

# Boosting Bioenergy in Europe

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# Boosting Bioenergy in Europe

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## **Foreword**

by Dan Asplund and Jean-Marc Jossart

The objective of this brochure is to give an overview of the bioenergy situation in Europe with the current trends and objectives. The brochure also gives an analysis of the financial steering instruments in Europe and proposes an action plan.

The brochure is made of an executive summary (about 20 pages) available as pdf and printed version and the complete brochure (about 200 pages) available as pdf only (contact : [jossart@aebiom.org](mailto:jossart@aebiom.org)).

The bioenergy situation and the action plan are more detailed for seven countries (Austria, Belgium, Bulgaria, Finland, France, Germany and Sweden) as a consultation with policy makers and industries will be carried out in these countries to evaluate the relevance of the targets and proposed measures.

Therefore your comments on the following questions will be particularly welcome :

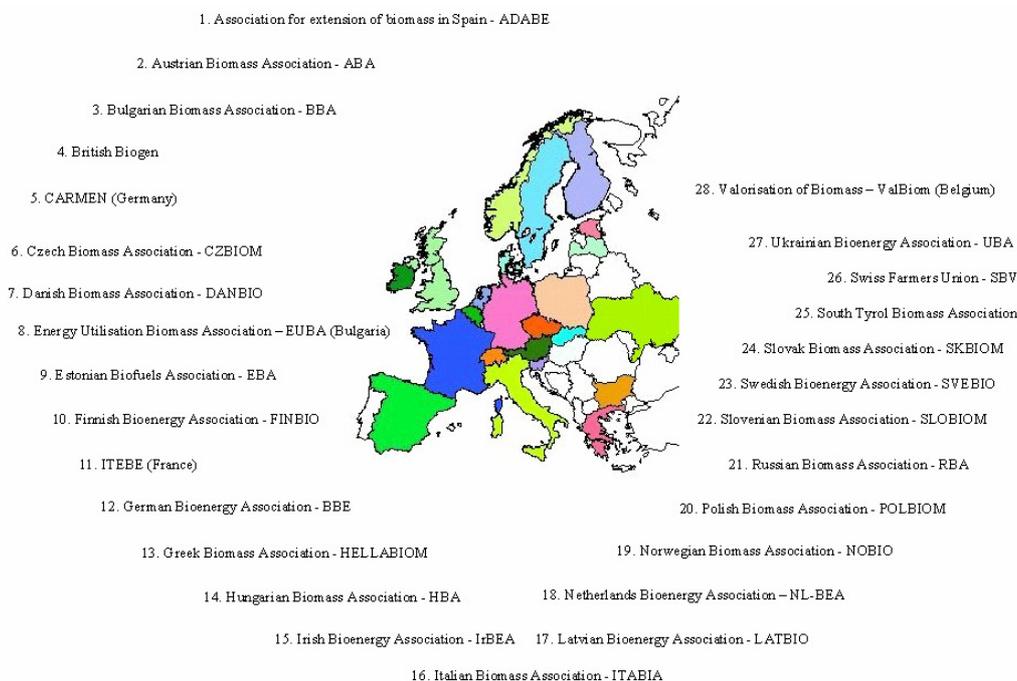
- Do you think the proposed objectives are realistic and achievable ?
- Do you think the measures proposed could be implemented ?

# AEBIOM – the European Biomass Association



The European Biomass Association (AEBIOM) is an international non-profit association (aisbl) established in 1990, for the promotion of biomass production and implementation in Europe. It is a network of 28 national biomass associations in the following countries : Austria, Belgium, Bulgaria (2 members), Czech Republic, Denmark, Estonia, Finland, France, Germany (2 members), Greece, Hungary, Ireland, Italy (2 members), Latvia, Norway, Poland, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Ukraine, United Kingdom.

Hungary, Ireland, Italy (2 members), Latvia, Norway, Poland, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Ukraine, United Kingdom.



Each national association has members so that in total AEBIOM represents a network of more than 4000 companies, organisations and individuals.

AEBIOM is managed by a General Assembly, a Steering Committee and a Board of Directors consisting of a President, a Vice-President, six Directors and a General Secretary/Treasurer.

AEBIOM activities cover networking among its members, the lobbying of European bodies, information dissemination. AEBIOM also manages European projects (more details on web site).

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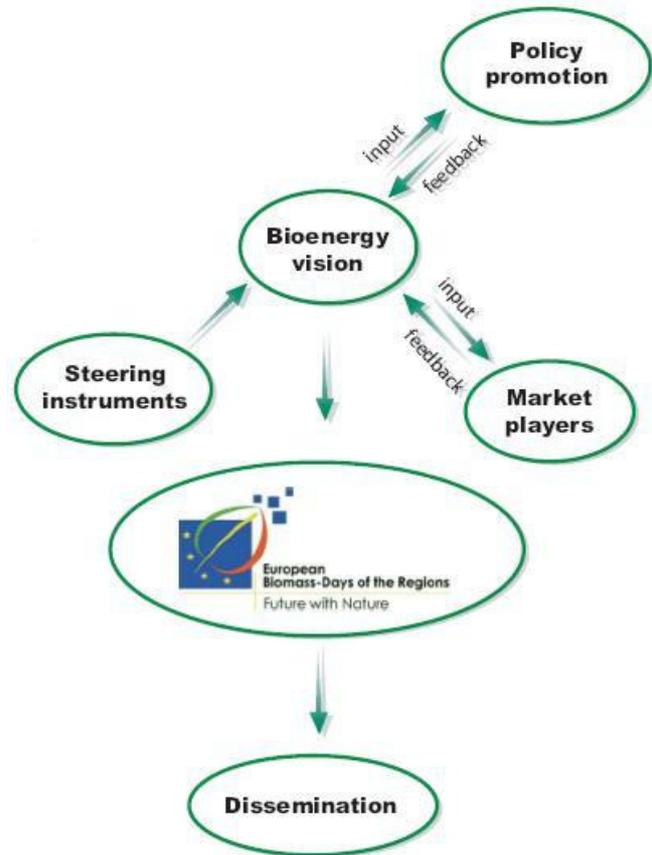
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## Boosting Bioenergy in Europe : the project

The project aims at Boosting Bioenergy in Europe through targeted actions in 2005 and 2006, proposed by the European Biomass Association and 8 of its members. It covers EU 25 but more detailed work will involve 7 countries (AT, BE, BU, DE, FI, FR, SE).

Firstly a vision for bioenergy will be worked out with a strategy to develop further bioenergy, based on the identification of detailed objectives, while financial steering instruments will be taken into account. This strategy will be confronted with the views of national decision-makers and industries, allowing the strategy to be evaluated. The European Biomass Days will make the link with the public. Communication activities will disseminate the project outcomes.

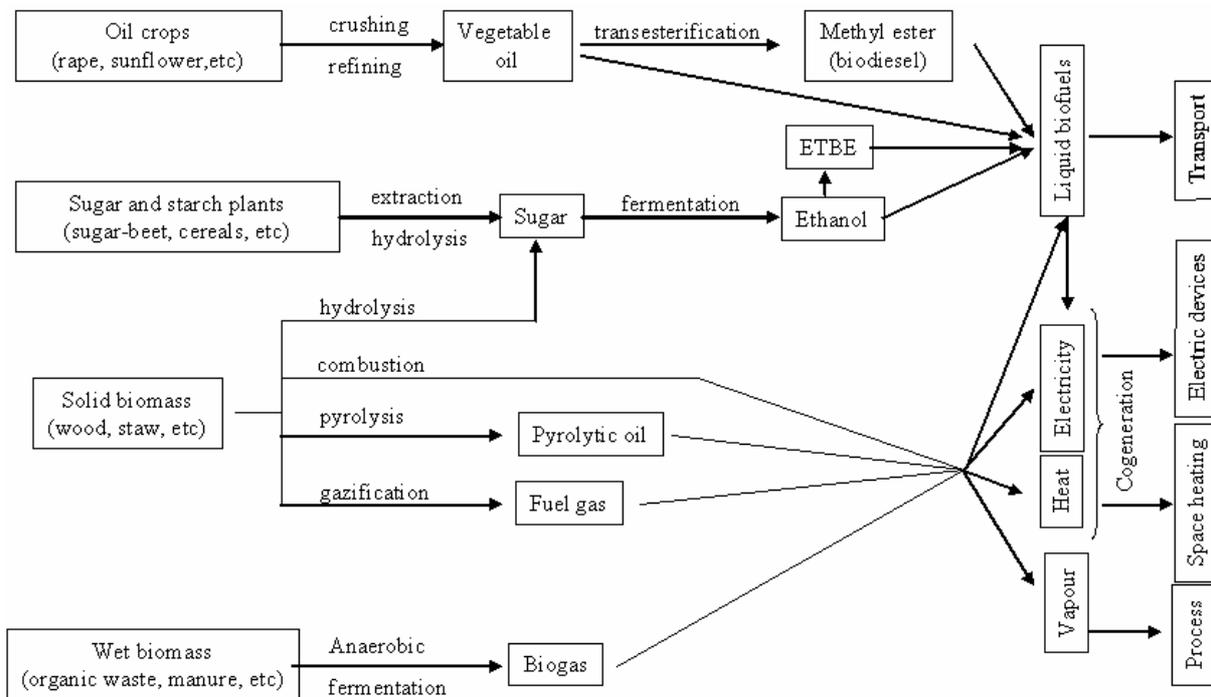


The project will produce reports and the present brochure, organise the European Biomass days (500 events) and 2 international conferences for bioenergy professionals.

## Bioenergy in a nutshell

Biomass is generated by plants through photosynthesis with the energy provided by the sun. Wood is the oldest fuel known to mankind. For centuries wood was used for heating and cooking. In the developing world, wood is still used for the same reasons. In the 18<sup>th</sup> and 19<sup>th</sup> centuries, wood was gradually supplanted by higher energy density, easily handled and by cheap fossil fuels — coal, oil and gas. Nowadays there is a growing interest in bioenergy which can be used in a modern and efficient way for the production of heat, electricity and transportation fuels. Biomass, exploited in a sustainable manner, is a regenerative source of energy.

Figure 1 : Bioenergy routes



Biomass can originate in forest, agriculture and waste streams.

1. Forest and wood-based industries produce wood that is the largest solid biomass resource. Its procurement logistics from forest to bioenergy plants are subject to major improvements. The sector covers a wide range of different biofuels with different characteristics — wood logs, bark, wood chips, sawdust and more recently pellets,. Pellets offer great opportunities for developing the bioenergy market worldwide, due to their dense energy content and standardised characteristics.
2. Agriculture can provide by-products in the form of animal manure and straw and dedicated energy crops can be grown on available land, either by cultivating the same crops (rape, wheat, maize, etc.) with alternative uses or by growing new types of crops (willow, miscanthus, energy grasses, etc.).

3. Biodegradable waste is the biomass that can take several forms, including the organic fraction of municipal solid waste, wood waste, refuse-derived fuels, sewage sludge, etc.

Each biomass resource has different characteristics in terms of moisture content, calorific value, ash content, etc that call for the appropriate conversion technologies for bioenergy production. These conversion routes use chemical, thermal and/or biological processes. Finally biomass/bioenergy can be classified according to its end use as follows :

- Heat production: Combustion of wood for heat production is the main bioenergy route in the world, with a constant drive for improved efficiency and reduced pollutant emissions. Several systems can be considered, depending on the size. Small-scale heating systems for households typically use wood logs or pellets. Medium-scale users typically burn wood chips in grate boilers while large-scale boilers are able to burn a larger variety of fuels, including wood waste and refuse-derived fuel. Heat can also be produced on a medium or large scale through cogeneration which provides heat for industrial processes in the form of vapour and can supply district heat networks.
- Electricity : Combustion followed by a vapour cycle is the main technology for the time being but new technologies are emerging such as gasification. Co-combustion of biomass and coal is also under implementation by electric utilities. Biogas from anaerobic digestion is mainly used on site for cogeneration applications. The solid and liquid residues from the process are often used as fertilisers on farm land.
- Liquid biofuels : Vegetable oils methyl esters (biodiesel), can be used, both blended with fossil diesel and in pure form. Use in blends below 5% does not require any modification of the engine. Some minor modifications might be necessary when using biodiesel at 100%. Its acceptance by car manufacturers is growing. Pure vegetable oils can also be used in blends or in pure form, but in the latter case engines have to be adapted. Ethanol is produced by fermenting sugar-based raw materials, followed by distillation. It can be used in gasoline engines either at low blends (5-10%, and up to 20%), high blends in Flexible Fuel Vehicle (5%) or in pure form in adapted engines. Ethanol can also be processed into ETBE (ethyl tertio butyl ether) and blended with gasoline (15%). Liquid biofuels can also be produced from upgraded biogas (methane) and their production from wood-based materials is under development.

Bioenergy is characterised by advantages and drawbacks that must be considered in order to ensure efficient implementation.

Drawbacks :

- Generally low energy content,
- Possible competition for the resource with material applications like particle board or paper,
- Generally higher investment costs for conversion into final energy in comparison with fossil alternatives.

Advantages :

- Widespread availability in Europe,
- Contribution to the security of energy supplies,
- Generally low fuel cost compared with fossil fuels,
- Biomass as a resource can usually be stored in large amounts and bioenergy can be produced on demand,
- Creation of stable jobs, especially in rural areas,
- Developing technologies and know-how offer good opportunities for technology exports,
- Carbon dioxide mitigation and other emission reductions (SO<sub>x</sub>, etc).

## Executive summary

### Boosting Bioenergy in Europe

#### The project

##### *Relying on oil will become a more and more risky business*

Energy in Europe is mainly produced from fossil fuels that used to be relatively cheap and convenient to transport and use. However these fuels emit pollutants and greenhouse gases into the atmosphere. Limited quantities in the world lead to unreliable supplies, causing erratic pricing in the short term and increasing the risk of socio-economic disasters in the medium term. The recent rise of to over 60 dollars per barrel (September 2005) should be seen as a warning.

##### *Bioenergy represents two thirds of the renewables*

Tackling these problems should lead to actions in favour of the rational use of energy and development of renewables. Both solutions have to be promoted including renewables, even though these energies are not among the cheapest. Energy efficiency measures will become more and more costly as long as it progresses because cheapest measures will be implemented first. Bioenergy represents two thirds of renewable sources, with a large potential waiting to be exploited. It will become cheaper with performance enhancement, economies of scale and competition.

##### *BOOSTING BIO proposes objectives, new financial instruments and feedback from policy makers and companies*

This brochure is produced by the project Boosting Bioenergy in Europe. It aims at giving an overview of the bioenergy situation in Europe regarding trends, objectives and financial instruments. An action plan is proposed. The bioenergy situation and the action plan are more detailed for seven countries (Austria, Belgium, Bulgaria, Finland, France, Germany and Sweden) as a consultation with policy makers and industries will be carried out in the framework of this project to evaluate the relevance of the targets and proposed measures.

#### Key legislation in Europe

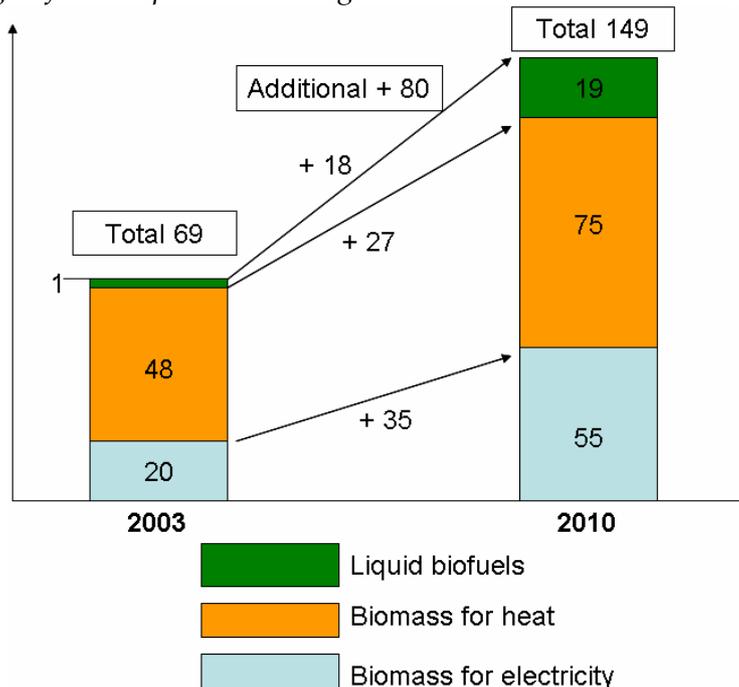
##### *Precise targets for electricity and liquid biofuels are proposed*

Reference Communications from the Commission and European Directives are the cornerstones of bioenergy policies in Europe. The following is a non-exhaustive list of these documents, and the actions in train :

- The White Paper (COM(1997)599) on renewable sources of energy which aims at doubling RES from 1995 to 2010, from 6 to 12% of the EU's gross inland energy consumption.
- Directive (2001/77) for the promotion of electricity from RES that sets out an objective of 22,1% RES-E for 2010 and individual targets for member states,
- Directive (2003/30) for the promotion of liquid biofuels that proposes a target of 5,75% for all countries by 2010,
- Communication (COM(2004) 366) evaluates the state of development and concludes that targets will not be met by using business-as-usual policies in the Member States.
- The Common Agriculture Policy is gradually opening up to include energy crops through the set-aside regime and specific support schemes,
- Efforts to reach the Kyoto objective for reducing greenhouse gas emissions and the recent related Emission Trading Scheme are favourable driving forces behind bioenergy projects,
- The Biomass Action Plan (COM(2005)528) reinforces the willingness to speed up bioenergy in Europe and proposes new objectives for EU25.

*Bioenergy should increase more than twofold*

Targets for Europe 25 according to the Biomass Action Plan (Mtoe)

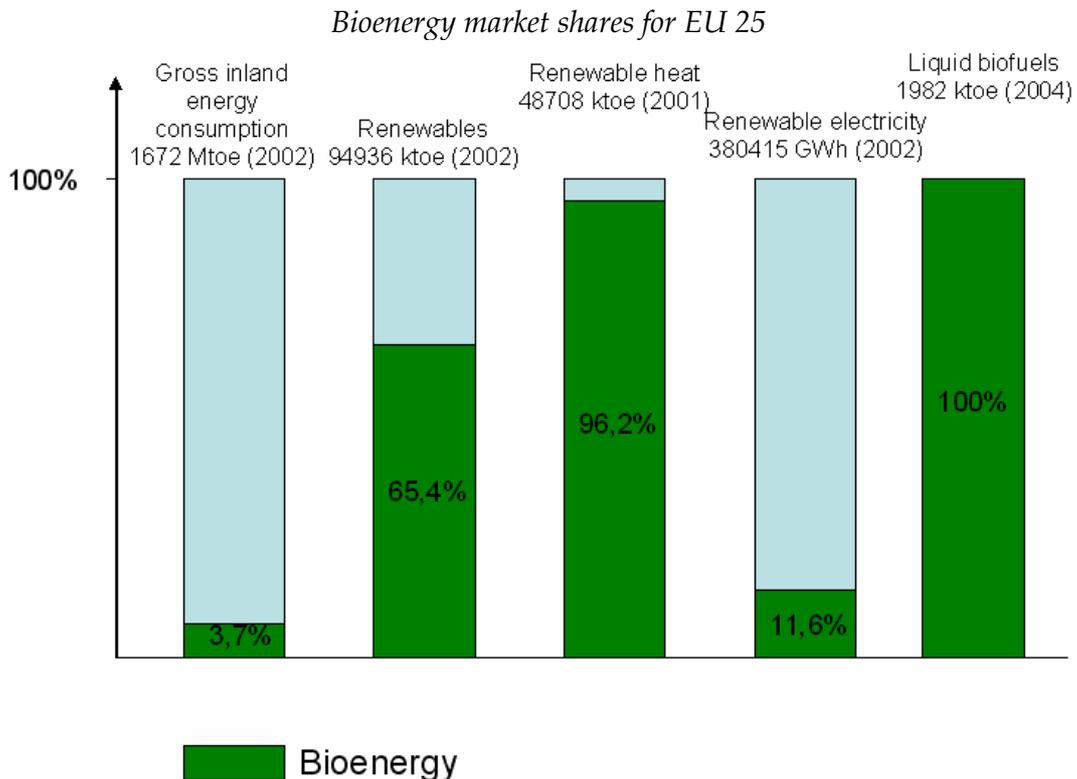


**Bioenergy, by far the major contribution to renewables**

*Bioenergy covers all liquid biofuels production and almost all renewable heat.*

Bioenergy represents the major share of energy production among renewables, in second place for renewable electricity after large hydro schemes, and also represents almost all renewable heat and the entire market for transportation biofuels. Bioenergy is widespread all over Europe depending on the available resource and

the markets. Many types of resources, conversion technologies and markets are combined, making bioenergy a challenging but enthusiastic sector to develop.



## What actions should be taken at European level ?

### Need of strong policy push from European Union

#### *Not so much European harmonisation of instruments as political push*

Biomass and bioenergy markets are diversified. Numerous biomass sources with different characteristics are combined with many technologies at various stages of development and with different markets e.g. for electricity, heat, fuel. It means that different political and social framework conditions in the EU 25 need to be considered. Various instruments and measures applied at country level are not necessarily controversial as they take into account economic, political and environmental framework conditions in the national and local environments. It should not be a primary short-term aim to try to harmonise the instruments and political support for bioenergy across Europe. But the ambitious and strong policy push from the Union is essential as a driving force behind national governments.

#### *Give long-term perspectives to raise trust in bioenergy*

Long-term perspectives are needed for the support policies because project developers and financial bodies need to reduce their risks for high investments. Clear commitments have to be taken at political level, showing that bioenergy is not just a fashion.

## Policies

### Energy

#### *Don't forget heat*

Across Europe many schemes have been implemented to support renewable electricity and liquid biofuels for transportation, but insufficient support is currently given to bioheat. Heat is the main energy market and bioheat is produced with very high efficiencies, meaning that the use of the limited biomass resources available in the heat sector will maximise final energy production and CO<sub>2</sub> savings.

A directive on heat is necessary with coordinated objectives for Member States and an action plan. The Union should pave the way for member states to develop initiatives in this heat market through appropriate incentives (feed-in tariffs, certificates, fiscal advantages, etc.). The process must take energy efficiency policies into account.

### Agriculture

#### *Absence of ambitious agricultural policy for bioenergy*

The new Common Agriculture Policy – CAP uncouples subsidies and production, allowing the farmers in theory more flexibility to grow crops in response to market needs. The economic situation in this sector is far from satisfactory with a lot of uncertainties for the farmers. Reconversion into bioenergy needs investments (biogas plant, heat network, etc) that many farmers cannot afford individually. Whilst there has been no specific EC policy to aid or extend the development of all plant-derived non-food products, some non-food crop species do benefit from aid (e.g. hemp and flax; linseed; high erucicid rapeseed. EC-funded regimes exist in several EU member states for starch potatoes). Bioenergy crops are often considered as a way to regulate the food markets rather than a serious alternative for the future. Some improvements to CAP are possible to integrate these concerns:

- European decision-makers in the field of agriculture should develop a European Vision of the future European agriculture as a supplier of raw materials and renewable energy and as a main component of greenhouse gas abatement. This Vision should be based on ambitious targets, policy measures, budget allocations for support measures and information campaigns;
- Integrate into the Rural Development Programme a specific measure in support of bioenergy e.g. investment aids for bioenergy facilities, mandatory for Member States but voluntary for farmers;
- Increase the subsidy and eligible area available for energy crops (currently energy crop aid comes to 45 • /ha for maximum 1,5 Mha,)
- Make sugar beet eligible for set aside and for energy crop aid,
- Negotiate the Blair House agreement towards a removal of the barriers to energy crops on set aside, currently 1 Mt soybean equivalent;
- Make domestic biomass resources/biofuels as competitive as imported products by linking the support mechanisms for individual/differentiated production costs based on used raw materials;

- Develop large-scale programmes for R&D and applied demonstrations of energy crops. Farmers should be informed and educated about the alternatives that are reliable and economic.

### **Environment**

#### *Make small bioenergy applications eligible under the Emission Trading Scheme*

Up to now the overwhelming majority of biomass power plants have not benefited from the European Emission Trading System (ETS). This is due to the fact that status quo emission rights are only granted to fossil-fired plants exceeding 20 MW. But whenever there is a fuel switch from fossil energy to biomass in plants smaller than 20 MW, these plants will not be rewarded for the resultant reduction in CO<sub>2</sub> because they had no emission rights to sell in the first place. Therefore AEBIOM requests a review of the ETS in 2006 to prevent discrimination against small biomass plants in the ETS.

### **Standardisation**

#### *Standards are facilitating market and business growth*

The constant development of biomass production and bioenergy applications increases the need for standardisation in many areas. Uniformisation in Europe is essential to ensure trade in biomass and related technologies among countries. A growing market needs common rules. The following aspects in particular are urgent:

- Harmonised and balanced emission thresholds for bioenergy facilities, both small and large scale;
- Define standards for biofuels (solid, liquid and gaseous) and equipment (boiler quality, storage, security measures, etc.);
- Define specifications for ethanol and high blends of gasoline, taking into account the experiences in Brazil and USA;
- Increase biodiesel percentage in the diesel standard EN590 and adjust standard EN 14014 in order to allow the use of ethanol in the process;
- Define specifications for pure plant oil.

### **Market**

#### *Let's give bioenergy fair competition rules*

Enhancing conditions to develop the bioenergy market is essential in Europe. This applies to the whole chain of bioenergy, from raw materials to equipment and services, to sales of final products. Several measures are proposed:

- Establish fair competition between domestic bioenergy as against the oil and natural gas industries and imported biofuels;
- Develop infrastructure to produce/collect transport biomass, and supply energy to clients in a way that is as convenient as fossil fuels. Pellets are part of the success stories in Austria or Sweden for example;
- Removal of administrative barriers to bioenergy projects (speed up the delivery of permits, etc.);
- Guarantee fair grid access for bioelectricity and biogas;

- Set up more demonstration projects to widen the range of reference plants and spread experience in new energy chains. These projects are a very good basis for dissemination activities;
- Remove barriers such as the unreasonable treatment of biomass as waste, inflated fire safety precautions and excessive delays in obtaining permits for bioenergy projects;
- Harmonise trade regulations at EU level;
- Speed up the implementation of Directive 2003/30/EC in all Member States. Mandatory targets should be considered;
- Give incentives on the demand side for bioenergy (e.g. no parking fees for biofuel fuelled cars in cities);
- Promote the renewal of public and private/agricultural transport fleets that are biofuel-compatible.

## **Financial instruments**

### *Taxes on fossil fuels will prepare the future*

The most powerful way to increase bioenergy use is to raise fossil fuel prices significantly. In most cases bioenergy is not competitive yet, although there are exceptions (waste, large-scale heat, etc.). Increasing the price of fossil-based energies prepares the future. It is a terrible mistake to wait for the next energy crisis to develop alternatives. Taxes on fossil fuels are needed at once to make bioenergy more user competitive. Such market development, even if the competitiveness is artificial in the short term, will lead to economies of scale, technological improvements and market competition that will make bioenergy strong and reliable in the future.

Taxes on fossil fuels are fully compatible with the polluter pays principle and the concept of external costs that have to be incorporated into the fuel price.

### *Apply the lowest VAT rates on biofuels, conversion technologies and derived energy*

So far the VAT rates on biofuels differ from one country to another. To make bioenergy more competitive the lowest VAT rates should be applied on all bioenergy related products and services. This includes the biofuels, the conversion technologies and the final products (heat – including district heating - and electricity). This is especially important for private households that are not reimbursed for VAT expenses.

### *Towards high efficiency and reduction in CO<sub>2</sub>*

As a general rule financial instruments should favour biomass use with a high efficiency rate and high reduction in CO<sub>2</sub> emissions, considering the limited resources available. Blind support systems that are only linked to the quantities of electricity produced or that are based on a percentage of investment should be improved. More intelligent support schemes are needed that will integrate more efficiently the final energy produced and CO<sub>2</sub> reduction, given the limited quantity of biomass available.

For example, the co-combustion of biomass in coal power plants for electricity and the ensuing production are only acceptable in the short term in order to create, develop and organise a market for biomass fuels. But incentives for cogeneration should be more attractive as this normally more than doubles the amount of final energy produced. The same thinking holds for liquid biofuels production from wood in comparison with cogeneration or heat-only solutions. The same principle again applies to biogas units or cogeneration plants that sometimes produce surplus heat because of a structural or periodical lack of demand.

In addition, large-scale use of biomass should not be detrimental to the biomass supply of small-scale plants according to the principles outlined above.

### **Financial support**

*Bioenergy is typically associated with low fuel costs but with high investment costs for conversion*

Converting the current fossil-based energy system progressively to renewables requires huge investments related to fuel procurement and conversion facilities. This is particularly true for bioenergy that has typically low fuel costs but high investment costs. The support for coal and nuclear plants should be reduced substantially and transferred to support RES as these older industries are established and are able to finance their own development.

The European Investment Bank should increase its share of loans to bioenergy projects and structural funds of the Union should focus more on bioenergy. Guarantees for loans that reduce risks for the banks thereby reducing the cost of the loans should be considered. Higher risk and higher transaction costs due to non-standard procedures should also be balanced out by financial support.

*Small-scale bioenergy production should be considered*

Bioenergy is produced by a wide range of investors, from very large-scale company power plants to small biomass stoves used by individuals. Even these small projects are worth supporting as heat in the private sector is an essential part of the energy sector. Appropriate financial backing has to be worked out.

### **Support integrated R&D**

*Appropriate R&D for bioenergy is essential to ensure sustainable market growth*

In many technologies, including bioenergy, further progress and results must be achieved in terms of efficiency, environmental performance and economic competitiveness. R&D is an excellent instrument with a positive correlation to the performance of these technologies, the creation of new markets, companies, and employments.

R&D should be strengthened and integrated at EU-level to increase synergies and avoid duplication. There should be a shift towards renewables away from the huge budget that has been spent since the 1960s on nuclear and coal energy. In particular the following aspects should be emphasised:

- Technological and cost reduction for biomass procurement systems, specifically for forest residues collection and transportation;
- Maximising integration of biomass in existing fossil fuel based facilities;
- Improving gasification and biogas technologies to obtain better gas quality;
- Decentralised high efficiency cogeneration technologies;
- Combining chemical and energy products (concept of biorefinery);
- Cost reduction of bioenergy conversion systems for all technologies;
- Reducing emissions and particularly particles, NO<sub>x</sub> and CO at reduced cost;
- Applying system analysis that integrates energy, environmental and economic issues with commonly agreed assessment tools;
- Applying system analysis to socio-economic and macro-economic aspects related to the energy system

## Statistics

### *Improve quality and time frame*

Statistics are an essential tool to monitor the development of renewables. Bioenergy in particular suffers from the current European statistical methods as the distinction between biomass and waste is not always clear cut. The importance of the non-commercial part of biomass for heat is neglected. It is therefore urgent to revise the national questionnaire and take bioenergy features into account. It should also allow fair comparison between member states. And last but not least the data should be available more rapidly (the current delay exceeds 2 years !)

### *More focus on heat and conversion efficiency*

Heat is a large market (roughly 50% of the final energy consumption) to be considered globally for the rational use of energy and bioenergy. It is a pity that heat does not appear clearly in the statistics. In addition, only the fuel is mentioned and not the final heat. The possibility of taking the conversion efficiency into account should be considered. Efficiency where biomass is concerned is particularly important because the range of production methods can be very broad and the wrong conclusions will be reached if the biomass, used in open fire places, insets or in automatic pellets systems, is computed in the same way. At the present time the conversion efficiency is analysed only for cogeneration applications.

## Information

### *The public should know about the bioenergy alternative*

Information campaigns are needed in all Member States to increase public awareness of the threat of the present energy system, with its emphasis on the inevitable shortage of fossil reserves, increasing price volatility in the future and possible economic recession with unemployment. At the same time alternatives such as bioenergy should be promoted to show that they are reliable, economic and environmentally sound. Changing the energy system takes time. We propose the following activities at European level :

- Increase EU-wide framework activities with national involvement (European Biomass Days, Green Week, Energy Globe, etc),
- See that successful country projects are publicised in other countries,

- Launch awareness campaigns in the European media.

## Training

*Training will give confidence to bioenergy professionals who will then confidently promote the technology*

The training of professionals such as architects, consultants and installers is an essential step towards the large-scale implementation of bioenergy. People unacquainted with these new technologies will naturally consider them to be risky and tend to advise customers in a 'business-as-usual' way. Giving these professionals in-depth information and experience through training sessions, visits, conferences, etc. is fundamental.

Sharing experiences across Europe is also a key element to exchange knowledge and know-how.

## Country analysis

### Austria

*Biomass should be increased by 75%*

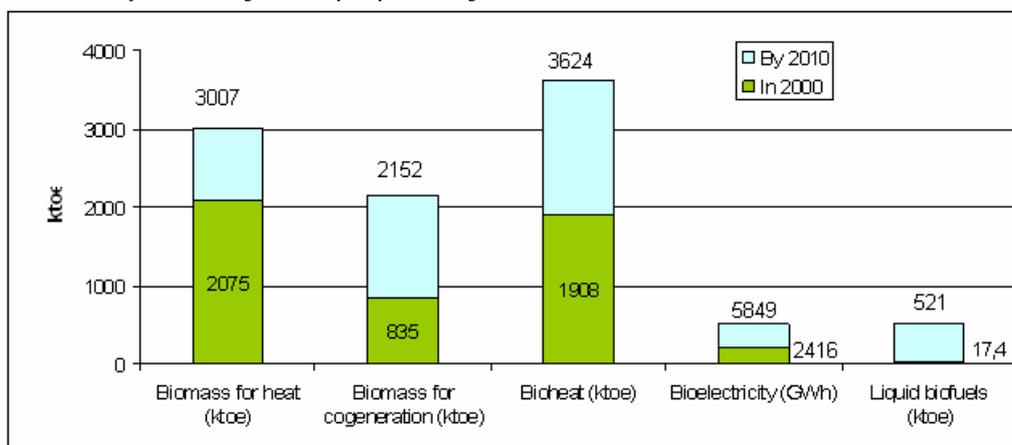
In 2003 the Austrian government formulated the following targets for RES and bioenergy:

- increase the share of RES in primary energy supplies by 1 % per year; this results in a 30 % share of RES by 2010,
- increase the contribution of biomass by 75 % by 2010,
- increase the share of green electricity up to 78,1 % by 2008,
- support biofuels.

*4800 M• investment is needed*

The Austrian Biomass Association has converted these targets into the primary energy needed and final energy production. The realisation of the additional biomass and biogas installations within the heat and electricity market would lead to a total investment of 4800 M• with very positive effects on the further development of the bioenergy industry as well as on rural development in Austria.

Objectives by 2010 proposed by ABA (Austria Biomass Association)



note : biomass refer to the biofuels before conversion while bioheat and bioelectricity refer to the final energy after conversion. For bioelectricity figures are given in GWh but for the scale figures have been converted into ktoe.

*Attractive feed-in price for electricity and subsidies for bio-heat units are available*

In Austria renewables are supported by various instruments such as indicative goals, legal regulations, financial promotion and tax incentive programmes as well as research and development. The most important legal regulation is the Eco-Power-Act of 2002 defining feed-in-tariffs for RES electricity. This legislation has led to the rapid growth of electricity production from wind and biomass. Furthermore, a huge variety of financial support programmes in the form of subsidies have supported the development of bioenergy especially in the heat market in recent decades. Austria has also increased energy and mineral oil taxes, but compared to countries like Sweden or Italy energy taxes on fuels for heating purposes are much lower.

*New support programme or eco-heat certificates for the heat market are needed*

Improvements and new instruments are proposed to speed up bioenergy use :

- **Electricity sector:** the very successful feed-in tariff system should be guaranteed for some years to come and tariffs should be maintained at their present level, especially for small CHP plants based on solid biomass and for biogas plants.
- **Biofuels for transportation:** no new measures are necessary. The measures, which are scheduled to come into force on 1 October 2005 and in 2007, should be implemented.
- **Heat sector:** further initiatives to boost bioenergy are especially necessary in the heat sector. The high investment costs are the greatest obstacle to the replacement of fossil heating systems by biomass heating systems. Therefore two main instruments in support of the replacement of fossil heating systems by biomass systems are proposed and could be applied alternatively: the Austrian Support Programme for biomass heating systems or the Ecoheat legislation.

## Belgium

### *A complicated policy structure does not help bioenergy*

Belgium is a Federal State consisting of 3 regions : the Walloon Region, the Flemish Region and the Brussels-Capital Region. The evolution of the Belgian energy policy has been shaped by the country's general political evolution, and has led to the transfer of wide competences from the State to the Regions. At present, there are no national targets for using biomass energy.

### *ValBiom has defined concrete targets for heat, electricity and liquid biofuels*

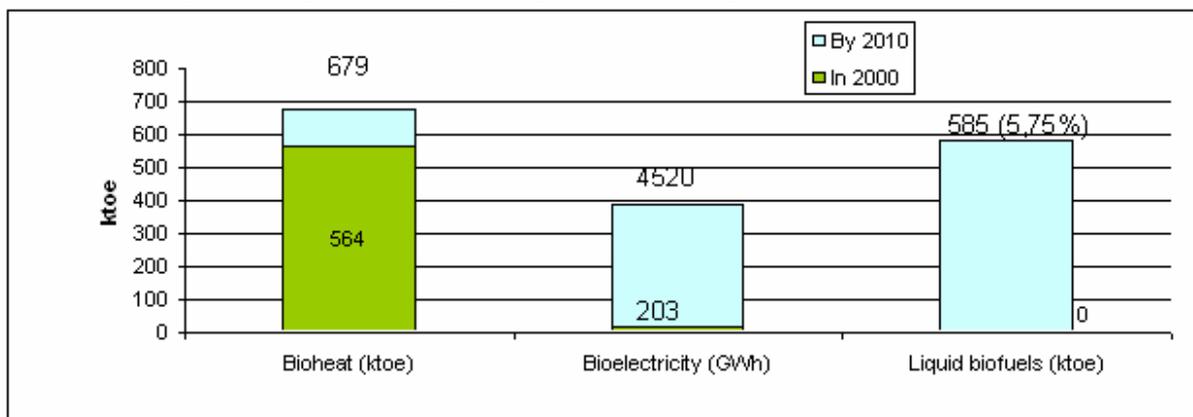
The Belgian Biomass Association (ValBiom) has defined targets for the year 2010, based on the targets of the two main Regions (Wallonia and Flanders):

- 8% of total final heat consumption from biomass;
- 75 000 households using wood as the main source of heat;
- a further 200 MW produced by industrial wood heating systems;
- a further 50 MW produced by wood heating district systems;
- 6% of total electricity consumption from biomass;
- 5.75% (585 ktoe) liquid biofuels.

