Background note

Bioenergy policy - implementation and best practice on a regional level

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Introduction

On 23 January 2008 the European Commission put forth an integrated proposal for Climate and Energy Action – the „Energy and climate package". This package includes a directive on the promotion of the use of renewables that sets an overall binding target for the European Union of 20% renewable energy by 2020 and a 10% minimum target for the market share of biofuels by 2020.

Taking into account the national circumstances, Member States are free to decide their preferred 'mix' of renewables in order to take account of their different potentials, but must present National Action Plans outlining their strategies to the Commission. The national action plans shall also set out "adequate measures to be taken to achieve these targets, including national policies to develop existing biomass resources and mobilise new biomass resources for different uses".[1]

With regard to biomass use the EU Biomass Action plan (2005)[2] also encourages Member States to develop national action plans (nBAPs). While the renewables action plans are mandatory, the nBAPs are voluntary. Until the end of 2007 only six countries (Denmark, Estonia, Ireland, the Netherlands, Slovenia and UK) had developed national Biomass Action Plans, seven countries were still in the state of preparation (Austria, Belgium, Czech Republic, France, Germany, Latvia, Slovak Republic and fourteen Member States had not launched initiatives yet (JRC, 2007[3]).

Given the ambitious objectives for renewable energy, and bioenergy in particular, and considering the "effort sharing" approach[4] under the Renewable Directive, most Member States will need to increase their biomass production and bioenergy use significantly.

As there are various implementation options and increased bioenergy production effects can range from considerably negative to highly beneficial, it will be crucial to build on experiences from different regions in Europe in order to learn from the different approaches and to reduce the risk of making the wrong decisions. Unbalanced concepts to achieve bioenergy targets can lead to the

[1] Article 4, European Commission (2008): Proposal for a directive on the promotion of the use of energy from renewable sources, COM(2008) 19 final, Brussels, 23.1.2008

[2] European Commission (2005): Biomass action plan COM(2005) 628 final, Brussels, 7.12.2005

[3] JRC (Niina Kautto) 2007: "Status of Bioenergy and national Biomass Action Plans in the European Union, http://sunbird.jrc.it/refsys/pdf/RE%20Snapshots%202007.pdf

[4] Member States have to achieve different levels of improvement, taking into consideration current levels of renewable energy use and the national GDP. See Annex I European Commission (2008): Proposal for a directive on the promotion of the use of energy from renewable sources, COM(2008) 19 final, Brussels, 23.1.2008.

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increase of land use conflicts, further depletion of the environment (in particular soil, water and biodiversity) and also to shortages in food production.

The paper gives an overview of the challenges and opportunities of regional bioenergy production approaches and gives some examples of good/best practices in different Member States. This should enable a fruitful discussion at the conference and the possibility to learn from other Member States approaches.

Challenges and opportunities on regional level

While governments are making commitments, many civil society organisations and scientists are ringing alarm bells. More and more concerns are raised that the rapid expansion of bioenergy without adequate concern has side-effects that outweigh the benefits by a high order of magnitude. Such negative side effects are linked to increased GHG emission, environmental pollution[5] and food prices[6].

However, biomass production and use can also be beneficial to achieve environmental objectives, reduce CO2 emissions compared to fossil fuel use and support rural development efforts if the risks are considered carefully.

Essentially, the question if effects will be positive or negative depends on how EU and national targets are implemented on the regional level with regard to:

- Land use planning
- Bioenergy feedstocks and farming practices
- Impacts on GHG emissions over the whole life cycle
- Social effects in rural areas
- Support schemes in and for rural areas

Land use planning

As a major land user in Europe (approx. 50% of total land area), agriculture has a significant impact on environmental resources such as water, soil and biodiversity. The ambitious bioenergy targets in Europe and other parts of the world lead to considerable additional demand for land in order to increase production[7]. Aside from the global context, these additional demands also correspond not only with existing land use conflicts in the EU within the agricultural sector (e.g. food vs. energy crops), but also with needs driven by other policies, such as the Water Framework Directive, policies for the protection of biodiversity and the extension of organic farming. These latter policy measures tend all to reduce the inputs of agricultural production as well as the total area of cultivation. In contrast, the high biomass demand for energy production sets incentives to expand production into areas which are currently not or hardly used (e.g. use of set-aside areas[8] or

