Sector Report - Biofuels

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EXECUTIVE SUMMARY

Growing demand for fuel has increased India's dependence on imported oil.

Indian economy is on a sustainable growth path. Natural fallout of growing economy is increasing use of fossil fuels. We foresee a significant need for oil for economy to continue its growth streak of over 9% for next three years. From the current level of annual crude consumption of over 153.82 million tonnes of which import is at 73%, going forward by FY10, the requirement is slated to go up 177.085 (CAGR of 4.8%) million tonnes.

The rising international fuel prices and the growing demand have necessitated the use of Biofuels.

The annual forex outgo purely on account of crude import currently stands at Rs. 2199.91 billion ($ 57.27billion) and by FY10 at current price of US $ 100, this is likely to increase to approximately Rs. 4985.99 billion ($ 129.80 billion).

A natural fallout of current events of growing demand for fuel, rising international oil prices and the growing emphasis on use of environment friendly fuels – we strongly believe that Indian Biofuels segment can grow manifold from the current size of mere Rs. 11,577.5 million.

Emphasis on clean environment is also a key demand driver for Biofuels.

India has a population of over 1 billion; an effective Government policy to strongly implement usage of ethanol in fuel consumption will significantly increase the size of this emerging sector. Currently in India the petrol and diesel demand stands at 62.69 million tonnes and is expected to go upto 79.76 million tonnes by 2011-2012. Thus at 5% blending rate the demand for biofuels will rise from 3.13 million tonnes to 3.99 million tonnes and at 10% blending rate the demand will rise from the current 6.27 million tonnes to 7.28 million tonnes by 2011-2012.

Ethanol and **Bio-diesel** are the most commonly used Biofuels.

In India, ***Ethanol*** and ***Bio-diesel*** are the two most widely used biofuels.

Ethanol Industry:

In India, ethanol is produced primarily from molasses, as a byproduct when cane is crushed to make sugar. Ethanol production of India is ranked 4th largest in the world. However, the production capacity of ethanol in India is much

more than its actual production as its alternate sugar can be produced through the same route.

Ethanol has wide range of applications in different segments, such as, medicines, fertilizers, paints, perfumes and so on. It can also be used in vehicles as it blends easily with petrol and causes no harm to the engine.

The 5% ethanol-blending mandate announced by Government of India has scaled up the demand for ethanol in India.

As a result, the demand for ethanol is steadily increasing in India. This demand will witness an upward trend due to the 5% blending mandate recently announced by the Government of India and the much awaited 10% blending mandate, which is expected to be announced in October 2008.

Availability of feedstock is the prime concern facing the Indian Ethanol Industry.

Considering the huge upsurge in ethanol demand in the near future, the Government has allowed the production of ethanol directly from sugarcane juice as the quantity of ethanol produced from sugarcane juice is seven times more than that produced from molasses.

Shortage of feedstock continues to remain the prime concern for the ethanol industry and hence, efforts have been directed towards ensuring steady supply of feedstock. Many companies have also developed innovative processes for extracting oil from alternative feedstocks such as sweet sorghum and tropical sugar beet, in order to ensure an uninterupted supply of ethanol.

The Bio-diesel Industry in India is still in the nascent stage of development.

Biodiesel Industry:

Biodiesel is an eco-friendly fuel produced from indigenously available renewable sources. It is eco-friendly because it is biodegradable, non-toxic and free from hazardous suspended particulate matters like aromatic compounds, carcinogen, sulfur etc. It is blended with diesel and used in compression ignition engines (diesel engines).

The objective of the National Biodiesel Mission is to meet 20% of India's diesel requirement by 2001- 2012.

The biodiesel production in India is in its initial phases of expansion and the commercial production is still waiting for a start. The densities of raw materials for biodiesel production in India are high but it is lacking in production and plantation of feedstock (Jatropha) for biodiesel production.

This issue was addressed by the National Biodiesel Mission formulated by the Government of India, with an objective to meet 20% of India's diesel requirements by 2011-2012.

Huge growth potential has still remained untapped in the Indian Biofuel Industry.

The implementation of the project was planned in two phases, wherein the demonstration phase was carried out over a period of 2003-2007 aimed at cultivating 400,000 hectares of Jatropha to yield about 3.75 tonnes of oilseed per hectare annually and the commercialization period during 2007-2012 will continue Jatropha cultivation and install more transesterification plants to cater to the increased fuel demand by 2011-2012.

A clear roadmap for the future from the Government will lead to a structured growth in the Biofuel industry.

To reduce this over dependence on Jatropha, experiments have been carried out to facilitate biodiesel production from other non-edible oil species like Pongamia, Mahua, Neem, Seemaruba etc. But it will take some time before reaching any certain conclusion, as the gestation period for these plants is very high. Thus, clarity on the Government policies will help bring in investments from big players for energy farming to ramp up feedstock supplies, a major bottleneck for the industry to grow.

Conclusion:

Uninterrupted feedstock supply and **technological developments** will lead the Biofuel Industry.

- The increasing demand for fuel and the rapidly increasing international fuel prices have prompted the countries around the world to look for alternative sources of fuel i.e. Ethanol and Biodiesel.
- Government's primary objectives behind promotion of biofuels industry are environmental factors along with diversity & security of energy supply. The growing fuel demand has become the primary driving force for the industry's growth.
- Expanded biofuels production has the potential to create new opportunities for sustaining the rural development in a market-orientated common agricultural sector.
- However, there is a lack of clarity on the current approach and the policy support for the promotion of Biofuels, which needs to be addressed immediately.
- At the same time emphasis has to be given on developing the technology for handling multi-feedstocks which are readily available.

INDSEC

INDIAN BIOFUEL SECTOR

25 January, 2008

We believe that the Indian Biofuel Industry is at the threshold of new phase marked by phenomenal growth and development owing to the growth in fuel demand and ever increasing international oil prices.

The emphasis on usage of environment-friendly fuels has further enhanced the growth prospects for the biofuel industry. With the increasing support from the Government and several technological improvements taking place for enhancement in biofuel production, we foresee immense growth potential in the biofuel industry.

In the current scenario, companies like Praj Industries and Southern Online Bio Technologies Ltd. are contributing significantly towards the advancement of the industry.

Global energy demand – supply disparity:

With the overall economic development around the world, the demand for energy has increased manifold. The world crude oil demand has grown at around 2% in recent years and by 2030, the global energy demand is projected to reach approximately 15,000 million TPA of oil equivalent. Demand for oil will rise to 118 million barrels per day (bpd) level from current level of 86 million bpd, driven in largely by the transportation sector.

The member countries of the Organization for Economic Cooperation and Development (OECD) will remain the leading consumers of energy in 2030, collectively accounting for nearly 47% of global energy demand. However, the energy consumption of fast-growing countries such as India and China is also expected to grow rapidly. Global supply, however, may not keep pace with the ever-increasing consumption despite accelerated search for new reserves.

Indian energy requirement:

India has witnessed a steep rise in energy consumption in the recent years and is today the world's sixth largest energy consumer with the demand growing at an annual rate of 4.8%. The demand for diesel is estimated to grow at an annual rate of 5.8% till 2030.

However, the current oil and gas reserves in India are not adequate to fulfill this growing demand. India produces about 30% of its annual crude oil requirement of approximately 105 million tonnes. For the balance 70%, the country relies on imports. The transportation sector accounts for almost 50% of the total crude oil consumed. This has increased the risk exposure of the country to the high price of the crude oil in the international market.