### *Necessary investments are impressive*

Investments needed to reach these objectives are evaluated at 300 M• per year for the next 10 years for heat and electricity and 300 M• for the instalment of new liquid biofuel capacities.

*Objectives by 2010\* proposed by ValBiom (Belgian Biomass Association)*



\* objectives are calculated for 2020 for Flanders  
see also note under the graph of Austria

### *Efficient certificates systems are implemented*

In Belgium, renewables are supported by different instruments such as grants and fiscal incentives. The most worthwhile systems are renewable energy certificates, cogeneration certificates and green certificates.

### *Concrete ValBiom proposals are on the table*

Improvements and new instruments are proposed to boost bioenergy and include:

- a system of green certificates for heat production from biomass;

- a new fossil CO<sub>2</sub> tax;
- a labelling systems for imported biomass resources and biomass heating systems;
- a permanent inventory of biomass resources in Belgium;
- actions to promote the use of pellets for stoves and boilers;
- an adapted taxation of liquid biofuels for ethanol, biodiesel and vegetable oil, also for high blending rates.

## **Bulgaria**

### *The energy model has to be reformed*

The Bulgarian energy policy is today directed towards increased efficiency, security of supply and diversification, market deregulation, the use of renewables and environmental protection. The Bulgarian Government launched a number of National Energy Programmes in order to reach the goals of the EU energy policy. Many of these programmes are financed from EU Commission pre-accession funds, directly aimed at biomass utilization.

### *Bioenergy has an important role*

The Bulgarian National Energy Strategy is aiming at a RES market share of 10,2% by the year 2010.

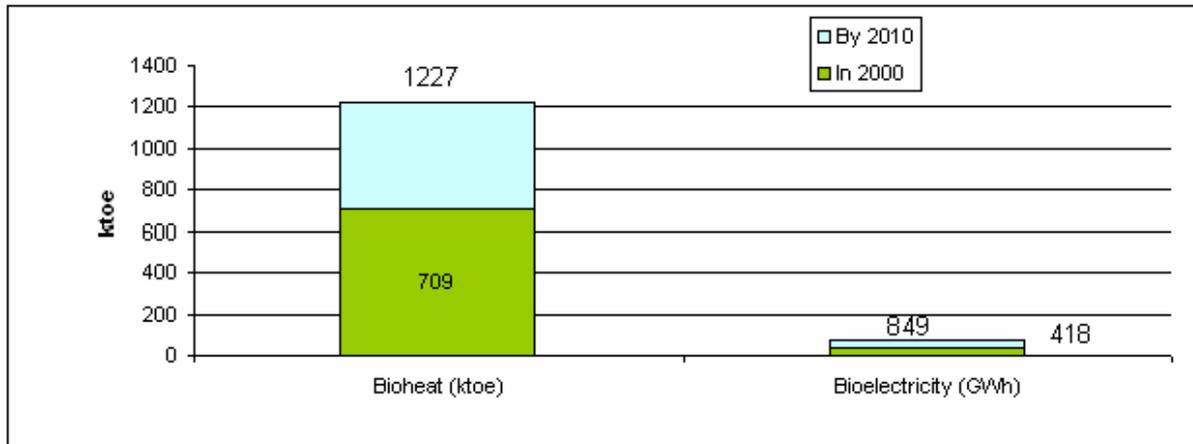
The long-term objective is the promotion of biomass as a clean, affordable and CO<sub>2</sub> neutral energy source in the Bulgarian energy supply, and the stimulation of the use of biomass as a renewable source of energy.

The second objective of the Bulgarian Government is to define, on a pilot basis, the actual costs and benefits of switching from fossil fuels to wood to heat the country's municipal buildings.

### *Large buildings are a target market for new bioheating facilities replacing current inefficient systems*

In Bulgaria, old and outdated fossil fuel boilers are the most common means of heating in larger buildings. The efficiency of the equipment is low, and the emissions of SO<sub>x</sub>, CO<sub>2</sub>, CO and soot are considerable. At the same time, in many areas large quantities of wood residues from the wood processing industry are left unused. Due to the high cost of fossil fuels, switching to alternative fuels is generally very economical, although, it involves considerable investments which the owners of large buildings (often municipalities) cannot usually afford.

Objectives proposed by EUBA (Energy Utilisation Biomass Association)



see also note under the graph of Austria

*Towards energy efficiency, better financial support and green certificates*

The major improvements proposed by EUBA are the following :

- Improving the energy efficiency
- Renewable energy sources, promotion of their utilization in accordance with the programs of the EU for sustainable development
- Legislative regulation of the fund "Energy efficiency"
- Harmonization of the Bulgarian legislation with the European one, including in the field of the energy efficiency and renewable energy sources
- Special accent on the energy efficiency development
- Ensuring financial support for development of the energy efficiency in Bulgaria
- Implement green certificates for the power sector

**Finland**

*Bioenergy should increased by 22%*

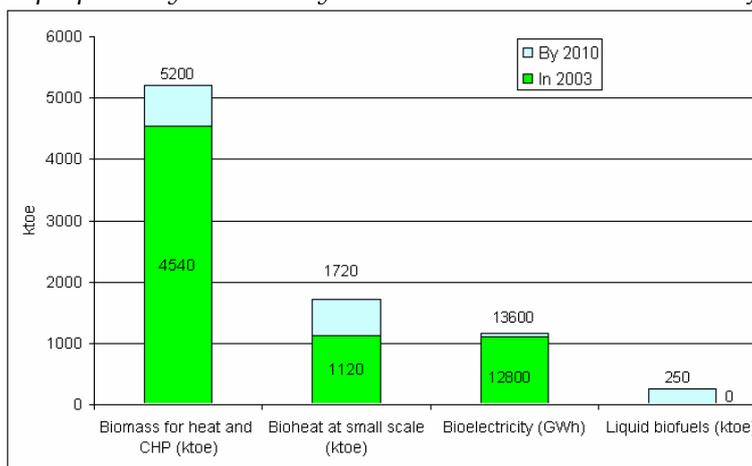
In Finland 22% of the total energy consumption and 20% of the electricity requirements are met by using bioenergy. Bioenergy represents almost 80% (7 Mtoe, peat excluded) of energy production among renewables. In 2003 the new National Action Plan for Renewables (NAPRES) was launched in Finland – along with a new nuclear power capacity (1600 MW). The target is to increase the use of renewable energy at least up to 30% and bioenergy up to 22% by 2010 and up to 45% until 2025. RES-E target is 31,5% of total electricity production by 2010. The result was that especially bioenergy CHP-investments were continued in the positive way. Today over 400 biomass heat and power plants are operating. In Finland bioenergy are supported by financial promotion and especially by strong research and development network.

The Government gave the new Energy and Climate Strategy proposal to the Parliament by the end 2005. Large debate and progressive lobbying have been arisen - more nuclear power capacity or RES-investments according to NAPRES – or both but then via a mini-NAPRES? The Parliament will make its decisions and milestone

guidelines during the winter 2006. However, bioenergy potentials and practical technology know-how are huge in the country. Also the question about the share of liquid biofuels is still open (target 2005 is 0,1%, ?% in 2010). The future use of peat is also discussed (6% of total energy consumption, peat is annually growing more than is used) along with different kinds of biomass. Especially wet forest biomass and bio-wastes need an effective mixture fuel, in Finland it has been peat.

FINBIO supports the fulfilling the targets of NAPRES 2003.

*Objectives proposed by FINBIO by 2010 (The Biomass Association of Finland)*



see also note under the graph of Austria

*There is a need to fulfil NAPRES, EU's RES-E and liquid biofuels directives*

**Electricity sector :** FINBIO advocates for common power tax bases and tax/support harmonisation in Nordic countries, and also progressively at EU level. CHP plant technologies and multi cogeneration possibilities have to be promoted.

**Heat sector :** Half of buildings are connected today with district heating systems, but DHS-sector is using only 10% bioenergy. 25% of individual houses are heated mainly with wood fuels (firewood and chips). There is room for increasing this RES-heat shares through taxes, VAT and public support. Pellets systems are especially appropriate for private family houses. Technical development is still needed (nano-particles, etc).

**Biofuels for transportation :** Finland should take over a national target according to EU proposal. Existing administrative barriers should be kicked away, tax reform must be realised and oil companies should be obliged to blend 5.75% of biofuels to fossil transport fuels until 2010.

**Others:** To ensure that NAPRES will meet its full targets, new large bioenergy technology programmes and further contributions for R&D&D-work are needed.

## Germany

### *RES and bioenergy in particular are priorities for the German government*

The Federal Government of Germany is aiming at a RES market share of 4,2% in primary energy consumption by 2010, of 12,5% in electricity generation and a 5,75% share of biofuels in the transport sector. However, these targets are not technologically differentiated. Targets for the RES heat market don't exist. The new government is in favour of the market development of bioenergy.

### *Objectives for Germany*

Sector	RES Targets Government 2010	Bioenergy Market Share 2004	Bioenergy Targets BBE 2010
Electricity	12,5 % RES	1,6 % / 9.367 GWh	4,4 % / 23.600 GWh
Heat	-	3,9 % / 5,1 Mtoe	6 % / 6,4 Mtoe
Transport fuel	5,75 % Bioenergy / 3,2 Mtoe	1,6 % / 0,94 Mtoe	8 % / 4,5 Mtoe
Primary Energy	4,2 % RES / 14,3 Mtoe	2,37 % / 7,5 Mtoe	5 % / 17,6 Mtoe

### *Successful feed-in price for renewable electricity and tax exemption for liquid biofuels*

To develop the RES and bioenergy markets several regulations and support programmes have been implemented including the Renewable Energy Source Act (EEG) whose provisions for differentiated fixed remuneration fees for RES electricity production and the exemption of biofuels for transportation within the mineral oil tax are the most important and successful.

### *But bioheat suffers from insufficient and unstable budgets*

The Market Incentive Programme (MAP) supports investments in the RES heat sector. But its budget is dependent on the annual budget negotiations of the government and is still far too small to initiate the same market development in the bioheat sector as it can be observed in the electricity and transport sector. The encouraging growth rate of about 34% in the wood pellet sector is considered to be an absolute minimum.

### *BBE asks for continuation of electricity and liquid biofuels policies, obligation of liquid biofuels incorporation, a certificate system for bioheat*

While the support system for the electricity and transport sector have already boosted the bioenergy market, greater efforts and improvements are necessary to achieve BBE targets in view of the market potential.

- **Overall:** Huge investments are necessary for further market development and will require investment security and a reliable support policy. Therefore EEG continuity, guaranteed by fixed compensation fees and its compulsory acceptance by grid operators beyond 2007, are as vital as the extension beyond 2009 of the preferential treatment of pure biofuels for transportation within the mineral oil tax.

- **Electricity:** The feed-in tariffs within the EEG have to be evaluated and adjusted regularly to mobilise idle biomass potential as already stipulated in the Act.
- **Transport:** The mineral oil industry should be obliged to blend 5% of biofuels with fossil transport fuels until 2010. Only the percentage of biofuels higher than the obligatory amount should be exempt from the mineral oil tax. To ensure fair competition Directive 2003/30/EC has to be implemented in all EU Member States.
- **Heat:** Clear and binding objectives in the heat market are necessary to increase awareness and policy support for bioheat. A support system, independent of governmental budget negotiations, to subsidise higher investment costs for bioheat systems is essential. An apportionment procedure could be a promising model for the bioheat market, one, for instance, which obliges retailers of fossil fuels to agree a certified RES heat quota, depending on the energy content or CO<sub>2</sub>-activity of the fossil-based energy they sell to carriers. In the short term it is obvious that the MAP budget must be increased.
- **R&D:** In contrast to the role of bioenergy in future energy supplies, its share in the national budget for energy research and development amounts only to 0,66% (6,6 m • in 2002). This disparity has to be abolished and the R&D budget greatly increased to achieve cost decrease potential and the development of innovative and efficient biomass conversion technologies.

*With an optimised policy investments in bioenergy will continue*

The effective support of bioenergy has led to a turnover of 3,75 bn• in 2004. If the framework conditions for bioenergy market development are optimised, it is expected that between 2001 and 2010 about 36 bn• will have been invested in this market.

## Sweden

*The political framework in Sweden in good*

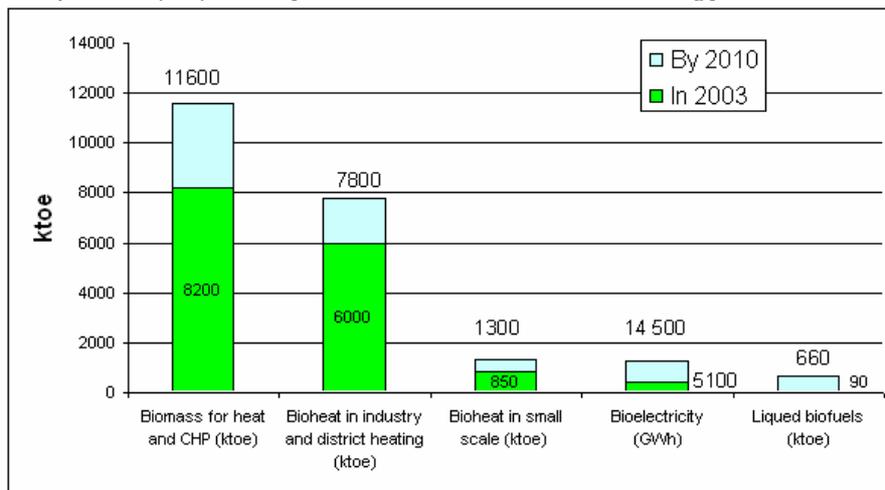
In an international context renewable energy sources have a strong and fast-growing position in the Swedish energy system. The strong development of bioenergy since the 1970s has depended on good raw-material resources and technological know-how backed by political will, incentives and decisions.

*A recent green certificate system has led to many new investments*

The dominant strategy of the Swedish government has been energy taxation and Eco taxation in combination with research, information and awareness campaigns. In 2003 a system of green electricity quotas was introduced. This trading system has already generated much greater investment in the production capacity of renewable bioelectricity, both in industry and in district heating systems.

The Swedish Bioenergy Association, based on developments in the last few years, on expectations, and investment decisions by industry and district heating companies, has estimated the following targets.

Objectives proposed by the SVEBIO (Swedish Bioenergy Association)



see also note under the graph of Austria

*Improve technical and economic conditions especially for small scale heating systems*

**Heating sector :** In the residential sector investment costs are still a main obstacle to fast development. Furthermore, the technical solutions must be improved for better user convenience. This means that the income tax exemption for investment in bioenergy heating in new private housing must be extended beyond 2006. Technical development of small-scale bioenergy heating systems must be funded, preferably by targeting easy handling and low emission systems. The taxation of fossil fuels and electricity for heating should remain at their current level.

*Give durability to green certificates system and develop a European market*

**Electricity sector:** Quotas for electricity certificates that are needed by the consumers has to be raised and the durability of the system secured.. A European-wide electricity certificate trading system might be a strategic goal for the European energy policy. The market-orientated system with electricity certificates can be combined with feed-in prices to develop technologies that are not yet commercial.

*Apply mandatory and financial incentives instruments*

**Liquid biofuels :** The Union must accept a level of at least 10 percent blending of ordinary petrol with ethanol and 10% FAME in diesel. The installations of pumps for renewable fuels at larger petrol stations must be supported by binding regulations. Incentives like free parking, exemption from traffic jam taxation and favourable taxation for cars fuelled with liquid biofuels etc. must be realised.

**Others:** Support to Research, Development and Demonstration projects especially black liquor and large scale gasification need to be improved.

Present policy raising taxation on energy and emissions parallel with lowering taxation on labour must continue.

Develop new steering instruments supporting energy production from farmlands.



# Part I. Bioenergy policies and objectives

## 1. Europe

### 1.1. Overview of major European policies

#### Energy

Policies in the field of energy are undoubtedly the major driving forces to support bioenergy implementation in Europe. Some key legislations are outlined below.

#### *The White Paper aims at doubling RES from 1995 to 2010*

The White Paper Energy for the Future: Renewable Sources of Energy<sup>1</sup>, renewable energy sources are given an indicative target of 12% for its contribution to the EU's gross inland energy consumption by 2010, in comparison with about 6% in 1995. A comprehensive strategy and action plan to achieve this goal is outlined. Specific objectives were set to regulate and create favourable framework conditions for RES. This included increased funding, both at national and community level. The Member States were allowed to achieve their increase of RES according to their own potential. New initiatives for transport and electricity were introduced. Special measures were suggested for the transport sector in order to increase the market share for liquid biofuels.

*Tableau 1 : Objectives of the White Paper*

	1995	2010
Biomass for energy	44,8 Mtoe	135 Mtoe
Bioelectricity	22,5 TWh	230 TWh
Bioheat	38,04 Mtoe	75 Mtoe
Liquid biofuels	0	18 Mtoe

As a follow up of the above mentioned White paper the EU's Campaign for Take-Off for Renewables<sup>2</sup> was launched. It was designed to kick-start implementation of the EU's strategy for introduction of RES. Specific objectives for 2003 were set for bioenergy in terms of :

- 10 000 MWth of combined heat and power biomass installations
- 1 000 000 dwellings heated by biomass
- 1 000 MW of biogas installations
- 5 million tonnes of liquid biofuels

<sup>1</sup> COM(1997) 599, Energy for the future: Renewable Sources of Energy – White Paper for a Community Strategy and Action Plan

<sup>2</sup> CAMPAIGN FOR TAKE-OFF, Energy for the Future: Renewable Sources and Action Plan (1999-2003)

*The Green Paper stressed that Europe's dependence on imported fossil fuels will soon reach 70%*

In the Green Paper, Towards a European Strategy for Security of Energy Supply<sup>3</sup> the Commission expressed a strong will and need to reduce the import of energy to the EU. The dependence of imported energy to the EU has already passed 50% and is expected to reach 70% within the next 20-30 years with a business as usual scenario.

*Tableau 2 : Objectives for renewable electricity according to directive 2001/77 (% , as production of renewable electricity divided by gross national electricity consumption)*

	1997	2010
Austria	70	78,1
Belgium	1,1	6
Cyprus	5	6
Czech Republic	3,8	8
Denmark	8,7	29
Estonia	0,2	5,1
Finland	24,7	31,5
France	15	21
Germany	4,5	12,5
Greece	8,6	20,1
Hungary	0,7	3,6
Ireland	3,6	13,2
Italy	16	25
Latvia	42,4	49,3
Lithuania	3,3	7
Luxembourg	2,1	5,7
Malta	0	5
Netherlands	3,5	9
Poland	1,6	7,5
Portugal	38,5	39
Slovakia	17,9	31
Slovenia	29,9	33,6
Spain	19,9	29,4
Sweden	49,1	60
United Kingdom	1,7	10
EU 15	13,9	22,1
EU 25	12,9	21

Remark :: For new member states the reference year is 1999-2000

*Directive 2001/77 states national targets for renewable electricity*

A directive 2001/77 on Promotion of electricity produced from renewable energy sources in the internal electricity market<sup>4</sup> has been issued in 2001. National targets to reach by 2010 were set for EU15 member states. National targets were also negotiated

<sup>3</sup> COM(2000)769, Green Paper, Towards a European strategy for security of energy supply

<sup>4</sup> Directive 2001/77/EC, Promotion of electricity produced from renewable energy sources in the internal electricity market

later with the new member states. These targets are indicative and do not split among renewables.

*Directive 2003/30 proposes a target of 5,75% for liquid biofuels in 2010 while directive 2003/96 proposes their defiscalisation*

In the directive 2003/30 on Promotion of the use of biofuels or other renewable fuels for transport<sup>5</sup> indicative targets of 2,0% in 2005 and 5,75% in 2010 of total liquid biofuel consumption in the transport sector were set. The same target is proposed for all members states. These targets are not mandatory but special reporting requirements ensure that the Member States will evaluate these targets seriously.

In parallel another directive 2003/96 on Restructuring the Community framework for the taxation of energy products and electricity<sup>6</sup> allows the Member States to apply exemption or reduced rate of taxation on liquid biofuels. The procedure is easier than in the past and specific rules have to be applied, particularly to avoid overcompensation of extra costs of biofuels.

*Commission's communication COM(2004)366 points out that current trends are not sufficient*

The Communication on "The share of renewable energy in the EU" (COM(2004) 366) concluded that further efforts – in particular in the biomass sector – are needed in order to achieve the above policy objective. A business as usual policy will not be sufficient

The Commission considers that the necessary legal and policy framework have been implemented at European level and it is now up to the Member States to speed up their actions at national, regional and local levels.

*A Biomass Action plan will be issued by the European Commission*

Based on the conclusion that bioenergy should received a stronger impulse the Commission is working on a Biomass Action Plan, to be issue in 2005. A large consultation with stakeholders is organised.

Other directives have been adopted which partly impact biomass like directive 2002/91 on energy performance of buildings and directive 2004/8 on cogeneration. This latter directive aims at doubling cogeneration from 9% in 1994 to 18% in 2010, with special provisions for renewables.

Even if a target of 20% share of renewables in 2020 was put forward by the Bonn conference (June 2004) the Commission considers that an assessment of the RES is necessary, notably regarding economic effects, technical feasibility and environmental considerations. A debate will be organised on this issue in view of stating a target in 2007 for the period beyond 2010.

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<sup>5</sup> Directive 2003/30/EC, Promotion of the use of biofuels or other renewable fuels for transport

<sup>6</sup> Directive 2003/96/EC, Restructuring the Community framework for the taxation of energy products and electricity

## Agriculture

### *Common Agricultural Policy is increasingly open to bioenergy*

The Common Agricultural Policy (CAP) is more or less under permanent restructuring since 1992. We are moving from a production oriented policy subsidy to a more market oriented and environmentally-friendly CAP. Farm support is now more geared by consumer's concerns and public priorities. Overproduction of food commodities has increased the need to find out solutions, highlighted recently by GATT decisions for the sugar sector.

The set aside regime was the solution put forward since 1992, allowing the possibility to grow non food crops. A specific support scheme for energy crops has also been implemented more recently (45 €/ha support for maximum 1,5 Mha) with an increasing interest in the Member States.

The enlargement of the EU to 10 new member states is quite a challenge with an increase of the agricultural land by 30% and a larger agricultural economic and social weight in these countries.

Developing new outlets becomes essential and bioenergy offers a unique opportunity to drive farmers towards future main resource providers for the renewable industry and towards major stakeholders for greenhouse gas mitigation.

## Environment

### *Measures to combat climate change offer opportunities to biomass projects*

The all-embracing goal for greenhouse gas reduction is stated in the Kyoto Protocol of the United Nations Framework Convention on Climate Change, UNFCCC<sup>7</sup>. The EU is committed to reduce its emissions, a basket of six greenhouse gases, by 8% from a 1990 baseline level to a target level calculated as an average between 2008 and 2012. Of the six greenhouse gases carbon dioxide is the most important as it contributes to about 80% of the total emissions of greenhouse gases from the Union. In June 1998 a system of burden sharing was agreed by the MS. All MS in the EU have now ratified the Kyoto Protocol that has now entered into force after the recent ratification by Russia.

An important initiative from the Union to fulfil the goals for greenhouse gas reduction has lately been introduced with the new directive on Establishing a scheme for greenhouse gas emission allowance trading within the Community<sup>8</sup>. It entered into force in January 2005. Biomass has been allocated a zero emission factor. It means that companies implementing bioenergy can substitute fossil energy and get emission allowances that can be sold on the market.

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<sup>7</sup> UNFCCC, 1997: Protocol to the United Nations Framework Convention on Climate Change, the Kyoto Protocol

<sup>8</sup> Directive 2003/87/EC: Establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

*Biological waste will soon not be accepted anymore for landfilling*

The EU Landfill Directive (1999/31/EC) of 1999 obliges Member States to progressively reduce the amount of organic waste going to landfill to 35% of 1995 levels within 15 years. Waste will become increasingly available and it makes sense to recover energy out of it.

## 1.2. Challenges for the future

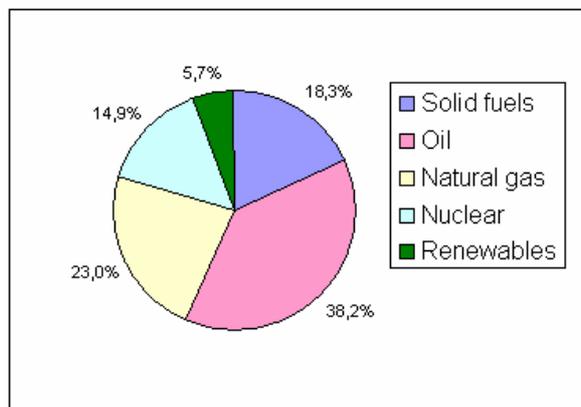
### Bioenergy

*Bioenergy represents 2/3 of the renewables*

In Europe renewables account for 5,7% of the total gross inland energy consumption (Figure 2) and biomass represent 65% of that, or 62 110 ktoe, according to Eurostat (Figure 3).

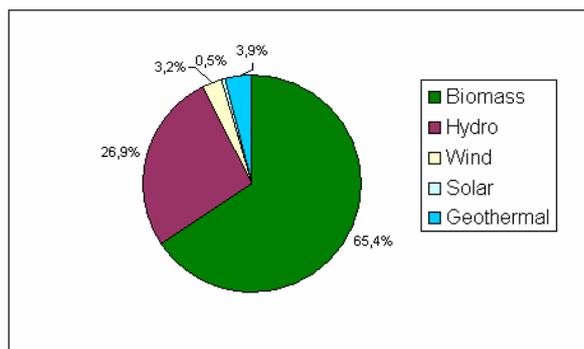
Unfortunately the percentage of renewable was increasing slowly during the last years. This is due to the fact that the growth rate of renewables is offset by the growth of the energy consumption.

Figure 2 : Gross Inland Consumption of energy in EU 25 (total is 1672 Mtoe in 2002)<sup>9</sup>



<sup>9</sup> European Commission, 2004, "EU energy and transport in figures", statistical pocket book 2004

Figure 3 : Share among renewables in 2002 (%)



The commission communication (COM(2004)366) redefines the targets for individual renewable sources according to the overall target of 12% (White Paper). The target will only be reached if the national plans based on the electricity directive are achieved, the requirements of the liquid biofuel directive are fulfilled and if the policies for renewable heat are improved. With present trends and measures the renewable energy share will range between 8 and 10%, and the 12% target of the White Paper will not be reached.

In 2001 for EU15, total biomass production for energy purposes was 56 Mtoe. By 2010, 74 Mtoe more biomass for energy are needed to reach the objective leading to a total biomass based energy production of 130 Mtoe in 2010.

The Biomass Action Plan - BAP (COM(2005)563) proposes new figures for EU25, to go from 69 Mtoe in 2003 to 149 Mtoe in 2010 (Tableau 3). Each sector has to contribute with the following additional biomass : biomass for electricity 35 Mtoe, biomass for heat 27 Mtoe, and biofuels 18 Mtoe. It is expected that this biomass increase will add 5% share of RES, reduce reliance on imported energy from 48 to 42% and avoid 209 Mt CO<sub>2eq.</sub> per year, and create 250 – 300 000 jobs mostly in rural areas. Many proposals are outlined in the BAP like (non exhaustive) :

- Work out a legislation for renewable heat.
- Equipment labelling.
- Reduced VAT for district heating supply.
- Promote liquid biofuels obligations.
- Encourage public procurement of clean vehicles.
- Revision of the waste framework legislation.
- Review standards for liquid biofuels.
- Encourage national biomass action plans.
- Etc.

Tableau 3 : Targets for EU15<sup>10</sup>

	1997 results	2002 results	2010 target	Bioenergy increase 2002-2010
RES Electricity*	337 TWh	380 TWh	84 – 93 Mtoe 630 – 660 TWh*	
Of which bioelectricity	24 TWh	44 TWh	22,1% of electricity 162 TWh	+ 118 TWh 32 Mtoe**
RES Heat	38,7 Mtoe	43,3 Mtoe	68 - 77 Mtoe	
Of which biomass for heat	38,04 µMtoe	42 Mtoe	66 Mtoe	+ 24 Mtoe
Liquid biofuels	0,2 Mtoe	0,8 Mtoe	19 Mtoe (5,75% of fuels)	+ 18 Mtoe
Total			182 Mtoe	
Of which biomass		56 Mtoe (in 2001)	130 Mtoe	+ 74 Mtoe

\* according to BAU or efficiency scenario

\*\* I can be noted that the Commission considers that 32 Mtoe of biomass are needed to produce 118 TWh, leading to an electricity efficiency of 32%.

Targets for EU25<sup>11</sup>

	2002 results	2010 targets	Bioenergy increase 2002-2010
Bioelectricity (TWh)	48	174	126
Biomass for electricity (Mtoe)	20,6	56	35,4
Biomass for heat (Mtoe)	48,2	74,8	26,6
Liquid biofuels (Mtoe)	0,5	18,6	18,1
TOTAL (Mtoe)	69,3	149,4	80,1

## Biomass for Heat

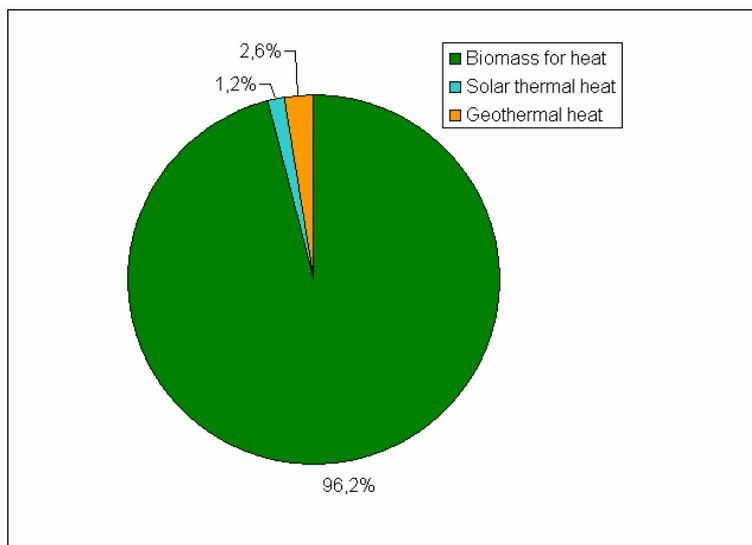
### *Biomass for heat, by far the biggest RES*

The renewable heat production in Europe is dominated by far by biomass for heat which represents almost all the renewable heat in all countries except in Cyprus and Greece where solar is well developed and Hungary, Slovenia and Spain where geothermal has a significant share.

<sup>10</sup> COM(2004)366, The share of renewable energy in the EU

<sup>11</sup> COM(2005)628, Biomass Action Plan

Figure 4 : Renewable heat in Europe in 2001 (46,9 Mtoe in EU25)<sup>12</sup>



It should be noted that the final heat is considered for solar thermal and geothermal and compared with the biomass resource for heat production. The conversion efficiency of biomass is not taken into account. However such figures are consistent with the current official statistics.

Heating with wood is well known. Traditionally wood logs are produced, sold and used on local markets to private households for heating in stoves, inserts or mass stoves. Such systems are in many cases secondary heating systems. Modern boilers using wood logs are now available with high efficiency and low emissions.

For small scale application pellets offer the possibility to run stoves and boilers automatically. Efficiencies and emissions are especially favourable in these systems. Standardisation and easiness of transport and handling of the fuel allows a wide market extension, not only on national basis but also the international trade with pellets has grown very fast the latest years. Pellets are as comfortable as traditional light fuel oil heating systems and in some countries heating with pellets today also have a high status of a modern ecological way of living.

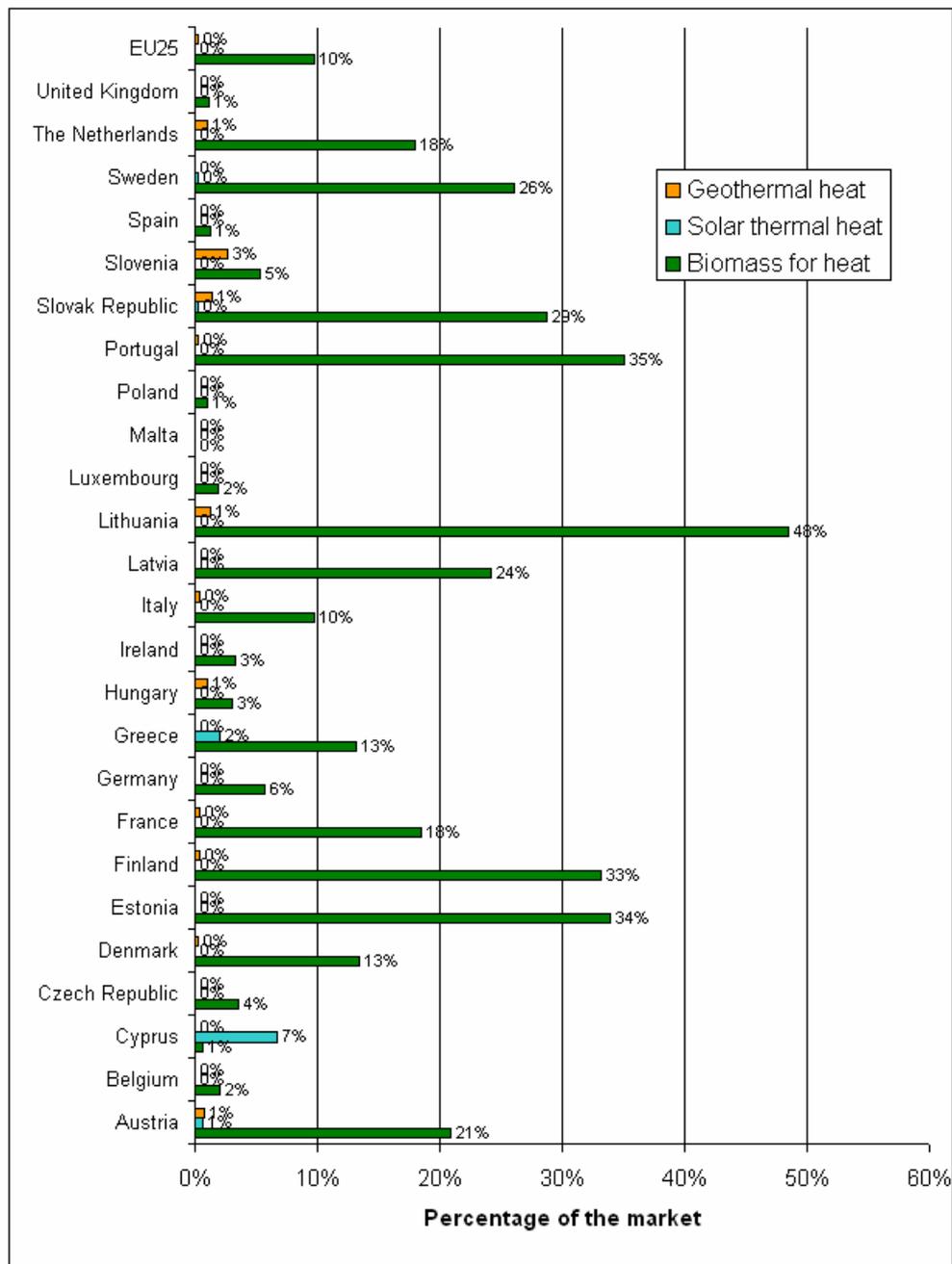
Wood chips from forest and industrial residues are the appropriate biofuels for medium to large scale boilers. It can be used in boiler for heat only applications or for cogeneration to supply a district heating system for example. The latest year's also pellets have shown an increasing use in medium to large scale boilers parallel to the growing production and trade.

The total number of installed stoves and boilers has more than trippled from 2001 to 2004 and was more then 350 000 units 2004 in the dominating pellet using countries SE, AT, DE, DK, FI, IT and PL<sup>13</sup>.

<sup>12</sup> SEC(2004) 547, European Commission, " The share of renewable energy in the EU. Country Profiles. Overview of Renewable Energy Sources in the Enlarged European Union", as support to COM(2004)366

<sup>13</sup> Source: Altener project, Pellets for Europe, [www.pelletcentre.info](http://www.pelletcentre.info)

Figure 5 : Shares of the market \* for biomass for heat, solar thermal heat and geothermal heat <sup>14</sup>



\* as broad approximation, the volume of the heat market is assimilated to the final energy consumption minus the transport and electricity sectors. Non energy uses are not taken into account in the final energy consumption. However electricity consumption for heat is not considered.

<sup>14</sup> 1. SEC(2004) 547, European Commission, " The share of renewable energy in the EU. Country Profiles. Overview of Renewable Energy Sources in the Enlarged European Union", as support to COM(2004)366  
 2. European Commission, 2004, "EU energy and transport in figures", statistical pocket book 2004

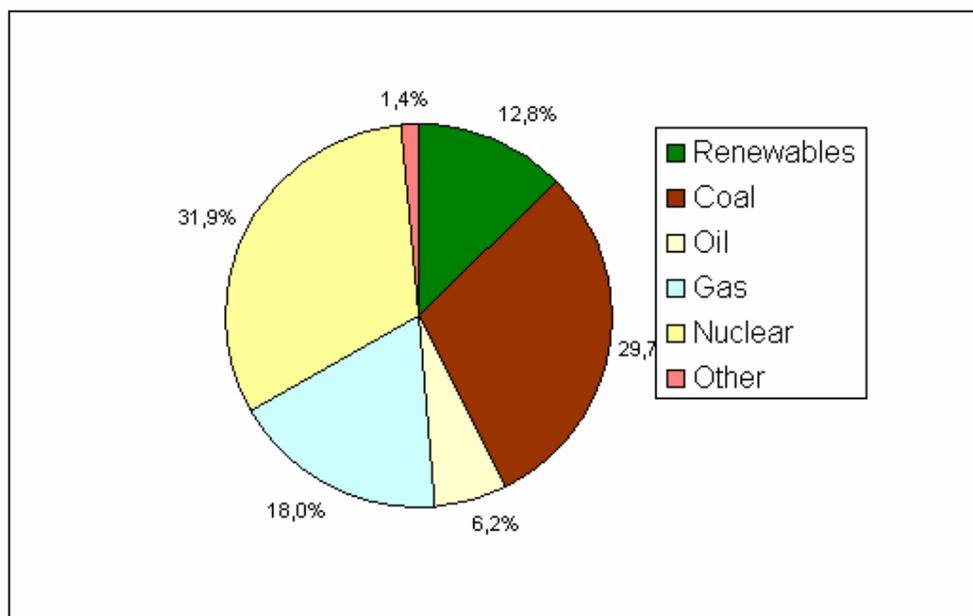
Biogas is also used for heat purposes (about 40%) but the growth rate in this sector is much smaller than expected (3,2 Mtoe for crude biogas in 2003 against 15 Mtoe expected in the White Paper for 2010).

