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The potential of green gene technology in biomass production – a legal examination

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Targets and incentives for biomass production

The European Union, with its EU-Climate and Energy Package from January the 23rd 2008[1], has set ambitious targets for renewable energies in the EU by the year 2020. The first goal is to increase the share of renewable energies in electricity production to 20 %. The second aim, is to comprise Biofuel a 10 % share of all vehicle fuels. Germany goes even further with its Climate Program. The National Strategy of Sustainability and the Biofuel Road Map[2] each propose an increase to 17 % of biofuels by 2020[3]. These targets are in part implemented into national Law by several Acts such as The Federal Imission Control Act which sets binding targets for the increased share of Biofuels each year or the Act on Renewable Energy and the Energy Tax Act which both provide support for companies that bring biofuels on the market. There are even more economic incentives from the Federal Office of Economy and Export Control (BAFA) as well as from the Reconstruction Loan Corporation (KfW) that finance the Renewable Energy Incentive Program (MAP)[4]. Due to all of the recent incentives provided by governments, interest in sustainable fuel sources is growing and the production of biomass is becoming ever increasingly popular.

Current cultivation and research of plants used for biomass production

In 2006, 1.6 million hectares or 13 % of all agricultural land in Germany were used for the cultivation of renewable biomass resources[5]. An EEA study states that in the year

1 Europe's climate change opportunity, www.europa.eu; see also: European Parliament resolution on climate change adopted on 14 February 2007 (P6_TA(2007)0038) and European Union Strategy for Biofuels (2006); see also Renewable Energy Roadmap (COM (2006) 848 final); An Energy Policy for Europe (COM (2007)1).

2 all from 2007.

3 Addititional German targets to 2020: 6 % of the current natural gas consumption substituted by biogas and increasing the share of heat production from renewables to 14 %.

4 See for the European Level Common Agriculture Policy (CAP): European Commission: Promotion of the Use of biofuels or other Renewable fuels for transport, Directive 2003/30/EC.

5 SRU, Klimaschutz durch Biomasse, 2007; FNR, Nachwachsende Rohstoffe - alter Hut auf neuen Köpfen, 2006, www.fnr-server.de.

2020, at least three million hectares will be used for biomass production[6]. There are two possible future developments which can increase efficiency. First, more land will be used. Yet, the space available for cultivation is not endless. Second, farmer profits will increase as their harvests become more productive and more profitable. Therefore some believe GMO (Genetically Modified Organisms) could be a solution. Subsequently various entities are involved in research and cultivation of genetically engineered biomass plants.

In 2008 the Monsanto Company, a multinational agricultural biotechnology corporation, plans to commercialize a new variety of genetically engineered maize called "Mavera". This maize contains a high starch content which enhances the ethanol production[7]. Targeted Growth Inc., another company that deals with Gene Technology, has tested genetically modified energy plants like canola, maize and soy beans[8]. Their aim is to increase seed size, the rate of germination, the root mass and the like. Their focus is to postpone the cessation of cell division to increase the size of plant seeds[9]. To date there are no GM energy crops on the market in Europe. Nevertheless, extensive research continues. Corporations[10], such as Syngenta, a Swiss pharmaceutical company, are conducting research on crops that contain enzymes which assist in the process of decomposition, thus simplifying the production of ethanol. Syngenta has applied for a license to import the genetically modified maize Event 3272[11]. While the EU rejected the application for Event 3272 because this maize is expected to contaminate feed, food and environment, the USA and China granted the permit for the cultivation[12]. Therefore there should be further scrutiny to the biodiversity.

Biodiversity impacts of biomass plants

As previously stated, it is highly probable that new land will be used for the cultivation of energy plants. Therefore, grassland or otherwise virgin land needs to be converted into monocultural cropland and habitats will get lost[13]. To understand the impacts on

6 EEA, How much bioenergy can Europe produce without harming the environment? 2006.

7 Monsanto, Annual Report 2006, p.10; Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, http://www.corporateeurope.org/docs/AgrofuelsRealityCheck.pdf, 2007, p. 11.

8 www.targetedgrowth.com/PressReleases/Monsanto.pdf.

9 T. Fritz, Das Grüne Gold, 2007, 16; H. Moldenhauer, et al., Nachwachsende Rohstoffe, 2006, 1ff; Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, http://www.corporateeurope.org/docs/AgrofuelsRealityCheck.pdf, 2007, p. 11.