Projected Petrol and Diesel Demand		
Year	**Petrol Demand (MT)**	**Diesel Demand (MT)**
2006 – 2007	10.07	52.32
2011 – 2012	12.85	66.91
2016 – 2017	16.40	83.58

Considering this demand – supply mismatch, the Government of India has undertaken two strategic measures:

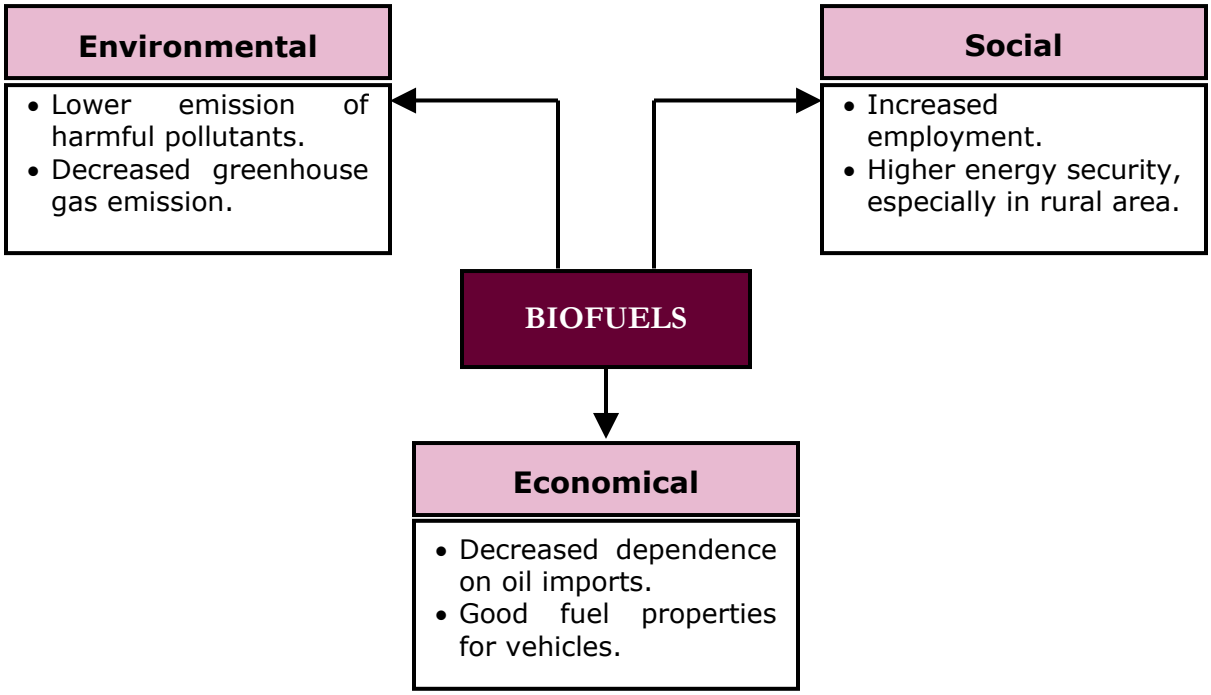
- Accelerating the exploration and production activities in the Oil & Gas Sector,
- Promoting the consumption of alternate fuels.

Dependence on conventional petroleum based fuels has endangered the environment and ecology with disastrous consequences to natural resources. The use of biofuels such as anhydrous ethanol and biodiesel will minimize the dependence on oil imports to some extent and reduce the harmful vehicular emissions and also improve the rural economy.

Biofuels in India:

With the increasing oil prices and the promotion of the clean environment policies, the use of Biofuels in India commenced in 2003. The Indian Biofuels sector is driven primarily by ***Ethanol*** while ***Biodiesel*** is in the process of gaining acceptance as a fuel. The Government has formulated the National Biodiesel Mission, which aims at meeting atleast 20 % of the country's diesel requirements by 2011 – 2012.

Biofuels offer a number of environmental, social and economic advantages such as:



Advantages of Biofuels:

A. Environmental Advantages:

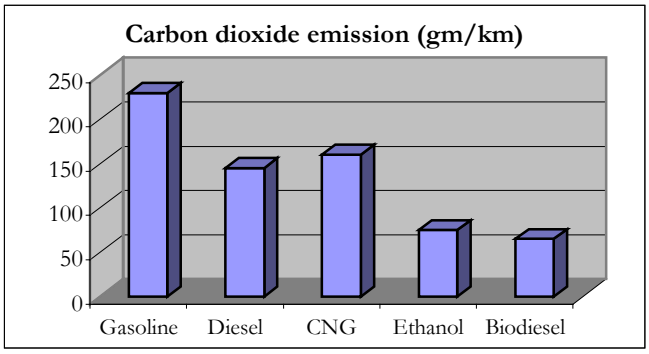
- **Reduced emission of harmful pollutants:**

  Ethanol and biodiesel, both being oxygenated compounds contain no sulphur and hence, do not produce harmful pollutants like sulphur oxide. However, fuels such as petrol and diesel have to undergo a process called hydro-de-sulphurization to remove the sulphur content. This leads to a reduction in lubricity, which has to be restored by using additives. On the contrary, biodiesel has natural lubricity and hence, no lubricity-enhancing additive is required.
  Given that ethanol and biodiesel contain oxygen, the levels of carbon monoxide and other hydrocarbons in the exhaust are also controlled.

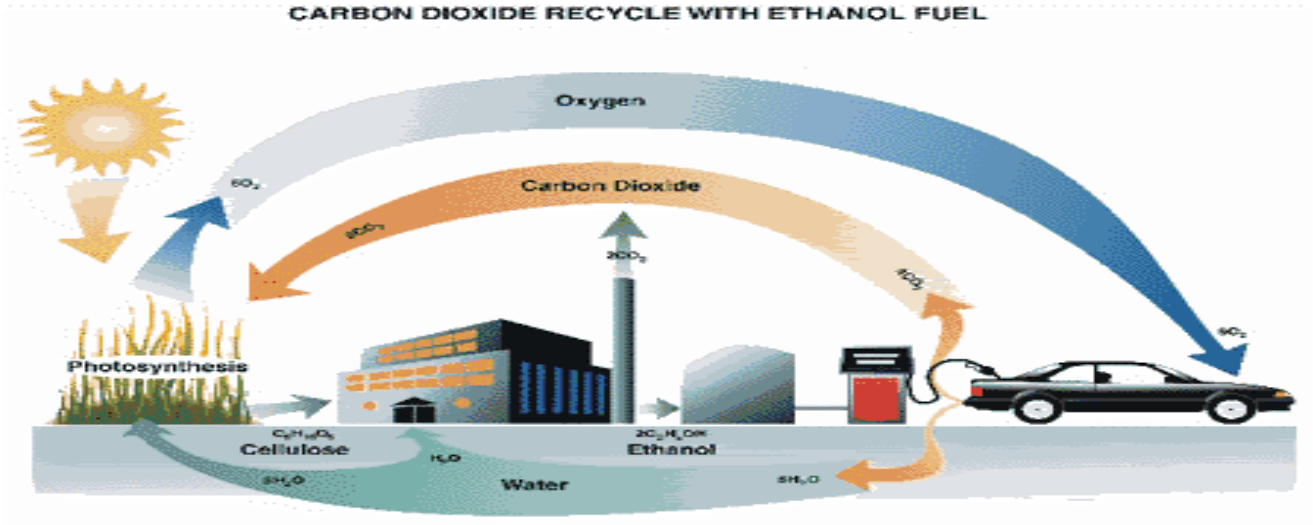
Biodiesel emissions compared to conventional diesel		
Emissions	**100% biodiesel**	**20% biodiesel**
Regulated Emissions		
Total Unburned Hydrocarbons	-93%	-30%
Carbon Monoxide	-50%	-20%
Particulate Matter	-30%	-22%
No_x	+13%	+2%
Non-Regulated Emissions		
Polycyclic Aromatic Hydrocarbons (PAH)	-80%	-13%
NPAH (Nitrated PAH)	-90%	-50%
Life cycle emissions		
Carbon Dioxide (LCA)	-80%	
Sulphur Dioxide (LCA)	-100%	

- **Decreased greenhouse gas emission:**

Biofuels contain about 10% oxygen, which stops the emission of harmful gases when they are burnt.



Biofuels are capable of net reduction of carbon dioxide from the atmosphere. The carbon dioxide released by biofuels into the atmosphere would be absorbed by the plantations set up for biodiesel production, thus recycling carbon and resulting in net reduction of carbon from the environment.



B. Social Advantages:

- **Increased Employment:**

  The biofuels sector provides immense employment opportunities in India, especially in the rural areas. The sugar industry, which largely supports the ethanol industry, is the biggest agro industry in India and provides employment to almost 46 million farmers, which comprises of almost 8% of the rural population. Thus, the development of the biofuel industry will lead to the socio-economic development in the rural areas.

- **Increased Energy Security:**

  India is witnessing an ever-increasing demand for energy and the demand is expected to remain high in the future as well. However, the current oil reserves in the country can satisfy only 30% for the domestic requirement. Although the Government has taken efforts to increase oil exploration and production activities, India is dependent heavily on the imported fuels. This not only increases the import cost but also increases the exposure to the international price fluctuations.

  Biofuels will play a very important role in mitigating this risk by providing an alternate resource for energy and thus help in securing the future energy supply in the country. Biodiesel can be manufactured with existing industrial infrastructure and opens more opportunity for the energy security than the conventional system based on fossil fuels.

