biofuel production (1-G, 2-G and 3-G[1]); 2) use of multiple feedstocks[2]; and 3) encouraging biofuel blending to supplement gasoline and diesel use in vehicles and machinery, as well as in stationary and portable power applications[3].

Fuel Ethanol

A National Blend Rate of 10 Percent by 2022

Despite its objectives to ensure energy security, the GOI's biofuel policies have never included production mandates. The EBP was partially, but never fully successful in meeting blending mandates during years of surplus sugar production, and even less during cyclical downturns in the sugarcane harvest. There has been no progress acting on the National Biodiesel Mission (NBM) mandate because the economic and agronomic conditions of a successful program based on jatropha were never achieved.

[1] 1-G: First generation, 2-G: Second generation, etc.
[2] Creation a National Biomass Repository is proposed
[3] Example: diesel generators or water pumps for irrigation

The GOI's current EBP mandate is to reach a ten percent national average blend by 2022. Previously, the GOI instituted this objective across all cane-growing states but could only achieve less than five percent due to inadequate price incentives and occasionally insufficient feedstocks. Despite the ambitious blending target, the GOI continues to commit to its long-term objective of redirecting surplus sugar to drive ethanol production. However, there is no evidence that sugar export subsidies will be discontinued in favor of increased fuel ethanol use.

In May 2020, the GOI's Department of Food & Public Distribution notified sugar mills of new financing opportunities to promote the development of ethanol production capacity. These incentives include soft loans up to USD $2.4 billion (Indian Rupee [INR] 18,600 crores[4]) available to finance up to 362 projects, including 349 sugar mills and 13 molasses-based standalone distilleries. Additionally, loan interest subsidies, which were first announced in June 2018 total to an estimated USD $534 million (INR 4,045 crores). This new thrust by the GOI will likely sharpen the resolve to block ethanol imports, but it may also limit any actions by India to dump sugar at subsidized prices in international markets (Official Notification). However, as of June 2020, of the 166 sugar mills that have applied for bank loans, only 57 received approval for their ethanol expansion projects, and just 37 have received funding. The initial response would likely have been more favorable, if the GOI had committed to a pricing formula for fuel ethanol tenders that accounted for feedstock price changes which guarantees mill/distillery profitability, while committing to an annual expansion schedule. This may have reduced risk on the internal rate of return of new investments.

Previously, in December 2019, India signed a Memorandum of Understanding with the Government of Brazil to upgrade its ethanol production facilities and to help develop the technology needed for blending ethanol. The agreement allows for technical assistance with the intended goal to create a dual sugar-ethanol system that would give Indian industry the flexibility to chase higher returns as it switches between cane crushing for sugar or ethanol for EBP. However, unlike Brazil, India is a huge consumer of sugar at 27.6 million metric tons (MMT) in the latest three-year average, compared to 10.6 MMT in Brazil for the same period, indicating that India's domestic sugar consumption would need to be vastly relegated for a dual sugar-ethanol system to fully function.

The intended objectives of these initiatives is to boost national fuel ethanol production capacity while expanding plant capacity to switch between sugar and ethanol markets, increase feedstock supplies for fuel ethanol production while reducing sugar stocks, substitute domestic ethanol for gasoline to lower reliance on crude oil imports, reduce pollution in Tier-1 and Tier-2 cities through increased ethanol blending and boost both global and domestic sugar prices by reducing India's surplus sugar exports. The COVID-19 pandemic has slowed down this agenda, as relatively weak domestic sugar demand has affected sugar mills liquidity and curbed interest in further capital investments. Further, OMCs have struggled with reduced fuel demand as vehicle movements were restricted for two months during the national lockdown. As a result, the OMC's infrastructure development needed to increase blend rates is now a low priority for 2020.

[4] One crore equals ten million.

India's short-term target to achieve E10 by 2022 appears unachievable, due to limitations in robust blending infrastructure and interstate commerce barriers around procurement. Even with an optimistic assumption with consistent growth and a rebound in the fuel pool to 47 billion liters in 2022, the amount of ethanol required to achieve E10 would be approximately 4.7 billion liters (against 1.95 billion liters this year). This suggests that India's fuel ethanol consumption will have to grow by 1.4 times in the next two years (i.e. 2.75 billion liters more) to meet the target. Given that India's nameplate capacity is 3.5 billion liters, local production would need to be increased by an additional 1.2 billion liters in the next two years. India could still come close to achieving its 2022 blending goal if there were consecutive bumper sugarcane harvests, eliminated sugar export subsidies and more permittable imports.

Going beyond 2022, Post estimates it is implausible for India to achieve E-20 by 2030, given numerous challenges, including the sugarcane industry's general inability to supply India's ethanol demand, especially if sugarcane remains the primary feedstock and the gasoline pool increases as expected. Further, if fuel-grade ethanol imports remain restricted or prohibited, it will continue to minimize overall supply capacity. Finally, it remains unlikely that that agricultural waste cellulosic, algae or municipal waste-based "advanced fuels" will be capable of covering more than a relatively small portion of light vehicle transport fuel demand in 2030, even with huge subsidy outlays.

i) Ethanol Policy

a) Expanded Eligible Feedstock and 2-G Purchasing Agreements

Under the 2018 Biofuels Policy, the EBP allows ethanol procurement sourced from B-heavy molasses, sugarcane juice, and damaged food grains[5] such as wheat and broken rice. During the agricultural crop year (July-June) when the Ministry of Agriculture & Farmers Welfare typically projects an over-supply of food grains, the policy allows surplus conversions food grains to ethanol, based on the approval of the National Biofuel Coordination Committee. While alternative raw materials such as sugar beet or sweet sorghum, and starch-containing products such as corn, cassava or rotten potatoes can be used to increase ethanol production, the expansion of available feedstock continues to have limited potential compared to cane molasses. Furthermore, disbursed collection systems for biofuel feedstock have not proven viable for unsubsidized biofuel production.

In April 2020, the GOI approved the use of surplus rice as a biofuel feedstock. However, as rice is a key staple for the region, local food security concerns will likely inhibit such use. As of July 2020, there were no significant movements or offtakes to suggest that rice was being utilized.

The procurement mechanism under the Ethanol Purchase Agreements (EPA) remains unchanged and can be referred to in Post's previous annual report (GAIN: IN9069).

[5] The challenges will be 1) collection and transport costs to plants, and 2) refineries to adjust conversion process as a mix of feedstock delivered to plants may change, negatively affecting yields and profits.

b) Import Licenses Remain Compulsory for Biofuel (non-fuel use) Imports into India
The license applies to denatured ethyl alcohol (all strengths), undenatured ethyl alcohol (strength by volume of 80 percent or higher), pure biodiesel and biodiesel blends Over 30 percent, and petroleum oils containing up to 30 percent biodiesel (GAIN IN9048).

While there have been media reports over recommendations of a "possible increase" in the Minimum Support Price (MSP) for sugar[6] and given a surplus in the 2020 sugar season, the MSP range will still remain less attractive for sugar mills for whom a stronger incentive exists to divert more domestic ethanol for use in the EBP. This will further encourage industrial users to seek imports to fill their consumption gap, creating demand for both domestically produced and imported ethanol, assuming that international ethanol prices remain competitive and crude oil prices remain firm.

c) Ethanol Administered Price
In September 2019, the Cabinet Committee on Economic Affairs (CCEA) approved the following prices for the forthcoming sugar season 2019-20 during the ethanol supply period, which runs from December 1, 2019 to November 30, 2020[7]:

- Ethanol derived from C-heavy molasses fixed at INR 43.75/liter or $0.61/liter (from the previous price of INR 43.46/liter).
- Ethanol derived out of B-heavy molasses and partial sugarcane juice fixed at INR 54.27/liter or $0.76/liter (from the previous price of INR 52.43 per liter).
- Ethanol derived from 100 percent sugarcane juice fixed at INR 59.48/liter or $0.83/liter (from the previous price of INR 59.13/liter) for mills that will divert 100 percent sugarcane juice for ethanol production.
- Additionally, Goods and Services Tax (GST) and transportation charges will also be assessed. The OMCs were advised to fix realistic transportation charges so that long distance ethanol transport is not discouraged.
- OMCs were advised to prioritize ethanol in the following order: 100 percent sugarcane juice, B-heavy molasses/partial sugarcane juice, C-heavy molasses and damaged food grains and other sources.

ii) Biodiesel Policy

India's aspirational biodiesel blend goal for on-road use is B5 by 2030. In 2020, the national average blend rate is estimated at 0.16 percent. Biodiesel is manufactured from imported palm stearin and small volumes of non-edible oils, UCO and domestically sourced animal fats. Under its 2018 biofuel policy, the permitted raw materials were retained from the existing list while expanding the list of non-edible oilseeds. Biodiesel use remains negligible due to limited feedstock availability, a lack of an integrated and dedicated supply chain and import restrictions. To meet its blending mandate, India would need to substantially invest in new plants to

[6] Source: Business Standard of India
[7] Source: PIB Press Release

augment annual production capacity from its current 680 million liters and create a supply chain infrastructure for UCO, while enforcing necessary collection mechanisms, similar to China's production and supply chain system.

