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Biofuels Annual

2015

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Report Highlights:

Domestic ethanol production in calendar year (CY) 2016 will remain close to this year's level of 2.2 billion liters due to stable supply of sugarcane for sixth consecutive year (MY 2015/16). Fuel ethanol market penetration in CY 2016 and CY 2015 will be 2.9 percent and 2.8 percent, respectively. Both the ethanol blending program (EBP) and National Biodiesel Mission (NBM) are likely to see some momentum after the government amended and introduced several recent policy changes; which were long expected.

Post:
New Delhi

Executive Summary:

Domestic ethanol production in CY 2016 will remain close to this year's level of 2.2 billion liters due to stable supply of sugarcane for sixth consecutive year (MY 2015/16, Oct-Sept). Fuel ethanol market penetration will be 2.9 percent. The government owned petroleum companies (known colloquially as oil marketing companies (OMCs) are forecast to purchase an estimated 800 million liters of ethanol in CY 2015 and achieve fuel ethanol market penetration of 2.8 percent.

Lately, some measures such as fixed pricing mechanism for fuel ethanol procurement for OMCs, allowing ethanol produced from other non-food feedstock's besides molasses for the Ethanol Blending Program (EBP), and providing an excise duty exemption for ethanol produced in MY 2015/16, will help sugar mill clear partial debts, infuse cash flows and curtail (by some estimates) upwards of $750 million in crude oil imports.

On the biodiesel front, the market penetration is way below one percent but following the deregulation of diesel price in line with gasoline, private biodiesel manufacturers will now be encouraged to sell biodiesel directly to consumers. Further, the price of biodiesel will now be market determined, encouraging biodiesel production from multiple feedstock (crude oil, used cooking oils, animal fats etc.). A advanced biofuel production is in nascent stage as its commercial production and economic viability remains to be demonstrated.

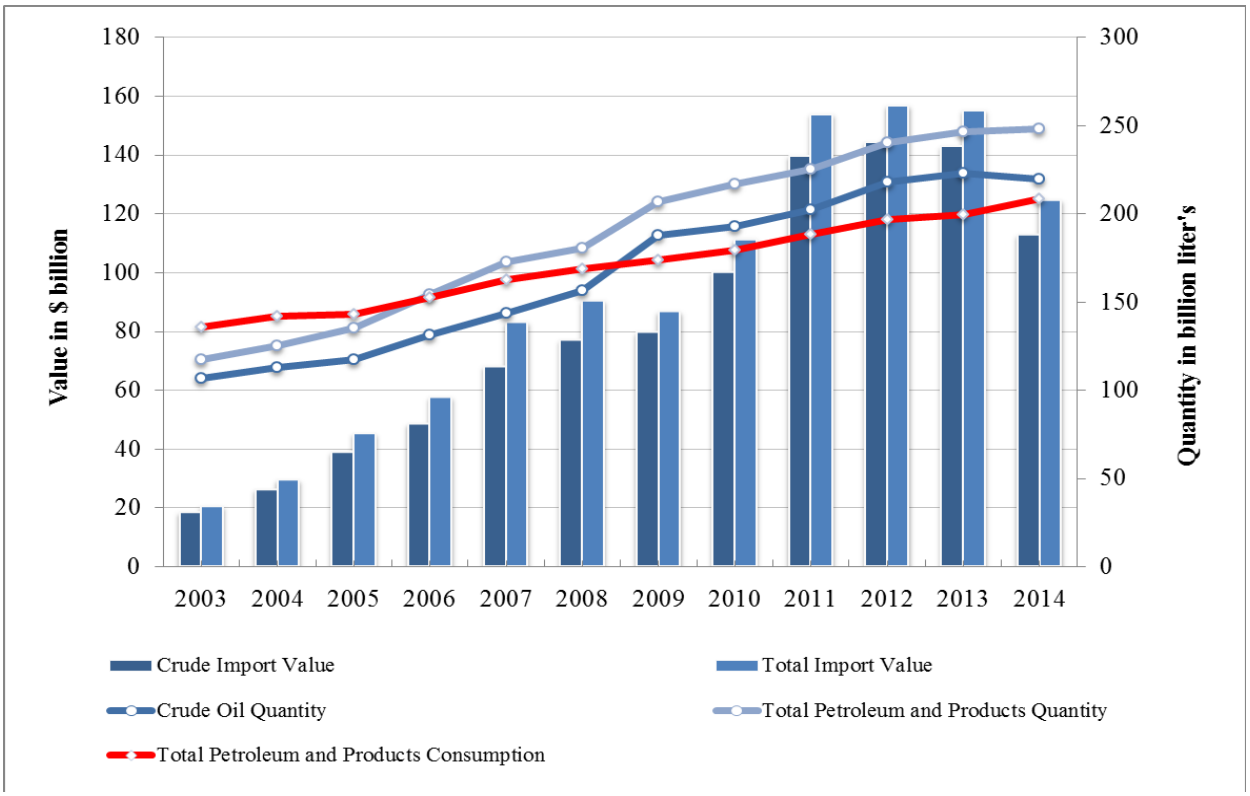
Author Defined:

Overview:

India is expected to be the world's fastest growing economy in Indian fiscal 2015-16 (April-March) at 7.5 percent. Growth is expected to further accelerate to 7.9 percent in 2016-17 and eight percent in 2017-18. Gradual implementation of reforms in India has supported business and investor confidence and encouraged capital inflows. Further, the decline in global oil prices has helped India improve fiscal and current account balances, enabled some subsidy reforms and facilitated an easing of monetary policy.

According to the latest Worldbank Report, global growth is expected to be 2.8 percent in 2015, but is expected to pick up to 3.2 percent in 2016–17. Developing economies are facing two transitions. First, the appreciation in the U.S. dollar is exerting downward pressure on capital flows to developing countries. Second, despite some pickup in the first quarter of 2015, lower oil prices are having an increasingly pronounced impact. In oil-importing countries, the benefits to activity have so far been limited, although they are helping to reduce vulnerabilities.

Figure 1. India: Import of Crude Oil, Petroleum Products and Total Consumption



Source: Petroleum Planning and Analysis Cell, Government of India (GoI)
Note: Time scale is Indian fiscal year

Post assumes that India's economic growth will further drive its energy consumption across all major sectors, and will continue to be the fourth largest primary energy consumer, trailing only the China, United States, and Russia (Source: U.S. EIA). India continues to rely on imports for a considerable amount of its energy use. India's import of gasoline and petroleum products has outgrown consumption demand in last decade. However, in last fiscal (2014/15), imports grew marginally while its value shrunk (Figure 1) due to the steep fall in crude oil prices (since mid of last year) which incidentally provided cushion against the strengthening dollar during same period. Industry think tanks assume that India's crude oil import bill in current fiscal (2015/16) will reduce further if crude oil prices remain modest and USD/INR exchange rate remains stable.