## Bioelectricity

*Bioelectricity represents more than 50% of renewable electricity in some countries*

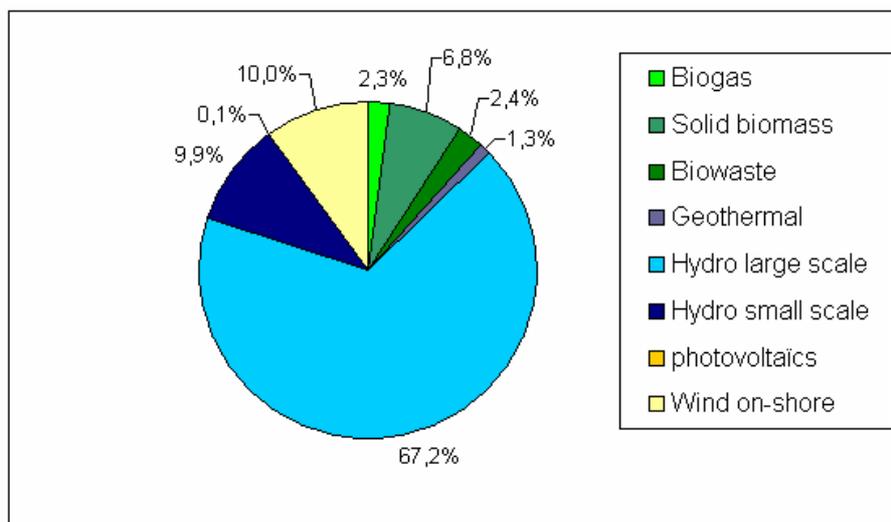
Renewable electricity accounts for 12,8% of the total electricity production in EU25. Bioelectricity still represents a small share of the total renewable electricity in Europe, almost 12%. In some countries however bioelectricity represents almost half of the renewable electricity or more, like in BE, EE, FI, NL and UK.

Figure 6 : Electricity production by fuel in EU25 (total 3018 TWh in 2002)<sup>15</sup>



<sup>15</sup> European Commission, 2004, "EU energy and transport in figures", statistical pocket book 2004

Figure 7 : Renewable electricity in 2002 (380 415 GWh in EU25)<sup>16</sup>



Bioelectricity in Europe is mainly produced from solid biomass in the form of wood chips (FI, SE, ES), industrial by-products like black liquor or waste wood (SE, DE, FR, DK, UK) and biogas from landfill and animal manure (DE, IT, ES, FR).

Adapted technologies for electricity production from biomass **combustion** are available and operative through conventional steam turbines. Cogeneration makes sense to improve global efficiency and where district heating facilities are widespread. Condensing power plants can also improve efficiencies.

**Co-firing** of biomass in coal power plants allows a quick move towards more biomass use in electricity production. It is favoured by the possibilities to integrate biomass as zero emission fuel within the Emission Trading scheme.

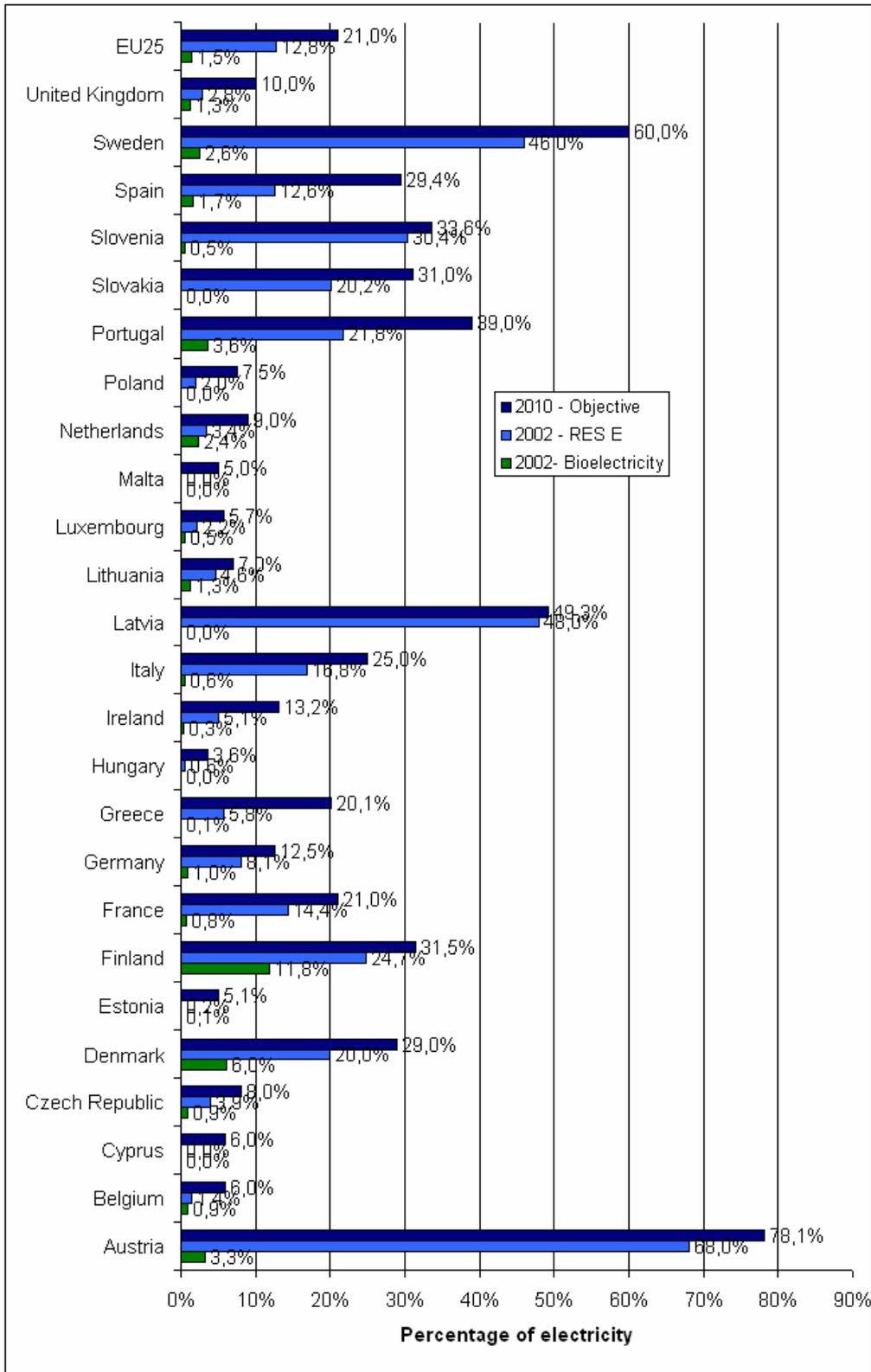
Biomass **gasification** has started its commercial development for large scale applications (> 10 MW) with a few operative sites (Güssing- AT, Lathi - FI, Ruien-BE). Smaller scale (< 1 MW) is still at a demonstration scale but looks promising for decentralised applications.

Innovative systems like the organic rankine cycle (ORC) for cogeneration are also emerging commercially. In the future research, development and demonstration efforts will help new promising technologies like stirling motor and micro gas turbine to develop.

<sup>16</sup> SEC(2004) 547, European Commission, " The share of renewable energy in the EU. Country Profiles. Overview of Renewable Energy Sources in the Enlarged European Union", as support to COM(2004)366

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Figure 8 : Renewable electricity shares in 1997, 2002, of which bioelectricity, and objectives for 2010 <sup>17</sup>



<sup>17</sup> SEC(2004) 547, European Commission, " The share of renewable energy in the EU. Country Profiles. Overview of Renewable Energy Sources in the Enlarged European Union", as support to COM(2004)366

Introduction of relevant steering instruments has shown a potential to almost treble cogeneration in the Swedish industry and in district heating systems from 2003 to 2010. Bioelectricity will target 16 TWh in 2010. Bioelectricity alone will probably fill the national target of 10 TWh new renewable electricity by 2010 from 2002 level.

In recent years bioelectricity grew constantly only in FI, SE, DK and UK.

*Bioelectricity progression is weak ...*

According to the Commission (COM(2004)366) the overall target of 22% green electricity for EU15 in 2010 will not be met under current policies even under a scenario of reduced total electricity demand due to energy efficiency measures. On the basis of current trends, it is likely that 18 to 19% will be produced, and this is partly explained by a poor performance of bioelectricity.

However, there are considerable differences between the countries. EU 15 countries can be roughly divided into three groups that are more or less on track to reach their targets for the share of green electricity:

- DK, FI, DE and ES have initiated energy policies that should allow them to achieve their national targets.
- AT, BE, FR, IE, NL, SE and UK have started to implement appropriate policies that could allow them to reach their objectives.
- EL and PT need to reassess their policies if they also wish to be on the track.
- IT and LU adopted new laws in March 2004. The effects have not been assessed until now.

The situation in new member states will be assessed later, as their first progress reports is not due until 2006.

*... and its objective has been revised downwards*

Consequently the target of the White Paper for bioelectricity is revised by the Commission downwards to 162 TWh (against 44 TWh in 2002), meaning a challenging 18% growth per year compared with 7% for the past years (see also Tableau 3).

## Liquid biofuels

*Liquid biofuels capacities are increasing*

Liquid biofuels amounted to 1982 ktoe in 2004 or about 0,7% of the market, dominated by biodiesel (Figure 9)<sup>18</sup>. Biodiesel from rapeseed is the most common with a production of almost 2 Mt in 2004, mainly in DE, FR and IT. Biodiesel is mainly used in low blending with diesel, but high blends and pure biodiesel are also on the market.

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<sup>18</sup> 1. Euroserv'ER, 2005, "Biofuels barometer", in Systèmes Solaires n°167, June 2005  
2. AEBIOM calculation, based on total market of 2002 from Eurostat

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Figure 9 : Share of biodiesel and bioethanol in 2004<sup>18</sup>

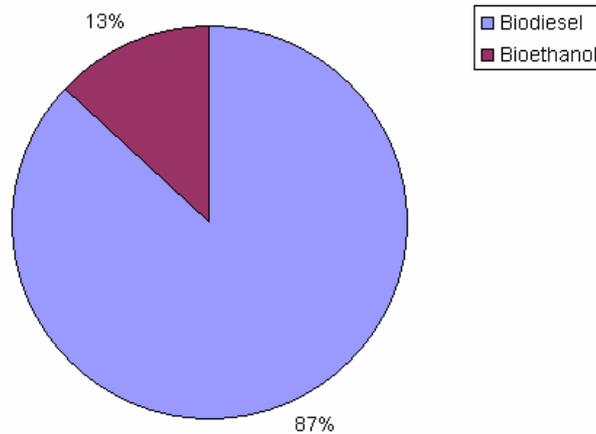
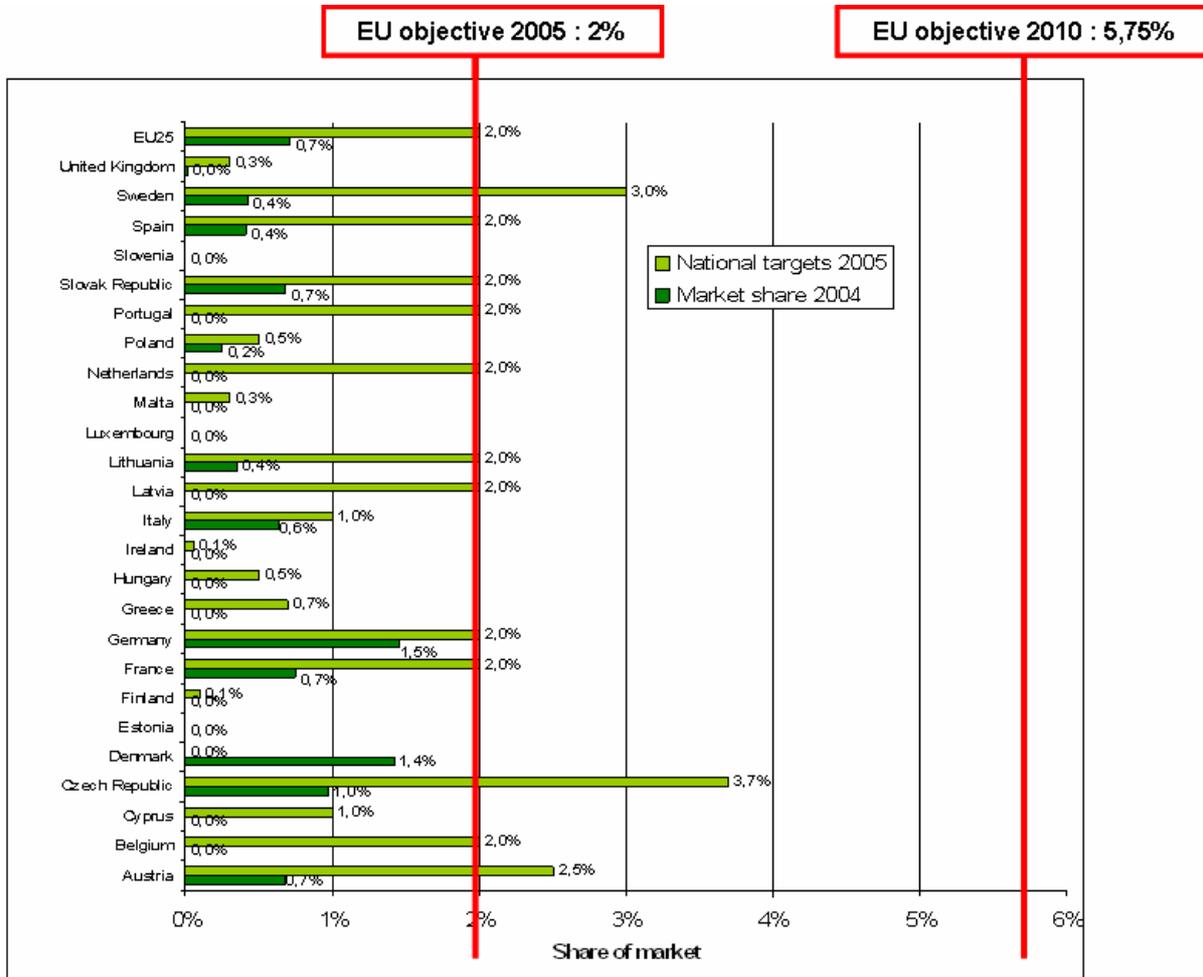


Figure 10 : Liquid biofuels market development in 2004, national objectives for 2005 and EU objectives for 2005 and 2010 (% of the market)<sup>19</sup>



Ethanol is mainly produced in ES, FR and SE for a total of almost 500 000 t in 2004. Wheat and to a lesser extend sugar-beet and cellulose from wood are the raw

<sup>19</sup> 1. Euroserv'ER, 2005, "Biofuels barometer", in Systèmes Solaires n°167, June 2005  
2. European Commission, paper by P. Hodson

materials. Ethanol is used as low blending with gasoline, at high blending for adapted vehicles (flexi fuel) or even in a pure form, but most of it is processed into ETBE (Ethyl Tertio Butyl Ether) as additive to gasoline.

Other transport fuels are developed at currently lower market volume like biogas in Sweden or pure vegetable oil in Germany.

*A new impulse with the European directive 2003/30*

Thanks to a new impulse given by European directives 2003/30 and 2003/96 member states were forced to consider liquid biofuels development in their country (Figure 10) and many new production units are planned.

## 2. National trends and objectives

### 2.1. Austria

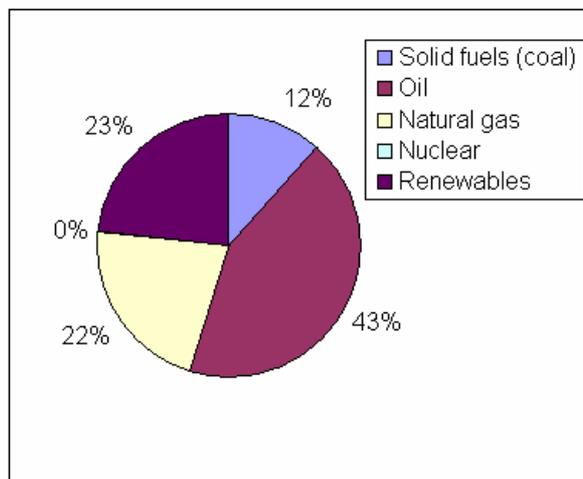
#### 2.1.1. Bioenergy overview

*Biomass covers 11% of the primary energy supply*

The Austrian energy supply is based on a balanced mixture of energy sources, which is characterized by the prominent role of renewables. The energy supply is based on oil (43 %), gas (22 %), renewables (23 %) and coal (12 %) (Tableau 4).

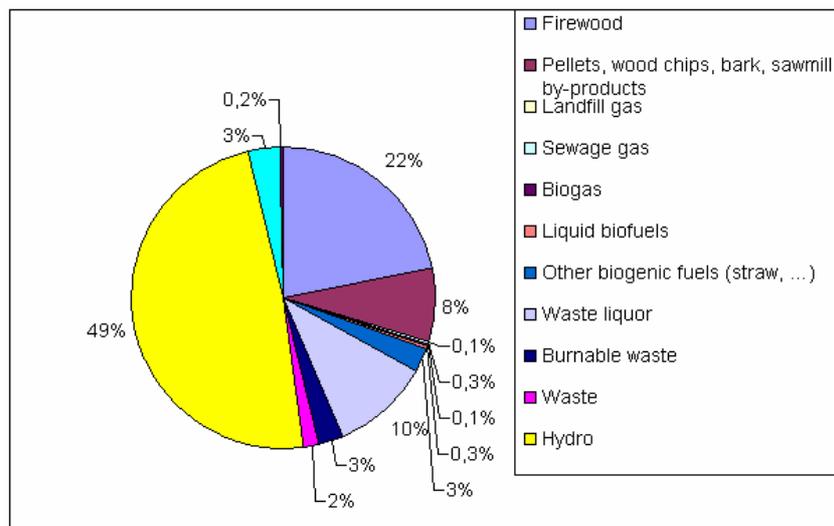
Hydropower and biomass are the two main sources of RES. Biomass covering about 11 % of the primary energy supply and hydropower 12 %. Biomass in Austria consists mainly of firewood, pellets, wood chips, bark, sawmill by-products, straw, black liquor and biogas (Tableau 5).

Tableau 4 : Primary Energy in Austria (total is 30,5 Mtoe in 2002)<sup>20</sup>



<sup>20</sup> AUSTRIAN ENERGY AGENCY (2004): Daten zu erneuerbarer Energie in Österreich 2004, Wien, Juli 2004.

Tableau 5 : Breakdown of renewables (total is 7063 ktoe in 2002)



*Biomass should be increased by 75%*

In 2003 the Austrian government formulated the following targets for RES and bioenergy:

- to increase the share of RES in primary energy supply by 1 % per year; this results in a 30 % share of RES in 2010 (based on 23 % in 2002);
- to increase the contribution of biomass by 75 % until 2010;
- to increase the share of green electricity up to 78,1 % until 2008;
- to support biofuels.

At the end of 2004 the Austrian Energy Agency analysed if those targets will be reached until 2010. The analysis is based on the WIFO<sup>21</sup>-baseline-scenario, which calculates with an annual increase of primary energy supply in Austria from 2000 to 2010 by 1,3 %. The main conclusion of this analysis is that the 30 % share of RES in primary energy supply (9,51 Mtoe) in 2010 will not be reached. Following the current trends only a share of 27,9 % RES will be reached in 2010. The target to increase the contribution of biomass by 75 % (+1,55 Mtoe) until 2010 will be reached. According the current trends an increase of 94 % from 2,07 Mtoe in 2000 up to 4,02 Mtoe in 2010 is forecasted.

Biomass contains the energy sources firewood, pellets, wood chips, bark, sawmill by-products, landfill gas, sewage gas, biogas, liquid biofuels, other biogenic fuels (straw,...). Waste liquor, burnable waste and waste are not included in the 75 % target for biomass, but they are included in the 30 % RES target.

*Biomass should provide 5679 ktoe primary energy in 2010*

<sup>21</sup> WIFO: Austrian Institute of Economic Research, ÖSTERREICHISCHES INSTITUT FÜR WIRTSCHAFTSFORSCHUNG – WIFO (2001): Energieszenarien bis 2020, im Auftrag des BMWA und BMLFUW, Wien, April 2001

According to the targets of the Austrian government on RES the total utilisation of biomass in Austria should be increased from 2928 ktoe in 2000 to 5679 ktoe in 2010, with the following breakdown :

- transport sector (mobility) : increased from 17,4 ktoe in 2000 to 521 ktoe in 2010
- biomass for electricity sector (CHP) : 835 ktoe in 2000 to 2152 ktoe in 2010
- biomass for heat sector : 2075 ktoe to 3007 ktoe.

With those targets in 2010 a share of 29,9 % RES could be reached and the contribution of biomass would be increased by 125 %. Within the heat and electricity market biomass and biogas plants with a total investment of 4800 M€ will have to be installed.

These targets are more detailed below for each of these sectors.

#### *The potential reaches more than 8000 ktoe*

The available biomass potential to provide the necessary biomass primary energy for the heat and electricity sector is estimated with 8217 ktoe, from which 3958 ktoe would come from forestry by products, 1134 ktoe from refined wood and 1319 ktoe from solid industrial residues<sup>22</sup>.

### **2.1.2. Heat trends and targets**

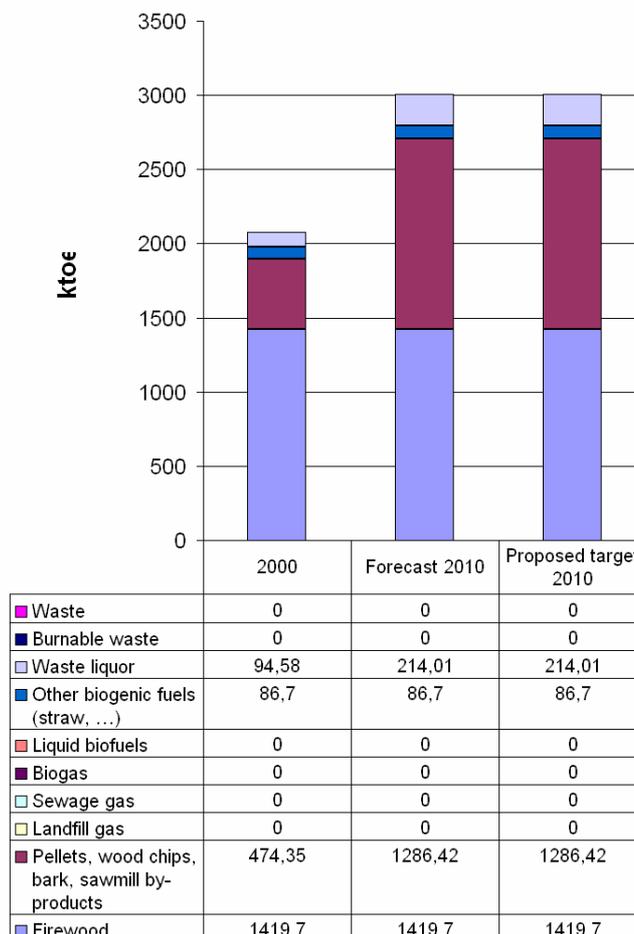
#### *About 1000 ktoe additional biomass for heat in 2010*

It is forecasted that under the current RES supporting policies and expected market conditions the utilisation of biomass, including waste liquor, burnable waste and waste, in the heat market will increase from 2075 ktoe in 2000 up to 3006 ktoe in 2010. If this forecast can be realised then the proposed target of the Austrian Biomass Association for 2010 can also be reached.

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<sup>22</sup> BTG (2004): Bioenergy`s role in the EU energy market – A view of developments until 2020; report to the European Commission, 2 April 2004.

Tableau 6 : Forecast of Austrian Energy Agency and proposed targets of the Austrian Biomass Association for biomass for heat\*



\* this figure includes waste to be consistent with national objectives and Eurostat statistics. However waste cannot be considered as biomass and should be treated separately according to the Austrian Biomass Association.

The additional biomass for the heat sector would come from pellets, wood chips, bark and sawmill by-products (812 ktoe) and from waste liquor (119 ktoe), whereas firewood consumption is estimated to remain stable at a level of about 1420 ktoe.

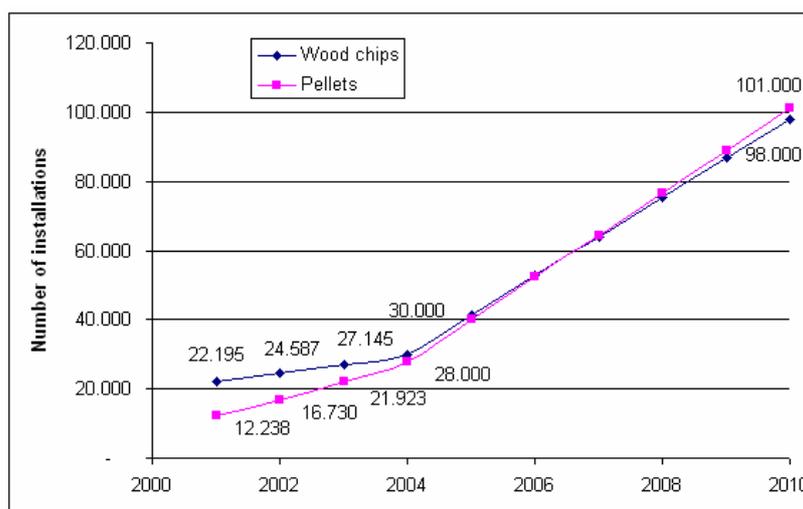
It is expected that from the additional 812 ktoe of biomass primary energy 50,5 % will be used in wood chips and bark heating systems, 26,3 % in biomass district heating plants and 23,2 % in pellet heating systems. For the installation of the additionally needed biomass district heating plants, woodchips and pellets heating systems a total investment of about 3300 M• will be needed.

### Individual heating systems

*Trebling wood chips and pellets systems by 2010*

Nearly two thirds (60 %) of biomass in Austria is used in the low temperature range by small domestic consumers burning firewood, wood chips or pellets in individual heaters or central heating furnaces<sup>23</sup>. Biomass use in individual heating systems in 2002 can be calculated with 1843 ktoe. In slightly less than 500000 principal domiciles biomass is used for individual heaters or central heating systems. The majority of these installations are operated in line with modern combustion technology. The efficiency of the new devices rose from an average 60 % to 80 % in the course of the past years. In order to achieve further handling comfort when using biomass, pellets have been increasingly promoted over the past years and the expected results have materialised: Pellet fired installations growth rate significantly surpassed those fired with wood chips. At the end of 2004 about 30000 wood chips heating systems and 28000 pellet heating systems were installed in Austria within a capacity range of up to 100 kW<sup>24</sup>. To reach the defined targets for 2010 additionally 68000 wood chips heating systems (Ø 35 kW) and 73000 pellet heating systems (Ø 15 kW) will have to be installed (Tableau 7).

Tableau 7 : Trend in number of wood chips and pellets heating systems and targets for 2010



**Industry**

Almost one third of the entire biomass input is used for the generation of process heat (21 %) and in combined heat and power plants (11 %). The most important branches in industry using this mostly in-house biomass (sawmill by-products like bark and wood chips, waste liquor) are sawmills, paper and wood pulp industry and wood working industry. In 2002, 645 ktoe of biomass were used for process heat and about 338 ktoe for combined heat and power.

<sup>23</sup> AUSTRIAN ENERGY AGENCY (2004): Daten zu erneuerbarer Energie in Österreich 2004, Wien, Juli 2004

<sup>24</sup> JONAS, A. AND H. HANEDER (2003, 2004, 2005): Zahlenmäßige Entwicklung der modernen Holz- und Rindenfeuerungen in Österreich, NÖ-Landes-Landwirtschaftskammer, St. Pölten, 2003, 2004 und 2005.

## District heating

### *About 1000 new district heating plant have to be installed by 2010*

About 8 % of biomass in Austria is used in the low temperature range by district heating plants burning biogenic fuels (bark, sawmill by-products, wood chips, straw). In 2002 about 245 ktoe of biomass were used for district heating. In many cases the heating plants are built and operated by small cooperatives founded by farmers. 843 plants had become operational by the end of 2003 with a capacity of 1,005 MW. To reach the targets for 2010 additionally 994 biomass district heating plants (Ø 1 MW) will have to be installed.

### 2.1.3. Cogeneration trends and targets

In Austria there is no plant in operation for electricity only production. Only cogeneration has to be taken into consideration.

#### *Austria feed-in tariff are boosting bioelectricity*

In the year 2000 Austria got a modern legislation to foster the development of electricity production from wind, biomass, PV and small hydro. According to this new legislation 4 % of the electricity produced will have to come from biomass, wind or photovoltaic in 2007. To reach these targets since the year 2003 new feed-in tariffs exist, which have to be paid to the independent producer of electricity. These new feed-in tariffs have triggered a rapid development in the installation of biomass and biogas CHP plants.

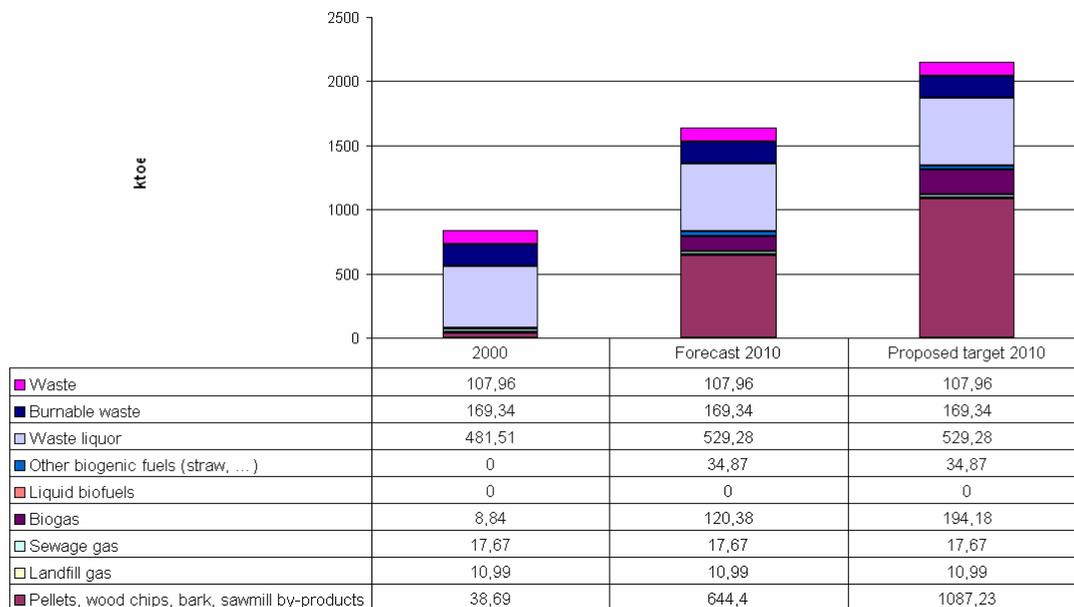
It is forecasted that under the current RES supporting policies and expected market conditions the utilisation of biomass in the electricity market will increase from 835 ktoe to 1634 ktoe in 2010. To reach the proposed target for 2010 the utilisation of biomass in the electricity market would have to be increased up to 2151 ktoe.

The additional biomass for the electricity generation to reach the defined targets for 2010 shall come from pellets, wood chips, bark and sawmill by-products (+ 1048 ktoe), biogas (+ 185 ktoe), other biogenic fuels like straw (+ 35 ktoe) and from waste liquor (+ 48 ktoe).

To reach the Austrian targets of the RES electricity directive (78,1 %) based on the forecasted electricity consumption for 2010 (71,9 TWh), 2,71 TWh of electricity should be produced from solid biomass, 0,79 TWh from biogas, 0,19 TWh from landfill and sewage gas or other biogenic fuels and 1,54 TWh from waste liquor.

For the installation of the necessary plants based on solid biomass and biogas a total investment of about 1500 M• will be needed.

*Tableau 8 : Forecast of Austrian Agency and proposed targets of the Austrian Biomass Association for biomass for cogeneration\**



\* this figure includes waste to be consistent with national objectives and Eurostat statistics. However waste cannot be considered as biomass and should be treated separately according to the Austrian Biomass Association.

## Industry

### 39 new CHP plants

In 2000 the industry utilised 62 ktoe of biomass (pellets, wood chips, bark, sawmill by-products, landfill and sewage gas) as well as 481 ktoe of waste liquor, 169 ktoe of burnable waste and 108 ktoe of waste in cogeneration plants. For 2010 it is forecasted that the industry will utilise 319 ktoe of pellets, wood chips, bark and sawmill by-products, 29 ktoe of landfill and sewage gas, 35 ktoe of other biogenic fuels (e.g. straw) as well as 529 ktoe of waste liquor, 169 ktoe of burnable waste and 108 ktoe of waste in cogeneration plants. It is estimated that in 2010 about 39 CHP plants based on pellets, wood chips, bark and other sawmill by-products with 138,8 MW<sub>el</sub> will be in operation in industry, for a production of about 833 GWh.

## District heating

### *490 new small CHP plants operated by farmers*

In 2000 about 5,3 ktoe of biomass (pellets, wood chips, bark, sawmill by-products) were utilised by electricity utilities in cogeneration plants. For 2010 it is forecasted that 278 ktoe of pellets, wood chips, bark and sawmill by-products will be utilised by electricity utilities (36 CHP plants with 120,6 MW<sub>el</sub>) and 11,3 ktoe by cooperatives of farmers operating district heating plants (10 CHP plants with 4,9 MW<sub>el</sub>). To reach the targets for 2010 additionally 443 ktoe will have to be utilised by farmers in district heating plants. Therefore additionally 490 CHP plants based on pellets, wood chips, bark and other sawmill by-products with 172 MW<sub>el</sub> will have to be operated by cooperatives of farmers (Ø 350 kW<sub>el</sub>).

## Others

### *85 new biogas plants*

In 2000 about 8,8 ktoe of biogas were utilised by farmers and cooperatives of farmers in cogeneration plants. For 2010 it is forecasted that 120 ktoe of biogas will be utilised by farmers in cogeneration plants (280 biogas plants with 70 MW<sub>el</sub>, Ø 250 kW<sub>el</sub>). To reach the targets for 2010 additionally 74 ktoe of biogas will have to be utilised by farmers (85 biogas plants with 43 MW<sub>el</sub>, Ø 500 kW<sub>el</sub>).

Furthermore for 2010 it is forecasted that 36 ktoe of pellets, wood chips, bark and sawmill by-products will be utilised by other operators (10 CHP plants with 15,7 MW<sub>el</sub>, Ø 1,57 MW<sub>el</sub>).

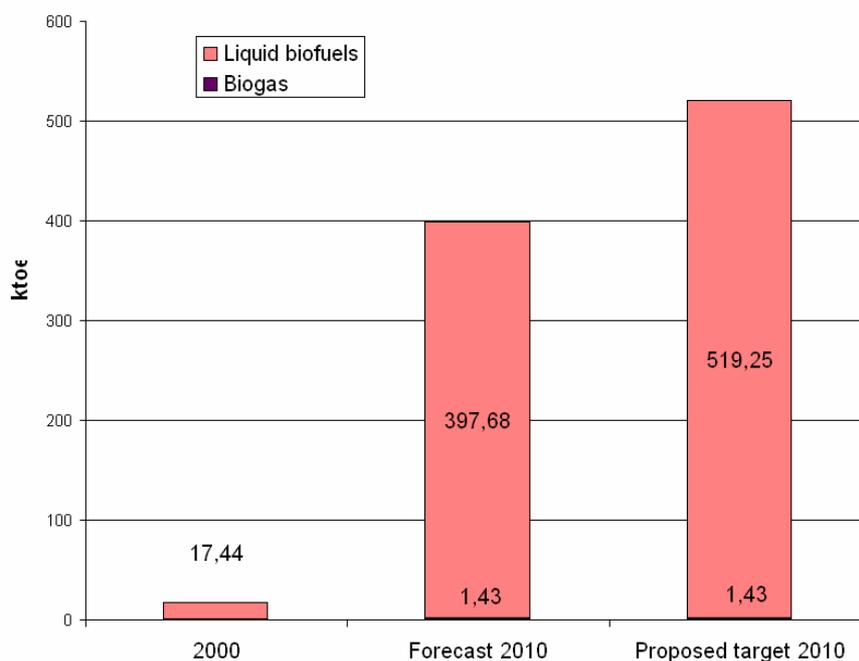
## 2.1.4. Liquid biofuels trends and targets

### *Reach 4,3% in 2007 and 5,75% in 2010 or 521 ktoe*

According to the implementation of the EU Biofuels Directive 2003/30 in Austria from 1 October 2005 at least 2,5 % (calculated on the basis of energy content) of total fuels placed on the market must be of biogenic origin. This percentage should increase to 4,3 % in 2007 and to 5,75 % in 2008.

In the WIFO-Baseline-Scenario the national sale of mineral oil products in the transport sector in 2010 in Austria is predicted at 6950 ktoe. Based at this figure the biofuel demand in 2010 to fulfil the 5,75 % target would be 399 ktoe. In a new prognosis of fuel consumption the Federal Environment Agency estimated the national sale of mineral oil products in the transport sector in 2010 in Austria at 9052 ktoe. Based at this figure the biofuel utilisation should increase from 17 ktoe in 2000 to 521 ktoe in 2010 to fulfil the 5,75 % target.

Tableau 9 : Forecast and proposed targets for liquid biofuels



The current production capacity of biodiesel in Austria amounts to just over 100000 tonnes per year. There are currently nine large-scale and three pilot biodiesel plants in operation in Austria. In 2003, 55000 tonnes of biodiesel were produced in Austria. From this quantity, however, approximately 90 % was sold abroad, as the price which can be obtained for biodiesel in Italy and Germany is currently higher than that in Austria<sup>25</sup>.

