

# **Biofuels in South Asia: An Overview**

## ***Editorial Introduction***

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Increasing energy demand and spiraling oil prices are putting financial strain on countries and also causing environmental degradation. Energy security has assumed greater significance than ever as energy consumption, food production, improved livelihoods and environmental quality are interrelated. Asian countries with dense population are more prone to energy crises than to their counterparts in the world. All countries in this region are net importers of petroleum fuels. In this context, as an indigenous and renewable energy source, use of biofuels can play a vital role in reducing the dependence on petroleum import and catalysing the rural economic development. In the last few years, interest in these green fuels has grown dramatically followed by the equivalent market responses.

Biofuels are presently receiving much worldwide attention. The bright prospects are primarily driven by Brazil, the United States and Europe. The trend continues in some Asian economies largely because of the increased economic activity, which has resulted in high growth of primary energy demand specifically for industrial and transportation use. The biofuel use may ease supply security of high energy consuming Asian economies. It is also being looked as environmentally safe fuel, which may contribute in reducing green house gases.

South Asia, with a geographical area of 5.1 million hectares, is home to 1.5 billion people and is witnessing a sustained and rapid economic growth. As a result primary energy demand in this part of the globe has increased by 64 per cent since 1991 reaching 584 million ton in 2003-04. In this context, liquid biofuels as an alternative energy source can play a significant role in the energy scene of this region.

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Recent developments have made these fuels economically interesting in view of the resource potential and the possibility of improving environmental performance, along with employment generation and empowerment of the rural economy. However, development of this biomass-based energy sector would require assured availability of resources and efficient technologies to keep pace with society's need for these clean and viable alternatives.

It is now a well-accepted fact that biofuels have lower environmental externalities and is acceptable on well-acknowledged environmental standards. This brings in the issue of international environmental agreements and increased use by environmentally conscious countries. It is known that most developed and developing countries spend huge foreign exchange on oil imports. Therefore, these countries would like to introduce use of biofuels aggressively by cutting down the cost of production and subsidising to the effect of impacting aggregate trade. The literature emerging from developed countries suggests that the arguments regarding trade in bio-fuels will surface on four counts in future discussion. First, it will feature in market access context from the point of view of the net exportable countries. Second, the support measures to the farmers will get into discussions especially in the context of comparison between developed and developing countries. These steps will provide an opportunity to some of the developed countries to push their sizeable farm subsidies under non-actionable group putting forth the biofuel front. Third, the debate may emerge in the context of technical barriers to trade as the technologies are well developed by a few countries. Lastly, the biofuel sector may also cause a flutter in the context of the neglected interface between environmental agreements (Kyoto Protocol) and WTO. The declaration of the agreement on South Asian Free Trade Area (SAFTA) gives both hopes and aspirations for added efficient cooperation in the promotion of biofuels. In short, a well-conceived biofuel programme with effective cooperation among the countries has the potential to lead South Asia to high rates of energy sustainability.

### **Sources and Preference for Biofuels**

In the South Asian countries there are significant variations in the composition of the energy mix. More than 90 per cent of the South Asian energy demand is from fossil fuels.<sup>1</sup> In this, petroleum accounts for more than 34 per cent. More than 70 per cent of the oil demand is

met through import and the quantum of imported petroleum is projected to be double by 2020. In this context Biofuel is seen as an alternative to petroleum energy which can play a significant role. Biofuel is an ester-based fuel oxygenate derived from renewable bio-resources such as *Pongamia Pennata*, *Jatropha curcas*, soybean, mustard, rapeseed, peanuts, palm oil, other vegetable oils, and animal waste like beef tallow.<sup>2</sup> It can be used in pure form but not advised accordingly due to the problem of *polymerisation* (vegetable oils contain triglycerides that end up in high oil gumminess resulting in formation of long saturated carbon chains) and therefore largely blended with petroleum diesel (petrodiesel) for use in compression-ignition (diesel) engines.<sup>3</sup>

Non-edible oil as biodiesel provides a win-win proposition for the densely populated Asian countries. Perennials such as *Pongamia pinnata* and *Jatropha Curcas* have offered an excellent opportunity to remedy the problems of environmental protection and oil crisis. Strategies for rehabilitating degraded lands and improving livelihoods through biodiesel plantations based on field experiences offer good potential.

### **Biofuel Promotion in Asia**

Among Asian countries, Thailand is tapping the potential of tapioca, cassava and palm oil, while in Indonesia both Palm oil and *Jatropha* are being tapped. In India thrust is on *Jatropha Curcas*, which can be grown in both arid and semi arid regions. High oil prices volatility and inconsistency in oil supply in the last decade have resulted in the increased awareness in major energy consuming Asian countries to look for an alternative that is indigenous and is sustainable. Already there are major players from the EU and US looking at vast lands of Asia and Africa as a potential gold mine of opportunity. European Union Biofuels Directive (2003/30/EC) lays down guidelines to expand the production and use of biofuels derived from agricultural, forestry and organic waste products. The directive sets only indicative targets and not mandatory targets. The target for 2005 is 2 per cent of transportation fuel and 5.75 per cent by 2010. Thus as per the biofuels directive, member states should ensure that a minimum proportion of biofuels and other renewable fuels is placed on their market. If the objectives set in the directive are achieved, the consumption of biofuels in the EU will increase from 1.4 million tons oil equivalents in 2001 to 19 million tons in 2010.

The Energy tax directive (2003/96/EC, 27.10.2003), gives the possibility to member states to grant tax reductions/exemptions in favour of biofuels, under certain strict conditions. The exemption or reduction in taxation applied by member states must be adjusted to take account of changes in raw material prices to avoid over-compensation. In turn most of the Asian countries are in the process of putting policies and legal mandates in place to have a viable and mandatory fuel mix with bioenergy (see Table 1).

Many Asian countries like Philippines, Thailand, Indonesia, Japan and China have initiated the bio-diesel programme but they all are at different stages of development. The Philippines has launched the Cocobiodiesel (a form of biodiesel known as Coco Methyl Ester or CME) programme, which is a derivative of coconut oil. Thailand is fast developing gasohol, a blend of gasoline and plant-based ethanol. But the bio-diesel initiative in Thailand is still in experimental stages. Malaysia, which is the world's largest producer of palm oil, is moving towards the direction of taking a set of initiatives for promoting the use of palm bio-diesel. The government unveiled a National Bio-fuel Policy in August 2005. Indonesia, the world's second-largest palm oil producer, is preparing a biofuel scheme for the next five years.<sup>4</sup> Indonesia aims to boost crop area under palm plantations to 8 million hectares in the next three years from the current 5 million hectares. Indonesia is exploring the world biodiesel market as world palm oil demand stagnates.<sup>5</sup> Though China ranks third in the world in ethanol production, not much of it is used as fuel. The Chinese bio-ethanol fuel programmes are a product of State sponsored five-year plans.<sup>6</sup>

**Table 1. Promotion of Biofuels in Asia**

Country	Source of Biofuel	Suggested Percentage of blending	Year of National Biofuel Policy or Act issued
China	Ethanol	10	2005
India	Ethanol, <i>Jatropha</i> oil and Pongemia Oil	5*	2003
Japan	Ethanol	3	2003
Malaysia	Palm oil	5	2005
Thailand	Topioca and Ethanol	10	2005
The Philippines	Coconut oil	10	2005

*Note:* \* Some bulk users, like public transport corporations are using up to 10 per cent and planning to use up to 20 per cent.

*Source:* Prepared by the author.

Though new ethanol plants are under construction, projections show that the demand for ethanol required for a 10 percent blend for all cars in China would far exceed the projected supply even after taking into account all the present proposed initiatives.<sup>7</sup> At the same time biodiesel production in China is still at a very nascent stage.

In South Asia much of the ethanol production comes from India and Pakistan. Use of alcohol as a fuel becomes significant option in these countries very recently. In Bangladesh, at present LPG are making inroads and biofuels have yet to make an impact. Private companies are making plans to manufacture fuel alcohol in the country. An investment of \$4.5 million will be made for a 12000litres/day ethanol plant, which uses molasses as a feedstock (Bangladesh Observer, 2005).