Energy consumption basket and end usage

Of the total primary energy consumption basket, coal and oil constitute 66 percent and combustible renewable and waste accounts for 25 percent of the total energy use. Natural gas has seven percent share. Other renewable such as wind, geothermal, solar, and hydroelectricity represent a 2 percent share of the Indian fuel mix. Nuclear holds a one percent share.

In terms of end usage across major sectors, energy demand across the transport sector is highest. Road transport sector accounts for 5 percent of India's Gross Domestic Product (GDP) as of fiscal 2011/12).

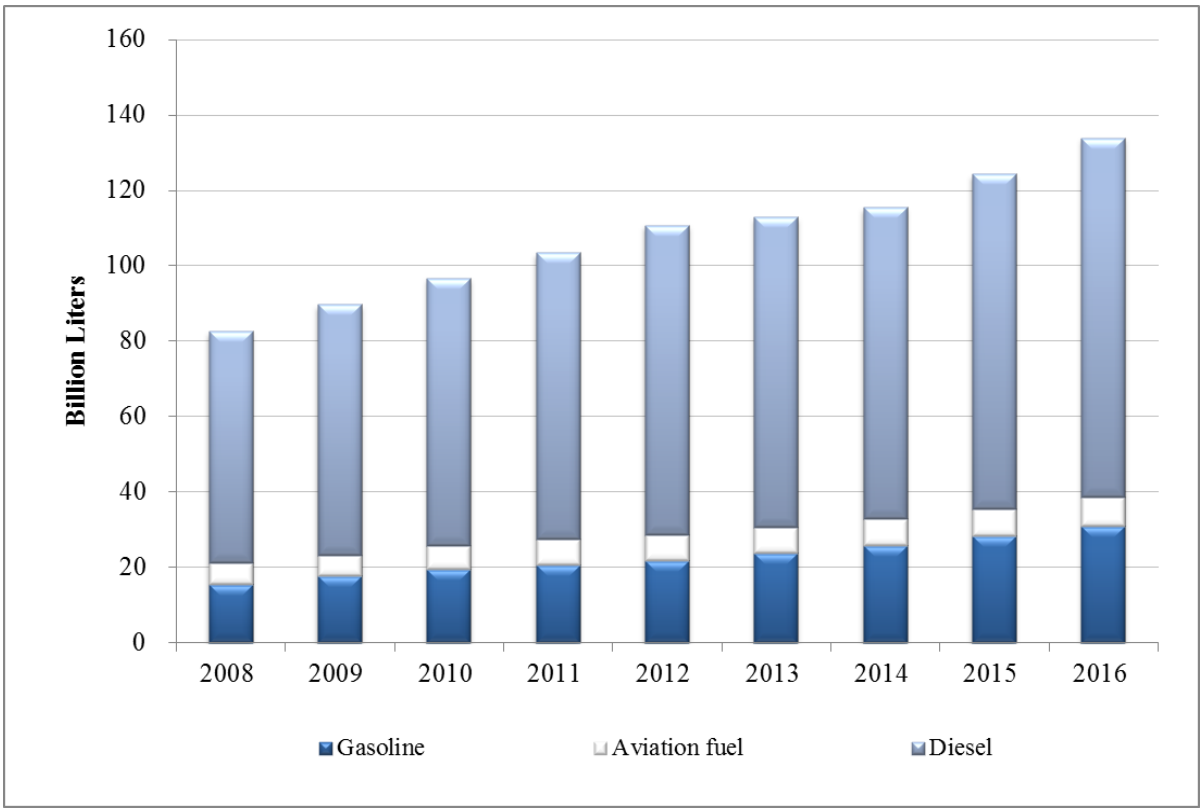
Easy availability, adaptability to individual needs and cost saving are some of the factors which go in favor of road transport. Road transport also acts as a feeder service to railway, shipping and air traffic. With the vehicle population growing at 8-10 percent annually, the share of road traffic as percent of freight and passenger traffic is estimated upwards of 60 percent and 90 percent, respectively.

The total number of registered motor vehicles in India as of March 31, 2013 were 173 million wherein two-wheelers constituted 73 percent and 'car, jeep and taxis' held 14 percent of total share, respectively (Annual Report 2014-15, Ministry of Road Transport and Highways (MRTH)). Continued economic growth, increasing urbanization, rise in consumer spending levels and with improving road infrastructure, new vehicle registration is expected to push total registered motor vehicle population to 210 million mark by end of current fiscal (2015/16).

As vehicle ownership expands, so will the demand for gasoline and petroleum products rise in tandem. Currently, diesel alone meets an estimated 72 percent of transportation fuel demand followed by gasoline at 23 percent (Figure 2) and their combined demand is expected to grow at the rate of 6 percent in coming years. Further, it's estimated that in next ten years, by the average demand for transport fuels will rise from an estimated 124 billion liters in CY 2015 to 202 billion liters in CY 2024 (Table 1).

The current growth in transport activity and consequent increase in expenditure and consumption of petroleum products which comes at a cost to the environment is raising serious concerns. Since India is the fourth (EIA energy data) largest global contributor to carbon emissions, the government of India (GoI) transport policy has targeted EURO-III and IV as reference emission norms for vehicles, which in turn require adoption of clean and green fuel. Bharat Stage-III norms are already enforced across the country while Bharat stage-IV (equivalent to Euro-IV) emission norms are applicable across 12 to 14 major cities. To meet that objective, the Union Cabinet approved the National Policy on biofuels on December 24, 2009 (PIB press release).

Figure 2. India: Consumption of Transportation Fuels, in CY



Source: Petroleum Planning and Analysis Cell, Government of India (GOI)
*: Estimated for IFY 2016

Table 1. India: Fuel Use Projections (Billion Liters)

Calendar Year →	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Gasoline Total	28	31	33	36	39	42	45	48	52	56
Diesel Total	89	95	99	103	108	112	117	122	127	132
On-road	53	57	60	62	65	67	70	73	76	79
Agriculture	11	11	12	12	13	13	14	15	15	16
Construction /mining	4	4	4	4	4	4	5	5	5	5
Shipping/rail	4	5	5	5	5	6	6	6	6	7
Industry	10	10	11	11	12	12	13	13	14	14
Heating *	7	8	8	8	9	9	9	10	10	11
Jet Fuel Total	7	8	8	9	10	10	11	12	13	14
Total Fuel Markets	124	134	141	148	156	164	173	182	192	202

Source: Industry and trade sources
*: Heating / power generation
Proportion of diesel consumption through 2024 are indicative only.

