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Biofuels and WTO: An Emerging Context

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Abstract: Biofuels are strongly emerging as partial substitutes for fossil fuel and this has an economic as well as environmental angle. Sooner or later, the trade angle of the biofuel sector is likely to feature in international discussions and at that time, we may have to look into the arguments that focus on trade that is associated with environmental issues. At Doha, in the Ministerial meeting under Para 51, the issue emerged though indirectly, but the literature emerging from developed countries suggests that the arguments will surface on four counts. First, it will feature in the market access context from the point of view of the net exportable countries. Second, the support measures to the farmers will get into the 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 the non-actionable group putting forth the biofuel front. That will have a bearing on the Hong Kong agreement. 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. This paper is only indicative of the forthcoming arguments as the use rates of biofuels are still quite low but raises a few intriguing questions.

Introduction

Biofuels are preferred the world over as partial substitutes to traditional fossil fuels on two major counts. First, this is a renewable fuel with least environmental externalities. Second, it is economically viable and associated with strong income transfer effects. Biofuels are now set to become the most acceptable substitute owing to the environmental advantages and economic acceptance. A number of questions are however, raised in this context. Biofuels save on the traditional fossil fuels and this will have a bearing on the trade sector. It is known that most developed and developing countries spend a huge amount of

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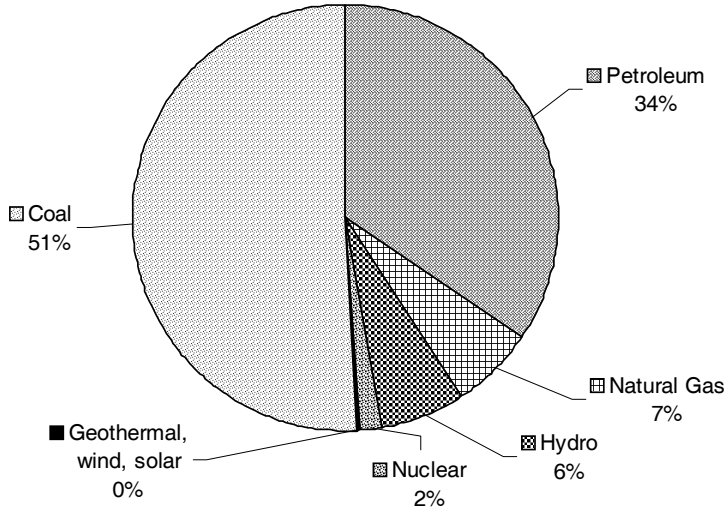
foreign exchange on oil imports. Therefore, these countries would like to introduce the use of biofuels aggressively by cutting down the cost of production and subsidizing the same. The effect of these measures will impact aggregate trade, trade related issues therefore will come into play. It is now a well-accepted fact that biofuels have lower environmental externalities and are acceptable on well-acknowledged environmental standards. That brings in the issue of international environmental agreements and the increased use by environmentally conscious countries. Increased production and use of biofuels will be provided with incentives in the production sector and that will fetch in agreements on the aggregate measure of support. This paper is an attempt to discuss some of these issues keeping the Indian context at the core of the discussion. We are quite aware of the limitations of the data, of the literature in the Indian context and of the present low use rates. In such a situation some of these are distant consequences, but raising the issues on this platform is yet essential.

Biofuels and Energy Use

Biodiesel is 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. Presently it is partially replacing the traditional fuel. Biofuel is an ester-based fuel oxygenate derived from renewable bio-resources such as *Pongemia Pennata*, *Jatropha curcas*, soybean, mustard, rapeseed, peanuts, other vegetable oils, and animal waste like beef tallow (Francis, George *et al*. 2005). It can be used in pure form but not advised due to the problem of Polymerisation (vegetable oils contain triglycerides that end up in high oil gumminess resulting in the formation of long saturated carbon chains) and therefore, is largely blended with petroleum diesel (petrodiesel) for use in compression-ignition (diesel) engines.[1] The rationale of blending biofuels with the fossil fuel rests on a few counts namely: (i) ethanol and biodiesel are less damaging from the environmental point of view due to the composition of the emission; (ii) it provides energy security in rural areas; (iii) it has a strong employment and income generating effect; (iv) the plants are soil enriching and help in arresting soil degradation; (v) its introduction answers the global concern about the greenhouse effects, and (vi) it reduces the dependence on huge oil imports and saves foreign exchange as well as reduces dependence on the oil exporting countries.[2]

Figure 1: India's Fuel Share of Energy Consumption, 2001 (Btu)



Source: EIA (2001).

In India, almost 90 per cent of the total energy consumption comes from fossil fuels (coal, petroleum and natural gas). Only 0.2 per cent of non-traditional sources are used. Among the fossil fuels, coal accounts for about 50 per cent of India's energy consumption. Petroleum is the second highest providing 34.4 per cent of energy consumption, while natural gas and hydroelectricity meet with 13 per cent of the consumption (see Figure 1). Recently, natural gas has grown in importance, as its share in India's energy consumption is rising. Non-conventional sources of energy like wind, solar energy, and biomass constitute a very small share of the country's energy consumption. It is a well-accepted fact that the markets for all fuels develop with the growth of the economy. This happens due to a circular causation. While the demand for infrastructure increases with production activities, these activities in turn create the need for additional infrastructure. That generates demand for fuel and fuel substitutes.