[5] Zah, R.; Böni, H.; Gauch, M.; Hischier, R.; Lehmann, M.; Wäger, P. (2007): Life Cycle Assessment of Energy Products: Environmental Assessment of Biofuels - Executive Summary , available at http://www.bioenergywiki.net/images/8/80/Empa_Bioenergie_ExecSumm_engl.pdf

[6] The discussion of increase food prices is currently debated with the highest emotions. Jean Ziegler, independent expert of the United Nations Human Rights Council recently argued that biofuel is a crime against humanity. See The Guardian, Saturday April 5 2008

[7] European Commission, Directorate General for Agriculture and Rural Development, Directorate G. Economic analysis, perspectives and evaluations, G.2. Economic analysis of EU agriculture, Note to the file, Subject: The impact of a minimum 10% obligation for biofuel use in the EU-27 in 2020 on agricultural markets, Rev: Impact assessment Renewable Energy Roadmap March 2007. July 2007

[8] Set aside land, which was obligatory for farmers to some extent in the past years is suggested to function as an important refugium for different flora and fauna species. Due to the current demand for agricultural products, the Council approved last year zero set-aside rate for autumn 2007 and spring 2008 sowings.

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marginal land which are rich in biodiversity but not always under protection). In this context, displacement effects have to be taken into account, if energy cropping forces former land uses to move to other areas.

Land use planning, which Member States are still responsible for, can be a suitable regulating instrument to deal with land use conflicts. However, national planning systems hardly address the new issue of bioenergy production yet. Best practices are therefore needed regarding the following issues:

- Solving competition for land between biomass use for food, industrial and energy purposes
- Integration of concepts of regional biomass supply and logistics in land use planning

Bioenergy feedstocks and farming practices

Concerns about the increase of energy cropping refer inter alia to an expected intensification of agricultural production corresponding with overuse of residues, additional water use for irrigation and an increased input of pesticides and fertilisers. These could have significant negative impacts on the environment, and in particular on water deterioration, soil degradation and additional GHG and pollutants emissions.

On the other hand, some energy crops have the potential to reduce the environmental pressure. For example, short rotation coppice plantations and perennial energy grasses can significantly reduce water pollution risks[9] in the long run[10] and contain a significant water saving potential[11]. Although each energy crop leads to different environmental impacts[12], it can be said that perennial crops mostly cause lower environmental pressures than annual crops.

However, acknowledging the high variance in local land conditions, farming practices need to be adapted site-specifically (e.g. climatic, physical (topography, soils) conditions) and should consider the ecological sensitivity of the actual land used for bioenergy cropping.

Illustration1: Improving the status of water by bioenergy cropping

Perennial cropping for bioenergy purposes in flood prone areas could be a possible solution by generating win-win solutions for farmers and flood protection (WCL, 2007). Studies in the US have looked at planting bioenergy crops in flood-prone areas, because as perennial crops they do not have to be re-established annually and can withstand periods of flooding. Harvesting of these crops in wet areas would have to be timed carefully to occur during dry periods to minimize rutting and compaction of the land (U.S. Congress, Office of Technology Assessment, 1993).

Agroforestry systems could also be used in flood prone areas. Hershey and Wallace (1993) found that water breaks of trees planted perpendicular to the flow of high energy flood waters were economical, based solely on the reduction of damages to crops, assuming floods occur every 10 years.

However, it should be noted that these results have to be seen as preliminary and further research is needed to better understand the relation between bioenergy cropping and flood protection.

[9] Christian D.G.; Riche A.B. (1998): Soil Use and Management, Volume 14, Number 3, September 1998.; Kristensen E. F. (no year): Harvesting and handling of miscanthus, Danish experiences, available at http://www.shortrotationcrops.org/PDFs/IEA_Miscanthus.pdf

[10] Aspects such as poor soil cover in the first year and nitrate flushes at the end of their lifetime have to be considered. See Dworak, T.; Eppler, U.; Petersen, J.E.; Schlegel, S.; Laaser,C. (2008): "A review of the possible impact of biomass production from agriculture on water" for details.

[11] EEA, European Environment Agency (2006c): How much bioenergy can Europe produce without harming the environment? EEA Report No 7/2006. Copenhagen: EEA . [http://reports.eea.europa.eu].; Kleinschmit J. (2007): Biofueling Rural Development. Carsey Institute. Policy Brief Winter 2007.

[12] For an overview of environmental pressures by crop see Annex 4 of the EEA Report No 7/2006.

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Impacts on GHG emission over the life cycle

Bioenergy production only contributes to the EU's climate change objectives if its use leads to substantial reductions in GHG emissions compared to the use of fossil fuel equivalents. In addition to selecting the right conversion technique and applying land use in accordance to local conditions, creating integrated infrastructural concepts for appropriate biomass supply are prerequisites for meaningful emission reduction by bioenergy application.

Impacts need to be measured and compared based on an overall life cycle assessment, taking into account land use change and additional land for energy cropping. However, an overall life-cycle-assessment for bioenergy has not yet been rendered satisfactory. Despite the numerous methodological problems of entirely balancing GHG emissions from biomass production over transport to its conversion, it has been proven by numerous studies that biomass use for heat and electricity has a far better energy balance than the production of liquid biofuels.[13]

Illustration 2: Electricity from poultry litter: BMC Moerdijk (Netherlands)

A biomass power plant in Moerdijk turns stackable poultry litter into electricity using combustion. Annually, some 440,000 tons poultry litter – from 626 farms - will be converted into 36.5 Megawatts of electricity, which is sufficient to cover the demand from 90,000 households. It is the largest plant of its kind in the world. Biomass power from poultry litter is economically viable because of rising energy prices and increasing difficulties for poultry farmers to dispose of manure. In March 2008 the first shipment of litter arrived at the plant, which will be ready for operation in May 2008.

The production unit reduces emissions of greenhouse gases by almost 100,000 tons per annum. In addition, energy consumption (and related emissions of carbon dioxide) from the transport of poultry litter are expected to decrease by around 60 percent.

The combustion of poultry litter will reduce pressure on the market for litter and manure. The plants' capacity equals a third of total Dutch production of stackable poultry litter, and two thirds of litter production in the provinces of North Brabant and Limburg.

Social effects in rural areas

Evidence on social effects in European rural areas derived from implementation of bioenergy targets is still largely anecdotal.[14] The issues discussed in this context are inter alia:

- **Job creation**. Many advocates of bioenergy development often reflect on its positive effects on job creation. Despite the fact that technologies for renewable energy sources are mostly more labour intensive than conventional energy (such as lignite plants), the added value for regional job creation depends strongly on the context. Positive effects on jobs can only be generated if persons obtaining employment in the bioenergy sector would otherwise (i) have been unemployed, or (ii) have earned a lower salary in other sectors, or (iii) would lose their job in the near future, for example due to structural change in agricultural production (e.g. scale effects). Consequently, arguing for positive economic effects will be relatively weak for high income regions or for regions with low unemployment rates.[15]

[13] e.g. SRU 2007
[14] E.g. Childs, B, Bradley, R, WRI 2008: "Plants at the Pump"; IEA Task 29: Socio-Economic Drivers in implementing bioenergy projects. Technology Report "Bioenergy and Job Generation" 2005.
[15] Novozymes (2007): Biofuel thematic paper – Socio-economic impacts and developing countries, available at http://biomass.novozymes.com/files/documents/Thematic%20paper%20-%20Socio-economic%20impacts%20and%20developing%20countries.pdf

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- **Local food markets**. Biomass production for bioenergy affects not only global food markets; it might also have an impact on regional food supply. Given a higher profitability of energy crops, farmers might switch from previously produced food for regional markets to the production of biomass for energy purposes. Long term contracts with operators of conversion plants could additionally drive them to change their production patterns.
- **Energy dependencies**. Rural areas are mostly connected to centralised energy supply. Biomass, which bears the advantage of being a storable energy source opposed to other renewables like wind or solar power, plays a major role for the further decentralisation of energy generation. Rural areas producing their own energy could thereby reduce their dependency on (increasingly expensive) fossil fuels from the global market. At the same time, however, it has to be kept in mind that regions relying on biomass to high extent face the risk that the energy supply can run short in the event of crop failures.