Scope

Biofuels seek to provide a higher degree of national energy security in an environmentally friendly, cost-effective and sustainable manner by supplementing conventional energy resources, reducing dependence on imported fossil fuels and meeting energy needs of India's vast rural population by use of non-food feed stocks.

Believing India to be endowed with significant potential for generating energy through renewable resources, the GoI is promoting and encouraging production and use of a) ethanol derived from sugar molasses/juice for blending with gasoline and b) biodiesel derived from inedible oils and oil waste for blending with diesel.

Additionally, biomass has been playing an important role as fuel for sugar mills (captive use), textiles, paper mills, small and medium enterprises (SME) and has significant potential in breweries, textile mills, fertilizer plants, paper and pulp industry, solvent extraction units, rice mills, and petrochemical plants. The total estimated biomass power potential in India is estimated upwards of 40,000 MW of which the power generation through bagasse cogeneration is estimated at 10,000 MW (conservative estimate is close to 5000 MW).

POLICY AND PROGRAM: 'INDIA'S BIOFUEL POLICY'

The GoI approved the National Policy on Biofuels on December 24, 2009. The policy encourages use of renewable energy resources as alternate fuel to supplement transport fuels and had proposed an indicative target to replace 20 percent of petroleum fuel consumption with biofuels (bioethanol and biodiesel) by end of 12th Five-Year Plan (2017).

In a bid to renew its focus and strongly implement the EBP, the Cabinet Committee of Economic Affairs (CCEA) on November 22, 2012, recommended 5 percent mandatory blending of ethanol with gasoline. The government's current target of 5 percent blending of ethanol in gasoline has been partially successful in years of surplus sugar production and unfilled when sugar production declines. Presently, the contracted ethanol supply for CY 2015 is sufficient to meet 2.8 percent blending target.

Notably, several recent policy decisions such as deregulating diesel prices in line with gasoline, allowing private biodiesel manufacturers to sell biodiesel directly to consumers, fixed pricing mechanism for fuel ethanol procurement for OMCs and excise duty exemption for ethanol produced in MY 2015/16 will induce some momentum to the EBP, infuse cash into the local sugar industry, help millers clear partial debts, and curtail (by some estimates) upwards of $750 million in crude oil imports.

SALIENT FEATURES OF INDIA'S BIOFUEL POLICY

- Derive biofuel from non-feed stock that would be grown on degraded soils or wastelands not otherwise suited to agriculture, thus avoiding a possible conflict of fuel versus food security.

- Strengthen India's energy security by encouraging use of renewable energy resources to

supplement motor transport fuels. An indicative 20-percent target for blending of biofuel for both biodiesel and bioethanol is proposed by end of 12th Five-Year Plan (fiscal 2012/13 through fiscal 2016/17).

- Minimum Support Price (MSP) mechanism for inedible oilseeds to provide fair price to oilseed growers but subject to periodic revision.

- Ethanol produced from other non-food feedstock's besides molasses like cellulosic and lingo-cellulosic materials and including petrochemical route, may be allowed to be procured subject to meeting the relevant Bureau of Indian Standards (BIS) standards (Cabinet Decisions).

- On December 10, 2014, the GoI announced a price fixing scheme for fuel ethanol procurement for parastatal oil marketing companies (OMCs). The program fixes landed-ethanol prices at OMC depots from INR 48.50 to INR 49.50 per liter, a three to five percent increase over the previous price.

- On January 16, 2015, the Union Cabinet decided to suitably amend Para 5.11 and 5.12 of the national biofuel policy for facilitating consumers of diesel in procuring bio-diesel directly from private bio-diesel manufacturers, their authorized dealers and joint ventures (JVs) of OMCs authorized by the Ministry of Petroleum and Natural Gas (MoPNG), GoI.

- The price of biodiesel will now be market determined.

- If necessary, GoI proposes to consider creating a National Biofuel Fund for providing financial incentives, including subsidies and grants, for new and second generation feed stocks, advanced technologies and conversion processes, and production units based on new and second generation feedstock.

- Thrust for innovation, (multi-institutional, indigenous and time bound) research and development on biofuel feedstock (*utilization of indigenous biomass feedstock included*) production including second generation biofuels.

- Meet the energy needs of India's vast rural population by stimulating rural development and creating employment opportunities and addressing global concerns about containment of carbon emissions through use of environment friendly biofuels.

- Bring biofuels under the ambit of "Declared Goods" by the GoI so as to ensure their unrestricted interstate and intrastate movement. Except for a concessional excise duty of 16 percent on bioethanol, no other central taxes and duties are proposed to be levied on biodiesel and bioethanol.

- Biofuel technologies and projects would be allowed 100 percent foreign equity through automatic approval to attract foreign direct investment (FDI), provided the biofuel is for domestic use only, and not for export. Plantations of inedible oil bearing plants would not be open for FDI participation.

- Setting up of National Biofuel Steering Committee (NBSC) under Prime Minister to provide policy guidelines.

For more information, please follow the link to biofuel policy.

Institutional Mechanism

The National Biofuel Policy proposes to set up a National Biofuel Coordination Committee (NBCC) headed by the Prime Minister. Given the role of different agencies and ministries in the biofuel program, the role of NBCC to provide high level coordination, policy guidance and review on different aspects of biofuel development, promotion and utilization becomes more imperative. The committee would meet periodically to review the progress and monitor the biofuel program. The policy also supports development of Biofuel Steering Committee headed by Cabinet Secretary to oversee implementation of its policies on regular basis.

