

USDA Foreign Agricultural Service

# GAIN Report

Global Agricultural Information Network

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## India

## Biofuels Annual

## 2010

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**Report Highlights:**

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 bio-diesel and bio-ethanol by 2017. India's biofuel strategy continues to focus on the use of non-food resources; namely sugar molasses for production of ethanol and non-edible oils for the production of biodiesel. The government's current target of 5 percent blending of ethanol in petrol has been successful in years of surplus sugar production, but unfilled when sugar production declines. Biodiesel production in India is very small due to inadequate supplies of feedstock.

**Post:**  
New Delhi

### **Executive Summary:**

The Government of India (GOI) approved the National Policy on Biofuels on December 24, 2009. The biofuel policy encourages use of renewable energy resources as alternate fuels to supplement transport fuels (gasoline and diesel for vehicles) and proposes a target of 20 percent biofuel blending (bio-diesel and bio-ethanol) by 2017.

Presently, the government is unable to implement compulsory blending of 5 percent ethanol in petrol (gasoline) due to the short supply of sugar molasses in 2009/10 and 2008/09 because of overall low sugarcane crop production in India. Consequently, India imported about 280 million liters of ethanol in CY 2009 to meet the demand for industrial and potable liquor production<sup>[1]</sup>. With a bumper sugarcane and sugar production outlook for 2010/11, the government is likely to renew its focus and implement the mandatory 5 percent ethanol blending in petrol. Industry sources report that the government is likely to take a decision on the purchase price of ethanol for the Ethanol Blending Program (EBP).

Commercial production of biodiesel in India is very small and its utilization is mostly confined to the unorganized sector. The government's ambitious plan of producing sufficient bio-diesel by 2011/12 to meet its mandate of 20 percent diesel blending is unrealized due to a lack of sufficient jatropha seeds to produce bio-diesel. Advanced biofuels in India are still at the research stage and it will take time before commercial production becomes economically viable.

Biomass is frequently used in sugar mills, textiles, paper mills, and small and medium enterprises (SME) for both heat and power generation.

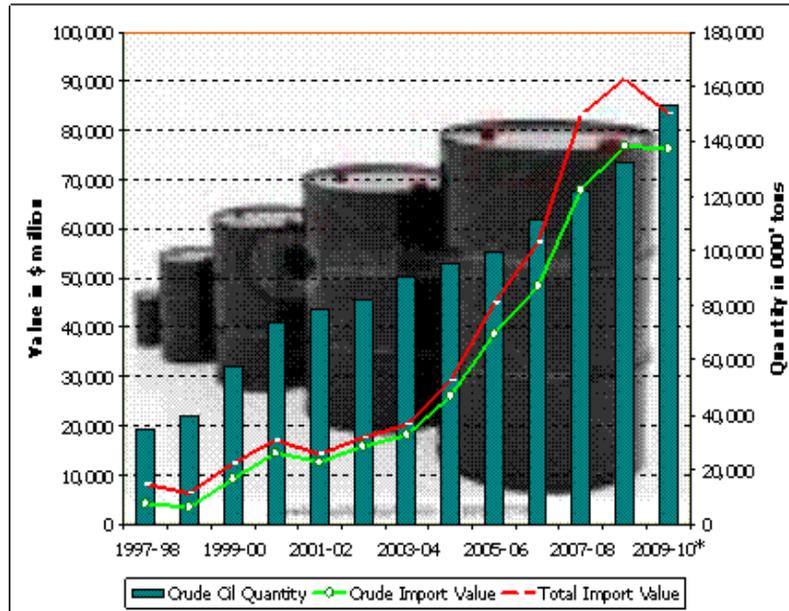
<sup>[1]</sup>India does not import ethanol or other biofuels for fuel purpose