Illustration 3: Germany – Bio-Energy-Village Jühnde (Lower Saxony)[16]

Juehnde is Germany's first bioenergy village to have an independent supply of heat and electricity by means of biomass mainly from regional agricultural sources. It supports the employment of local inhabitants in agriculture and in running the bioenergy plant. Moreover, it creates welfare through the village's income by selling the excess energy and saving energy costs for local inhabitants.
The project greatly benefitted from the strong involvement and support in a bottom up process involving local residents. Furthermore, the financial support schemes from the regional and federal level as well as the scientific support of the University Göttingen had a very positive influence.
The system works with wood chips and silage and helps to avoid 3.300 t of CO2 emissions per year.
The bioenergy plant has three essential components:
1. A 700 KW anaerobic digestion plant with a block-type thermal power station. The electricity produced here is fed into the public grid. The heat generated by the combustion of the gas in the engine is fed into the village heating grid.
2. A 550 KW wood chip burning boiler. The wood chip boiler is particularly needed in winter, when the heat demand of the village increases. In the event of a complete break down of the whole plant and for extreamly cold days in winter, an additional oil powered boiler can provide heat for the village, accounting for approx. 5% of the annual demand of heat.
3. The village heating grid. The heating grid consists of approx. 6.000 m of pipes. It was installed in the whole village, connecting 142 households. The heat produced per year is about 3.500.000 kWh with a water temperature of approx. 80°C.
The was fully put into operation in 2005, after five years of intensive planning by the local community.

Support schemes

As outlined above, an important key issue in order to achieve sustainable bioenergy production is appropriate land use planning. However, even if such a policy is in place, rural development always depends on the decisions of various actors in the region. Farmers, for instance, are free to decide the type of crop they grow (food/non-food) or how they use their forest (e.g. for nature conservation) as long as they meet the required environmental standards. However, financial incentives such as subsidies, feed in tariffs or regulating measures like taxes and charges on certain products (e.g. Nitrate-tax, fertilizer taxes, water prices) significantly influence farmers` decisions.

Sustainability standards for biomass production, which are currently hotly debated within European institutions, as well as their national and regional implementation (e.g. through certification

[16] See http://www.bioenergiedorf.de/

schemes) play a special role in this context, since they will set general requirements for possible developments in the bioenergy sector.

Aside from the conditions for biomass production on a farm level, it is also important to consider local and regional investment policies for the establishment of conversion plants. New plants might be an incentive for farmers to change their production patterns towards energy crops, mainly if they have the opportunity to enter contracts with plant operators which secure long-term buyer-seller-relations.

Ilustration 4: The Wood Energy Programm in France

France has chosen to develop wood for energy through "The wood energy and local development program" since 1995. The objectives are:

- *In the domestic sector*: maintaining the wood consumption levels and facilitating the replacement of equipment by improving energy efficiency.

- *In the industrial, public and tertiary sectors:* creating 1 000 wood boiler plants (600 in the public sector and 400 in the industrial sector); reaching a wood consumption of 300 ktep (42 ktep/year); organizing the wood supply networks.

The leadership and management of the Wood Energy program was entrusted to ADEME[17] and formalized by contracts between the State, the Regions and the Departments. Two main categories of actions can be underlined:

- local actions like studies, leadership, monitoring the program objectives, evaluation of resources and demand, organization of wood energy supply, and monitoring of supply networks ;

- national actions in relation to research and development programs, general studies (wood based domestic heating, monitoring pollutant emissions, etc.) and the development of suitable communication tools.

