SwedBio

Sida's Helpdesk for Environmental Assessment
Swedish EIA Centre
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Biofuels – Potential and Challenges for Developing Countries

Photo: Ausi Petrelius

Sugar cane harvesting in North Eastern Brazil.

Biofuel production is expanding rapidly, the key drivers being the outlook of rising prices of fossil fuels and the need to reduce carbon emissions, primarily in developed nations. In the South, where much of the expansion is taking place, many of the concerns with large scale production for export are not unique to biofuels. However, the scale and pace is extra challenging.

Developing countries with e.g. favourable climate and cheap labour attract investors to plan large scale plantations. Sugar cane, jatropha and oil palm are the most common feedstock. Such investments have multifaceted social and environmental impacts. Carefully planned, biofuels can offer increased local energy security, employment opportunities and reduced dependency on oil imports. Much experience shows that smaller scale production systems can be more successful in creating local benefits.

Box 1

Bioenergy

Bioenergy: Energy produced from biomass = all types of organic materials, including wood, charcoal, energy crops, agricultural and forestry wastes, manure etc.

Liquid Biofuels: Fuel produced from renewable resources, especially plant biomass, vegetable oils, and treated municipal and industrial wastes, for use in combustion engines directly or blended. The most important first generation biofuels are ethanol and biodiesel.

Bioethanol is an alcohol derived from sugar or starch crops (e.g. sugar beet, sugar cane, sorghum, wheat, cassava or maize) by fermentation. Ethanol can be used in either neat form in specially designed engines, or blended with petroleum fuel.

Biodiesel is derived from vegetable oils (e.g. rapeseed oil, jatropha, soy bean, jatropha, pongamia, musine, castor beans or palm oil) by reaction of the oil with methanol. Biodiesel can either be used directly in diesel engines or blended with diesel derived from fossil fuels.

Second generation biofuels: Derived from cellulosic materials such as timber, waste products from forestry, agriculture or households – or produced as biodiesel from e.g. algae. These are estimated to become competitive at the earliest by 2020.

About this fact sheet

This fact sheet has been produced by Sida's Helpdesk for Environmental Assessment and SwedBio on commission by Sida (Swedish International Development Cooperation Agency). It aims to summarise the main challenges and provide recommendations on how to address these to enhance positive impacts for poverty reduction and the environment. The focus for this fact sheet is on liquid biofuels (see Box 1).

Photo: Gunilla Åkesson

By replacing wood, biofuels can contribute to lessen the work burden for women and reducing the pressure on nearby forests. On this photo, women in Ribaue district, Mozambique.

Box 2

Ethanol production in Brazil – lessons learnt

Brazilian sugar cane is the most energy efficient crop for biofuels today, due to a highly efficient production process, suitable growing conditions, manual labour and active government policy and subsidies since the 1970's.

Outgrower schemes have succeeded in ensuring that 30–35% of sugarcane in Brazil is produced by small scale farmers. The ethanol production has created around 1 million employment opportunities, but depends on the degree of mechanization. It has reduced dependency on oil imports and exposure to volatile international prices.

The large scale monoculture production system has exacerbated land owner concentration. This has caused displacement and increased competition for land, increasing the risk for conflict and preventing pro-poor land reform.

The working conditions are often critical with low salaries and little or no access to health care. The plantations are often burned prior to harvesting which results in health risks for plantation workers.

This production system can cause dramatic indirect effects (see Box 3).

Global demand

Biofuel targets in the EU and the US are of major importance for the rapid expansion, but this demand is volatile and fluctuates with the oil price. Biofuels are seen as a transitional solution in the conversion from fossil fuels towards more sustainable energy systems. Other alternatives such as wind power and solar energy are developing rapidly. Today, US maize and Brazilian sugar cane (see Box 2) dominate the world production of ethanol, accounting for 80–90%. As for biodiesel, the EU accounts for 75% of the total production.

Do biofuels cause less CO_2 emissions?

The actual GHG (green house gas) savings compared to fossil fuel are highly variable and depend on type of feedstock, degree of mechanization, the extent of fertilizer use as well as earlier land use and indirect effects of land use change.

Estimations of GHG savings of biofuel compared to fossil fuels vary. LCA (life cycle analysis), which includes the production cycle, is usually an underestimate since it often excludes emissions from direct and indirect land use changes (see Box 3). Sugarcane ethanol has the highest savings (85–95%), followed by rapeseed biodiesel (20–50%), and maize ethanol (40%) which primarily uses coal in the production process[1]. GHG savings can even be negative as in the case of palm oil, due to deforestation and peatland conversion.

Potential

Poverty reduction Availability of energy is fundamental to intensifying agriculture, industrial development and pro-poor growth. Locally produced liquid biofuels, e.g. biodiesel, could lead to national and local benefits such as reduced pressure on forests, reduced dependency on oil imports and limited exposure to volatile international prices. However, large scale production for export is not as likely to have these effects.

Employment Biofuel could offer beneficial employment opportunities, provided Corporate Social Responsibility (CSR) policies are implemented. Small scale production has shown promising results. Brazil's first biodiesel cooperative, Cooperbio, involves about 25,000 families using castor bean, jatropha, sunflower and other species produced in small scale diversified systems.

Opportunities for small-holders

Substituting fuelwood and dung for biofuels could both increase local energy efficiency, decrease health risks and pressure on forests. In Mali, a community program has developed small scale jatropha plantations that provide not only liquid fuels but also electricity, heat and mechanical power for a variety of local uses. Smallholders could also increase their incomes as biofuel crops become cash crops, but markets should be accessible, and mechanisms in place to ensure that price increases accrue farmers.

Trade Whether biofuel production gives opportunity for export depends on the local context and the various subsidy schemes (Figure 1). "Opportunities for developing countries to take advantage of biofuel demand would be greatly advanced by the removal of the agricultural and biofuel subsidies and trade barriers that create an artificial market and currently benefit producers in OECD countries at the expense of producers in developing countries" (FAO-Diouf 2008).

Challenges

Socio-economic challenges

Food prices Estimates of the role of biofuels in the hike of food prices during 2008 have been much debated. It is estimated that 30% (International Food Policy Research Institute) to 65% (World Bank) of the increase in food prices can be attributed to the increased production of biofuels instead of food.

Tenure and Conflicts Large scale biofuel production often competes with other land and water uses. Power imbalances make it difficult for local communities to negotiate sufficient compensation for e.g. lost land, especially if they hold no formally recognized tenure rights. Indigenous communities and women are particularly vulnerable.

1 World Watch Inst. 2007 'Biofuels for Transport'

2 Biox Group using EU Calculation Tool

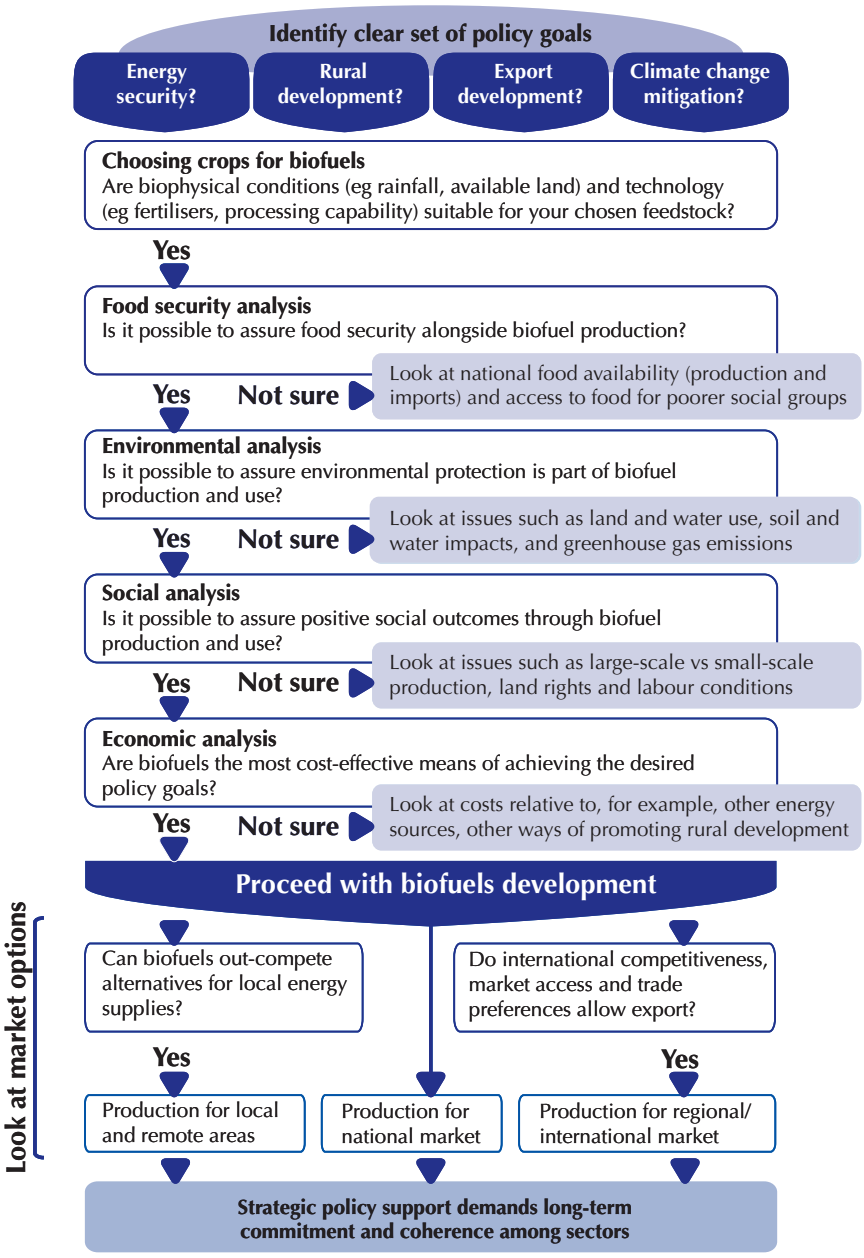

Figure 1. Strategic national choices on biofuel development: a decision tree. With permission from IIED. Source: http://www.iied.org/pubs/pdfs/17032IIED.pdf

The rapid expansion of biofuel production has already led to concentration of land, displacement of farmers and food scarcity (see Box 2 and 3). The "marginal lands" that are being targeted are often inhabited and utilized by rural women and men for different subsistence purposes. One important livelihood in Africa that relies much on marginal lands is livestock, forming the backbone of the rural economy.

Environmental challenges

Soil and Water Many biofuel crops are highly water intensive. Crops like sweet sorghum, tropical sugar beet and jatropha can grow on drier soils, but may require irrigation and fertilisers to become commercially attractive. Sugar cane cultivation is the second biggest user of agricultural pesticides in Brazil, causing e.g. pollution of water ecosystems.

Deforestation, climate change and ecosystem services Large scale monoculture biofuel production often leads to deforestation. Rapidly expanding oil palm plantations in South East Asia, considered one of the largest threats to tropical forests and peat lands, serve as alarming examples. These ecosystems store millions of tons of carbon which is released when they are exploited. Deforestation is in turn a major threat to biodiversity, local communities and indigenous groups dependant on biodiversity

Photo: Anders Fristrom

Ethanol production facility in Brazil.

Box 3

Indirect effects of land use change

Indirect effects are often overlooked and are not included in most LCAs, nor in most GHG emission calculations.

- *When current land use is changed*, the previous land users will encroach into new areas of forests or marginal lands. Illegal logging in the Amazonian region and SE Asia are other proven negative effects linked to biofuel expansion.

- The EU diverts a huge amount of rape seed into biofuel, leaving a hole in the food market to be filled by imports – largely *palm oil* (picture below). This promotes oil palm expansion in Asia, Africa and South America, largely at the expense of existing forests and savannas.

Photo: Linda Engström

Oil palm plantation in Malaysia.

Box 4

Assessment tools

Many organisations and governments, including EU, are currently developing sustainability standards and criteria for biofuel production. One example is the Roundtable for Sustainable Biofuels, RSB.

SEA, Strategic Environmental Assessment, is a tool that can help ensure that policies, plans and programs are environmentally, socially and economically beneficial. SEA provides a means of involving relevant stakeholders prior to decisions. It can help promote informed, strategic decision making, elaboration of alternatives, win-win strategies and measures to enhance positive impacts and minimise negative ones. Finally, performing an SEA can identify cumulative effects of all biofuel production plans going on simultaneously in a country/region. (http://www.oecd.org/dataoecd/4/21/37353858.pdf)

Poverty and Social Impact Analyses can be used to highlight social consequences and systematically strengthen the different stakeholders' involvement in the assessment of the anticipated social changes and impact.

for their livelihoods. Intact forest, savannas and wetlands provide ecosystem services – the benefits people obtain from ecosystems – such as protection against extreme weather events and erosion, carbon storage and pollination needed for e.g. coffee, fruit and other crop production.

Issues to consider for pro-poor biofuel production

Figure 1 can, in addition to the issues highlighted below, be helpful to your understanding and in your dialogue with development cooperation partners.

Context specific assessments The impacts and potential of biofuel production for poverty reduction is complex. Context specific analysis can ensure that production systems (scale, crops, sites, processing) are responsible and adapted to local needs, capacity and gender roles. Strategic Environmental Assessment (SEA) is one of the tools recommended by the Paris Declaration (see Box 4).

Photo: Gunilla Åkesson

Jatropha produced in small scale by a local farmers' association in Mecuburi district, Mozambique.

Policy and institutional weaknesses The successful promotion and sustainable production of biofuel require strong policy and institutional support, often cited as primary constraints to the effective implementation of sustainable development.

Local energy security To ensure local energy supply, priority can be given to decentralized energy production appropriate to local conditions.

Participation Stakeholders, particularly less influential groups such as local communities, indigenous peoples and women, should be involved from the onset of planning. It is important to allocate adequate time for informed stakeholder participation.

Food security Secure tenure rights, investment in agriculture and policies are needed to ensure local food production and that impacts on food prices do not disadvantage the poor.

Intact ecosystems The impact on biodiversity, ecosystems and ecosystem services needs to be assessed (see Box 4).

Investment in research and technology There is lack of research of the potential and challenges connected to different crops for biofuel production in developing countries. It is important to strengthen collaboration on research also on other sources of renewable energy.

GHG emissions Incentives and targets for biofuels should be based upon lifecycle GHG analyses that include emissions from e.g. indirect land use. Stronger policies are needed to slow down rates of deforestation and to ensure that biofuel production does not exacerbate the issue of increasing GHG emissions.

Reference websites:
http://www.fao.org/bioenergy
http://www.oxfam.org
http://www.worldwatch.org
http://www.acts.or.ke

Photo: Gunilla Åkesson

Secure land rights for small scale family farming are important for creating safe livelihoods. On the photo, a Mozambican farmer.

Sida's Helpdesk for Environmental Assessment

The Helpdesk is commissioned by Sida to assist in integrating environmental consideration into Swedish development cooperation. We provide advice, training and guidance for Sida staff and support to capacity building to partners in developing countries.

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SwedBio

SwedBio is a program at the Swedish Biodiversity Centre (CBM) initiated by Sida with the purpose to promote a proactive approach to biodiversity within the frame of Swedish development cooperation. SwedBio strives for the advancement of a fair, sustainable and productive use of; as well as sound management of biodiversity, as a base for poverty reduction.

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