It is a well-accepted fact that fuel demand is largely dictated by lagged real GDP. The growth of the economy (represented by real GDP growth) is thus the main determinant of fuel demand. It is expected that Indian GDP will grow by more than 8 per cent per annum during the near future and it is also an agreed fact that the growth rate of

demand for fuels in any country will be above half of that of Gross Domestic Product (GDP) growth. Our energy demand is therefore expected to grow at more than 5 per cent per annum owing to an increase in urbanization, standard of living, and expanding population. In India, the elasticity of fuel demand was 3.06 in the First Plan and peaked at 5.11 during the Third Plan. It came down to 1.65 in the eighties, but during the nineties, an elasticity of around 1.5 is projected in the near future (TERI *Report on Market assessment for fuel cells in India*). The market for biofuels will develop out of three important conditions. First, it is the shortage and price of the fossil fuels that will make it necessary to shift to an alternative. Second, the pollution created by the increased density of vehicles using traditional fossil fuels will make it obligatory to search for alternatives. Third, biofuels will automatically lead to more vegetation and use of forest, non-forest products apart from bringing in proper usage of waste lands.

Presently, our energy use is largely from the fossil fuels. While the country is short of petroleum reserves, it has large arable land as well as good climatic conditions (tropical with adequate rainfall in large parts of the area) to account for biomass production each year. That provides a good opportunity to shift towards this alternative source. The GDP-Fuel equation (Fuel demand explained by the lagged GDP) clearly shows that fuel demand is increasing at 4.30 per cent per annum between 1970-71 and 2002-03. Therefore, in order to support an envisaged growth of GDP at around 8 per cent per annum, the rate of growth of fuel supply

Table 1: Fuel Supply Overview

Component	Quantity
Proven Oil Reserves (1/1/04E)	5.4 billion barrels
Oil Production (2003E)	819,000 barrels per day (bbl/d),of which 660,000 bbl/d was crude oil
Oil Consumption (2003E):	2.2 million bbl/d
Net Oil Imports (2003E):	1.4 million bbl/d
Crude Oil Refining Capacity (1/1/04E)	2.1 million bbl/d
Natural Gas Reserves (1/1/04E)	30.1 trillion cubic feet (Tcf)
Natural Gas Production (2002E)	883 Bcf (Billion cubic feet)
Natural Gas Consumption (2002E)	883 Bcf
Recoverable Coal Reserves (2001E)	93.0 billion short tons
Coal Production (2002E)	393 million short tons (Mmst)
Coal Consumption (2002E)	421 Mmst
Net Coal Imports (2002E)	28 Mmst

Note: Units are mentioned with each component, Reference Year in Brackets.
Source: Data from www.indiastat.com

needs to be about 5 per cent annually. If experience is any indication of the fact that the present supply will not be able to meet the future demand of fuel by the year 2011-12. India may face severe fuel shortages, affecting all user sections such as transport, communication, as well as agriculture. But markets have still not developed for biofuels and the process is quite slow compared to the potential.

Biofuels and Emerging Markets

Among the well-established biofuels, ethanol is produced mainly from cane or molasses, generally a bi-product of the sugar industry, and thus is a renewable resource. It can also be produced from starch, potatoes and even wood. Similarly, oil is usable as biofuels and could be extracted from other oilseeds but as the demand for edible oil outpaces its supply, it is economically not viable to use edible oil for production of biodiesel. Alternatively, there are a few tree species, which produce seeds rich in fuel oil. Of these, some promising tree species are *Jatropha curcas* (Ratanjyot, Chandrajyot), *Simerouba Glauca* and *Pongamia pinnata* ('honge'or 'Karanja'), which are well established in India's climatic conditions. These are largely grown on cultivable wastelands, on degraded forest areas and could also be cultivated as a plantation as well as grown on the sides of railway tracks, roads and bunds of irrigation canals. Among various combinations of blended biodiesel, the most common combination is B-15 (15 per cent biodiesel with 85 per cent petro-diesel). B-15 has been designated as an alternative fuel. But as the biodiesel industry is still in an infant stage and assaying into full-fledged manufacturing processes, there are various compositions being used in actual practice. Several industries and commercial establishments such as hotels, hospitals and restaurants are already using some form of the alternative fuel and as such are potential customers for such fuels.

The demand for biofuels mainly emanates from vehicles that include all transportation vehicles. In India, the density of vehicles has been growing at a very rapid rate. The growth has been phenomenal during the nineties (see Figure 2). The increase in motor vehicles is phenomenal in the case of cars, jeeps, taxis and trucks. We can also see this from the growth rates of motor vehicles in the country (see Table 2). The demand for biofuels will be largely from buses and transport vehicles that are growing at 2.23 and 2.06 per cent per annum. Therefore, we can expect the biofuel sector to grow initially at above 8 per cent per

Table 2: Percentage Increase and the Growth Rate of the Types of Vehicles: 1980-81 to 2002-03

Types of Vehicles	Average (in 000 numbers)		% In]crease	Growth Rate (1990-91 to 2002-03
	1980-81 to 1989-90	1990-91 to 2002-03		
Two Wheelers	6572.70	27325.31	315.74	2.37
Cars, Jeeps & Taxis	1811.20	5037.38	178.12	2.59
Buses	225.90	495.23	119.23	2.23
Trucks	878.40	2256.15	156.85	2.06
Others	1474.10	4290.31	191.05	2.26
Total	10962.30	39404.38	259.45	2.36

Source: Data from www.indiastat.com

annum and to settle down in the neighbourhood of a 5 per cent growth rate per annum in the long run.

