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Global Agricultural Information Network

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India

Biofuels Annual

2011

Approved By:

Thom Wright

Prepared By:

Amit Aradhey

Report Highlights:

Biofuel production and consumption in India is at its nascent stage and is evolving. The Government of India (GOI) approved the National Policy on Biofuels on December 24, 2009. The policy proposes a target of 20 percent blending of biofuel both for bio-diesel and bio-ethanol by 2017. India's biofuel strategy continues to focus on use of non-food resources; namely sugar molasses for production of ethanol and non-edible oils for production of biodiesel. The government's current target of 5 percent blending of ethanol in petrol has been partially successful in years of surplus sugar production and unfilled when sugar production declines. Since commercial production of biodiesel in India (through *jatropa*) is small, large scale blending of biodiesel with conventional diesel has not yet started.

Post:

New Delhi

Executive Summary:

The Government of India approved the National Policy on biofuels on December 24, 2009. The biofuel policy encourages use of renewable energy resources as alternate fuel to supplement transport fuels and proposed an indicative target of 20 percent blending of biofuel (bio-diesel and bio-ethanol) by 2017.

Presently, the government is unable to implement compulsory blending of 5 percent ethanol in petrol. However, with an outlook of bumper sugarcane and sugar production in 2011/12, the government is likely to renew its focus and strongly implement the mandatory 5 percent ethanol blending in petrol provided the Union Cabinet takes a decision on the purchase price of ethanol for the Ethanol Blending Program.

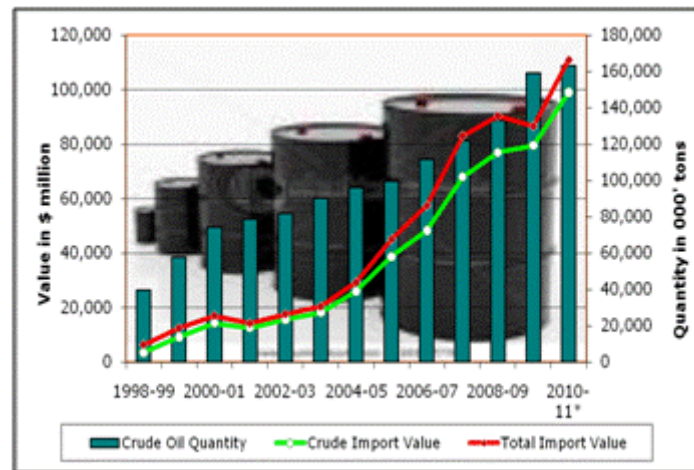
Production of biodiesel in India is commercially insignificant and will take a long time to be demonstrated as economically viable biofuels. The government's plan to blend 20 percent of biodiesel with conventional diesel by 2011/12 is improbable due to the unavailability of high yielding drought tolerant jatropha seeds and a lack of sufficient jatropha seeds to produce bio-diesel.

However, biomass available in the country can and has been playing an important role as fuel for sugar mills, textiles, paper mills, and small and medium enterprises (SME). In particular there is a significant potential in breweries, textile mills, fertilizer plants, the paper and pulp industry, solvent extraction units, rice mills, petrochemical plants, etc. to harness biomass power.