### **Policy and Programs:**

#### **INTRODUCTION:**

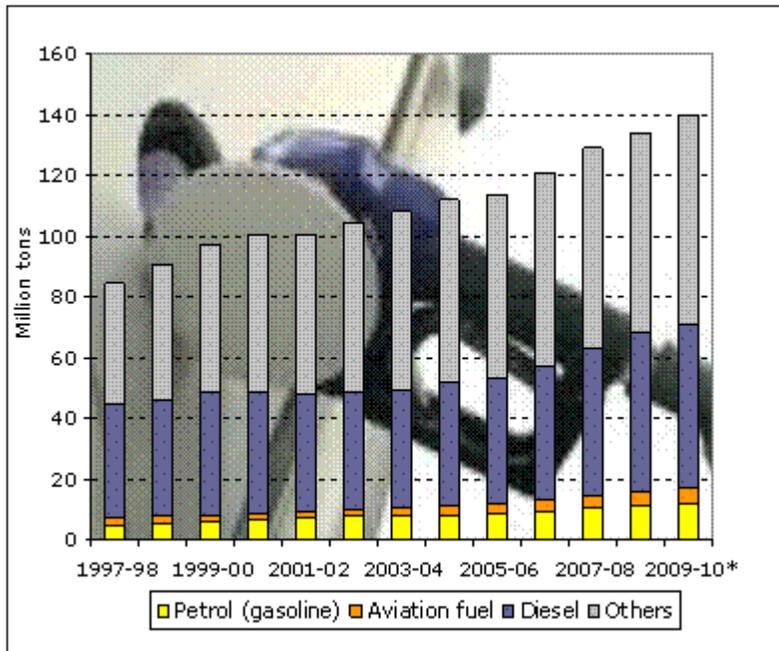
India is the fifth largest primary energy<sup>[1]</sup> consumer and fourth largest petroleum consumer in the world. Growing population and rapid socio-economic development has spurred an increase in energy consumption across all major sectors of the Indian economy. Given limited domestic energy resources, most energy requirements are met through imports. Provisional estimates indicate that India meets more than 76 percent of its petroleum demand through imports. Import expenditures on petroleum products (Chart 1) in fiscal 2009/10 is currently estimated at over \$83 billion, up four times the value in fiscal 2003/04. Consequently, Indian petroleum consumption (Chart 2) has also gone up from 84 million tons in Indian Fiscal Year (IFY) 1997/98 to 134 million tons in IFY 2008/09 and is expected to grow over 136 million tons in IFY 2009/10.

**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 2009/10

Per an estimate from the GOI's Petroleum Conservation Research Association, the average consumption of petroleum products <sup>[2]</sup> in India is as follows:

1. Transport (Petrol, Diesel, CNG, Aviation Fuel) : 51 percent
2. Industry (Petrol, Diesel, Fuel Oil, Naphtha, Natural Gas): 14 percent
3. Commercial buildings and Others: 13 percent
4. Domestic (LPG and Kerosene): 18 percent
5. Agriculture (Diesel): 4 percent

Energy demand across the transport sector is likely to be higher <sup>[3]</sup> given double digit growth in the Indian economy, rise in domestic spending levels, and improving road infrastructures have all led to an increase in new vehicle registrations and ownership. India's on-road vehicle population <sup>[4]</sup> has increased from 49 million to more than 65 million vehicles over the last five years and is expected to grow annually by 8 to 10 percent. Diesel and gasoline-based oils meet more than 95 percent of the requirement for transportation fuel, and demand has been expected to grow by 6 to 8 percent per year during the 11<sup>th</sup> Five Year Plan (2007-12).

The current growth in transport activity and the consequent increase in petroleum consumption is posing serious concerns for the environment. Given that India is the world's fourth <sup>[5]</sup> largest 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 about economic, environmental <sup>[6]</sup> and energy security, and is looking for use of alternate fuels to meet energy demand in a technically efficient, economically viable and environmentally sustainable manner.

Presently 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 <sup>[7]</sup> on December 24, 2009.