Domestically sourced UCO was identified as a feedstock with a large, untapped potential for biodiesel production[8]. The GOI's Food Safety and Standards Authority of India (FSSAI) took various initiatives to divert UCO from the food value chain and help curb current illegal practices to reuse UCO in cooking. Repurposed Used Cooking Oil (RUCO) is the name of the functional body that will enable the collection and conversion of UCO to biodiesel. The Ministry of Petroleum and Natural Gas (MoPNG) claims that India annually uses about 27 billion liters of cooking oil, of which 1.4 billion liters can be collected to produce 1.1 billion liters of biodiesel. (Source: PIB). While the potential of UCO as a feedstock for manufacturing biodiesel is just five percent of the overall cooking oil annually consumed, India could still achieve an average on-road blending rate of B2, even if all of 1.1 billion liters of UCO derived biodiesel were used in CY 2020. To achieve a 2020 B5 blend target, India would need to revamp its production capacity to 2.65 billion liters, a massive increase from its realized 680 million liters.

In August 2019, the MoPNG invited an expression of interest (EOI) by state run OMCs (Indian Oil Corporation [IOCL], Hindustan Petroleum and Bharat Petroleum) to procure UCO-origin biodiesel to be blended with petroleum diesel across 100 cities. Under the scheme, the OMCs would procure the entire supply of UCO-origin biodiesel for a three-year period and will pay biodiesel producers $0.71, $0.73 and $0.76 per liter in the first, second and third years respectively (Source: PIB). Furthermore, OMCs will also assume transportation costs and Goods and Services Tax (GST) for the first year, following which, in November 2019, IOCL issued letters of intent (LOI) to establish six biodiesel plants using UCO as feedstock. Biodiesel refineries are slated for construction in Gujarat, Uttar Pradesh and Rajasthan with an overall capacity to annually produce 10,200 Metric Tons (MT) of biodiesel. However, due to COVID-19 their status is uncertain.

Further, after repeated deadline extensions, FSSAI issued an official directive to food business operators (FBO) for compulsorily disposing off their UCO to authorized collection agencies or aggregators, in a move likely to improve traceability[9]. FSSAI requires that FBOs consuming more than 50 liters of oil per day to strictly maintain usage records and refrain from reusing cooking oil more than three times.

For a more historical perspective on India's biodiesel policy, please refer to (GAIN IN9069).

iii) Other Biofuels: Drop-in-fuels, Bio-CNG, Bio-Hydrogen, Bio-methanol, Di-Methyl-Ether

A task force on *waste to energy* created by the National Institute for Transforming India (NITI Aayog) estimated that India annually generates 62 MMT of municipal solid waste (MSW). MSW has significant potential to support agriculture by producing compost as well as drop-in fuels and energy, including

[8] Source: FSSAI Launches RUCO, Press Note and Gazette Notification
[9] FSSAI also launched a mobile app named RUCO.

biogas/electricity. Also, many technologies are available for converting waste into biofuels and other higher-value biochemicals but are in the nascent stage and need to be proven on a commercial scale.

Institutional Mechanisms

The 2018 National Biofuel Policy established a National Biofuel Coordination Committee (NBCC) headed by the Minister of Petroleum and Natural Gas and comprised of representatives of various ministries. To monitor the implementation of the biofuel program, the biofuels working group is organized under the Chairmanship of the Joint Secretary (Refinery), MoPNG, along with technical experts, representatives from relevant ministries, OMCs, the Petroleum Conservation Research Association (PCRA)[10] and other stakeholders.

As previously noted, NBCC approved the use of available surplus rice with the Food Corporation of India (FCI) as a feedstock for utilization in EBP and for manufacturing alcohol-based sanitizers. The move received heavy criticism for food security concerns (Source: PIB). As of July 2020, industry sources indicate no movements have occurred on this approval.

Note: For an overview of government stakeholders, please refer to *Role of Stakeholders/Institutional Mechanism* section.

Financial Support for Biofuel Producers and Consumers

Financing and Fiscal Incentives

To accelerate production, the GOI will consider utilizing financial incentives including subsidies, grants, tax credits, accelerated depreciation on plant expenditures, differential pricing vis-à-vis -1G Ethanol, Viability Gap Funding (USD $735 million, INR 5,000 crore), all within a six-year timeline. This would augment additional tax incentives for businesses, and higher purchase prices for 1G biofuels. These incentives should encourage stakeholders to set up 2-G ethanol bio-refineries. However, there have been no recent developments around the same.

The GOI encourages biofuel sector joint ventures and investments. For instance, 100 percent foreign direct investment (FDI) in biofuel technologies is encouraged through an automatic approval route, provided that the production is only for domestic use. In addition to exploring opportunities for generating carbon credits, the National Bank for Agriculture and Rural Development and other public sector banks are encouraged to provide funding or financial assistance through soft loans[11]. However, the GOI has not provided details regarding the funding targets for producers.

[10] PCRA is an organization established in 1978, under the umbrella of the MoPNG that is engaged in promoting energy efficiency in various sectors of the economy.

[11] Typically loans with no interest or a below-market rate of interest.

Fiscal Stimulus to Augment Ethanol Supply for EBP

The EBP promotes ethanol blending to reduce pollution, encourage value addition along the value chain and improve cash flows for millers to enable arrears payments for cane growers. The CCEA has approved additional funds under the "Scheme for extending financial assistance (interest subvention) to sugar mills for enhancement and augmentation of ethanol production capacity." The funds include soft loans[12] up to $2.4 billion (INR 18600 crores) available to finance some 362 projects, of which 349 are sugar mills and 13 molasses-based standalone distilleries. Additionally, loan interest subsidies which were announced in June 2018 will total up to an estimated $534 million (INR 4045 crores). However, as mentioned earlier, the utilization of these funds has been limited, with only 37 projects actually receiving any funding as of June 2020.[13]

Last year's JI-VAN Yojana[14] program was launched with an annual cost of $277 million from 2018-19 to 2023-24, which envisaged producing second-generation (2G) ethanol from biomass and other wastes to bridge the supply gap for the EBP program. Phase I of the scheme aims to establish six commercial programs and five demonstration sites. Financial assistance provided via the Viability Gap Funding[15] for commercial projects is subject to a maximum of 20 percent of the total project cost, capped at a maximum of $19.5 million. Financial assistance for demonstration projects is limited to $1.95 million.

In June 2020, the Centre for High Technology (CHT), the implementation agency for the scheme, unveiled a request for selection for project developers to set up "Demonstration scale 2G Integrated Bioethanol Projects," with an annual capacity ranging between 0.3 million liters to 1.12 million liters along with a feedstock capacity between five to 15 tons per day. (See: CHT/PM JI-VAN/RFS/Demonstration/2020/02)

B) Renewable Energy, Greenhouse Gas (GHG) Emissions & Climate Change

Renewable Energy

India has an ambitious renewable energy target of 450 gigawatts (GW) by 2030. As of April 2020, a total capacity of 86 GW of renewable energy has been installed in the country, with an estimated 44 percent consisting of wind energy, 40 percent in solar, 11 percent in bio-power, and 5 percent in hydropower. By 2022, the GOI plans to add an additional 175 GW in renewable energy, including 100 GW in solar, 60 GW in wind energy, 10 GW from biomass[16] and 5 GW from hydropower.