Author Defined:**INTRODUCTION**

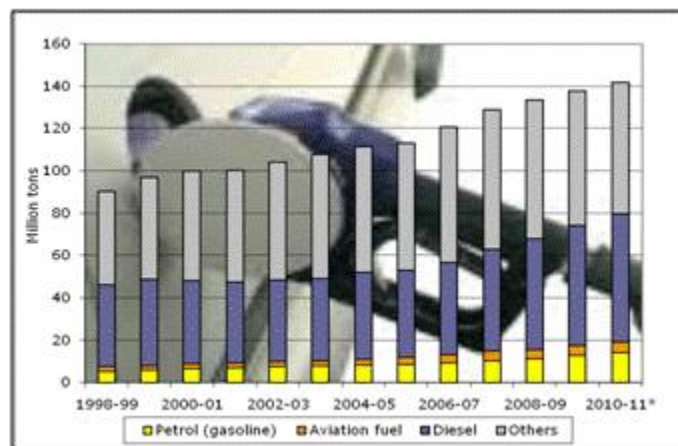
India is the fifth largest primary energy consumer (per international energy annual) and the fourth largest petroleum consumer in the world. A growing population, increasing per capita income, infrastructural development and rapid socio-economic development has spurred an increase in energy consumption across all major sectors of the Indian economy. It is estimated that India meets 80 percent of its total oil consumption through petroleum and petroleum product imports. Given limited domestic energy resources, escalating global crude oil prices, and growth in domestic consumption of petroleum products, India's oil import expenditure has increased. Expenditure on the import of petroleum products (Chart 1) in fiscal 2010/11 is currently estimated at over \$ 110 billion, up \$24.3 billion over the previous year, and almost five times the value in fiscal 2003/04. Consequently petroleum consumption (Chart 2) in India has also gone up from 91 million tons in Indian Fiscal Year (IFY) 1998/99 to 138 million tons in IFY 2009/10 and is expected to grow to over 142 million tons in IFY 2010/11.

Chart 1: Import of Crude Oil and Value of Petroleum Products



Source: Petroleum Planning and Analysis Cell, Government of India (GOI)

Chart 2: Consumption of Petroleum Products



Source: Petroleum Planning and Analysis Cell, Government of India (GOI)

*: Estimated for 2010/11

The average consumption of petroleum products in India is estimated as ([petroleum consumption](#)):

Transport (Petrol, Diesel, CNG, Aviation Fuel) : 51 percent

- Industry (Petrol, Diesel, Fuel Oil, Naphtha, Natural Gas): 14 percent
- Commercial and Others: 13 percent
- Domestic (LPG and Kerosene): 18 percent
- Agriculture (Diesel): 4 percent

In terms of end-use, energy demand across the transport sector is likely to be higher (roads being the dominant source of transport in India carry almost 90 percent of the countries passenger traffic and 65 percent of its freight), as growth in the economy, rises in domestic spending levels, and improving road

infrastructure have led to increases in new vehicle registrations and ownership (especially four wheel vehicles). The on-road vehicle population in India (industry estimate) in last five years has increased from 49 million to more than 65 million vehicles in 2009 and is expected to cross 120 million by 2015 assuming motor vehicle population grows at 8 to 10 percent per year.

Diesel and petrol (gasoline) based oils meet more than 95 percent of the requirement for transportation fuel, and the demand has been expected to grow by 6 to 8 percent per year during the 11th Five Year Plan (2007-12). The current growth in transport activity and the consequent increase in expenditure and consumption of petroleum products are posing serious concerns for the environment.

Given that India is the fourth ([energy data](#)) largest global contributor to carbon emissions, the GOI transport policy is targeting EURO-III and IV norms for vehicles, which in turn would require adoption of clean and green fuel. The government is seriously concerned for economic, environmental (India's carbon emissions are growing at the rate of 3.2 percent annually) and energy security and is looking for alternate fuels to meet energy demand.

With an aim to meet the above objectives, the Union Cabinet has finally approved the National Policy on biofuels on December 24, 2009 ([PIB press release](#)). Endowed with significant potential for generating energy through renewable resources, the GOI is promoting and encouraging production and use of i) ethanol derived from sugar molasses/juice for blending with gasoline and ii) biodiesel derived from non-edible oils and oil waste for blending with diesel.