Among all the actions moving in the direction of the set priorities in the domestic sector, there are: the creation and the extension of the quality label "Flamme Verte" on all wood-based heating systems, in compliance with new European standards; the creation and promotion of the label "NF Bois de Chauffage" which aims to improve the wood billets quality. In the industrial, public and tertiary sectors, the implementation of the Wood Energy Program has allowed the creation of **2 150 wood boiler plants** in which about 1 400 installations were created between 2000 and 2006. The whole power installed is 1 400 MW which consumes **390 ktep** (322 ktep between 2000 and 2006).

Considering these promising results, French state and ADEME have decided to renew the Wood Energy program until 2010. The objectives were increased by more than 70 %: wood consumption should reach 72 500 ktep/year in comparison to 42 000 ktep/year for the 2000-2006 period.

Illustration 5: EcoFund's support for development of the biomass market in Poland.

With over 18 million hectares of agricultural land, Poland has a vast potential for development of biomass-based energy. Currently 230.000 tons/year of agricultural biomass are used for bioenergies, the potential is estimated to 31.130.000 tons/year

Over a long time, one of the main obstacles hindering the development of biomass-based energy was the uncertain supply of raw materials. This created a characteristic 'vicious circle' – investors did not want to construct new installations because supplies were not secured, while farmers did not invest in production of energy crops or straw for energy purposes because a stable market that would secure sales did not exist.

EcoFund[18] – one of the largest institutions financing environmental infrastructure and activities in Poland – decided to change that situation. It has introduced a system of subsidies for energy crops, at the level of PLN

[17] Agency for Environment and Energy Management

1000/ha (which covered around 15 – 20% of investment costs). One of the criteria to obtain the subsidy was to secure a local subject to purchase the product. This gave preference to comprehensive projects, frequently financing the development of energy plantations and the construction of installations to utilize their products.

As a result, until 2006, EcoFund supported the construction of 83 biomass boiler houses of total capacity = 223 MWt. This reduced coal combustion by 193 thousand tons annually and decreased CO2 emissions by 405 thousand tons/year.

Concluding remarks and issues for discussion

To date, the EU's political objective to extend the use of biomass for energy purposes is not yet sufficiently harmonized by rural development policies and implementation measures. The points discussed above show that regional implementation imposes several conflicts, given that other functions and services of rural areas aside from biomass production should be maintained and additional environmental impacts should be kept minimal.

Finding the right balance requires an integrated approach that moderates the interests from different policy fields influencing bioenergy production such as agriculture, environment, transport, rural development, waste disposal, technology development etc.

With the implementation of the bioenergy targets still in its infancy, such integrated approaches are scarce. Tools and instruments (e.g. land use planning, production restriction and financial incentives) for such integration are there, but their effective adoption has not yet been commonly organised.

The question of which existing approaches have been successful can be a starting point for the meaningful implementation of bioenergy targets.

The AGRINERGY conference "Reality Check on EU Bioenergy Targets" 19-20 May in Brussels aims to set such a starting point through discussions on positive and less effective examples. Nevertheless, future research initiatives will have to continue this process to get a much better overview of beneficial conditions and programmes, and to learn why other regions may have failed at balancing the land use interests properly.

Main questions for discussion:

- Is there evidence that the development of rural areas is strengthened from bioenergy production?"
- Which production standards are needed for different energy crops to avoid environmental deterioration?
- How can environmentally friendly energy crops be promoted and a further intensification of agriculture be avoided?
- How to ensure that sustainable bioenergy production is considered in the national land use planning strategies?
- What are suitable approaches to avoid/solve land use conflicts on the regional level?
- How can different policy objectives (environmental protection, food security and biomass for energy supply) be combined in an integrated approach? Where are the limitations and where to set priorities?
- Which measures and support schemes could be the most efficient to achieve the national (and regional) targets?
- Which policy incentives that support food and energy crops equally should be established?
- How can life cycle assessments and impact assessments be incorporated in political decisions on regional levels in order to avoid further negative impacts from agriculture?

[18] EcoFund is a foundation established by the State Treasury. Since 1992 it obtains financial resources from conversion of the Polish debt.

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