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[12] A soft loan aka soft financing is a loan with a below-market rate of interest among other concessions to borrowers like longer repayment periods or interest holidays. Soft loans are usually provided by governments to projects they think are worthwhile.

[13] Source: PIB Press Release March 2019, and DFPD Notification on Augmenting Ethanol Supply.

[14] Source: Cabinet approves "Pradhan Mantri JI-VAN Yojana.

[15] Viability Gap Funding (VGF) means a grant (one-time or deferred), provided to support infrastructure projects that are economically justified but fall short of financial viability. The lack of financial viability usually arises from long gestation periods and the inability to increase user charges to commercial levels.

[16] Biofuel isn't included as part of the broader renewable energy outlook.

As of April 30, 2019, power from biomass combustion, biomass gasification and bagasse cogeneration[17] reached upwards of 9.3 GW installed capacity. India is close to realizing its 10 GW by 2022 target, provided that an additional GW be added per year. The principal driver will be the use of bagasse in sugar mill cogeneration plants. The existing scheme which runs through 2020 supports biomass-based cogeneration promotion in sugar mills and other industries by offering financial assistance through a capital subsidy per additional megawatt capacity, if delivered through more efficient co-generation technologies.

The GOI's ambitious goal of achieving 100 GW produced by solar[18] by 2022, aims at encouraging Indian consumers to establish solar photovoltaic systems. This is likely unachievable given the long-term power purchasing agreement between power distribution companies and power generating companies which has no scope for renegotiations. Due to revenue loss and the added maintenance and reconfiguration costs of additional infrastructure needed to integrate rooftop systems into the grid, incentivizing consumers to implement solar energy projects to increase solar energy production remains a challenge.

With the MoPNG taking stewardship of the 2018 biofuel policy, the Ministry of New and Renewable Energy's renewed focus is now generating or producing energy from biogas. Production will be from biomass/urban, industrial and agricultural wastes. India envisages a share of 21 percent coming from renewable energy in its total electricity consumption by March 2022, as per its Renewable Purchase Obligation (RPO) targets (Source: Order No. 23/03/2016-R&R, and RPO Clarification). However, in fiscal year (FY) 2019, India has RPO attainment of 10.77 percent. Only the states of Karnataka, Andhra Pradesh, Rajasthan and Tamil Nadu have been able to meet and exceed their RPOs. Given the impact of COVID-19, many Indian states have extended their compliance timelines for meeting their FY 2020 RPO targets.

India's commitment towards renewable energy is commendable, however, any realized environmental benefits may be thwarted by India's fossil fuel production. For instance, Coal India (a GOI-owned mining corporation), is intending to boost annual coal production from 600 million MT annually to one billion MT by 2024, while another 41 coal mining blocks are being privatized under the Public Private Partnership vehicle. India also aims to amplify its liquefied natural gas (LNG) supply, from the current six percent of its total energy mix to 15 percent by 2030. Likewise, the GOI's revised energy projections indicate domestic oil demand to double from 5.05 million barrels/day in 2020 to 10 million barrels/day by 2030. LNG demand is also slated to triple from 150 million to 500 cubic meters/day from 2020 to 2030. India also aims to double its refining capacity by 2030 from 250 million tons, to 450-500 million tons.

Seen in the larger context of India's ongoing efforts to develop its fossil fuel resources (especially coal) and expand oil refining capacity, and given that fuel-grade ethanol remains prohibited in addition to high biodiesel tariffs, India's primary motivation for its ambitious biofuel policy remains focused on increasing self-sufficiency and rural development. This biofuel policy is less based on human health or environmental benefits, but rather the use of local resources and diverted surplus sugar, created by India's sugar price support

[17] 9,131.5 MW from Biomass power/cogeneration and 138.3 MW from waste to energy.
[18] 40 GW is to be attained through decentralized and rooftop-scaled solar projects.

mechanisms and export subsidies. However, this prioritization is near identical for all countries with biofuel programs.

Greenhouse Gas (GHG) Emissions

By 2020, the GOI had committed to reduce GHGs from 2005 levels by 20-25 percent and 33-35 percent by 2030. While India's carbon dioxide (CO_2) emissions fell by one percent in FY 2019-20 (until March 2020), there will likely be a steeper decrease in the rest of the year on account of the pandemic and low coal and oil consumption, a general economic slowdown and the GOI's impetus on renewable energy.

The Indian transportation sector is key to achieving GHG reductions. To support the GOI's goal of reducing air pollutants and lowering carbon emissions, the transportation sector intended to upgrade vehicles using current Bharat Stage (BS)-IV standards to be compatible with BS-VI fuel[19] by April 2020. As of June 2020, the Supreme Court of India officially discontinued the sale and registration of BS-IV vehicles. The court had earlier permitted ten additional sale-days following the end of the COVID-19 national lockdown to make up for the lost six days in sales and revenue in the automotive trade. However, India's leap from BS-IV to BS-VI has been risky, as a revival of demand and price corrections have become key for cost recovery on part of OMCs and automobile manufacturers' sunk costs.

National Greenhouse Gas Inventory

In 2014, India's GHG emissions included 2.6 million giga-grams (Gg) of CO_2e without Land Use, Land-Use Change and Forestry (LULUCF). The LULUCF sector continues to remain a net sink. Considering emissions and removals from the LULUCF sector, net national emissions were 2.3 million Gg of CO_2e. A summary of emissions and removals from these sectors is presented in Figure 1. The relative contribution of various GHGs by sector in the total inventory is also included.

India submitted its second biennial report to UNFCC in Dec, 2018. Please refer to GAIN report IN9069 and India Submitted its 2nd Biennial Report to UNFCC in Dec 2018) for additional information.

India's Post-2020 Climate Goals

India intends to submit its revised national goals on reducing fossil fuel use in the 26th session of the Conference of Parties (COP 26) under the United Nations Framework Convention on Climate Change (UNFCCC) in November 2021. Existing excerpts can be accessed here.

For more information please visit the following links: India's Intended Nationally Determined Contribution: Working toward Climate Justice, MOEF Climate Change, GOI and refer to National Action Plan on Climate Change.

[19] The Bharat Stage VI (BS-VI) regulation is an upgrade of the existing emission norms for on-road vehicles in India. BS-VI emission norms have many implications, among the most important is the adoption of a lower permissible level for sulphur content in transport fuel, i.e. 10 parts per million (PPM). The previous BS-IV standard required 50 ppm of sulphur.

Figure 1. India Green House Gas Emission by Sectors

	CO_2 emission	CO_2 removal	CH_4	N_2O	HFC 23	CF_4	C_2F_6	SF_6	CO_2 equivalent
TOTAL without LULUCF (Gg)	**1,997,891.85**	**-**	**20,005.35**	**475.29**	**1.59**	**2.61**	**0.71**	**0.004**	**2,607,488.12**
TOTAL with LULUCF (Gg)	**2,015,107.88**	**319,860.23**	**20,053.54**	**476.71**	**1.59**	**2.61**	**0.71**	**0.004**	**2,306,295.43**
1. ENERGY	1,844,705.03	-	2,133.37	65.35	-	-	-	-	1,909,765.74
2. IPPU	153,186.81	-	177.85	10.36	1.59	2.61	0.71	0.004	202,277.69
3. AGRICULTURE	-	-	14,709.78	349.39	-	-	-	-	417,217.54
4. LULUCF	17,216.04	319,860.23	48.19	1.42	-	-	-	-	-301,192.69
5. WASTE	-	-	2,984.35	50.18	-	-	-	-	78,227.15
Memo Item (not accounted in total Emissions)	**812,030.60**	**-**	**0.11**	**0.11**	**-**	**-**	**-**	**-**	**812,067.87**
International Bunkers	4,943.53	-	0.11	0.11	-	-	-	-	4,980.81
Aviation	3,681.65	-	0.03	0.10	-	-	-	-	3,714.12
Marine	1,261.88	-	0.08	0.01	-	-	-	-	1,266.69
CO_2 from Biomass	807,087.06	-	-	-	-	-	-	-	807,087.06

Source: Adopted From Second Biennial Report, Submitted to UNFCC by MoEFCC, December 2018

C) Import Duties/Export Taxes and Levies

Table 1. India: Biodiesel Import Duties
(percent ad valorem on Customs, Insurance and Freight (CIF) value)

ITC HS Tariff Number	Total Import duty
Biodiesel and mixtures thereof, not containing or containing less than 70 percent by weight of petroleum oils and oils obtained from Bituminous minerals (greater than B30 to B100) [3826 0000]	24.32 percent (10 percent basic plus 10 percent Social Welfare Surcharge (SWS) on basic custom duty plus 12 percent IGST***)
Petroleum oil and oils obtained from Bituminous minerals (other than crude), containing by weight more than 70 percent or more of petroleum oils, contain biodiesel, other than waste oils (B1-B30), [2710 2000]	30.98 (10 percent basic plus 10 percent Social Welfare Surcharge (SWS) on basic custom duty plus 18 percent IGST).