Various state governments will work closely with respective research institutions, forestry department, universities etc. for development and promotion of biofuel program in respective states. Several states (http://www.pcra-biofuels.org/whois.htm) have drafted policies and set up institutions for promoting biofuel in their states. In order to deal with different aspects of biofuel development and promotion in the country, several ministries have been allocated specific roles and responsibilities such as

Ministry of…	Role
New and Renewable Energy (MNRE)	Policymaking and overall coordination concerning biofuels. Undertake Research and Development (R&D) on various applications of biofuels
Petroleum and Natural Gas (MoPNG)	Responsible for marketing biofuels as well as development and implementation of pricing and procurement policy
Agriculture (MoA)	R&D of biofuel feedstock through Indian Council for Agricultural Research and Indian Agricultural Research Institute (sweet sorghum, jatropha, *Pongamia*, and inedible oilseeds). Undertake jatropha plantation in non-forest land.
Rural Development	Plantation of jatropha on wastelands. Integrate biodiesel program with rural development schemes (such as Mahatma Gandhi National Rural Employment Guarantee Scheme). Coordinate R&D with other departments/agencies
Science and Technology (DST)	Support research on biofuel crops through bio-technology
Road Transport and Highway (MRTH)	Plantation along highway rights-of-way and use biofuel blended fuel. Work with automobile manufacturers association in India for engine modification, emission norms
Railways (MoRail)	Undertake plantation of jatropha over wastelands along rail rights-of-way and trials of biodiesel blended fuel on railroad locomotives.
Environment and Forest (MoEF)	Ensure plantation of jatropha and tree borne oilseeds in forest wastelands; get Central Pollution Control Board to monitor health and environmental effects.

ETHANOL POLICY

Ethanol is produced in India from sugarcane molasses and partly from grains. Beginning January 2003, GoI mandated the use of 5-percent ethanol blend in gasoline through its ambitious EBP. Ethanol and alcohol production in India depends largely on availability of sugar molasses (a byproduct of sugar production). Since sugarcane production in India is cyclical, ethanol production also varies accordingly and therefore does not assure optimum supply levels needed to meet the demand at any given time.

At times, lower availability of sugar molasses and resultant higher molasses prices affect the cost of production of ethanol, thereby disrupting supply of ethanol for the blending program at pre-negotiated fixed ethanol prices. However, recently announced price fixing scheme for fuel ethanol procurement for OMCs and with sugarcane cycle expected to enter its sixth year of surplus production, the EBP is likely to accelerate; but with slower pace.

Developments in EBP

Date	Action	Comments
January, 2003	The MoPNG made 5 percent ethanol blending (Gazette on EBP) in gasoline mandatory across 9 States and 5 Union Territories	Partially implemented due to unavailability of ethanol (due to low sugarcane production in 2003/04 and 2004/05)
September, 2006	Resurgence in sugarcane production in 2005/06 and 2006/07 led GoI mandate 5 percent blending of ethanol in gasoline across 20 states and 4 Union Territories (excludes Northeast, Jammu & Kashmir and Andaman & Nicobar) subject to commercial viability	OMC contracted for 1.4 billion litres of ethanol for EBP at Rs 21.50/litre from Nov 2006 to Nov 2009. Only 540 million litres of ethanol supplied till April 2009 due to short supply of sugar molasses. GoI deferred implementation due to short supply of sugarcane in 2007/08
September, 2008	Union Cabinet approved the National Biofuel Policy. Five percent blending mandatory across all states in the country.	GoI deferred the plan again due to short supply of sugarcane and sugar molasses in 2008/09.
October, 2008	Third phase of implementing EBP envisaged blending ratio to be increased to 10 percent.	Since there was no official notification released, oil marketing companies have not started 10 percent ethanol blending.
November 2009	Government held meeting to decide blending target for EBP	Status-quo remains, targets 5 percent EBP
August 2010	Government fixed an ad-hoc provisional procurement price of Rs 27 per liter of ethanol by OMC for EBP program. Decision was taken to constitute expert committee under Chairmanship of Dr. Choudhary, Member of Planning Commission, to recommend a formula for pricing	Expert Committee in March 2011 had recommended that ethanol be priced 20 percent lower than gasoline price. No consensus yet on pricing policy of ethanol. In any event when ethanol supply runs short, government proposed to reduce import duty on alcohol and molasses. OMC caveated the proposal

	ethanol.	that alcohol or molasses could not be imported for EBP; it has to be exclusively sourced from domestic produced molasses.
CY 2011	OMC unable to procure contracted ethanol supplies from sugar mills and ethanol manufacturers. The MoPNG, GoI has not been able to implement compulsory blending of five percent ethanol in gasoline.	Most of the domestic ethanol producers or suppliers were disqualified to supply ethanol. Non-finalization of ethanol pricing formula and procedural delays by various state governments delayed the procurement for EBP. Industry sources estimate that 365 million liters of ethanol was supplied against the contracted 570 million liters. During same period, a major share of molasses production was diverted as cattle feed to Europe.
CY 2012	OMC targets to procure 1 billion liters of ethanol for fiscal 2011/12.	After deducting the ethanol requirement for EBP in non-implementing states (such as Tamil Nadu, West Bengal, Odisha, Jharkhand, Chhattisgarh & Madhya Pradesh), the present requirement worked out to 720 million liters, of which suppliers had offered to supply 610 million liters. With lesser supply in few states, the contracted supply was subsequently drawn down to 430 million liters and further down to 305 million liters during CY 2012. Surplus molasses was exported as cattle feed to Europe.
CY 2013	In a bid to renew its focus and strongly implement the EBP, the (CCEA on November 22, 2012, recommended five-percent mandatory blending of ethanol with gasoline. Henceforth, the procurement price of ethanol shall be decided by between	The Union government under the Motor Spirits Act on January 2 notified that few states such as Uttar Pradesh, Delhi, Haryana, Punjab, Karnataka and Goa can even achieve up to 10 percent ethanol blending target, but the overall average for the country as whole should reach five percent by end of June 30, 2013. The interim (ad-hoc) price of INR 27 per liter would no longer hold as price would