POLICY AND PROGRAM: 'INDIA'S BIOFUEL POLICY'

The Government of India (GOI) approved the National Policy on Biofuels on December 24, 2009

SALIENT FEATURES OF INDIA'S BIOFUEL POLICY

- The creation of a National Biofuel Steering Committee (NBSC) under the Prime Minister to provide policy guidelines.
- Strengthen India's energy security by encouraging the use of renewable energy resources to supplement transport fuels. A 20 percent target for blending of biofuel for both biodiesel and bioethanol is proposed.
- Meet the energy needs of a vast rural population in India to stimulate rural development and create employment opportunities.
- Address global concerns about containment of carbon emissions through the use of environment friendly biofuels.
- Derive bio-fuel from non-feed stock that would be raised on degraded or wastelands that are not suited to agriculture, thus avoiding a possible conflict of fuel verses food security.
- Facilitate and bring about optimal development and utilization of indigenous biomass feedstock for the production of biofuels. The policy also envisages development of a new generation of more efficient biofuel conversion technologies based on new feed stocks.

- A Minimum Support Price (MSP) mechanism to ensure a fair price for bio-diesel oilseed growers. The implementation of the proposal would be considered carefully after consultation with stake holders, central and state governments and then by Biofuel Steering Committee and finally decided by National Biofuel Coordination Committee.
- Oil Marketing Companies have proposed to purchase bio-ethanol at the Minimum Purchase Price (MPP) based on the actual cost of production and the import price of bio-ethanol. In the case of biodiesel, the MPP should be linked to the prevailing retail diesel price.
- If necessary, the 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.
- Bring bio-fuels under the ambit of “Declared Goods” by the Government so as to ensure its unrestricted movement within and outside the States.
- Except for a concessional excise duty of 16 percent on bioethanol, no other central taxes and duties are proposed to be levied on bio-diesel and bio-ethanol.
- Thrust for innovation, (multi-institutional, indigenous and time bound) research and development on bio-fuel feedstock production including second generation biofuels.
- Biofuel technologies and projects would be allowed 100 percent foreign equity through automatic approval route to attract Foreign Direct Investment (FDI), provided biofuel is for domestic use only, and not for export. Plantations of non-edible oil bearing plants would not be open for FDI participation.

For more information on ‘India’s Biofuel Policy’ please follow the link ([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 the 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 progress and monitor the biofuel program. The policy also supports development of the Biofuel Steering Committee headed by the 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 programs in the respective states. A few states (<http://www.pcrabiofuels.org/whois.htm>) have drafted policies and set up institutions for promoting bio-fuel 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	Policymaking and overall coordination concerning biofuels. Undertake Research and Development (R&D) on various applications of biofuels
Petroleum and Natural Gas	Responsible for marketing bio-fuels as well as development and implementation of pricing and procurement policy
Agriculture	R&D of biofuel feedstock through ICAR and IARI (sweet sorghum, <i>jatropha</i> , <i>pongamia</i> , and non-edible oilseeds). Undertake <i>jatropha</i> plantation in non-forest land.
Rural Development	Plantation of <i>jatropha</i> on wastelands. Integrate bio-diesel program with rural development schemes (such as Mahatma Gandhi National Rural Employment Guarantee Scheme). Coordinate R&D with other department/agency
Science and Technology	Support research on biofuel crop through bio-technology
Road Transport and Highway	Plantation along highway and use biofuel blended fuel. Work with automobile manufacturers association in India for engine modification, emission norms etc.
Railways	Undertake plantation of <i>jatropha</i> over wastelands along railway track and trials of bio-diesel blended fuel on railway engines.
Environment and Forest	Ensure implementation of <i>jatropha</i> and tree-borne oilseeds plantations in forest wastelands; get Central Pollution Control Board to monitor health and environmental effects.

ETHANOL POLICY

Ethanol is produced in India from sugarcane molasses for blending with petrol. Beginning January, 2003, GOI mandated the use of 5 percent ethanol blend in petrol through its ambitious Ethanol Blending Program (EBP).