- **Increased Social Welfare:**

  A large part of the Indian population, especially in the rural areas, does not have access to energy. The lack of affordable energy is a major setback in the progress of the nation as it leads to an uneven economic development and a disproportionate improvement in the standard of living.

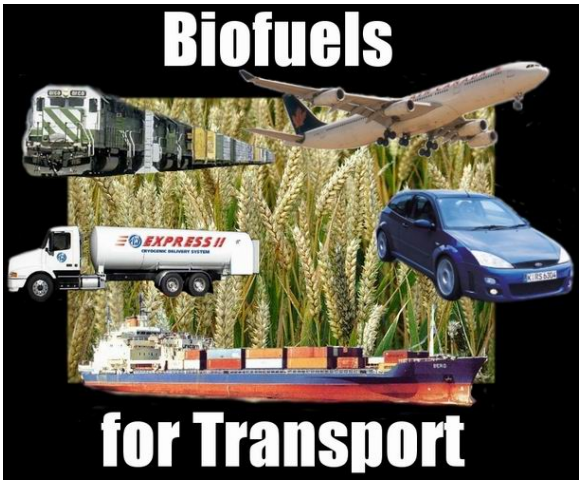
  The enhanced use of renewable energy such as biofuels will help in improving the living conditions in the rural areas, leading to a balanced economic development.

C. Economical Advantages:

- **Good Fuel Properties:**

  Biofuels such as ethanol and biodiesel can be used as substitutes for petrol and diesel, respectively. Biodiesel has good fuel properties, comparable to or even better than petroleum diesel. It has 10% built-in oxygen content that helps it to

burn fully. It can be used in existing diesel engines and fuel injection equipment without affecting operating performance. Other advantages are the almost zero sulphur content and the reduced amount of carbon monoxide, unburned hydrocarbons and particulate matter in the exhaust.



Ethanol has a research octane number of 120, much higher than that of petrol, which is between 87 and 98. Thus, ethanol blending increases the octane number without having to add a carcinogenic substance like benzene or a health-risk posing chemical like Methyl Tertiary Butyl Ether (MTBE). The energy content of ethanol is only 26.9 MJ/kg compared to 44.0 MJ/kg for petrol. This would suggest that the fuel economy (km/liter) of a petrol-powered engine would be 38.9 % higher than that of an ethanol-powered engine. The flammability limit of ethanol (19% in air) is higher than that of petrol (7.6%), and likewise the auto-ignition temperature of ethanol is higher than that of petrol (366^{o}C versus 300^{o}C). Thus, ethanol is safer than petrol due to the lower likelihood of catching fire.

But there are a few technical issues that need to be resolved. Biodiesel has a high viscosity at low temperatures, leading to flow problems at these temperatures. For long-term storage in hot, humid conditions, ethanol may require a biocide to prevent bacterial growth.

Factors affecting Biofuel Industry:

The biofuel industry is influenced primarily by two factors, viz. ***feedstock cost*** and ***government regulations***. These factors have a direct impact on the production costs and hence, play an important role in commercial production and marketing of biofuels.

A. Feedstock:

Feedstock constitutes almost 60 to 80% of the production cost of biofuels and hence, it influences the prices of biofuels and in turn the margins gained from marketing of biofuels. The cost of feedstock varies largely from one region to the other.
Also the lack of availability of domestic feedstock has inhibited several biofuel manufacturers from entering this market.

As a result, Indian manufacturers are considering importing palm oil to produce biodiesel. Similar availability issues also affect the better-developed Indian ethanol industry, as ethanol is primarily manufactured from molasses - a by-product of sugar. Since sugarcane production is cyclical, the availability and cost of production of ethanol varies depending on sugarcane crop yields.

Securing feedstock through vertical integration will greatly help biodiesel manufacturers in mitigating availability issues and keeping the cost of production under control. Moreover, using non-edible oils as feedstock can aid in avoiding competition with food applications.

Besides this, supply side of feedstock is also a critical success factor that would impact the industry. Short supply and potential changes in feedstock quality affect the output. The related logistics for acquiring the feedstock would also be of immense importance. It is so because the oils used in production of biofuels are generally produced by small community farmers or by a single large farmer or by a processor who has installed an expeller processing seeds bought from the farmers. These few suppliers will be able to supply the huge quantity required by the Biodiesel plants. Hence, an efficient logistics would be essential for the industry.

B. Government Regulations:

Along with feedstock, Government regulations also play an important role in the development of the biofuels industry. The Government policies have a great impact on the demand and prices of biofuels. In India, Government has formulated the ethanol and biodiesel-blending program to boost the demand for biofuels in the country.

However, India's ethanol-blending program, which was slated to be announced in 2003, could not be implemented due to lack of locally produced feedstock. Also, plantations for alternate feedstock like Jatropha take at least three to four years to yield seeds. As a result, the implementation of biofuel blending program had to be postponed.

At a 5% blending mandate, biodiesel demand would have been 2.6 million TPA in 2006-2007, which is expected to grow to 3.35 million TPA by 2011-2012. At a 10% blending mandate, India would require around 6.7 million TPA of biodiesel by 2011-2012.

Even though there was sufficient potential for biodiesel demand in the country, it was not materialised due to lack of raw material availability and the absence of a blending mandate by the Government. As a result, biodiesel manufactures started looking at using palm oil imported from South East Asia as feedstock. However, biodiesel

manufactured in this manner could not cater to local demand due to high prices of palm oil, coupled with high import duties.

After considering these roadblocks in the development of the biofuels industry, the Government formulated the National Biofuel Mission, wherein due emphasis was given to the cultivation of Jatropha oilseeds and thus increase the availability of feedstock for the manufacturing of biofuels. This program has not only helped in keeping a check on the fuel prices, due to availability of locally produced feedstock, but has also led to socio-economic development in the rural regions, where the farmers and feedstock collectors are able to get fair prices for their produce.

Thus, feedstock and Government policies jointly influence the growth of the biofuels industry in India.

Opportunities for Biofuels in India:

Indian vehicle makers are joining the global race to make less-polluting greener vehicles, teaming up with international firms and pouring money into research that could result in commercially viable technologies quickly. Petrol and diesel are used overwhelmingly in passenger and commercial vehicles in India, with cleaner-burning Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG) gaining in popularity but curtailed by their limited availability.

- **Emission norms for vehicles:**

  The pressure on improving the fuel quality and the stringent emission norms have helped in shifting the focus from conventional diesel, which emits high level of pollutants, towards biodiesel blended fuel, which helps in reduction of pollutants.

  Usage of biodiesel in engines has had the following effects on the engine performance and exhaust emission:

  - Significant reduction in exhaust emission,
  - Lower carbon dioxide and hydrocarbon emission as compared to diesel,
  - 25 to 50% lower particulate emission, due to higher oxygen content in biodiesel,
  - Significant decrease in the non-regulated emissions like PAH and nPAH.

  However, the following difficulties have to be addressed while using biodiesel:

  - Excess carbon deposits on engine parts,
  - Biodiesel is more prone to oxidation and polymerization, which may create problems while diluting engine oil,
  - Oil pumping becomes difficult as it thickens due to formation of sludge.

The following measures could be taken to overcome the above challenges:

- Usage of additives alongwith engine oil to avoid seepage of biodiesel,
- Use of proper additives will help in reducing the poor oxidation stability of biodiesel,
- Using appropriate biodiesel blends as per engine specifications will improve engine performance.

- **Rising international fuel prices:**

  A constant rise has been observed in the international crude oil prices. Recently, the price of crude oil touched the $ 100 per barrel mark, prompting the nations world over to look at alternate sources of fuel, in order to keep a check on the domestic fuel prices.

  In this scenario of rising fuel cost, biofuels are being considered as the most prominent substitute for energy. With the international crude oil prices expected to remain firm in the future, the demand for biofuels will surely witness an upward trend in the years to come.

- **Emphasis on environmental friendly fuels:**

  The increasing Government emphasis on the usage of environmental friendly fuels will augur well for the Indian biofuel industry. This will further boost the demand for cleaner fuels such as biofuels. The Government has also taken initiatives for developing the biofuel industry to accommodate the rising demand for the biofuels.

Biodiesel Industry in India:

Biodiesel is a domestic, renewable fuel for diesel engines derived from transesterification of natural oils. It is a diesel-equivalent processed fuel, which is blended with diesel and used as a fuel in diesel engines. The blending percentage may vary from 5% to 100% and is accordingly graded as B5, B10 to B100, which indicates the proportion of biodiesel in the blended diesel.