##### **SNAPSHOT OF INDIA'S NATIONAL POLICY ON BIOFUELS:**

- Setting up a National Biofuel Coordination Committee under the Prime Minister for a broader policy perspective and set up a National Biofuel Steering Committee (NBSC) to provide policy guidelines.
- Strengthen India's energy security by encouraging use of renewable energy resources to supplement transport fuels. A 20 percent target for blending of biofuel for both bio-diesel and bio-ethanol by 2017 is proposed.
- Meet the energy needs of a vast rural population as well as stimulate rural development and create employment opportunities.
- Address global concerns about the containment of carbon emissions through the use of environmentally friendly biofuels <sup>[8]</sup>.
- Derive bio-fuels from non-feed stock that would be raised on degraded land 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 next-generation, more efficient biofuel conversion technologies based on new feed stocks.
- 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 the Biofuel Steering Committee and finally decided by National Biofuel Coordination Committee.
- Oil Marketing Companies propose to purchase bio-ethanol at a 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.
- As necessary, the GOI proposes considering 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 feed stocks.
- Except for a concessional excise duty of 16 percent on bio-ethanol, no other central taxes and duties are proposed for on bio-diesel and bio-ethanol.
- A thrust for innovation, (multi-institutional, indigenous and time bound) on research and development of bio-fuel feedstock production, including second generation biofuels.
- Biofuel technologies and projects will be allowed 100 percent foreign equity through automatic approval routes 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.

#### **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 (see table below), NBCC will provide high level coordination, policy guidance and review on biofuel development, promotion and utilization programs. The policy suggests setting up of a Biofuel Steering Committee headed by Cabinet Secretary to oversee implementation of its policies on regular basis.

Under the National Biofuel Policy, state governments will work closely with research institutions, forestry departments, universities, etc. for the development and promotion of biofuel programs in their respective states. A few states <sup>[9]</sup> have drafted policies and set up institutions for promoting bio-fuel in their states. Several ministries have been allocated specific roles and responsibilities in biofuel development and promotion in the country.

#### **ETHANOL POLICY**

Ethanol is produced in India from sugar molasses for blending with petrol. Beginning January, 2003, the 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 <sup>[10]</sup> in petrol (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 8 Union Territories subject to commercial viability	OMC contracted for 1.4 billion liters of ethanol for EBP at Rs 21.50/liters from Nov 2006 to Nov 2009. Only 540 million liters 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. Blending ratio to be raised to 10 percent. Targets 20 percent blending by 2017.	GOI deferred the plan again due to short supply of sugarcane and sugar molasses in 2008/09.

Since Indian sugarcane production is cyclical, ethanol and alcohol production in India depends on the availability of sugar molasses (a byproduct of domestic sugar production). Lower sugar molasses availability and consequent higher molasses prices have impacted ethanol’s cost of production, thereby causing a disruption in the supply of ethanol at pre-negotiated fixed ethanol prices. Presently, the government is unable to implement compulsory blending of 5 percent ethanol in petrol (gasoline) due to the short supply of sugar molasses in 2009/10 and 2008/09 on low sugarcane crop production. With a bumper sugarcane and sugar production outlook for 2010/11, the government is likely to renew its focus and implement the mandatory 5 percent ethanol blending in petrol. Industry sources report that the GOI is likely to take a decision on providing a hike in purchase price <sup>[11]</sup> of ethanol for the Ethanol Blending Program (EBP) for upcoming 2010/11 season.

**Augmenting ethanol supply:**

Currently, the government does not allow use of imported ethanol for the EBP program, as the focus is on developing domestic production capacities. To augment supply, the GOI has permitted ethanol production directly from sugarcane juice <sup>[12]</sup> while ensuring that the move does not constrain production of sugar or ethanol for industrial use. Efforts to produce ethanol from sweet sorghum, sugar beets, and sweet potatoes, however, are at the experimental stage. The government does not provide any direct financial assistance or tax incentive for the production or marketing of ethanol or ethanol blended petrol. The GOI is offering subsidized loans (through sugarcane development funds) to sugar mills for building ethanol production units. The loans would cover a maximum of 40 percent of the project cost to sugar mills for development of ethanol production unit.

**Impediments:**

Higher taxes and levies in different states have impacted the Ethanol Blending Program. Rules and regulations (high excise duty <sup>[13]</sup>, inter state charges etc.) applicable to the control of alcohol for potable industry use are equally applicable for ethanol blending with petrol, thereby constraining its availability and utilization for the EBP.

