The EU Biomass Action Plan

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Introduction

This paper summarizes the Biomass Action Plan published by the European Union on December 7th 2005, as well as the EU's Strategy for Biofuel published on February 8, 2006. It further discusses the status of bioenergy policy in selected countries. The Biomass Action Plan sets a comprehensive framework for accelerating the deployment of biomass for power generation, heating purposes and transport fuels. It proposes a wide range of different approaches and support instruments to be implemented on the national level. China and the European Union are in a similar situation when it comes to bio-energy: there is a vast potential of biomass for energy but it is not entirely clear which competing applications and technologies are the most beneficial and how to support accelerated deployment of these resources. The EU Biomass Action Plan may serve as an example to address bio-energy in a holistic way, considering also environmental, economic and agricultural aspects.

Biomass in the European Union

European energy policy focuses on the three main objectives of competitiveness, sustainability and security of supply. In the context of this energy policy, the main policy target for renewable energy sources is to double their share in gross inland energy consumption, from 5.4 % in 1997 to 12.0 % in 2010[1]. Legislative actions to facilitate this target have been undertaken to promote renewable energy electricity generation by increasing the production from 14.0 % in 1997 to 21.0 % by 2010[2] and to promote biofuels for transport applications by replacing diesel and petrol up to 5.75 % by 2010[3].

Biomass presently accounts for the largest share of renewable energy used in the EU (Figure 1).

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[1] White Paper for a Community Strategy and Action Plan (COM(97)599 final). Download: http://ec.europa.eu/energy/res/legislation/doc/com599.htm

[2] Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market". Download: http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

[3] Directive 2003/30/EC of the European Parliament and the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport. Download: http://ec.europa.eu/energy/res/legislation/doc/biofuels/en_final.pdf

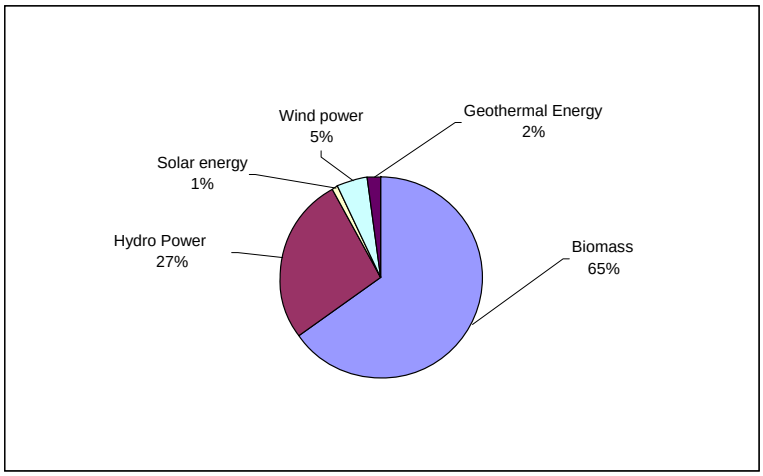

Figure 1: Share of sources on total primary energy production from renewable energy technologies in the European Union in 2004. Source: EurObserv'ER, 2005 European Barometer of Renewable Energies.

Nevertheless, a large potential remains untapped, especially in the new member states of Eastern Europe (Table 1).

Million tonnes of oil equivalent (mtoe)	**Consumption 2003**	**Potential 2010**	**Potential 2020**	**Potential 2030**
Wood direct from forest (increment and residues)	67	43	39-45	39-72
Organic wastes, wood industry residues, agricultural and food processing residues, manure		100	100	102
Energy crops from agriculture	2	43-46	76-94	102-142
TOTAL	**69**	**186-189**	**215-239**	**243-316**

Table 1: Consumption and potential of biomass for energy purposes in the 25 member states of the EU. Source: Communication from the Commission, Biomass action plan, 2005.

However, the table above does not include the potential contributions of Bulgaria and Romania, which will be EU members by 2010. These countries have a high biomass production potential as each have 0.7 hectares of agricultural land per capita, compared to 0.4 in the EU25.

Despite its potential, growth rates for the biomass sector so far have not been sufficient to achieve aspired targets.

The European Commission[4] has therefore already announced in its 2004 communication to the Council of the European Union and the European Parliament on the share of renewable energy in the EU[5] its intent to create a coordinated "Biomass Action Plan"[6], which was subsequently presented in 2005, highlighting the need for a coordinated approach to biomass policy. Currently, about 4 % of primary energy use in the European Union (EU) is met by energy produced from biomass. The main objective of the biomass action plan is to at least double this share by 2010. The action plan itself only sets the framework, whereas its implementation and the responsibility for achieving the aspired targets lie with the individual member states.

The European Parliament strongly supported the initiative of the Commission to set up a biomass action plan in their "resolution on the share of renewable energy in the EU and proposals for concrete actions"[7], calling for an "ambitious document". Advantages of biomass according to the European Parliament include relatively low costs, less intermittence due to short-term weather changes in comparison to other renewable energy sources, promotion of regional economic structures and provision of alternative sources of income for the agricultural sector. The biomass action plan adopted by the Commission includes many of the concrete actions suggested in the parliamentary resolution.

The biomass action plan presents measures to increase the development of biomass energy from wood, wastes and agricultural crops by creating market-based incentives and removing barriers to the development of the market. It is intended to promote biomass in the heating, electricity and transport sectors, and also sets out comprehensive measures affecting biomass supply, financing and research.