	the OMC and suppliers of ethanol (CCEA recommendation). OMC floated a joint e-tender in first week of January for procuring 1.4 billion liters of ethanol to be supplied during April 2013 through March 31, 2014. With the validity of the offer for the domestic tender expiring on May 27, 2013, the offer was further extended on request by two months through July 26, 2013. Per one of the CCEA recommendations, in case of any shortfall in domestic availability, the OMCs and chemical companies were free to import ethanol for EBP. Since OMCs were falling short by more than 820.3 million liters of ethanol, they floated a global tender in third week of January to augment remaining supplies. The tender floated in January 2013 for 1.4 billion liters of ethanol supply through March 14 was extended to November 2014.	now be decided by market forces. Indian ethanol suppliers (sugar manufacturers) offered to supply 551 million liters. Price quoted by suppliers ranged from INR 38 to INR 54 per liter (*delivered at OMC Depot*). The price quoted by few bidders was perceived to be on the higher side. OMCs received five offers from both Indian and international suppliers, of which one was rejected. (This was the first time the government had allowed foreign suppliers to offer ethanol for domestic EBP. Suppliers offered around 620 million liters of ethanol. However, the price quoted (INR 69 to 92 per liter of ethanol, C&F depot) was perceived to be high and therefore the global tender was rejected. Of the total ethanol offered by suppliers, the quantity accepted for procurement by OMCs was 382 million liters. Per industry sources, during CY 2013, all the contracts were valid for supplies until November 2014, but OMC got validity extended through May 2015. The fuel ethanol blend rate that could be achieved then was 1.6 percent.
CY 2014	OMCs floated another tender in July 2013 for procuring 1.33 billion liters of ethanol for supply during December 2013 through November 2014. In January 2014, OMCs floated an EOI for procuring additional ethanol. GoI was contemplating to raise EBP	The quantity offered by sugar mills/ethanol manufacturers was 618 million liters. The quantity accepted by OMC for procurement was 247 million liters. Quantity offered by sugar mills was 53 million liters and the whole volume was accepted to be procurement by OMCs. Total quantity accepted by OMC was thus 247 + 53 million liters = 300 million

	program from 5 to 10 percent in near future.	liters. Assuming that OMC shall come out with another tender soon for ethanol procurement for CY 2015, Post anticipated that OMC shall procure another 50 million liters in December 2014. The cumulative volumes likely to be accepted by OMCs for blending with gasoline will be 350 million liters, which translates market penetration at 1.4 percent.
	There was a proposal to revise the formula to fix the benchmark price for ethanol procurement. The proposed formula would be based on the average of the refinery transfer price (RTP) or cost of petrol to the oil marketing companies for the previous financial year instead of the lowest RTP, which stood at INR 44 a liter. The revised formula was expected to be a win-win opportunity for both the stakeholders.	The EBP was being implemented in a total of 13 states with blending level of about 1.2 percent. Post expected some momentum when the new pricing formula was put in place and 'implemented'. Major distilleries were reported to have exported ethanol as well as molasses (as cattle feed) as way to infuse cash flows in otherwise surplus sugar season when sugar mills are finding difficult to break-even.
	On December 10, 2014, GoI announced a price fixing scheme for fuel ethanol procurement for OMCs. The program fixes landed-ethanol prices at OMC depots from INR	The OMCs were offering a ceiling price of INR 44 per liter ($0.74), delivered at various depots. The ex-mill prices of molasses based products (rectified spirit, extra neutral alcohol and fuel ethanol ($.67 per liter)) ranged from INR 33-46 per liter. The offered price by OMC then was still attractive for some suppliers or sugar mills although prevailing (average) retail price of gasoline was still on a higher side. This will likely accelerate India's EBP, infuse cash into the local sugar industry, help millers pay down debts, and curtail (by some estimates) upwards of $750 million in crude oil imports. In previous years, Post has observed that India has the capacity to fulfill its ethanol blending

	48.50 to INR 49.50 per liter ($0.76 to $0.77/liter), a three to five percent increase over the previous price.	mandate, provided there are equal incentives for both the producers and blenders. Read GAIN IN4121 for further information.
CY 2015	In July 2014, OMCs floated a tender for procuring 1.56 billion liters of ethanol from supply from December 2014 to November 2015. Subsequent to above tender OMC floated an EOI in December 2014 seeking to procure upwards of 1.6 billion liters (970 + 670 million liters) of ethanol. Further, OMCs floated an EOI in March 2015 seeking 656 million liters (367+289 million liters) of ethanol. A third EOI was expected to float in May/June and will be open for bidding in July. In April 2015, GoI removed 12.36 central excise duty levied on ethanol supplied for blending with gasoline.	The actual supply started from January 2015. Around 622 million liters was offered by sugar mills of which 355 million liters was believed to be accepted by the OMCs (INR 44.5/liters). Quantity offered by sugar mills was 532 million liters of which 362 million liters was accepted by OMCs. The quantity offered by sugar mills was 125 million liters of which 93 million liters was accepted by OMC. It's estimated that OMC may be able to procure additional 40 million liters by end of CY 2015. Total quantity accepted by OMCs for blending will be (355+362+93+40) = 850 million liters. Industry sources expect that of this total, around 800 million liters may actually blend with gasoline, thereby doubling the existing blend rate to 2.8 percent. The excise duty exemption will be applicable for ethanol produced from molasses generated during the next sugar season (October 2015-September 2016) and supplied for blending with gasoline (PIB Press Release). Industry sources claim that sugar mills are expected to benefit to an extent of INR 5 per liter on sale of ethanol for blending. Post expects that in CY 2016, India may be able to achieve 2.9 to 3 percent blend rate if market conditions remain favorable. Further, it is estimated that by end of CY 2017, India would require more than 6.6 billion liters (Table 1) of

		ethanol to meet its ambitious target of 20 percent EBP. Given the current pace of development, a target to meet 5% blending of ethanol (1.4 billion liters) with gasoline looks plausible.

Expanding domestic ethanol supply could address supply issues

- If mills are given the freedom to flexibly deploy the juice extracted from cane, whether to crystallize most of it into sugar or ferment it into alcohol, they will produce more of whichever fetches higher revenues[1]. Additionally, diverting B-heavy molasses could produce additional ethanol when required. The cyclical swings in sugar production could also be addressed provided India's EBP is robust.

- Current research and development activities are focused more on second-generation bio-diesel production from locally available ligno-cellulosic material or agricultural and forest residues; which has its own set of challenges and opportunities. Both the private and public sectors claim to be successful in customizing technology (low-cost) to generate power (on pilot scale) from bio-mass resources, particularly ligno-cellulosic material. However, scaling up of such projects on a commercial scale is yet to be seen, while industry observers are optimistic.

- Public and private institutions can also promote use of alternate crops such as sweet sorghum, sugar beet, sweet potatoes, pearl millet and broken rice to supplement domestic ethanol production, though the efforts to produce ethanol from these feed stocks are only experimental or at pilot stage.

- The GoI offers subsidized loans through sugarcane development funds to sugar mills for setting up of ethanol production units.