Biodiesel programme in India is in the formative years of development. Both the Central and State governments are keen to push the biodiesel programme considering the benefits of large scale rural employment and sustainable energy sources. At the Central governmental level biodiesel programme started in 2003 when the Committee on Development of Bio-fuel (Planning Commission) recommended launching of a National Mission on Bio-diesel.<sup>8</sup> The special focus of the National Mission was on plantation of *Jatropha* on wastelands. In August 2003 Ministry of Rural Development (MoRD) was identified as the nodal ministry and in January 2005 a Detailed Project Report was prepared with extensive consultations for the pilot phase (*Jatropha* plantations on 400,000 ha). The government of India announced the Biodiesel Purchase Policy in 2005 and implemented National Mission on Biodiesel in 2006. The major step forward in the Indian ethanol programme was the Government of India notification on EBP (Ethanol Blending Programme). This notification made five per cent ethanol doping in petrol mandatory in nine states and four territories, with effect from 1 January 2003. At the State government level, several States have initiated biodiesel programmes and policies.

States like Chattisgarh, Uttaranchal, Rajasthan, Andhra Pradesh and Tamil Nadu have already formed nodal agencies for bio-diesel development and announced draft bio-diesel policies. These states have initiated plantation programmes as well.

There is a need to work out a legal regime supporting biofuel initiatives. This would provide a legal mandate for the compulsory blending of biofuels with regular fuels. To facilitate the entry of more players in the biofuel industry and to ensure the uninterrupted supply

of biofuels, the production of the same should be made economically viable. Thus the law should also provide for various tax breaks and subsidies. Once the biofuel industry attains the economies of scale to be self-sustaining, these incentives can be gradually withdrawn.

### **Future Challenges**

Although technologies, policy support, and demand for biodiesel are building up, the main constraint is supply of raw material. Validated and good quality data on agronomic practices, yield potential, diseases and pest management, and water requirement are not available. Many failures of planting programmes have been attributed to the selection of inappropriate species, varieties and climatic condition. Therefore choice of appropriate species plays a key role in such programmes, which is governed by a full understanding of the climatic and edaphic factors among others. Extensive research programmes also need to be implemented to channelise inexpensive alternate feedstocks for biofuel production. There is an urgent need to undertake research on all aspects of biodiesel plantations along with legislative framework.

There is also a need to enhance production and supply of *Jatropha* and *Pongamia* 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 plantations. The total number of species with oleaginous seed material mentioned from different sources varies from 100 to 300 and of them 63 belonging to 30 plant families holds promise.<sup>9</sup> Two species namely *Jatropha curcas* and *Pogamia pinnata* are favoured in Indian context because of their contrasting plant characteristics.

Further more, the respective governments may undertake identification of existing resources and country specific feedstocks, which can be channelized for biofuel production. Depending on the climate and soil conditions, different countries should look for suitable types of vegetable oils. Import of full-fledged technology from other countries is also a good option, but this should be coupled with indigenous technological interventions.

Biodiesel plantations can be successfully utilized in order to improve livelihoods on sustainable basis. It has also the potential for generating the employment from plantation, harvest and processing activities, which will reduce migration from rural areas. Participation of women Self-Help-Groups (SHGs) in managing the plantations will boost their livelihoods and will empower the women. Biodiesel plantation provides

win-win situation to protecting environment, increased income, and generating employment opportunities in rural areas. And South Asian countries have enormous potential for biofuels and have complementary endowment on a contiguous landmass, which can help tremendously in developing an integrated bioenergy framework. Incredibly organized planning and intense research efforts are two key components for the implementation of a sustainable biofuels programme. As land requirement emerges as a major prerequisite in the biodiesel programme, there should be proper identification programmes for wasteland and documentation of marginally productive and wastelands, which can be targeted for plantation of oil bearing plant species, without compromising on food production.