Source: www.cbic.gov.in, updated as of May, 2020

Table 2. India: Ethanol Import Duty (percent ad valorem on CIF value)

ITC HS Tariff Number	Total Import duty
Ethyl alcohol and other Spirits, denatured, of any strength; denatured ethanol; and denatured spirits [2207 2000]	Basic custom duty on denatured ethanol for manufacture of excisable goods* is 2.5 percent. However, denatured spirits assessed 5 percent duty for all goods except above**
Undenatured Ethanol [2207 1000] of an alcoholic strength by volume of 80 percent or higher	150 percent (SWS of 10 percent on basic Customs duty exempted, State excise/VAT as applicable)

Source: www.cbic.gov.in (updated as of May, 2020)
*: If the importer follows the procedure set out in the Customs (import of goods at concessional rate of duty) Rules, 2017
**: Ethyl alcohol used for blending gasoline will attract five percent Integrated Goods and Service Tax, supplied to OMCs
***: Central excise duty is a fixed amount and not a percentage on price. Additionally, as indicated in 2019, the five percent road and infrastructure cess (tax) on ethanol-blended petrol has been abolished (Excise on Biodiesel, Excise on 10 percent blend gasoline, Excise on 5 percent blend gasoline).

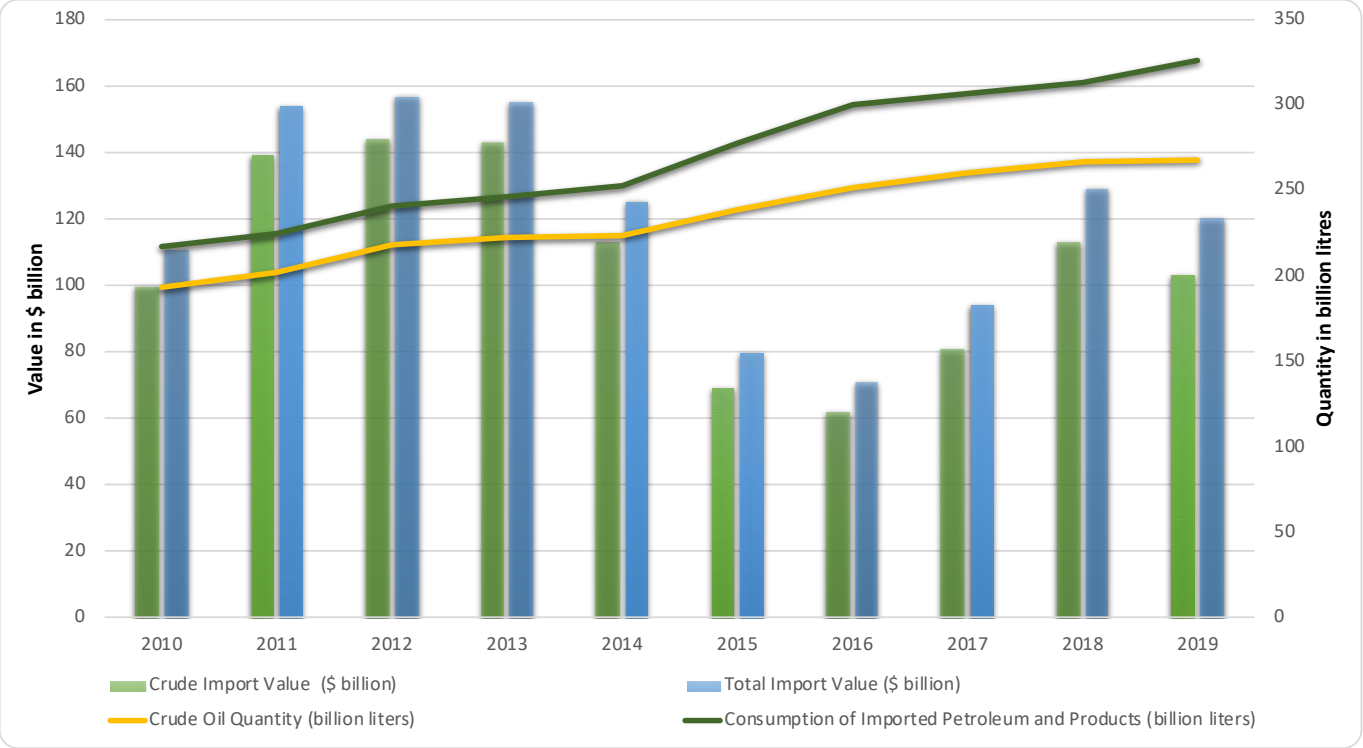
Section III. Gasoline and Diesel Pools

India's Fuel Pool to Remain Impacted
Petroleum remained India's largest import at $111.9 billion in FY 2019, 17 percent of its overall import share. Earlier this year, crude oil prices reached historic lows, and in April traded negative, resulting in a steep decrease in oil imports, dropping to $101.4 billion in FY 2020 (Figure 2). As of July 2020, oil imports declined by 55.3 percent year-on-year due to a significant decrease in Indian oil consumption from the COVID-19 lockdown and reduced world oil prices.

India's transportation fuel consumption fell an estimated 50 percent during the March-May period, directly attributed to the national lockdown. As India has reopened in phases, domestic transportation fuel demand is set to recover to pre-COVID sale volumes by the end of CY 2020, according to industry sources. From January to March 2020, gasoline demand was down 20 percent, diesel consumption lowered by 21 percent, and jet fuel was 39 percent weaker compared to the corresponding period last year.

Transportation Sector among the Largest Energy End-Users
Diesel alone meets an estimated 40 percent of transportation fuel demand, followed by gasoline at 28 percent (Figure 3). Road traffic accounts for an estimated 60 percent of total freight traffic (versus air and ship) and 90 percent of total passenger traffic.

Figure 2. India Crude Oil and Petroleum Products Imports and Consumption



Source: Petroleum Planning and Analysis Cell, GOI, time scale in calendar year (January-December)

In terms of fuel type usage, two-wheeled vehicles typically use gasoline, while four-wheeled passenger and commercial vehicles mostly use diesel. Out of the total vehicle classifications, including commercial, four, three and two-wheeled vehicles, FY 2019 vehicle sales data suggests 80 percent of India's domestic sales were in the two-wheeled segment, which runs on conventional gasoline.