Increase in the density of motor vehicles could be visualized in five distinct phases. The first phase marks initial slow growth up to 1985-86, followed by the second phase that ended at 1990-91. The third phase began in 1990-91 and provides actually three distinct periods in that span of 12 years. What we can see from Figure 2 is the sharp growth after 1995. That culminated into a high incremental demand for petroleum products during nineties (see Figures 3 and 4). It can be seen from the table that increase in the consumption of petroleum products during the nineties has been phenomenally high. The change is substantial in Consumption of Liquid Petroleum Gas, Petrol Coke, High Speed Diesel Oil, Naptha and Motor Gasolene. In India, we may have to continue to depend on

Figure 2: All Types of Registered Motor Vehicles in India

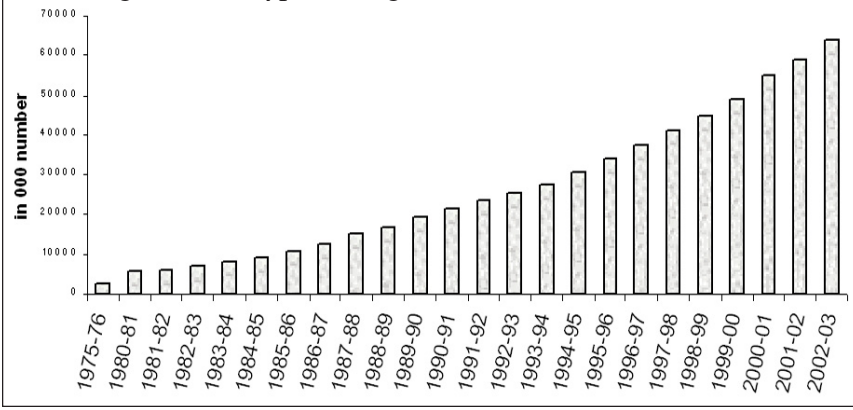


Figure 3: Total Sales/Consumption of Petroleum Products: India 1950-2002

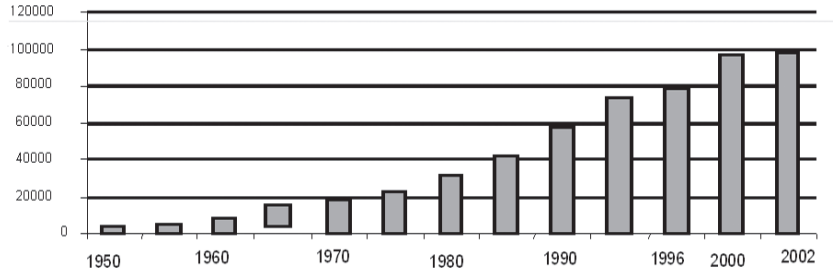
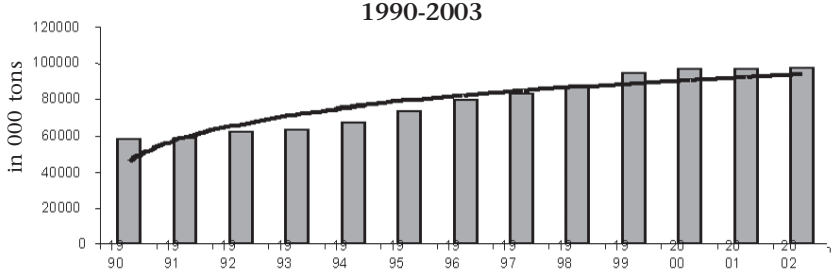


Figure 4: Total Sales/Consumption of Petroleum Products in India 1990-2003



the fossil fuels especially imports of petroleum products which is growing at the rate of 2.3 per cent per annum (see Table 3). That will force us to depend on international markets either for petroleum products or even for biofuels. This situation is globally similar and may worsen in the future as can be seen in Annexure Tables 1 and 2.

Biofuels could be used with petroleum in a combination of 85:15 with a few categories and thus at the present consumption level, the volume of market for biofuels works out to be 2.787 million tons. That demand is certainly too huge to be met with the ongoing programmes and thus there will be a little dent on the import bills. Our present production of crude oil from own sources is about 680 thousand barrels per day and that is fluctuating significantly, needless to add that this supports a very small portion of our demand.