10 E.g. Monsanto Company or Target Growth Inc. which focus on enhancing ethanol production by a higher starch content or postponing the cessation of cell division to increase the size of plant seeds, T. Fritz, Das Grüne Gold, 2007, 16; H. Moldenhauer, et al., Nachwachsende Rohstoffe, 2006, 1ff; Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, http://www.corporateeurope.org/docs/AgrofuelsRealityCheck.pdf, 2007, p. 11.

11 Application for import and use of genetically modified Event 3272 maize under Regulation (EC) No 1829/2003.

12 Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, 2007, p. 11.

13 Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, http://www.corporateeurope.org/docs/AgrofuelsRealityCheck.pdf, 2007, p. 12.

biodiversity[14], it is important to note that carbon compounds in biomass waste left on the ground are consumed by other micro organisms[15]. The widespread human use of this biomass for energy purposes (which would normally compost the field) would threaten these organisms and their natural habitats[16].

GM crops could increase these problems and cause additional effects on the environment. The use of herbicides and direct drilling means that the soil does not need turning for weed control as in most conventional production systems[17]. Last but not least the chance of brutalization and of out crossing of genes must be mentioned[18]. Both can promote invasive species[19] which displace local plant life and create so called "superweeds" that have the best attributes of both the wild plant and the GM plant. It is also possible that bacterial toxins such as the Bt-Toxin from the GM Plant can transfer from plant species to animal species in the food chain[20]. There have been related studies regarding this phenomenon in butterflies and beetles[21]. Ultimately, the problems associated with the use of land for the purpose of bioenergy generation, including deforestation, soil erosion, nutrient leaching and biodiversity loss will remain the most vexing and deserve the most attention and, therefore, legal adaptation.

Adaptation of the legal framework

At the European level the package of directives that will be passed in 2008 should include the objective that the substitution of fossil fuels by renewable energies has to be

14 This paper does not focus on the very controversial discussion of whether or not biomass production and usage indeed minimizes greenhouse gases: P. J. Crutzen, et al., Atmos. Chem. Phys. 2007, Biofuels produce greenhouse gas emissions during their manufacture. The sources of these emissions are: fertilisers and agricultural processing, transportation of the biomass, processing of the fuels, and transport and delivery of biofuels to the consumer.

15 Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, http://www.corporateeurope.org/docs/AgrofuelsRealityCheck.pdf, 2007.

16 USDA, National Soil Erosion Research Labortory, http://www.ars.usda.gov/main/site_main.htm?modecode=36021500, 2008.

17 The Kyoto Protocol is a protocol to the international Framework Convention on Climate Change with the objective of reducing Greenhouse gases that cause climate change.

18 I. Heap, The international survey of herbicid resistant weeds-Herbicid Resistance Action Committee (HRCA), 2005, www.weedscience.com.

19 R. Hails/W. Timms, Genetically Modified Organisms as Invasive Species? in: Nentwig (Hrsg.), Biological Invasions, 2007, p. 293; N. C. Ellstrand/K. A. Schierenbeck, Proc Natl Acad Sci USA 97: 7043-7050, 2000.

20 J. D. Harwood, et al., Molecular Ecology 2005, S. 2815f.; C. Zwahlen/D. A. Andow, Environmental Biosafety Research 2005, p. 113; L. B. Obrist, et al., Ecological Entomology 2006, p. 143f.

21 H. R. Mattila, et al., Entomologia Experimentalis et Applicata 2005, p. 31; J. Romeis, et al., Nature Biotechnology 2006, p. 63f; A. R. Zangerl, et al., Proceedings of the National Academy of Science USA 2001, S. 11908; G. P. Dively, et al., Environmental Entomology 2004, p. 1116f.; C. Zwahlen, et al., Molecular Ecology 2003, p. 1077f.; C. Crecchio/G. Stotzky, Soil Biology & Biochemestry 2001, p. 573; A. Hilbeck, Transgenic host plant resistence and non-target effects, in: Letourneau/Burrows (Hrsg.), Genetically Engineered Organisms, 2001, p. 167.; J. D. Harwood, et al., Molecular Ecology 2005, p. 2815.

sustainable. Such goals should be included in the reformed Biofuel Directive (2003/30/EC), the Habitats-Directive (92/43/EWG), the Deliberate Release Directive (2001/18/EC), and the Renewable Energy Directive (2001/77/EC). This objective has then to be implemented into the Member States Law. Another point on the European scale is that the European government's aid in supporting energy crop farming and the actual process of energy generation should be dependent on crop rotation and on a mixed use of materials in the biomass processors. This would prevent the creation of monocultures which are – among other things – responsible for the loss of biodiversity. The grave concerns regarding environmental impacts of the growing demand for agrofuel have led to the idea of "sustainability certification"[22]. However, the criteria thus far developed only cover two issues: Greenhouse Gases and high biodiversity value areas[23]. Additionally, it will be important that all stakeholders such as groups affected by the expansion of monocultures as well as environmental organizations be involved in the impact assessments and criteria development for a European Certification System. Sustainability strategies and standards must also apply internationally[24].