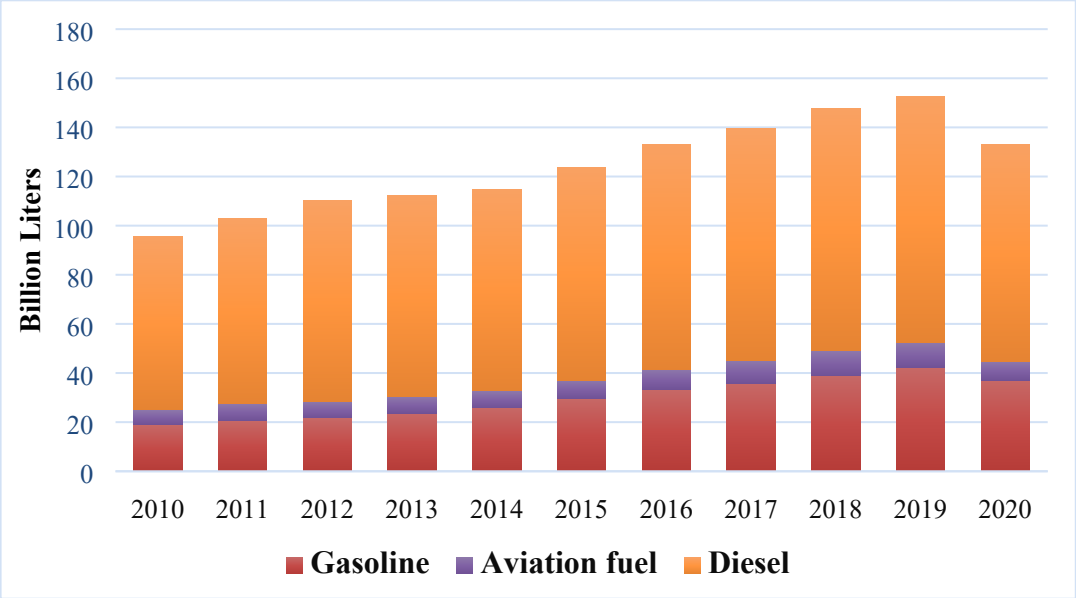
India's automobile industry is one of the hardest hit by the pandemic. On the supply side, most manufacturing plants suspended operations due to the lockdown. Concurrently, consumer spending and vehicle demand is projected to continue to be limited in the ensuing months. According to the Society of Indian Automobile Manufacturers (SIAM), in CY 2020, new vehicle registration volumes for all categories will sharply decline by 35-40 percent. Similarly, India's ambitious plan to implement its Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles' (FAME[20]) legislation is delayed, which was developed under the Ministry of Heavy Industries & Public Enterprises.

The GOI has allocated $96.8 million[21] in its fiscal Union Budget for FAME-India for FY 2020-21. Currently, imported electric vehicles have become costlier with the GOI increasing customs duties ranging between 5-15 percent, in a bid to push for local production.

[20] FAME, Ministry of Heavy Industry, GOI.
[21] Budget outlays on major schemes.

As of 2018, the ownership ratio was estimated at 30 vehicles per 1,000 people. It is likely to grow to 33 vehicles by 2022 and reach 45 vehicles by 2030 (Source: Stratas Advisors). In the medium-term, there will be a decline in vehicle demand growth due to ride-sharing platforms that have become substantially more developed, and as technology-driven, mobile app ridesharing services gather increased market share.

Figure 3. India Liquid Fuel Consumption, In Calendar Year



Source: Petroleum Planning and Analysis Cell (PPAC), GOI
* 2020 estimates | **Consumption only includes on-road diesel use

Table 3. India: Fuel Use Projections, Million Liters

Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*f*
Gasoline Total	20,716	21,842	23,749	25,848	29,651	33,265	35,701	38,896	42,266	37,194
Diesel Total	75,866	82,238	82,256	82,674	87,064	91,965	94,524	98,700	100,241	88,212
On-road	45,520	49,343	49,354	49,605	52,239	55,179	56,715	59,220	60,145	52,927
Agriculture	9,104	9,869	9,871	9,921	10,448	11,036	11,343	11,844	12,029	10,585
Construction and Mining	3,035	3,290	3,290	3,307	3,483	3,679	3,781	3,948	4,010	3,528
Shipping and Rail	3,793	4,112	4,113	4,134	4,353	4,598	4,726	4,935	5,012	4,411
Industry	8,345	9,046	9,048	9,094	9,577	10,116	10,398	10,857	11,027	9,703
Heating	6,069	6,579	6,580	6,614	6,965	7,357	7,562	7,896	8,019	7,057
Jet Fuel Total	6,809	6,626	6,789	6,960	7,564	8,458	9,279	10,243	10,192	7,644
Total Fuel Markets	**103,392**	**110,706**	**112,794**	**115,482**	**124,280**	**133,688**	**139,504**	**147,839**	**152,700**	**133,050**

Source: PPAC, GOI.
Note: *f* =forecast year. All forecasts and breakdown of diesel consumption is based on June 2020 industry and trade reports.

Section IV. Ethanol

India has over 330 distilleries (both molasses and grain-based) with a combined capacity to produce over 6 billion liters of rectified spirits (alcohol) per year. Of this total, approximately 200 distilleries have the capacity[22] to distill 3.5 billion liters of ethanol (denatured and undenatured) to be used in fuel, industrial, medical-grade and potable liquor applications. Final C and B-heavy molasses, sugarcane juice, food grains unfit for human consumption and any other potential raw materials available in the country may be used for making fuel-grade ethanol. In a bid to widen the feedstock base, India has recently approved use of surplus rice for fuel ethanol production, but there is no indication if any will be used for CY 2020.

Consumption

India's CY 2020 total ethanol consumption is forecast to rise 5.3 percent to a record 3.62 billion liters. Last year, 3.37 billion liters were consumed. Consumption will outgrow production for the sixth consecutive year, largely driven by burgeoning fuel ethanol demand used for gasoline blending. In 2020, as a result of the COVID-19 pandemic, medical grade ethanol consumption increased due to amplified domestic consumption in hand sanitizers and disinfectants. Ethanol consumption growth (nine percent annual, five-year average, 2015-2020) is rather strong compared to production growth (five percent annual, five-year average). The rise in domestic fuel prices, coupled with relatively appealing ethanol purchase prices are both driving increased ethanol consumption, while consecutive above-average sugarcane harvests have lifted production.

An eight percent ethanol blend in 2020 would be achievable if India's total molasses supply were used to produce fuel ethanol. However, continued sugarcane availability for the EBP will result in a 2020 national blend average of 5.2 percent, which is still higher than last year's 4.5 percent, and a new record. The blend rate would potentially be much higher if fuel-use ethanol imports were permitted, duty rates were lowered, and procurement program inefficiencies rectified, such as interstate trade barriers. Industry sources estimate that the OMCs could procure around 2.03 billion liters in 2020. Ethanol demand for the EBP program is lower than last year due to lowered 2019-20 sugarcane production forecasts, owing to unfavorable weather conditions in key growing states of Maharashtra and Karnataka, which prompted the OMC's to readjust their procurement volumes.

Of the 5.1 billion liters requirement initially established by OMCs for ethanol supply year[23] 2020, approximately 1.92 billion liters of ethanol have been finalized (quantity as per Letter of Intent [LOI]) against 924 million liters which are underway to be blended as of June 22, 2020. Post estimates CY 2020 fuel use supply per LOI at approximately 1.95 billion liters. Since the ethanol quantity demanded at higher prices may

[22] Estimated ethanol manufacturing capacity as of 2019 sugar season basis number of operational days allowed by Pollution Control Boards.
[23] India's ethanol supply year (ESY) is December to November. Tenders are usually floated every year in August/September for the upcoming ESY. This is followed by three cycles of three rounds each, leading to quarterly allocations of ethanol.

be less, the industrial and potable sectors will need to augment some of their supplies from grain-based distilleries, partly from raw material imports or by directly importing the finished products.

Production

India's CY 2020 ethanol production is forecast at approximately 3 billion liters, 17 percent above last year and a record volume. Molasses supply for fuel use will marginally increase in response to price incentives to divert B-heavy molasses and sugarcane juice to produce fuel grade ethanol, but at the cost of diverting excess sugar from being refined. As of June 2020, the Indian Sugar Mills Association reported 1.7 billion liters in contracted supplies, of which approximately 924 million liters have been delivered, comprising of 781 million from C-heavy molasses, 685 million liters from B-heavy molasses, 111 million liters from damaged food grains and 125 million liters from sugarcane juice.

In 2019, an estimated 2.5 billion liters of ethanol was produced (from molasses), with 1.9 billion liters blended with gasoline to mark a 4.5 percent blend rate. The differential and remunerative price to ethanol suppliers has marginally increased ethanol availability for the EBP Program.

Last year, India exported 1.7 billion liters of molasses, up 70 percent over 2018 volumes. Top destinations for Indian molasses included the Netherlands, United Kingdom, South Korea, Philippines and Italy. Indian molasses imports in 2019 were 63 million liters, primarily from Nepal, Norway and Bangladesh. This year, industry sources indicate the GOI will support export opportunities to improve cash flows for the sugar mills. As of February 2020, India has already exported 164 million liters of molasses. In the domestic market, monthly molasses sales to the potable liquor industry remains strong. Molasses is a state subject, with respective states governing its domestic and international flow.