Oil accounts for about one third of India's total energy consumption. India's major oil production facilities are located in Mumbai High, Upper Assam, Cambay, Krishna-Godavari, and Cauvery basins. The Mumbai High field is the largest oil reserve, with an output of around 2.6 lakh barrels per day (bbl/d). But that is way below the

Table 3: Per cent Increase and Growth of Petroleum Products 1970-71 to 2002-03

Petroleum Products	Average (In '000 tons) 1970-71 to 1989-90	1990-91 to 2002-03	Per cent change	Growth rate (1990-91 to 2002-03)
Liquified Petroleum Gas	747.7	4795.2	541.3	2.60
Motor Gasoline	1863.3	5085.7	172.9	2.69
Naphtha	2397.9	6667.4	178.1	3.39
Kerosene	4800.8	10029.3	108.9	2.73
Aviation Turbine Fuel	1160.5	1990.5	71.5	2.52
High Speed Diesel oil	10635.8	31788.4	198.9	1.72
Light Diesel oil	1182.5	1440.5	21.8	5.91
Fuel oil	6851.9	11079.2	61.7	2.23
Lubricants	608.8	979.7	60.9	4.59
Bitumen	1079.1	2228.0	106.5	2.22
Petroleum Coke	177.7	701.6	294.8	4.64
Refinery Fuel	1739.4	4260.5	144.9	3.54
Others	604.8	2416.8	299.6	3.37
Total	34093.0	84226.4	147.0	2.31

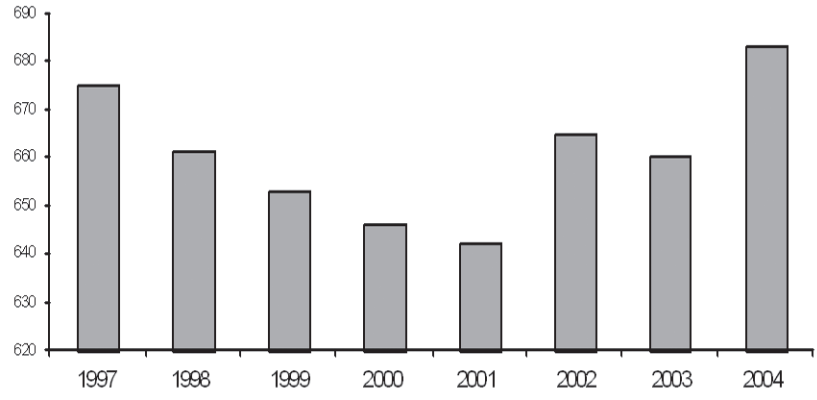
Source: Indian Petroleum and Natural Gas Statistics, 2002-03/Ministry of Petroleum and Natural Gas, Govt of India, New Delhi.

ever-increasing demand for oil in India. Presently, the net import of oil in India is about 78 million tons and costs INR 760 billion. Future oil consumption in India is also expected to grow rapidly, to 2.8 million bbl/d by 2010, from 2.2 million bbl/d in 2003.[3] India is attempting to limit its dependence on oil imports by expanding domestic exploration and production. To this end, the Indian Government is pursuing the New Exploration Licensing Policy (NELP), first announced in 1997, which permits entry to multinationals. India proceeded with the award of 25 oil exploration blocks in early January 2000. Reliance Industries, in partnership with Niko Resources of Canada became one of the major explorers of oil. Our crude oil production according to the Tenth Plan Working Group is estimated to be around 33-34 mmt per annum even though there will be an increase in gas production from 86 mmsemd (2002-03) to 103 mmsemd in 2006-07. That will certainly leave a huge gap in the demand and the home production to be met with imports. This can be seen from the EIA sourced data presented in the figure.

Projected Future

It is very clear that if ideally biofuels (B-15) are substituted at 15:85 ratios, then the country will save sufficiently on fuels. The present

Figure 5: India's Crude Oil Production (Thousand Barrels per Day)



import of crude oil and petroleum products cost the government about INR 764,240 million (2003-04). If biofuels are substituted, the country will save about INR 114,640 million worth of foreign exchange. That will be a quite a large saving but it cannot happen in one go. If light diesel oil, motor gasoline, fuel oil and lubricants are to be substituted gradually with 15 per cent of bio fuels then the production of biofuels has to be in the range 2.8 million tons. This will need about 10 million hectares of land under these crops. The estimated national potential of biofuels is estimated at 2 million tons at today's consumption levels and may grow up to 200 million tons in the next two decades (see Tables 4 and 5). If one gets the present production scenario and the availability of land, the targeted programme could be drafted. The main challenge, however, will be the distribution network. This has to be sorted out by routing biofuels use through the existing fuel vendors and possibly by connecting a market chain incorporating the current Petro products distribution network.

Table 4: Projected Growth of Use in Fuel Oil: Future Plans

Item	Annual Growth %		
	10th Plan	11th Plan	12th Plan
Motor Gasoline (MS)	7.3	5.0	5.0
Aviation Turbine Fuel (ATF)	3.2	3.2	3.2
High Speed Diesel (HSD)	5.6	5.0	4.5

Source: Panigrahi *et al.* (2004).

Table 5: Projected Fuel Requirements and Domestic Supply

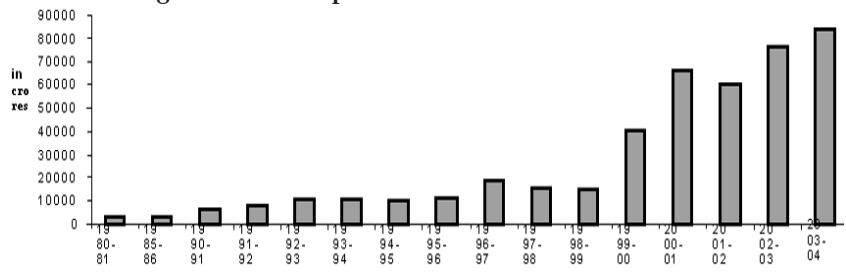
Item	Projection in thousand MT				Domestic supply %	
	2002-02	2006-07	2011-12	2016-17	10th Plan	11th Plan 12th Plan
MS	7070	10067	12848	16398	22.2	Lower than 10th
ATF	2299	2691	3150	3687	22.2	Plan projection
HSD	39815	52324	66905	83575	22.2	If foreign JV is ignored
NG	81.33	179	313		47.9	

Source: Panigrahi *et al.* (2004).