In India the biodiesel industry is in the nascent stage. However, there has been greater awareness on biodiesel in India in the recent times due to shortage of petrodiesel and their soaring prices. With the Government introducing the biofuel blending mandate the demand for biodiesel will see a steady rise in the years to come.

The Planning Commission of Government of India had formulated the National Biodiesel Mission for the development and commercialization of biodiesel in India. The project was executed in two phases, of which Phase I was implemented between 2003 and 2007. This was the demonstration phase, which involved,

- Development of Jatropha oilseed nurseries,
- The cultivation of 400,000 hectares with Jatropha,
- The setting up of seed collection and Jatropha oil extraction centers, and
- The installation of an 80,000 million TPA oil expellers to produce biodiesel from Jatropha oil.

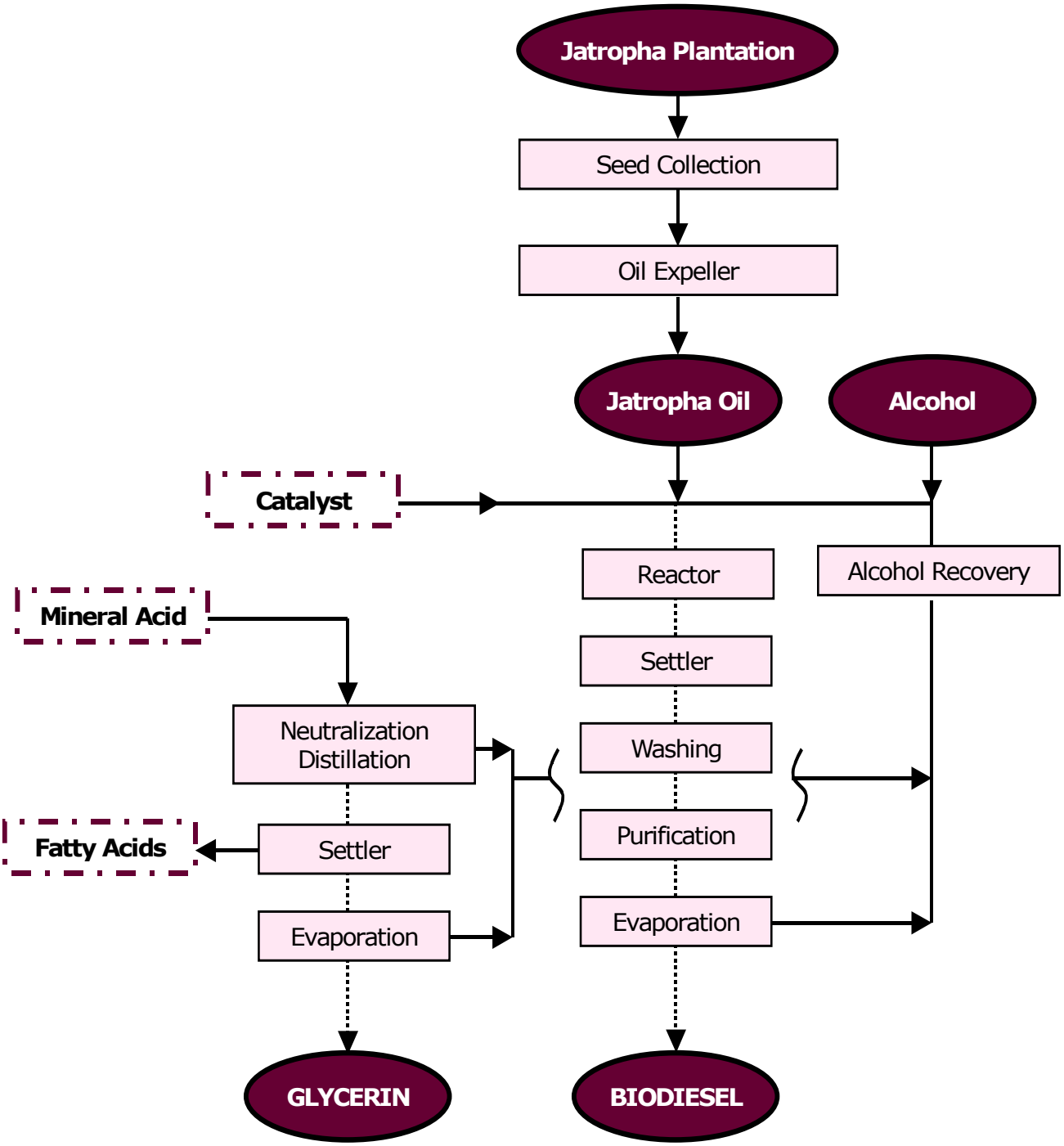
Phase II will focus on a self sustaining expansion programme leading to the production of biodiesel to meet 20 % of the country's diesel requirements by 2011-12.

Biodiesel demand estimates:

The biodiesel demand at various levels of blending shows that there is tremendous growth potential for the biodiesel industry, which is now coming to light.

Year	@ 5% Blending MMT	@ 10% Blending MMT	@ 20% Blending MMT
2004-2005	2.35	4.70	9.39
2005-2006	2.48	4.96	9.91
2006-2007	3.13	6.27	12.54
2011-2012	**3.99**	**7.98**	**15.95**

Production process of Biodiesel:

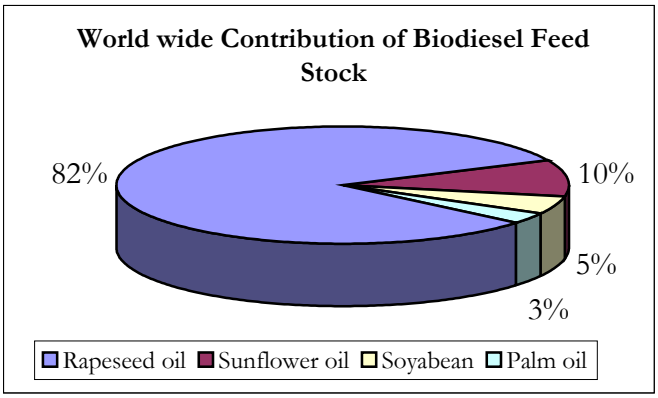


The **byproduct of the production process,** also have mutliple uses and hence, makes biodiesel a profitable and worth pursuing business proposition.

Byproduct	Usage
Glycerine	Useful for Pharmaceutical and Soap Factories.
Unsap Matter	Useful for Soap Manufacturers.
Oil Cake	Used as Manure for Agricultural lands

Feedstock for Biodiesel Production:

Biodiesel is usually made from vegetable oil. Rapeseed oil has 82% of the share of the world's biodiesel feedstock, followed by sunflower oil (10%), soybean (5%) and palm oil (3%). However, the choice of feed is country specific and depends on availability.



In India biodiesel is produced from oil sources such as sal oil, mahua, neem oil and karanja oil (pongamia pinnata). However, extensive research from agricultural research centers has suggested the use of Jatropha Curcas oilseed as the most suitable feedstock for India's biodiesel programme.

Even though there are plenty of varieties of tree borne oil seeds, Jatropha Curcas shrubs are considered the ultimate potential variety, and the Pongamia Pinnata comes in the next. The other probable biodiesel yielding trees in India are:

Calophyllum Inophyllum

Rubber Seeds

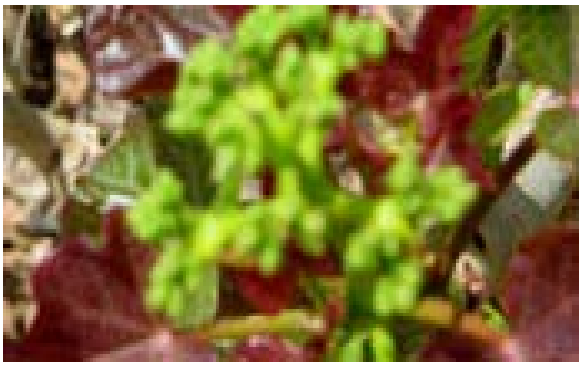
Calotropis Gigantia

Euphorbia Tirucalli

Boswellia Ovalifololata

Pongamia Pinnata

Jatropha:



Of all the above mentioned biodiesel yielding sources, Jatropha carcass stands at the top as a high-yielding biodiesel source. One hectare Jatropha plantation with 4400 plants per hectare under rain fed conditions can yield upto 1500 liters of oil. It is estimated that about 3 million hectares of plantation is required to produce oil for 10% replacement of petrodiesel.