Impediments

Procedural hurdles such as non-issuance of export permits for interstate transport of ethanol, delay in issuing no-objection certificates (NOC), plus higher taxes and levies across different states have impeded the EBP. Rules and regulations, including the high excise duty (central excise duty of INR 750 per metric ton on molasses versus 12.36% ad valorem on industrial alcohol (exempted from next sugar cycle), interstate charges, and so on applicable to control alcohol for potable industry use are equally applicable for ethanol blending with gasoline, thereby severely constraining its availability and utilization for EBP.

BIODIESEL POLICY

The GoI had launched the National Biodiesel Mission (NBM) identifying jatropha (*jatropha curcas*) as the most suitable inedible oilseed for biodiesel production. The central government and several state governments provide fiscal incentives for supporting planting of jatropha and other inedible oilseeds.

[1] Excerpts from *Hindu Business Line* column "Dithering on ethanol", March 14, 2014.

Several public institutions, government departments, state biofuel boards, state agricultural universities and cooperative sectors also supported the biofuel mission in various capacities.

The Planning Commission of India had set an ambitious target of planting 11.2 to 13.4 million hectares to jatropha by the end of 11th Five Year Plan (2011/12). However, the GoI's ambitious plan of producing sufficient biodiesel by 2011/12 (marketing year October/September) to meet its mandate of 20-percent blending with diesel was unachievable mostly due to unavailability of sufficient feedstock (jatropha seeds) and lack of high-yielding drought-tolerant jatropha cultivars. Hence most of the biodiesel units operating in India have shifted to alternative feed-stocks such as edible oil waste (unusable oil fractions), animal fat and inedible oils, utilizing almost 28 percent of their existing capacity to continue year round operations.

Meeting a hypothetical 5-percent biodiesel blending target would require a dedicated plantation of energy crops or a probable switch to alternate sources of biodiesel from locally available tree-borne oilseeds, utilizing multiple feedstock and imported biodiesel (if viable).

Lately, GoI has deregulated diesel price in line with gasoline. Following up, the Union Cabinet has also allowed private biodiesel manufacturers, their authorized dealers and joint ventures (JVs) of OMCs authorized by the MoPNG to sell biodiesel directly to consumers subject to their product meeting prescribed BIS standards.

Developments in NBM:

Date	Action	Comments
April, 2003	Demonstration phase 2003 to 2007: Ministry of Rural Development appointed as nodal ministry to cover 400,000 hectares under jatropha cultivation. This phase also proposed nursery development, establishment of seed procurement and establishment centers, installation of trans-esterification plant, blending and marketing of biodiesel	Public and private sector, state government, research institutions (Indian and foreign) involved in the program achieved varying degrees of success.
October, 2005	The MoPNG announced biodiesel purchase policy in which OMC would purchase biodiesel across 20 procurement centers across the country to blend with high speed diesel w.e.f January 2006. Purchase price set at INR 26.5 per litre	Cost of biodiesel production higher (20 to 50 percent) than purchase price. No sale of biodiesel.
CY 2008	Self-Sustaining Execution phase 2008 to 2012: Targeted to produce sufficient biodiesel for 20 percent blending by end of XIth (2008-12) five year plan	Lack of large scale plantation, conventional low yielding jatropha cultivars, seed collection and extraction infrastructure, buy-back arrangement, capacity and confidence building

		measures among farmers impeded the progress of this phase.
CY 2010	An estimated 0.5 million hectares has been covered under jatropha cultivation of which two third plant populations is believed to be new plantation and would take two to three years to mature	Assuming 80 percent biodiesel requirement is met though jatropha oilseeds, the biodiesel thus obtained will just meet 0.01 percent of total biodiesel required for 5 percent blending by 2010/11.
CY 2011	No additional wastelands have been brought under jatropha cultivation except for few captive plantations managed by OMCs.	The government may have to offer fiscal incentives (coupled with carbon credits) to growers to adopt better agronomic practices during first 2-3 years of plantation development besides marketing and price support mechanism to encourage jatropha plantation.
CY 2012	The production of biodiesel from jatropha seeds remained commercially insignificant.	According to the MoPNG, no biodiesel (from jatropha) has been procured by oil marketing companies for blending with diesel in last three to four years.
CY 2013	Biodiesel production from multiple feed-stocks (crude oil, used cooking oils, animal fats etc.) was an economically viable option left with the producers.	Most of the plants utilizing this technology were able to make commercial sales in last few years despite running close to third of their installed capacities (480 million liters estimated). Industry sources claim that small to medium scale industries are the major buyers of biodiesel (methyl ester) who blend it with conventional diesel. Industry sources claimed that the average purchase price of biodiesel in India then was around INR 45-48 per liter (includes freight) and seem viable for blending as regular diesel was selling at a price premium of 18-20 percent over biodiesel (methyl ester).
CY 2014	Industries engagement with tree-borne oilseeds as alternate to jatropha for biodiesel production gets due attention.	Seed yield from jatropha plantation (on pilot scale) were observed to be significantly lower than stipulated. Consequently, cost of production of biodiesel from jatropha seed is too high providing little incentive for producers to go full throttle. Evidently, in last few years, few stakeholders (from private

		and government sector) were engaged in identifying tree-borne oilseeds (neem, pongamia, mahua and kusum) as alternate to jatropha for bio-diesel production, but on an experimental basis. However, availability, feasibility and sustainability of tree-borne oilseeds still need to be validated. Biodiesel producers claim to realize INR 38-40 from sale of a liter of biodiesel (excludes transportation cost). Hopes are high that if subsidy on diesel gets gradually phased out, then biodiesel producers may get a larger pie.
	GoI in October 2014 deregulated diesel prices in line with gasoline.	The retail price will now be decided by the market forces and GoI will no longer have to compensate OMCs for selling diesel below market prices. This step will incentivize firms engaged in biodiesel production in India.
CY 2015	On January 16, the Union Cabinet chaired by the Prime Minister, Shri Narendra Modi, gave its approval for amending the Motor Spirit (MS) and High Speed Diesel (HSD) Control Order for Regulation of Supply, Distribution and Prevention of Malpractices dated 19.12.2005. The Cabinet has also decided to suitably amend Para 5.11 and 5.12 of the National biofuel policy for facilitating consumers of diesel in procuring bio-diesel directly from private bio-diesel manufacturers, their authorized dealers and JVs of OMCs authorized by the MoPNG. This decision will encourage the production and use of bio-diesel in the country.	The amendment will allow private biodiesel manufacturers, their authorized dealers and JVs of OMCs authorized by the MoPNG as dealers and give marketing and distribution functions to them for the limited purpose of supply of bio-diesel to consumers. The investment and production conditions (as applicable) specified in the marketing resolution dated March 8, 2002, of MoPNG will also be relaxed and a new clause added to give marketing rights for biodiesel (B100) to the private biodiesel manufacturers, their authorized dealers and JVs of OMCs authorized by the MoPNG for direct sales to consumers. As the price of diesel is already deregulated, private biodiesel manufacturers are encouraged to sell biodiesel directly to consumers subject to their product meeting prescribed BIS

		standards (PIB Press release). Further, industry sources claim that few private firms are selling biodiesel at discount (3-5 percent) to conventional diesel and still making decent profits.