International Agreements

One of the main issues that surfaces here for discussion is the role that biofuels will play in the context of international agreements. The Cartagena Protocol on Biosafety, which is commonly called as the Biosafety Protocol (BSP), is a multilateral environmental agreement that entered into force on 11 September 2003 after 50 countries ratified it. By 28 July 2004 there were 105 parties agreeing to the discipline of the Cartagena Protocol on Biosafety (BSP) (Canada signed the BSP but never ratified it and the US was never a party to it). The BSP explicitly allows countries to use the Precautionary Principle and allows countries to block products that have used unacceptable technology anywhere in its production. Therefore, the BSP will not be having any direct consequences for the biofuel sector. However, the part of the agreement that concerns on environmental quality may have to be considered here as having a clear bearing. Biofuels have implications for producers as well as the users of biofuels. For the producers it will be a question relating to finding markets and sustaining them, whereas the net importer may have to accept the quality and demand generated elsewhere. The Kyoto protocol, however, will have a clear bearing on the biofuel sector and will boost demand for biofuels. The Kyoto Protocol requires that

Figure 6: Net Import Value of Crude Oil in India



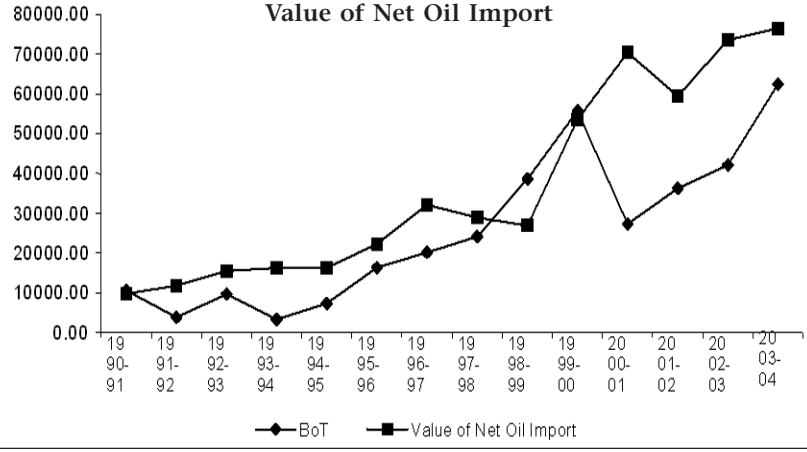
developed countries must reduce their greenhouse gas emissions by at least 5 per cent from the 1990 levels during the commitment period 2008-12. That would become obligatory and will certainly feature in the coming negotiations. In addition to these, the general discipline of trade and tariff will also operate in this context.

Trade and Foreign Exchange

Biofuels will enter the trade discipline not only as a commodity but as a category which will have significant economic and environmental implications. It is well known that oil prices and oil imports significantly influence the macro-economic parameters in developed as well as the developing world. The sensitivity of macro-economic parameters of developing countries to oil stocks is more critical. Among the macro economic aspects, Balance of Trade is quite an important determinant of countries trade performance. India had an adverse Trade Balance during the last three decades and a large share of this was contributed to by the oil sector. India has to depend largely on import of crude oil and such imports increased sharply during the nineties. The total import of the quantity of crude oil was 20,699 thousand m tons in 1990-91 which increased to 90,434 thousand tons in 2003-04 (see Figure 6). The foreign exchange spent on this trade was INR 61 billion in 1990-91 and that increased to INR 835 billion in 2003-04.

It becomes obvious that the oil sector is quite crucial for the trade balance (see Figure 7). The relationship between the aggregate trade

Figure 7: Trends in the Balance of Trade and Value of Net Oil Import



balance and value of net imports of oil sector is quite strong and the correlation works out to be 0.84 (significant at 1 per cent level of significance). In this context, the substitution of biofuels will influence trade balance though not substantially, at least by 15 per cent if one excludes the spill over effects.

The transport sector remains the most problematic sector as the search for an economical alternative to petroleum-based fuel has been unsuccessful so far. Hence petro-based fuels will continue to dominate the transport sector in the foreseeable future but their consumption can be minimized by implementation of the bio-fuels programme expeditiously.

Global Policy Environment and WTO

Biofuels have not been discussed in any global policy environment explicitly. However, there are sufficient leads that indicate the possibility of biofuels emerging on the scene sooner or later. In the global policy environment, bio-fuels are pertinent from three distinct perspectives. First, as discussed above it may be considered in the context of environmental agreements, due to its dependence on the biomass, reduction of harmful emissions and the impact on the forest use. It is feared that the utility of certain species may lead to their over exploitation but at the same time its positive effect on green-house gases will also be weighted. Second, the emission standards in the case of biofuels also features as an important point for discussion. It is stated in an official Report of the India's Planning Commission that the emission standards are globally accepted and that may boost the use of biofuels.[4] Third, since biofuels will be largely substituting the fossil fuels the trade angle enters into picture. This will bring in arguments about the support to the industry as well as the tariff discipline. That also provokes discussion of the policy in the WTO forum.