The residue oil cake after extraction of oil from Jatropha can be used as organic fertilizers. It is also estimated that one acre of Jatropha plantation could produce oil sufficient to meet the energy requirement of a family of 5 members and the oil cake left out when used as fertilizer could cater to 1 acre of land. The fact that Jatropha can be grown in any wastelands with less irrigation gives it a distinct advantage for consideration as the prime biodiesel feedstock in Indian conditions.

Advantages of using Jatropha Curcas:

- The **oil yield per hectare** for Jatropha is among the highest for tree-borne oil seeds. 31% to 37% of oil can be extracted from a Jatropha seed.
- Jatropha biodiesel has fuel properties and provides engine performance that is very similar to petrodiesel fuel
- Jatropha biodiesel readily mixes with petrodiesel fuel and it **runs in any diesel engine without modification.**
- The trend of using cleaner burning fuel is growing worldwide and it is possible through Jatropha biodiesel.
- Jatropha Curcas is **resistant to drought and can be planted even in the desert climates**, and it thrives on any type of soil, grows almost anywhere; in sandy, gravelly and saline soils.
- Jatropha Curcas quickly establishes itself and will produce seeds round the year if irrigated.
- Jatropha is eco-friendly and biodegradable.
- It can be produced locally.
- It reduces country's dependency on imported fuel.
- Brings the wastelands under cultivation as most arable land is already being used to grow food.
- Acts as a source of revenue for the farmers and poor people (Tribal).

Cost of Cultivating Jatropha:

	Seeds						Seedlings					
Land	Normal Soil			Fertile Soil			Normal Soil			Fertile Soil		
Spacing	2 x 2 mts.			2 x 3 mts.			2 x 2 mts.			2 x 3 mts.		
Density	2500			1670			2500			1670		
Year	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
	Costs (Rs.)											
Land Preparation	2000	0	0	1670	0	0	2000	0	0	1670	0	0
Planting	5000*	0	0	3330*	0	0	10000#	0	0	8680#	0	0
First Year Cost	1500	0	0	1500	0	0	1500	0	0	1500	0	0
Fertilizers	0	2000	2000	0	2000	2000	0	2000	2000	0	2000	2000
Irrigation	2000	1500	1500	2000	1500	1500	3000	3000	3000	3000	3000	3000
Harvesting	2000	2000	2000	2000	2000	2000	2500	2500	2500	2500	2500	2500
Total	**12500**	**5500**	**5500**	**10500**	**5500**	**5500**	**19000**	**7500**	**7500**	**17350**	**7500**	**7500**

* - (Rs. 2/- per Seed)
\# - (Rs. 4/- per seedling)

Outlook for the biodiesel industry:

Biodiesel will take a while to establish itself as an effective biofuel, since Jatropha plantations in the country are still in the initial stages of development. Three to four years and many plantations later, the country may have the feedstock necessary for the large-scale production of Jatropha oil for use in biodiesel. Besides Jatropha, alternative feedstock such as, Pangamia, Simarruba, Neem, etc. have to be promoted in order to recure the over dependence on Jatropha.

The absence of a clear Government policy on biofuels and lack of availability of domestic feedstock has inhibited several biofuel manufacturers from entering this market. Hence, Indian manufacturers are considering importing palm oil to produce biodiesel. The use of palm oil however increases the cost of production and squeezes the margins of biodiesel manufacturers.

Hence, until the domestic feedstock situation improves, oil (raw material) should be allowed for duty-free import for producing biodiesel at competitive rates, and freer import of plant and machinery should be permitted.

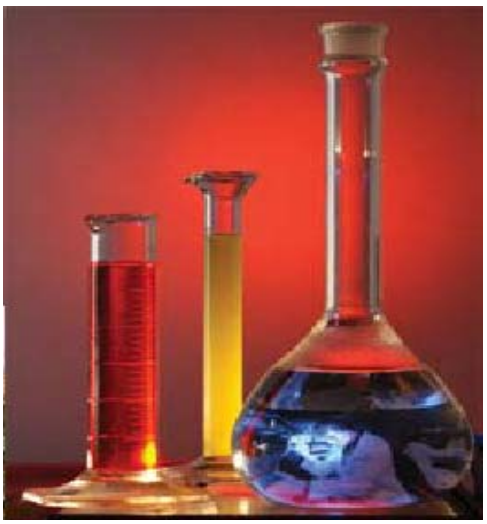
Unavailability of advanced technology to produce biodiesel from non-edible oils is another hurdle in the development of the Bio-diesel industry. Companies like Praj and Southern Online Bio Technologies Ltd. have now addressed this issue by developing technologies that allow multi-handling of feedstock.

Ethanol Industry in India:

Ethanol is produced in India by the fermentation of sugarcane molasses, and is an excellent biofuel, which can be blended with petrol. Molasses is a byproduct of the sugar manufacturing process. One ton of sugarcane produces about 40 kgs. of molasses from which, about 10 liters of ethanol can be obtained. Instead of molasses, if sugarcane is directly and fully used to manufacture ethanol, the yield of ethanol is 70 liters per ton.

India is one of the largest producers of sugar in the world. In terms of sugarcane production, India and Brazil are almost equally placed. The annual projected growth rate of the area under sugarcane cultivation in India is at 1.5% p.a. and has almost doubled during the last five years.

India is currently passing through a glut situation with the sugarcane closing stocks of over 100 lac tonnes at the end of the year since 1999-2000. Correspondingly, molasses production has also increased. Thus, alongwith sugarcane production, phenomenal growth is also taking place in the production of molasses, the basic raw material for the production of ethanol from sugarcane.



There are also other agro routes available for ethanol production. Besides, more efficient agricultural practices for improved sugarcane yield, crops like sweet sorghum and tropical sugar beet also represent attractive alternate feedstock for ethanol. By reducing dependence on molasses, manufacturers can exercise better control over their production costs. Reduction in production costs will be a huge relief to them, since the bargaining power on the prices of biofuels firmly rests with the Government and oil marketing companies.

Feedstock for Ethanol Production:

The use of feedstock has a great impact on the price of fuel produced. Ethanol can be produced using sugarcane juice as well as molasses. However, a significant difference is observed in the quantity and price of fuel produced from sugarcane and molasses. The variations in prices are explained hereunder:

- **Sugarcane:**

The current price of sugarcane, as fixed by the Government under the minimum statutory price, is Rs. 695 per ton based on a sugar recovery of 8.5 %. At 10.5 % recovery rate, the price of sugarcane, after state excise taxes, is Rs 900 per ton. Assuming an ethanol yield of 70 liters per ton of sugarcane, the raw material cost of ethanol is Rs. 13 per liter. On addition of salary and wages of operational staff, capital related charges of investment, energy cost of producing anhydrous alcohol, and cost of transport and marketing, **the cost of producing ethanol directly from sugarcane is Rs. 20 per liter.**

The cost of production can be brought down further through the following options:

- Allowing a **market-based sugarcane price.**
- **Combining ethanol manufacture with sugar manufacture**, which would permit a major part of the cane cost to be off-loaded to sugar.
- **Using the bagasse byproduct and spent wash more efficiently.** The spent wash, which is produced in large quantity (about 15 liters per liter of ethanol produced), can be used as a valuable biogas (60% methane). This biogas can be used to offset 67% of the energy cost of making anhydrous alcohol through distillation. Plants can further use bagasse, which is left after crushing the sugarcane, as boiler fuel for electricity generation at 97 KW per ton of sugarcane crushed.

- **Molasses:**

The cost of molasses in India varies widely across different states; it has been as low as Rs. 50 per ton and as high as Rs. 2,000 per ton in the past. A sizeable part of the cost is central excise duty, sales tax, transportation cost, etc., and the statutory controlled sugarcane and sugar prices. Assuming a molasses price of Rs 3,000 per ton and a yield of 220 liters of ethanol per ton, the feedstock cost would be Rs. 13.64 per liter ethanol. Further, the addition of direct costs and other finance costs will take the **cost of producing ethanol directly from molasses to Rs.17 per liter**.

