ENERGY CURRENT

Revisiting the Energy-Food Linkage

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INTRODUCTION

In the industrial age, fossil fuel energy has been widely used to generate food. In the 21st century we are witnessing a reversal of the process whereby large-scale conversion of food for producing oil or biofuels for our machines is taking place. **We are 'growing oil from soil.'** Two main types of first generation liquid biofuels are Ethanol and Biodiesel. Ethanol is carbohydrate-derived: Produced from sugar (sugarcane, sugar beet tubers, sweet sorghum, etc) and from starches (such as corn, wheat and cassava). Whereas biodiesel is lipid-derived, being produced mainly from vegetable oil through the process of transesterification. Essentially, we are displacing land required for food production to produce liquid fuel, in both cases of ethanol and biodiesel. This paper is an attempt to holistically analyze the current and future potential impact of biofuel production on global food security, with a special emphasis on India. Alternatives, strategies and policies are also discussed.

METHODOLOGY

The methodology used is as follows. Hard data on actual consumption of various first generation feedstocks for biofuel production was collected. Then field-stock yield assumptions for land-use estimates have been studied. The extent of land alienation required for various levels of biofuel production was then assessed. This assessment is based on current consumption of gasoline and diesel and the replacement levels being proposed in blending policies evolved by governments. There is a specific focus on the Indian policy and its likely impact on food self-sufficiency. Latest international studies by multilateral organizations like FAO and World Bank have been documented to gather factual evidence. A futuristic long-term post-fossil fuel scenario has also been attempted. While doing so, the potential and efficiency of emerging second generation technologies to mitigate food-insecurity have been studied. Based on that, new technology and policy options, as well as strategies have been elaborated.

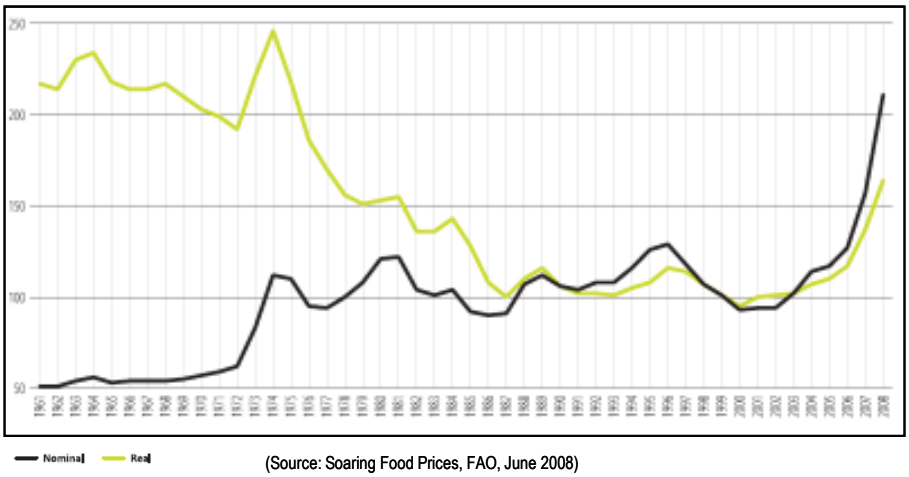
DISCUSSION

Global Scenario: Several studies published in 2008 by reputed multilateral organizations under the UN-Brettonwoods umbrella have highlighted the strong linkage between biofuel production and galloping food prices. First and foremost evidence comes from a recent study by the F.A.O.

The production of 1st generation biofuels distorts food markets in three ways:

- Diverts land / grain away from food for producing fuel e.g.
  - One-third of the corn grown in USA is now used to produce ethanol.
  - 50% of the vegetable oil in the EU is diverted for production of biodiesel.
- The lucrative biofuel industry has increasingly encouraged farmers to divert land to biofuel crops.
  - It is a myth that biofuel crops are grown on wastelands.
- Diversion of grains and the resultant shortages have fuelled financial speculation in grains, driving up food prices higher and higher.