### **Policy Measures**

- One of the options for promoting livelihoods of poor is through promotion of plantation by user groups or SHGs on common pool lands like degraded forests, community owned lands, low quality lands not suitable for annual food crops production, railway setbacks, canal embankments, tank foreshore, etc.
- There is need to have a strategy to develop/rehabilitate degraded lands through biodiesel plantations by efficient use of existing natural resources.
- Lack of scientific information about suitable management practices as well as identification of high-yielding accessions and lack of high yielding cultivars on large scale holds back development in this area. There is an urgent need to undertake detailed research for development of management practices, high-yielding cultivars, mass multiplication techniques, suitable development models for increasing supply of raw material for bio-diesel production.
- There is need to promote decentralised extraction and decentralised processing. Asian countries should promote and utilize the expellers available locally as it will minimize the cost of transport of raw material, and will generate employment in rural areas. There is a possibility of using oil directly in the irrigation pumpsets and can be blended directly with diesel up 10 per cent for use in farm machinery.
- Recycling of cake for production of biogas and compost. The cake offers an excellent opportunity for reducing the dependence on fertilizers and its marketing will generate additional income. The cake can also be used for production of biogas before composting

and both these two processes will improve nutrient availability to the crops and will reduce pressure on energy demand for domestic use.

- Biofuel plantations can earn carbon credits. Powerguda, a remote tribal hamlet in the Adilabad district of Andhra Pradesh in India, became an environmental pioneer when it sold the equivalent of 147 tons of carbon dioxide in verified emission reduction as carbon replacement to the World Bank in October 2003. The World Bank paid US \$ 645 to Powerguda women SHGs to neutralize the emissions from air travel and local transport by international participants attending its international conference in Washington, USA held on 19-21 October 2003.
- Employment generation from plantation, harvest and processing activities will reduce migration from rural areas, which is a big concern in most Asian countries. Participation of women SHGs in managing the plantations will boost their livelihoods and will empower the women.
- It has both tangible benefits as well as in-tangible benefits. There are innumerable in-tangible benefits like: a) potential to produce a green fuel that will reduce carbon dioxide emissions and re-circulating atmospheric CO<sub>2</sub> through the process of photosynthesis; b) greening of waste and marginal lands, which has positive impact on hydrology; c) alleviate soil degradation, deforestation and conserve soil and rainwater; and d) improved ecosystem and environmental sustainability.

### **This volume**

This Special Volume on Biofuels has five papers. Each paper has dealt with a specific issue related to Biofuels to indicate the emerging trends in South Asia. The paper by Suhas Wani, Osman, D'Silva and Sreedevi has focused on how rural livelihoods and biodiesel plantations in Asia can enhance environmental protection. From macro perspective, Rammohan and Thomas Phillippe have explored a legal framework to support biofuels which can be used as an instrument for energy access and security as part of the environment protection and rural empowerment in South Asia. Linoj Kumar, Prabha Dhavala and Sameet Maithel argue how resources and technologies can play a vital role in promoting biofuels in South Asia in their paper on Liquid Biofuels in South Asia. Equally important is whether WTO agreements have any



implications on promotion and use of biofuels in Asian region. This has been discussed threadbare by Despande. I hope this special Volume would enable to generate more comprehensive dialogue on these issues, which would help to clear the clouds and promote use of biofuels.

## Endnotes

- <sup>1</sup> Hussain Leelaratne and Razaak 2002.
- <sup>2</sup> Biodiesel is a one of the main components of biofuels. It was introduced in a few countries around World War II, to power vehicles and the interest was renewed in the recent past, now it is partially replacing the traditional fuel.
- <sup>3</sup> EIA, 2001.
- <sup>4</sup> <http://www.planetark.com/dailynewsstory.cfm/newsid/33161/story.htm>
- <sup>5</sup> <http://www.planetark.com/dailynewsstory.cfm/newsid/31182/story.htm>
- <sup>6</sup> Moore, Janet 2005 <http://www.startribune.com/117/story/73696.html>
- <sup>7</sup> Slingerland and Geuns 2005.
- <sup>8</sup> Report of the Committee on Development of Biofuels, Planning Commission 2003.
- <sup>9</sup> Hegde, 2003.

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