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Conference Paper

Food versus fuel

Session Handouts, Global Economic Symposium 2008 (GES), 4-5 September 2008, Plön Castle, Schleswig-Holstein, Germany

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Environment: Dealing with Climate Change

Food versus Fuel

Summary

Partially replacing gasoline and diesel with biofuels requires agricultural products that compete with food production for the world's scarce fertile land resources. The sharp rise in agricultural prices over the past few years has been driven not only by the growing world population and rising incomes in emerging economies, but also by the expansion of biofuels. In this sense, protecting our climate conflicts with combating hunger.



To what degree do biofuels indeed mitigate climate change? To what degree do they indeed raise the price of food for the poor? What is the right balance between food and fuel in the allocation of land?

How could we avoid the conflict between food and fuel? What is the appropriate role of technology (second generation biofuels), taxes and subsidies, of government regulation in dealing with this problem?

Proposed Solutions

Expert Opinion

The contribution of biofuels to climate protection depends on a large number of factors and is in many cases not adequately known. Especially the impact of land conversion from other agricultural activities and – even more so – from natural or abandoned land to biofuels needs to be assessed. But not only the carbon balance is important in the case of land conversion, the impact on biodiversity and on valuable natural resources should be taken into account as well.

The relationship between the expansion in biofuel production and the prices for food is clear theoretically: it will raise food prices. But so far the impact current biofuel production on prices seems to be small, may be with the exception of maize in the USA. However, the planned expansion of the consumption of biofuels in many countries of the world, including the USA, China and the EU, requires a thorough assessment of the economic rationality as well as the ecologic and potentially positive climate impacts.

Agricultural production with a high level of productivity is usually an activity that is very energy intensive. This represents a burden for the greenhouse gas savings of biofuels, but it also makes the conflict between biofuels and food production difficult to handle. Food production is in practically all cases not subject to climate policy instruments, yet its greenhouse



gas emissions should face a carbon price in the same way as other economic activities. With the exception of Brazil, biofuels receive support beyond the level of the current cost of greenhouse gases as it is revealed by markets such as the European Emission Trading Scheme for CO₂ and thus represent a climate policy options that is more costly than most other options. Allotting food its “climate costs” and phasing out government interventions for biofuels – such as the mixing requirements that are in place in many countries – would make more transparent what the mix between food and fuels should be. This would require a fundamental reorientation of climate policies throughout the world.

Even with a climate policy that is based more on the true economic cost of different abatement options there will remain the social problem that the needed increase in food production in the next decades will be accompanied by rising prices. These present a heavy burden on the attempts to eradicate hunger from the earth as an increasing number of people will lack sufficient income for purchasing food at the predicted prices. An expansion of land areas designated to food production, a smaller than planned share of first generation biofuels, a shift in consumption patterns away from meat and towards more vegetarian diets, and the activation of productivity improvements belong to the options that are likely to be needed to achieve the social and moral challenge of eradicating hunger.

Strategy Perspectives

Proposed Solution on Food versus Fuel

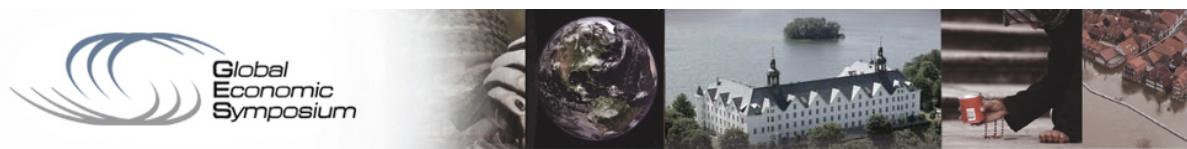
Derom Bangun

Vice President II, RSPO Round Table on Sustainable Palm Oil; Executive Chairman, Indonesian Palm Oil Producers Association

The issue on Food versus Fuel can be considered as an integrated part of global warming issue. The obvious strategy of food production increase should be guided by measures not only to minimize green house gas (GHG) emission but also to increase carbon stock. The positive impact of substituting fossil fuel with biofuel should not be offset by negative impact resulted during the production of feedstock for the biofuel. The negative impact should be minimized or eliminated by implementing sustainable practice. In other cases, where feedstock production has been indicating no negative impact, regulation should be introduced so as to create positive impact in building up carbon stock.

EU proposals for biofuels is an example where the criteria were set up to prevent negative impact during the production of certain feedstocks. To be accepted as feedstock for biofuels, palm oil should be produced in accordance with a set of criteria and this is a burden to palm oil industry. On the other hand, other vegetable oils industry can do business as usual and have their oils accepted as feedstock. In order to contribute more to the mitigation of global warming, EU Proposals need to be widened by introducing additional criteria for the other vegetable oils even if their production is considered to be free from negative impact. This additional criteria should guide the industry to contribute positive impact like increasing carbon stock by means of reforestating a small fraction of the cultivated area. This will be seen as sharing the burden of mitigating global warming.

The proposed strategy will address both food versus fuel dilemma and global warming simultaneously. So instead of focusing only on the reduction of GHG emission, the strategy should include the increase of carbon stocks. Some countries have developed agriculture so advance that to obtain a balanced proportion of forest to agriculture land, there is a need to do reforestation action to build up carbon stocks. To keep steady level of total food



production, the conversion of agriculture land into forest should be compensated by higher productivity resulted by research and improved technology.

The increasing food demand should also be satisfied by increasing area of agriculture land, which in most cases means change of land use. This should be done in a sustainable manner. For palm oil industry, 8 principles and 39 criteria already set up by RSPO (Roundtable on Sustainable Palm Oil) would avoid conversion of primary forest and any land containing high conservation value (HCV).

The right balance of allocated land for food crop and fuel crop can only be determined by free market mechanism although the role of subsidy and regulation should be taken into consideration. The right area of land for food crop should be adequate to produce the world demand including wastages. For “bifunctional crop” like vegetable oils, it is the produce rather than the cultivated land that need to be allocated. Although general view considers food is more important fuel, it is worth considering that housewives in many parts of the world could not feed their children if they have only rice without kerosene or firewood for cooking the rice. Both food and energy are essential needs. Therefore, the use part of vegetable oils as feedstock for biofuel in order to relief tight supply of energy or to maintain energy security should be acceptable. When the price of mineral oil is so high as to make production of biofuel from vegetable oil is profitable, the strategy should allow it. The allocation of vegetable oils between food and fuel will be dictated by market price.

Finally, the relatively high price of food should be passed down to farmers to provide a strong driving force to increase volume of agricultural produce. Therefore, the strategy should also include efforts to maintain the price of agricultural produce relatively high and prevent it from falling below an attractive level.

In summary, strategy to solve food versus fuel issue should include the increase of food production in sustainable manner, restricting conversion of land use from food to energy crop by introducing an obligation to increase carbon stock and to maintain the price of agricultural produce above an attractive level.

Food versus Fuel: Response

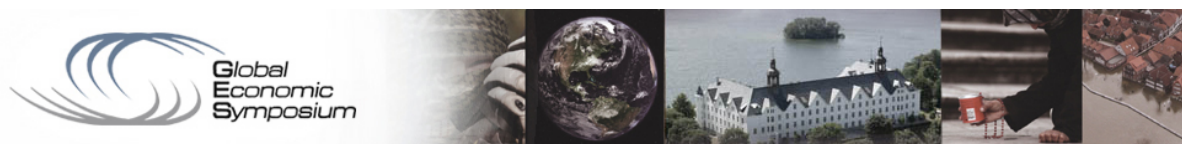
Lester Brown

Founder and President, Earth Policy Institute

Whether the substitution of biofuels for gasoline or diesel reduces carbon emissions depends on the feedstock. In converting grain to ethanol the net reduction in carbon emissions is marginal at best. In the clearing of rainforest to produce palm oil, as in Indonesia, there is an enormous release of carbon associated with the destruction of the rainforest that yields a negative balance for many years.

There have been many estimates of the effect of biofuel production on food prices. A World Bank paper estimates it at 70 percent, an estimate that appears reasonable. The world demand for grain expanded an average of 21 million tons per year from 1990 to 2005. During each of the last two years, 2007 and 2008, it has increased by well over 40 million tons per year. This doubling in annual grain use is entirely attributable to the additional grain going into ethanol production in the United States.

Now that we have both the technology and capacity to, in effect, convert grain into oil, i.e. ethanol, the price of grain is tied to the price of oil. As the price of oil rises so too will the price of grain.



From an agricultural point of view the automotive demand for biofuels is insatiable. If the entire U.S. grain harvest were converted to ethanol it would satisfy perhaps 18 percent of U.S. automotive fuel needs. At the micro level, the grain required to fill a 25-gallon SUV tank with ethanol will feed one person for a year.

The incentives for biofuel production, whether renewable fuel standards or direct subsidies, should be limited to levels that will not raise world food prices. As to second generation biofuels, i.e. those from cellulosic sources, these are often proposed because they can be produced on marginal land. But if they are profitable on marginal land why wouldn't they be enormously more profitable on prime cropland, thus continuing to compete with food crops for land and water resources?

OECD: Economic Assessment of Biofuel Support Policies – Executive Summary

Stefan Tangermann

Director for Trade and Agriculture, OECD

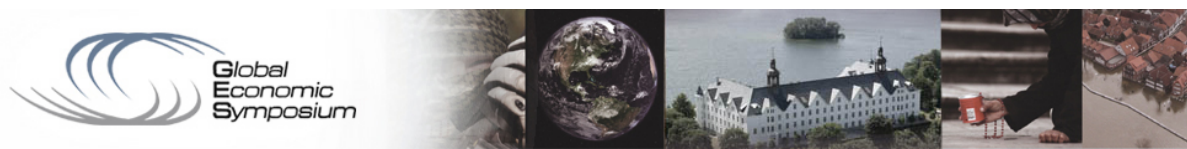
The production and use of biofuels – mainly ethanol based on cereals and sugar crops, and biodiesel based on vegetable oils such as rapeseed or canola oil – have grown rapidly over the past few years and are expected to further double in the decade to come. The United States and Brazil remain the largest ethanol producers with 48% and 31% of global ethanol output in 2007, respectively, while the European Union accounts for about 60% of global biodiesel production. A large number of other countries' governments have begun, or are considering promoting biofuel production and use.

In most countries, biofuels remain highly dependent on public support policy. This report estimates support to the US, EU and Canadian biofuel supply and use in 2006 at about USD 11 billion per year, projected to rise to USD 25 billion in the medium term (all medium-term projections in this executive summary refer to the annual average for the 2013-17 period). Many different forms of support are provided at various stages of biofuel production and use but the three major categories of support are:

- **Budgetary support measures**, either as tax concessions for biofuel producers (refineries), retailers or users, or as direct support to biomass supply, biofuel production capacities, output, blending, specific infrastructure or equipment for biofuel users. All these measures directly affect the public budget either in the form of forgone tax revenues or of additional outlays.
- **Blending or use mandates** require biofuels to represent a minimum share or quantity in the transport fuel market. While these measures generally are neutral for public budgets, the higher production costs of biofuels result in increased fuel prices for the final consumer.
- **Trade restrictions**, mainly in the form of import tariffs, protect the less cost-efficient domestic biofuel industry from competition from lower-cost foreign suppliers and result in higher domestic biofuel prices. These measures impose a cost burden on domestic biofuel users and limit development prospects for alternative suppliers.

The high level of public support has placed biofuels policy at the centre of a debate about the expected environmental, energy and economic benefits. This report presents new economic analysis, provides policy recommendations and identifies areas where more research is necessary. The report focuses on liquid biofuels for transport derived from agricultural feedstocks or from biomass related to agricultural production.

There are many reasons for public interest in and support for biofuels. Prioritising these policy objectives is difficult and varies by country, over time and across government ministries. With



increased concerns about climate change, however, the reduction of greenhouse gas (GHG) emissions and fossil energy savings can safely be counted among the prime reasons to support biofuel production and use.

Ethanol based on sugar cane – the main feedstock used in Brazil – generally reduces GHG emissions by 80% or more over the whole production and use cycle, relative to emissions from fossil fuels. Current support policies in the US, the EU and in Canada target feedstocks that tend to reduce GHG emissions by much less. Biofuels produced from wheat, sugar beet or vegetable oils rarely provide GHG emission savings of more than 30% to 60%, while corn (maize) based ethanol generally allows for savings of less than 30%. Current budgetary support, mandates and trade restrictions (not considering the most recent US and currently discussed EU initiatives) reduce net GHG emissions by less than 1% of total emissions from transport. Fossil fuel use is also reduced by less than 1% for most of these transport sectors and by 2-3% in the EU diesel sector. These relatively modest effects come at a projected cost equivalent to about USD 960 to USD 1700 per tonne of CO₂-eq. saved, or of roughly USD 0.80 to USD 7 per litre of fossil fuel not used.

The sometimes predicted improved economic viability of biofuel production and use associated with higher crude oil prices so far has not materialised in many countries. Most production chains for biofuels have costs per unit of fuel energy significantly above those for the fossil fuels they aim to replace. Despite the rapid and substantial increase in crude oil prices and hence in the costs for gasoline and fossil diesel, the cost disadvantage of biofuels has widened in the past two years as agricultural commodity prices soared and thereby feedstock costs increased.

The medium-term impacts of current biofuel policies on agricultural commodity prices are important, but their role should not be overestimated. The price effects attributable to biofuel policies derive largely from increased demand for cereals and vegetable oils. With biofuel support policies in place in 2007, 12% of global coarse grain production and 14% of global vegetable oil production could be used for biofuels in the medium-term, up from 8% and 9% in 2007, respectively. But future policy developments matter: with full implementation of the recently enacted US Energy Independence and Security Act and the currently proposed new EU Directive for Renewable Energy, close to 20% of global vegetable oil production and more than 13% of world coarse grain output could shift to biofuels production.

Current biofuel support measures are estimated to increase average wheat, maize and vegetable oil prices by about 5%, 7% and 19%, respectively, in the medium term. Prices for sugar and particularly for oilseed meals are actually reduced by these policies – a result of slightly lower production of sugar cane-based ethanol in Brazil and significantly higher bio-diesel-related oilseed crush. The new US and proposed EU initiatives could further increase commodity prices by a similar magnitude.

The price impact of second-generation biofuel production would depend on the amount of feedstock biomass that would be produced on current crop land. If the total production area is significantly expanded, the price effects would be reduced but concerns over negative environmental impacts on sensitive areas and high-carbon soils, including GHG emissions, water use and biodiversity losses, would increase.

Linked to the price effects noted above, existing and any additional support for biofuels might have important implications for global land use and are likely to accelerate the expansion of land under crops particularly in Latin America and large parts of Africa. While this might provide additional income opportunities to generally poor rural populations, care would need to be taken to avoid possible environmental damages, including accelerated deforestation, additional release of greenhouse gases, loss of biodiversity and runoff of nutrients and pesticides.



Based on this analysis, a number of **policy recommendations** are offered:

- The multifold objectives behind the public support for biofuels as well as the side effects of biofuel production call for differentiated and suitable policy approaches. Appropriate policy mixes will depend on countries' priorities and conditions. There is no "one size fits all" policy mix that meets all different objectives and minimizes negative effects.
- The primary focus for fossil energy saving needs to be redirected from alternative fuels towards lower energy consumption, particularly with respect to the transport sector. Generally, the costs of reducing GHG emissions by saving energy are much lower than by substituting energy sources. It should also be noted that while the strong increase of GHG emissions in the transport sector is a concern, the costs of emission reductions are often substantially lower in other sectors, e.g. by better insulation of buildings.
- With respect to alternative transport fuels, a clear focus needs to be placed on those biofuels that maximise the reduction of fossil fuel usage and GHG emissions. Minimum reduction criteria should be established, set at ambitious levels and tightened over time to enhance technological progress in this rapidly developing field.
- The type of land used for biofuel production affects the environmental performance of these fuels. Governments should favour the use of areas not currently used for crop production – either degraded or with low nature values – while use of environmentally sensitive land needs to be discouraged. The production of large biofuel quantities will have an important impact on land use that needs to be carefully monitored in order to ensure sustainable supply chains.
- Import tariffs on feedstock or biomass to protect domestic production impose an implicit tax on biofuels production by raising input prices. Tariffs are also applied to biofuel imports, distorting resource allocation and imposing a burden on users. Opening markets for biofuels and related feedstocks would allow for more efficient and lower cost production, and at the same time could improve both environmental outcomes and reduce reliance on fossil fuels.
- Further development and expansion of the biofuels sector will contribute to higher food prices over the medium term and to food insecurity for the most vulnerable population groups in developing countries. Modifying current support policies along the lines outlined above would reduce this unintended impact. In addition, with a more liberal trade environment, increased biofuel production might be a viable option in some developing countries, thereby improving employment and income opportunities.

Some areas for **further research** have also been identified:

- The high productivity of first generation biofuel production from tropical and semi-tropical countries deserves further examination, in particular regarding the potential economic benefits relative to sustainable resource use.
- More generally, interdisciplinary research is needed to better understand the environmental risks related to land use change resulting from biofuels expansion and to capture the interrelationships between economic and environmental effects. Present analysis shows that problems can be significant, but clearly remains at too aggregate a level to provide conclusive answers. The environmental problems of land use changes are not restricted to biofuels produced in sensitive areas. Indirect land use changes (where sensitive areas become converted to produce crops other than for biofuels due to biofuel-induced incentives) can create quite similar negative effects, and require effective monitoring at field level.
- Both the commercial-scale development of advanced and second-generation biofuel technologies and the exploitation of the improvement potential of different first-



generation biofuel supply chains need – and indeed get – sustained R&D efforts over time. Biogas and BTL-fuels from organic waste or other biomass and cellulosic ethanol from crop and forest residues are options with potentially very low feedstock costs. Second-generation biofuels from dedicated biomass such as grasses and fast-growing trees may offer higher energy yields.

- Research and development should not focus solely on biofuels. In the long run, innovations in solar energy generation, hydrogen fuel cells and other technologies offer much promise.