To reach the 5,75 % target in 2008 the following production are required :

- about 480000 tonnes of biodiesel
- about 150000 tonnes of bioethanol
- about 1732 tonnes of bio-methane

### 2.1.5. Objectives for Austria

In 2003 the Austrian government formulated the following targets for RES and bioenergy:

- to increase the share of RES in primary energy supply by 1 % per year; this results in a 30 % share of RES in 2010
- to increase the contribution of biomass by 75 % until 2010
- to increase the share of green electricity up to 78,1 % until 2008
- to support biofuels

<sup>25</sup> UMWELTBUNDESAMT (2004): Biofuels in the transport sector in Austria in 2004, Report – Summary of information from the Republic of Austria in accordance with Article 4(1) of Directive 2003/30/EC for the reporting year 2003, Vienna, June 2004.

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Those targets can only be fulfilled, if the total utilisation of biomass in Austria will be increased from 2928 ktoe in 2000 to 5679 ktoe in 2010. Therefore the Austrian Biomass Association has defined the following targets how the contribution of biomass should be increased within the different energy sectors:

- transport sector (mobility): from 17,4 ktoe in 2000 to 521 ktoe in 2010
- biomass for electricity sector (CHP): from 835 ktoe in 2000 to 2152 ktoe in 2010
- biomass for heat sector: from 2075 ktoe in 2000 to 3007 ktoe in 2010

The realisation of the additional biomass and biogas installations within the heat and electricity market would lead to a total investment of 4800 M• with very positive effects on the further development of the bioenergy industry as well as for the rural development in Austria.

*Tableau 10 : Summary table of reference bioenergy use and objectives of the Austrian Biomass Association*

Categories	Fuel type	Reference year 2000				Objectives of ABA for 2010			
		Biomass required (ktoe primary energy)	Bioheat (ktoe final energy)	Bioelectricity (GWh final energy)	Liquid biofuels (ktoe)	Biomass required (ktoe primary energy)	Bioheat (ktoe final energy)	Bioelectricity (GWh final energy)	Liquid biofuels (ktoe)
Biomass for heat	Firewood	1420	923	NR	NR*	1420	1136	NR	NR*
	Pellets, Woodchips, bark, sawmill by-products	474	379	NR	NR	1286	1029	NR	NR
	Other	181	145	NR	NR	301	241	NR	NR
	Sub-total	2075	1447	NR	NR	3007	2405	NR	NR
Biomass for cogeneration	biogas	9	4	36	NR	194	87	790	NR
	Pellets, Woodchips, bark, sawmill by-products	39	23	90	NR	1087	652	2529	NR
	Other	787	433	2290	NR	870	479	2530	NR
	Sub-total	835	460	2416	NR	2152	1218	5849	NR
Biomass for liquid biofuels	Biodiesel		NR	NR	17,44		NR	NR	396
	Bioethanol		NR	NR	-		NR	NR	124
	Biogas		NR	NR	-		NR	NR	1
	Sub-total		NR	NR	17		NR	NR	521
<b>Total</b>		<b>2910</b>				<b>5158</b>			

\* NR = Not Relevant

## 2.2. Belgium

### 2.2.1. Bioenergy overview

*Renewables represent about 1% of primary energy consumption for the year 2003*

Belgium is a Federal State consisting of 3 regions : the Walloon Region, the Flemish Region and the Brussels-Capital Region. The evolution of the Belgian energy policy has been shaped by the general political evolution of Belgium, leading to the transfer of large competence from the State to the Regions. This evolution is also inscribed in the building of Europe and the greater role played by the European Union institutions in the major political and socio-economic choices, in particular in the field of energy. The Federal government keeps full control over the national energy policy. The Belgian reform of 1988 gave autonomous competencies to the Regions, in particular with respect to rational use of energy and renewable energy.

One of the strengths of Belgium's energy economy is the great importance of oil products, natural gas and nuclear power<sup>26</sup>. Renewables represent about 1% of primary energy consumption for the year 2003<sup>27</sup>. Bioenergy covers more than half of the renewable electricity and almost all renewable heat (*Figure 12, Figure 13*).

For the future, the 31 January 2003 law put down the gradual exit from nuclear power to produce electricity. Except in case of absolute necessity, related to electricity security supply, all Belgian nuclear power plants will be closed at the end of a 40 years use period (between 2015 and 2025). It will be forbidden to implement any new atomic reactor in Belgium.

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<sup>26</sup> Marchal D. [2002]. Biomass survey in Europe (Eubionet), country report of Belgium (<http://www.eubionet.net>).

<sup>27</sup> Federal Public Service Economy, SMEs, Self-employed and Energy (<http://mineco.fgov.be>, 09.05.2005).

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Figure 11 : Primary energy consumption in Belgium (1998 – 2003), total and renewable<sup>27</sup>

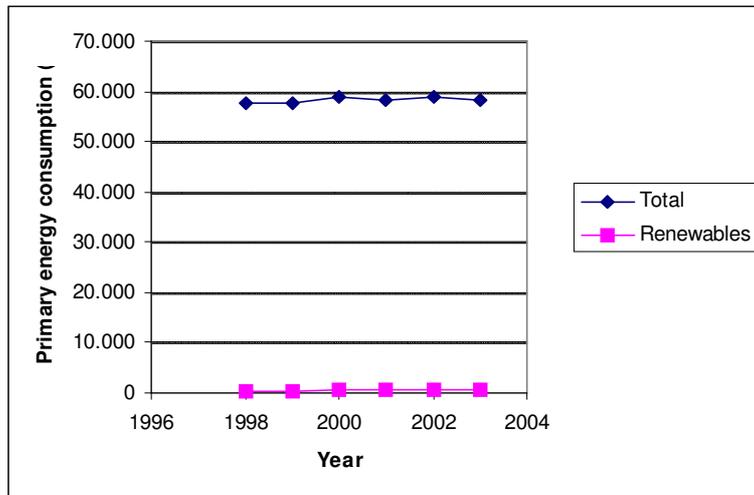


Figure 12 : Breakdown of electricity from renewables in Belgium, 2001

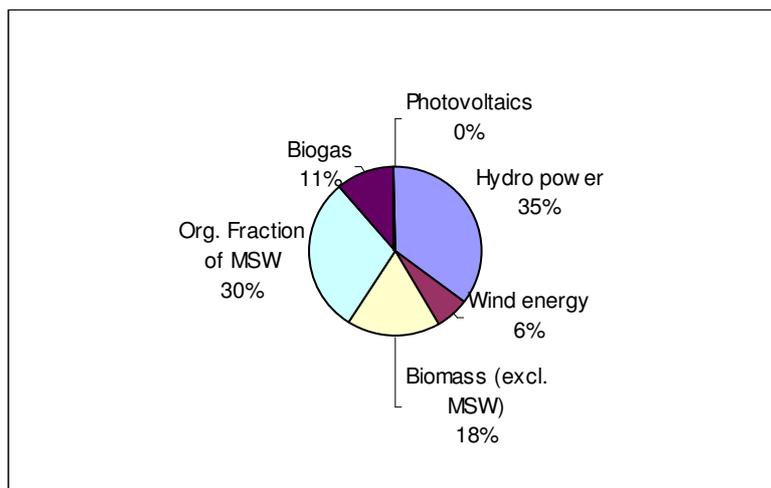
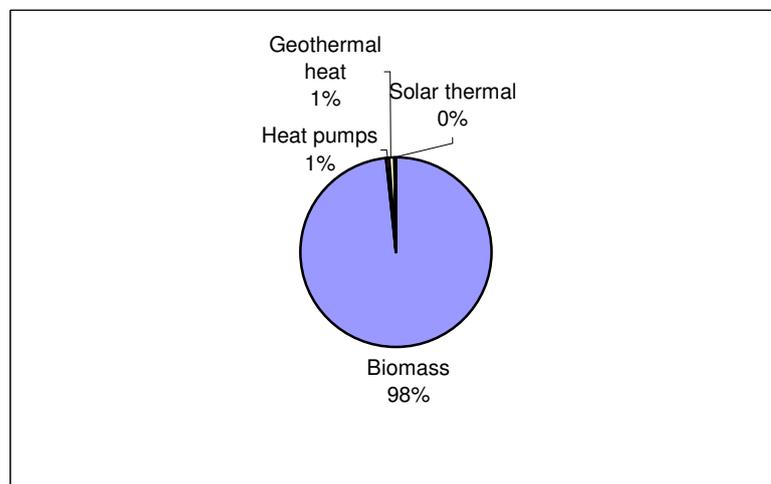


Figure 13 : Breakdown of heat from renewables in Belgium, 2001



## 2.2.2. Heat trends and targets

### *8,4% of total final heat consumption from biomass by 2010 in Wallonia*

In Belgium, following Palmers et al. [2004]<sup>28</sup>, the overall penetration of heat from renewable energy sources amounted up to 391 ktoe in 2001. The major contribution to the overall RES-H generation came from biomass (384 ktoe in 2001).

In the Walloon Region for the year 2000, the amount of heat produced from dry biomass was about 258 ktoe (forest residues, industrial by-products, fire wood. More than half are produced (simultaneously with 12,8 ktoe “green” electricity) by Burgo Ardennes plant (wood pulp industry)<sup>29</sup>.

The Walloon Government noted the Plan for Sustainable Energy Management in its 18 December 2003 session. This Plan is indicative but gives the Walloon political lines in the field of energy. Targets for 2010 are given in the Tableau 11.

*Tableau 11 : Heat production from biomass by 2010 in Wallonia<sup>30</sup>*

Renewable energy	ktoe	% of total final heat consumption
Forest and agricultural residues, wood logs and energy crops	352,5	8,2
Anaerobic fermentation	8,6	0,2
Total biomass	361,1	8,4
Total renewable energies	374,9	9

The greatest part of « green heat » will be produced from woody biomass (forest and agricultural residues, energy crops).

Total for renewable energies represents 9% of the heat final consumption in Wallonia (it represented 6% for the year 2000, or 256,8 ktoe).

Concerning heat trends and targets for Flanders, there are no recent detailed data.

<sup>28</sup> Palmers G., et al. [2004]. Renewable energy evolution in Belgium 1974 – 2025, part I – Sustainable production and consumption patterns. Brussels, Belgian Science Policy, 140 p.

<sup>29</sup> Gouvernement wallon [2003]. Plan wallon pour la maîtrise durable de l'énergie. For more information, see <http://energie.wallonie.be>.

<sup>30</sup> Gouvernement wallon, 2003

## Individual heating systems

### *54000 households using wood as main energy source for heating in 2001*

Following the INS figures (National Statistic Institute), there were about 54000 households using wood as main energy source for heating in 2001.

The situation is quite different today, because there is a renewed interest for wood-heated systems, especially because of the fuel oil prices increase. New solid biofuels arise on the fuel market, as pellets for example.

Nevertheless, it is not yet possible to give accurate figures to illustrate this situation. A first evaluation was performed in the field of pellets market by ValBiom for Wallonia<sup>31</sup>. By the end of 2004, there were 29 pellets boilers and 298 pellets stoves in Wallonia. There was an important increase between 2003 and 2004.

### *2 000 new wood heating systems by 2010 in Wallonia*

Targets for 2010 : to reach the objectives of the Walloon Plan for Sustainable Energy Management, it would be necessary to install about 50 MW in wood heating systems (boilers and stoves). It represents about 2000 new heating units (boilers or stoves), a consumption (wood primary energy, mainly pellets but also wood logs) of about 202 GWh (17,4 ktoe).

## Industry

The first developments of wood-based heating systems in industry were in the field of wood industry chain (sawmill, ...). For the year 2003, there were about 40 companies which were using wood as main energy source for heating.

For the year 2001, biomass represented 190,9 ktoe for final energy consumption in the Belgian industry sector<sup>32</sup>.

### *Further 100 MW installed in industrial wood heating systems by 2010 in Wallonia*

Targets for 2010 : : to reach the objectives of the Walloon Plan for Sustainable Energy Management, it would be necessary to install about 97 MW in wood heating systems. It represents about 50 new heating units, a consumption (wood primary energy) of about 850 GWh (73,1 ktoe).

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<sup>31</sup> Marchal D. [2005]. Le marché des granulés de bois en Wallonie. Bulle (Switzerland), 5<sup>ème</sup> Forum suisse sur les granulés de bois.

<sup>32</sup> Energy data for the Walloon Region 1990 - 2001 (ICEDD, 2003).

## District heating

At the present time, there are several projects of wood district heating systems in rural cities in Wallonia. The first of them should begin during winter 2005 – 2006.

### *Further 31 MW installed in wood heating district systems by 2010 in Wallonia*

Targets for 2010 : to reach the objectives of the Walloon Plan for Sustainable Energy Management, it would be necessary to install about 31 MW in wood heating district systems (mainly in tertiary sector). It represents about 52 new units, a consumption (wood primary energy) of about 125 GWh (10,7 ktoe).

## 2.2.3. Electricity and cogeneration trends and target

### *3,3% of total electricity consumption from biomass by 2010 in Wallonia*

For the period 1996 – 2001, the gross electricity consumption has increased with an average of 2,4% per year in Belgium, up to about 79,8 TWh en 2001. The electricity production from renewable energy sources (included large-scale hydro power) has increased with an average of 12% per year; from 538 GWh up to about 949 GWh in 2001. If large-scale hydro-power is excluded, the average is 14% per year from 438 GWh up to about 804 GWh in 2001.

During the period 1990 – 2001, the contribution from renewable electricity (excluding large-scale hydro-power) has grown from 0,7% to 1,0% in 2001. If large scale hydro power is included in RES-E, then the contribution from renewable electricity has grown from 1% en 1990 to 1,2% in 2001.

For the year 2001, electricity production from biomass (solid biomass, organic fraction of MSW and biogas) represented 59% of the RES-E production<sup>33</sup>.

Since the beginning of the year 2003, the Ruien Plant, in Flanders, makes possible to produce 17 MW from biomass. Electrabel Company has the objective to transform some plants producing electricity from coal to plants using biomass.

There are 104 sites in Wallonia receiving Green certificates for the production of electricity (electricity from renewables + quality CHP). It represents 474 MWe electric power<sup>34</sup>. Electricity from biomass represents 39% of total electric power from “green electricity” (186 MWe). It represents about 342 GWh (electricity from biomass + biomass CHP). One can notice the recent opening of a 100% biomass (wood pellets) power plant in Wallonia (80 MWe).

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<sup>33</sup> Palmers G., et al. [2004]. Renewable energy evolution in Belgium 1974 – 2025, part I – Sustainable production and consumption patterns. Brussels, Belgian Science Policy, 140 p.

<sup>34</sup> Commission wallonne pour l’Energie (CWAPE), <http://www.cwape.be> (09.05.2005).

For the Flemish Region, electricity from biomass represents 74% of the total electricity power from “green electricity” (213 MWe). The objective is to produce 6% of electricity from renewables by the year 2010. For the year 2002, there was an electricity production of about 120 GWh from biomass (and about 60 GWh from wind energy)<sup>35</sup>.

The reference target set by the European directive on RES-E is 6% electricity from renewables by the year 2010 for Belgium.

Targets defined in the Walloon Plan for Sustainable Energy Management<sup>36</sup> are given in the following table.

Tableau 12 : Electricity production target from renewables by 2010 in Wallonia<sup>36</sup>

Renewable energy	GWh in 2010	% of total consumption
Forest residues	370	1,5
Energy crops	225	0,9
Biomethanation/Landfill gas	225	0,9
Total biomass	820	3,3
Total renewable energies	2000	8

#### *820 GWh from biomass by 2010 in Wallonia*

Targets for 2010 : to reach the objectives of the Walloon Plan for Sustainable Energy Management, it would be necessary to produce 820 GWh from biomass in 2010. It represents a power of about 100 MWe.

To reach the Walloon objectives in the frame of “energy management” (heat and electricity from renewables, quality CHP from fossil fuels), the investments are evaluated to 720 M•, shared over the next 10 years (2003 – 2012). That means 72 M• each year (about 10% of the yearly investments for the electric sector at the present time). Investment related to CHP are evaluated to 400 M• and those related to heat production from renewables are evaluated to about 300 M•<sup>36</sup>.

All the investments for the Walloon Region should represent about 142 M• per year for the next 10 years.

If we assume the same rate for the Flemish Region, **total investments for Belgium should reach about 300 M• per year for the next 10 years**. Those figures are given as an indication. They should be confirmed (or adapted) in the future.

<sup>35</sup> Vlaamse Reguleringsinstantie voor de Elektriciteits-en Gasmarkt (VREG), [www.vreg.be](http://www.vreg.be) (09.05.2005).

<sup>36</sup> Gouvernement wallon [2003]. Plan wallon pour la maîtrise durable de l'énergie. For more information, see <http://energie.wallonie.be>

## 2.2.4. Liquid biofuels trends and targets

*Belgium adopted the EU targets of 2% liquid biofuels in 2005 and 5,75% in 2010*

Belgium has a relatively high consumption of fuel for transport (2,7 Mm<sup>3</sup> gasoline and 7,5 Mm<sup>3</sup> diesel in 2004, increasing globally by about 2% per year). 34% are consumed in the Walloon region.

Belgium decided on 4 March 2005 to adopt the targets proposed by the Directive 2003/30, 2% for 2005, increasing by 0,75% per year, to reach 5,75% in 2010. It means an objective of 585 ktoe of liquid biofuels by that latter year (199 ktoe for Wallonia).

*Companies have projects to build biodiesel and ethanol plants*

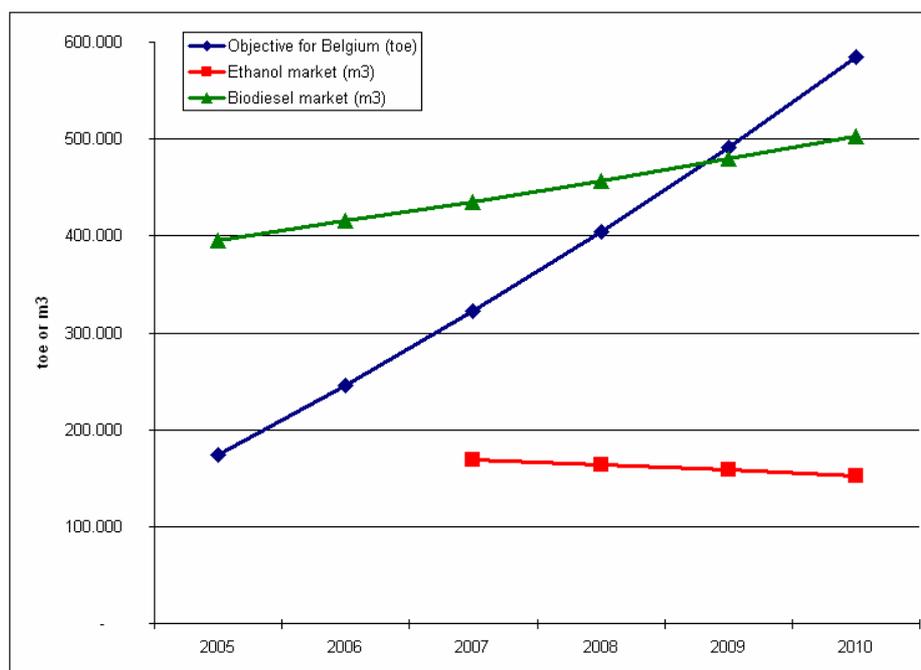
This objective is particularly challenging knowing that Belgium has only one biodiesel production plant. However many projects are discussed, backed up by several driving forces (vicinity to large harbours, strong agriculture in Wallonia, large markets in BE and NL due to existing large refineries). Planned capacities are as follow :

- 400 000 m<sup>3</sup> ethanol (2 projects)
- 500 000 m<sup>3</sup> biodiesel (4 - 5 projects)
- 2-30 000 m<sup>3</sup> rape oil (many projects at farm level and cooperatives)

It should be noted that the future biodiesel production capacity match the market needs while we can expect a capacity exceeding the demand for ethanol (Figure 14).

Globally the total investment would roughly reach 300 M• in the coming years.

Figure 14 : Objective for liquid biofuels in Belgium and potential market\*



\* potential market with 7%v ethanol (15% ETBE and 47% ethanol in it), and 5%v biodiesel (as permitted by standard EN590).

*Fiscal advantages have been defined*

On 13 May 2005 the Government decided positively on a fiscal advantage of 366 •/m<sup>3</sup> biodiesel, 592 •/m<sup>3</sup> ethanol and complete exemption for pure rapeseed oil (accepted by the Commission). A call for tender procedure will be used to allocate agreements to producers, similarly to the French way to handle it.

*Targeted ValBiom recommendations*

Several key points have to be highlighted by ValBiom :

- The Belgian agricultural resource allows producing ethanol while only a very small percentage of biodiesel can be produced with inland grown rape.
- A market limited by maximum percentages in the standards (7% ethanol - 15% ETBE and 47% ethanol in it - and 5% biodiesel) is not sufficient to reach 5,75%. Higher percentages of liquid biofuels need to be implemented, for biodiesel as well as for ethanol.
- As the capacity of ethanol production will exceed the market needs by far it is recommended to progressively develop a market for high ethanol blends (E85, E100) and study the possibility of ethanol blends in diesel.
- New large production plants need time to get permits and to be build, that do not allow them to be operational before 2007.

## 2.2.5. Objectives for Belgium and its regions

*The achievement of the bioenergy objectives in the two main regions of Belgium needs a significant increase in the biomass supply*

The targets in terms of renewable energy sources (heat and electricity) are shown in **Tableau 13**. Objectives for liquid biofuels are defined in point 2.2.4.

*Tableau 13 : Bioenergy targets of the three regions of Belgium*

	HEAT					ELECTRICITY				
	Heat consumption		RES Heat		Bioheat	Electricity consumption		RES Electricity		Bioelectricity
	ktoe	%	ktoe	%	ktoe	GWh	%	GWh	%	GWh
Brussels <sup>(1)</sup>	1133	?	?	?	?	5208	2,5	130	?	?
Flanders <sup>(2)</sup>	?	?	883	?	318	?	?	15459	?	3700
Wallonia <sup>(3)</sup>	4165	9	375	8,4	361	25000	8	2000	3,4	820
Belgium	5298		1257		679	30208		17589		4520

(1) 2006 targets, not defined afterwards

(2) 2020 targets

(3) 2010 targets

Biomass resources for Flanders and Wallonia are given in Tableau 14. The potential biomass resources of the Brussels Region have not been estimated yet. Biomass

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resources available today in Belgium are only residual biomasses as dedicated crops are not developed today.

*Tableau 14 : Biomass resources annual quantities and available energy in the two main regions of Belgium (Flanders and Wallonia)*

Source	Flanders (1)			Wallonia(2)		
	Total (Mtons)	Available (Mtons)	Available energy (ktoe)	Total (Mtons)	Available (Mtons)	Available energy (ktoe)
Solid agricultural residues	n.d.	n.d.	n.d.	0,783(3)	0,02(3)	9
Manure	4,914	3,445	100	2,0(3)	0-2,0(3)	0-58
Forest residues	0,3	n.d.	0	0,456	0,319	137
Wood industry residues	1,456	0,788	283	0,454	0,096	44
Industrial organic residues	3,8	0,29	18	n.d.	n.d.	n.d.
Green waste	0,745	0,745	66	0,076	0,037	18
<b>TOTAL</b>			<b>467</b>			<b>209-267</b>

n.d. : not determined

(1) Devriendt et al (2004)

(2) Marchal et al (2003)

(3) ValBiom (2004)

In Tableau 15 we confront the energy figures shown in Tableau 13 and Tableau 14.

*Tableau 15 : Comparison between bioenergy targets and available bioenergy in the two main regions of Belgium (Flanders and Wallonia).*

	Flanders			Wallonia		
	Target 2020	Available biomass	Potential final energy (1)	Target 2010	Available biomass	Potential final energy (1)
Bioheat (ktoe)	318	467	374	361	238	190
Bioelectricity (GWh)	3700	5435	1359	820	2764 (2)	691

(1) Heat conversion yield : 80 %, electricity conversion yield : 25 %

(2) This value is the median of the two values given in table 1.3.2.

*Presently available biomass is not sufficient to satisfy bioheat and bioelectricity*

From Tableau 15, we may draw the following conclusions :

- in Flanders, presently available biomass resources are sufficient to satisfy the bioheat demand until 2020; there is a surplus available that can be used to produce bioelectricity (810 GWh available energy) equivalent to 203 GWh of useful energy (electricity);
- however, presently available biomass resources in Flanders are not sufficient to satisfy the bioelectricity demand; the gap is equal to 2341 GWh, this is to say 9364 GWh of available energy considering a conversion yield of 25 %;
- in Flanders, bioheat and bioelectricity demands cannot be satisfied in the same time with the presently available biomass resources; considering that bioheat demand can totally be met and that 203 GWh bioelectricity are produced in addition, 13990 GWh of available (potential) energy are lacking;
- in Wallonia, nor the bioheat nor the bioelectricity demands can be satisfied with presently available biomass resources;
- if the 2764 GWh of available bioenergy in Wallonia are used to satisfy the bioheat demand, the gap to meet the 2010 target is equal to 2486 GWh of potential bioenergy; consequently, to produce the 820 GWh representing the 2010 bioelectricity target for Wallonia requires 3280 GWh of potential bioenergy.

In conclusion, for Belgium as a whole, 19 756 GWh of available bioenergy are lacking. There is no doubt that the achievement of the bioenergy objectives in the two main regions of Belgium needs a significant increase in the biomass supply either through the development of energy crops, through an increased availability of existing biomasses or through biomass importing.

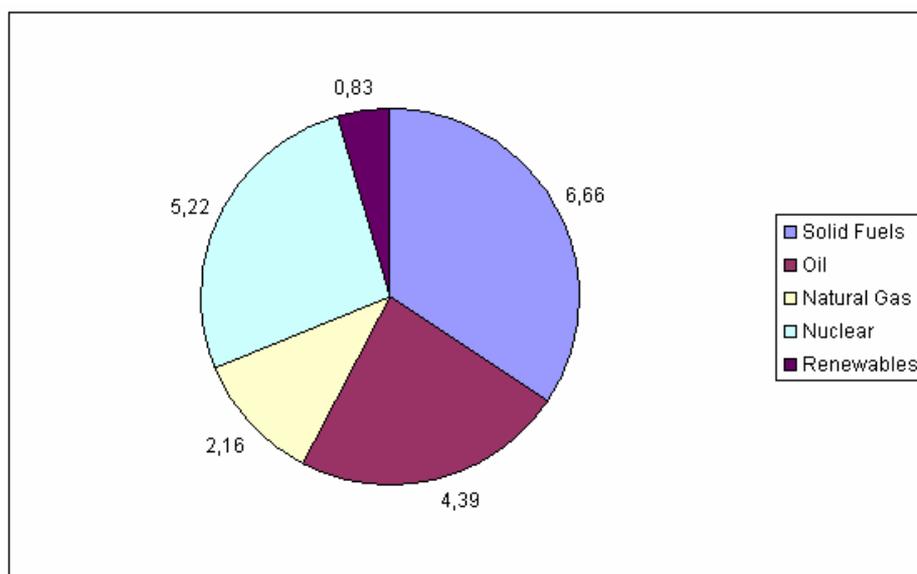
## **2.3. Bulgaria**

### **2.3.1. Bioenergy overview**

*An old and inefficient energy picture*

At present the energy supply structure of Bulgaria is based on fossil fuels like oil, diesel and coal. Heating systems, both large and small scale, are generally old (more than 20 years) and inefficient. Sub-optimal combustion of the fossil fuels causes high emissions of soot, CO and SO<sub>x</sub>, which is severely damaging for the human health and the natural environment. In addition, the emission of CO<sub>2</sub> affiliated with fossil fuel combustion is one of the major causes of the global greenhouse problem. Exploitation of renewable (clean) energy sources is practically non-existent in Bulgaria.

Figure 15 : Primary energy in Bulgaria in 2002 (Mtoe)<sup>37</sup>



*Energy is now expensive*

Furthermore, the price of fossil fuels has risen sharply after the breakdown of the communist structure at the beginning of the 1990s. This, in combination with the low efficiency, makes the systems expensive; their use is minimised to save on fuel costs. The financial means available for heating are all used for buying fuel and not for replacing or upgrading the boiler systems.

*Large amounts of biomass are wasted*

The first step toward solving these problems is increasing energy efficiency in the buildings, so that less fuel is required. A logical second step is replacing the existing boilers with new biomass boilers. On certain locations, replacing the existing boiler with a biomass boiler is a very attractive option. In the more remote areas, where a lot of wood is available, biomass as fuel is much cheaper than fossil alternatives. Sawmills produce a lot of waste wood (around 50% of the log intake), which can be used as very cheap fuel for boilers. At the moment most sawmills are just dumping their waste wood in the vicinity; the rotting wood causes acidification of soil and ground water. Besides, recent measurements by Bulgarian Energy Efficiency Agency have indicated that such dumps emit considerable amounts of methane to the air, and thus contribute to the greenhouse effect. This practice will increase in the future, when the Bulgarian wood industry gets back on its feet.

The potential to develop bioenergy in Bulgaria is considerable (Tableau 16, Tableau 17).

<sup>37</sup> European Commission, 2004, "EU energy and transport in figures", statistical pocket book 2004

Tableau 16 : RES Technical Potential for Republic of Bulgaria in 2010

RES	Theoretical Potential,1000 toe
Wind energy	31
Small HPPs /up to 2 MW	71
Photo-voluic Panels	53
Active Thermal Solar Energy Systems	161
Forest Waste	121
Agriculture Waste-liquid	7
Agriculture Waste-solid	132
Energy plants-wood	245
Energy plants-liquid	30
Industrial Wastes	13
Residential Waste	23
Methane	13
Geothermal energy	95
Passive Thermal Solar Energy Systems	33
<b>Total</b>	<b>1028</b>

*National Programmes are implemented for RES, waste and energy efficiency*

A National Energy Programme has been launched in Bulgaria with three pillars :

- **National Programme for Renewable Energy Sources**

This programme is managed by the Agency of the energy efficiency, as an action plan for investment projects for large scale use of biomass (agriculture, forestry, industrial and household), biogas from the landfills, geothermal, wind and sun energy (voltaic installation).

- **National Waste Management Programme**

The programme is developed by the Ministry of Environment and Water on the base of the Environmental Protection Act and of the Limitation of the Harmful Impact of the Waste upon Environment Act. The aim of the programme is to promote an environmental waste management all over the Bulgaria.

- **National Energy Efficiency Fund**

Some European energy programmes are also eligible in Bulgaria like the European TEMPUS Programme and the Sixth Framework programme.

Tableau 17 : Annual potential of the available unused biomass for production of heat energy  
[dense m<sup>3</sup>]/year (2003)

Region	Harvested wood per root	Waste wood [dense m <sup>3</sup> ]/year	Total
Blagoevgrad	636120	190836	826956
Pazardzhik	586741	176022	762763
Sofia	505438	151631	657069
Bourgas	462574	138772	601346
Smolian	414385	124316	528701
Lovech	339442	101833	441275
Stara Zagora	311844	93553	405397
Plovdiv	299358	89807	389165
Varna	266819	80046	37931
Kiustendil	256280	76884	333164
Sliven	248267	74480	322747
Veliko	224593	67378	291971
Tarnovo			
Haskovo	209360	62808	272168
Shumen	200960	60288	261248
Silistra	194569	58371	252940
Kardzhali	176315	52895	229211
Gabrovo	175370	52611	227981
Montana	158876	47663	206539
Vidin	155254	46576	201830
Targovishte	152220	45666	197886
Razgrad	148321	44496	192817
Pernik	136653	40996	177649
Rouse	117818	35345	153163
Vratza	114050	34215	148265
Pleven	108318	32495	140813
Dobrich	107421	32226	139647
Iambol	61130	18339	79469
Sofia - city	27225	8168	35393
<b>Total</b>	<b>6795721</b>	<b>2038716</b>	<b>8834437</b>

### 2.3.2. Current market for Bioenergy

#### Heat consumers and Energy demand

*Many family houses are currently heated with biomass*

The total potential market reaches 3 600 000 households including actual residential households and administrative buildings, with heat sources as follow :

- 50% with electricity

- 10% with oil
- 30% with coal
- 10% with biomass

An average household with residential area of 80 m<sup>2</sup> and heating volume of 200 m<sup>3</sup> has 8 kW peak load for heating with 46,5% utilization rate during the heating season and consumes 3,2 Mcal/h (76,8 Mcal/day, 2,3 Gcal/month, 11,5 Gcal/season).

#### *Toward Sustainable Energy Supply Companies*

In Bulgaria, old and outdated fossil fuel boilers are the most common means of heating in larger buildings and building blocks. The efficiency of the equipment is low, and the emissions of SO<sub>x</sub>, CO<sub>2</sub>, CO and soot are considerable. At the same time, in many areas there are large quantities of wood residues from the wood processing industry, which are currently being dumped. Due to the high fuel costs, fuel switching is generally very economic; however, it involves considerable investments, which the owners (often municipalities) usually cannot gather.

#### *A nice leverage effect*

**Steps to be taken:** In order to realize a massive fuel switch from fossil fuels to biomass fuels, parties intend to establish a Sustainable Energy Supply Companies (SESCO) in Bulgaria. The SESCO will install a number of wood fuelled boilers, for the use of which the clients pay a fee. This fee will be below the average avoided fossil fuel costs of the clients; after 4-5 years, the equipment will be transferred to the client. The generated revenue will be reinvested in new installations, thus increasing the number of installations twofold before year 2007, and fivefold by year 2010.

#### *That saves fossil fuels*

**Environmental effects:** The environmental effects are three-fold. (1) The use of fossil fuels for heating will be reduced in an increasing trend. Preliminary calculations, based on assumed average fuel switch projects, show savings of around 100 tons of fossil fuels per one boiler installation and per year. The direct savings within the project could thus amount to 500 t/y. With the intended reinvestments, the amounts would surpass 1000 kt/y in year 2007 and 3000 kt/y in 2010. (2) The disposal of wood residues from the wood processing sector will be accomplished. Large parts of the available residues are currently unused, and lay decomposing in piles where they are dumped. The mentioned average installation would consume approximately 300 Mtons of wood per year, resulting in the disposal of 1500, 3000 and 9000 Mt/a in years up to 2010 respectively. (3) The fossil fuel decrease and organic waste disposal directly lead to reduced emissions to air. It concerns emissions of SO<sub>x</sub> and CO<sub>2</sub> (from decreased fossil use), CO and soot (from better combustion), and the greenhouse gases CH<sub>4</sub> and N<sub>2</sub>O (from avoided wood residue decomposition).

#### *Involving majors*

**Involvement of local governments:** Bulgarian municipalities are the major potential clientele of the SESCO, as they generally own a number of larger buildings within their boundaries. A high level involvement of municipalities will thus be safeguarded. Through the Municipal Energy Efficiency Network, many municipalities have already indicated to be very interested in participating in fuel switch projects.

### 2.3.3. Objectives for Bulgaria

The long-term objectives of Bulgaria are the following

- Promoting biomass as a clean, affordable and CO<sub>2</sub> neutral energy source in the Bulgarian energy supply, and stimulation of the use of biomass as a renewable source of energy.
- Developing the Bulgarian market for small, low-cost biomass fuelled boiler systems for public buildings and housing, replacing existing inefficient and polluting fossil fuel boilers.
- Establishing long-term technical and commercial co-operation agreements between Bulgaria and EU countries.

EUBA has defined concrete objectives for bioenergy (Tableau 18). Several priorities are considered :

1. Energy Efficiency Law and regulatory basis
2. Institutions and organizations
  - EE-related structural unit
  - Programs and funds
  - interdisciplinary aspects
3. Incentives and stimulation
  - social programs
  - Budget savings management
4. Pioneering role of NGO`s
  - Project development
  - Education Promotion, Consultancy

Tableau 18 : Objectives proposed by EUBA (Energy Utilisation Biomass Association)

	In 2004	For 2010
Biomass for heat (ktoe)	709	1227
Bioelectricity (GWh)	418	849

## 2.4. Finland

### 2.4.1. Bioenergy overview

*30% of primary energy is indigenous Bioenergy covers 22% of total primary energy supply*

Finland has one of the highest energy intensities in the EU, both per capita (over 6 toe/capita) and per unit of growth development products - GDP. The primary energy consumption was 35,5 Mtoe in 2004 (Figure 16). Approximately 30% of Finland's total energy consumption is met by using indigenous energy sources. The most important indigenous sources of energy are wood-based fuels, peat, recycling biofuels from industry and municipalities and hydropower. Also wind energy is coming but a share is still under 1%. The use of peat is annually around 2 Mtoe (5-7% of total consumption).

*Bioenergy covers 22% of total primary energy supply*

Renewable energy sources accounted for 25% of the total energy consumption (8 Mtoe without peat) (Figure 17). Biomass (88,3%) and hydropower (10,2%) are the main sources of RES. The use of wood-based biofuels is 20% of the country's primary energy consumption, from which industrial bioliquors 55%, industrial solid wood residues 25% (bark, sawdust etc), small scale use 16% and forest chips about 4%.

Figure 16 : Primary Energy Consumption in Finland (35,5 Mtoe in 2004)<sup>38</sup>

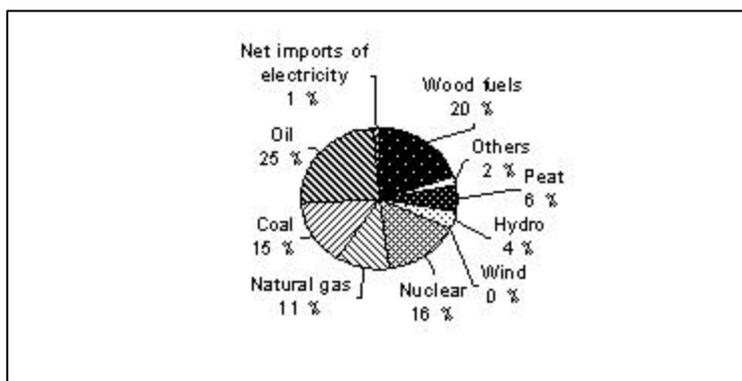
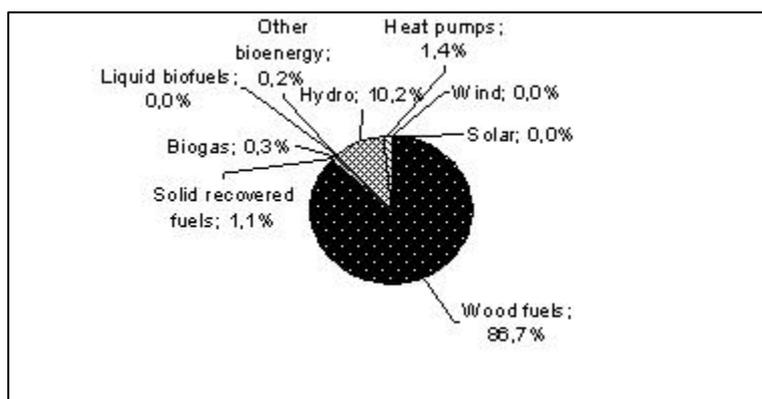


Figure 17 : Breakdown of renewables (8,0 Mtoe in 2003, without peat)<sup>38</sup>



*Pulp and paper industry is a major bioenergy player*

Bioenergy represents today huge amount of the primary energy use in Finland. Wood and wood-based fuels play an important role in the decentralised and diversified energy system. Finland's geographic and climatic features, as well as the important role energy-intensive industries play in the economy have spurred the development of efficient energy systems. The pulp and paper industry supplies over two fifths of the heat and electricity it needs by utilising its solid and liquid wood residues. About 35 million m<sup>3</sup> (solid) of wood is used annually for energy production, covering about 20% of the total consumption of primary energy. The main provider and user of wood-based energy is the forest industry, which obtains wood fuels at a competitive price in connection with raw wood procurement or as a by-product of wood processing. Also the use of RDFs and peat is "every-day-business".