The German Act on Renewable Energy Sources, as a consequence, should financially promote the supply of current only when the energy from biogas processors that is put into the electricity network derives from a mixture of materials. The Federal Imission Control Act should not only ask for certain quotas of the biofuel share in fuels, but also set parameters so that the biofuel comes from sustainable cultivation. The same is valid for the Energy Tax Act. The Renewable Energy Incentive Program (MAP) should, like the European government aids, only support the cultivation of biofuel plants under the following circumstances: crop rotation was used, grassland was not changed into field land, and cultivation did not happen in an area of high biodiversity value. The drafted German Biomass Sustainability Ordinance from December 2007[25] allows the financial promotion through The Act of Renewable Energy Sources only if it is proven that the farmers perform a sustainable cultivation and protect natural habitats while minimizing Greenhouse Gases. Section 2 of the drafted Biomass Sustainability Ordinance defines sustainable cultivation as the indemnification of the usage if Best Practice Rules from agriculture and forestry or the rules of Cross Compliance are followed. Good Agricultural Practices are a collection of principles applied to on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economical, social and environmental sustainability[26].

22 A sustainability scheme is prepared by the german government and the EU-Commission – www.iscc-project.org; others: UK initiative: www.lowcvp.org.uk; Dutch 'Cramer report': www.senternovem.nl/mmfiles/Criteria_voor_duurzame_biomassa_productie_Eindrapport_Engelse_versie_tcm24-205854.pdf; Details on the approach taken by the European Commission can also be found in their consultation: http://ec.europa.eu/energy/res/consultation/biofuels_en.htm; see drafted German Biomass Sustainability Ordinance, BioNachV - http://www.bmu.de/erneuerbare_energien/downloads/doc/40712.php.

23 Biofuelwatch, Agrofuels - Towards a Reality check in nine key areas, http://www.corporateeurope.org/docs/AgrofuelsRealityCheck.pdf, 2007.

24 E.g. no destruction of rainforests.

25 http://www.bmu.de/erneuerbare_energien/downloads/doc/40712.php.

26 UN FAO (Food and Agriculture Association).

When it comes to the Cultivation of GM Plants for energy purposes additional improvements should be made in the Gene Technology Law. There is the Gene Technology Plant Cultivation Ordinance[27], from April 2008, for the cultivation of GM plants. This Ordinance refers not only to modified energy crops but to all GM plants. Even though the German Gene Technology Act mentions that whoever plants GM crops must ensure the prevention of the out crossing of genes the drafted ordinance does not set minimum distances between cultivated fields and nature conservation areas. Another correction should be made when it comes to the authority that is granting the permit for GM Release. As it pertains to the deliberate release and the placement on the market of GM-Energy Crops, the jurisdictional authority should change from the Federal Agency of Consumer Protection[28] and Agriculture to the Federal Nature Conservation Agency. This would ensure that the approval process considers all essential biodiversity issues. This is especially valid when GM plants are used for purposes other than consumption.

Conclusion

As Biomass Production will be a growing industry it is very likely that more land will be transformed into agricultural land and that the characteristics of plants will be adjusted to the demands of the Biofuel industry. Because regular biomass plants have the potential of harming the environment in general and biodiversity in particular and because both effects could be intensified by GM plants, the following adaptations of the Legal Framework should be seriously considered:

- The financial promotion provided, should all be dependent on a mixture of plants on the field (crop rotation) as well as a mixture of materials in the Biomass Processors.
- The control and execution of Good Agricultural Practice should be improved.
- A certification system should be created which proves that the energy or the fuel coming from biomass is processed in a sustainable manner.
- Minimum distances of at least 1000 meters between GM-Fields and protected nature areas should be implemented.
- The jurisdictional authority to grant the permit for GM Plant cultivation and placement on the market should be the Federal Agency for Nature Protection when the use is for biomass production only.

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27 http://bundesrecht.juris.de/bundesrecht/gentpflev/gesamt.pdf.

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