Impediments

The combination of smaller land holdings and ownership issues with government- or community-owned wastelands has resulted in very little progress made by state governments to create large jatropha plantations. Negligible commercial production of biodiesel from jatropha seeds (through old technology) has stymied efforts and investments by both private and public-sector companies. Additionally, purchase price of biodiesel should be made attractive to boost production.

ETHANOL

India has around 330 distilleries which can produce over 4 billion litres of rectified spirit (alcohol) per year. Of this total, about 143 distilleries have the capacity to distill over 2 billion liters of conventional ethanol. India produces conventional bioethanol mostly from sugar molasses and partly from grains. Production of advanced bioethanol is in its research and development stage.

Table 2. India: Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 *
Beginning Stocks	734	1,374	1,642	1,240	1,021	627	624	468	377	166
Production	2,398	2,150	1,073	1,522	1,681	2,154	2,057	2,002	2,219	2,186
Imports	15	70	320	92	39	34	33	107	120	300
Exports	23	12	14	53	119	177	234	175	200	140
Consumption	1,750	1,940	1,780	1,780	1,995	2,015	2,012	2,025	2350	2350
Fuel Consumption	200	280	100	50	365	305	382	350	800	900
Ending Stocks	1,374	1,642	1,240	1,021	627	624	468	377	166	162
Production Capacity										
No. of Refineries	115	115	115	115	115	115	115	115	115	115
Nameplate Capacity	1,500	1,500	1,500	1,500	1,500	2,000	2,000	2,000	2,000	2,000
Capacity Use (%)	160	143	72	101	112	108	103	100	111	109
Feedstock Use (1,000 MT)										
Feedstock A	9,992	8,958	4,469	6,342	7,004	8,975	8,573	8,343	9,246	9,108
Market Penetration										

Fuel Ethanol	200	280	100	50	365	305	382	350	800	900
Gasoline	14,189	15,368	17,606	19,563	20,716	21,842	23,749	25,848	28,252	30,879
Blend Rate (%)	1.4	1.8	0.6	0.3	1.8	1.4	1.6	1.4	2.8	2.9

Source: FAS/New Delhi Estimates based on information from trade sources
*: Forecast

Production

Domestic ethanol production in CY 2016 will remain close to this year's level of 2.2 billion liters due to stable supply of sugarcane for sixth consecutive year. Fuel ethanol market penetration will be 2.9 percent. Likewise blend rate of 2.8 percent looks achievable in CY 2015. Industry sources have indicated that the OMCs have committed to procure close to 800 million liters during CY 2015. Technically, the installed capacity is sufficient to meet around 8 percent of blending with gasoline.

The landed-ethanol price delivered at OMC depot is fixed from INR 48.50 to INR 49.50 per liter ($0.76 to $0.78/liter), a three to five percent increase over the previous price. The offer is attractive for sugar mill given that average retail price of gasoline is on slightly higher side. However, with sugar mills already running on negative margins due to high production cost and depressed sugar prices, any procedural delay in EBP could encourage them to divert ethanol to chemical and potable industries. Additionally, mills could divert molasses as cattle feed or for exports if their prices are competitive.

Consumption

Ethanol consumption in CY 2016 will remain stable at this year's level of 2.3 billion liters despite the fact that a third of total ethanol supply is expected to blend with gasoline. Steady rise in supply of molasses and strong demand from allied sectors will support larger ethanol consumption.

Trade

India continues to be a net importer of ethanol. Starting 2003, when GoI laid its ambitious EBP, the trade balance for ethanol has been negative, but has tapered down in last five years in response to rise in domestic production.

During CY 2014, India imported 107 million liters (largest in last five years) of ethanol worth $87 million dollars mostly from United States (66 million liters). Exports were limited to over 18 million liters; worth $15 million. The United States, Netherland, Spain, Bhutan and Pakistan were major exporters of ethanol to India while Saudi Arabia, Ghana, Kenya, Nepal, Cote d lvoire, and Cameroon were major importers.

The latest trade data for first quarter of CY 2015 indicate that India has imported ethanol upwards of 35 million liters; worth $29 million, of which 25 million liters were from the United States. Exports were close to 2.8 million liters worth $ 2.6 million of which Ghana bought close to a million liter.

In India, export of biofuel is only permitted after it meets the domestic requirement and the final

decision is taken by the National Biofuel Coordination Committee. The GoI provides no financial assistance for exports of biofuels. However, current trade regulations allow duty-free imports of feed stocks for re-export by certified export oriented units.

Duty

The basic Customs duty on import of denatured ethanol has been reduced from 7.5 percent to 5 percent as per Customs Notification No.12/2014 dated July 11, 2014. Lower import duty helps make imports attractive and economically viable. Traditionally, India imports ethanol only to meet shortfalls in demand during years of lower sugar production. Demand is mostly for consumption across the potable liquor and chemical industries and **not for fuel**. There are no quantitative restrictions on import of biofuels as well.

Table 3. India: Import duty on biofuels (percent ad valorem on CIF value)

ITC HS Tariff Number	Total Import duty (percent)
2207.20 Denatured Ethyl Alcohol and Spirits (including ethanol)	5
3824.90 Chemical products not elsewhere specified (including biodiesel)	26.42

Source: Central Board of Excise and Customs, GoI
12/11.07.2014

Ending Stocks

Steady rise in consumption demand; particularly in last 5 years has led to steep decline in stocks from over one million liters in CY 2010 to just 166 million liters in CY 2015. Anticipating higher blend rate in CY 2016, end stock will remain tight.

BIODIESEL

The enthusiasm of producing biodiesel from jatropha has apparently faded despite its potential to withstand drought and rehabilitate degraded wastelands. Limited availability of jatropha seeds (due to poor productivity), static plantations (inspite of being state subject, only a few states have been able actively to promote jatropha plantation with public and private sector participation), lack of promising varieties/cultivars, rising wage rates, and inefficient marketing channels has risen the cost of production, making it economically unviable proposition.

