

INDIAN BIOFUEL SCENARIO: AN ASSESSMENT OF SCIENCE AND POLICY

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“The use of vegetable oils for engine fuels may seem insignificant today. But such oils may in the course of time become as important as petroleum and the coal tar products of present time.” - Rudolf Diesel In 1912



Biofuels offer an attractive alternative to fossil fuels, but a consistent scientific framework is needed to ensure policies that maximize the positive and minimize the negative aspects of biofuels. Numerous countries are moving towards the partial and gradual replacement of fossil fuels with biofuels, mainly ethanol and biodiesel. The increased move towards biofuels is spurred by global political, economical and environmental events, especially rising crude oil prices. Current sky touching hike in oil prices from US\$60 and US\$70/barrel in 2006 to current (July 2008) price of US\$ 140 a barrel has threatened the economic stability of oil-dependent countries and of the world at large.

The International Energy Agency projected that biofuels would be competitive with petroleum at petroleum prices of between US\$60 and US\$100 a barrel. That point has been crossed, and markets seem to be internalizing expectations of unstable and perhaps rising future oil prices. The competitiveness of biofuels, however, depends heavily on the relative prices of oil and of agricultural feedstock for biofuels.

Agricultural commodity prices increasing less than prices of other raw materials, biofuels have become competitive with petroleum in many developing countries' farm systems, even with today's technologies.

Biofuel Mission of India:

The country's energy demand is expected to grow at an annual rate of 4.8 per cent over the next couple of decades. Most of the energy requirements are currently satisfied by fossil fuels – coal, petroleum-based products and natural gas. Domestic production of crude oil can only fulfill 25-30 per cent of national consumption rest we are importing from other countries. In these circumstances biofuels are

going to play an important role in meeting India’s growing energy needs. Projected requirement of biofuel for blending under different scenario are given in table 1.

Table 1: Projected demand for petrol and diesel and biofuel requirements

Year	Petrol Demand Mt	Ethanol blending requirement (in metric ton)			Diesel Demand Mt	Biodiesel blending requirement (in metric ton)		
		@5%	@10%	@20%		@5%	@10%	@20%
2006-07	10.07	0.50	1.01	2.01	52.32	2.62	5.23	10.46
2011-12	12.85	0.64	1.29	2.57	66.91	3.35	6.69	13.38
2016-17	16.40	0.82	1.64	3.28	83.58	4.18	8.36	16.72

Source: Planning commission Govt. of India, 2003

Biodiesel Policy:

The demand for diesel is five times higher than the demand for petrol in India. But while the ethanol industry is mature, the biodiesel industry is still in its infancy. India's current biodiesel technology of choice is the transesterification of vegetable oil.

The Government of India has developed an ambitious National Biodiesel Mission comprising six micro missions covering all aspects of plantation, procurement of seed, extraction of oil, trans-esterification, blending & trade, and research and development to meet 20 per cent of the country’s diesel requirements by 2011-2012. Diesel forms nearly 40% of the energy consumed in the form of hydrocarbon fuels, and its demand is estimated at 40 million tons.

As India is deficient in edible oil and demand for edible vegetable oil exceeds supply, the Government decided to use non-edible oil from *Jatropha curcas* oilseeds as biodiesel feedstock. Extensive research has shown that *Jatropha curcas* offers the following advantages: it requires low water and fertilizer for cultivation, not browsed by cattle or sheep, pest resistant, easy propagation, high seed yield and ability to produce high protein manure. Some development works have been carried out with regards to the production of transesterified non edible oil and its use in biodiesel by Indian Institute of Science, Bangalore.

Advantages of using Jatropha Curcas

- The oil yield per hectare for *Jatropha* is among the highest for tree-borne oil seeds. The seed production ranges from about 0.4 tons per hectare per year to over 12 t/ha. There are reports of oil yields as high as 50 per cent from the seed. Typically, the seed production would be 3.75 t/ha, with an oil yield of 30-35 per cent, giving a net oil yield of about 1.2 t/ha.

- It can be grown in areas of low rainfall (200 mm per year), on low fertility, marginal, degraded, fallow and waste lands. Canals, roads railway tracks, borders of farmers' fields as a boundary fence/hedge in arid areas and even alkaline soils are appropriate for the crop.
- Jatropha is easily established in nurseries, grows relatively quickly and is hardy.
- Jatropha seeds are easy to collect as they are ready to be plucked before the rainy season and as the plants are not very tall.
- Jatropha is not browsed by animals.
- Being rich in nitrogen, the seed cake is an excellent source of plant nutrients.

Institutional Options for Jatropha Promotion:

There is ample scope and even necessity for involving diverse institutions in various stages of Jatropha production, promotion and rural livelihoods development. The list below helps us to identify the main kinds of institutions that can be involved in Jatropha production, promotion and rural livelihoods, development:

- Community-level Institutions
- Non Governmental Rural Development Organisations (NGOs)
- Technical Institutes, Academic Institutions and Universities
- Government Organisations /Departments
- Backs and other Micro-finance Institutions
- Planners and Policy-makers

Problems cited by farmers in Jatropha cultivation:

The following problems have been cited by farmers regarding Jatropha cultivation:

1. Lack of confidence in farmers due to the delay in notifying, publicizing and explaining the government biodiesel policy.
2. No minimum support price.
4. Lack of availability certified seeds of higher yield containing higher oil content.
5. No announcement of incentives/subsidy and other benefits proposed to be provided to farmers.

The government needs to take confidence-building measures and clearly formulate its policy and explain to farmers that their role is vitally important in the success of the biodiesel programme. Financial assistance should be given to NGOs in developing a large-scale awareness/training program for farmers. The government should arrange tours for reputable NGOs and progressive farmers to other countries/States to enable them to witness the success of biodiesel production first-hand.

Ethanol Blending:

The production of biofuels has already began in India, however many implementation problems remain and current plans do not necessarily benefit the rural poor. In October 2004, ten states (Andhra Pradesh(except Chittor and Nellore districts), Goa, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu (only in districts Coimbatore, Dindigul, Erode, Kanayakumari, Nilgiri, Ramanathpuram, Tirunelveli, Tuticorin and Virudhunagar), Uttar Pradesh and Uttaranchal) and three union territories (Daman and Diu, Dadra and Nagar Haveli and Chandigarh) were mandated by the Government of India to sell a 5 percent blend of ethanol and gasoline called gasohol as per Bureau of Indian Standards specifications if the price of sourcing indigenous ethanol for supply of ethanol-blended petrol is comparable to the price of indigenous ethanol for alternative uses, and the delivery price of ethanol at the location is comparable to the import parity price of petrol at that location and the indigenous ethanol industry is able to maintain the availability of ethanol for ethanol-blended petrol programme at such prices.

Currently, most ethanol in India is made from molasses after the sugar has been extracted from the sugarcane.

Need for biofuel strategies:

- Provide local solutions for national security
- Offer village level energy security
- Short gestation periods and therefore cut down delays
- Technology Components can be simplified
- Provide employment opportunities for unskilled and semi-skilled persons
- Lead to eco-friendly sustainable energy solutions

BRAZIL AND BIOFUEL: A SUCCESS STORY

BRAZIL is the only country to have succeeded in large-scale production and use of biofuels. Brazilian government wrote the world's first biofuels policy, a decree ² to develop ethanol as a fuel and blend it with gasoline. Today the sugar and ethanol production chain in Brazil is completely liberalized and, after a long period of research and investment in the science and technology of sugar cane and ethanol production, production costs are competitive with gasoline. The government established a mandatory blending of anhydrous ethanol into gasoline that varies from 20% to 25%. In 2003 flexi-fueled¹ cars started to be commercialized. By 2006, they represented 83.1% of new cars sold ¹ creating a very strong internal market for ethanol.

The Environmental Debate and Biofuels:

Earth Summit held in Rio de Janeiro, Brazil in 1992 resulted in two important Conventions: the Convention on Biological Diversity (the CBD) and the United Nations Framework Convention on Climate Change (UNFCCC). The Kyoto Protocol is one of the most concrete products of the UNFCCC processes which came into force in 2005. Responsibilities for the most polluting countries, including quotas for greenhouse gas emission reductions are first time defined in Kyoto Protocol. Current policies to gradually increase renewable energy use in transportation sectors are part of a broader agenda of reducing dependence on fossil fuels and reducing greenhouse gases to mitigate climate change and its impacts through carbon sequestration. A wide range of technologies are being introduced to increase use of renewable sources of electricity, including wind power, photovoltaic panels, small hydropower plants, biogas and biomass conversion plants. The only products currently available to significantly replace liquid fossil fuels in transportation on a global scale are biodiesel and ethanol fuels, however, despite advances of electric cars and hydrogen powered ones. As a result, several policies have been proposed recently to support biofuels research and production (Amaral and Pezzo 2007)

Future Challenges:

- Sufficient validated data on agronomic practices, yield potential and water requirement of biofuel crops are not available.
- Need to enhance production and supply of *Jatropha* and *Pogamia* and other non-edible oils to be used as biodiesel. The proposed strategy is to bring vast areas of degraded and low quality lands under biodiesel plantation.

BIOFUEL PLANTATION VS CARBON CREDITS

POWERGUDA, a remote tribal hamlet in the Adilabad District of Andhra Pradesh in India, sold the equivalent of 147tons of carbon dioxide in verified emission reduction as carbon replacement to the World Bank paid US \$ 645 to Powerguda women SHGs to neutralized the emission from air travel and local transport by international participants attending its international conference in Washington, USA held on 19-21st October 2003

SOURCE: Raju K. U. (2006)

Conclusion:

Policy makers, businesses, scientists and societies as a whole is how to responsibly establish sustainable production systems and biofuel supplies in sufficient volume that meet current and future demands. Biofuels are not a panacea. They do not solve all problems related to the over-consumption of fossil fuels, such as the emissions of greenhouse gases and climate change. But if properly deployed, biofuels can be environmentally beneficial and contribute to the diversification of the energy matrix globally, thus reducing the vulnerability that comes with dependence on a single energy source. A concerted and coherent scientific agenda involving scientists from different countries and disciplines is most welcome and needed to meet the challenge of designing technologies, systems and policies that maximize the positive potential of biofuels and reduce their negative impacts. Without expansion, continuity, commitment and proper concentration of efforts, the multiple, isolated initiatives being carried out in the world will not help us sufficiently understand the critical questions of sustainable production of biofuels.

References:

Amaral W. A. N. do and Pezzo C. Mapping a Course for Biofuels: Science-informed Policy Needed, Global Change News Letter No. 70 December 2007

Gonsalves Joseph B. An Assessment of the Biofuels Industry in India, United Nation's Conference on Trade and Development, 18 October 2006, Geneva.

Raju K. U. (2006) Biofuel in South Asian countries: an overview, Asian Biotechnology and Development Review, Vol. 8, No. 2, PP 1-9

Planning Commission, Government of India. Report of the Committee on Development of Biofuel, 16 April 2003.

http://www.un.org/esa/sustdev/documents/docs_unced.htm

http://unfccc.int/kyoto_protocol/items/2830.php

<http://www.ipcc.ch/pub/un/syren/spm.pdf>

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