Figure: Extended Annual FAO Food Price Index 1998 – 2000=100



(Source: Soaring Food Prices, FAO, June 2008)

The figure above shows the following important pointers. Since 2006, the average annual growth rate of food prices has been 15%, a historic high. In the first three months of 2008, international nominal prices of all major food commodities reached their highest levels in nearly 50 years. Prices in real terms were highest in nearly 30 years. The FAO food price index rose, on average 8% in 2006 and 24% in 2007. In the first quarter of 2008, the index rose 53% compared to the first-quarter of 2007. Vegetable oil prices on an average increased by more than 97% during the same period, signalling its strongest links to biodiesel production. This was followed by food grains (87%) and dairy products (58%). In short, the cereals and oilseeds sector are the worst affected because of increased demand from the biofuel industry. There is also a strengthening of linkages among different agricultural commodity markets (i.e. grains, oilseeds and livestock products) and others, such as those of fossil fuels, biofuel and financial instruments. This is not to forget some marginal supply-side issues like weather related production shortfalls or financial problems like the decline of the dollar. A World Bank study titled "A Note on Rising Food Prices" authored by Donald Mitchell was completed in April 2008. Mitchell is not an anti-biofuel campaigner, but an economist with 30 years experience and specialization in commodity markets. In sum, the report argued that the drive for biofuels by American and European Governments has pushed up food prices by 75%. Rising demand from China and India, weather related production shortfalls (Australia), higher energy and fertilizer prices, the decline of the dollar, etc… all together contributed to only 25% of the increase in food prices.

A feed-stock based analysis of second generation technology (currently not commercialized) shows that even though there may not be diversion of food, it would also put great pressure on land required to produce food. This is considered in view of the increasing population and diversion of land for other non-agricultural uses. However, alternative strategies and policies could be more effective. Production of biodiesel from algae is one good example, whereby land requirements could be significantly reduced. Decentralized rural biomass production though innovative agronomic practices can also help generate economic activity, employment and incomes in rural areas, without jeopardizing food security.

Indian Context: The Government of India has announced a "National Policy on Biofuels" in July 2008. The key features are:

- 20% blending of biofuels – both ethanol (with gasoline) and biodiesel (with diesel) – by 2017
- Blending levels prescribed for bio-diesel are recommendatory in the near term
- Existing 5% blending of ethanol has been raised to 10% from October 2008
- Biofuels brought under the ambit of "declared goods" to facilitate unrestricted movement within and outside the states

The strategy and approach of the policy states:

- "The focus for development of biofuels in India will be to utilize waste and degraded forest and non-forest lands only……Therefore, the issue of Fuel Vs. Food Security is not relevant in the Indian Context…"
- "Cultivators, farmers, landless labourers, etc… will be encouraged to undertake plantations that provide the feedstock … corporates will also be enabled to undertake plantations through contract farming…."

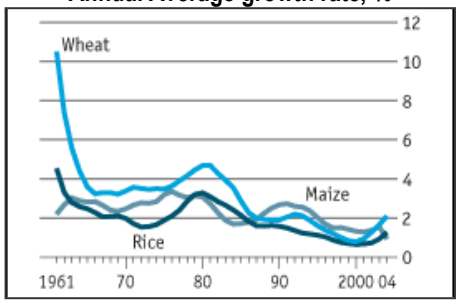
In the section on 'Interventions and Enabling Mechanisms' it is stated:

- "Plantations…. will be taken up on government / community wasteland, degraded or fallow land in forest and non-forest areas. Contract farming on private wasteland could also be taken up… plantations on agricultural lands will be discouraged…"

Currently, we produce about 1 million tonnes of fuel ethanol in India. This is sufficient to achieve 10% blending. But for 20% blending in 2017–18, we would require 3.87 million tonnes of fuel ethanol. Average sugarcane yield in India is 66.8 tonnes per hectare. One tonne of sugarcane yields 73 litres of ethanol. So one hectare of sugarcane gives 4926 litres of ethanol. For meeting the 3.87 million tonnes of ethanol requirement in 2017 for 20% blending, 1.07 million hectare land will have to be exclusively diverted to ethanol production.