Consequently, there has been no commercial sale of biodiesel across the biodiesel purchase centers set up by the GoI. The initial hypothesis that 'jatropha' (*Jatropha curcus*) could grow in semi-arid regions with little care and fertilization' is proven void, with research trials contradicting the initial claim. Evidently, researchers have gradually shifted their focus and resources to study feasibility of producing bio-diesel from tree-borne oilseeds (TBOs) such as pongamia (*Pongamia pinnata*), neem (*Azadirachta indica*), kusum (*Schleichera oleosa*), mahua (*Madhuca longifolia*), and waste edible oils. Some firms

claim to import limited quantity of biodiesel (assuming they were viable) and sell it locally after meeting prescribed standards.

Table 4. India: Biodiesel Production from Multiple Feedstock (Million Liters)

Calendar Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Beginning Stocks	45	38	42	45	45	50	45
Production	90	102	115	120	130	135	140
Imports	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0
Consumption	52	60	70	75	80	90	100
Ending Stocks	38	42	45	45	50	45	40
Production Capacity							
No of Biorefineries	5	5	5	6	6	6	6
Nameplate Capacity	450	450	460	465	480	480	500
Capacity Use (%)	20.0%	22.7%	25.0%	25.8%	27.1%	28.1%	28.0%
Feedstock Use (1,000 MT)*							
Used Cooking Oil	38	42	48	49	50	50	52
Animal Fats & Tallow's	6	6	7	7	6	5	6
Other Oils	50	58	65	70	75	85	85
Market Penetration							
Biodiesel, on-road use	26	30	35	38	40	45	50
Diesel, on-road use	42,625	45,520	49,343	49,354	49,605	53,284	57,244
Blend Rate (%)	0.06	0.07	0.07	0.08	0.08	0.08	0.09
Diesel, total use	71,041	75,866	82,238	82,256	82,674	88,807	95,407

Source: Industry and Post estimates
CY 2016 is projected
* Used cooking oil includes vegetable oils such as rice bran oil, palm stearine, cotton seed oil and fatty acid oils while 'Other Oils' include tree oils, palm sludge etc.

Currently, India has 5-6 large capacity plants (10,000 to 250,000 MT per year) currently utilizing 28 percent of the installed capacity to produce 125-140 million liters of biodiesel from multiple feed-stocks such as inedible vegetable oils, unusable edible oil waste (used-once), and animal fats. The biodiesel thus produced is purchased by small and medium enterprises, sold to experimental projects carried out by automobiles and transport companies (state sponsored or private trial runs), apart from minor sales to unorganized consumers such as cellular communication towers, brick kilns, progressive farmers, and to institutions that run diesel generators as source of power back-up.

ADVANCED BIOFUELS

The Indian biofuel industry, both private and public sector, claim to be successful in developing and customizing technology for converting ligno-cellulosic materials in form of wood biomass, agricultural (corn cob, bagasse, stalk of forage crops) waste and forest waste. Trials are underway to process municipal solid waste, micro-algae and photosynthetic organisms into advanced biofuels. However, given the technological challenges, commercial production and economic viability remains to be demonstrated.

Biomass for heat and power

Scope

Biomass resource has the potential to produce grid-quality power utilizing various conversion technologies notwithstanding the scope to optimize power generation from sugar bagasse. Wide benefits include its renewability, wide adaptability, carbon neutrality and the potential to generate employment in rural areas. The potential could be enhanced further if dedicated plantation in forest and degraded land are linked to biomass power (MNRE, GoI). Additionally, biomass (*non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms*) has been playing an important role as fuel for sugar mills, rice mills, textiles, and raw material for paper mills, small and medium enterprises.

Biomass material

Bagasse, rice husk, straw, cotton stalk, coconut shells, soy husk, de-oiled cakes, coffee waste, jute wastes, peanut shells, and sawdust are used a raw material for power generation The crop residues from non-fodder crops, e.g., cotton, oilseeds, chilies and bamboo residues may also be considered as good alternatives for biomass power production (DST, GoI). However, the use of biomass as cattle feed and part utilization by power industries may lead to a rise in cost of fuel for biomass power plant as it may not be available unless exclusively grown for power generation.

Biomass Availability and Power Potential

Biomass availability in India is estimated at upwards of 915 million metric tons (MMT) which covers both agricultural (657 MMT/year) and 'forestry & wasteland' residues (260 MMT/year). The combined power potential from both resources is estimated at 33,292 MWe (agro: 18,730 MWe and forest and wasteland: 14,562 MWe) (Source: Biomass Knowledge Portal).

Bagasse power cogeneration

With modernization of new and existing sugar mills, surplus power generation through bagasse cogeneration in India's 550 sugar mills is estimated at 10,000 MW (target for 12th Five-year plan is to achieve 32 percent of total potential) if these mills were to adopt technically and economically optimal levels of cogeneration for extracting power from the bagasse they produce.^ The optimum cogeneration capacity installed in Indian sugar mills is one of the highest among major sugar producing countries. The total estimated biomass power potential is thus estimated upwards of 40,000 MW.

Note: Some think tank estimate bagasse based power generation potential close to 5000 MW. Considering the preceding estimate, total biomass power potential scales down to proportionate value.

The GoI has initiated several programs and schemes for promoting renewable energy sources.

Seventeen Indian states have policies for development of biomass power. Biomass power projects attract fiscal incentives such as accelerated depreciation, concessional customs duties, and income tax exemptions. Emphasis will be put on development of fuel value-chain business models while encouraging the operating period of bagasse cogeneration projects from 180-220 to 300-plus days. Further details may be accessed from mnre.gov.in

Table 3. India's Biomass-Based Commercial Energy Achievement

Sector	Cumulative Achievements (March 31, 2015)	Total target by end of 12th five year plan
A. Grid Interactive Power (Capacities in MW)		
Biomass power and gasification	1410.20	1525
Bagasse cogeneration	3008.35	3216
Waste to power	115.08	324
B. Off-Grid /Captive Power (Capacities in MW_{EQ})		
Waste to energy	154.47	NA
Biomass (non-bagasse) Cogeneration	591.87	NA
Biomass Gasifiers		
i)Rural	17.95	NA
ii)Industrial	152.05	NA
Biogas based energy system	4.07	NA

Source: Ministry of New and Renewable Energy, GoI Notes:
NA: Not Available
MW: Megawatts
MW eq: Megawatts equivalent