Developments in EBP

Date	Action	Comments
January, 2003	Ministry of Petroleum and Natural Gas (MoPNG) made 5 percent ethanol blending (Gazette on EBP) in petrol (gasoline) mandatory across 9 States and 5 Union Territories	Partially implemented due to the 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 the GOI to mandate 5 percent ethanol blending in gasoline across 20 states and 8 Union Territories subject to commercial viability	Oil Marketing Companies (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. The GOI deferred implementation due to a short supply of sugarcane in 2007/08
September, 2008	The Union Cabinet approved the National Biofuel Policy. Five percent blending became mandatory across all states in the country. The third phase of implementing EBP envisaged the blending ratio to be increased to 10 percent, with a	GOI deferred the plan again due to short supply of sugarcane and sugar molasses in 2008/09. Blending target of 10 percent under present circumstances seems to be distant reality.

	targeted 20 percent blending by 2017.	
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Ethanol and alcohol production in India depends on the availability of sugar molasses (a byproduct of sugar production). Since sugarcane production in India is cyclical, ethanol production also varies, thus not assuring the optimum supply levels needed to meet the demand at a given time. Lower sugar molasses availability and consequent higher molasses prices affect ethanol cost of production, thereby causing disruption in the supply of ethanol for the blending program at pre-negotiated fixed ethanol prices.

Presently, the Ministry of Petroleum and Natural Gas, GOI has not been able to implement compulsory blending of 5 percent ethanol in petrol (gasoline) due to disagreement between different ministries over the compulsory 5 percent EBP. There is disagreement over the ethanol blending program (EBP) and the interests of potable liquor and chemical makers. There is also opposition to the proposed increase in the price oil companies pay for buying ethanol to Rs 27 per litre from the earlier price of Rs 21.50 per litre. Further, there is apprehension towards the possibility of diverting food grains for the manufacture of ethanol due to the government's likely adoption of food security law proposed by the National Advisory Council.

To resolve the ongoing issue, the GOI established an expert committee on ethanol pricing in July, 2010, and was asked to recommend a long term formula for fixing the price of ethanol. The committee came up with a draft report in October 2010 recommending the ethanol price that was not agreed upon by other members. The issue stands unresolved till date.

Expanding ethanol supply

Currently, the government does not allow the use of imported ethanol for the EBP program, as the focus is on developing domestic capacities.

- Ethanol is manufactured directly from sugar molasses but given the projection for higher sugarcane production in India for 2011/12 (upswing in production cycle), the use of sugarcane juice (on experimental basis) for ethanol production seems to be a viable option especially under conditions of sugarcane glut in the country.
- The GOI is offering subsidized loans (through sugarcane development funds) to sugar mills for the creation of an ethanol production unit. The loan would cover a maximum of 40 percent of the project cost.
- Given the limited scope of bringing additional area under water intensive sugarcane cultivation, fluctuations in supply and pricing of ethanol could be stabilized through the use of alternate crops. Public and private institutions can promote the use of alternate crops such as sweet sorghum, sugar beets or sweet potatoes, to supplement domestic ethanol production, though the efforts to produce ethanol from these feed stocks are at experimental stage.

Impediments:

Higher taxes and levies across different states have impacted the EBP. Rules and regulations [high

excise duty (presently, there is central excise duty of Rs 750/- per ton on molasses which works out to 30 to 50 percent ad valorem, whereas on industrial alcohol the central excise duty is 16 percent ad valorem), inter-state charges etc] applicable to the control of the potable alcohol industry use are equally applicable for ethanol blending with petrol, thereby severely constraining its availability and utilization for the EBP.

BIO-DIESEL POLICY

The GOI launched the National Bio-diesel Mission (NBM) identifying *jatropha curcas* as the most suitable tree-borne oilseed for bio-diesel production. The Planning Commission of India had set an ambitious target covering 11.2 to 13.4 million hectares of land under *jatropha* cultivation by the end of the 11th Five Year Plan (2011/12). The central government and several state governments provide fiscal incentives for supporting planting of *Jatropha* and other non-edible oilseeds. Several public institutions, state biofuel boards, state agricultural universities and cooperative sectors are also supporting the biofuel mission in various capacities.

Developments in NBM

Date	Action	Comments
April, 2003	Demonstration phase 2003 to 2007: The Ministry of Rural Development appointed as nodal ministry to cover 400,000 hectares under <i>jatropha</i> cultivation. This phase also proposed nursery development, establishment of seed procurement and establishment centres, installation of a trans-esterification plant, blending and marketing of bio-diesel	Public & private sector, state government, research institutions (Indian and foreign) involved in the program achieved varying degrees of success.
October, 2005	MoPNG announced a bio-diesel purchase policy in which OMC's would purchase bio-diesel across 20 procurement centres across the country to blend with high speed diesel w.e.f January 2006. Purchase price set at Rs 26.5 per litre	Cost of bio-diesel production higher (20 to 50 percent) than purchase price. No sale of bio-diesel.
2008	Self Sustaining Execution phase 2008 to 2012: Targeted to produce sufficient biodiesel for 20 percent blending by the end of the XI th (2008-12) five year plan	Lack of large scale plantation, conventional low yielding <i>jatropha</i> cultivars, seed collection and extraction infrastructure, buy-back arrangements, capacity and confidence building measures among farmers impeded the progress of this phase.
2010	An estimated 0.5 million hectares has been covered under <i>jatropha</i> cultivation of which two-thirds is estimated to be new plantation, requiring two to three years to mature	The government may have to offer fiscal incentives to growers to adopt better agronomic practices during the first 2-3 years of plantation development besides marketing and price support mechanism to encourage the biodiesel program

The GOI's ambitious plan of producing sufficient bio-diesel by 2011/12 (marketing year

October/September) to meet its mandate of 20 percent blending with diesel is looking like a distant reality given the unavailability of sufficient feedstock (jatropha seeds) and lack of considerable research and development to evolve high yielding drought tolerant jatropha seeds.

Per a recent policy brief paper published by the National Centre for Agricultural Economics and Policy Research (NCAP), around 3.21 million tons of biodiesel would be required from an estimated area of 3.42 million hectares to meet a target of 5 percent blending by the IFY 2011-12. The above projection assumes a) rise in demand for diesel (@7.5 percent/annum since 2004-05) and b) considers jatropha to be a major feedstock for biodiesel (80 percent biodiesel requirement to be met through jatropha) with an average seed yield of 2.5 tons/hectare and 30 percent biodiesel recovery rate. The diesel demand in country by 2011-12 is projected at 64.19 million tons (76.5 billion liters).

Other issues such as smaller land holdings, ownership issues with the government or community owned wastelands, very little progress made by state governments to meet large scale jatropha plantations, and negligible commercial production of bio-diesel has stuck the efforts and investments made by both private and public sector companies.

Given the slow pace of jatropha planting and with reports of most of the bio-diesel companies in India working at very low capacity and some even lying idle, the GOI was contemplating to fix a higher price of Rs 34 per litre (compared to Rs 26.5 /litre last year) for the purchase of bio-diesel (please refer our previous GAIN report IN1058 for more information) through Oil Marketing Companies. Industry views this move as support to bring back the idle companies in running condition. The price is believed to have been mutually agreed to by the GOI and industry representatives. However, recently, industry and stakeholders have recommended a higher price tag (Rs 36 per litre) for purchase of biodiesel.

Ethanol

India has 330 distilleries which produce over 4 billion litres of rectified spirit (alcohol) per year. Of the total distilleries, about 120 distilleries have the capacity to distillate 1.8 billion litres (an additional annual ethanol production capacity of 365 million litres was built up in last three years after government provided funds to sugar mills) of conventional ethanol per year and meet the demand for 5 percent blending with petrol. Currently, India produces conventional bio-ethanol from sugar molasses and production of advanced bio-ethanol is in its nascent phase (research and development).