## BIO-DIESEL POLICY

On April, 2003 the GOI launched a National Bio-diesel Mission (NBM) identifying *jatropha curcas* as the most suitable tree-borne oilseed for bio-diesel production on wastelands. The Planning Commission of India had set an ambitious target of covering 11.2 to 13.4 million hectares of land under *jatropha* cultivation by end of 11<sup>th</sup> 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.

### Developments in NBM:

Date	Action	Comments
April, 2003	<b>Demonstration phase 2003 to 2007:</b> 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 trans-esterification plants, 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 bio-diesel purchase policy in which Oil Marketing Companies (OMC) 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 liter	Cost of bio-diesel production higher (20 to 50 percent) than purchase price. No sale of bio-diesel.
2008	<b>Self Sustaining Execution phase 2008 to 2012:</b> Targeted to produce sufficient biodiesel for 20 percent blending by end of XI <sup>th</sup> (2008-12) five year plan	Lack of large scale plantations, seed collection and extraction infrastructure, buy-back arrangements, capacity and confidence building measures among farmers impeded the progress of this phase.

The GOI's ambitious plan of producing sufficient bio-diesel to meet the mandate of 20 percent blending with diesel by 2011/12 is proceeding slowly. Commercial production of biodiesel in India is very small. According to trade and industry estimates, *jatropha* has been planted across 500,000 hectares of wasteland, of which 65-70 percent is estimated to be new plantation and would take three to four years to mature. As a result, there are insufficient *jatropha* seeds to crush for bio-diesel production <sup>[14]</sup>.

Given the slow pace of *jatropha* plantation growth and with reports that most of the bio-diesel companies in India are idle or at very low capacity, the GOI may consider a higher price of Rs 34 per liter (compared to Rs 26.5 /liter last year) for bio-diesel <sup>[15]</sup> purchases through Oil Marketing Companies (OMC). Some industry groups view this move as a positive step toward bringing some of the biodiesel companies back into business.

### Impediments:

Lack of high-yielding, drought-tolerant *jatropha* seeds, smaller land holdings, ownership issues with government or community owned wastelands, little progress made by state governments to meet large scale *jatropha* plantations, and negligible commercial production of bio-diesel have hindered the efforts and investments made by both private and public sector companies.

<sup>[1]</sup> According to International Energy Annual, India's primary energy consumption is 17.67 quadrillion Btu and production is 12.38 quadrillion Btu.  
[http://tonto.eia.doe.gov/country/country\\_energy\\_data.cfm?fips=IN](http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=IN)

<sup>[2]</sup> <http://www.pera.org/English/education/panindia.htm>

<sup>[3]</sup> Roads being the dominant source of transport in India carry almost 90 percent of the countries passenger traffic and 65 percent of its freight.

<sup>[4]</sup> Industry estimate

<sup>[5]</sup> [http://tonto.eia.doe.gov/country/country\\_energy\\_data.cfm?fips=IN](http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=IN)

<sup>[6]</sup> India's carbon emissions are growing at the rate of 3.2 percent annually.

<sup>[7]</sup> <http://www.mnre.gov.in/policy/biofuel-policy.pdf>

<sup>[8]</sup> Adoption of environment friendly biofuels to meet improved vehicle emission norms (EURO III and IV)

<sup>[9]</sup> <http://www.pera-biofuels.org/whois.htm>

<sup>[10]</sup> <http://petroleum.nic.in/gazethanol.pdf>

<sup>[11]</sup> In April 2010, the Empowered Group of Ministers (EGoM) decided to fix a price of Rs 27 for per liter of ethanol that will be blended with petrol. The price stands fixed for six months until a committee headed by Planning Commission member takes a decision.

<sup>[12]</sup> Petroleum marketing companies have acquired two sugar mills to produce ethanol from sugarcane juice on experimental basis.

<sup>[13]</sup> 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.

<sup>[14]</sup> The government may have to offer fiscal incentives to growers to adopt better agronomic practices during the first 2-3 years of plantation development in addition to besides marketing and price supports to encourage biodiesel program.