No application of biomass is in every important aspect superior to other applications (Table 1). Transport fuels from biomass, even though presently rather expensive compared to heating or power from biomass, are the only possibility to replace fossil fuels in the transport sector in the short and medium term. Biomass for electricity generation will in comparison lead to the largest environmental benefit in terms of mitigated green house gases. Heating applications are already today often cost- competitive, thus they represent a good opportunity to deploy

[4] The European Commission represents the executive body of the EU. Its primary role is to propose and implement legislation. Alongside the European Parliament and the Council of the European Union, it is one of the three main institutions governing the Union. The Commission consists of 25 Commissioners for different subjects, one from each member state of the EU. However, as the Council is an independent body, the Commissioners are not permitted to take instructions from the government of the country that appointed them. The European Parliament together with the Council composes the legislative arm. The Council consists of ministers of the governments of each of the EU member states. The European Parliament is directly elected by EU citizens once every five years. The parliament cannot initiate legislation, but it can amend or veto it in many policy areas and supervises the European Commission.

[5] Communication from the Commission to the Council and the European Parliament. The share of renewable energy in the EU. Brussels, 26.05.2004. COM(2004) 366 final. Download: http://ec.europa.eu/energy/res/legislation/country_profiles/com_2004_366_en.pdf

[6] Communication from the Commission. Biomass action plan. Brussels, 7.12.2005. COM(2005) 628 final. Download: http://ec.europa.eu/energy/res/biomass_action_plan/doc/2005_12_07_comm_biomass_action_plan_en.pdf

[7] European Parliament resolution on the share of renewable energy in the EU and proposals for concrete actions (2004/2153(INI)). Download: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P6-TA-2005-0365+0+DOC+PDF+V0//EN&language=EN

large amounts of biomass in a cost-effective way. In conclusion, all types of biomass applications should be promoted in a well balanced way.

	Heat	Electricity	Transport
Costs	++	+	-
Security of Supply	+	-	++
Employment	-	+	++
Climate Protection	+	++	-

Table 2: Relative qualitative assessment of biomass for energy applications.[8]

In accordance with the EU targets of a 12 % overall share of renewable energy, a 21 % share in electricity generation and a 5.75 % market share for biofuels, the Commission has indicated targets for the contribution of biomass in the heating, electricity and transport sectors (Figure 2). From a biomass energy use of 69 mtoe in 2003, the value has to be more than doubled to reach the intended 149 mtoe in 2010.

Against the present situation, the Biomass Action Plan (BAP) - if successful - would reduce the import share of crude oil from 77 % today to 71 %, the EU dependency on imported energy would decrease from a share of 48 % to 42 %. The BAP would prospectively reduce greenhouse gas emissions by 209 million tonnes, which represents 60 % of the original target of EU-15. An additional direct employment of 267,000 jobs would be created, mainly in rural areas. With a fossil fuel price level of 60 USD/barrel, the additional costs sum up to approximately € 2 billion per year, with many applications for heating and power generation already cost-competitive. In fact, the main burden would come from promoting transport fuels, still an expensive option.

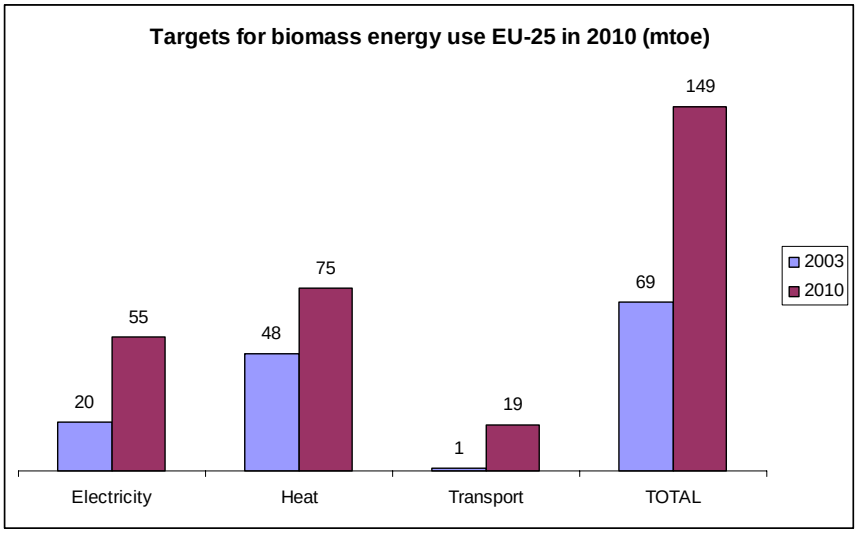

Figure 2: Targets 2010 compared to realised exploitation 2003 for EU-25. Source: Communication from the Commission, Biomass action plan, 2005

[8] Based on: European Commission: Biomass action plan. Impact Assessment. COM(2005) 628 final. SEC(2005) 1573. Brussels, 7.12.2005.
http://ec.europa.eu/energy/res/biomass_action_plan/doc/ sec_2005_1573_impact_assessment_en.pdf

Biomass Heating

Biomass in heating will have to grow from 48 mtoe in 2003 to 75 mtoe in 2010. The Commission identifies heating as the sector of biomass use that is growing the slowest. Traditional technology for biomass use in residential and industrial heating is considered to be available at a low price. New technologies to turn wood and clean residues into standardized pellets that are environmentally safe and easy to handle are getting used more. Still, additional measures are regarded as necessary to promote biomass heating. The Commission therefore will work on new specific legislation on renewable energy in heating in 2006, based on a critical review of the potential contribution of:

- Measures to ensure that fuel suppliers make biomass fuels available;
- The establishment of efficiency criteria for biomass and the installations in which it is to be used;
- Equipment labelling to increase consumer awareness of clean and efficient devices;
- Other technical measures;
- The appropriateness of setting targets;
- Voluntary agreements with industry.