<sup>38</sup> The Statistical Office of Finland

*And many types of wood based biomass resources*

Industry accounts for around half of energy end-use. Heating energy accounts for somewhat under a quarter, while transport accounts about 15 %. The remainder is used by households, agriculture and construction. Main user of wood-based biofuels is forest industry, but a lot of biofuel is also used in smaller municipal heating and power plants. Besides wood fuels and peat, the role of recovered biofuels, biogas and bioliquors has grown strongly in recent years. The use of agrobiomass fuels are growing, too. However, slower than in other part of Europe. Biomass use for traffic purposes is practically zero, still.

The share of fossil fuels is still over 50%, and 70% of fuels are import-based. So, there will be plenty of opportune business possibilities for renewables. There are still high potentials and growing interest especially for the use and new technology solutions for biogas and bioliquors as well as agrofuels which have been entered into the demonstration phase as well as biofuels for traffic purposes (biofuels below 0,01% in traffic in 2005).

**National Action Plan for Renewable Energy 2003 – 2010 (NAPRES)**

*Bioenergy should increased by 22%until 2010*

In Finland the Action Plan for Renewable Energy Sources was launched in 1999. The New National Action Plan for Renewables (NAPRES) was launched in 2003 (Tableau 19) - along with new nuclear power capacity (1600 MW). The target is to increase the use of renewable energy at least by 30% in this decade (100 PJ = 2,5 Mtoe, 7% more than earlier) and bioenergy by 22% until 2010 and by 45%until 2025. Electricity produced from renewable energy sources should account for 31,5 per cent of the total consumption of electricity in 2010. Bioenergy will increase absolutely the most, about 85% of the total growth. The vision for the year 2025 is to increase the use of renewable energy by about two-thirds of the present volume.

*BOOSTING BIOENERGY IN EUROPE*

*Tableau 19 : National Action Plan for Renewables (NAPRES) 2003-2010 (Mtoe, peat excluded):*

<b>Bioenergy by sector</b>	Used 2002	Goal 2005	Goal 2010	Goal 2025
* Industry	5,19	5,14	5,50	6,40
* District heating	0,45	0,72	1,05	1,46
* Small Scale	1,12	1,41	1,72	1,82
* Traffic	0,00	0,03	0,07	0,22
<b>Total</b>	<b>6,84</b>	<b>7,29</b>	<b>8,34</b>	<b>9,90</b>

**Bioenergy by sources**

* Industry wood wastes (liquor and solid):	5,33	5,33	5,69	6,19
* Wood fuels (small scale, not forest chips):	1,11	1,20	1,29	1,41
* Forest chips	0,29	0,53	0,91	1,51
* Bio-REFs	0,09	0,12	0,24	0,24
* Bio gas	0,02	0,05	0,10	0,19
* Agrobiofuels	0,01	0,02	0,05	0,12
* Biofuels for Traffic	0,00	0,03	0,07	0,22
<b>Total</b>	<b>6,84</b>	<b>7,29</b>	<b>8,34</b>	<b>9,90</b>

National Action Plan for Power Production by Renewables (NAPRES) 2003-2010 (TWh, peat excluded):

Energy Source	Used 2002		Goal 2010		Goal 2025	
	TWh	MW	TWh	MW	TWh	MW
<b>Bioenergy total</b>	<b>12,8</b>	<b>2033</b>	<b>13,6</b>	<b>3050</b>	<b>22,7</b>	<b>4700</b>
Hydro Power	10,6	2996	14,6	3300	16,1	3670
Wind Power	0,06	43	1,1	500	5,1	2000
Solar	0,002	2,8	0,5	40	0,5	500
<b>Renewables total</b>	<b>23,5</b>	<b>5075</b>	<b>29,3</b>	<b>6890</b>	<b>44,3</b>	<b>10870</b>
Share-% of total electricity production	27,2		31,5		41,6	

*Government gave the New Energy and Industry Strategy-proposal to the Parliament*

The new Energy and Climate Strategy-proposal was given by Government in late 2005. Final decisions are in the hands of the Parliament. Large debate and progressive lobbying have been arisen - more nuclear power capacity or RES-investments according to NAPRES – or both but then via mini-NAPRES? The Parliament will make its decisions and milestone-lines during the winter 2006. However, bioenergy potentials and practical technology know-how are huge in the country. Also the question about the share of biofuels in the transport sector is still

open (target for 2005 is 0,1%, ?% in 2010). Big question is also the future use of peat (6% of total energy consumption, peat is annually growing more than is used) with different kind of biomass. Especially wet forest biomass and biowastes need an effective mixture fuel, in Finland it has been peat.

#### *Develop RES-electricity as much as nuclear*

According to RES-E Directive the share of electricity generated from renewable energy sources should be in Finland 31,5% in 2010 (29,3 TWh). It has been estimated that demand for new electricity generating capacity would be about 3000 MW in 2010, and about 7500 MW in 2020. The Parliament put a strong bioenergy statement when approved to build a new nuclear power unit (the 5<sup>th</sup>) in the year 2002. The use of bioenergy and other renewables has to increase at least as much as the new nuclear power capacity until the year 2009 (1600 MW). However, large debate has arisen during the year 2005 about Finland's energy strategy – more nuclear power capacity or biopower investments ? The year 2006 will be the conclusive significance.

## **2.4.2. Heat trends and targets**

### **Individual heating systems**

#### *200 000 wood based central heating systems (25% of individual houses)*

Oil heating in residential houses has been slowly decreased from 70'ies. Today 25% of individual houses are heated mainly with wood fuels (there are almost 200 000 central house heating systems using wood in Finland). The small-scale systems are typically used in detached houses or farms. Wood chips and split logs (firewood) are used in most of the systems. However, firewood is often used together with oil or electricity heating. In total about 6 M m<sup>3</sup> (solid) firewood has been used annually for space heating in stoves and small-scale boilers. Usually, a wood stove or fireplace is used as an auxiliary heat source in single-family houses. Wood is mainly burnt cut or split into small size. The number of stoves and fireplaces reaches almost 2 millions. About 25% of split logs are used in sauna stoves. Wood pellets are burnt in about 1000 boilers. Pellet production and domestic use increase rapidly, but still about 85% of pellets are still exported, mainly to Sweden (pellet production 200 000 t, target 1 Mt in 2010). There exist only two farms in Finland using their own biogas for heating and electricity purposes. Potential for farm-scale energy production is quite huge.

Bioenergy use in small scale heating was 1,12 Mtoe in the year 2002. National target is to increase that by 46%, up to 1,72 Mtoe (growth 0,5 Mtoe) in 2010. There is an urgent need for small-house owners for supporting them by public money or tax-repaid for their plans when changing RES-heating systems. Also decreasing value added taxes, which are 22% both for installations and biofuels.

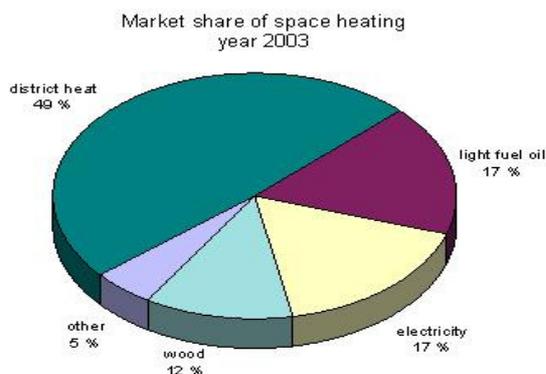
## District heating

### *Half of Finnish buildings are connected into the district heating systems*

District heating is the most common heating system in Finland. It is used in nearly all cities, towns and built-up areas. District heating accounts for about 50 per cent of the total heating market. The sales of district heat is an extensive business. District heating systems cover practically all densely populated areas of Finland. Over 90 per cent of residential blocks of flats, about half of terraced houses, and the bulk of Finnish public buildings and business premises are connected to the district heating network.

170 biomass fuelled District Heating plants (> 1 MW) were installed up to the 2004. The installed capacity of the biomass fuelled DH boilers amounted to 900 MW<sub>th</sub>. The main part of district heating systems are based on CHP plants.

Figure 18 : Market share of space heating (2003)



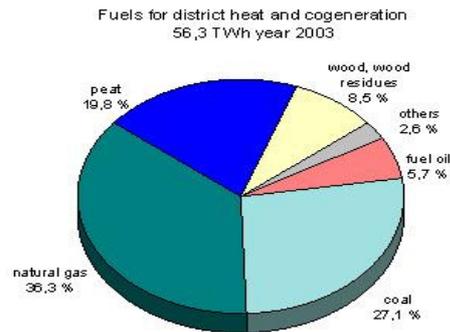
### *One fifth of the energy consumed goes to heating buildings*

In 2003, consumption of district heat in Finland was totalled 2,6 Mtoe (30,5 TWh). Residential buildings accounted for 56% of consumption, industry for 9% and other users for 35%. Because of the cold climate, it is necessary to heat houses in Finland for most of the year. About one fifth of the energy consumed goes to heating buildings. There are over 200 heat distribution utilities in Finland. About 50 of them produce also electricity in connection with district heating. Some municipalities have co-operation with power companies or local industries. Many large cities own CHP plants. The total district heating capacity is around 15 000 MW<sub>th</sub>.

### *Bioenergy use in district heating sector should increase 126% up to 1,05 Mtoe in 2010.*

District heat is produced locally, using the most economical fuels available. In the region covered by the natural gas network, the principal fuel is natural gas; the largest cities in coastal areas utilise coal and the large peat-producing areas mostly rely on peat. Wood and wood residues will increase. Use of recovered fuels has also increased considerably during the last few years.

Figure 19 : Fuels for district heat and cogeneration<sup>38</sup>



Bioenergy use in district heating sector was 0,28 Mtoe in the year 1997 and 0,45 Mtoe in 2002. But there still a considerable potential for expansion as well as for replacement of fossil fuels in the district heating systems. According to NAPRES national bioenergy, target is to increase that 126% up to 1,05 Mtoe in the year 2010 (CHP together).

### 2.4.3. Cogeneration trends and targets

#### *An impressive number of plants for CHP, for district heating and industry*

Today over 400 biomass heat and power plants are operating. Total installed capacity of the biomass-fuelled energy plants in Finland is about 17 500 MW<sub>th</sub> and 4 300 MW<sub>e</sub> (2004).

#### *Electricity is liberalised in Nordic countries*

The liberalisation of the electricity market in Finland started in 1995 and was completed in 1998. Today the electricity system of Finland is one part of Nordic electricity system and markets. There are free electricity markets inside Nordic countries. Energy companies can buy and sell electricity on-line freely over the Nordic: Finland, Denmark, Norway and Sweden (Nord Pool: stock exchange trading). Also consumers can freely purchase their electricity from the power company of their choice.

Power generation in Finland is based on a wide variety of production forms and it is highly decentralised. 120 generation companies or utilities own about 400 power plants. Electricity prices have been relative low, but during last 2 years prices have been increasing remarkably.

#### *Total electricity consumption is around 85 TWh and increases annually 3%*

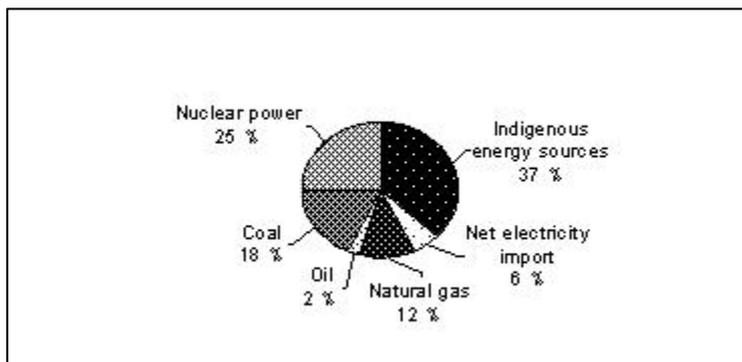
The total electricity consumption was 84,7 TWh in 2003: Nuclear power 27%, Conventional Condensation Power (mainly coal) 25%, Hydropower 11 %, Industrial CHP (mainly bioenergy) 16% and other CHP (mainly bioenergy) 20%, Windpower and others 1%. Finland both imports and exports electricity (import 11,3 TWh, export 7,0 TWh). Domestic electricity production was 94%, the rest was imported mainly

from Russia. The industry sector consumes more than half of electricity amount. During the last decade the production of electricity has been increased annually 3%.

*The largest share of bioelectricity in the Union*

The share of bioelectricity is absolute and relatively the biggest in the European Union. 20% of the electricity requirements are met by bioenergy, 29,7% by RES and 37,2% by indigenous energy sources (Figure 20). However, fossil fuels represent still 51% of total energy consumption and 32% of electricity production.

Figure 20 : Primary energy sources in electricity production (86,8 TWh in 2004)<sup>38</sup>



Target for 2010 : The target proposed by FINBIO is to grow the renewable energy amount up to 31,5% of total electricity production in the year 2010. Of this growth the share of bioenergy is about 80%. The biopower target is 13600 GWh in the year 2010 (12800 GWh in 2002) and RES-E target 29300 GWh (23500 GWh in 2002).

**Industry**

*Frontrunner in CHP technologies*

The number of biomass fuelled plants in the pulp and paper industry amounted to 40 units. The installed capacity of solid biomass fuelled boilers in pulp and paper industry (445 MW<sub>th</sub> + 2805 MW<sub>e</sub>) amounted to 4240 MW<sub>th</sub>/1111 MW<sub>e</sub>. The installed capacity of recovery boilers in pulp and paper industry amounted to 4100 MW<sub>th</sub>/680 MW<sub>e</sub>.

57 biomass-fuelled plants were installed in sawmills. The installed capacity of biomass-fuelled boilers in sawmills (heating plants 380 MW + CHP 70 MW) amounted to 450 MW<sub>th</sub>/12 MW<sub>e</sub>.

Industry uses mainly wood-based fuels (mainly by-products such as bark, sawdust, cutter shavings, black liquer etc. ) but also peat and RDFs in their own energy plants . It generates electricity and provides steam for industrial processes or the district heating network of a nearby town or municipality. Finland is a trendsetter in combined heat and power production, with CHP plants accounting for over 30 per cent of the total electricity production both in industry and larger municipalities. CHP plants and technologies for bioenergy are world-famous (from 1 MW<sub>e</sub>/2 MW<sub>h</sub>

up to the biggest unit 240 MW<sub>e</sub>/100 MW<sub>th</sub> process steam/60 MW<sub>th</sub> district heat). This broad palette of expertise helps ensure reliability and security supply, safety and competitiveness of energy production.

Bioenergy power and heat use in industry sector was 4,3 Mtoe in the year 1997 and 5,19 Mtoe in 2002. National target is to increase that 6%, up to 5,50 Mtoe in the year 2010. It is calculated that for bioheat purposes there is bioheat potential in the industry sector 4326 GWh (894 MW<sub>th</sub>) in 2010.

## Others

In electricity markets there are also more and more interest in the small-scale energy production and new technologies. But the electricity market prices have been very low in the past few years due to the market liberalization and good hydrological years in Nordic countries. However, in the last 2 years the prices has been increased and came unstable and difficult to forecast. Nord Pool electricity stock market causes market effects over prices and electricity business. Electricity companies are fighting with each others over their market shares and increasing profitabilities demands.

### *R&D is needed to develop smaller scale CHP*

New technologies are needed to allow high power-to-heat ratios in CHP small plants, to make smaller CHP bioplants competitive and to provide low emission levels and to facilitate operation and maintenance of private consumer applications. Especially farmers and municipalities want to utilise their biowastes into electricity, heat and also for traffic purposes, like biogas, bioliquers, agrofuels etc. Greater efforts, demonstrations and investments have just started for those in Finland.

## 2.4.4. Liquid biofuels trends and targets

### *Weak policy so far for liquid biofuels – no national target for 2010*

In Finland quite little efforts and public decisions has been done so far. The use of biofuels in traffic is just 0,1 % in 2005. In the beginning of the year 2004 biogas and liquid biofuels (except biodiesel) became tax-free, when earlier they have heavy extra taxation (20-fold compared diesel). Biodiesel still have the extra taxation. Same odd taxation was over biogas cars. In the beginning of the year, the taxation for those cars became “normal”, but the government put technical demands over bioenergy cars (EuroNorm5 which are demanded in other EU countries in the year 2008). Also administrative barriers for biofuels in traffic and biofuelcars still exists.

### *An ethanol plant is planned*

In addition there are no bioliquor or biodiesel service stations in the cities and municipalities like in Sweden and Germany. This sector and situation should be changed – sooner or later. There is a large potential for know-how and technology transfer projects and business. There is only one biogas car in the traffic and an

ethanol plant in Eastern Finland (75 000 t per year from grain) is under planning process. In autumn 2005 the Ministry of Trade and Industry will convene a committee to solve how Finland can reach the EU-directive in traffic.

FINBIO's target and demand is that also Finland will fulfill the EU's directive 2003/30/EC.

#### 2.4.5. Objectives for Finland

##### *Bioenergy has grown efficiently during the years – Future questionable in 2006-2010*

Finland is one of the world leaders in the utilisation and use of wood based fuels and peat and the development of biomass combustion technologies and efficient fuel supply chains. The expertise extends from the forests, peatlands, urban and industrial REF and biogas sources to heating and power plants, from root to soot. The total use of renewable energy sources is 8 Mtoe (without peat), which is 22,4% (2003) of total energy consumption. Biomass (88,3%) and hydropower (10,2%) are the main sources of RES. The use of wood-based biofuels is 20% of the country's primary energy consumption, from which industrial bioliquors 55%, industrial solid wood residues 25% (bark, sawdust etc), small scale use 16% and forest chips about 4%.

Today over 400 biomass heat and power plants (most of them are CHP plants) are operating. Total installed capacity of the biomass-fuelled energy plants in Finland is about 17 500 MW<sub>th</sub> and 4 300 MW<sub>e</sub>.

##### *Target to fulfill the NAPRES – to gain the 22% additional growth for bioenergy until 2010*

The National Action Plan for Renewables (NAPRES) was launched in 2003. The target is to increase the use of renewable energy at least by 30% and bioenergy by 22% in this decade (7% more than earlier). Electricity produced from renewable energy sources should account for 31,5 per cent of the total consumption of electricity in 2010. Bioenergy will increase absolutely the most, about 85% of the total growth. The vision for the year 2025 is to increase the use of renewable energy by about two-thirds of the present volume.

Government presented the new Energy and Climate Strategy for Parliament in late 2005. Parliament will make the final decisions about long term energy strategy and mainlines in winter 2006. Debat has arisen. Despite bioenergy has very positive reputation and practical results are utmost good, the main question in the Parliament is: New nuclear power capacity or biopower investments?

##### *FINBIOs objectives for bioenergy 2010*

FINBIO demands the NAPRES 2003 will be fulfilled, especially RES-E target. Main targets for bioenergy are challenging and realistic but two of them (for Agrofuels and Biofuels for Traffic) are not satisfactory in the mind of FINBIO. For Agrofuels the target has to be increase up 0,22 Mtoe (2,5 TWh) already in 2010, which is 40% of technical and economic production potential and little over 10% of total potential.

Pilot production and demonstrations have been started on a quite large scale already in 2004 (for instance production and energy use of Reed Canary Grass and biowastes from landfarms).

FINBIO also demands that Finland fulfils the EU-goals for Biofuels for Traffic. In the year 2005 the amount of biofuels in traffic is only 0,01% (target is 2% and 5,75% in the year 2010, 250 ktoe). The Ministry of Trade and Industry has just put a Committee to solve this “problem” and proposals will be given in early 2006.

*Tableau 20 : Objectives proposed by FINBIO (The Biomass Association of Finland)*

	In 2002	For 2010
Biomass for heat, (CHP+heat only) (ktoe)	4540	5200
Bioheat, small scale (ktoe)	1120	1720
Bioelectricity (CHP + Condens.) (GWh)	12800	13600
Liquid biofuels (ktoe)	0	250

## 2.5. France

### 2.5.1. Bioenergy overview

#### General energy context

Situation of Bioenergy sector in France is reflecting the choices made at the end of the 2<sup>d</sup> World War, at a period where the country, still a powerful actor in the world, decided and was able to implement two strong economical sectors to rebuild the economy, to become independent and to keep a respectable position in the world. These two sectors were energy linked to nuclear dissuasion and agriculture linked to independence of food supply; it's still the case today.

For these strategic reasons, France nationalized the energy sector from 1946, and it was created for electricity, gas and coal: Electricité de France, Gaz de France and Charbonnages de France, and later in 1966 for oil, the company ancestor of Total. This situation means a very strong concentration of the decision power, at the contrary of the decentralised nations, which gives strong possibilities for the priority sectors but which erases the alternatives one.

During the second oil crisis, from 1979 to 1986, with the anxiety, France made nevertheless some efforts to develop alternatives; research was started within big public companies, government favoured setting up of about 1000 energy plants using wood and biogas in all sectors, and a specific industry started to appear; for example 6 or 7 pellet factories were built between 1980 and 1982. But with the fast decreasing of the oil prices in 1986, all returned to traditional objectives and all benefits for the sector was lost.

Yet, France owns the main agricultural area in Europe (30 Mha) and the third forest area (15 Mha) with a favourable climate and could use these natural capacities as economic opportunities. But public companies are in place and to now, nothing was permit in those biosectors, which are owned and managed by million of people, incompatible arrangement with centralized management and interest.

Today, a recent announcement of the first ministry proves it, something is moving with the third oil crisis (since 2004) and the thousand-year-old tradition acts: big actors are now taking place and it an oracle of new start.

### The facts on renewables

General efficiency between primary and final energy in France (deducted losses from electric plants, refineries, distribution network, internal consumptions) was 58,37 % in 2004 (276,18 Mtoe/161,22 Mtoe).

From this primary energy (276,18 Mtoe before transformations & supply), renewable energies contributed in 2004 to satisfy approximately 7%; that means speaking about final energy data percentage should be really better for renewables.

Thanks to wood fuel and hydraulics, France is the first European producer of renewable energies in value but the ninth one per inhabitant.

*Tableau 21 : The production of primary energy from renewable sources in France in 2004*

France in Europe + overseas	2002	2003 (5)	2004 (6)
Total primary energy from thermal origin	11859	12491	12797
<i>including solid urban waste</i>	2043	2088	2133
<i>including wood</i>	8495	9002	9180
<i>including biogas</i>	329	343	353
Total primary energy from electrical origin (1)	5853	5723	5794
Total primary energy	17711	18214	18591

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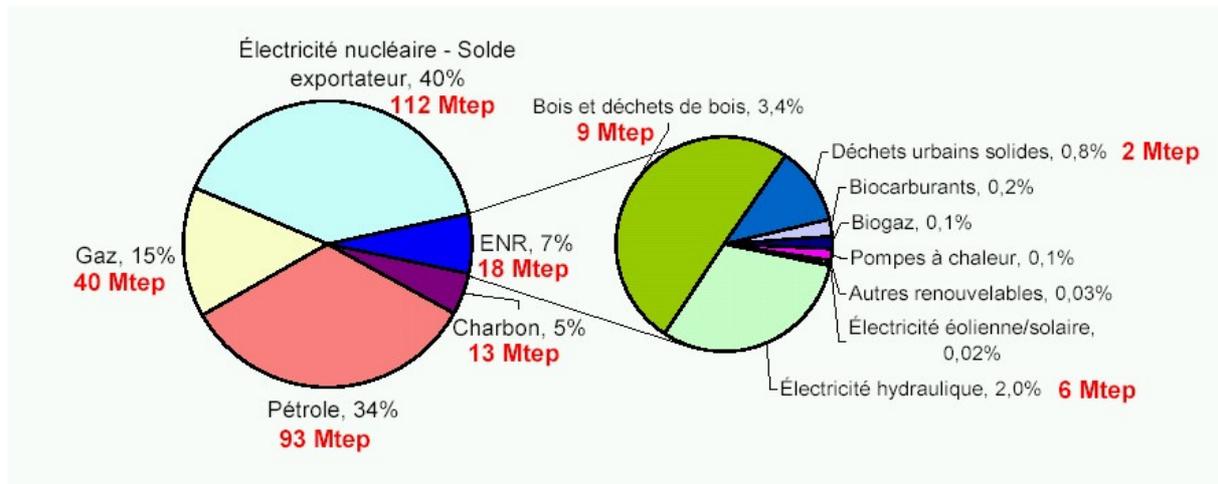
**Tableau 22 : Electrical and thermal productions from renewable sources**

France in Europe + overseas	2002		2003 (5)		2004 (6)	
	elec. GWh	therm. ktoe	elec. GWh	therm. ktoe	elec. GWh	therm. ktoe
Raw hydraulics (2)	67 571		65 867		66 449	
Eolien	298		423		605	
connected to the network	1		1		1	
non connected (6)						
Solar electricity	1		4		9	
connected to the network	15		17		18	
non connected (6)						
Solar thermal		25		29		32
Geothermal	17	119	23	120	29	121
electricity		9		9		9
district heating						
heat for agriculture						
Heating pumps		36		37		37
heat for industry		236		254		277
heat for households						
Urban solid waste	1 217	190	1 306	192	1 402	195
electricity alone		589		607		619
heat alone	1 683		1 804		1 938	
electricity & heat in cogeneration						
Wood	1 324	6 708	1 344	7 175	1 371	7 300
households (3)		144		153		166
collective housing & offices (3)		1 089		1 109		1 138
electricity & heat for industry		40		40		40
heat for agriculture						
Agricultural harvesting residues	340	186	370	192	366	190
Biogaz	385	6	400	6	405	6
landfills	55	33	60	30	60	30
cleaning water sludge		3		3		3
agriculture sludge	3	15	4	17	4	17
effluents des IAA (4)						
Liquid biofuels						
ethanol						
biodiesel		58		49		51
		305		350		395
Report	67 571		65 867	29	66 449	32
Hydraulics	299		425	129	606	130
Wind	16	25	21	291	27	314
Solar thermal	17	128	23	798	29	814
Geothermal		272		8 478		8 644
Heating pumps	2 900	779	3 110	192	3 340	190
Solid urban waste	1 324	7 980	1 344	56	1 371	56
Wood	340	186	370	399	366	446
Agricultural harvesting waste	443	58	464		469	
Biogas		363				
Liquid biofuels						
Total	72 911	9 791	71 623	10 371	72 656	10 647
Total in ktoe (1)		16 061		16 530		16 875

Source : Observatoire de l'Energie

- (1) : 1 GWh = 0,086 ktoe, excepted for geothermal (0,86 ktoe).
- (2) : including seaplant of the Rance and pumping plants
- (3) : without climatic corrections.
- (4) : IAA = food industries.
- (5) : provisory.
- (6) : estimated.

Figure 21 : Primary energy in France, with breakdown of sources<sup>39</sup>



### France's objectives for renewables to 2010

The programme law on the 13 July 2005, for energy orientation forecasted a production of primary energy covered by 10 % of renewable energy in 2010;  
 Increase renewable heat production by 50%: from 12,67 Mtoe in 2004 that means + 6 Mtoe

Increase renewable electricity consumption by 50 % to reach 21%: from 480 TWh in 2003, with an increased rate of 2% per year that makes 540 TWh in 2010, and the need to reach 21% is 113,5 TWh, minus the 2004 production 72,65 TWh, the objective is about + 40 TWh

Increase the liquid biofuels production to 5,75% of the consumption. But very recently, on the 13 September 2005, the first ministry announced a new target for liquid biofuels: reach 5,75% from 2008, 7 % from 2010 and 10 % from 2015. Considering a consumption of 51 Mtoe in 2004, and an increase of the consumption of 2% per year, the consumption of transportation fuel in 2010 would be close to 57,50 Mtoe. With the announced objective of 7%, that makes 4 Mtoe to produce in 2010, meaning an increase of about + 3,5 Mtoe

Total objective heat + electricity : + 11 Mtoe in 2010

<sup>39</sup> DGEMP / Observatoire de l'énergie

## Bioenergy market

Biomass used in France totalized 12,022 Mtoe in 2004 mainly from firewood, sawmill by-products, black liquor and urban waste, what covered 2/3 of the renewables production, following the such breakdown :

9,2 Mtoe from wood energy

2,1 Mtoe from waste

446 ktoe from liquid biofuels (51 ktoe bioethanol and 395 ktoe biodiesel)

276 ktoe biogas (Solagro 2003, amount effectively used)

Rates of bioenergy use on 2004 production

Total bioenergy on total primary energy:  $12/276 = 4,35\%$

Total bioenergy on total primary energy supplied (excluding fuel production loss):  $12/177 = 6,78\%$

Total bioheat on the total housing and tertiary heating :  $8,28/70 = 11,83\%$

Total bioelectricity

On total electricity production:  $5,54/572 = 0,9\%$

On total electricity consumption:  $5,54/480 = 1,15\%$

On total renewable electricity:  $5,54/72.65 = 7,62\%$

Total liquid biofuels on total transportation fuels :  $0,87\%$

France is still the first producer of wood energy in Europe and this production is more than 3 times the national production of coal, oil and gas together (2,9 Mtoe in 2004). This sector weights more than 50 000 equivalent jobs.

## Bioenergy objectives

A BTG study showed in 2004, that France has the first potential in Europe for bioenergy with 35 Mtoe, meaning 21% of the European potential.

Tableau 23 : Summary of the objectives in Mtoe of primary energy

Categories	Biofuel	2004	ITEBE target 2010
Heat	Firewood	7,3	8
	Chips & pellets for households	0,025	0,1
	Chips, by-products, wood and agricultural waste for industry	0,927	1
	Chips, by-products, waste wood for district heating	0,3	0.4
	Waste for heating	0,195	0.2
	Electricity alone	Waste for electricity	0,12
Cogeneration	Solid biomass	0	0
	Solid biomass	1	1,3
	Biogas	0,276	0.5
	Waste	0,785	1

Transportation	Liquid biofuels	0,446	4
TOTAL		11,37	16,5

ITEBE position: to boost by 30 % bioenergy in France to 2010

These reasonable targets were calculated knowing the technical limits of development, the professional capacities and the national policy.

### Details per sectors

#### Firewood to heat households

Considering the new interest regarding costs of energy and fiscal measures, but considering the decreasing of the general use of firewood for technical reasons, specially because the need of comfort and the going old of the rural population, considering the decreasing of the unitary consumption of the appliances because increasing of efficiency, considering the decreasing of consumption of the houses regarding new standards of construction, we think only about an small increasing to 2010, to reach about the 1990 level of consumption (2010 is only in five years):

8 Mtoe in 2010

#### Wood chips and pellet for households

Considering the big interest for comfortable and efficient appliances, considering the quality of the technical offer today, considering the new conditions of energy prices and fiscal help, but considering the very low level of equipment today, considering the high level of investment needed, considering the decreasing of the purchase power, considering the non-encouragement by authorities and considering their priority to develop firstly electricity and natural gas heating, we think about an increasing of only 400% of this market, meaning a growing of the market from 0.025 Mtoe to 0,1 Mtoe in 2010.

#### Wood energy for district heating

District heating by wood represents about 1500 plants in activity, of which 50% installed in the frame of the last wood energy plan (1994 to now). Installed power is about 800 MW and the wood consumption is lower than 300 000 toe.

At the current speed of development, with the taken actions and despite the new conjuncture a growing of 300 new MW is possible from the current situation to 2010, meaning about 100 000 toe of additional wood consumption.

Target : 0,4 Mtoe in 2010

#### Wood energy in industry

The consumption of wood energy in industry is increasing very slowly since 1970, with an increase of 30% in 35 years, meaning less than 1% per year. Recent costs of energy could boost this trend but only about an increase of more or less 3% per year, meaning a target of 2 Mtoe in 2010, including 1,675 Mtoe of current consumption and 0,325 Mtoe new, heating and cogeneration together.

#### Wood energy in cogeneration

Today consumption of biomass in cogeneration is close to 8% of the renewable electricity but only 0,9% of the total electricity production. Considering the current policies with very low prices of purchase, nothing could change significantly to 2010 if the policy don't change, and for wood, big wood industry is a big obstacle to the change.

Government launched a call at the end of 2004 for 200 MWth for electricity production by biomass, the result was 84 MWth but we don't have any guaranty on efficiency. A new call will be launched at the end of 2005 for 300 MWth. Our objective is to reach 0,3 Mtoe of primary consumption in

We ask to increase quickly the purchase price for biomass electricity and to open it outside of big industry, with efficiency condition of 65 % minimum (as for general cogeneration policy).

We ask also to promote big CHP plant with fluidized beds on district heating or in industry to use quickly large quantities of waste wood available and not used. Ten such plants could be installed to 2010, with a average of 50 MWth, meaning the consumption of 166 000 toe of primary energy. Plus the other plants with clean wood, new 300 ktoe of wood could be used in cogeneration to 2010.

Objective (current consumption already accounted in industry consumption): 0.3 Mtoe more

#### Wood energy for electricity production

This type of production without use of the heat doesn't exist today from biomass in France. But government was calling for it at the end of 2004, announced a new call or the end of 2005.

ITEBE objective is to stay at zero: we don't have enough wood to spend it with a so low efficiency, it's not a fatal fuel and it can be three times better valorised through heating or cogeneration.

#### Biogas in cogeneration and for electricity

Consumption of biogas doesn't grow because no policy for that, purchases prices are only interesting for big plants. Solagro evaluated the potential of production in small plants (average 1MWe) at 860 000 toe. Otherwise, a big part of the produced biogas is still not transformed in energy (minimum 106 000 toe said Solagro). That means a potential close to 1 Mtoe.

Potential and knowledge exist for a long time, and we ask for an increasing of the consumption from 180 000 toe to 500 000 toe in 2010.

#### Transportation fuels

Agriculture is close to industry and recent positions of the government demonstrated an important pressure to increase liquid biofuels production. We are not worry for this sector through industrial ways (ethanol and biodiesel). If politicians made what they said recently, French target in directive 2003/30 would be reached in 2008; for 2010 target is 4 Mtoe, we agree with that.

About short ways, raw oil and small biodiesel plants, it's completely different. It's no interest for government and for industry in those ways: too difficult to control and too big spread of the revenue. France still not legalized the use of oil on the roads and will not do anything to help this development.

We ask for the legalisation of oil as car fuel and ask for a policy for local development of energy in agriculture.

#### Solid waste

Solid waste management is not homogenous on the territory and a lot of things remain to do specially recycling as priority. About valorisation through energy, to much plants burn without any energy production, some produce electricity alone with very low efficiency.

The ITEBE position is only to promote energy valorisation with cogeneration, after valorisation of recyclable products, by burning or by fermentation.

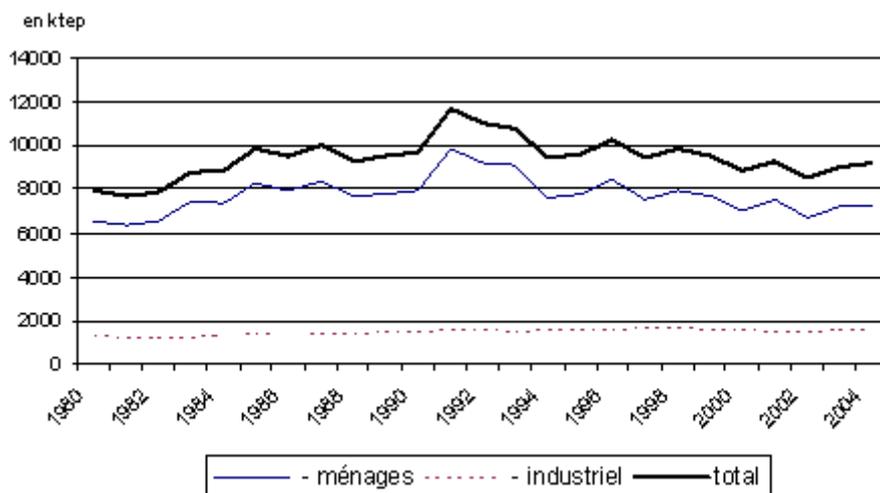
That means objective zero for electricity production alone and increasing of cogeneration. Go from 0,785 to 1 Mtoe in 2010 seem easy if we want it.

### 2.5.2. Heat trends and targets

Heat is to now supplied by solid biofuels close to 100 %, mainly with wood, and with some hundreds plants using straw or other waste of the agricultural industry.

	1980	1990	1995	2000	2001	2002	2003	2004
Primary supply energy by solid biofuels	7926	9720	9632	8896	9313	8498	9003	9180
Share of solid biofuels in total energy supply %	3,5	5,1	3,9	3,4	3,5	3,2	3,3	3,3

Figure 22 : Evolution of the primary consumption of wood per sector from 1980 to 2004 (Ceren/Ademe)



### Household's heating systems

The trend for the primary consumption of wood energy in households in on the decrease

	1980	1990	1995	2000	2001	2002	2003	2004
Consommation des ménages (ktep)	6530	7990	7810	7080	7571	6708	7175	7300
Part du secteur domestique dans la consommation totale de bois-énergie	82	82	81	80	81	79	80	80

Source : Ceren

The wood consumption in households decreased slowly to the 80s following the diminution of the number of farmers, who were the main consumers. The revival in 1982 corresponded with the second oil crisis and with the take off of the heating by nuclear electricity, people founding in wood a cheap extra heating to electricity. Consequently, 60 % of single houses installed a wood-burning appliance between 1982 and 1992. Since 1990, wood energy consumption go around 10 Mtoe per year, with a small decrease to 9 Mtoe since 1997

#### The market

6 millions of residences equipped with a wood-heating appliance.

230 to 270000 wood heating appliances commercialised each year (stoves - inserts - fireplaces - furnaces - boilers).