<sup>[15]</sup> According to the biodiesel purchase policy, the public sector oil marketing companies (OMC) shall purchase, through the select purchase centres, bio-diesel (B100), which meets the fuel quality standard as prescribed in the Bureau of Indian Standards specifications. The bio-diesel shall be purchased at a uniform price, as may be decided by the OMC from time to time, depending on market conditions. Such a uniform price (reviewed every six months) shall be inclusive of any taxes and duties and transportation cost for delivery at the purchase centre.

## Bioethanol and Biodiesel:

### Ethanol:

Currently, India produces conventional bio-ethanol from sugar molasses and production of advanced bio-ethanol is still in the research and development phase. India has 330 distilleries which produce 4 billion liters of rectified spirit (alcohol) per year. Of the total distilleries, about 115 distilleries have the capacity to distill 1.8 billion liters <sup>[1]</sup> of conventional ethanol per year sufficient to meet the 5 percent blending mandate.

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

Calendar Year	2006	2007	2008	2009	2010	2011
Opening Stock	483	747	1,396	1,673	1,243	1,145
Production	1,898	2,398	2,150	1,073	1,435	1,859
Imports	29	15	70	280	300	300
Total Supply	2,410	3,160	3,616	3,026	2,978	3,304
Exports	24	14	3	3	3	10
Consumption						
Industrial Use	619	650	700	700	720	750
Potable Liquor	745	800	850	880	950	1010
Blended petrol	200	200	280	100	50	200
Other Use	75	100	110	100	110	110
Total Consumption	1639	1750	1940	1780	1830	1970
Ending Stocks	747	1,396	1,673	1,243	1,145	1,224

Total Distribution	2,410	3,160	3,616	3,026	2,978	3,304
Production Capacity (Conventional Fuel)						
Feedstock Use (1,000 MT)						
Feedstock A (000' tons)	7,910	9,992	8,958	4,469	5,981	7,746

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

### Production:

With an outlook of bumper sugarcane and sugar production in 2010/11 <sup>[2]</sup>, the government is likely to renew its focus and strongly implement the mandatory 5 percent ethanol blending in petrol. This will, however, be dependant on whether or not the government takes a decision on the purchase price of ethanol for EBP. Higher sugarcane and sugar production in 2009/10 improved ethanol production but total supply remained at 2008/09 level mostly due to short stocks carried forward from the previous year (2008/09). Short supply of sugar molasses in 2008/09 severely constrained ethanol production and the consequent higher prices made it unviable to supply ethanol to petroleum companies at the negotiated prices.

### Consumption:

Strong growth in the consumption of ethanol across the chemical and potable liquor industry is expected to raise total ethanol consumption close to 2 billion liters in 2010/11, up 140 million liters over the previous year (Table 1). The growth in consumption across these sectors would severely constrain its supplies for EBP. Consequently, the availability of ethanol in 2010/11 for blending with petrol is roughly estimated at 200 million liters, against the target of 800<sup>[3]</sup> million liters set by the Ethanol Manufacturers in India. Ethanol consumption in 2009/10 was drawn down to 50 million liters from 100 million liters in 2008/09, mostly due to a short supply of molasses and higher demand for ethanol from competing industries. According to trade sources, higher market prices for ethanol were attractive for the suppliers to divert there supplies from EBP.

### Trade:

India does not import ethanol <sup>[4]</sup> or other biofuels for fuel purposes. During years of low sugar production, and consequent shortage of molasses and alcohol, India imports alcohol, mainly for industrial and potable liquor production. India exports small quantities of ethanol mostly for non-fuel use, to Sri Lanka, U.A.E and some African countries. Although there are no quantitative restrictions on imports of biofuels, high duties (Table 2) make imports economically unviable. The GOI does not provide any financial assistance for biofuel exports (biodiesel and ethanol). Current trade regulations allow duty free imports of feed stocks for re-export by certified export oriented units, but no such operations are in place.

**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:

End stocks of ethanol for the forecast year (2011) are likely to recover to 1.2 billion liters, up 79 million liters over the current year's estimate. However, stocks are down 449 million liters compared to 1.7 billion liters recorded in 2008. Tight end stocks are result of steady growth in consumption.