Table 1: Conventional Bioethanol Production and Distribution (million liters)

Calendar Year	2006	2007	2008	2009	2010	2011	2012
Opening Stock	483	747	1,396	1,673	1,283	1,085	1,049
Production	1,898	2,398	2,150	1,073	1,435	1,934	2,130
Imports	29	15	70	320	150	50	100
Total Supply	2,410	3,160	3,616	3,066	2,868	3,069	3,279
Exports	24	14	3	3	3	10	10
Consumption							
Industrial Use	619	650	700	700	720	750	775
Potable Liquor	745	800	850	880	900	950	1010

Blended petrol	200	200	280	100	50	250	300
Other Use	75	100	110	100	110	110	110
Total Consumption	1639	1750	1940	1780	1780	2010	2095
Ending Stocks	747	1,396	1,673	1,283	1,085	999	1,024
Total Distribution	2,410	3,160	3,616	3,066	2,868	3,069	3,279
Production Capacity (Conventional Fuel)							
Number of Biorefineries	115	115	115	115	115	115	115
Capacity (billion lit ³)	1.5	1.5	1.5	1.5	1.5	1.5	1.8
Feedstock Use (1,000 MT)							
Feedstock A (000 ³ tons)	7,910	9,992	8,958	4,469	5,981	8,060	8875

Source: FAS/New Delhi Estimates based on information from Trade Sources

Production

With an outlook of bumper sugarcane and sugar production in 2011/12, the government is likely to renew its focus and strongly implement the mandatory 5 percent ethanol blending in petrol provided the Union Cabinet takes a decision on the purchase price of ethanol for EBP. Further, sugar mills may divert their stocks for ethanol production to offset falling prices of sweetener, which in turn would provide supplementary income to the distilleries and would ensure farmers a better price for sugarcane. Short supplies of sugar molasses in preceding years constrained ethanol production and consequent higher prices made it unviable to supply ethanol to petroleum companies at the negotiated prices. Higher sugarcane and sugar production in 2010/11 has raised ethanol production and improved total ethanol supply to offset short (opening) stocks.

Consumption

The strong growth in consumption of ethanol across the chemical industry, the potable liquor industry and EBP is expected to raise the total ethanol consumption over 2 billion litres in 2011/12. Ethanol supply for EBP is unlikely to be constrained given the improved supply situation. According to industry and trade sources, ethanol availability during 2011/12 is forecast at 300 million litres, against the target of 1 billion litres set by the industry. Ethanol consumption for EBP in 2010/11 has been raised by 200 million litres from 50 million litres in 2009/10 mostly due to improved supply of molasses and steady demand of ethanol from competing industries. During 2009/10, higher market prices of ethanol were attractive for the suppliers to divert their supplies from EBP.

Trade

India imports ethanol only to meet shortfalls in demand during years of low sugar production. The demand is mostly for consumption across potable liquor and chemical industries and not for fuel purpose. Exports of ethanol are negligible, however, a small volume of ethanol exports (approx 41,000 litres during first three quarters of Calendar Year 2010) were noted for Ghana, Netherland, Tanzania, Saudi Arabia, Nepal, Liberia, Sri Lanka, U.A.E, Bhutan, Malaysia and other African countries.

Although there are no quantitative restrictions on the import of biofuels, high duties (Table 2) on tariff lines make imports economically unviable. The GOI does not provide any financial assistance for exports of biofuels (biodiesel and ethanol). However, current trade regulations allow duty free imports of feed stocks for re-export by certified export oriented units.

Table 2: 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)	28.64
3824.90 Chemical products not elsewhere specified (including biodiesel)	28.64

End Stocks

The end stocks for the forecast year (2012) are likely to recover to 1.2 billion litres, up 125 million litres over current year's estimate. Tight end stocks are the result of a steady growth in consumption.

Biodiesel

Commercial production of biodiesel in India (through *jatropha*) is small, with estimates varying from 140 to 300 million litres per year. There are about 20 large capacity biodiesel plants (10,000 to 200,000 tons per year) in India that produce biodiesel from edible oil waste (unusable oil fractions), animal fat and non-edible oils. The biodiesel produced is sold to the unorganized sector (irrigation pumps, agricultural usage, diesel generators etc) and to experimental projects carried out by automobiles and transport companies. However, as per industry sources, there has been no commercial sale of biodiesel to state owned transport companies except for trial runs. Additionally, there has been no commercial sale of biodiesel across the biodiesel purchase centres (set up by GOI) as the government advised biodiesel purchase price of Rs 26.5 (58.75 cents) per litre is still below the estimated biodiesel finished production cost (Rs 30 to Rs 40 per litre / 66-89 cents per litre). Lack of feedstock supply (*jatropha* seeds), higher wage rates and inefficient marketing channels are among few of the major factors that have contributed to higher production cost.