Pricing of ethanol produced from molasses:

		Stand alone distillery	Integrated with sugar production
Cost of molasses Transportation cost Total	Per ton Per ton	Rs. 3,000 Rs. 150 Rs. 3,150	Rs. 3,000 0 Rs. 3,000
Recovery of ethanol	liters	220	220
		Rs./liter	**Rs./liter**
Molasses cost after milling Steam cost @ Rice Husk Rs. 500/ton Power cost @ Rs. 4.50/KwH Chemical cost Labour cost Repair and maintenance **Total direct cost**	Rs./liter Rs./liter Rs./liter Rs./liter Rs./liter Rs./liter Rs./liter	**14.32** 0.25 0.59 0.2 0.25 0.15 **15.76**	**13.64** 0 0 0.2 0.25 0.15 **14.24**
Finance and other costs Indirect costs, including overheads Interest @12 per cent for borrowed capital of Rs.72 million (Debt/equity ratio=1.5) Interest @12 per cent for working capital for one month of molasses and ethanol Depreciation @ 10 per cent for Rs. 120 million Total finance and other costs	Rs./liter Rs./liter Rs./liter Rs./liter Rs./liter	 0.56 0.96 0.2 1.33 3.05	 0.28 0.96 0,2 1.33 2.77
Total costs	Rs./liter	**Rs. 18.81**	**Rs. 17.01**

Comparison of costs for different feedstock (for a plant with capacity of 30,000 liters (7,900 gallons) per day):

Ethanol from:	Rectified Spirit	Sugarcane	Molasses
Feedstock	38	152.5	79
Land	1.5	4.5	2
Civil and structural work	5	25	12.5
Plant and machinery	26	100	55
Preliminary and pre-operative expenses	1	8	3.5
Margin money of working capital	5	10	6

(Rs. In Million)

Government Initiatives:

- **Mandate on usage of 5% ethanol-blended petrol:**

  With a view to boost the biofuels sector and reduce environmental pollution, Government of India has been examining the prospects for the supply of ethanol-doped-petrol in the country for quite some time. In order to ascertain financial and operational aspects of blending 5% ethanol with petrol, Government had launched three pilot projects; two in Maharashtra and one in Uttar Pradesh during April to June 2001. These pilot projects had been set up for supplying 5% ethanol-doped-petrol only to the retail outlets under their respective supply areas since then.

  Apart from these pilot projects, several studies were undertaken simultaneously to ascertain the viability of ethanol-doped-petrol. The pilot projects in both the states have been successful and established blending of ethanol up to 5% with petrol and usage of ethanol-doped-petrol in vehicles.

  After the evaluation of these pilot projects, 5% ethanol-doped-petrol was made available in the following States and Union Territories:

  States:
  - Andhra Pradesh
  - Goa
  - Gujrat
  - Haryana
  - Karnataka
  - Maharashtra
  - Punjab
  - Tamilnadu
  - Uttar Pradesh

  Union Territories:
  - Damman and Diu
  - Dadra and Nagar Haveli
  - Chandigarh
  - Pondicherry

  Recently, **the Government mandated the usage of 5% ethanol-blended-petrol**, throughout the country, with immediate effect and is also willing to futher increase it to 10% blending from October 2008. This decision will surely augur well for the ethanol industry, as India will require 1.12 billion liters of ethanol annually to blend 10% of the alternative fuel with petrol.

  At the same time, it will directly benefit the sugarcane producing states like Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat and Bihar, which have been facing a serious problem of excess sugarcane cultivation for the current year and also in the years to come.

- **Permitted production of ethanol from sugarcane juice:**

Government **has also allowed sugar companies in India to manufacture ethanol directly from sugarcane juice**, instead of using molasses. 100 tonnes of sugarcane produces 10 tonnes sugar and 4 tonnes of molasses. From these 4 tonnes of molasses, 1,080 liters ethanol is produced. On the other hand, if 100 tonnes of sugarcane is crushed directly, 7,500 liters of ethanol can be produced. Apart from this, sugar mills spend Rs. 500 to 700 to produce one ton of sugar, while the total cost of producing one liter of ethanol is only Rs. 2.

With this flexibility, sugar mills can follow the method adopted in Brazil where sugar factories switch to ethanol or sugar depending on the prices of commodities. This decision would not only help sugar mills cut losses by reducing sugar inventories and make the biofuel more affordably, but will also contribute in meeting the ethanol demand for 10% blending with petrol.

- **Withdrawal of inter-state tax on ethanol:**

Government has decided to withdraw the Rs. 1.5 per liter inter-state tax on ethanol produced in Maharashtra.

Maharashtra has an ethanol glut and has a capacity to produce 80 crore liters per year. However, the ethanol-blending requirement form Maharashtra is only 10 crore liters at 5% blending and 20 crore liters at 10% blending. Therefore, the state can supply ethanol to others in huge volumes.

Opportunities and Challenges faced by the Ethanol industry:

The Indian ethanol industry is less competitive in international markets when compared to other major producers such as Brazil and the US. India's uncompetitive productivity can be attributed to the following causes:

- Low sugarcane yield per acre of land due to archaic farming practices, lack of irrigation and fertilizers;

- Depletion of ground water resources;
- Excessive dependence on the monsoons, which can be fickle and unreliable; and
- Lack of utilization of advanced technology in ethanol manufacture.

The following strategies can improve the efficiency of the ethanol industry:

- **Improved agricultural practices to increase sugarcane yield:**

  The following agricultural practices can be implemented to increase sugarcane yield:

  - Use of different water saving irrigation methods;
  - Inter-cropping with other crops;
  - Planting only in autumn and spring planting seasons and no planting in summer;
  - Biopest control;
  - Use of biofertilizers;
  - Employment of varieties according to agro-climatic conditions;
  - Drought management practices for sugarcane;
  - Ring pit method;
  - Use of quality seed;
  - Integrated weed management; and
  - Employment of mechanization.

- **Cultivation of alternate feedstock crops like sweet sorghum and tropical sugar beet:**

  Over dependence on sugarcane not only creates a pressure for increasing sugarcane production, but also increases the risk of irregular supply of feedstock. Hence, it is necessary to develop ways to use feedstock such as sweet sorghum and tropical sugar beet for extracting ethanol.

  Sweet sorghum is a grass type plant, similar to sugarcane It is suitable for India's dry vast tracks with limited irrigation. It requires minimum purchased inputs as compared to sugarcane. The crop has a four-month cycle permitting two crops per year.

  Sugar beet has high sugar content and is grown in the temperate climate of Europe. With proper genetics and cultivation practices, a variation of sugar beet, called tropical sugar beet, can be grown in India. Both sweet sorghum and tropical sugar beet offer advantages over sugarcane as explained in table below:

Comparison of sugarcane, tropical sugar beet and sweet sorghum:

	Sugarcane	***Tropical Sugar Beet***	***Sweet Sorghum***
Crop duration	About 12 – 13 months	About 5 – 6 months	About 3 ½ months
Growing season	Only one season.	Throughout the year (10mths), except rainy period	All season - Kharif, Rabi and summer
Soil requirement	Grows well in loamy soil	Grows well in sandy loam. Also tolerates alkalinity.	All types of drained soil
Water management	Requires water throughout the year	Less water requirement. 40 to 60 % compared to sugarcane	Less water requirement. Can be grown as rain-fed crop.
Crop management	Requires good management. Low fertilizer required. Less pest and disease complex.	More fertilizer requirement. Requires moderate management.	Low fertilizer requirement and less pest and disease complex. Easy management.
Yield per acre	25 to 30 tonnes	30 to 40 tonnes	20 to 25 tonnes
Sugar content on weight	8 to 12 %	15 to 18 %	8 to 10 %
Sugar yield	2.5-4.8 tonnes /acre	4.5-7.2 tonnes/acre	2-3 tonnes /acre
Ethanol production directly from juice	1700 to 2700 liter / acre	2800 to 4100 liter / acre	1140 to 1640 liter / acre
Harvesting	Difficult and laborious	Very simple. Both manual and with simple small mechanical machine can be used.	Very simple. Both manual and with simple small mechanical machine can be used.

- **Use of enzymatic fermentation of cellulose for ethanol manufacture:**

  Lignocellulosic materials such as straw and wood, which are often available as wastes, are much cheaper than grain. Converting them to ethanol, however, requires complex and costly processes. The development of new technologies has made it possible for lignocellulosic materials to become economic as ethanol feedstock. Moreover, with the use of low cost enzymes, the production cost of ethanol can be brought down.

- **Improved methods of producing anhydrous alcohol:**

  Fermentation produces 10% solution of ethanol in water. For use as a fuel, this solution has to be concentrated to 99.8% ethanol (anhydrous) for blending with petrol. Just distilling an aqueous solution of ethanol gives a 95% ethanol solution. A 95% ethanol solution can be used as a straight fuel. For producing anhydrous ethanol, the following processes are used:
  - Azeotropic distillation;
  - Extractive distillation;
  - Pressure Swing Adsorption (PSA) based on molecular sieves; and
  - Membrane separation.

  The first two methods are most commonly used and represent older generation technologies. In PSA/molecular sieve technology, the 95% ethanol solution is vaporized and sent through a bed of molecular sieves at high pressure. However, membrane separation appears to be the most energy efficient process for anhydrous ethanol. Membrane separation also has the lowest operating cost, is flexible and simple to use, and is easy to expand and maintain. Hence, It is the most efficient and cost-effective option.

Industry outlook:

The current period can be called as "a turn around period" for **sweet future for ethanol** manufacturers. With Government mandating the use of 5% ethanol-blended fuel, the Indian ethanol industry will witness unprecedented growth in the years to come. The future prospects also look promising for the industry, as the Government is keen on mandating the use of 10% ethanol-blended fuel from October 2008.

In order to boost the growth of this sector, the ethanol producers should concentrate on the technologies by bringing the cost of production at lower end by using good technologies requiring fewer utilities like steam, water and electricity and they should also concentrate on co-generation. The lower cost of production will help in bringing the ethanol prices down from the current Rs. 21.50 per liter. Focus on producing large quantum will also create a win-win situation due to the production cost.

Further, the support from oil marketing companies will act as a catalyst in accelerating the growth of this emerging sector.

Praj Industries Limited (Praj)

Share Price	: Rs. 154.00
BSE Sensex	: 17221.74
Nifty	: 5033.45
Sector	: Engineering
High / Low	: Rs. 556 /114
Year end	: March
Listed on	: BSE, NSE
Market Cap	: Rs. 28.16 bn.
BSE Scrip Code	: 522205
NSE Scrip Code	: PRAJIND
Shares in issue	: 182.89 mn.
Shareholding	**: Dec 2007**
Promoters	: 21.35%
Institutions	: 8.64%
Public & Others	: 53.58%
FIIs	: 16.43%

All currency in INR unless otherwise stated

Praj Industries Ltd. (Praj) is a leading Biofuels Technology company with a number of processes and systems for ethanol and biodiesel production to its credit. Praj provides end-to end solutions, backed by years of research and development, in 40 countries across 5 continents. It offers one of the largest resources to support the biofuels industry.

Praj offers innovative solutions to significantly add value in ethanol, bio-diesel and brewery technology and related wastewater treatment systems for customers, worldwide. It provides customized engineering and manufacturing solutions, systems and services with a strong infrastructure in design and engineering, which enables response to specific needs of output in accordance with process needs.

Praj is a knowledge-based company with expertise and experience in bioprocesses and engineering. The company has designed and supplied plant and equipment for a number of industries including Chemicals, Agrochemical, Power, Distilleries, Breweries, Fruit/Food Processing, Pharmaceutical and Dairies. Praj is amongst the world's single largest

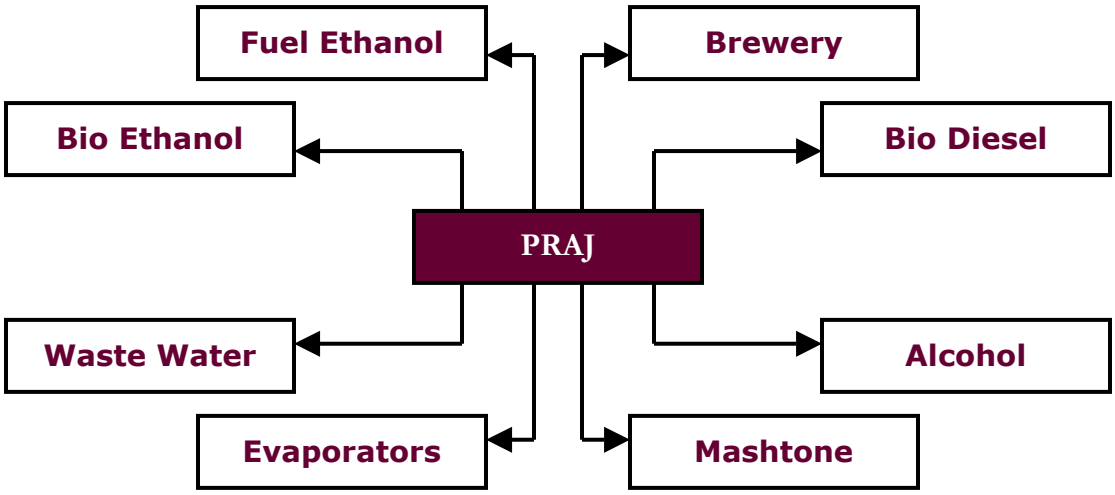
supplier of molasses-based distillery technology, plant and equipment.

Highlights of Praj Technologies are:

- Lower cost of production
- Better quality of end-product
- Application Engineering

Business areas of Praj Industries:

The company's principal activity is to manufacture turnkey plants and equipment for fermentation and distillation systems, worldwide. Distillery (Ethanol) plants and equipment and related wastewater treatment systems continue to form more than 85% of the revenues. Whereas, brewery and other process equipment account for the balance 15%.



The R&D wing of Praj, dedicated to ethanol technology, offers a competitive advantage over other players. Its foray into biofuels technology will also offer a sizeable potential growth, given that most countries are major diesel consumers and nearly 60% of the incremental growth in world transport fuel is diesel-based.

Currently, revenue contribution from the export market is likely to scale up, owing to the increasing business opportunities in Europe and the UK, the US and Brazil.

Opportunities in biofuels:

World ethanol production, as per industry estimates, is expected to surpass 90 billion liters by 2010. Globally, over 300 to 400 ethanol plants are likely to be installed over the

next three to four years. Countries, which are not very high gasoline consumers, like Peru and Colombia in South America, Philippines and Indonesia in Asia or even OPEC countries like Nigeria have also announced ethanol programs, while large users of gasoline like USA, China, Japan and EU nations, continue to promote ethanol. Thus, in order to keep pace with the growing demand, companies, including Praj, are investing into identifying newer energy crops like sweet sorghum and the next frontier of ethanol, cellulosic raw materials, new micro-organisms, new plant models which will be more energy efficient.

Moreover, per acre cost of ethanol production is moving down. This price reduction, coupled with other technological improvements will help in generating better margins going ahead.

Business associations and tie-ups:

- **Association with Tata Chemicals:**

Praj Industries has bagged an order from Tata Chemicals to set up a fully integrated, commercial scale plant for ethanol production from sweet sorghum, with a production capacity of 30,000 liters per day at the Nanded district of Maharashtra. The plant will have a capacity to crush 900 tonne of sweet sorghum per day.

Tata Chemicals will cultivate sweet sorghum in about 4,000 hectares of land for which the company has made arrangements with local farmers. The plant will generate its own power with the help of bagasse generated from the milled stock. The plant will be fully operational by mid 2008, thus boosting the revenues of Praj.

- **Expansion in Kandla SEZ:**

Praj has set up a manufacturing unit at the Kandla Special Economic Zone (SEZ). The commissioned area is about 75,000 sq. ft., which has a capacity to manufacture 3500 tonnes of equipment. The facility is equipped with state-of-the-art machinery and a very high level of automation in welding and other processes.

The SEZ facility was an outcome of the company's pursuit of global business of biofuels projects,

which involve supply of larger dimensioned equipment. A major benefit of this unit is its proximity to the Port, which will in itself cut down on transportation/logistics cost. Further, the tax benefits availed by the company will also boost the profit margins of PRAJ.

- **Entry into US markets**

  The acquisition of the US-based CJ Schneider, an equipment provider, is also likely to expand the PRAJ's client base in America. However, it could well be two to three years before the investment in this acquisition starts to pay back.

- **Opportunities in European markets:**

  The company recently commissioned UK's first ethanol plant for British Sugar at Wissington, Norfolk. Praj has joined an ICRISAT (International Crops Research Institute for Semi Arid Tropics)-backed consortium that seeks to promote ethanol production using sweet sorghum.

  The plant would produce 70 million liters fuel grade ethanol from beet sugar syrup. The agreement would allow Praj Industries to access research outputs of ICRISAT on ethanol-thru-sweet sorghum to further refine their ethanol engineering activities.

- **Joint Venture in Brazil:**

  Ethanol production in Brazil is poised to double by 2010. Today, Brazil is at a major turning point in terms of technology and plant designs and Praj sees an opportunity to serve these changing requirements.

  Praj has formed a joint venture with Brazil's Jaragua Equipamentos Industriais, a leading Brazilian engineering major, wherein Praj will hold 54% stake. The venture, situated in Brazil, will provide the company an entry into the global ethanol market. This will help Praj tap the huge ethanol production market in Brazil. Praj's ability to break into new markets also lends more visibility to its earnings. However, it could face stiff competition from established players in the respective markets.

Business expansion opportunities:

- **Ethanol blending mandate:**

  The Government's decision to blend ethanol with petrol is a welcome move. With sugar prices on a downturn, sugar companies could rely to a greater extent on byproducts such as ethanol for revenues and profits. Hence, capex in this segment is likely to continue and will also attract additional investment in further improving technology and infrastructure as well as in setting up appropriate processes. This would augur well for Praj.

- **Entry into Biodiesel technology:**

  Nearly 60% of the world's transport fuel growth will come from diesel, which can easily be replaced by biodiesel. This opens up vistas of opportunity in the biodiesel industry, especially in US and Europe regions, which are now pursuing biodiesel earnestly. Praj is planning to capitalize on its presence on these regions.

- **Biofuel blending norms in Europe:**

  The European Union's proposal to reduce carbon emission by 8% by 2012 also offers a substantial growth potential. Envisaging the upcoming demand, Praj has entered into a joint venture with the Netherlands-based Aker Kvaerner. Praj could leverage Aker's execution capabilities and the extensive European market knowledge, while using its own technology to cater to the European market.

- **Ethanol blending mandate in Philippines:**

  Praj has also signed a Memorandum of Association (MoA) with the department of agriculture of the Philippines Government to promote energy crops and technology for biofuels production in the Philippines.

  The Philippines Government has mandated 5% blending of biofuels in all transport fuel sold in the country, and is keen on increasing the blending limit. It is also an effort to promote local feedstock including sugarcane, cassava (for ethanol), coconut palm oil (for biodiesel) and new energy crops such as sweet sorghum for ethanol and Jatropha for biodiesel.

Financial Performance:

Operating margin was at 19.2% in FY07, an increase of 560 bps on Y-o-Y, driven by exceptionally strong margins H2FY07. This rise in margins has been supported by a significant growth in other income component during the year.

Net margin was at 14.2%, up 550bps Y-o-Y for FY07. We expect stable EBITDA margins going forward but expect net level profitability to be softer.

We expect the revenues to remain buoyant continue on back of several ventures initiated by PRAJ in the international markets and increasing global acceptance of ethanol as a blending additive and fuel. These near-term forays will undoubtedly support the margin growth for the company.

At CMP of Rs. 154.30 per share, the stock trades at PER of 9.53x of its FY08E earnings and 6.03x of its FY09E earnings. ***Thus we recommend a BUY on PRAJ.***

Consolidated earning summary for Praj Industries Ltd.					**(Rs mn.)**
	FY2006	**FY2007**	**YoY**	**FY2008 (P)**	**FY2009 (P)**
	12 mths	**12 mths**	**%**	**12 mths**	**12 mths**
Income from operations	2,675.7	6,109.3	128.3	9,262.5	12,777.5
Other Income	43.3	152.0		243.8	336.3
Expenditures	2,335.1	5,330.9		7,629.5	10,179.8
Op. Profit	364.8	1,170.4	220.8	1,876.7	2,933.9
Interest	24.8	27.3		28.2	29.4
Gross Profit	340.0	1,143.1	236.1	1,848.5	2,904.5
Depreciation	26.9	33.1		40.7	48.9
PBT	313.1	1,110.0	254.5	1,807.8	2,855.7
Tax	80.5	243.9		452.0	713.9
Profit	232.6	866.1	272.3	1,355.9	2,141.7
Equity capital	162.2	167.8		167.8	167.8
OPM (%)	13.6%	19.2%		20.3%	23.0%
GPM (%)	12.7%	18.7%		20.0%	22.7%
NPM (%)	8.7%	14.2%		14.6%	16.8%
EPS (Rs)	2.9	10.3		16.2	25.5
CEPS (Rs)	3.2	10.7		16.6	26.1

Southern Online Bio Technologies Limited

Southern Online Bio Technologies Ltd (SBT), formerly Southern Online Services Ltd., is promoted by first generation entrepreneurs. SBT's successful track record of over six years includes providing broadband internet services to up-market corporate clients besides providing dial-up internet services to individual customers. Originally a regional player in the Internet Service Provider (ISP) business, the company ventured into biodiesel when it setup a multi-feed 40,000 liters per day biodiesel plant

The Biodiesel Project:

Considering the opportunities in the field of production and supply of alternative fuels to petroleum-based fuels, SBT has now moved into the greenfield area of production of bio-diesel.

SBT's biodiesel unit has been established at Samsthan Narayanpur Village & Mandal, Nalgonda District in technical collaboration with Lurgi AG (Germany) with 40,000 liters per day capacity. The project entailed an investment of Rs.25.72 crore. This plant was commissioned on 12th July 2007, and is capable of using a variety of vegetable and other organic oils as feedstock to produce biodiesel. It is today the largest such facility in India. The first time segment revenues

stood at Rs. 187.57 lacs for Q1FY08, while the segment registered a loss of Rs. 18.87 lacs as a result of to low volumes, due to recent commissioning

The biodiesel unit has many outstanding features some of which include wasteland development by cultivating Pongamia / Jatropha as basic raw material, involving tribals, farmers and rural folk, generation of rural employment, conservation of precious foreign exchange and cutting down the threat of pollution.

Project Highlights:

- The company has already used a number of raw feedstocks such as fish oil, cottonseed oil, mahua oil, sal oil, kusum oil and successfully produced final product viz. biodiesel to meet the exacting standards.

- Jatropha and Pongamia are the most popularly known raw materials for production of biodiesel, but as a measure of prudence, the company has created a multi-feed facility to virtually eliminate the risk associated with supplies of feedstock.

- The biodiesel plant can accommodate a variety of feedstocks including (but not limited to) fish oil, cottonseed oil, mahua oil, sal oil, kusum oil, jatropha, pongamia, castor oil, palm sludge, neem oil, fatty acids, animal fats and used cooking oil.

- The customer list of the company already includes Airtel, Idea, AP State Road Transport Corp and TNT Express. Significant new customers added recently include RDSO (Lucknow), and Kirloskar Oil Engines. The company participated in the 1.15 crore liters per annum bio-diesel tender floated by APSRTC and was the lowest bidder. The company has received endorsement of its biodiesel product quality from Kirloskar Oil Engines and Hindustan Motors.

- With an installed capacity of 40,000 liters per day biodiesel in the existing unit, management has targeted production of 1.2 crore liters in FY09.

- The company has plans to upgrade the current production capacity at the biodiesel unit from 12500 TPA to 25000 TPA over a period of 3 years.

Financial viability of the project:

Project Cost	Rs. in million	257.20
Production Capacity	Liters Per Day	40000

First segment Revenue

Selling Price	Rs. Per Liter	27.50
Liters Produced during the Quarter	Million	0.96
Liters Produced Per Day		10687.75
Capacity Utilization		27%

Assuming 40% Capacity Utilization in 1st Year

Production	Liters in million	5.28
Revenue Generated	Rs. in million	145.20
Cost of Production	Rs. in million	97.70
Profit	Rs. in million	47.50

Assuming 60% Capacity Utilization in 2nd Year

Production	Liters in million	7.92
Revenue Generated	Rs. in million	217.80
Cost of Production	Rs. in million	146.52
Profit	Rs. in million	71.28

In the first segment of production, SBT produced 0.96 million liters of biodiesel (at 27% capacity utilization) which was sold at the rate of Rs. 27.5 per liter. Assuming capacity utilization of 40% and 60%, respectively for the First two years of operations, the biodiesel project will generate revenues of Rs. 47.5 million and Rs. 71.3 million for the two years, indicating net margins of almost 33%.

Future plans:

- **Greenfield biodiesel unit:**
  - Encouraged by the positive response of customers and the immense potential of the biodiesel market, the company has planned to set up a greenfield expansion of 250 TPD biodiesel in Visakhapatnam, Andhra Pradesh.

- This facility will be about seven times the size of the current facility, and will have several advantages such as economies of scale in project cost and unit production cost. Additionally, it is proposed to be setup in an SEZ and will enjoy several tax concessions.

- The total project cost is envisaged to be Rs. 90 crores, out of which the company has already tied up funds of over Rs. 23 crores via the recently approved preferential issue of shares/warrants to promoters and non-promoters at Rs 30 per share. The rest of the funding is being tied up by way of debt and equity.

- **Demerger:**

  - The company will soon be demerged into two separate companies, to focus effectively on the biodiesel business and the core ISP business.

  - It is expected that this demerger, when implemented, will result in better focus and clearer revenue and profit attribution to the two businesses of the company as also result in unlocking of shareholder value in the long term.

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