Figure 23 : Breakdown of energy in single houses

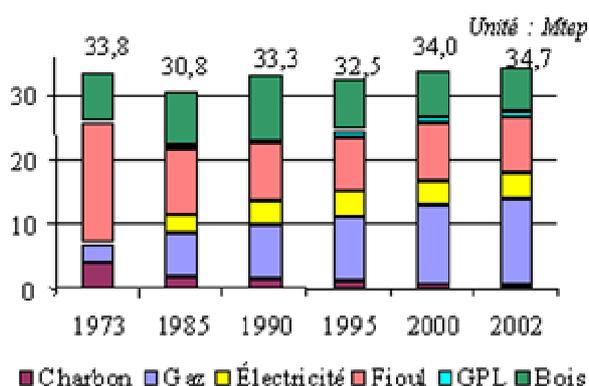


Figure 24 : Number of houses without central heating with breakdown per energy in 2002

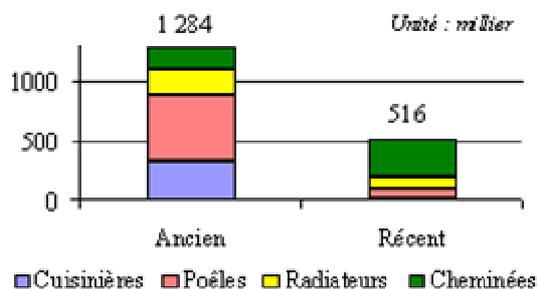
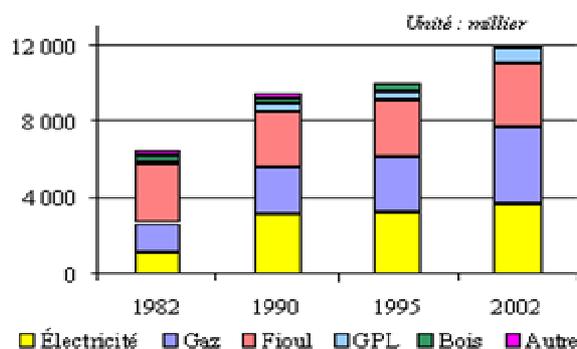


Figure 25 : Evolution per energy of the number of house with central heating with boiler



## Industry

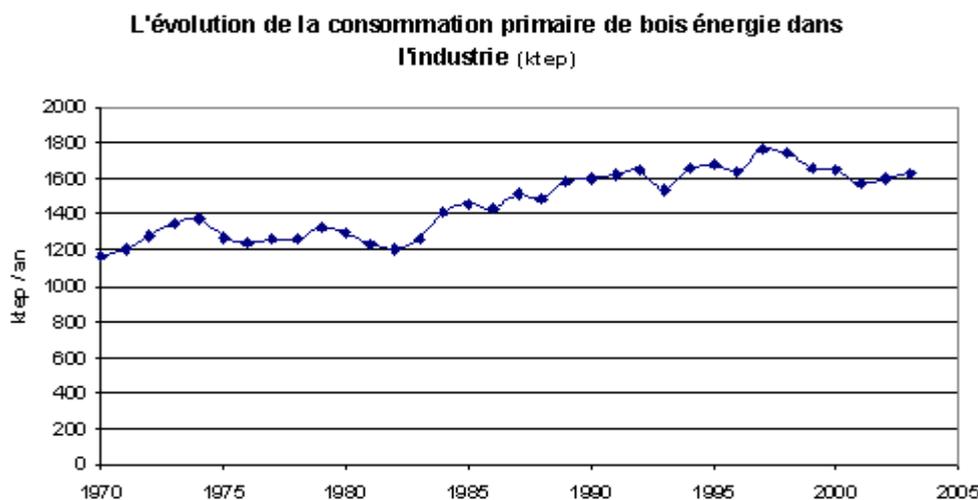
Some food or textile industries use their production residues or agriculture harvesting residues to heat, burning dry one (fruit stones, nutshell, coffee grounds,..) or methanise the wet other to burn biogas. This sector use about 120 ktoe.

Otherwise bioenergy consumption in French industry concerns mainly wood in sawmills, carpentries, palettes factories, furniture factories, paper and board industry, which use barks, sawdust, shavings, chips and black liquor.

French wood industry used 1,674 Mtoe of wood as primary energy in 2004, which means only 30 % more than in 1970. This quantity grows slowly, reflecting two phenomena: increasing of the wood waste valorisation and decreasing of the number of companies. Globally this trend follows the low increasing of the wood construction market, about 1% per year.

	1980	1990	1995	2000	2001	2002	2003	2004
Industry consumption (k toe)	1299	1601	1677	1653	1572	1603	1633	1674

Figure 26 : Evolution of wood energy consumption in industry<sup>40</sup>



It very difficult to say how many companies are concerned because no enquiries was made, but the number is at the level of 5000, all sizes together (50 kW to 200 MW). In the future, with the concentration of the companies, this number will decrease.

## 2.6. Germany

### 2.6.1. Bioenergy overview

#### *Bioenergy is 2,4% of the energy supply*

The share of RES on the primary energy consumption increased in 2004 to 3,6 %, against 3,1 % in 2003. In 2004 bioenergy enjoyed a share on the primary energy demand of 2,37 % with 7,5 Mtoe.

The development of the primary energy consumption is backed by a booming bioenergy market mainly in the transportation and electricity market due to the preferential treatment of biofuels for transportation in the Mineral Oil Tax and the Renewable Energy Source Act (EEG) on the electricity market. The 2,4% share of bioenergy on the primary energy consumption is therefore subdivided into 0,55% electricity generation, 1,51% heat supply and 0,31% for transportation.

<sup>40</sup> Observatoire de l'Energie / CEREN

Figure 27 : Primary energy supply (total is 14438 PJ or 344,8 Mtoe in 2004)<sup>41</sup>

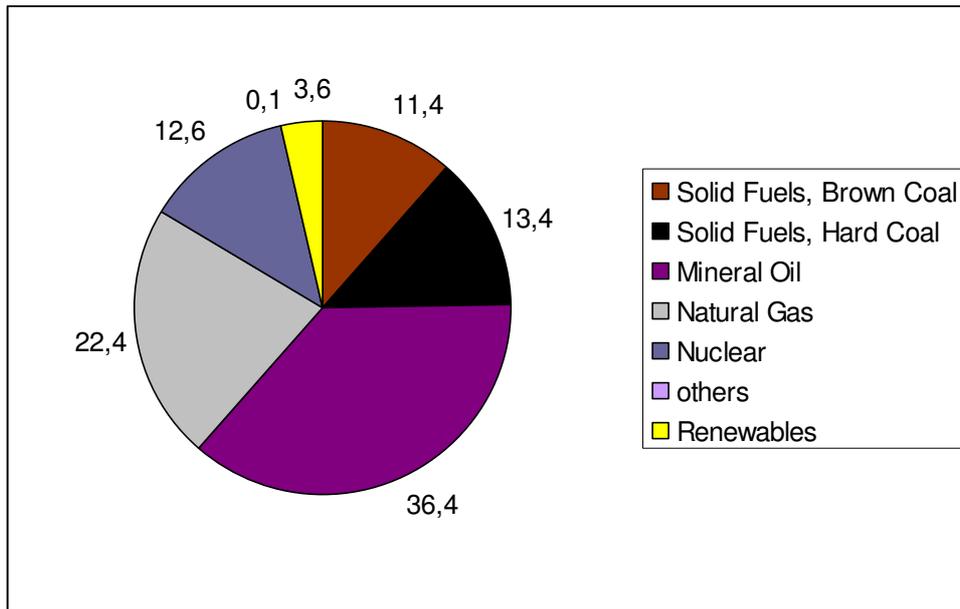
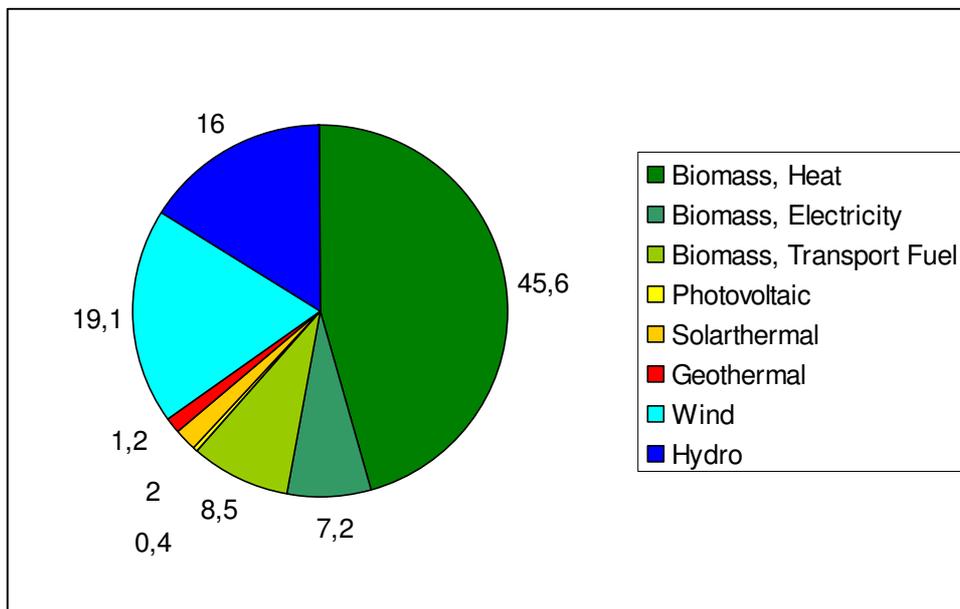


Figure 28 : Breakdown of renewables 2004 (total is 131 TWh final energy, 515,4 PJ or 12310 ktoe in 2004)<sup>41</sup>



*Targets for 2010 and beyond have been defined*

In the frame of EU legislation the Federal Government of Germany adopted the following indicative EU-targets :

- double the share of energy supply from renewable energy sources by the year 2010 compared with 2000, to reach 4,2%,

<sup>41</sup> Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit: Erneuerbare Energien in Zahlen, Berlin, Juni 2005

- reach 12,5 % renewable electricity,
- reach a liquid biofuel share of 5,75 % on the final energy consumption in the transportation sector.

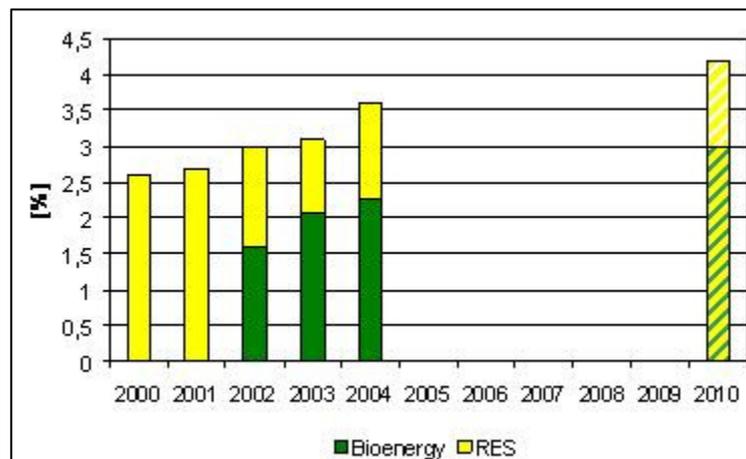
According to EU politics there are no targets defined for the heat market despite a backlog demand in the bioheat market both on European and national level. By 2020 at least 20 % of electricity generation and 10 % of the primary energy demand will be derived from renewable energy sources and it is even planned to reach a RES-E share on the electricity supply in 2050 of 50 % in conjunction with strong efforts to increase energy efficiency.

### *Biomass should provide 10,2 Mtoe in 2010*

With reference to an assumed primary energy demand of 341 Mtoe in 2010<sup>42</sup>, to fulfil a RES market share of 4,2 % approximately 14,3 Mtoe are necessary. The Federal Ministry of Consumer Protection, Food and Agriculture considers a share of at least 3 % (10,2 Mtoe) of bioenergy on the primary energy demand in 2010 as attainable.<sup>43</sup>

Under consideration of the recent RES development and the projected targets for 2010 it is very likely that Germany will reach its target of at least 4,2 % RES on the primary energy consumption in time.<sup>44</sup>

Figure 29 : Development of RES primary energy consumption and projection<sup>45</sup>



### *A large untapped potential*

The figures show that the bioenergy market is growing continuously. In the next 15 years bioenergy is supposed to have the highest market growth rates beneath the

<sup>42</sup> Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Ecologically optimized extension of renewable energy utilisation, Berlin 2004.

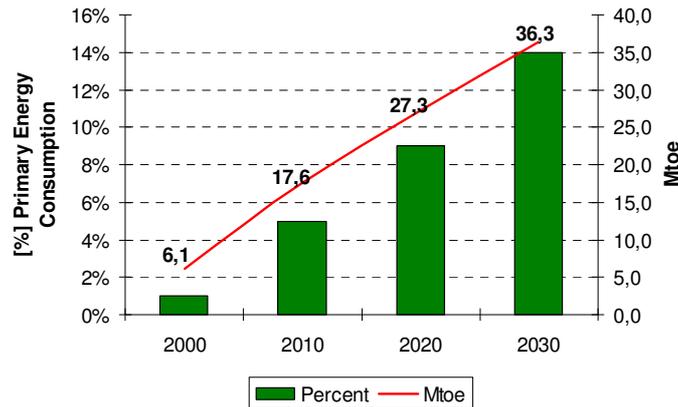
<sup>43</sup> Federal Ministry of Consumer Protection, Food and Agriculture BMVEL: Scheme for Biomass Energy Use, Berlin, 2005.

<sup>44</sup> Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Erste vorläufige Abschätzung zur Entwicklung der erneuerbaren Energien im Jahr 2004 in Deutschland, Stand Februar 2005, Berlin, 2005.

<sup>45</sup> BBE, AGEE-Stat, BMVEL

renewable energy sources and can significantly contribute to the primary energy demand. Nevertheless, its market potential is only tapped by a fraction yet. Bioenergy is actually used predominantly for heating with forest wood in fireplaces at home, as fuel in the transport sector and in the use of by-products in large power plants. In comparison, the potentials of agriculture, forestry, and waste management have hardly been developed and could provide much more than they do now.

Figure 30 : Potential biomass contribution to the Primary Energy Consumption<sup>46</sup>



Biomass by-products accumulate anyway, but at the moment, they are hardly used. In the future, a second life as a source of energy awaits these solid as well as liquid materials – they can supply approximately 15,5 Mtoe per year<sup>47</sup>. The greatest potential is offered by wood from forest thinning, biogas from manure, straw from grains, and wood wastes like old furniture, woody construction material, or cutting by-products from industry. The energy use of used wood and waste wood is today already exhausted in particular due to the Renewable Energy Source Act.

The area for energy crop cultivation can be enlarged to 2 Mha in 2010 and 4,4 Mha in 2030 as agriculture’s increasing yields require less and less area to provide the same food quantity.

As a result of the estimated biomass potential and under consideration of progress in efficiency, technology development and projected energy demand biomass could even contribute with 17,6 Mtoe to the primary energy consumption in 2010 meaning a share of approximately 5 %. The market share is subdivided into 4,4 % on the electricity market, 6,0 % on the heat market and 8 % on the transportation sector.

In 2020 this share can be further increased to 9 % on the primary energy demand (9,5 % electricity generation, 10,0 % heat supply and 9,9 % fuels for transportation)<sup>48</sup>.

<sup>46</sup> Institute for Applied Ecology, Material Flow Analysis of Sustainable Biomass Use for Energy, Darmstadt, 2004.

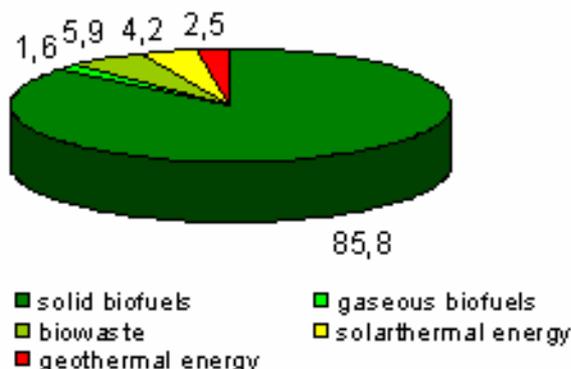
<sup>47</sup> Institute for Applied Ecology: Bioenergy – new Growth for Germany, Darmstadt, 2004.

<sup>48</sup> Institute for Applied Ecology: Material Flow Analysis of Sustainable Biomass Use for Energy, Darmstadt, 2004.

## 2.6.2. Heat trends and targets

In the RES heat market bioenergy enjoys a market share of 93 %, leading to a contribution of 3,9 % to the total heat market. All in all the bioheat generation could continuously be enlarged from 4,2 Mtoe in the year 1997 to 5,1 Mtoe in 2004<sup>49</sup>.

Figure 31 : RES heat supply in 2004<sup>50</sup>



### *Bioheat backs RES-Heat market with 93 %*

The German Bioenergy Association aims a market share of 10 % bioheat in 2020. With an assumed market growth for 2010 a market share of 6 % or 6,4 Mtoe seems realistic. But for that strong efforts and a political support is vital.

## Bioheat in individual households

In the bounds of the different biomass resources wood is predestined for an utilisation in the sector of individual heating in dwellings within heating systems with a capacity of up to 50 kW. The biogenic heat market is actually backed by the utilisation of wood logs and forest wood residues in additional heating systems. Almost 9 million systems using solid biomass are estimated for private households in Germany. The vast majority of such systems are additional heating systems. There are about 750 000 systems used as main heating (central and stove heating). Based on this stock, the total consumption of solid biofuels was determined backed on a representative survey of 20325 households about their average wood fuel demand per system type in 2002. The total solid biofuel consumption amounted to around 10,4 Mt or 3,6 Mtoe per year for 2002 in the sector of private households.<sup>51</sup>

### *Woodpellet market is boosting*

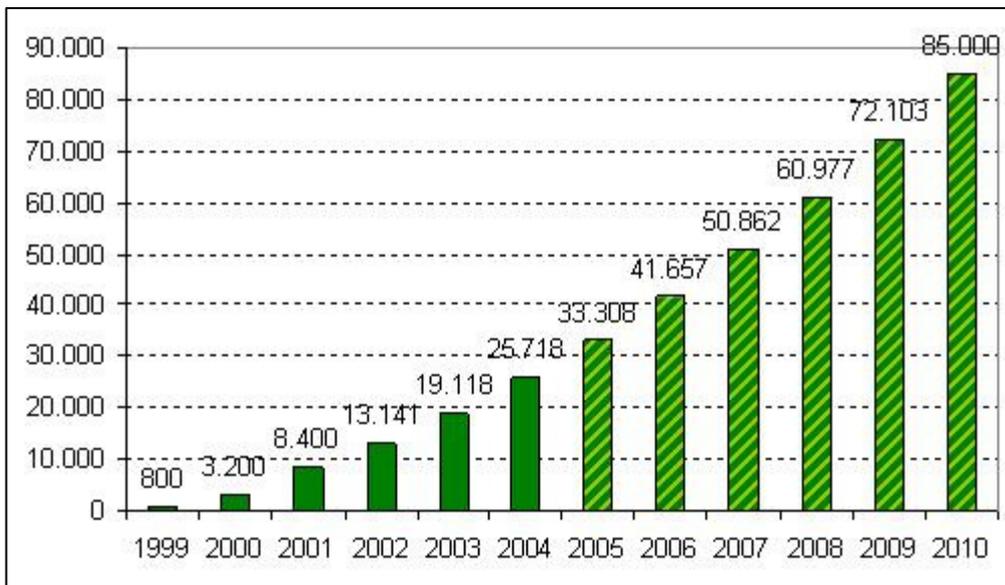
<sup>49</sup> Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Erste vorläufige Abschätzung zur Entwicklung der erneuerbaren Energien im Jahr 2004 in Deutschland, Stand Februar 2005, Berlin, 2005.

<sup>50</sup> AGEE-Stat

<sup>51</sup> Federal Ministry of Economics and Labour (BMWA): Energy consumption of private households and the tertiary sector (trade, commerce and services), Berlin, 2004.

The market for wood pellets increased significantly however on a low level. In 2004 about 25700 wood pellets systems have been installed compared with 19118 units in 2003. It is supposed that in 2006 about 41657 units could have been installed in total. Under the assumption of a constant growth rate of 10 to 15 % the amount of the yearly sold wood pellets systems could be heightened to 15000 units in 2010. If the prediction is done with a growth rate of 20 to 25 % even 22000 additional units per year in 2010 are expected. The installed capacity of the wood pellet systems is estimated of 410000 kW resulting into a heat generation of 60 ktoe, based on the wood pellet demand in 2004<sup>52</sup>.

Figure 32 : Market development of wood pellet systems and projection with a 10% growth rate<sup>53</sup>



The dynamic of the wood pellet market is also reflected by the expansion of wood pellets producers. Actually there are 20 production facilities and about 300 trading companies known in Germany compared to two producers in 1999.<sup>54</sup> Further on there are plans for many more production facilities in the near future. The production capacity increased from 72100 tonnes in 2002 to 226700 tonnes in 2004 and is expected to reach 300000 tonnes in 2005. In 2010 a wood pellet demand of approximately 450000 to 500000 tonnes per year will arise if the market for wood pellet systems develops as mentioned above.

<sup>52</sup> German Energy Pellet Association DEPV: Der Holzpelletmarkt in Deutschland, presentation on the BBE working group meeting "solid biomass" May 2005.

<sup>53</sup> DEPV

<sup>54</sup> Mantau, Udo, Jochen Keimer: Standorte der Holzwirtschaft – Der Pelletmarkt, University of Hamburg, 2004.

## Industry and tertiary sector

### *More than 300 large biomass plants*

Facilities with a capacity of more than 1 MWth are referred to industry. Due to surveys of the University of Hamburg about 352 biomass plants with a capacity above 1 MWth can be recognised in 2003, some of them are not in operation yet (13,4 %).<sup>55</sup> Approx. 95 plants produce electricity, 60 % of them in CHP<sup>56</sup>. A part of the biomass plants are closed-by to timber industry or are even operated by timber processing companies.

### *And 138 000 smaller installations*

Related to an analysis of the measurement records of the Chimney Sweep Guild and the statistics of BAFA for supported installations for the sector of commerce, trade and services which was run by the Institute for Energy and Environment in 2004 approximately 138000 installations within a capacity range of 15 to 1000 kWth can be identified, about half of them in the private sector, so that finally approx. 73000 installations in the capacity range 15 – 500 kWth can be referred to the tertiary sector. The total wood consumption in the tertiary sector was in order of approximately 1,8 – 2,6 Mt in 2002 (corresponding to about 0,62 – 0,91 Mtoe). This total amount can be split into roughly 50 % woodchips/pellets and 50 % split logs/other wood<sup>57</sup>.

## 2.6.3. Electricity trends and targets

### *Objectives on the electricity market will be achieved*

The Federal Government aims to a share of renewable energy supply in the electricity sector to at least 12,5 % by the year 2010 compared with 4,5 % in 1997 (24,91 TWh). In 2004 their share on the electricity market was 9,3 % (55,86 TWh) so that Germany is on a good way reaching its target on time<sup>58</sup>. Bioenergy will play the main role to fulfil the objective in conjunction with the off-shore wind energy technology. In 2010, according to the Institute for Applied Ecology, bioenergy could contribute with 4,4 % to the electricity market based on an assumed electricity demand of 533 TWh.

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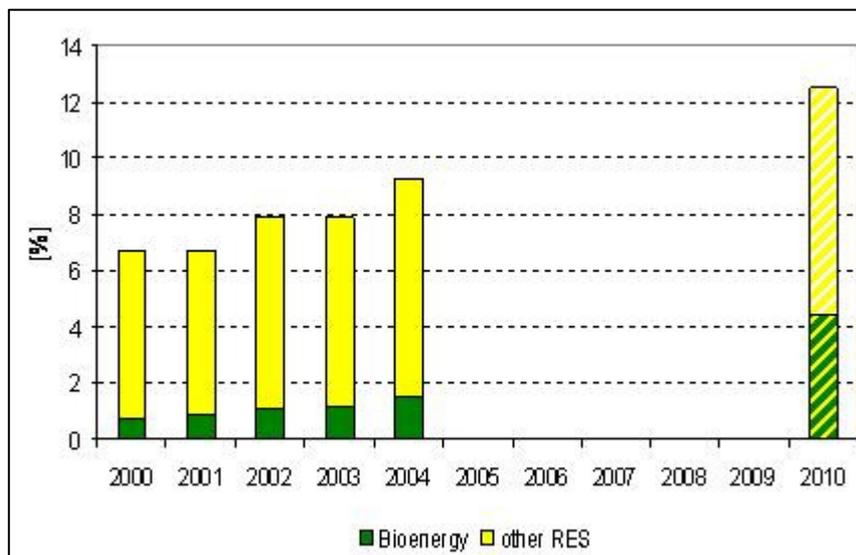
<sup>55</sup> Mantau, Udo: Holzrohstoffbilanz – Überschuss oder Knappheit, in: Holzenergie 2004, proceedings, Bonn, 2004.

<sup>56</sup> Institute for Energy and Environment: Fortschreibung der Daten zur Stromerzeugung aus Biomasse, Leipzig 2004.

<sup>57</sup> Federal Ministry of Economics and Labour (BMWA): Energy Consumption of private households and the tertiary sector (trade, commerce and services), Berlin, 2004.

<sup>58</sup> Federal Ministry for the Environment, Nature Conservation and Nuclear Safety BMU: Renewable Energy Sources in figures. Preliminary results for 2004. Berlin 2005.

Figure 33 : Development of RES electricity generation and national target/bioenergy potential<sup>59</sup>



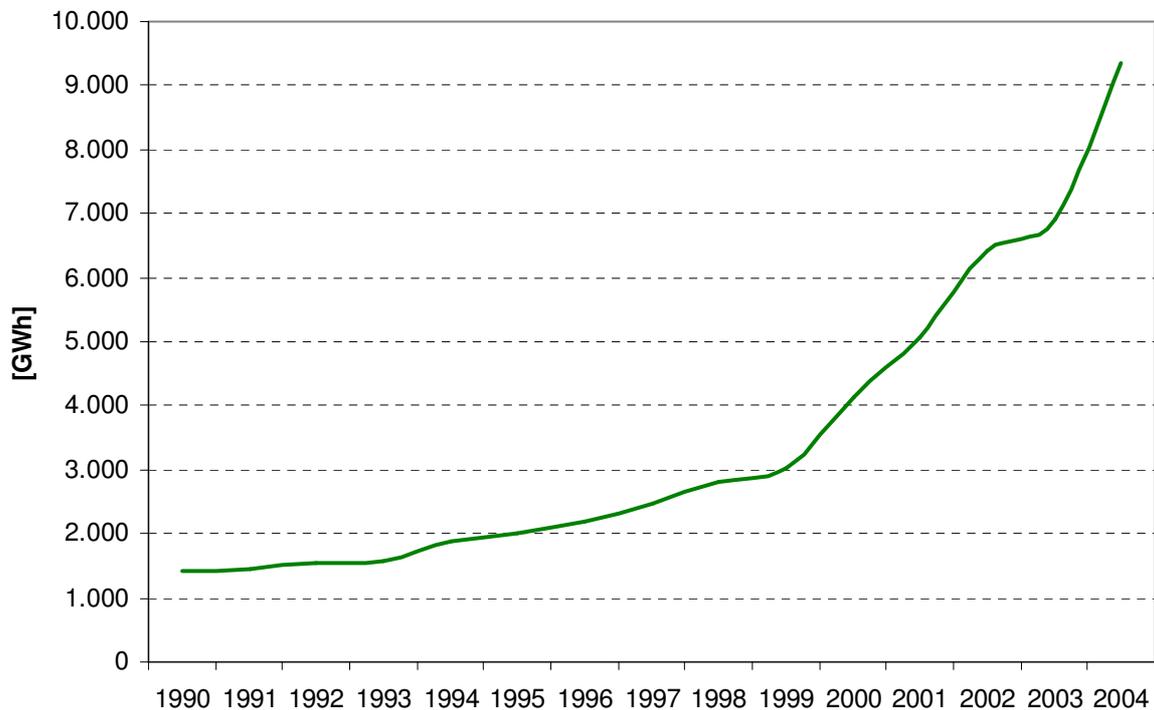
## Utilities and cogeneration

### *EEG strongly supports bioelectricity generation*

With a close look on the electricity generation with biomass from 1990 until now it is obvious that the development has speeded up in the last 5 years. Whereas in 2001 bioenergy accounted for 5065 GWh electricity generation its market share could almost be doubled with 9367 GWh in only a three year period. This development was mainly initiated by the commencement of the Renewable Energy Sources Act (EEG) and its amendment in 2004, which collateralised private investments in renewable energy facilities for electricity generation in the long run. About 900 M€ have been invested into the biogenic electricity market last year with a realised turnover by operation of biopower plants of 650 M€. Especially in the field of solid biomass and biogas power generation there could be recognised a high increase of about 50 %. They accounted for 5,3 TWh in 2004 compared with 3,5 TWh in 2003. In conjunction with liquid and other gaseous biofuels and the biogenic fraction of waste biomass even accounted for 9,4 TWh electricity generation in total, a share of 1,6 % of the final electricity consumption in Germany in 2004.

<sup>59</sup> BBE, AGEE-Stat

Figure 34 : Development of bioelectricity<sup>60</sup>



*Waste wood and biogas dominate bioelectricity generation*

With about 42 % solid, biomass dominates the biogenic electricity generation. Approximately 100 waste wood power plants have been installed until 2005 with a total capacity of 475 MW<sub>el</sub>, 60 % of them are being operated as CHP. The average capacity of these utilities is 5 MW<sub>el</sub>, but due to the favourable compensation rates for waste wood within the Renewable Energies Source Act the installed capacity of new utilities is increasing. From 15 new facilities in 2003 ten facilities had a capacity of more than 5 MW<sub>el</sub>. In 2004 about 39 new utilities have been built. Further plants are in planning, but still insecure due to regional waste wood shortages. An expansion of additional 12 facilities and a total capacity to 650 MW<sub>el</sub> until 2006 seems to be realistic<sup>61</sup>. For electricity generation with solid biomass in 2003 about 4,7 Mio t of wood have been utilised, predominantly waste wood (80 %).

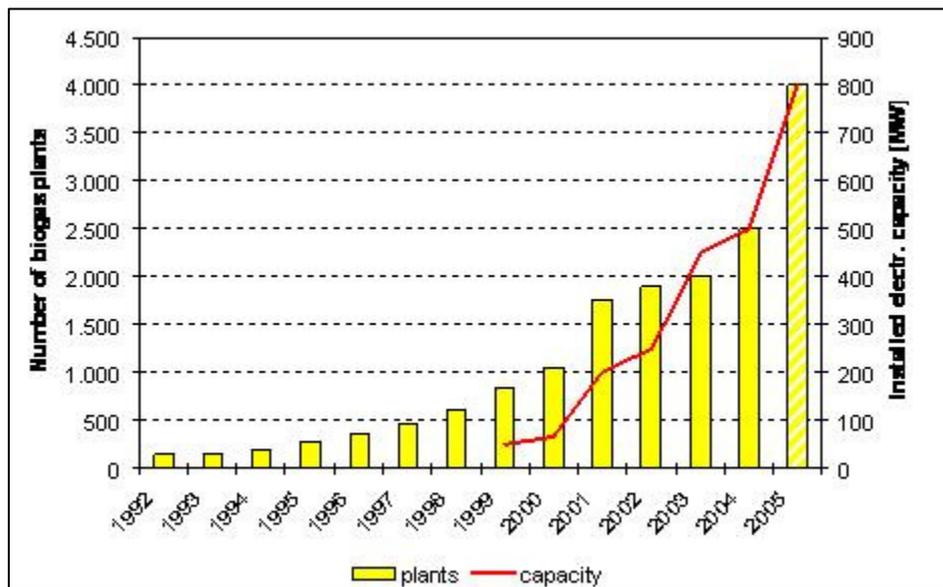
The share of biogas on the biogenic electricity generation in 2004 accounted for 14 % with estimated 2000 to 2500 facilities and an installed capacity of 430 - 500 MW<sub>el</sub> producing 1,3 TWh electricity in 2004. The investments in new biogas plants in 2005 are supposed to reach 470 M€ resulting into a growth up to 4000 biogas plants and 600 – 800 MW<sub>el</sub> installed capacity until 2006.<sup>62</sup>

<sup>60</sup> AGEE-Stat

<sup>61</sup> Institute for Energy and Environment: Extrapolation of the data of electricity generation with biomass, report for the working group RES-Statistics of the BMU, March 2004.

<sup>62</sup> German Biogas Association FvB

Figure 35 : Market development of biogas plants and projection<sup>63</sup>



#### 2.6.4. Liquid biofuels trends and targets

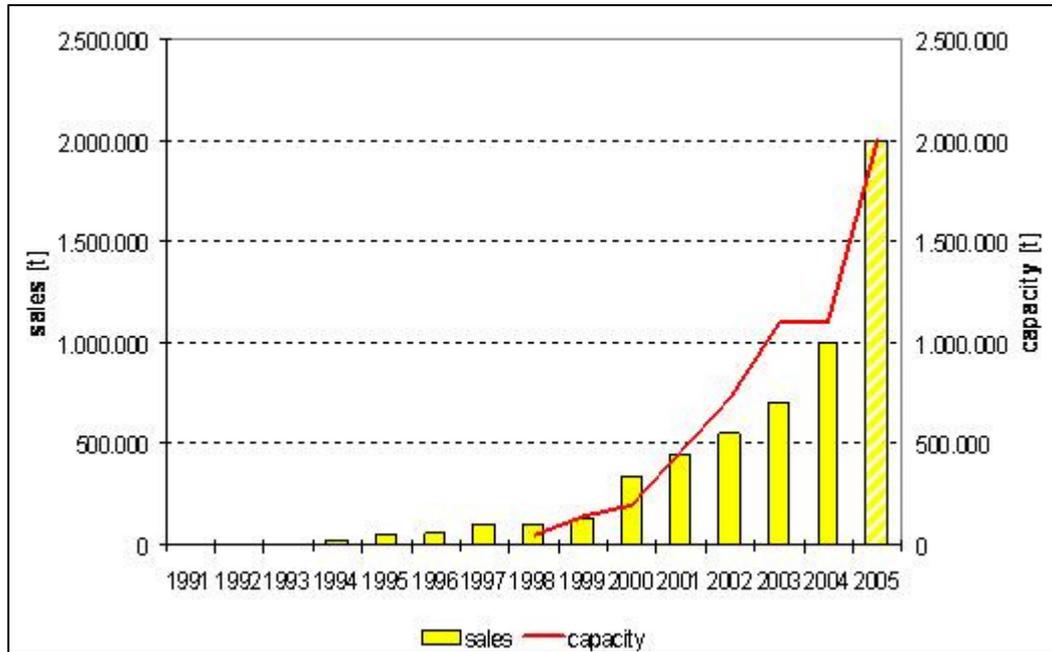
*With 1,6 % market share biodiesel is an established fuel*

Almost disregarded in public the greatest development on the bioenergy market happened in the traffic sector. Germany has adopted the indicative EU targets of 5,75 % for the transport sector in 2010 and supports the development of the biofuel market with an exemption from the mineral oil tax until 31 December 2009. As a result of rising fuel prices for petrol and diesel and the commencement of the tax exemption for pure and blended biofuels since 2004 the biofuel share on the final energy consumption for transportation increased from 0,9 % in 2003 to 1,6 % (0,94 Mtoe) in 2004. Biodiesel has become an established fuel in the last ten years and is now available in Germany at early every tenth filling station. It has conquered a substantial share of the fuel market with a turnover of about 800 M• in 2004. Its market share could be increased by 53 % compared with 2003. In Germany biodiesel is generally produced on the basis of rape seed oil: last year rape seed was grown on 700 000 ha farm land for biodiesel production on its own.

In 2004 about 30,1 Mt of mineral diesel were sold in Germany. With a sold amount of more than 1,2 Mt of biodiesel it enjoys a share on the diesel market of more than 3,3%. Today's production capacities are more than 1,2 Mt in approximately 35 production facilities and are expected to reach the 2 Mt threshold until 2006. To reach the indicative 5,75 % target of the European Directive 2003/30/EC approximately 2,1 Mt (1,85 Mtoe) of biodiesel are necessary based on an assumed diesel consumption of 30,8 Mt in 2010.

<sup>63</sup> FvB

Figure 36 : Market development of biodiesel and projection<sup>64</sup>



Until 2003 Biodiesel was brought to the market only as pure fuel, but since the amendment of the ordinance for fuel quality (10. BImSchV) it is possible to blend biodiesel up to 5 % to conventional diesel without branding. In consequence 6 refineries in Germany have started to add biodiesel to mineral diesel, more refineries are being retrofitted at the moment. If all refineries in Germany are going to blend mineral diesel with biodiesel by 5 % it will lead to an additional demand of 1,5 Mt<sup>64</sup>.

*Bioethanol production facilities are being put up*

With the exemption of all biofuels from the mineral oil tax since January 2004 the production of bioethanol for the substitution of petrol started to become competitive. For bioethanol this exemption is limited to undenatured alcohol with more than 99 % ethanol content. As a consequence 3 large scale production facilities based on crop with a total production capacity of 590000 tonnes per year will start operation in 2005. Other facilities are being planned at the moment. In 2004 about 50000 t bioethanol had been produced contributing with 35 ktoe to the final energy consumption in the transport sector.

To reach the 5,75 % target of the Directive approximately 2,1 Mt of bioethanol are necessary leading to a requirement of another 1,6 Mt production capacity and an investment of approximately 1000 M€. Considering the potential for bioethanol production resulting of the balance of sugar and crop exports and set aside land about 6,3 Mt of bioethanol production per year are possible according to 20 % of the petrol market in 2020.<sup>65</sup>

<sup>64</sup> Union for the Promotion of Oil Seed and Protein Plants UFOP <http://www.ufop.de>

<sup>65</sup> Fachagentur Nachwachsende Rohstoffe: Basisdaten Biokraftstoffe, January, 2005.

## 2.6.5. Objectives for Germany

### *Bioelectricity and transport fuel develop well, bioheat needs more support*

The Federal Government of Germany aims to reach until 2010 a market share of RES of 4,2% in the primary energy consumption, of 12,5% in electricity generation and of 5,75% share of biofuels in the transport sector. Due to favourable steering instruments in the electricity and traffic sector Germany is on a good way to reach its aims in these sectors.

The implementation of the Renewable Energy Source Act (EEG) in 2000 and its amendment in 2004 boosted especially the market growth of electricity generation with biomass (100 plants in 2004) and biogas (2.500 plants in 2004) and seems to be one of the most effective instruments to increase RES electricity market shares in the short-term while decreasing remuneration rates guarantee technology development and advancements in efficiency. Actually RES have already a market share of 9,3 % on the final electricity demand out of which bioenergy accounts for 1,6 %. Until 2010 the contribution of bioenergy to the electricity supply could be heightened to at least 4,4 %, but for a further market development huge investments are necessary which will demand investment security meaning a continuity of the EEG and a fixed guarantee of the compensation fees.

Despite its huge potential the bioheat market developed marginally. Its market share in the final energy demand increased slightly from 3,8 % to 3,9 %. With 34,5 % high growth rates happened only in the sector of wood pellet systems, but still on a low absolute level leading to 25718 units in 2004. The Market Incentive Programme, only support instrument for the RES heat market in Germany, is in fact valuable to attenuate higher investment costs for RES systems, but due to its dependence on the annual budget negotiations of the Federal Government and its strict limitations it is not far reaching enough to boost the bioheat market according to its potential and to utilise the enormous idle biomass potential. The implementation of an effective steering instrument with a clear aim and timeframe is therefore necessary.

All in all Germany could considerably increase its Share of Renewable Energy Sources in Gross Inland Energy Consumption from 1,8 % in 1995 to 3,6 % in 2004. With 7,9 Mtoe bioenergy has already contributed to two third. To fulfil the 4,2 % target until 2010, approx. 14,3 Mtoe RES are necessary, the share of bioenergy is expected to reach 3 % or 10,2 Mtoe. But if it can be managed to maintain the successful instruments in the electricity and transport sector, to implement an equivalent instrument in the RES heat market and to utilise the potential of forest wood and energy crop cultivation a bioenergy contribution of 17,6 Mtoe to the Gross Inland Energy Consumption in 2010 is attainable meaning a share of 5 %.

Tableau 24 : Summary table of reference bioenergy use and objectives of the German biomass association

Categories	Fuel type	Reference year 2004				Objectives of BBE for 2010			
		Biomass required	Bioheat (ktoe final energy)	Bioelectricity (GWh final energy)	Liquid biofuels (ktoe)	Biomass required	Bioheat (ktoe final energy) BBE objective 6 %	Bioelectricity (GWh final energy) BBE objective 4,4 %	Liquid biofuels (ktoe) Gov. Objective 5,75 %
Biomass for heat	(Fire)wood	14,59 Mt in 2002 <sup>66</sup>	4526 <sup>61</sup>	NR	NR*		741	NR	NR*
	Pellets <sup>67</sup>	140000 t	60	NR	NR	450 kt	192	NR	NR
	Others		556 <sup>61</sup>	NR	NR			NR	NR
	<b>Sub-total</b>	<b>14,7 Mt</b>	<b>5142</b>	NR	NR	2,85 Mt	<b>933<sup>68</sup></b>	NR	NR
Biomass for cogeneration	biogas			1350	NR		5169	8100	NR
	Wood chips	3 Mt <sup>69</sup>	240	2340	NR			9300	NR
	Other			2247	NR		267	6200	NR
	<b>Sub-total</b>			<b>5937<sup>70</sup></b>	NR		<b>5436<sup>69</sup></b>	<b>23600<sup>69</sup></b>	NR
Biomass for electricity only	Wood chips	1,7 Mt <sup>60</sup>	NR	1560	NR		NR		NR
	Other		NR	1870	NR		NR		NR
	<b>Sub-total</b>	<b>1,7 Mt<sup>65</sup></b>	<b>NR</b>	<b>3430<sup>61</sup></b>	NR		NR		NR
Biomass for liquid biofuels	Biodiesel	2,8 Mt Rape Seed	NR	NR	924	5,25 Mt Rape Seed	NR	NR	1860
	Bioethanol	-	NR	NR	35	6,7 Mt Wheat; 1 Mha	NR	NR	1344
	<b>Sub-total</b>	<b>-</b>	<b>NR</b>	<b>NR</b>	<b>959</b>	<b>-</b>	NR	NR	<b>3204</b>

\* NR = Not Relevant

To reach the targets for 2010 it is assumed, that for efficiency reasons and optimised material flows the bioheat supply is backed mainly on CHP waste heat whereas small scale heating systems are relevant only for wood pellet systems. So the main material flows in the heat market should go into CHP at the expense of inefficient old additional heating systems. Accordingly about 20% of the biomass for the electricity generation is used in co-firing plants and 80% in decentralised bio-CHP facilities.

<sup>57</sup> Institut für Energetik und Umwelt: Wärmegewinnung aus Biomasse. Anlagenband zum Abschlussbericht. Energieverbrauch der privaten Haushalte und des Sektors Gewerbe, Handel, Dienstleistungen (GHD), Leipzig, April 2004.

<sup>67</sup> German Energy Pellet Association DEPV: Der Holzpelletmarkt in Deutschland, presentation on the BBE working group meeting "solid biomass" May 2005.

<sup>68</sup> Öko-Institut: Stoffstromanalyse zur nachhaltigen energetischen Nutzung von Biomasse, Darmstadt, Mai 2004.

<sup>69</sup> Institut für Energetik und Umwelt: Fortschreibung der Daten zur Stromerzeugung aus Biomasse, Leipzig, März 2004.

<sup>70</sup> Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit: Erneuerbare Energien in Zahlen, Berlin, Juni 2005.

## 2.7. Sweden

### 2.7.1. Bioenergy overview

*Biomass covers more than 22% of the primary energy supply*

The use of biofuels in Sweden has shown a large and steady growth since mid 1970s. There are several reasons for this. First the country has major forest resources and a long tradition of their utilisation, both in pulp- and paper industry, sawmills and as biomass fuels. But the main reason is the rise of the oil price and development of national energy and Eco-taxations.

Parallel with the growth of biofuels a drastic change in the Swedish energy mix has taken place. The production of electricity has grown strongly since 1970s as a result of an extensive introduction of nuclear power and expansion of hydropower. The supply of coal raised during 1980s, but declined during the 1990s. Large heat pumps were introduced in the district heating systems in the 1980s, and a distribution net for natural gas was built in south-western Sweden during the same period. Wind power was introduced as late as in the end of 1990s, but despite a fast expansion their contribution to the national electricity supply is very minor.

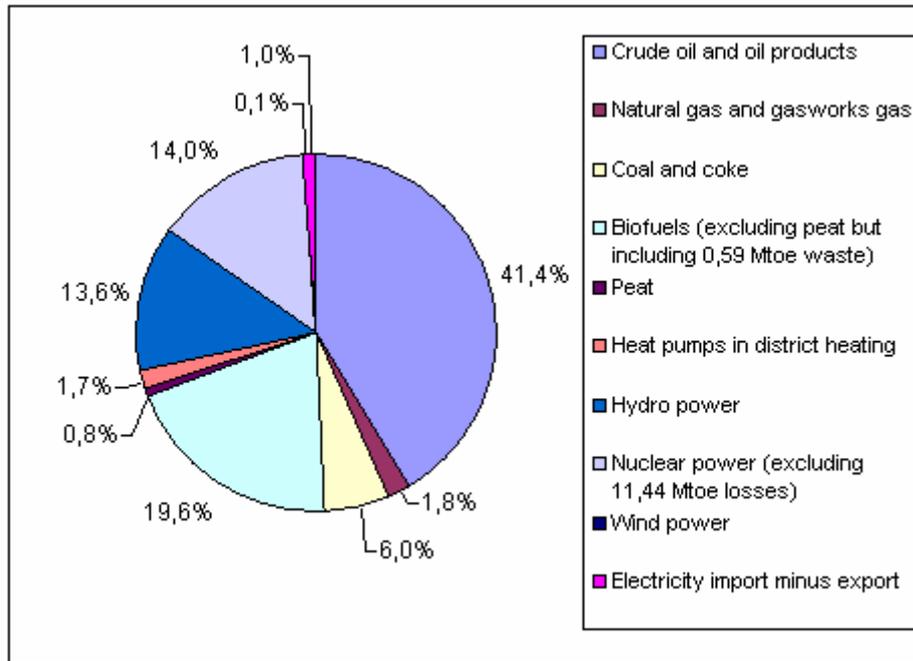
*The strong development of bioenergy is to a great extent a result of high energy and Eco-taxation*

Use of oil and oil products has decreased drastically from 28 to about 17 Mtoe since 1970s<sup>71</sup>. During that period the oil has been replaced by electricity and energy saving both in industry and in heating systems. The energy mix in 2002 is shown in Figure 37.

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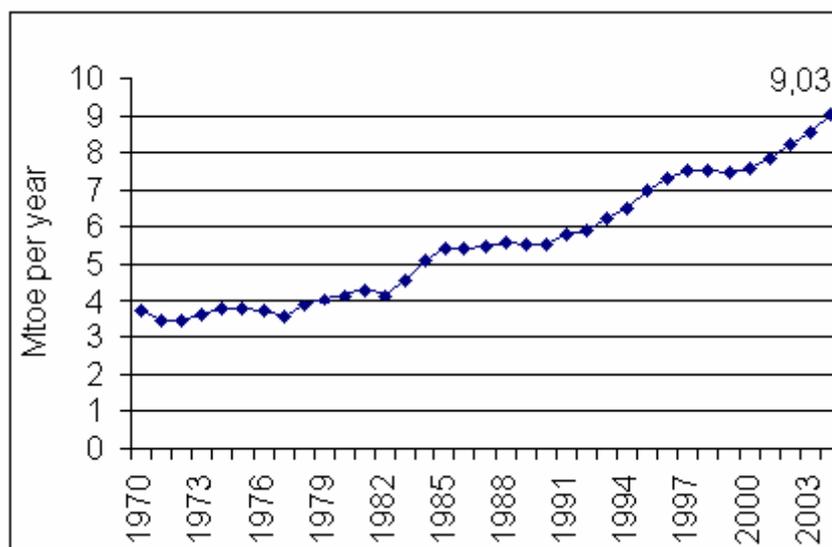
<sup>71</sup> Swedish Energy Agency, Facts and Figures 2004

Figure 37 : Total energy supply in Sweden (41,93 Mtoe excluding losses in nuclear power in 2002)



There are no national targets for biomass expressed in figures, except for liquid biofuels and new bioelectricity production. However the political frameworks are strong as well as the political will. The present government (2005) has declared that **“Conditions will be created to break Sweden's dependency of fossil fuels until 2020”**.

Figure 38 : Development of total supply of biofuels in Sweden, excluding peat



## 2.7.2. Heat trends and targets

### Use of wood fuels in individual households, residential and service sector (except district heating)

*Wooden fuels provides about 1 Mtoe (13%) of total energy used for heating and hot water in residential and non residential premises*

Firewood and wood pellets are the most frequently used biofuel assortment for Swedish residential houses today. During and after the oil crises in the 1970ties, the firewood use increased steeply. But since the beginning of the 1990ties the level of bioenergy use in the sector has been almost constant (Figure 39), however with a significant increase the latest years. In residential houses wood is the most commonly used biofuel. 20 –25 percent of residential houses outside district heating nets are using firewood as the primary heating source. Firewood is often used together with oil or electricity in multi-purpose boilers. Multi-purpose boiler systems are very popular and the share of these systems is almost 30%.

The use of oil for heating in the sector has decreased with about 86 ktoe a year the latest years and reached 696 ktoe in 2003 in one and two dwelling buildings, 206 ktoe in multi-dwelling buildings and 275 ktoe in non residential premises<sup>72</sup>.

There is no clear price statistics for firewood because of a pattern of local markets. The firewood market is therefore commonly viewed as "informal". The pulpwood assortment locally sets the upper limit for firewood prices. Sweden is the leading wood pellet market in Europe. The Swedish pellet market has developed continuously since the early 1990s. Between 2003 and 2004 the use of pellets in individual housings grew by 50 percent. During the first years of pellet market development, the large-scale customers dominated while the trend in later years is that the small- and medium-scale segments are most dynamic. In 2004, 1,25 million tonnes (500 ktoe) of wood pellets were consumed in Sweden. The small-scale segment comprised 35% of the total pellet consumption in 2004. About 60000 households in Sweden used wood pellets in 2004 in boilers or stoves. Still, pellet use only amounts a minor part (17%) of the total bioenergy use in the residential sector and firewood is dominating the renewables.

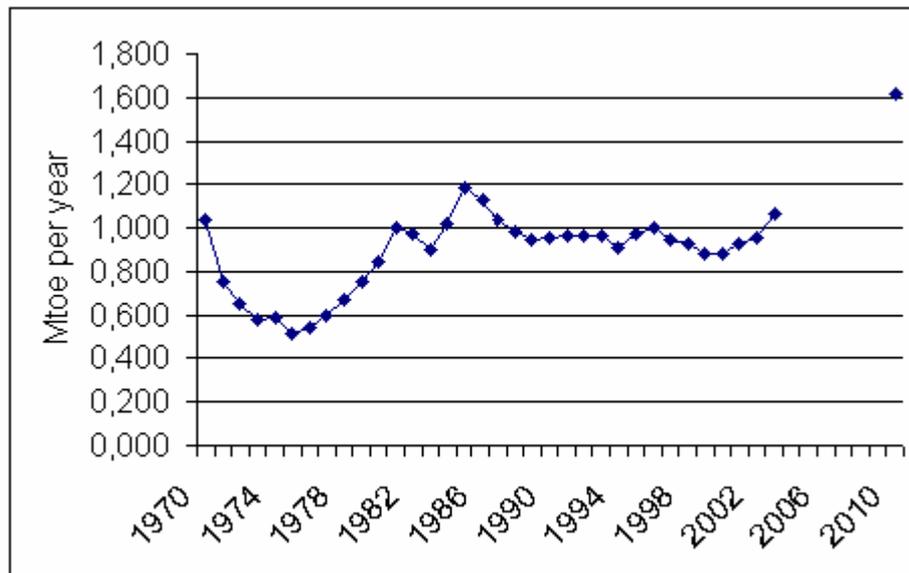
*Despite a 50% growth between 2003 and 2004 for pellets use traditional wooden fuels still dominates the heat market for dwellings and non-residential premises*

Of in total 7,65 Mtoe used for heating including hot water in the sector (2002) about 44% was used in one and two dwelling buildings, 31% in multi-dwelling buildings and 25% in non residential premises like offices, business- and official localities.

There are no national biofuel targets for heat or wood fuels in the residential sector in Sweden.

<sup>72</sup> Statistics Sweden, 2005, Statistics for dwellings and non-residential premises for 2000-2003

Figure 39 : Use of biofuels in the residential and service sector and suggested SVEBIO target for 2010



*It is possible to convert almost all oil-heating and 10% of electric heating in residential and non residential premises till 2010*

Suggested goals and targets for 2010 :

- Convert almost all oil-heating in one and two dwelling buildings in a twelve year period. Half to biofuel and half to heat pumps and district heating. Additional 33 ktoe biofuels a year gives 247 ktoe till 2010.
- Convert almost all oil-heating in non residential premises in a twelve year period, half to biofuel and half to heat pumps and district heating. Additional 9 ktoe biofuels a year gives 60 ktoe till 2010.
- Convert half of electric heating systems with water piping to pellets systems at a pace of 18 ktoe a year, within a twelve year period. This gives 126 ktoe additional biofuel till 2010.
- Install pellets stoves in houses with direct electric heating at a pace of 10 000 stoves a year, giving an additional 8 ktoe a year and 60 ktoe biofuel till 2010.

The fulfilling of these goals needs energy savings equal to the expansion of the energy demand in the sector.

The program would expand bioenergy use for heating purposes in individual household, residential and service sector with 71 ktoe a year from 2003, and a target of totally 1610 ktoe till 2010.

## Heat in industry

*Bioheat in forest and forest related industry has been slowly but steady growing since 1980s*

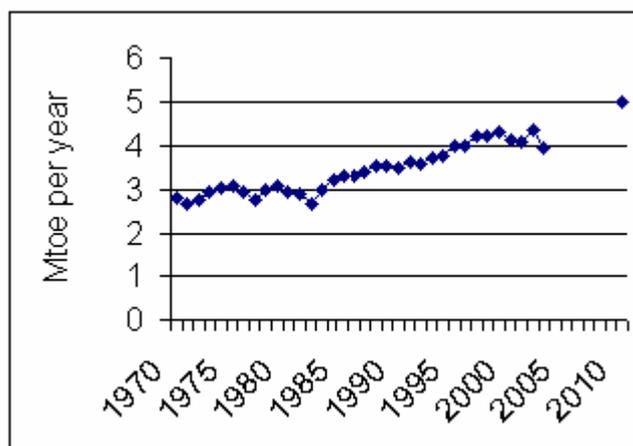
Dominating parts of the Swedish industry, paper and pulp and metallurgic industry, is very energy consuming and export dependent. The industry has had a reduced rate of carbon dioxide taxation, which has made it less profitable to convert from fossil fuels to biofuels in the sector, compared to the residential sector.

Only within the forestry related industry heat production from biofuels has been common, e.g. use of by-products such as bark and scrap wood for drying purposes and black liquor. The growth of these uses has been steady over the years, but not fast.

However today a combination of raising fossil fuel prices, the Emission Trading Scheme and a new carbon dioxide taxation has made it more profitable for the industry to invest in bioheat. A great number of investments have been noted lately.

There are no national targets at present for heat production in industry.

Figure 40 : Supply of biofuels for heat in industry and suggested SVEBIO target for 2010



*Internal use of black liquor is the dominating use of biofuels in the Swedish industry*

Biofuels are today the second largest energy source in the Swedish industry after electricity. Internal use of black liquor is dominating with 3,04 Mtoe (2003) followed by by-products in paper- and pulp industry, 0,64 Mtoe (2003) and by-products in the sawmill industry with 0,43 Mtoe<sup>73</sup>. The use of bioheat in industry is very conjuncture dependent.

Suggested additional use for 2010

<sup>73</sup> Swedish Bioenergy Association, Effects on electricity production in the Paper and Pulp Industry 2004 (in Swedish)

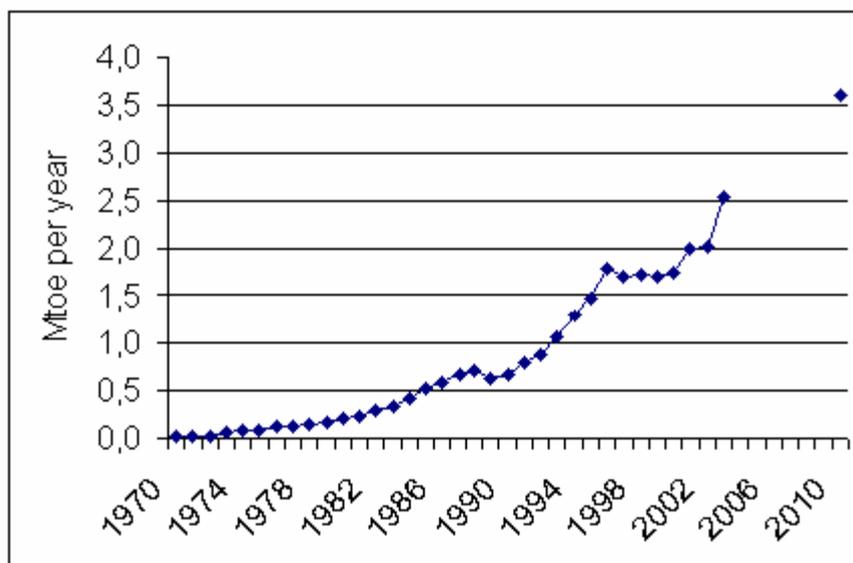
Industry uses about 1,8 Mtoe oil for process steam and heat production. It is reasonable to believe in a continually developing supply of biofuels, giving additional 825 ktoe and about 5 Mtoe total supply of biofuel 2010. This includes heat from new bioelectricity production.

### Use of biofuels in district heating

*There is still a considerable potential for expansion as well as for replacement of fossil fuels in the district heating systems*

The development of district heating has been very strong since the beginning of the 1970ties, from 1,26 Mtoe (almost 100 percent oil) 1970 to 4,83 Mtoe 2003. There is still a considerable potential for expansion in the sector, especially for smaller local grids, but also in larger communities.

Figure 41 : Supply of biofuels for heat in district heating, excluding peat and suggested SVEBIO target for 2010



The total supply of fuels 2003 (4,830 Mtoe) was dominated by biofuels followed by heat pumps and oil. The use of oil has decreased from its maximum in 1980 (2,66 Mtoe) to 0,43 Mtoe 2003. Among the biofuels wooden fuels in the form of cutting residues from forestry are dominating, but with an increasing amount of wooden pellets and briquettes. 2003 the supply of wooden fuels was 1,46 Mtoe, waste 0,60 Mtoe, tall oil 0,26 and others 0,17 Mtoe, in total about 2,5 Mtoe (0,34 Mtoe peat excluded). The use of wooden fuels in district heating has grown five times since 1990. The use of waste has also grown considerably, 0,26 Mtoe since 1990.

There is no national target at present for heat production in district heating.

Suggested additional use for 2010

A target of additional 1,14 Mtoe biofuels should represent replacement of all oil (0,43 Mtoe) and 0,71 Mtoe new district heating. This would expand the use of bioenergy for heat in district heating to a target of 3,6 Mtoe for 2010.

### 2.7.3. Cogeneration trends and targets

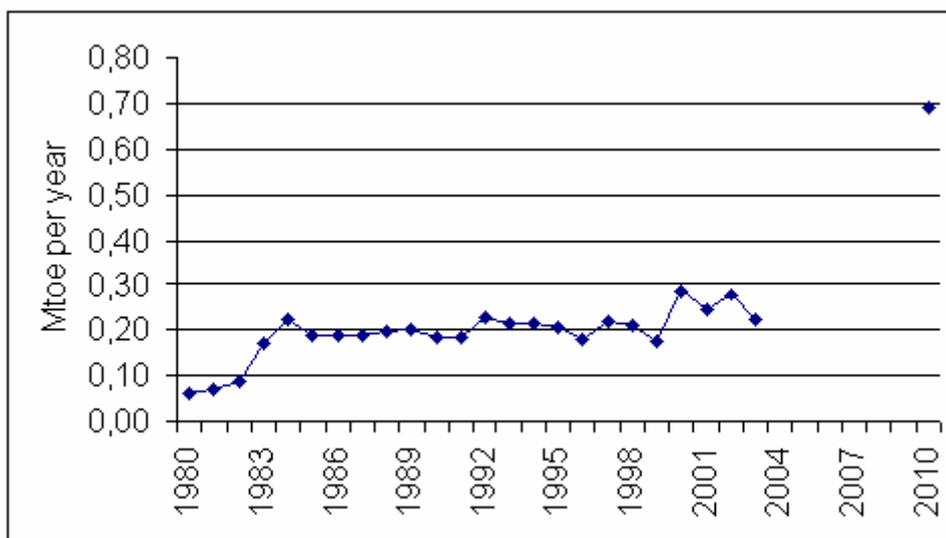
#### Cogeneration in industry

*Bioenergy cogeneration in industry have shown a low development, mostly due to low electricity prices and favourable taxation of fossil fuels*

The development of cogeneration (industrial back pressure) in industry has been relatively slow compared to the industrial large use of electricity and biofuels. The production is changing with industrial conjunctures, but during the latest years the investments in electricity generation capacity has grown very strongly as a result of the newly introduced electricity certificates. The biofuels are dominated by forestry rest products. Promising research and demonstration projects with of gasification of black liquor can drastically raise the paper and pulp industries generation capacity of bioelectricity.

There are no specific national targets for cogeneration in industry, except for a global national target of new renewable electricity of 10 TWh/year 2010 from the 2002 level.

Figure 42 : Biofuels in industry for co generation and SVEBIO target for 2010



*Recent investment decisions will enhance the bioelectricity production capacity dramatically. The reason is the 2003 introduced green electricity certificates*

Suggested additional production for 2010

The total bioelectricity production capacity including new decided capacity will be about 5,2 TWh in 2010. The Swedish forest industry has in a recent questionnaire

made by SVEBIO 2004<sup>74</sup> calculated with an additional electricity production capacity of 2,3 TWh from 2003 to 2008. Most of the investment decisions are already taken and the main part of the construction work will have been done to 2008. This very strong development is a result of the green electricity certificate system introduced 2003. When evaluating the curve above (Figure 42) it has to be taken in to consideration that until 2003 the industry used coal in the cogeneration electricity production of taxation reasons. Fuels used in the electricity production where exempted from carbon dioxide taxation.

The estimated target for bioelectricity production in industry is set to 7,2 TWh (about 0,69 Mtoe fuel) for 2010.

### **Cogeneration in district heating**

*The potential for developing further cogeneration capacity in district heating is relevant*

The Swedish district heating systems has developed from being net users of electricity in the period 1975-1985 to relevant producers of about two percent of the country total electricity consumption. The potential for more electricity production is still relevant. The development has been very strong especially during the latest years as a result of the introduction of the electricity certificates 2003.

*The production of bioelectricity within the district heating systems will more then double as a result of the green electricity certificates*

Suggested additional production for 2010

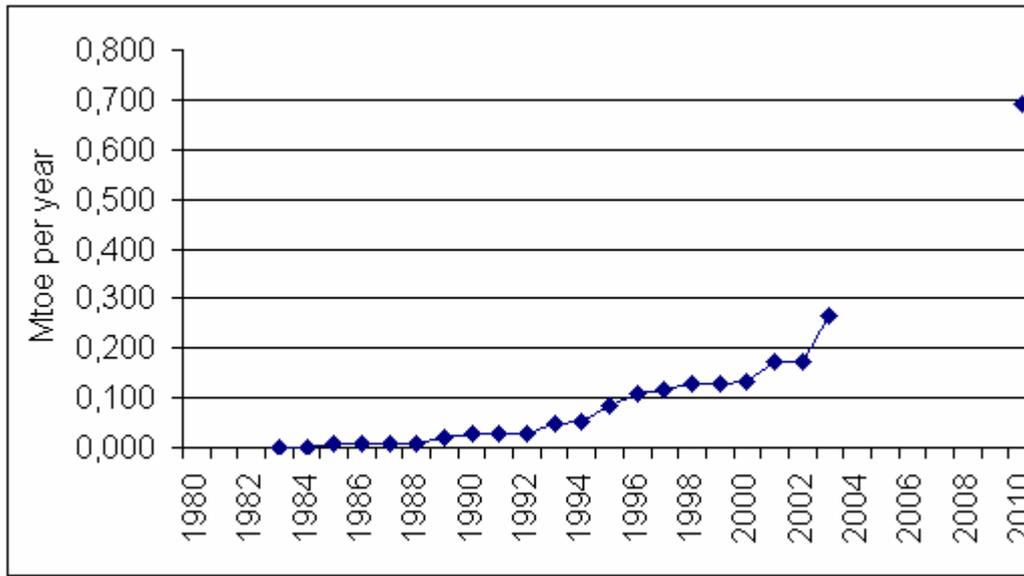
The estimated target for bioelectricity production in district heating is set to about 7,3 TWh (0,69 Mtoe fuel) for 2010 including 1,45 TWh from refuse, but excluding peat. This is based on a recent questionnaire to the industry made by the SVEBIO and the Swedish District Heating Association<sup>75</sup>. The very strong development from 2004 to 2010 is a result of the introduction of the certificate system 2003. The development is based on investments of about 2300 M• of which most already has been taken. The big gap in the curve below (Figure 43) between 2003 and 2010 is partly caused by the same reasons as for the industry, i.e. fossil fuels were notified for the electricity production of taxation reasons.

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<sup>74</sup> Swedish Bioenergy Association, 2004, Effects on electricity production in the Paper and Pulp Industry, Internal report (in Swedish)

<sup>75</sup> Swedish Bioenergy Association and Swedish District Heating Association, 2005, Co-generation in the Swedish district heating industry and the certificate system Internal report (in Swedish)

Figure 43 : Biofuels in district heating for electricity generation and SVEBIO target for 2010

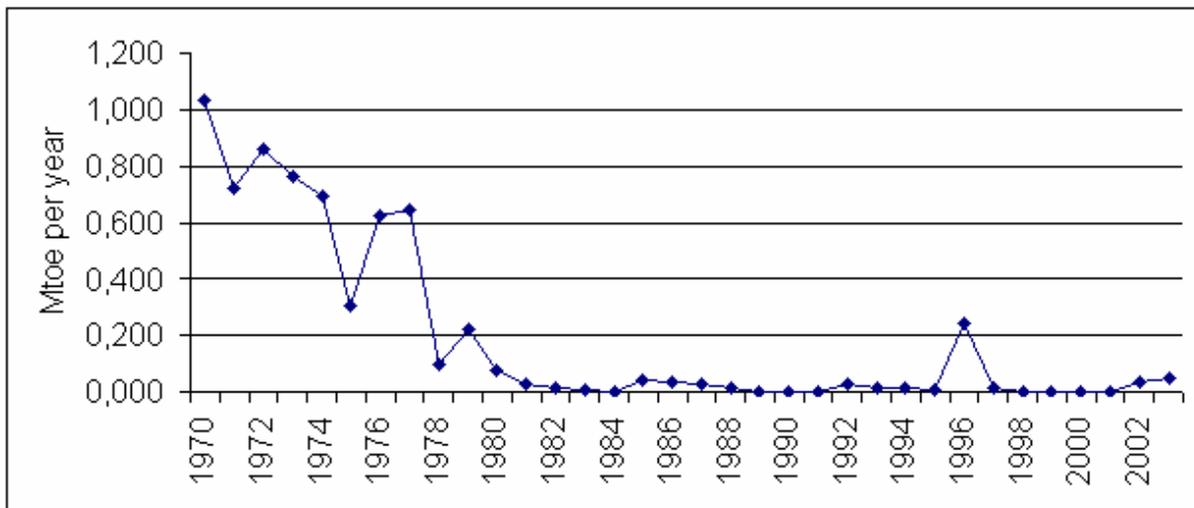


**Co-firing trends and targets**

*Cofiring and cold condense practically don't exist since the 1980ties*

Electricity generation by cold condense is today very limited and only some reserve capacity for effect peaking during high load situations remains in the electricity system.

Figure 44 : Cold condensing power



#### 2.7.4. Liquid biofuels trends and targets

*Liquid biofuels still holds a minor part of the market for transport fuels, but are very fast growing. Low percent blending with ethanol is dominating*

Renewable fuels in the transport sector accounted for about 1,1% of total use 2003 (excluding international bunker oil) in transport. Ethanol is dominating and fast growing with 76 ktoe (149 600 m<sup>3</sup> in 2003). The recent figure for 2004 is 277 700 m<sup>3</sup><sup>76</sup>.

Two major factories are today producing ethanol for transports within the country. One factory in Norrköping produces 26 ktoe (50 000 m<sup>3</sup>) from grain and the other one in Örnköldsvik with 11 ktoe (18 000m<sup>3</sup>) from wooden cellulose. Of the imported ethanol half is from Brazil and half wine ethanol from southern Europe.

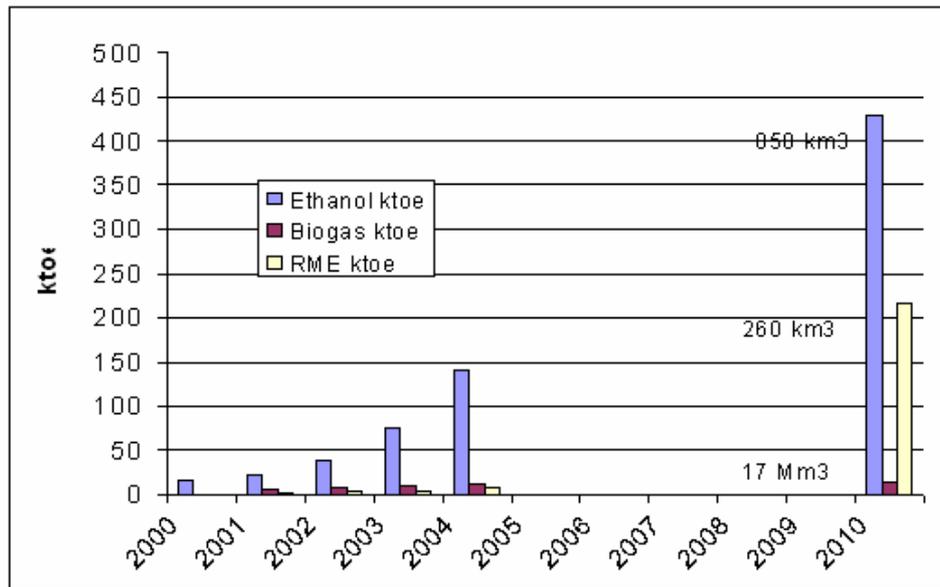
The national strategy is low blending (E5) in standard fuels, this is the cheapest and fastest way to enhance the use of biofuels in the transport sector. However E85 blending recently has started to grow fast on the Swedish market as result of a variety of incentives. Very important has also been that the two big car producers Volvo and Saab now are manufacturing and selling Eco-cars, flexifuel and biogas cars. At present every tenth new sold car is an Eco-car. Biogas has still a limited use and contributed 7,3 ktoe in 2003, but is also expected to take a larger market share in the future. In some cities biogas already now plays an important role in the public transport sector. Biodiesel (RME) has at present a low market share this can be substantially raised if present regulations for low percent blending can be changed.

There is a national target of 3 percent renewable transport fuels 2005 that will to be achieved as well as the EU target of 5,75 percent for 2010.

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<sup>76</sup> Swedish Energy Agency, 2005, Energy supply in Sweden, short time prognose 2005-08-15

Figure 45 : Use of liquid biofuels and SVEBIO targets



Suggested target for liquid biofuels in 2010 :

- Ethanol : 430 ktoe
- Biodiesel : 215 ktoe
- Biogas : 15 ktoe

The main part of the additional use of liquid biofuels for 2010 will have to be imported. The national production capacity 2010 has been estimated 129 ktoe ethanol from grain and 34 ktoe from cellulose. 86 ktoe biodiesel and 86 ktoe biogas. A new factory for 40 000 tons biodiesel is under construction in Karlshamn.

## 2.7.5. Objectives for Sweden

*Raw material resources and technical know how can continue the present strong development of bioenergy. Additional 3,4 Mtoe primary bioenergy (peat excluded) for heat and electricity can be reached till 2010 (about 5% a year). The use of liquid biofuels can develop substantially up to 660 ktoe till 2010 (in the range of 10% of the present use in road traffic)*

The aims of the Swedish bioenergy politics has differed through the years. After the oil crises the most important aim with the energy policy was to replace imported oil with domestic fuels. Later on an important additional reason for the different incentives promoting biofuels has been environmental concern.

The dominating strategy by the Swedish government has been energy taxation and Eco taxation in combination with research, information and demonstration campaigns. In 2003 a very effective system of green electricity quotas was introduced. This trading system has already shown a remarkable raise in investment for new production capacity for renewable electricity both in the industry and in district heating systems.

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Sweden has in a successful way chosen taxation and market based steering instruments in its energy policy, trying to avoid subventions and feed in prices that disturb the market.

*Tableau 25 : Summary table of reference bioenergy use and objectives of the Swedish bioenergy association*

Categories		In 2003				Objectives of SVEBIO for 2010			
		Biomass required (ktoe primary energy)	Bioheat (ktoe final energy)	Bioelectricity (GWh final energy)	Liquid biofuels (ktoe)	Biomass required (ktoe primary energy)	Bioheat (ktoe final energy)	Bioelectricity (GWh final energy)	Liquid biofuels (ktoe)
Biomass for heat		6242	5512	NR	NR	6079	5310	NR	NR
Biomass for cogeneration		1960	1323	5130	NR	5537	3738	14490	NR
Biomass for liquid biofuels (2004)	Biodiesel	-**	NR	NR	7	-**	NR	NR	215
	Bioethanol	-	NR	NR	141	-	NR	NR	430
	Biogas	-	NR	NR	11	-	NR	NR	15
	Sub-total	-	NR	NR	159	-	NR	NR	660
Total		8203	6835	5130		11617	9047		

\* NR = Not Relevant

### 3. Summary of national bioenergy objectives and comparison with biomass potential

According to the EU goals for bioenergy defined by the Commission (Tableau 3) AEBIOM calculated the likely contribution from each Member States for biomass for heat, bioelectricity, biomass for bioelectricity and liquid biofuels. A comparison with the objectives defined in this project gives an idea on how close the objectives of the national biomass associations are to the EU objective.

The national objectives are just indicative figures based on a same calculation method for all countries, adapted to reach the overall EU targets. In reality each member state has different characteristics and a case by case calculation would be needed.

It should be noted that such comparison is difficult because available statistics in the considered countries are not always compatible (no differentiation between biomass for heat, electricity, cogeneration, etc.).

#### 3.1. Biomass for heat

*The Commission proposes a global target for biomass for heat and AEBIOM calculates theoretical national targets*

The total biomass used for heat in 2001 is given by the Commission<sup>77</sup>, as well as the target of 74 800 ktoe for EU25 countries in 2010. As the countries have various development of the heat market from biomass, it would not be realistic to increase biomass for heat uniformly. For example one can't consider an equal increase in Finland where biomass represents about 1/3 of the total heat market and The Netherlands where biomass represents roughly 1% of the heat market. As a tentative approach of national targets for biomass for heat we multiplied the national percentage of biomass for heat using the following formula :

$$\text{Percentage in 2010} = \text{percentage in 2001} \times 1,25 + 3,35$$

This formula gives a linear increase of the biomass for heat; the smallest the percentage in 2001, the highest proportional increase. Using such calculation Belgium has to increase biomass for heat by a factor 2,95 (from 2 to 5,9%) while Sweden has to increase by a factor 1,34 (from 38,4 to 51,3%). When multiplied by the market for heat in 2010 (see also remark of Figure 5) we can calculate the needed biomass for heat in 2010 (Tableau 26).

