

## EU Biomass Potential and Environmental Constraints

Berien Elbersen\* and Jan-Erik Petersen\*\*

\* Alterra, Wageningen, The Netherlands

\*\* European Environment Agency

Increasing the use of bioenergy offers significant opportunities for Europe to reduce greenhouse gas emissions and improve the security of its energy supply. However, the substantial rise in the use of biomass from agriculture and other sectors for producing transport fuels and energy can put significant environmental pressures on farmland or forest biodiversity as well as on soil and water resources. Consequently, it may counteract current and potential future environmental policies and objectives, such as improving the quality of ground and surface waters or biodiversity protection. These issues are addressed in the EEA report No 7/2006 on 'How much bioenergy can Europe produce without harming the environment?' and the approach and results are presented in this presentation.

The scenario analysis presented here pinpoints the environmental aspects that should be looked at when increasing bioenergy production on farmland. The model also gives an indication of how much agricultural biomass is potentially available without harming the environment and without counteracting current and potential future EU environmental policies and objectives.

The key scenario assumptions for estimating the environmentally compatible bioenergy production potential on farmland are:

- a) Assumptions for the maintenance or further development of an 'environmentally orientated farming' in the EU: the present share of 'environmentally orientated' farming would need to increase to about 30% of the Utilised Agricultural Area in most Member States by 2030; at least 3% of present intensively used farmland should be set-aside by 2030 for nature conservation purposes; no conversion of permanent grassland, agro-forestry areas (Dehesas and Montados) and olive groves through ploughing for targeted biomass crops.
- b) Further technological development and research would allow a diversification of energy crops and conversion pathways for different types of biomass (2nd generation conversion pathways, biogas, efficient bioenergy combinations).
- c) The selection of energy crops and their management at farm level would follow environmental guidance (adaptation to bio-physical constraints and ecological values of a region, appropriate crop mixes and rotations, low use of inputs, double cropping practices etc.).

The environmentally-compatible bioenergy potential from agriculture could reach up to 142 MtOE by 2030, compared to 47 MtOE in 2010. Approximately 85 % of the potential will come from only seven Member States (Spain, France, Germany, Italy, UK, Lithuania and Poland). This potential is contingent upon assumptions regarding the farmland area available for energy crop production in each Member State, the competition with food and export markets, the impact of environmental constraints and the yield of the assumed bioenergy crops.

In addition, four major caveats have to be highlighted for interpreting the results of the study:

- a) The model assumptions had to be restricted to environmental impacts in Europe given available resources, data and limited knowledge about effects in other regions of the world. The price rises in world food markets and recent studies indicate that the indirect effects of European bioenergy production, even if it builds on land that is assumed surplus to European food requirements, clearly outweigh the potential environmental effects within Europe itself, in particular with regard to life cycle GHG balances of bioenergy pathways (Searchinger et al., 2008; Fargione *et al.*, 2008).
- b) The study only estimates the technically available biomass potential but does not make any predictions about the potential that can realistically be exploited under economic and logistic constraints. The latter is likely to be significantly lower than the estimates given in the EEA study, in particular since some of the assumed technological pathways are at least currently considerably more expensive than mainstream biofuel pathways (at least excluding indirect environmental costs).
- c) The study does not analyse the amount of greenhouse gas emissions that can be avoided through the exploitation of the environmentally-compatible potential within the EU-25. This strongly depends on the way in which biomass is converted into heat, electricity, and transport fuels and which fossil fuels are replaced. A detailed analysis of the avoided greenhouse gas emissions at EU level would be useful in completing the environmental assessment of different bioenergy production options.
- d) Further analysis would also be needed for exploring the potential impacts of climate change on the cultivation and yield of energy crops as this aspect was beyond the scope of the study.

Policies are needed for supporting environmentally-friendly farming in general and the environmentally-compatible production of energy crops in particular. At the same time there are many research needs to support the quick introduction of new biomass crops with low environmental pressures, the so-called low input-high output crops.

#### **Further research needs**

- The identification of the most suitable biomass crops is a complicated issue and still needs a lot of RTD also in relation to the practical implementation in existing farming systems.
- Great yield differences between experimental fields and practical applications by farmers at either small or larger scale. It is not only high yields but also energy content and energy balance that need to be considered in both experimental and practical applications.
- There is also still a lot of RTD needed on plant breeding, selection of crops, varieties and crop genetics which may improve characteristics of crops suitable for biomass production under different climatic circumstances (certainly arid conditions).
- Until now only very limited work on exploring the available bioenergy options has highlighted some potential 'win-win' solutions from energy cropping. However more research efforts and practical applications are needed.

- There is still a lot of RTD requirements needed on finding measures to improve the efficiency in relation to the input-output ratio in the cropping phase and the energy efficiency in the full chain, including the part from converting biomass to energy.
- At this moment biomass subsidies are not linked to a “sustainability” standard” (climate effect, biodiversity, security of supply, rural economy, etc): More research should therefore be done on answering the questions: What is sustainable? How do you measure it? How do you certify that?

### **Opportunities for EC-US cooperation**

There should be opportunities to collaborate on all identified research questions given above.

### **Literature:**

EEA (2007), Estimating the environmentally compatible biomass potential from agriculture, Technical report no. 12/ 2007. Copenhagen. (December, 2007).

Fargione, J.; Hill, J.; Tilman, D.; Polasky, S. & Hawthorne, P. (2008), Land clearing and biofuel carbon debt. Scienceexpress, 7 February 2008.

Searchinger, T.; Heimlich, R.; Houghton, R.; Dong, F.; Elobeid, A.; Fabiosa, J.; Tokgoz, S.; Hayes, D. & Yu, T. (2008), Use of US cropland for biofuels increases greenhouse gases through emissions from land use change. Scienceexpress. 7 February 2008.