In addition, an amendment of the directive on the energy performance of buildings to increase incentives for renewable energy will be considered. A study of how to improve the performance of household biomass boilers and reduce pollution will be conducted.

New emphasis will also be given to district heating since it can manage the use of renewable fuels more easily and burn more types of fuels with lower emissions. Biomass is regarded as more suitable for district heating than for individual heating. The Commission therefore proposes to add the supply of district heating to the list of goods and services to which Member States may apply a reduced VAT rate and to extend to district heating any reduced VAT rate already applied to natural gas or electricity.

Member states of the EU have chosen to support heat from biomass mainly with investment grants, followed by some countries with tax exemptions (Table 3). These instruments have triggered some growth in some countries (e.g. Austria, Denmark, France, Germany, Sweden) but have generally failed to promote the necessary deployment. In particular, allocated budgets for investment grants fell short.

	Biomass Heat	Solar Heat	Geothermal Heat
Investment Grants	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Luxemburg, Portugal, Spain, UK	Austria, Belgium, Denmark, France, Germany, Greece, Luxemburg, Portugal, Spain, UK	Austria, Belgium, Denmark, Germany, Greece, Portugal, Spain, UK
Tax exemptions	Ireland, Italy, Netherlands, Sweden	Ireland, Italy, Netherlands, Portugal, Sweden	Ireland, Italy, Sweden
Obligation		Denmark, Spain	Sweden

Table 3: Dominant national instruments in EU-15 to promote heat from renewable energy.[9]

Electricity from Biomass

Electricity from biomass will have to increase from 20 mtoe generated in 2003 to 55 mtoe generated in 2010. The framework for the production of electricity from biomass is provided by the directive on renewable energy in electricity generation[10]. Member states have to achieve national indicative targets, which are consistent with the overall indicative target of 12 % of gross national energy consumption by 2010 and in particular with the 22.1 % indicative share of electricity produced from renewable energy sources in total EU electricity energy consumption by 2010. However, in its 2004 communication on the share of renewable energy in the EU, the Commission pointed out that the 2010 target will likely not be achieved under current policies and measures. Only a share of 18% - 19% seems likely. The Commission identifies as the main reason for this that the generation of electricity from biomass has not been growing to the extent anticipated when setting the targets.

Accordingly, the Commission encourages member states in the biomass action plan to make use of the potential of all cost effective forms of biomass electricity generation. Available biomass technologies suggested to be used are co-firing by mixing biomass with coal or natural gas or running freestanding power stations.

The Commission notes that large centralized power plants, e.g. those burning straw in Denmark or forest residues in Finland, have the best economic performance, especially if heat is also used (combined heat and power, CHP). Smaller decentralized plants burning solid biomass or biogas tend to cost more, but offer additional advantages for the environment and for rural development. To promote smaller decentralized plants, EU structural funds[11] or its

[9] German Federal Ministry for the Environment: Konsultationspapier zur Entwicklung eines Instruments zur Förderung der erneuerbaren Energien im Wärmemarkt. (In German: Consultation on the development of an instrument to promote renewable energy in the heating market. Berlin. May 24,2006. http://www.erneuerbare-energien.de/files/erneuerbare_energien/downloads/application/pdf/konsultationspapier_waermegesetz.pdf

[10] "Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market". Download: http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

[11] Structural Funds and Cohesion Funds are funds allocated by the EU for the related purposes of supporting the poorer regions of Europe and integrating the European infrastructure. Current programmes run from 2000 to 2006 with a budget of 195 billion euro for Structural Funds and 18 billion euro for the Cohesion Fund. Together with the Common Agricultural Policy (CAP), the structural and cohesion funds account for the majority of total EU spending. (http://europa.eu/scadplus/leg/en/lvb/l60013.htm).

rural development program can be used to identify suitable locations in relation to biomass availability, transport infrastructure, grid connection potential and labour markets.

The recent report of the European Commission on national support mechanisms to promote electricity from renewable energy concluded for biomass forestry that

- "Denmark's system with feed-in tariffs and centralised co-generation plants using straw combustion and the Finish hybrid support system (tax relief and investment) clearly show the best performance, in terms of both effectiveness and economic efficiency of support. A long tradition in high-tech biomass use for energy purposes, stable planning conditions and a combination with heat generation can be considered as key reasons for this development.
- Although feed-in tariffs in general show better outcomes, since investor risks where green certificates are concerned seem to hamper the real take-off of the biomass sector, the analysis is more complex in the biomass forestry sector. Factors other than the choice of financial instrument (infrastructural barriers, installation sizes, optimal forest management and the existence of secondary instruments, etc.), considerably influence the effectiveness of systems.
- In nearly half of European countries, the support for biomass forestry it insufficient to develop this high-potential sector further. In many regions incentives would be needed, targeted at forest harvesting, to increase the wood-flow from EU forests to all users, thus preventing possible distortions in the market for wood residues."[12]

Concerning electricity from biogas, the report found that nearly 70% of the EU countries do not provide enough support for the deployment of biogas. According to the report, "six countries have an effectiveness higher than the EU average, four of them with feed-in tariffs (Denmark, Germany, Greece, Luxemburg) and two of them with green certificates (Italy, United Kingdom). As in the biomass forestry sector, these results are influenced by other factors:

- The agro-economic possibilities and the choice of the size of plants. Large plants have a higher effectiveness. Small plants are supposed to be more important for the rural economy, but the cost is higher.
- The existence of a complementary support scheme. The biogas sector is intimately linked to environmental policy for waste treatment. Countries like the UK support biogas with a secondary instrument such as tax relief. Complementary investment aid is also a good catalyst for this technology.
- For agricultural biogas, generation costs are higher but so are the environmental benefits. With landfill gas, the cost is lower but the environmental benefit is reduced."