India requires additional feedstock supplies to boost fuel ethanol production to realize its long-term blending objectives. However, allowing surplus sugar and molasses exports undermines its capacity to produce greater fuel ethanol quantities, and prevents India from reaching its fuel ethanol consumption goals. To achieve its ethanol use ambition, India must strengthen measures needed to divert molasses to the EBP system.

Trade

Imports

Despite increased domestic production, India remains a net ethanol importer[24]. In CY 2019, Indian ethanol imports (mostly denatured) increased 15 percent to 704 million liters, valued at USD $289 million. For the seventh consecutive year, the United States is the largest ethanol supplier to India. Strong local demand for industrial and medical grade consumption continues to drive Indian imports of U.S. ethanol. This year, the U.S. ethanol share was down by one percent, but still remains dominant at 93 percent of India's total ethanol imports.

[24] For all end-uses.

Generally, India's industrial ethanol users require imports to augment their cumulative demand, particularly when local supply is short. This deficiency has noticeably grown since 2016, but now with the COVID-19 pandemic, ethanol imports swelled by 78 percent (mostly denatured) from January to April 2020, spurred by industrial and medical-grade users, of which the U.S. share was 28 percent. Indian ethanol imports will remain bullish in 2020, despite increased domestic production and the GOI impetus to divert surplus feedstock for ethanol production. Post estimates India's 2020 imports will grow to an estimated 870 million liters, (mostly denatured) the highest in a decade, with the United States remaining the largest supplier.

In 2019, India's other import suppliers included Indonesia, Singapore, Pakistan, South Africa and the United Arab Emirates (Figure 4). Indonesia has emerged as a new competitor and supplied approximately 4.3 percent of imports last year. Brazil, China, South Korea, Spain and the Netherlands all continue to be intermittent suppliers.

Exports

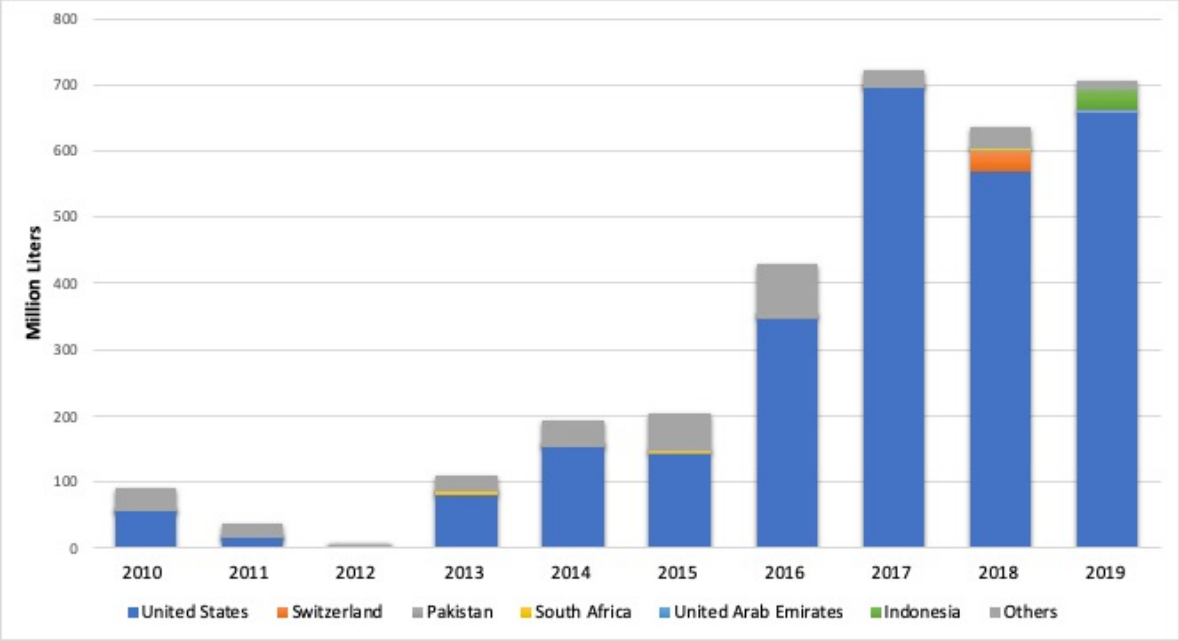
In 2019, India's ethanol exports were 50 million liters, dropping from 129 million liters in 2018 (mostly undenatured). Exports are further expected to drop to an estimated 40 million liters in 2020, owing to increased domestic demand due to the pandemic and feedstock limitations, and further exacerbated by increased molasses exports.

Table 4. India: Ethanol Used as Fuel, and Other Industrial Chemicals (Million Liters)

Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020[f]**
Beginning Stocks	125	33	60	60	75	61	128	150	201	37
Production	1,681	2,154	2,057	2,002	2,292	2,061	1,671	2,693	2,552	2,976
Imports	61	5	108	193	204	432	722	607	704	870
Exports	119	177	233	180	165	136	141	129	50	40
Consumption	1,715	1,955	1,932	2,000	2,345	2,290	2,230	3,120	3,370	3,620
Fuel Consumption	365	305	382	350	685	1,110	675	1,600	1,900	1,950
Ending Stocks	33	60	60	75	61	128	150	201	37	223
Production Capacity										
Number of Refineries	115	115	115	115	160	161	161	166	170	200+
Nameplate Capacity	1,500	2,000	2,000	2,000	2,100	2,210	2,215	2,300	3,000	3,500
Capacity Use (%)	112	108	103	100	109	93	75	117	85	85
Co-product Production (1,000 MT)										
Bagasse	102,714	108,309	102,360	105,642	108,699	97,485	79,176	111,874	99,942	117,555
Press Mud*	13,695	14,441	13,648	14,086	14,493	12,852	10,438	15,660	13,176	15,948
Feedstock Use for Fuel (1,000 MT)										
Molasses	1,521	1,271	1,592	1,458	2,854	4,625	2,813	6,250	6,963	7,222
Market Penetration (Liters)										
Fuel Ethanol	365	305	382	350	685	1,110	675	1,600	1,900	1,950
Gasoline	20,716	21,842	23,749	25,848	29,651	33,265	35,701	38,896	42,266	37,194
Blend Rate %	1.8	1.4	1.6	1.4	2.3	3.3	1.9	4.1	4.5	5.2

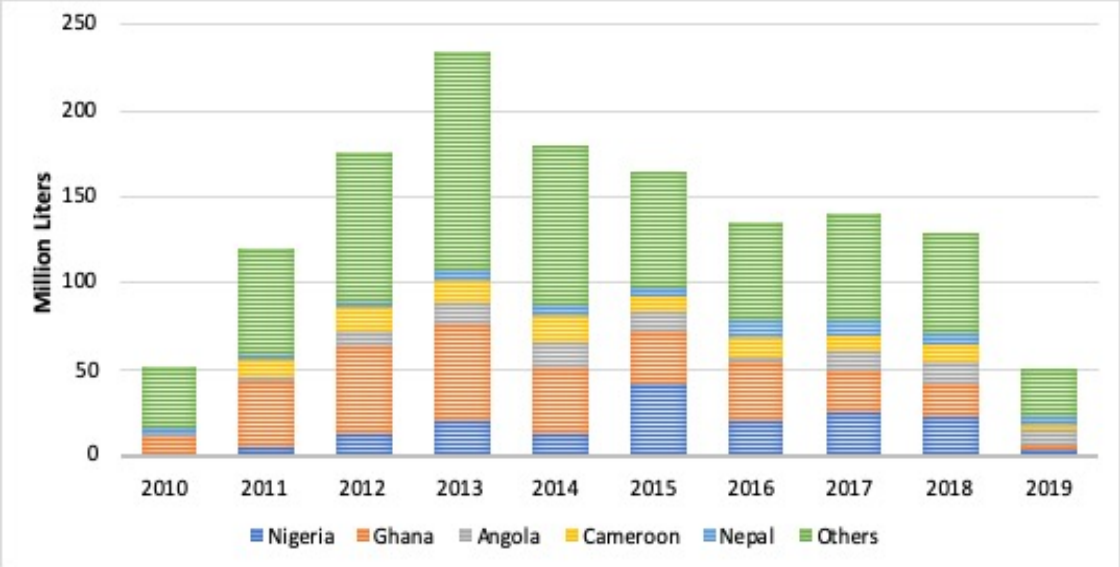
Source: FAS, Trade Data Monitor (TDM) and Industry Sources
f =Year 2020 is projected
Please note for ethanol imports originating from the United States, the data used is from U.S. Census Bureau. HS codes include (a) denatured, fuel 2207.20.0010, (b) ethanol denatured, other 2207.20.0090, (c) ethanol undenatured, fuel 2207.10.6010 and (d) ethanol undenatured, other 2207.10.6090
* Leftover sugarcane residue after juice extraction