Biodiesel is now a tradable commodity with significant economic and environmental implications. It gets included in environmental goods and services. Bio-diesel is one component of biofuels and a chemical compound (an ester) that can be made from vegetable oils and animal fats. Bio-diesel can be used in its pure form or mixed with traditional fuels. Biofuels have a significant impact on the emission levels and these reduce the harmful gases to a large extent. These positive implications on environment brings biodiesel into the international debate. In the Kyoto Protocol, it is stated that the developed countries

should reduce their emission levels. The CO_2; NO_2; and SO_2 emission standards are agreed upon and that would become obligatory (see Table 6). Many of these countries have already passed specific legislation establishing voluntary or mandatory replacement of fossil fuels by biofuels. Importing biofuels from other, mainly developing countries, could help them reach their targets. However, many biofuel exporting countries still face technical trade barriers. To prevent asymmetry between trade liberalization objectives and Kyoto Protocol reduction targets, new approaches and policy space are warranted in order to ensure that trade liberalization efforts and policies in implementing the Kyoto Protocol become truly and mutually supportive. Even though this belongs to environmental standards, it will certainly feature in the coming WTO negotiations. The main pollutants emitted in the combustion of fossil fuels are carbon, sulphur, and nitrogen oxides, along with suspended particles.

As a secondary pollutant, ozone is formed in the troposphere from interaction among hydrocarbons, nitrogen oxides and sunlight. These have significant impact on human health. Therefore, biofuels are justified on health and environmental grounds. As the developing countries use a lower amount of fossil fuels, the pollution levels are also quite low here; pressure may therefore be mounted, on the developed world.

The experience of many countries including Brazil show that biofuels could be produced at a low cost and the cost of production decreases over the years. Therefore, developing countries could take advantage of biofuels by producing for the purpose of trade. Notwithstanding all the advantages, biofuels are likely to face significant trade barriers from developed countries. First, the developed countries are almost fully dependent on indigenous producers and therefore,

Table 6: Emission Reduction due to use of Biofules

Emission	Reduction (%)
CO	67
HCHydrocarbons	30
PM Particulate matter	68
SOOT	50
PAH	85
CO_2	100
NO_2	2-6
S	8-100

Source: CETESB, 2004.

may support the sector substantially with domestic subsidies. Second, they could bring forth some restrictive regulations often based on quality and technology of production (non-tariff considerations), and third, the technology, as well as investment would favour fossil fuels, as the use rates of the fossil fuels would remain significant. That will provoke the oil exporting nations to take up the arguments especially on tariffs.

Biofuels have become a high priority issue in the US, the EU and in a number of other countries around the world, due to concerns about oil dependence, reduction in NO_2, S, and CO_2 emissions or restrictions on other octane enhancement additives and oxygenation. The National Biodiesel Board of the United States carried out studies on the introduction of biodiesel and a major part focuses on support to the farmers and trade implications. Soyabean and mustard are high on the US agenda for supporting the biodiesel sector. That fetches in the domestic support discipline under Aggregate Measure of Support. The Doha Declaration has a significant bearing on this issue. It states, "with a view to enhancing the mutual supportiveness of trade and environment, we agree to negotiations without pre-judging their outcome, on: (i) the relationship between existing WTO Rules and specific trade obligations set out in the Multilateral Environmental Agreements (MEA)".[5] (ii) It further states that the WTO negotiations without environmental goals shall not prejudice the WTO rights of any member that is not a party to the MEA.

Many countries have provided significant tax concessions to the users of biofuels. Germany and Italy levy no tax on biodiesel, whereas UK has a 20 per cent lower tax on biodiesel than on other fuels. Several states in US have lower taxes on biodiesel. In the EU, there is a preferential treatment for ethanol imports. Internal production is subsidized through tax reduction of as much as EUR 0.65 per gallon, Stlg 0.2 in UK, EUR 0.38 in France, and EUR 0.525 in Sweden (EIA). Soyabean based biodiesel is the main fuel substitute in US and Brazil and it is likely that soyabean growers of the US will benefit from large tax concessions and that may be used as one avenue to convert the actionable subsidies on soyabean sector in the US to non-actionable green box subsidies.

The biofuels sector interfaces with the WTO regime in five important ways. First, it involves *de-minimis* Market Access (WTO, Art XXXVII) featuring from the viewpoint of the Oil Exporting countries.