[12] European Commission: The support of electricity from renewable energy sources. COM(2005) 627 final. Communication. Brussels, 7.12.2005.
http://ec.europa.eu/energy/res/biomass_action_plan/doc/ 2005_12_07_comm_biomass_electricity_en.pdf

Transport Biofuels

The directive on the promotion of the use of biofuels[13] adopted in 2003 aims to promote the substitution of the conventional oil-derived transport fuels of diesel and petrol by biofuels derived from agricultural crops, notably biodiesel and bioethanol. To achieve this, the directive sets indicative targets for biofuel substitution and gives a legal framework for fiscal and other national measures to promote biofuels (in accordance with the taxation directive for energy products and electricity[14]). The targets for the biofuel share of all transport fuels are set at 2 % by 2005 and 5.75 % by 2010. However, the 2005 target was not achieved as the sum of national targets expressed by Member States will only realize a biofuel share of about 1.4 %.

3.9 million tons of biofuel (biodiesel and bioethanol) were produced in the EU in 2005. With about 80 % of biofuel production, biodiesel is the leading biofuel (Figure 3).

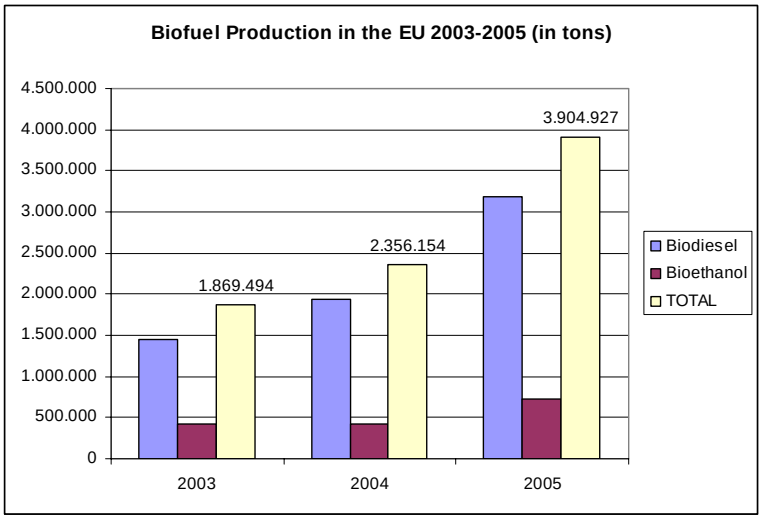

Figure 3: Development of transport fuel production from biomass in the EU-25 between 2003 and 2005. Source: EurObserv'ER, Biofuels Barometer, May 2006.

With a production of 1,669,000 tons, Germany is the leading biodiesel producer in the EU and alone provides more than half of total EU production. The German growth in this sector can be explained by very favourable legislation that provides a total tax exemption for biofuels, regardless if they are pure or mixed with a fossil fuel. However, Germany is going to reintroduce taxation by August 2006. To keep the biofuels market growing, fuel suppliers will gradually be forced to raise the biofuel incorporation rate up to 5.75 %. Thereby, an obligation in the style of an RPS will be introduced relaxing the burden from biofuel support on public budgets.

Biodiesel production has increased by 64% in the EU from 2004 to 2005. With a total production of 3,184 million tons the European Union is by far the largest biodiesel producer

[13] Directive 2003/30/EC of the European Parliament and the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport. Download: http://ec.europa.eu/energy/res/legislation/doc/biofuels/en_final.pdf

[14] "Directive 2003/96/EC of the Council of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity". Download: http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

worldwide. Bioethanol production amounted to 722,000 tons in EU 25, which represents an increase by 70 % against 2004. The European Union ranks now fourth in the world after Brazil, the USA and China.

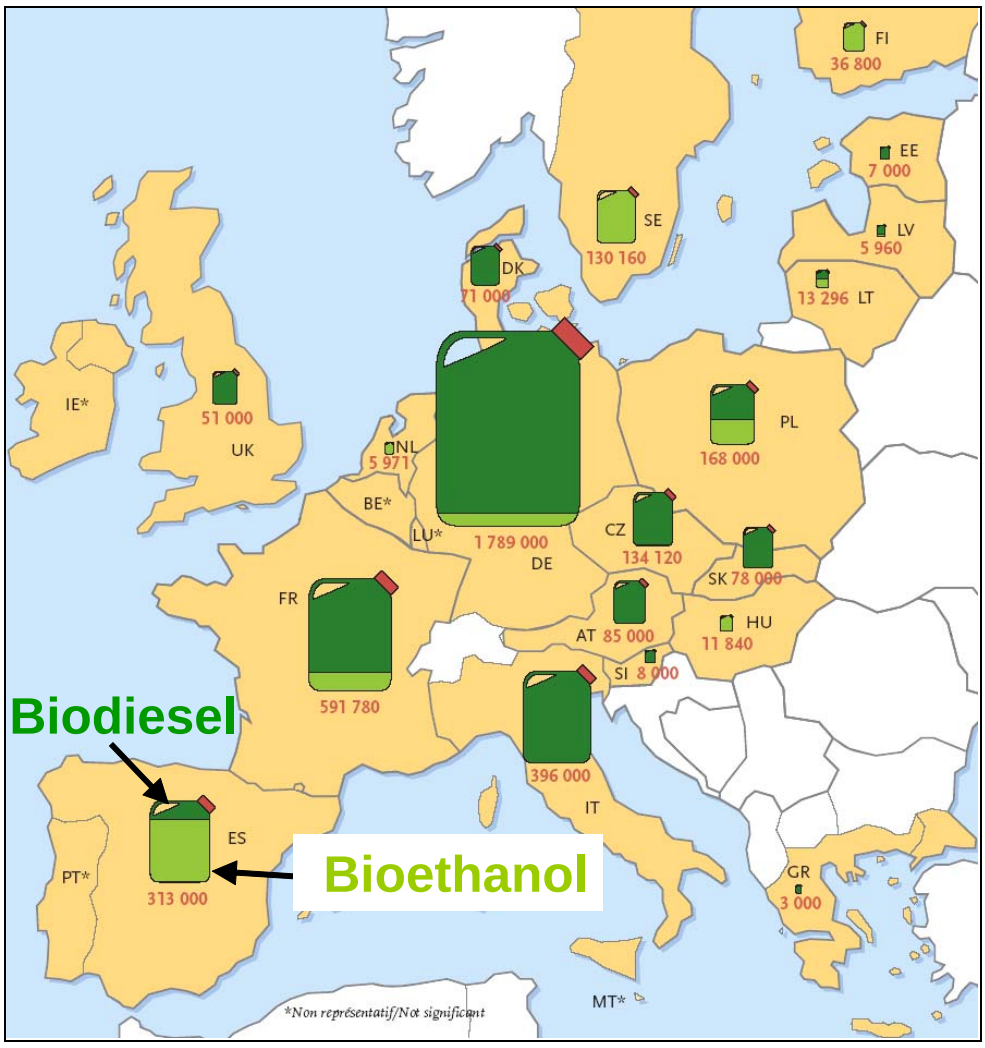

Figure 4: Biofuel production in EU-25 in 2005. Source: EurObserv'ER, Biofuels Barometer, Mai 2006.

For implementing the Biofuels Directive, EU Member States can use tax exemptions and biofuel obligations.

- Fiscal policy can promote biofuels since the energy taxation directive provides a framework for tax exemptions. The national governments must assure however that the tax reduction or exemption does not lead to overcompensation of the additional costs of biofuel production. The taxation advantage cannot exceed the difference in cost between the promoted fuel and an equivalent fossil fuel. The German example shows that tax exemptions can be a useful instrument for expanding the biofuels market. Other countries that use this instrument such as the United Kingdom, Austria, and Spain also show strong growth rates.

- The instrument of biofuel obligations that is used by some Member States requires fuel supply companies to incorporate a given percentage of biofuels in the fuel they

offer on the national market or face a penalty. Obligations are in place in France and Austria and will come into force in Slovenia in 2006 and in the Czech Republic, Germany and the Netherlands in 2007. Advantages of obligation schemes include placing the responsibility at the originating sector at only a negligible increase in the cost of fuel. Fuel supply companies have an incentive to push down the cost of biofuels and strive for cost efficiency. The Commission encourages Member States to give favourable treatment to second-generation biofuels in biofuels obligations. Second-generation bioethanol from cellulose delivers a gasoline substitute which is identical to bioethanol produced from sugar or cereals. Second-generation biodiesel is chemically different from vegetable-oil-based bio diesel. Gasification of biomass produces a "synthesis gas" which mainly consists of carbon monoxide and hydrogen. By exposing this gas to the Fischer-Tropsch synthesis a mixture of gasoline, jet fuel and diesel is produced. Expectations are that with higher efficiency in conversion and the possibility to use the entire crop rather than only parts the yield will increase substantially.

Tax exemptions have been an extremely successful tool to promote the use of biofuels. A number of Member States has chosen this approach in the past since it is easy to implement and allows for a secure additional income to biofuel suppliers (Table 4). However, the resulting burden on public budgets due to a loss on oil tax income is substantial. Moreover, with high and volatile oil prices it is difficult to avoid overcompensation of the cost gap between fossil and biofuels, which recently led to excess subsidies.

Table 4: Tax exemptions for biofuels in European Union member states (Status Spring 2005).[15]

Country	Petroleum tax for unleaded petrol (EUR/1,000 liters)	Tax exemption for biofuels
Austria	417.00 or 432.00 (depending on sulphur content)	100% for pure biofuels and for up to 5% of blended bioethanol or 2% of blended biodiesel.
Belgium	507.56 or 522.43 (depending on sulphur content)	100% for pure biofuels and for up to 5% of blended biofuels.
Cyprus	299.08	No tax exemption, investment subsidy available.
Czech Republic	339.90	Since June 2004, 100% of biodiesel in a 31% blended fuel. Since August 1999, 100% of bioethanol in an up to 5% blended fuel and ETBE in an up to 15% blended fuel. Additional direct promotional measures are available.
Denmark	539.38	No tax exemption.
Estonia	337.45	100%
Finland	596.50 or 587.60	51% till end of year 2004.
France	639.60	Yearly adjustment, in 2004: 38€/100 liters for the bioethanol content in ETBE, 37€/100 liters for direct blending of bioethanol (for the first time in 2004), 33€/100 liters for vegetable oil.
Germany	669.80 or 654.50 (depending on sulphur content)	100% for pure biofuels and for the biofuel content in blended fuels.
Great Britain	688.52 up to 733.65	From 2005 20 pence per liter for 3 years at least.
Greece	296.00 or 316.00 (depending on octane number)	Tax exemptions are under discussion, implementation is likely.

[15] Source: Henke, Jan: Biokraftstoffe. Eine weltwirtschaftliche Perspektive. Kiel 2005.

Hungary	407.56 up to 459.57 (depending on petrol specification)	100% for ETBE and for biodiesel.
Ireland	442.68 or 547.79 (depending on octane number)	Tax exemption for pilot projects feasible. Total quantity (pure vegetable oil + biodiesel + bioethanol) is limited to 8 million liters. EU approval still pending.
Italy	541.84	0.29 € per liter of pure biofuel; also 0.29 € per liter of ETBE.
Latvia	287.65	Since May 2004 reduced rates.
Lithuania	287.04	Since May 2004 exemption on the biogenic content.
Luxemburg	442.09	No tax exemption.
Malta	310.10	No tax exemption.
The Netherlands	658.88	Promotional measures are under discussion, implementation probably in 2005.
Poland	320.28	Exemption depending on quantity of blended content.
Portugal	522.60	Promotional measures are under discussion, implementation probably in 2005.
Slovakia	375.53	No tax exemption, promotional measures are under discussion.
Slovenia	361.89	No tax exemption.
Spain	395.69 or 426.92 (depending on octane number)	100% for pure biofuels and for the biofuel content in blended fuels.
Sweden	327.24 or 527.24 (depending on petrol specification)	100% for biofuels, ETBE is not exempted.

The Commission will deliver a report on the directive's implementation in 2006. Issues to be addressed in the report include the national targets for the market share of biofuels, the use of biofuel obligations and the requirement that includes a system of certificates to make sure that only biofuels whose cultivation complies with minimum sustainability standards will count towards the targets. As a national example, the German government will issue an ordinance defining sustainability standards for biofuels. Fuels not fulfilling these standards will not benefit from tax exemptions or biofuel obligations.

As biofuels and their raw materials are traded on world markets, the EU favours a balanced approach to domestic production and imports. This intended approach consists of:

- Facilitating the use of a wider range of vegetable oils for biodiesel, to the extent that no significant ill-effects on fuel performance are introduced;
- Maintaining market access conditions for imported bioethanol at least at the level of the current trade agreements;
- Balanced approach in ongoing free trade agreement negotiations with countries or regions that are producing ethanol with respect to the interests of domestic producers and EU trading partners;
- Support of developing countries that wish to produce biofuels and develop their domestic markets. This is of particular importance with regard to sugar reforms.

An EU Strategy for Biofuels was published on February 8, 2006 supplementing the Biomass Action Plan.[16] It details seven policy axes for further deployment of biofuels in the EU:

[16] European Commission: An EU Strategy for Biofuels. Communication. COM(2006) 34 final. Brussels, 8.2.2006. http://ec.europa.eu/energy/res/biomass_action_plan/doc/2006_02_08_comm_eu_strategy_en.pdf

1. **Stimulating demand for biofuels** by enforcing more strictly national targets, encourage member states to promote second-generation biofuels and promote public procurement of vehicles using biofuels.
2. **Capturing environmental benefits** by incorporating CO_2-reduction due to biofuels in CO_2 emission targets for car fleets and by developing criteria for the sustainability of biofuel feedstock cultivation in the EU and third countries.
3. **Developing the production and distribution of biofuels** by incorporating the promotion of biofuels in the so-called cohesion policies to equalise living conditions throughout the EU and by ensuring that biofuels are not discriminated unduly by technical standards.
4. **Expanding feed stock supplies** by making sugar production for bioethanol eligible for both the non-food regime on set-aside land and the energy crop premium; by assessing the opportunities for additional processing of cereals from existing intervention stocks into biofuels, to contribute to reducing the amount of cereals exported with refunds; by assessing the implementation of the energy crop scheme by the end of 2006; by monitoring the impact of biofuel demand on commodity and by-product prices, their availability for competing industries and the impact on food supply and prices, in the EU and in developing countries; by financing a campaign to inform farmers and forest holders about the opportunities of biofuels; by bringing forward a Forestry Action Plan, in which the energy use of forest material will play an important part; by reviewing how animal by-products legislation could be amended in order to facilitate the authorisation and approval of alternative processes for the production of biofuels and by implementing the mechanism proposed to clarify standards for the secondary use of waste materials.
5. **Enhancing trade opportunities** by assessing the advantages, disadvantages and legal implications of putting forward a proposal for separate nomenclature codes for biofuels; by maintaining market access conditions for imported bioethanol that are no less favourable than those provided by the trade agreements currently in force, maintain in particular, a comparable level of preferential access for ACP countries and take into account the problem of preference erosion; by pursuing a balanced approach in ongoing and future trade negotiations with ethanol-producing countries and regions with the EU respecting the interests of both domestic producers and EU trading partners, in the context of the rising demand for biofuels; by proposing amendments to the "biodiesel standard" to facilitate the use of a wider range of vegetable oils for biodiesel production, and allow ethanol to replace methanol in biodiesel production.
6. **Support developing countries** by developing a coherent biofuels assistance package and assist in developing national biofuel platforms and biofuel action plans
7. **Support Research and Development** in particular of second-generation fuels and the bio-refinery concept with fuels, heat, power and materials as an output.

Biomass Supply

The agricultural commodity market for decades has been regulated in Europe. Agriculture and rural development make up the biggest part of the EU budget with about 50 billion euros out of a total budget of 116 billion euros in 2005.[17] Through the creation of job opportunities in

[17] Budget 2005: the first EU budget adopted by and for the enlarged Union. IP/04/1491. Brussels, 16 Dec 2004.

mainly rural regions, bioenergy has the potential of economically stabilizing such regions and can thus positively contribute to European cohesion. The Commission's intent to support an adequate supply of biomass is therefore compatible with the overall EU support of the agricultural sector.

Common agricultural policy (CAP): The largest single expenditure item in the EU budget is the Common Agricultural Policy. Since the 2003 reform of the CAP income support for the agricultural sector is no longer linked to the crops produced. As a result, farmers can respond freely to the increasing demand for energy crops. In the future, the vast majority of subsidies will be paid independently from the volume of production. To avoid abandonment of production, member states may choose to maintain a limited link between subsidy and production under well defined conditions and within clear limits. These new "single farm payments" will be linked to the respect for environmental, food safety and animal welfare standards. Severing the link between subsidies and production will make EU farmers more competitive and market orientated, while providing the necessary income stability.[18]

The reform included an "energy crop payment", under which a fixed premium of € 45 per hectare is available, with a maximum guaranteed area of 1.5 million hectares as the budgetary ceiling, for the production of energy crops. The possibility was also introduced to use mandatory "set-aside" land[19] for growing non-food crops (including energy crops). However, the Commission leaves the question of which appropriate energy crops to grow to be decided on the regional or local level. The Commission will finance an information campaign about the properties of energy crops and the opportunities they offer.

Forestry: The Commission is preparing a forestry action plan for 2006, which will also address energy uses of wood. The impact of the energy use of wood and wood residues on forest based industries will be reviewed.

Biomass from Waste: The Commission is addressing the prevention and recycling of waste and preparing a proposal on the revision of the waste framework legislation. Considered options include the promotion of waste management techniques that reduce the environmental impact of using waste as fuel, a market approach to recycling and recovery activities, developing technical standards to enable recovered materials to be considered as goods to make it easier to use them for energy purposes and encouraging investment in energy-efficient techniques for the use of waste as fuel.

Biomass Research

The Commission's proposal for the Seventh Framework Programme for Research Development addresses the importance of biomass research. The development of an industry-led "Biofuel technology platform" is encouraged, binding together actors from academia, industry and government to join forces. In particular, such platforms serve to identify promising technologies and bring forward road maps. Research into the optimization of agricultural and woody crops for energy purposes and biomass for energy conversion processes is emphasized. High priority is to be given to research into the "bio-refinery" concept with regard to finding valuable uses for all parts of the plant as well as into second-

[18] http://ec.europa.eu/comm/agriculture/capreform/index_en.htm

[19] To reduce excess agricultural production, the EU has introduced premiums for "set-aside" land. On this land, no agricultural production is allowed, but with the exemption of energy crops.

generation biofuels (e.g., cellulosic ethanol), with the aim of improving their efficiency and cost-effectiveness.

Spending for research and development of biomass technologies has been given different priorities so far in the EU Member States. Some countries like Austria and Sweden have put considerable emphasis on funding biomass research in comparison to the funding of other renewable energies technologies (Table 4).

2004 RD&D Budget in million euro	Austria	Denmark	Germany	Ireland	Italy	Portugal	Spain	Sweden	United Kingdom
Total Energy RD&D	34.29	47.39	372.09	10.20	292.55	3.02	45.55	100.82	72.51
R&D on Renewable Energy Sources	9.76	23.56	57.08	2.92	52.15	1.26	22.53	34.35	29.34
R&D on Bio-Energy	7.36	9.75	4.03	1.37	2.57	0.53	3.73	25.25	4.17
% Bio-Energy of Total Energy RD&D	21.46%	20.57%	1.08%	13.45%	0.88%	17.64%	8.18%	25.05%	5.75%
% Bio-Energy of Total RES	75.40%	41.37%	7.06%	46.97%	4.92%	42.34%	16.53%	73.52%	14.21%

Table 5: RD&D budgets for energy, RES and bio-energy sectors in selected European Countries in 2004. Source: IEA, Beyond 20/20 Web Data Server, RD&D Budgets, July 2006.

National Biomass Action Plans

The Commission encourages the development of national biomass action plans. They are seen as an instrument to identify priorities for the types of biomass to be promoted and how biomass resources can be developed. Promotional measures at the national level should be indicated. An action plan can also be linked to consumer information campaigns on the benefits of biomass. Regions might also develop their own action plans.

EU financial support for biomass energy

The Commission considers the structural and cohesion funds[20] as important instruments for supporting the development of biomass production. This is especially the case for Central and Eastern Europe as low labour costs and high resource availability can give these regions a comparative advantage in the production of biomass. The funds can support the retraining of farmers, the provision of equipment for biomass producers, investment in facilities to produce biofuels or other materials and fuel switching to biomass by electricity and district heat producers. The Commission therefore calls on Member States when preparing their national programmes to take the potential benefits of biomass into account. The Commission has proposed Community strategic guidelines for rural development which emphasize renewable energy in general and biomass supply chains in particular. It also proposes a specific working group to consider biomass opportunities within rural development programmes.