Figure 4: India Ethanol Imports



Source: U.S. Census Bureau, Trade Data Monitor and Ministry of Commerce, GOI
Note: *Others* include Singapore, Canada, Belgium, Sri Lanka and the United Kingdom

Figure 5: India Ethanol Exports



Source: Trade Data Monitor and Ministry of Commerce, GOI
Note: *Others* include Democratic Republic of the Congo, Lebanon, Jordan, Malawi and Rwanda

Section V. Biodiesel

The biodiesel market remains informal, dispersed with minimal domestic production. With many countries operating at a minimum of B5, and several countries including Brazil, Thailand, Argentina, Malaysia, Indonesia running at B10 or higher, India's market has a tremendous growth potential, provided there is a viable strategy for building a financially sustainable domestic industry coupled with market access for imports. Compared to the EBP, a very limited number of suppliers produce biodiesel, and most of their production capacities are under-utilized with few viable feedstock sources and limited GOI support mechanisms to create demand pull.

Most of India's biodiesel production is consumed by locally dispersed, informal groups through stationary power generation. Support received through OMC procurement is insufficient to build commercial sales. India's 2019 import license requirement also applies to biodiesel, and as such, imports will remain very limited. Past field trials, which used *jatropha*, some tree-borne oilseeds[25] and other non-edible oilseeds grown on non-arable, rain-fed lands have failed to advance mainly due to low yields. India does not produce drop-in renewable diesel.

Consumption

In the last ten years, annual biodiesel consumption has grown four percent to 185 million liters. In 2020, domestic consumption is expected to decline by three percent due to lower production. The blend rate for on-road use has marginally increased over the years but remains below two-tenths of one percent.

The estimated biodiesel quantity procured for blending with diesel for on-road use remains near 50 percent of total use. Buyers of such blended diesel are limited to some OMC retail outlets, the Indian railways, State Road Transport Corporations in various states, road transport fleet companies, and port authorities. Retail biodiesel prices are benchmarked with the retail diesel price in India, with the current IGST[26] rate at 12 percent.

The remaining biodiesel demand comes from various stationary applications. Smaller buyers will continue to procure biodiesel for small and medium scale enterprises following the temporary decline in demand during the lockdown. These buyers include progressive farmers (operating irrigation pumps and tractors), brick kilns, mobile communication towers and backup power generators.

[25] Tree borne oilseeds include Karanja, Mahua, Neem, Jojoba, Wild Apricot, Cheura, Kokum, Simarouba, etc.
[26] IGST, or Integrated Goods and Services Tax is levied when there is an interstate transfer of goods or services. It is one of the three components of the GST.

Production

India has six plants with combined annual biodiesel production capacity of 680 million liters. The existing plants' production capacity ranges from 11 million to 225 million liters. In CY 2020, India will produce close to 225 million liters of biodiesel, five million liters below 2019 levels due to the COVID-19 pandemic which rendered plant closures and limited feedstock accessibility for more than a month. The subsequent lockdown most affected UCO from FBOs, which were largely shut down.

Biodiesel producers use non-edible industrial oil (palm stearin), UCO, animal fats, tallows and 'other oils' (sludge, acidic oils, and tree-borne oils, etc.) to produce biodiesel, utilizing 33 percent of the total installed capacity. Capacity has changed little over the years, and with the exception of UCO, there are no official regulations for supplying available feedstocks for biodiesel production.

The biodiesel industry is still in its nascent stage because jatropha and other inedible oilseeds grown on non-arable lands have failed to reach yields needed, and there is no supply of virgin (first use) animal fat or veg oil available for biodiesel. With just 680 million liters of production capacity, a 2020 nationwide B5 market would require 2.65 billion liters, nearly four times India's current annual capacity. While India has been looking for a viable feedstock that does not compete with food use or occupy arable land, the belated focus on UCO[27] is a welcome step, but would require an enforceable, stringent collection mechanism for the country to tap into the full potential of this feedstock. As India does not have a fossil fuel carbon tax, it will likely need to subsidize UCO-derived biodiesel to accelerate industry adoption.

Trade

India's 2020 biodiesel exports are expected to grow by seven percent year-over-year to 58 million liters. Nearly all product is exported to Europe (primarily Spain and Belgium), taking advantage of EU incentives provided to waste-based biofuels exporters. The GOI only allows biodiesel exports from its Special Economic Zones and Export Oriented Units. India's biodiesel imports remain negligible and will continue to decline in 2020 by 71 percent, owing to long-established import restrictions and rising domestic consumption.

[27] Twelve years ago, UCO became a key biodiesel feedstock in the United States, Canada and Europe and has remained ever since.

Table 5. India Biodiesel Production from Multiple Feedstocks (Million Liters)

Biodiesel (Million Liters)											
Calendar Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020*f***
Beginning Stocks	45	15	13	14	15	11	13	13	18	25	23
Production	100	111	126	132	138	152	158	170	185	230	225
Imports	0.0	0.0	0.0	0.3	1.7	0.8	2.7	7.1	25.2	7.0	2
Exports	0	0	0	3.9	41.5	33.1	41.7	7.6	23.1	54.0	58
Consumption	131	113	125	128	102	118	119	165	180	185	180
Ending Stocks	15	13	14	15	11	13	13	18	25	23	12
Production Capacity (Million Liters)											
Number of Biorefineries	5	5	5	6	6	6	6	6	6	6	6
Nameplate Capacity	450	450	460	465	480	500	550	600	650	670	680
Capacity Use %	22.2%	24.7%	27.4%	28.4%	28.8%	30.4%	28.7%	28.3%	28.5%	34.3%	33.1%
Feedstock Use for Fuel (1,000 MT)											
Non-edible Industrial (palm stearin)	50	58	65	70	75	85	90	100	110	140	145
Used Cooking Oil	38	42	48	49	50	55	55	55	60	65	50
Animal Fats & Tallow's	6	6	7	7	6	5	6	6	8	10	9
Market Penetration (Million Liters)											
Biodiesel, on-road use	36	31	42	49	32	41	48	72	83	85	87
Diesel, on-road use	42,625	45,520	49,343	49,354	49,605	52,239	55,179	56,715	59,220	60,145	52,927
Blend Rate (%)	0.09	0.07	0.08	0.10	0.06	0.08	0.09	0.13	0.14	0.14	0.16
Diesel, total use	71,041	75,866	82,238	82,256	82,674	87,064	91,965	94,524	98,700	100,241	88,212

Source: Industry Sources and Post estimates[28]
f=Year 2020 projected

Section VI. Advanced Biofuels

Advanced Biofuels

The Indian biofuel industry in both the private and public sectors claims some success in developing the technology needed to convert wood and agricultural wastes (corn cob, bagasse, forage crops stalks and stover) to cellulosic fuels. Field trials remain mostly in the developmental stage and researchers are looking at efficient ways to process municipal solid waste and micro-algae into advanced biofuels. India's 2018 biofuel policy is intended accelerate progress to achieve advanced biofuel commercialization. Incentives include subsidies and grants, research and development FDI and subsidized pricing mechanisms considered more favorable than schemes for first generation biofuels. Final action for approving these incentives is subject to review by the National Biofuel Coordination Committee (See: Biofuels Policy).

[28] The statistics on production, consumption and ending stocks of biodiesel are approximates since there is no official data available.

Municipal solid waste conversion to syngas (synthesis gas) to convert into methanol, ethanol or other bio-chemicals continues to receive increased global attention and holds considerable promise for all countries. Another feedstock in the early stages of commercialization is waste flue gas from steel and other heavy industries, which can be converted through different technology platforms to ethanol and other biochemicals. Additionally, research trials are underway that investigate biofuel manufacturing from forest feedstock/softwood products.