### **Biodiesel:**

There are about 20 large capacity biodiesel plants (10,000 to 100,000 tons per year) in India that produce biodiesel from edible oil waste (unusable oil fractions), animal fat and non-edible oils. Commercial production of biodiesel from jatropha and non-edible oilseeds is small, with estimates varying from 140 to 300 million liters per year. 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. Industry sources report some sales of biodiesel to state owned transport companies.

There has been no commercial sale of biodiesel across the biodiesel purchase centres (set up by GOI) as the government notified a biodiesel purchase price of Rs 26.5 (57 cents) per liter which is still below the estimated biodiesel finished production cost (Rs 30 to Rs 40 per liter / 65-86 cents per liter). Inefficient marketing channels and lack of feedstock supply (jatropha seeds) are among some of the major factors that have contributed to higher production costs.

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

In April, 2010, General Motors (GM) and U.S. Department of Energy (DOE) entered into a five year partnership with the Central Salt and Marine Research Institute (CSMRI), Bhavnagar, Gujarat to explore the potential (through research and development) of jatropha plantations as a source of alternative fuel and sustainable energy crops for biodiesel production in India. The collaboration plans to set up a jatropha plantation near the GM manufacturing facility in Gujarat and provide support to research and developmental activities. The Central Salt and Marine Research Institute fall under Council of Scientific and Industrial Research, Ministry of Science and Technology, GOI.

<sup>[1]</sup> An additional annual ethanol production capacity of 365 million liters was built up in last three years after government provided funds to sugar mills.

<sup>[2]</sup> sugar marketing year 2010/11 (October/September)

<sup>[3]</sup> Industry Estimate

<sup>[4]</sup> Ethanol and other spirits have been imported from countries such as Brazil, South Africa, United Kingdom, Pakistan, France, Germany, United States of America and neighboring countries.

### **Advanced Biofuels:**

Research and development activities <sup>[1]</sup> are being carried 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 the technology challenges, commercial production of advanced biofuel would take a long time before its being demonstrated as economically viable biofuels.

<sup>[1]</sup> Experimental or pilot trials of advanced biofuels are also being carried out by select industry groups and government's research institutes.

## Biomass for Heat and Power:

The Ministry of New and Renewable Energy is implementing a biomass power program (Table 3) 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 16,000 Mega Watts (MW) Equivalent. With modernization of new and existing sugar mills, the surplus power generation through bagasse cogeneration in sugar mills is estimated at 5000 MW. Thus the total estimated biomass power potential <sup>[1]</sup> is about 21,000 MW.

The availability of biomass in India is estimated at about 540 million tons per year, including residues from agriculture, agro-industrial, forestry and plantations. Around 120-150 million tons of agro-industrial and agricultural residues <sup>[2]</sup> per year can be made available for power generation. Biomass <sup>[3]</sup> 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, 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](http://www.mnre.gov.in)

**Table 3: India's Biomass based Commercial Energy Achievement**

S.No	Sources/Systems	Achievements during 2009-10 (up to 31/03/2010)	Cumulative Achievements (up to 31/03/2010)
1.	Biomass Power (Agri-residues)	153.30 MW	865.60 MW
2.	Biomass Power Cogeneration (Non-bagasse)	50.80 MW	232.17 MW
3.	Biomass Power Cogeneration (Bagasse)	295.30 MW	1334.03 MW
4.	Waste to Energy	4.72 MW	64.96 MW
5.	Biomass Gasifier	13.28 MW eq	122.14 MW eq
6.	Family Type Biogas Plants	106,000 units	4.24 million units

Source: Ministry of New and Renewable Energy, GOI

Notes:

MW: Megawatts

MW eq: Megawatts equivalent

<sup>[1]</sup> [http://www.mnre.gov.in/annualreport/2009-10EN/Chapter%206/chapter%206\\_1.htm](http://www.mnre.gov.in/annualreport/2009-10EN/Chapter%206/chapter%206_1.htm)

<sup>[2]</sup> 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.

<sup>[3]</sup> Non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms