The European Biofuels Policy and Sustainability

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Introduction

Various policy goals – reducing greenhouse gas emissions, boosting the decarbonisation of transport fuels, diversifying fuel supply sources and developing long-term replacements for fossil oil while increasing income and employment in rural areas – have motivated the European Union (EU) to promote the production and use of biofuels using both legislation and formal directives. However, EU biofuels production is impeded by its limited production area, yields and relatively high production costs. Therefore a large amount of biofuels has to be imported from developing countries in Latin America, Asia and Africa. Due to increasing concerns about the world-wide impacts of biofuels on food prices, rainforest destruction and social issues, the EU has proposed a directive to guarantee that biofuels produced in or imported into the EU are produced in a sustainable way (EU Commission 2008). This proposal will be critically analysed in this article. First, the targets for biofuels in the EU and other countries and the ecological and social impacts of biofuels production will be addressed.

Biofuel Targets

The EU is aiming at replacing 5.75% of all transport fossil fuels (petrol and diesel) with biofuels by 2010 and 10% by 2020 (EU Commission 2007). Influenced by the concerns addressing the negative impacts of biofuels mentioned above, the EU has broadened the 10% biofuel target: apart from biofuels other renewable energy sources such as electricity or hydrogen may contribute as well. Besides the EU there are many other countries with ambitious biofuel targets (Table 1).

Impacts of Biofuels Production

The production of biofuels can lead to different ecological, economic and social impacts which can overweigh their advantages. The main concerns are related to the destruction of habitats and thus biodiversity, e.g., through deforestation, the acceleration of climate change by releasing high amounts of stored carbon, the competition with food production resulting in high prices for food, the availability of water and negative social impacts (e.g., child and forced labour).

Country	Biofuel Target	Main Energy Plant/resource at Present
Brazil[a]	25% bioethanol since 2003 5% biodiesel by 2013	sugar cane soybean, palm oil, castor oil
China	10% bioethanol in five provinces (biodiesel without significance)	maize, wheat, cassava, sweet sorghum, waste oil, jatropha,
EU[b]	5.75% biofuels by 2010 and 10% biofuels by 2020	wheat, sugar beet, canola, sunflower, soybean
India	10% bioethanol by 2008 5% biodiesel by 2012	molasses, sugar cane jatropha, palm oil (import)
Indonesia	10% biofuels by 2010	sugar cane, cassava, palm oil, jatropha
Canada	5% bioethanol by 2010, 2% biodiesel by 2012	maize, wheat, straw, animal fats, vegetable oil
Malaysia	5% biodiesel in public transportation	palm oil
Thailand	10% bioethanol by 2011 10% biodiesel by 2012	molasses, sugar cane, cassava palm oil, waste oil
USA	136 Mio. m^3 bioethanol by 2022 (approx. 12%) 3.78 Mio. m^3 biodiesel by 2012 (approx. 2%)	maize soybean and other oleiferous fruits

[a] The shares will be exceeded due to economically competitive bioethanol production costs of 30 $/barrel.
[b] The shares are under discussion and will probably be dropped.

Table 1: Biofuel Targets (share of all transport fossil fuels) of Selected Countries (according to LfL 2007)

Conservation of Biodiversity

The increasing demand for biofuels will result in changes in land use which can negatively affect the goal to conserve biodiversity. A significant change in land use derives from the intended abolishment of the EU obligation of set-side land in 2009 (EU Commission 2009). Also in other parts of the world set-aside land which contributes to the conservation of biodiversity is cultivated again due to an increase in the demand for biofuels (and food), e.g. in the CIS countries, South America and Asia. Moreover, rainforests are cleared to plant oil palms and pastures rich in biodiversity are used more intensively or even converted to arable land. A further

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negative impact on biodiversity results from constraints to the expansion of organic farming which has positive impacts on biodiversity. These effects can counteract the EU targets of Gothenburg to stop the decline of biodiversity in Europe by 2010 (EU Rat 2001) and the targets of the Convention on Biological Diversity, an international treaty that was adopted by the United Nations in Rio de Janeiro in June 1992.

Protection of the Climate

Direct and indirect land use changes and direct and indirect emissions of greenhouse gases (GHG) during plant production can induce high GHG emissions leading to increased net GHG emissions rather than savings from substituting fossil fuels by biofuels (RFA 2008). Accordingly, converting peatland rainforests in Indonesia and Malaysia incur a very long "carbon payback time" of over 400 years (Fargione et al. 2008). Moreover, the use of nitrogen fertilizers in biofuels production can lead to N_2O emissions with a global warming potential which is 300 times higher than that of CO_2. Due to these N_2O emissions, the replacement of fossil fuels by biofuels may not bring the intended climate cooling (Crutzen et al 2008).

Water Supply

Water is a major prerequisite of biomass production. Irrigation of agricultural land claims for 70% of the pumped water. Lundqvist et al. (2007) assumes that the global consumption of water will double until 2045 if the EU and the U.S. adhere to their biofuel development plans and their ambitious biofuel targets. In regions with scarce water resources the start-up or extension of biofuels production can lead to problems concerning drinking water abstraction and the conservation of biodiversity (Berndes 2002, De Fraiture et al. 2008). However, looking at the implications of biofuels production on the water balance, it has to be considered that "green" water has not been adequately included in the calculation so far. The usage of "green" water which is bound in the soil and plants has no implications on the availability of drinking water (Falkenmark et al. 1998). Only the "blue" water of aquifers, lakes and rivers used for the irrigation of biofuel plants is relevant for the water balance. Besides, water quality can be affected by using fertilizers and pesticides to grow biofuel plants if these substances end up in surface or ground water. The National Research Council (2007) assumes that increased wheat production for biofuels in the US could damage the water supplies as well as water quality.

Food Supply

The extension of biofuels production can arouse conflicts with the production of food, because first generation biofuels are based on the same edible plants. The OECD (2007) and FAO (2007) declared that the growing demand for biofuels accounts for increased food prices and biofuels production leads to deferrals on the world markets for commodities. However, as only 1.9% of the global arable land is used for biofuels production, the growing demand for biofuels cannot be the only driving force for high food prices. Other influencing factors may be higher production costs and a growing demand for high value food products such as meat and milk. Moreover, the development of the trade volume in future markets presumes that speculative transactions and new financial instruments are the main reasons for the dramatic increase in food prices. Because of these high food prices one of the millennium goals of the United Nations may not be reached, namely to halve the proportion of people suffering from hunger by 2015 (UN 2008). On the other hand, today enough food is produced to satisfy the needs of the world population (Baumann 2008). In spite of a rising demand for food and biofuels, there will be enough land available for sufficient food production even in 2020 (RFA 2008).

Social Aspects

In developing countries biofuels production can contribute considerably to value creation. For instance, in Brazil the sugar and ethanol industry is the economic sector that shows the highest number of employees (Brazilian embassy 2007). However, forced labour and degrading working conditions can be observed. According to the World Bank an industrial and export-oriented agriculture should be the main strategy to fight poverty and hunger in rural areas of developing countries (World Bank 2007). But for this purpose large-scale farming is required. That may conflict with a diversified agriculture and small farming operation. One of the worries of the IAASTD[1] (2008) is that strong investors will concentrate the ownership of agricultural resources and suppress smallholders and peasant communities. This could lead to negative impacts on employment and income in rural areas as well as to environmental problems. Thus, regulations concerning the production of biofuels in developing countries are necessary to avoid

problems similar to those of cash crop growing (Fritsche et al. 2005).

The EU Proposal for a Sustainable Biofuels Production

Due to these various issues the European Commission made a proposal for a directive on the promotion of the use of energy from renewable sources in January 2008. Amongst others this directive should assure a sustainable production of biofuels (EU Commission 2008). The proposal was already discussed by the Council of the European Union and the Committees of the EU Parliament. This article refers to the outcome of the first reading in December 2008 (EU Council 2009). In particular the mentioned directive aims at preventing an expansion of the area needed for the production of biofuels at the expense of biodiversity. The proposed rules apply to biofuels produced in the EU as well as to imported biofuels and other bioliquids[2]. A certification system is planned to ensure compliance with the sustainability criteria. Thus, only biofuels shall be taken into account for the national biofuel targets if

- the required production areas have not been forests undisturbed by significant human activity, protected areas, species-rich grassland or land with high carbon stock (wetlands, continuously forested areas) in January 2008;
- the GHG emission saving from their use is at least 35% and at least 50% from 2017 and to 60% for new installations from 2017.

The proposal could meet the challenges concerning biodiversity and climate change coming along with the production of biofuels. However, a closer look reveals some deficiencies, which are discussed below.

Leakage Effects

A major weak point of the EU proposal is that leakage effects[3] cannot be averted. On the one hand only biofuels produced for use in the EU are certified. Thus, exporting countries like Brazil or Malaysia can use land which does not comply with the proposed EU directive for the production of biofuels to satisfy their own needs or the demand of importing non-EU countries. On the other hand the proposal does not envisage instruments to prevent impacts caused by indirect land use change, since land used for food production may be occupied for the production of biofuels. Food production, for which the sustainability criteria of the proposal are not valid, then has to be moved to other areas. Eickhout et al. (2008) found similar results. To avoid these indirect effects, broadening the criteria to the production of food and feed was arrogated (BMU 2008). At least the EU proposal recommends concluding agreements addressing the indirect effects with third countries. However, even if the prevention of undesired land use change was achieved, an enlargement of the production of biofuels could affect biodiversity, since a considerable part of biodiversity can be found outside of protected areas (Haber 2008).

Concerning the production of biodiesel from palm oil, leakage effects are even exacerbated under certain circumstances by defining default values for GHG emission savings in the EU proposal. According to these values, biodiesel from palm oil and hydrotreated palm oil[4] cannot achieve the threshold for GHG emission savings because of methane gas emissions resulting from open storage of oil mill residues and effluents (figure 2). Against this, the GHG emission threshold can be reached by using the residues and effluents to produce biogas in a fermenter plant. Instead of using the default values, the EU proposal alternatively permits the calculation of GHG emission savings according to the calculation method defined in the proposal. In doing so, it is allowed to take into account carbon stock changes in biomass and soil which are due to land use changes. For example, by converting food or feed cropland (medium carbon stock) into an oil palm plantation (high carbon stock), the resulting GHG emission savings are above 140% (figure 1)[5].

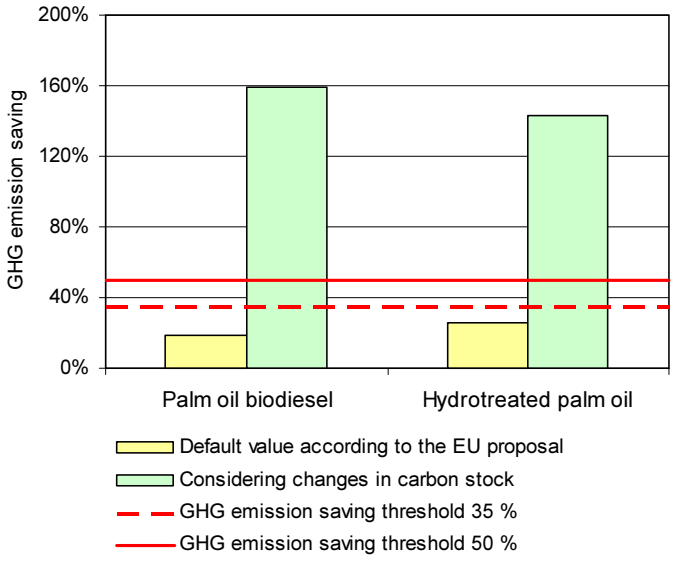

Figure 1. GHG emission savings due to biofuels production from palm oil, with and without converting agricultural land to an oil palm plantation. Values for carbon stock and yields following EU Commission (2008), all other values and the calculation method used are according to EU Council (2009).

Thus, the conventional palm oil production (without the co-production of biogas) could be certified, which would promote the conversion of cropland into oil palm plantations and hence the leakage effect.

Further Review of the EU Proposal

The stepwise increase of the threshold for GHG emission savings from 35 to 50% from 2017 (and to 60% for new installations from 2017) will indeed induce technical progress. However, first generation biofuels will only make a minor contribution to the total EU GHG emission savings: a target of a 10% share of biofuels in the transport sector by 2020 would lead to only 1% savings of total EU emissions[6]. An earlier and further augmentation of the savings threshold should be aspired.

Only two sustainability criteria are operationalised for the certification according to the EU proposal, namely biodiversity and climate protection. Following a holistic view (see Kopfmüller et al. 2001) this is not sufficient to assure a sustainable production of biofuels. The implementation of other criteria concerning the environment like soil and water protection would be desirable. If latter should have to be implemented, shall be decided by 2012. Food security and social aspects are addressed in the EU proposal, but only reporting and monitoring of food and commodity prices as well as other social aspects in the European community and important exporting countries are considered. Moreover, the reports shall state whether important exporting countries have ratified and implemented certain conventions of the International Labour Organisation (e.g., concerning forced or child labour). If an unfavourable development is identified, the commission shall propose corrective actions. Since possible consequences are not described, it is not clear whether this part of the regulation will become effective.

A more comprehensive approach for a global sustainability standard for the biofuels production has been proposed by the Roundtable on Sustainable Biofuels (RSB 2008). Besides regulations to reduce GHG emissions and the loss of biodiversity, also regulations to protect water, soil and air as well as to ensure food security, human and labour rights are included. However, another question is whether it will be possible to effectively implement appropriate legislation and regulation and control the compliance with the criteria in important developing countries. Furthermore, the fast-rising demand for biofuels is a hurdle for the implementation of environmental, social and human rights standards for biofuels production.

Conclusion

The EU proposal is a step forward towards a sustainable production of biofuels. However, only two ecological criteria, i. e., climate protection and biodiversity, are implemented in the certification system; social criteria are not included. Thus, a sustainable biofuels production is not assured from a holistic point of view. In addition, considerable leakage effects are to be expected if third countries expand the production of biofuels for their own needs or for export to other countries than the community at the expense of areas which are not appropriate production sites in terms of the proposed sustainability criteria.

Because of the shortcomings of the EU proposal the biofuel targets have already been reviewed by the EU and several member states. Adjusting the targets to the availability of suitable land and the feasibility of a socially acceptable biofuels production would be desirable. Furthermore a global strategy for sustainable biofuels production would be reasonable to coordinate measures to enhance efficiency and environmental compatibility within the framework of an international panel. Efforts in research and development for innovative biofuels production technologies should be part of this strategy as well as the development and implementation of social standards. Despite the occurring sustainability issues, great opportunities for biofuels and a more righteous use of the available resources seem to be possible by introducing technical and regulatory measures.

Footnotes

[1] International Assessment of Agricultural Science and Technology for Development.

[2] Such as the combustion of palm oil in a combined heat and power unit.

[3] Spatial dislocation of issues that cannot be avoided by a certification system. See also Lewandowski and Faaij (2006: 91).

[4] Palm oil thermochemically treated with hydrogen which then has a greater lower heating value than biodiesel from palm oil.

[5] Figures are calculated based on the default values for carbon stock of several land use types from a former version of the proposal (EU Commission 2008a). These default values are not part of the proposal anymore and a methodology for the calculation of land carbon stocks shall be developed by 31 December 2009 based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories – volume 4. Nevertheless, basically the described

mechanism might still be valid irrespective of the calculation method.

[6] The share of the transport sector in GHG emissions is about 21% in the EU (EEA 2007).

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