Section VII: Notes on Statistical Data

Unless otherwise noted, calendar year (CY) is used in this report which is January to December. Fiscal year (FY) is April to March. Marketing Year (MY) or Ethanol Supply Year is December to November.

From Section IV: Ethanol

Table 4
Molasses: 1 MT = 240 liters. Since both C-heavy (final) and B-heavy molasses will be used for 2020 ethanol production; the combined conversion rate reaches 270 liters. Ethanol yield from B-Heavy molasses is considered at 300 liters/MT.

Bagasse conversion factor = 41 percent of cane crushed. Bagasse is the fibrous residue that remains after sugarcane or sorghum stalks are crushed to extract juice. It is burned in power plants to generate energy and can be used to produce cellulosic biofuels or building materials.

Press Mud = 5.4 percent of actual cane crushed, although it is reported to vary from 3.5 to 5.5 percent. Press mud is industrial waste residue resulting from sugarcane juice filtration. It can be used as an organic fertilizer and has potential as feedstock for biogas through anaerobic digestion.

Figures 4 and 5
HS Codes: Commodity: 2207 as, Ethyl Alcohol, Undenatured, Of an Alcoholic Strength by Volume Of 80% Vol. Or Higher; Ethyl Alcohol and Other Spirits, Denatured, Of Any Strength

Commodity: 271020, Petroleum Oils and Preparations Containing Biodiesel, Containing by Weight Gt=70% Petroleum Oils or Oils of Bituminous Minerals, Other Than Waste Oils

Commodity: 382600, Biodiesel and Mixtures Thereof, Not Containing or Containing Less Than 70% By Weight of Petroleum Oils or Oils Obtained from Bituminous Materials. Ethanol exports are commonly undenatured, while imports are mostly denatured ethyl alcohol.

Data Source: Trade Data Monitor (TDM), which gives trade data supplied by each reporting country's official government trade data sources.

Note: For U.S.-origin ethanol imports, the data used is from the U.S. Census Bureau. The HS codes used are (a) denatured, fuel 2207.20.0010, (b) ethanol denatured, other 2207.20.0090, (c) ethanol undenatured, fuel 2207.10.6010 and (d) ethanol undenatured, other 2207.10.6090.

Furthermore, A U.S. ethanol consignment marked *fuel-grade* does not necessarily mean that its end-use will be only for fuel use. It is a classification, as the U.S. ethanol codes were updated in 2012 to the current 10-digit HS Code. Since 2012, the U.S. system using ten-digit codes ending in '*10'* were designated as "fuel" (exports and imports) and those ending in '*90'* were designated '*Other industrial chemicals, not fuel and not beverages*.' Beverage is always undenatured, but fuel ethanol and ethanol for other industrial uses (non-fuel) can fall under *both* 2207.10 and 2207.20. India mostly imports denatured ethanol, and a minor fraction of total imports is undenatured**.** Ethanol (ethyl alcohol [80 percent or higher by volume or strength]) in India is fully harmonized at the 6-digit level code, 2207.10 (undenatured) and 2207.20 (denatured).

From Section V. Biodiesel/Renewable Diesel

The production, consumption and ending stocks of biodiesel statistics are approximate and are collated using industry sources since there is no official source data available.

Table 5

India Biodiesel production: The biodiesel yield for biodiesel feedstock such as (1) non-edible oil that includes palm stearin, palm oil free fatty acid is 1,050 liters per metric ton of feedstock weight. Similarly, (2) 1 MT of Animal Fats = 1,043 liters and (3) 1 MT of UCO = 1,043 liters.

Section VIII: Appendix

The National Policy on Biofuels 2018 defines biofuels and permits the use of the following feedstock:

1) **Bioethanol**: Ethanol produced from biomass such as sugar containing materials, like sugar cane, sugar beet, sweet sorghum etc.; starch containing materials such as corn, cassava, rotten potatoes, algae etc., and cellulosic materials such as bagasse, wood waste, agricultural and forestry residues or other renewable resources like industrial waste;

2) **Biodiesel:** A methyl or ethyl ester of fatty acids produced from non-edible vegetable oils, acid oil, used cooking oil or animal fat, and;

3) **Advanced Biofuels**: Fuels which are (1) produced from lingo-cellulosic feedstock's (i.e. agricultural and forestry residues, e.g. rice and wheat straw/corn cobs and stover/bagasse, woody biomass), non-food crops (i.e. grasses, algae), or industrial waste and residue streams, (2) having low CO_2 emission and do not compete with food crops for land use. Fuels such as Second Generation (2G) Ethanol, Drop-in fuels, algae based 3G biofuels,

bio-CNG, bio-methanol, Di Methyl Ether (DME) derived from bio-methanol, bio-hydrogen, and drop-in fuels with MSW as the source/feedstock material will qualify as "Advanced Biofuels."

i) **Drop-in Fuels**: Any liquid fuel produced from biomass, agricultural-residues, wastes such as municipal solid wastes (MSW), plastic wastes, industrial wastes etc. which meets the Indian standards for motor spirit (MS), high speed diesel (HSD) and jet fuel, in pure or blended form, for its subsequent utilization in vehicles without any modifications in the engine systems and can utilize existing petroleum distribution system.

ii) **Bio-CNG:** Purified form of bio-gas whose composition and energy potential is similar to that of fossil based natural gas, and is produced from agricultural residues, animal dung, food waste, MSW and sewage water.

The major thrust of this policy is to ensure biofuel availability from indigenous feedstock. In this direction, the creation of a National Biomass Repository was proposed, following an appraisal of biomass across the country. Potential domestic raw materials for production:

- For ethanol production: B-Molasses, sugarcane juice, biomass in the form of grasses, agriculture residues (rice straw, cotton stalk, corn cobs, saw dust, bagasse etc.), sugar containing materials like sugar beet, sweet sorghum, etc. and starch containing materials such as corn, cassava, rotten potatoes, damaged food grains such as wheat and broken rice, and surplus food grains as available. Algal feedstock and cultivation of seaweeds can also be a potential feedstock for ethanol production.

- For biodiesel production: Non-edible oilseeds, UCO, animal tallow, acid oil, algal feedstock etc.

- For advanced biofuels: biomass, and MSW.

For a comprehensive coverage of India's Biofuel Policy 2018, please refer to past report (GAIN IN9069).

Role of Stakeholders/Institutional Mechanisms:

Ministry	**Role**
Ministry of Petroleum and Natural Gas (MoPNG)	Overall coordinating ministry for biofuels development: • National Biofuel Policy and its implementation • Research, development and demonstration on applications of biofuels • Marketing and distribution of biofuels • Blending levels of biofuels • Development and implementation of pricing and procurement policy • Dispute redressal • Foster international collaboration for advanced biofuel research and capacity building • MSW for transportation fuels
Ministry of Rural Development	Planting and supply chain activities, rural livelihood programs

Department of Agriculture & Cooperation (Ministry of Agriculture & FW)	Plant materials production through nurseries and planting for biofuels in coordination with other ministries
Ministry of Environment, Forest and Climate Change (MoEF&CC)	• Biofuel planting in forested lands and environmental issues concerning biofuels • Community involvement for growing area maintenance and supply chain
Ministry of Science and Technology (Department of Biotechnology and Department of Science & Technology)	• Research and demonstration for various feedstocks and improvement of technologies for biofuel development • Promote innovation and newer research in the biofuel area • Development of technologies for bio-refinery and value added products
Ministry of Road Transport and Highway (MoRTH)	Encourage biofuels consumption/usage in the transport sector
Ministry of Railways	Encourage biofuel consumption/usage
Department of Consumer Affairs (Ministry of CA, F&PD)	Developing specifications, standards and codes for ensuring quality control of biofuels for end use
Ministry of Heavy Industries and Public Enterprises	To advise equipment manufacturers to make equipment compatible with biofuels available in the market
Ministry of New & Renewable Energy	To produce energy through biogas including enriched biogas, bio-CNG and bio-power from biomass/urban, industrial and agricultural waste
Ministry of Housing & Urban Poverty Alleviation	To coordinate with states and ULBs for the availability of MSW as an important feedstock for biofuels, including municipal solid waste in urban areas
Ministry of Consumer Affairs, Food & Public Distribution, Department of Food & Public Distribution	Provide suitable financial incentives to the sugar sector for constructing ethanol distilleries

Attachments:

No Attachments