Since biodiesel crops are proposed to be produced from wastelands, let us examine how much "cultivable" wasteland is actually available. The most optimistic figure would be around 20 million hectares of 'cultivable' wasteland. The current yield level from rainfed Jatropha / Pongamia is around 1-2 tonnes/ha. Even assuming 2 tonnes/ha production, 20 million hectares can give only 40 million tonnes of oil seeds. At 35% oil content (Jatropha) 40 million tonnes of oil seeds will give 14 million tonnes of biodiesel (1 million tonnes of biodiesel requires 1.42 million hectares of land). Which means for 22 million tonnes of biofuel required around 2020 (20% blending), we need 31.24 million hectares of land which is much more than the available wasteland. So even for 20% blending of ethanol (1.7 million hectares of agricultural land) and biodiesel (11.24 million hectares of agricultural land, if all 20 million hectares of wasteland is considered cultivable) alienation of agricultural land would become necessary to the tune of 12.31 million hectares. Whereas, every year we would need to produce 5 to 6 million tonnes of additional foodgrains to meet the needs of our increasing population. Alienation of land is particularly dangerous in an era of climate change and diminishing returns from agriculture (as would be seen from the above figure).

Diminishing Returns
Crop yields in developing countries
Annual Average growth rate, %



Source: World Bank

The arable land area in India has reached a peak of around 140 million hectares. Our annual foodgrain production has stagnated around 200 million tonnes (plus or minus 10-15 million tonnes). By 2020, our population is projected to be 130 crore. Then our foodgrain requirement will increase substantially. Required annual average increase in foodgrains would be 5-6 million tonnes. Increased production of marine and livestock products is also difficult. Water woes, climate change, environmental destruction, soil erosion, etc., threaten to adversely affect food production. Any further agricultural land alienation for biofuels is suicidal, especially since land is already being diverted for many other non-agricultural purposes.

Besides the land diverted for commercial crops, agricultural land and resources are also being diverted for other purposes like:

- About 20 percent of the paddy lands in peninsular India are diverted for commercial aquaculture.
- Land diverted for industrialization, housing, roads and highways. The recent SEZs only have diverted about 65,000 hectares of land, and threaten to divert more.
- Land used for entertainment and tourism (hotels, airports and golf courses).
- Land lost to other large infrastructural projects like dams.
- Land diverted for increasing production of grain for livestock and beverages like beer.
- Diversion of irrigation water for non-farm use in all the above areas.

FINDINGS / RESULTS

The following are the results of the analysis:

- Biofuel production using first generation technologies have already significantly impacted food prices.

- Even though second generation technologies, (when commercialized) may not divert food to produce fuel, they will divert land to produce biomass. So land-use scenarios have to be developed on a country-to-country basis. Such land use scenarios (in the context of first and second generation technologies) have been developed for U.S.A. and the European Union.
- A 5% displacement of gasoline with ethanol in the EU requires about 5% of available cropland to produce ethanol while in the U.S. 8% is required.
- A 5% displacement of diesel with biodiesel requires 15% of EU cropland, and 13% in the U.S. (land requirement for biodiesel in higher because average yields per hectare of cropland are considerably lower than for ethanol).
- Land requirement to achieve 5% displacement of both gasoline and diesel would require 20% of the cropland in the EU and 21% in the U.S.
- Alternative strategies like algae-based biodiesel production need to be studied in greater detail.

CONCLUSIONS

- Maximum possible production of biofuels using first and second generation technologies in the most optimistic scenario would be 20% of the current petrol and diesel consumption.
- A biofuel-based long-term transportation policy means food insecurity. Alternative routes of transportation energy to be evolved.
- However, alternative strategies like algae-derived biodiesel or decentralized rural-oriented production possible by evolving age-old agronomic practices (like fence-planting) can help rural electrification, employment generation, etc.
- Biodiesel policies should give priority not to endanger global food security.

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