The EU biomass action plan is however mainly intended as a first step to coordinate measures to promote biomass in heating, electricity and transport and in the cross-cutting issues

[20] Structural Funds and Cohesion Funds are funds allocated by the EU for the related purposes of supporting the poorer regions of Europe and integrating the European infrastructure. Current programmes run from 2000 to 2006 with a budget of 195 billion euro for Structural Funds and 18 billion € for the Cohesion Fund. Together with the Common Agricultural Policy (CAP), the structural and cohesion funds account for the majority of total EU spending. (http://europa.eu/scadplus/leg/en/lvb/l60013.htm).

affecting biomass supply, financing and research. As such, it provides guidelines for states and regions to develop a suitable supporting structure for biomass on their own. The biomass action plan itself does not have a budget to allocate for specific biomass promotion projects.

In the following, an overview of the biomass action plan of Baden-Württemberg will be given as an example for a regional action plan.

The Biomass Action Plan of Baden-Württemberg

As is envisaged by the EU, the German "Bundesland" (state) Baden-Württemberg[21] has announced its own regional biomass action plan. The overall goals of the Biomass Action Plan of Baden-Württemberg[22] adopted in March 2006 conform to national and international intentions. Goals include a reduction of greenhouse gas emissions, a larger share of renewable resources in the energy mix, a reduction of energy import dependence and the promotion of agriculture and forestry in rural areas. The focus of the plan is on the economical and ecological implementation of biomass technologies. An integrated use of biomass (use of the material first and then energy recovery) is seen as offering convincing advantages. In this context, energy conversion technologies must aim for high energy cycle efficiency.

The main potential for the use of biomass in Baden-Württemberg (BW) is bioenergy through wood and biogas utilization. Regarding fuel, processes that make use of waste materials have to be promoted. Accompanying measures include promotion of research and knowledge dissemination.

The bioenergy potential of Baden-Württemberg is 8 – 10 % of the total primary energy supply (TPES) of 38.5 million toe and comes from agricultural and forestry production about one half each. However, the realized level of utilization in the year 2004 was only 2 % of TPES.

In 2005 about 5 % of the agriculturally used area (ca. 42,000 hectares) was used for growing renewable resources. In the short term further set-aside land and land for feeding animals is expected to be suitable for turning to grow energy plants. An increase to 10–15% is seen as realizable without much difficulty.

Baden-Württemberg has a usable potential of 11.5 million solid cubic meters of wood. Reserves to increase this quantity can mainly be found in small privately owned woodland and deciduous woodland. Therefore it is possible to increase energy recovery from wood by about one million solid cubic meters of wood.

Overall, the use of bioenergy for electricity and fuel in BW has a definite potential for development in comparison to the traditional generation of heat from wood. In 2004, 1,225 GWh of electricity, 4,067 GWh of heat and 1,712 GWh of fuel were generated from biomass from agriculture and forestry. The most important sectors are heat (wood) and fuel (rapeseed). Fuel from biomass had a market share of 2.1 % in 2004 with clear tendencies for growth.

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[21] Baden-Württemberg comprises an area of 35,751 km² and has about 10 million inhabitants. The gross domestic product in 2005 was about 330.715 billion euros, which equals a share of 15 % of the German GDP.

[22] Biomasse-Aktionsplan Baden-Württemberg. Nachwachsende Rohstoffe als Zukunftsmotor. Stuttgart, 07. März 2006.

Some important measures identified in the biomass action plan to promote renewable energy sources in Baden-Württemberg include:

- Evaluation of economic potential of renewable resources by the government of BW;
- Development of strategies to use the potential of the forestry sector, e.g. strategic partnerships between plant operators and raw material suppliers;
- Continued promotion of small district heating systems and extension of promotion to biogas distribution systems;
- In construction of new and renovation of old buildings owned by BW, the use of biomass technologies will get preferential treatment whenever economically feasible;
- Projects supported by the Development Program for Rural Areas will get preferential financial support if energy efficiency or the use of renewable energies or resources is promoted;
- Support of research on synthetic fuels at the Research Center Karlsruhe;
- Financial support for further research and development of pyrolysis and synthetic gas production from biomass as a basis for decentralized fuel production and the use of biogas as fuel;
- Increase of the share of wood as building material in construction from 20 % at present to 30 %;
- Promotional measures for the use of products from renewable resources, e.g. insulating materials and bio-degradable synthetic materials;
- Creating a network of parties involved with renewable resources and research establishments.

The biomass action plan is meant to complement the strategy of the BW government for energy supply, climate change and sustainable development. An inter-ministerial working group will implement the plan.

Lessons for China

The biomass action plan is an attempt to tackle the further deployment of energy in a comprehensive holistic way. The biomass action plan offers a toolkit for the promotion of bio energy. In this field, some experiences were gathered in the last 15 years in the European Union. In particular, tax exemptions for bio transport fuels have been proven extremely successful but also expensive when bio fuels gained a larger share of the transport fuel market. Reliable financial support as is granted with a feed-in tariff is only one but an important precondition for a successful promotion of electricity generation from biomass. At the same time, planning and building codes need to be adapted and an efficient biomass supply infrastructure including farming and forestry needs to be established. Regarding the heating sector, heating with biomass district heating grids is seen as a key factor for further and accelerated deployment of bio energy.

In the field of research and development (R&D) into new technologies there are opportunities for collaboration between China and the European Union, e.g. in the field of second-generation biofuels.