In order to revive and accelerate the biodiesel industry, a recent study taken up by the industry recommends the present procurement price of biodiesel to be reviewed and raised up to a level which is sustainable and realistic and suggests to ensure average procurement price of *jatropha* seeds at realistic level such that farmers do not shift land from 'food' to 'fuel' crop.

Establishment and promotion of *Jatropha* plantations is a state subject. Several corporates, petroleum companies and private companies have entered into a memorandum of understanding with state governments to establish and promote *jatropha* plantations on government wastelands or contract farming with small and medium farmers. However, only a few states have been able to actively promote *jatropha* plantation despite the government's incentives.

Advanced Biofuels

Research and development activities (experimental or pilot trials by select industry groups and government's research institutes) are being carried out to develop suitable technologies for production of advanced biofuels from wood biomass, agricultural and forest waste, municipal solid waste conversion, microalgae and photosynthetic organisms. Given technological challenges, commercial production of advanced biofuels would take a long time before its being demonstrated as economically viable biofuels.

Biomass for heat and power

The Ministry of New and Renewable Energy, GOI, is implementing the biomass power program with the objective of harnessing grid quality power from biomass resources through various conversion technologies along with optimizing power generation from bagasse produced in sugar mills. The benefits include its renewable nature, wide adaptability, carbon neutrality and the potential to provide large productive employment in rural areas. The current potential for power generation from surplus agriculture and forestry residues is estimated at 16,881 Mega Watts (MW) Equivalent (Table 3). The optimum cogeneration capacity installed in the Indian sugar mills is one of the highest among all the major sugar producing countries of the world. With modernization of new and existing sugar mills the surplus power generation through bagasse cogeneration in the country's 550 sugar mills is estimated at 5000 MW if these mills were to adopt technically and economically optimal levels of cogeneration for extracting power from the bagasse produced by them. Thus the total estimated biomass power potential ([biomass power](#)) is about 24,581 MW.

The availability of biomass in India is estimated at about 500 million tons per year covering residues from agriculture, agro-industrial, forestry and plantations. Around 120-150 million tons of surplus agro-industrial and agricultural residues (a survey by Ministry of New and Renewable Energy, GOI, indicated that 15-20 percent of total crop residues could be used for power generation, without altering their present uses) per year can be made available for power generation; which as per the Ministry is estimated at 18,000 MW. Biomass (non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms) availability in the country can and has been playing an important role as fuel for sugar mills, textiles, paper mills, and small and medium enterprises (SME). In particular; there is a significant potential in breweries, textile mills, fertilizer plants, paper and pulp industry, solvent extraction units, rice mills, petrochemical plants, etc.

The GOI has initiated several programs and schemes for promoting renewable energy sources, the details of which may be accessed from www.mnre.gov.in

Table 3: India's Biomass based Commercial Energy Achievement

	Sources/Systems	Estimated Potential	Achievements during 2010-11	Cumulative Achievement
			(up to 31/01/2011)	
1	Biomass Power (<i>Agri-residues and plantations</i>)	16,881 MW	143.50 MW	997.10 MW
2	Biomass Power Cogeneration (<i>Non-bagasse</i>)	-	61.19 MW	282.07 MW
3	Biomass Power Cogeneration (<i>Bagasse</i>)	5,000 MW	257 MW	1603.03 MW
4	Waste to Energy	2,700	7.50 MW	72.46 MW
5	Biomass Gasifier	-	6.72 MW eq	128.16 MW eq
6	Family Type Biogas Plants	12 Million	73,281 units	4.32 million units

Source: Ministry of New and Renewable Energy, GOI

Notes:

MW: Megawatts

MW eq: Megawatts equivalent