The international market for fossil fuels is well organized and any large-scale intervention in this situation is likely to be strongly resented. But probably that is a distant possibility due to the lower limits in the provision as well as the size of trade. Therefore, this issue may not come up for discussion in the immediate future, at least under this provision. The second issue arises from the Domestic Support angle, and here there is a possibility that trade in fuels may get restricted due to the possible generous support to the biofuels sector. The aggrieved countries may consider these as trade distorting support mechanisms and therefore these supports have to be classified into non-actionable groups or 'Green Box' with the help of the environmental sustainability argument. The developed countries may pick up this argument well before the developing countries could think about it. Nathanael in the Report on Growing Energy prepared recently, clearly indicates that the US should take advantage of the environmental angle to push the subsidies provided to farmers under non-actionable group.[6] Third, from the Sanitary and Phyto-Sanitary agreement point of view, acceptable standards of these biofuels have to be fixed before it gets into the trade discipline. These have to be internationally agreed standards. It is conceived by many that biofuels will be produced under the small-scale sector and if that happens then these standards will have to accommodate the conditions prevailing in the production system. The fourth issue crops up from the IPR regime of the WTO. Here the product patents have to be viewed before embarking on large-scale production of the product, if the production process as well as the product is going to be standardized. Last, the environmental angle and carbon trading arguments may enter in to the picture. The world community is discussing the Kyoto protocol and the emission discipline incorporated in it is the carbon trading argument. The protocol has set binding targets for reductions of emissions that each developed country has to commit and to endevour for such reductions. The protocol also provides institutions such as Clean Development Mechanism, Joint Implementation System and Emission Trading to promote activities for mitigating harmful impacts and deal with the impact of climatic change. These are likely to interface with the WTO discipline when the interested countries insist on the same. As such the Kyoto protocol has all that material needed for the trade regulation with environmental standards and that is the central point of the WTO discipline. Canada in 1999 suggested the setting up of a working group on biotechnology to find

out the adequacy and effectiveness of the existing WTO rules as well as the capacity of the member countries to implement these rules.[7] If the group is established it may have to consider all these aspects.

A significant development is that the Doha declaration pays attention to the issue though indirectly by stating that,

> "With a view to enhancing the mutual supportiveness of trade and environment, we agree to negotiations, without prejudging their outcome, on: (i) the relationship between existing WTO rules and specific trade obligations set out in Multilateral Environmental Agreements (MEAs). The negotiations shall be limited in scope to the applicability of such existing WTO rules as among parties to the MEA in question. The negotiations shall not prejudice the WTO rights of any Member that is not a party to the MEA in question; (ii) procedures for regular information exchange between MEA Secretariats and the relevant WTO committees, and the criteria for the granting of observer status; (iii) the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services".[8]

Finally, biofuels have a great promise with its positive environmental implications and with the present low use rates it is not featuring in the international agreements boldly. Sooner or later it will, however, feature prominently on environmental as well as trade negotiations significantly. Technology as well as the quality aspects will also emerge significantly during these arguments. We may have to wait and watch as India has miles to go before we meet even the basic demand.

Endnotes

1 EIA, 2001.
2 Panigrahi *et al.*, 2004, Govt of India, 2003, and Kumar, Senthil *et al*. 2003.
3 Tiwari, 2002.
4 GoI, Planning Commission, 2003.
5 WTO, 2001.
6 Nathanael *et al.*, Dec 2004.
7 WTO, WT/GC/3/359/, 12th October, 1999.
8 World Trade Organization, Ministerial Declaration, 2001.

References

CETESDB. 2004. *Report of the Saopaulo State Environment Agency*. Saupaulo Brazil.
EIA. 2001. "International Energy Annual 2001", DOE / EIA-0219, Energy Information Administration, Washington, DC.

EIA. 2003. Energy Information Administration, February 2003. www.eia.doe.gov/iea/
EIA. 2004. "Annual Energy Outlook: 2004", DOE/EIA-0383, Energy Information Administration, Washington,DC, January.
Francis, George, Raphael Edinger and Klaus Becker. 2005. "A Concept for Simultaneous Wasteland Reclamation, Fuel Production, and Socio-Economic Development in Degraded Areas in India: Need, Potential and Perspectives of Jatropha Plantations". *Natural Resources Forum*, Vol 29, pp12-24.
Government of India. 2005. Information from Various Ministries and Planning Commission, www.indiaimage.nic.in.
Government of India. 2003. *Report of the Committee of Development of Bio Fuel*: Planning Commission, Govt of India, New Delhi.
Kumar, Senthil, M. A. Ramesh and B. Nagalingam. 2003. "An Experimental Comparison of Methods to Use Methanol and Jatropha Oil in Compression Ignition Engine". *Biomass & Energy,* Vol 25, pp 309-18.
MoF. 2005. *Economic Survey*, Government of India, Ministry of Finance, New Delhi.
Nathanael Greene and others. 2004. "Growing Energy: How Biofuels can help End America's Oil Dependence", Natural Resource Defence Council, New York.
Panigrahi, Srikanta, K. 2004. "Introduction of Biofuels in India", Planning Commission, Government of India, New Delhi.
Panigrahi, Srikanta K. J. Mohan Reddy and P. Narendras. 2004. "Energy Security, Environmental Benefits and Carbon Trading potentials of Biofuels in India". A Paper presented at the International Conference on Biofuels, Perspectives and Prospects, September 16-17, New Delhi.
Tiwari, D.N. 2002. "Biofuels for India: Ethanol and Biodiesels". Keynote address at International Conference on Biofuels-Driving India's future, 7-9 November, New Delhi.
World Trade Organization. 2001. Ministerial Declaration, Ministerial Conference, Fourth Session, Doha, 9-14 November and WT/MIN (01)/DEC/1, 20 November. www.worldenergy.org/wec-geis/focus/wssd/goldemberg.pdf

Annexure Table 1

Primary Energy Consumption by Regions: History and Projections

(Quadrillion Btu)

Region/Country	History			Projections				Average Annual Percent Change, 2001-2025
	1990	2000	2001	2010	2015	2020	2025	
Developing Asia	52.5	80.5	85.0	110.6	129.7	150.5	173.4	3.0
India	7.8	12.7	12.8	16.4	19.5	23.2	27.1	3.2
Total Developing	89.3	133.8	139.2	175.5	202.5	232.4	265.9	2.7
Total World	348.4	398.9	403.9	470.8	517.3	567.8	622.9	1.8
Total Energy Consumption by Region and Fuel, Reference case, 1990-2025 (Quadrillion Btu)								
Developing Asia								
	16.1	30.2	30.7	42.0	49.2	57.4	65.7	3.2
Natural Gas	3.2	6.9	7.9	10.1	12.3	15.1	18.7	3.6
Coal	29.1	37.1	39.4	48.2	55.1	62.8	71.9	2.5
Nuclear	0.9	1.7	1.8	3.1	4.2	4.9	5.1	4.4
Other	3.2	4.5	5.1	7.2	8.9	10.3	11.9	3.6
Total	52.5	80.5	85.0	110.6	129.7	150.5	173.4	3.0

Annexure Table 1 continued

Annexure Table 1 continued

Region/Country	History			Projections				Average Annual Percent Change, 2001-2025
	1990	2000	2001	2010	2015	2020	2025	
Total Developing Countries								
Oil	35.9	56.9	57.6	75.2	86.3	99.3	112.6	2.8
Natural Gas	10.8	20.4	22.4	26.8	31.7	37.6	45.5	3.0
Coal	33.5	42.8	45.1	54.7	62.3	70.7	80.4	2.4
Nuclear	1.1	2.0	2.2	3.5	4.7	5.4	5.7	4.1
Other	8.0	11.6	11.8	15.2	17.5	19.5	21.7	2.5
Total	89.3	133.8	139.2	175.5	202.5	232.4	265.9	2.7
Total World								
Oil	135.1	155.9	156.5	185.4	204.0	223.8	245.3	1.9
Natural Gas	75.0	91.4	93.1	108.5	122.0	138.8	156.5	2.2
Coal	91.6	93.6	95.9	108.0	116.6	126.8	140.2	1.6
Nuclear	20.3	25.5	26.4	29.8	31.4	31.8	30.4	0.6
Other	26.4	32.8.	32.2	39.0	43.2	46.6	50.4	1.9
Total	348.4	398.9	403.9	470.8	517.3	567.8	622.9	1.8

Sources: History: Energy Information Administration (EIA), International Energy Annual 2001,DOE/EIA-0219(2001) Washington, DC, February 2003),web site www.eia.doe.gov/iea/. Projections**:** EIA, Annual Energy Outlook 2004,DOE/EIA-0383(2004) (Washington, DC, January 2004),Table A1;and System for the Analysis of Global Energy Markets (2004).

Annexure Table 2: Oil Consumption by Regions: History and Projections

(Million Barrels per Day)

Region/Country	History			Projections				Average annual Percent Change,
	1990	2000	2001	2010	2015	2020	2025	2001-2025
Developing Asia	7.6	14.5	14.8	20.2	23.7	27.6	31.6	3.2
India	1.2	2.1	2.1	2.8	3.5	4.4	5.3	3.9
Total Developing	17.3	27.6	27.9	36.4	41.8	48.1	54.5	2.8
Total World	66.1	76.9	77.1	91.4	100.5	110.3	120.9	1.9
Natural Gas Consumption by Region, Reference Case,1990-2025 (Trillion Cubic Feet)								
Developing Countries								
Developing Asia	3.0	6.6	7.5	9.5	11.6	14.1	17.4	3.5
India	0.4	0.8	0.8	1.2	1.6	2.0	2.5	4.8
Total Developing	10.1	19.3	21.2	25.2	29.8	35.3	42.6	2.9
Total World	73.4	88.7	90.3	105.1	118.1	134.2	151.1	2.2
Coal Consumption by Region, Reference Case,1990-2025 (Million Short Tons)								
Developing Asia	1,590	1,959	2,084	2,553	2,928	3,343	3,834	2.6
India	242	359	360	430	484	543	611	2.2
Total Developing	1,835	2.275	2,401	2,918	3,330	3,780	4,303	2.5
Total World	5,307	5,115	5,263	5,881	6,335	6,862	7,574	1.5
Nuclear Energy consumption by Region, Reference Case,1990-2025(Billion Kilowatt hours)								
Developing Asia	88	171	178	299	406	473	497	4.4
India	6	14	18	46	55	66	66	5.5
Total Developing	105	195	209	339	455	518	549	4.1
Total World	1,905	2,434	2,251	2,838	2,994	3,032	2,906	0.6

Sources: History: Energy Information Administration (EIA),International Energy Annual 2001,DOE/EIA-0219(2001) Washington, DC, February 2003),web site www.eia.doe.gov/iea/. Projections**:** EIA, Annual Energy Outlook 2004,DOE/EIA-0383(2004) (Washington, DC, January 2004),Table A1;and System for the Analysis of Global Energy Markets (2004).