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<sup>77</sup> SEC(2004) 547, European Commission, " The share of renewable energy in the EU. Country Profiles. Overview of Renewable Energy Sources in the Enlarged European Union", as support to COM(2004)366

**Tableau 26 : Biomass for heat : AEBIOM calculated national objectives and national associations objectives (ktoe)**

	Reference in 2001 <sup>12</sup>	AEBIOM calculation for 2010	Association reference (year)	Association objective for 2010
Austria	2373	3.347	2075 (2000)	3007
Belgium	384	1.124	564*	679*
Cyprus	3	17		
Czech Republic	432	945		
Denmark	891	1.337		
Estonia	398	537		
Finland	4818	6.510	**	**
France	9567	13.702		
Germany	5480	10.116	-	-
Greece	962	1.449		
Hungary	302	710		
Ireland	145	332		
Italy	5613	8.955		
Latvia	592	822		
Lithuania	574	757		
Luxembourg	25	74		
Malta	0	0		
Netherlands	324	1.340		
Poland	2539	4.285		
Portugal	1885	2.600		
Slovak Republic	103	349		
Slovenia	383	544		
Spain	3383	5.218		
Sweden	4995	6.680	7 713*** (2003)	10 232***
United Kingdom	700	3.050		
EU 15	41.545	65.833		
EU 10	5.326	8.967		
EU25	46.870	<b>74.800</b>		

\*these figures are valid for final bioheat and not for biomass for heat only applications

\*\*in Finland there is no statistics for heat only applications

\*\*\*includes bioheat from cogeneration

*Objectives for biomass for heat are not obvious to evaluate*

Analysis :

- The EU objective defined as biomass for heat might lead to difficult interpretation and calculation from the member states if biomass for cogeneration is concerned (or if bioheat produced from cogeneration is considered).
- Few members states have clear objectives for biomass for heat or bioheat.
- Objectives for ABA (Austria) and ValBiom (Belgium) are lower than the theoretical value needed to reach the EU objective.

- SVEBIO (Sweden) is proposing a higher target

All AEBIOM members give a clear priority to heat (or cogeneration) from biomass, due to the good chances for market development. Technologies for heat from biomass are already well developed and have very high standards, high efficiencies and low emissions.

### 3.2. Bioelectricity

National targets are proposed in the RES-E directive and AEBIOM calculates national bioelectricity targets

The additional renewable electricity between 2002 and the target for 2010 is calculated as a difference between statistics for 2002<sup>78</sup> and the targets of the directive 2001/77 combined with the probable electricity consumption in 2010 using a growth rate of 1,5% per year<sup>79</sup>.

We took 41,5% of this additional renewable electricity as the bioelectricity contribution in order to reach 174 000 GWh for EU 25 in 2010, as given in Tableau 3.

*ABA and SVEBIO propose a lower objective for bioelectricity than the Commission while ValBiom and BBE are proposing more ambitious figures*

Analysis :

- Objective for Austria by ABA is much lower than the expected objective needed to reach the EU objective. This means that ABA gives less priority to electricity as compared to heat, due to a better global efficiency and better market conditions.
- Objective of FINBIO (Finland) is close to the EU target.
- Objective of ValBiom (Belgium) is much higher than the EU objective. This is due to the current trends initiated by the green certificates and large scale ongoing projects.
- Objective of BBE (Germany) is higher than the calculation. BBE believes that this ambitious target can be achieved with a reasonable annual growth of 3% (against 25% for the period 2000 – 2004).
- The objective of SVEBIO for Sweden is below the EU objective

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<sup>78</sup> SEC(2004) 547, European Commission, " The share of renewable energy in the EU. Country Profiles. Overview of Renewable Energy Sources in the Enlarged European Union", as support to COM(2004)366

<sup>79</sup> IEA, 2004, "World Energy Outlook", IEA, Paris, 570 p ; growth rate for the alternative scenario.

**Tableau 27 : Bioelectricity : AEBIOM calculated national objectives and national associations objectives (GWh)**

	Reference in 2002	AEBIOM calculation for 2010	Association reference (year)	Association objective for 2010
Austria	2009	7.191	2416 (2000)	5849
Belgium	742	2.567	203 (2000)	4520
Cyprus	0	106		
Czech Republic	647	2.267		
Denmark	2125	4.188		
Estonia	11	207		
Finland	9897	13.244	12800 (2002)	13600
France	3525	24.996		
Germany	5648	19.841	9367*	23600
Greece	79	3.897		
Hungary	17	536		
Ireland	81	1.103		
Italy	1750	15.164		
Latvia	0	124		
Lithuania	128	370		
Luxembourg	34	98		
Malta	0	46		
Netherlands	2535	5.219		
Poland	31	3.889		
Portugal	1733	5.969		
Slovakia	0	1.982		
Slovenia	69	523		
Spain	3915	24.875		
Sweden	4000	17.089	5 130 (2003)	14 490
United Kingdom	4904	18.507		
EU 15	42.977	163.949		
EU 10	903	10.051		
EU25	43.880	<b>174.000</b>		

\* reference 2003 for solid and 2004 for biogas

Regarding biomass for electricity and cogeneration AEBIOM calculated the biomass required to produce the bioelectricity (table above), taking into account the efficiency of 20% in 2002 and 27% in 2010. The target of national associations distinguishes cogeneration and electricity only applications.

All AEBIOM members are giving priority to cogeneration. This is especially true for ABA (Austria) and SVEBIO (Sweden) for which electricity only plants should be banned. Figures are difficult to compare for Finland as CHP and heat only plants are combined in the statistics. No figures have been provided for Belgian and Germany due to the lack of appropriate statistics.

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*Tableau 28 : Biomass for bioelectricity - AEBIOM calculated national objectives and national associations objectives (ktoe)*

	AEBIOM calculation for 2002	AEBIOM calculation for 2010	Association reference (year) Cogen	Association reference (year) Electricity only	Association objective for 2010 Cogen	Association objective for 2010 Electricity only
Austria	864	2.290	835 (2000)	0	2152	0
Belgium	319	818	-	-	-	-
Cyprus	-	34				
Czech Republic	278	722				
Denmark	914	1.334				
Estonia	5	66				
Finland	4.255	4.218		4540*		5200*
France	1.515	7.960				
Germany	2.428	6.319	-	-	-	-
Greece	34	1.241				
Hungary	7	171				
Ireland	35	351				
Italy	752	4.829				
Latvia	-	40				
Lithuania	55	118				
Luxembourg	15	31				
Malta	-	15				
Netherlands	1.090	1.662				
Poland	13	1.239				
Portugal	745	1.901				
Slovak Republic	-	631				
Slovenia	30	167				
Spain	1.683	7.922				
Sweden	1.720	5.442	1960 (2003)	0	5537	0
United Kingdom	2.108	5.894				
EU 15	18.477	52.211				
EU 10	388	3.201				
EU25	18.865	55.412				

\*theses numbers are valid for CHP and heat plants

### 3.3. Liquid biofuels

The production in 2004 is given by statistics from Euroobserver<sup>80</sup>, while the Commission's objective for 2010 is uniform at 5,75%. AEBIOM used the total transportation fuels as given by Eurostat, using an annual growth rate of 2%.

*Tableau 29 : Liquid biofuels : AEBIOM calculated national objectives and national associations objectives (ktoe)*

	Reference in 2004	AEBIOM calculation for 2010	Association reference (year)	Association objective for 2010
Austria	51	428	17,4 (2000)	521
Belgium	-	538	0 (2004)	585
Cyprus	-	39		
Czech Republic	54	315		
Denmark	62	253		
Estonia	-	40		
Finland	-	256	0	250
France	375	2.886	446 (2004)	4000
Germany	936	3.704	959 (2004)	3204
Greece	-	380		
Hungary	-	210		
Ireland	-	239		
Italy	286	2.567		
Latvia	-	51		
Lithuania	4	72		
Luxembourg	-	117		
Malta	-	12		
Netherlands	-	721		
Poland	23	541		
Portugal	-	419		
Slovak Republic	13	113		
Slovenia	-	89		
Spain	135	1.893		
Sweden	34	459	159 (2004)	660
United Kingdom	8	2.617		
EU 15	1.888	17.477		
EU 10	94	1.481		
EU25	1.982	18.958		

<sup>80</sup> Euroobserver'ER, 2005, "Biofuels barometer", in Systèmes Solaires n°167, June 2005

*Estimation of the transport fuel market varies a lot*

Analysis :

- ABA (Austria) give a much higher objective for 2010 even if the 5,75% target is similar. This is due to a higher estimation of the total transport fuel market based on a recent study by the Federal Environment Agency.
- The ValBiom (Belgium) objective is higher for the same reason. In reality the fossil fuel price might affect the total fuel consumption and therefore the percentage target for biofuels.
- ITEBE (France) also comes with a much higher value due to a recent decision by national authorities to reach 5,75% in 2008 and 8% in 2010, increasing the objective proportionally.
- BBE (Germany) is proposing a lower objective due to different total fuels statistics for 2010.
- SVEBIO (Sweden) comes with a higher objective. This is based on the recent very strong development. In fact the figures are conservative if we look at the development in 2005. At present every tenth new private car that is sold is an eco-car.
- FINBIO (Finland) proposes an objective on 5,75% close to the AEBIOM calculation, but this objective has not been accepted (yet?) by the Government.

### 3.4. Comparison with biomass potential

*Separate heat, electricity from liquid biofuels*

The biomass required for heat and electricity can be compared with the potential (see below) for wood and biogaz. The potential for liquid biofuels production refers mostly to agriculture and should be treated separately according to AEBIOM. This might not be true beyond 2010 when wood might also be a source of raw material for liquid biofuels (ethanol from lignocellulose, Fischer Tropsch diesel).

*Uneven biomass potential, sometimes more forests, sometimes more agriculture*

Biomass originally comes from agriculture and forestry. In the figures below one can see that large agricultural areas are available in FR, DE, IT, PO, ES and UK, while large forests available for wood production are available in FI, FR, IT, PT, ES and SE. When comparing with the population (and to some extent to the energy consumption) we can conclude that the potential for bioenergy deployment exceeds 1 ha available in EE, FI, IE, LV, LI, SE and BU. This gives however only a broad picture of the potential as the productivity per hectare of land varies a lot depending on pedo-climatic conditions.

Figure 46 : Total agricultural area and forest available for wood production<sup>81</sup>

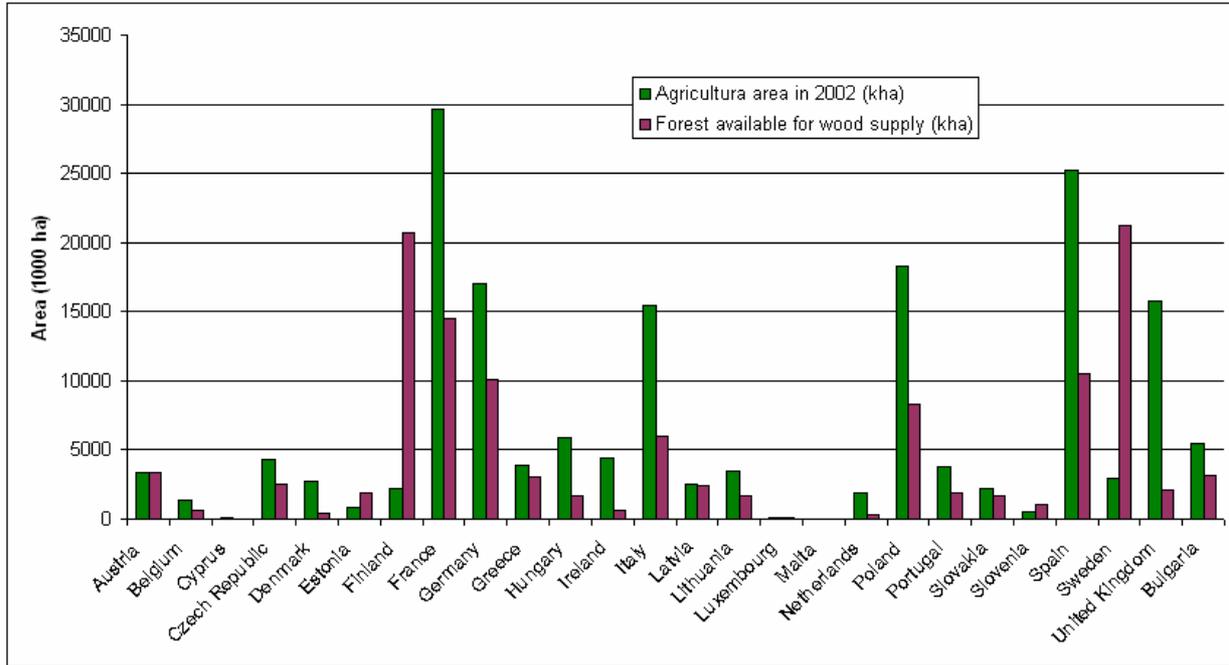
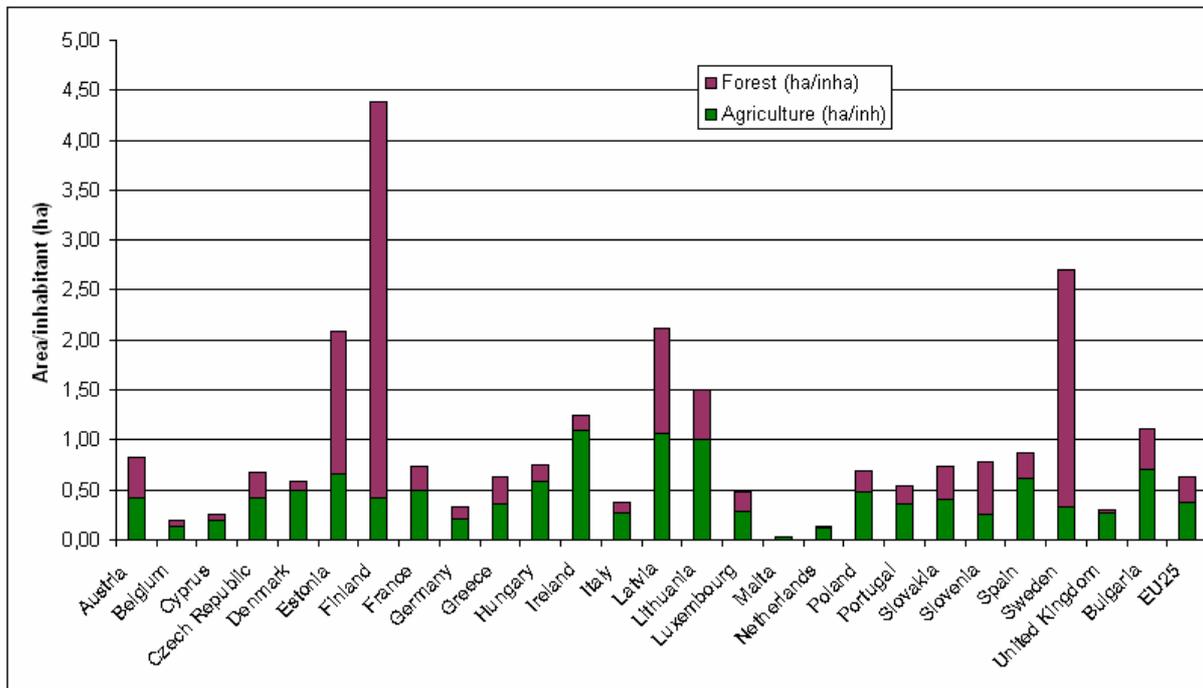


Figure 47 : Agricultural and forest surface per inhabitant



<sup>81</sup>1. [http://www.europa.eu.int/comm/agriculture/agrista/2003/table\\_en/index.htm](http://www.europa.eu.int/comm/agriculture/agrista/2003/table_en/index.htm)

2. European Commission- Eurostat, "Forestry statistics 1990-2002", pocketbook 2003 edition

The biomass potential was estimated in a recent study<sup>82</sup> that shows a resource of 166 Mtoe in 2010 (without liquid biofuels) and an increasing availability with time (details per country is given at *Figure 48*). Forestry by-products and (refined) wood fuels are the main resources, followed by solid industrial residues, solid energy crops, wet manure and biodegradable waste. A significant increase in this latter resource is expected due to the landfill directive that discourages landfilling of biodegradable waste.

The potential of wood for energy from forests available for wood production has also been estimated recently by the Finnish Forest Research Institute<sup>83</sup>. The study distinguishes roundwood balance (difference between net annual increment and fellings) and felling residues (biomass fellings minus removals). Stumps can also be recovered. Roundwood balance is positive, meaning that an increasing amount of wood is accumulating in the forests. Taking 25% of the resource, the study concludes that 24 Mtoe are available for bioenergy in EU 25.

Regarding biogas, Eurobserv'ER published figures on the potential for biogas, reaching almost 18 Mtoe for EU 15<sup>84</sup>. A very small share of the potential is currently exploited.

Additionally biomass can be traded between countries and imported in Europe in the form of pellets for example, that has a relatively high energy density and standards that make it a convenient biofuel for trade.

*The global potential exceeds the targets for wood based materials and for liquid biofuels from agriculture*

This biomass potential is sufficient to reach the Commission's objectives for electricity and heat, evaluated at 131 Mtoe (150 Mtoe minus 19 Mtoe for liquid biofuels, Tableau 3).

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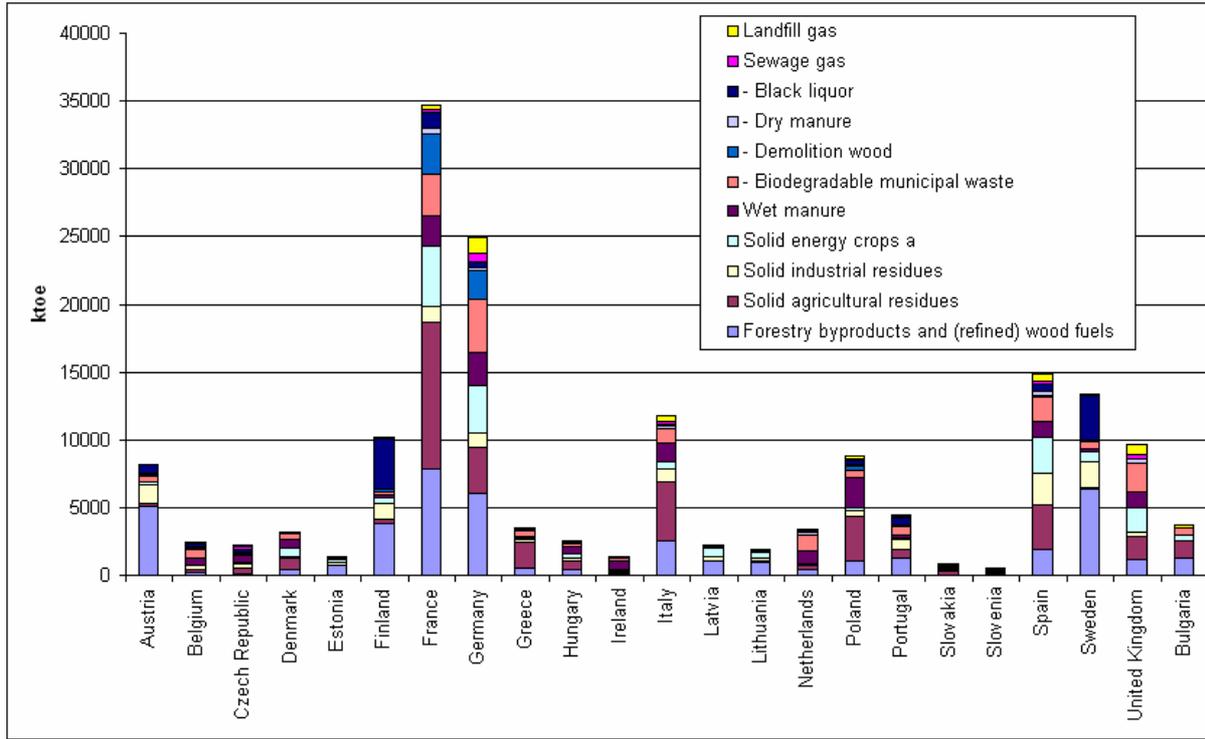
<sup>82</sup> BTG, 2004, "Bioenergy's role in the EU energy market - A view of developments until 2020", report to the European Commission, 2 April 2004

<sup>83</sup> Timo Karjalainen, Antti Asikainen, Jan Ilavsky, Raffaella Zamboni, Kaisa-Elina Hotari and Dominik Röser, 2004, "Estimation of Energy Wood Potential in Europe", Working Papers of the Finnish Forest Research Institute, <http://www.metla.fi/julkaisut/workingpapers/>

<sup>84</sup> Eurobserv'ER, 2004, "Biogas barometer", in *Systèmes Solaires* n°162, August 2004

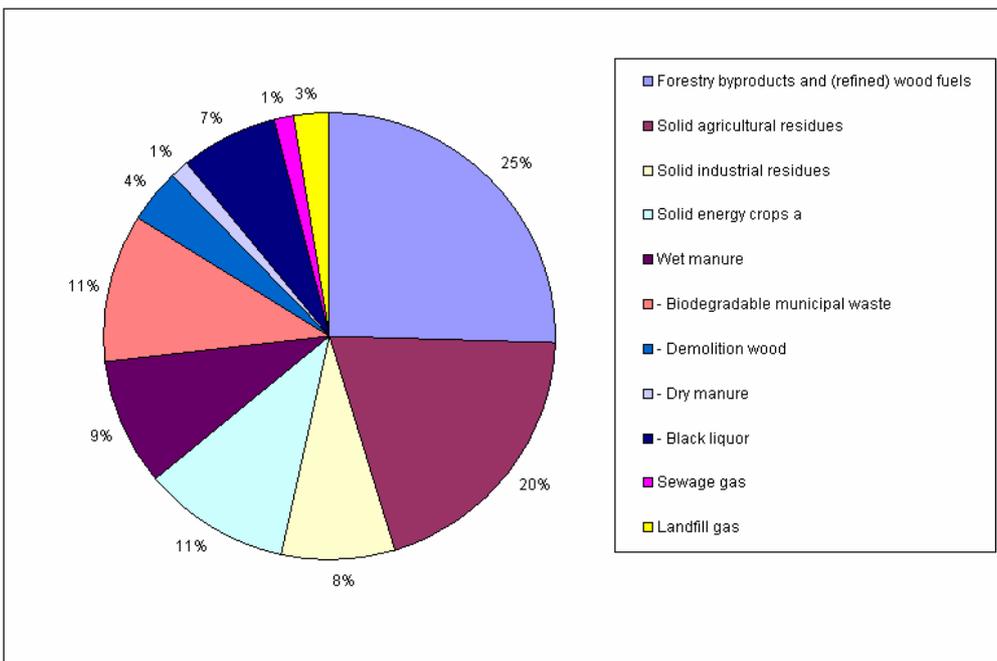
BOOSTING BIOENERGY IN EUROPE

Figure 48 : Biomass potential in EU25 and Bulgaria\*<sup>82</sup>



\* no data for Luxembourg, Cyprus and Malta.  
 \* this graph do not include crops for liquid biofuels.

Figure 49 : Share of the biomass resource in EU25



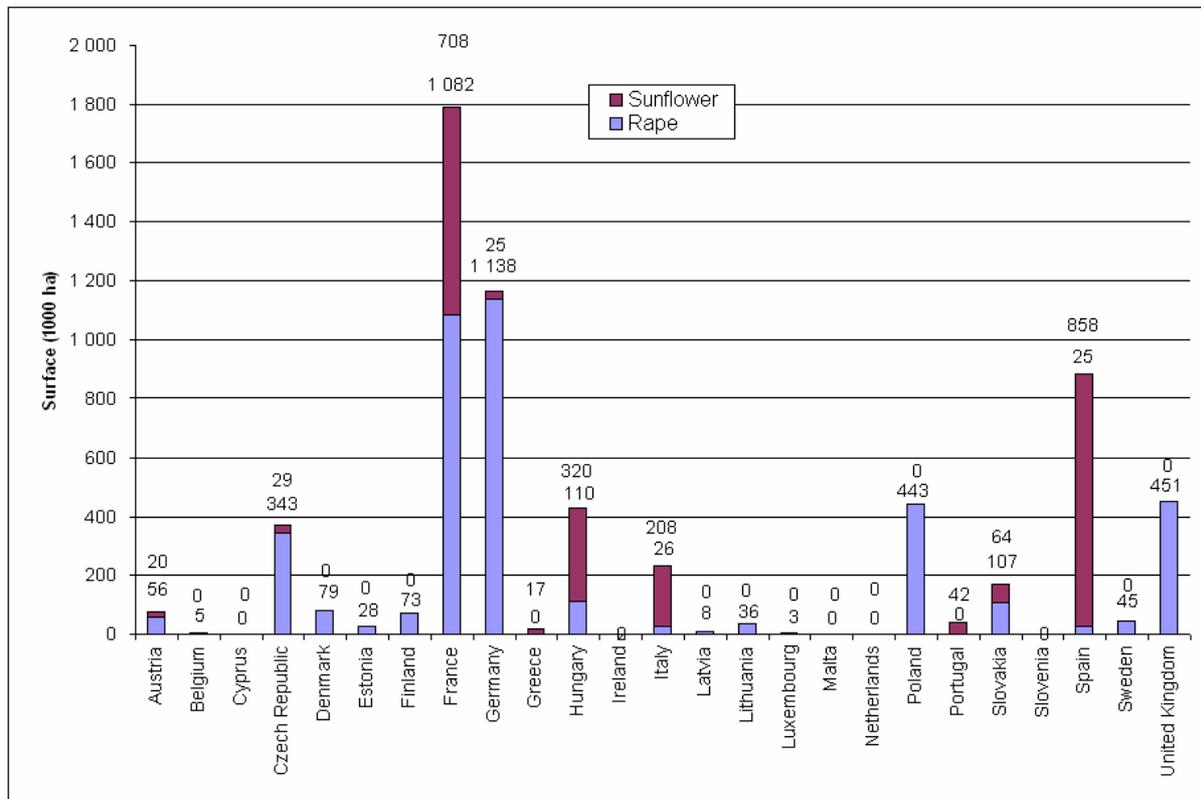
The potential for liquid biofuels relates to the area that will be devoted to energy crops and their energy yield. The total Used Agricultural Area (UAA) reaches 168

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Mha in EU25 and 6,1 Mha have been set aside on average during the years 2000 – 2002 in EU15. Idle land is also available in new member states.

The liquid biofuels productivity per hectare depends on the type of crop/biofuel and the yield. In good regions rape for biodiesel will produce 1,1 to 1,3 toe per ha, cereal and sugar beet for ethanol will produce respectively 1,3-1,4 and 2,8-3,7 toe/ha. **Figure 50** gives the surface of rape and sunflower in Europe<sup>85</sup> and gives an overview of the potential for biodiesel production. On average if we consider 1,5 toe/ha a surface of 12,5 Mha (or 7,5 % of UAA) would be needed to produce the 19 Mtoe required by 2010<sup>86</sup>.

*Figure 50 : Surface of rape and sunflower in Europe in 2001*



<sup>85</sup> [http://www.europa.eu.int/comm/agriculture/agrista/2003/table\\_en/index.htm](http://www.europa.eu.int/comm/agriculture/agrista/2003/table_en/index.htm)

<sup>86</sup> AEBIOM calculations



## Part II. Action plan for bioenergy

### 1. Overview of actions needed at European level

#### Need of strong policy push from European Union

##### *Not so much European harmonisation of instruments as political push*

Biomass and bioenergy markets are diversified. Numerous biomass sources with different characteristics are combined with many technologies at various stages of development and with different markets e.g. for electricity, heat, fuel. It means that different political and social framework conditions in the EU 25 need to be considered. Various instruments and measures applied at country level are not necessarily controversial as they take into account economic, political and environmental framework conditions in the national and local environments. It should not be a primary short-term aim to try to harmonise the instruments and political support for bioenergy across Europe. But the ambitious and strong policy push from the Union is essential as a driving force behind national governments.

##### *Give long-term perspectives to raise trust in bioenergy*

Long-term perspectives are needed for the support policies because project developers and financial bodies need to reduce their risks for high investments. Clear commitments have to be taken at political level, showing that bioenergy is not just a fashion.

#### Policies

##### Energy

##### *Don't forget heat*

Across Europe many schemes have been implemented to support renewable electricity and liquid biofuels for transportation, but insufficient support is currently given to bioheat. Heat is the main energy market and bioheat is produced with very high efficiencies, meaning that the use of the limited biomass resources available in the heat sector will maximise final energy production and CO<sub>2</sub> savings.

A directive on heat is necessary with coordinated objectives for Member States and an action plan. The Union should pave the way for member states to develop initiatives in this heat market through appropriate incentives (feed-in tariffs, certificates, fiscal advantages, etc.). The process must take energy efficiency policies into account.

## **Agriculture**

### *Absence of ambitious agricultural policy for bioenergy*

The new Common Agriculture Policy – CAP uncouples subsidies and production, allowing the farmers in theory more flexibility to grow crops in response to market needs. The economic situation in this sector is far from satisfactory with a lot of uncertainties for the farmers. Reconversion into bioenergy needs investments (biogas plant, heat network, etc) that many farmers cannot afford individually. Whilst there has been no specific EC policy to aid or extend the development of all plant-derived non-food products, some non-food crop species do benefit from aid (e.g. hemp and flax; linseed; high erucic acid rapeseed. EC-funded regimes exist in several EU member states for starch potatoes). Bioenergy crops are often considered as a way to regulate the food markets rather than a serious alternative for the future. Some improvements to CAP are possible to integrate these concerns:

- European decision-makers in the field of agriculture should develop a European Vision of the future European agriculture as a supplier of raw materials and renewable energy and as a main component of greenhouse gas abatement. This Vision should be based on ambitious targets, policy measures, budget allocations for support measures and information campaigns;
- Integrate into the Rural Development Programme a specific measure in support of bioenergy e.g. investment aids for bioenergy facilities, mandatory for Member States but voluntary for farmers;
- Increase the subsidy and eligible area available for energy crops (currently energy crop aid comes to 45 •/ha for maximum 1.5 Mha,)
- Make sugar beet eligible for set aside and for energy crop aid,
- Negotiate the Blair House agreement towards a removal of the barriers to energy crops on set aside, currently 1 Mt soybean equivalent;
- Make domestic biomass resources/biofuels as competitive as imported products by linking the support mechanisms for individual/differentiated production costs based on used raw materials;
- Develop large-scale programmes for R&D and applied demonstrations of energy crops. Farmers should be informed and educated about the alternatives that are reliable and economic.

## **Environment**

### *Make small bioenergy applications eligible under the Emission Trading Scheme*

Up to now the overwhelming majority of biomass power plants have not benefited from the European Emission Trading System (ETS). This is due to the fact that status quo emission rights are only granted to fossil-fired plants exceeding 20 MW. But whenever there is a fuel switch from fossil energy to biomass in plants smaller than 20 MW, these plants will not be rewarded for the resultant reduction in CO<sub>2</sub> because they had no emission rights to sell in the first place. Therefore AEBIOM requests a review of the ETS in 2006 to prevent discrimination against small biomass plants in the ETS.

## Standardisation

### *Standards are facilitating market and business growth*

The constant development of biomass production and bioenergy applications increases the need for standardisation in many areas. Uniformisation in Europe is essential to ensure trade in biomass and related technologies among countries. A growing market needs common rules. The following aspects in particular are urgent:

- Harmonised and balanced emission thresholds for bioenergy facilities, both small and large scale;
- Define standards for biofuels (solid, liquid and gaseous) and equipment (boiler quality, storage, security measures, etc.);
- Define specifications for ethanol and high blends of gasoline, taking into account the experiences in Brazil and USA;
- Increase biodiesel percentage in the diesel standard EN590 and adjust Standard EN 14014 in order to use ethanol in the process;
- Define specifications for pure plant oil.

## Market

### *Let's give bioenergy fair competition rules*

Enhancing conditions to develop the bioenergy market is essential in Europe. This applies to the whole chain of bioenergy, from raw materials to equipment and services, to sales of final products. Several measures are proposed:

- Establish fair competition between domestic bioenergy as against the oil and natural gas industries and imported biofuels;
- Develop infrastructure to produce/collect transport biomass, and supply energy to clients in a way that is as convenient as fossil fuels. Pellets are part of the success stories in Austria or Sweden for example;
- Removal of administrative barriers to bioenergy projects (speed up the delivery of permits, etc.);
- Guarantee fair grid access for bioelectricity and biogas;
- Set up more demonstration projects to widen the range of reference plants and spread experience in new energy chains. These projects are a very good basis for dissemination activities;
- Remove barriers such as the unreasonable treatment of biomass as waste, inflated fire safety precautions and excessive delays in obtaining permits for bioenergy projects;
- Harmonise trade regulations at EU level;
- Speed up the implementation of Directive 2003/30/EC in all Member States. Mandatory targets should be considered;
- Give incentives on the demand side for bioenergy (e.g. no parking fees for biofuel fuelled cars in cities);
- Promote the renewal of public and private/agricultural transport fleets that are biofuel-compatible.

## Financial instruments

### *Taxes on fossil fuels will prepare the future*

The most powerful way to increase bioenergy use is to raise fossil fuel prices significantly. In most cases bioenergy is not competitive yet, although there are exceptions (waste, large-scale heat, etc.). Increasing the price of fossil-based energies prepares the future. It is a terrible mistake to wait for the next energy crisis to develop alternatives. Taxes on fossil fuels are needed at once to make bioenergy more user competitive. Such market development, even if the competitiveness is artificial in the short term, will lead to economies of scale, technological improvements and market competition that will make bioenergy strong and reliable in the future.

Taxes on fossil fuels are fully compatible with the polluter pays principle and the concept of external costs that have to be incorporated into the fuel price.

### *Apply the lowest VAT rates on biofuels, conversion technologies and derived energy*

So far the VAT rates on biofuels differ from one country to another. To make bioenergy more competitive the lowest VAT rates should be applied on all bioenergy related products and services. This includes the biofuels, the conversion technologies and the final products (heat – including district heating - and electricity). This is especially important for private households that are not reimbursed for VAT expenses.

### *Towards high efficiency and reduction in CO<sub>2</sub>*

As a general rule financial instruments should favour biomass use with a high efficiency rate and high reduction in CO<sub>2</sub> emissions, considering the limited resources available. Blind support systems that are only linked to the quantities of electricity produced or that are based on a percentage of investment should be improved. More intelligent support schemes are needed that will integrate more efficiently the final energy produced and CO<sub>2</sub> reduction, given the limited quantity of biomass available.

For example, the co-combustion of biomass in coal power plants for electricity and the ensuing production are only acceptable in the short term in order to create, develop and organise a market for biomass fuels. But incentives for cogeneration should be more attractive as this normally more than doubles the amount of final energy produced. The same thinking holds for liquid biofuels production from wood in comparison with cogeneration or heat-only solutions. The same principle again applies to biogas units or cogeneration plants that sometimes produce surplus heat because of a structural or periodical lack of demand.

In addition, large-scale use of biomass should not be detrimental to the biomass supply of small-scale plants according to the principles outlined above.

## Financial support

*Bioenergy is typically associated with low fuel costs but with high investment costs for conversion*

Converting the current fossil-based energy system progressively to renewables requires huge investments related to fuel procurement and conversion facilities. This is particularly true for bioenergy that has typically low fuel costs but high investment costs. The support for coal and nuclear plants should be reduced substantially and transferred to support RES as these older industries are established and are able to finance their own development.

The European Investment Bank should increase its share of loans to bioenergy projects and structural funds of the Union should focus more on bioenergy. Guarantees for loans that reduce risks for the banks thereby reducing the cost of the loans should be considered. Higher risk and higher transaction costs due to non-standard procedures should also be balanced out by financial support.

*Small-scale bioenergy production should be considered*

Bioenergy is produced by a wide range of investors, from very large-scale company power plants to small biomass stoves used by individuals. Even these small projects are worth supporting as heat in the private sector is an essential part of the energy sector. Appropriate financial backing has to be worked out.

## Support integrated R&D

*Appropriate R&D for bioenergy is essential to ensure sustainable market growth*

In many technologies, including bioenergy, further progress and results must be achieved in terms of efficiency, environmental performance and economic competitiveness. R&D is an excellent instrument with a positive correlation to the performance of these technologies, the creation of new markets, companies, and employments.

R&D should be strengthened and integrated at EU-level to increase synergies and avoid duplication. There should be a shift towards renewables away from the huge budget that has been spent since the 1960s on nuclear and coal energy. In particular the following aspects should be emphasised:

- Technological and cost reduction for biomass procurement systems, specifically for forest residues collection and transportation;
- Maximising integration of biomass in existing fossil fuel based facilities;
- Improving gasification and biogas technologies to obtain better gas quality;
- Decentralised high efficiency cogeneration technologies;
- Combining chemical and energy products (concept of biorefinery);
- Cost reduction of bioenergy conversion systems for all technologies;
- Reducing emissions and particularly particles, NO<sub>x</sub> and CO at reduced cost;
- Applying system analysis that integrates energy, environmental and economic issues with commonly agreed assessment tools;

- Applying system analysis to socio-economic and macro-economic aspects related to the energy system

## Statistics

### *Improve quality and time frame*

Statistics are an essential tool to monitor the development of renewables. Bioenergy in particular suffers from the current European statistical methods as the distinction between biomass and waste is not always clear cut. The importance of the non-commercial part of biomass for heat is neglected. It is therefore urgent to revise the national questionnaire and take bioenergy features into account. It should also allow fair comparison between member states. And last but not least the data should be available more rapidly (the current delay exceeds 2 years!)

### *More focus on heat and conversion efficiency*

Heat is a large market (roughly 50% of the final energy consumption) to be considered globally for the rational use of energy and bioenergy. It is a pity that heat does not appear clearly in the statistics. In addition, only the fuel is mentioned and not the final heat. The possibility of taking the conversion efficiency into account should be considered. Efficiency where biomass is concerned is particularly important because the range of production methods can be very broad and the wrong conclusions will be reached if the biomass, used in open fire places, insets or in automatic pellets systems, is computed in the same way. At the present time the conversion efficiency is analysed only for cogeneration applications.

## Information

### *The public should know about the bioenergy alternative*

Information campaigns are needed in all Member States to increase public awareness of the threat of the present energy system, with its emphasis on the inevitable shortage of fossil reserves, increasing price volatility in the future and possible economic recession with unemployment. At the same time alternatives such as bioenergy should be promoted to show that they are reliable, economic and environmentally sound. Changing the energy system takes time. We propose the following activities at European level :

- Increase EU-wide framework activities with national involvement (European Biomass Days, Green Week, Energy Globe, etc),
- See that successful country projects are publicised in other countries,
- Launch awareness campaigns in the European media.

## Training

### *Training will give confidence to bioenergy professionals who will then confidently promote the technology*

The training of professionals such as architects, consultants and installers is an essential step towards the large-scale implementation of bioenergy. People unacquainted with these new technologies will naturally consider them to be risky

and tend to advise customers in a 'business-as-usual' way. Giving these professionals in-depth information and experience through training sessions, visits, conferences, etc. is fundamental.

Sharing experiences across Europe is also a key element to exchange knowledge and know-how.

## 2. Financial steering instruments in Europe

### 2.1. Introduction

*In most countries the prime aims with the financial steering instruments have been to minimise the dependence of imported fuels and to reduce CO<sub>2</sub> emissions*

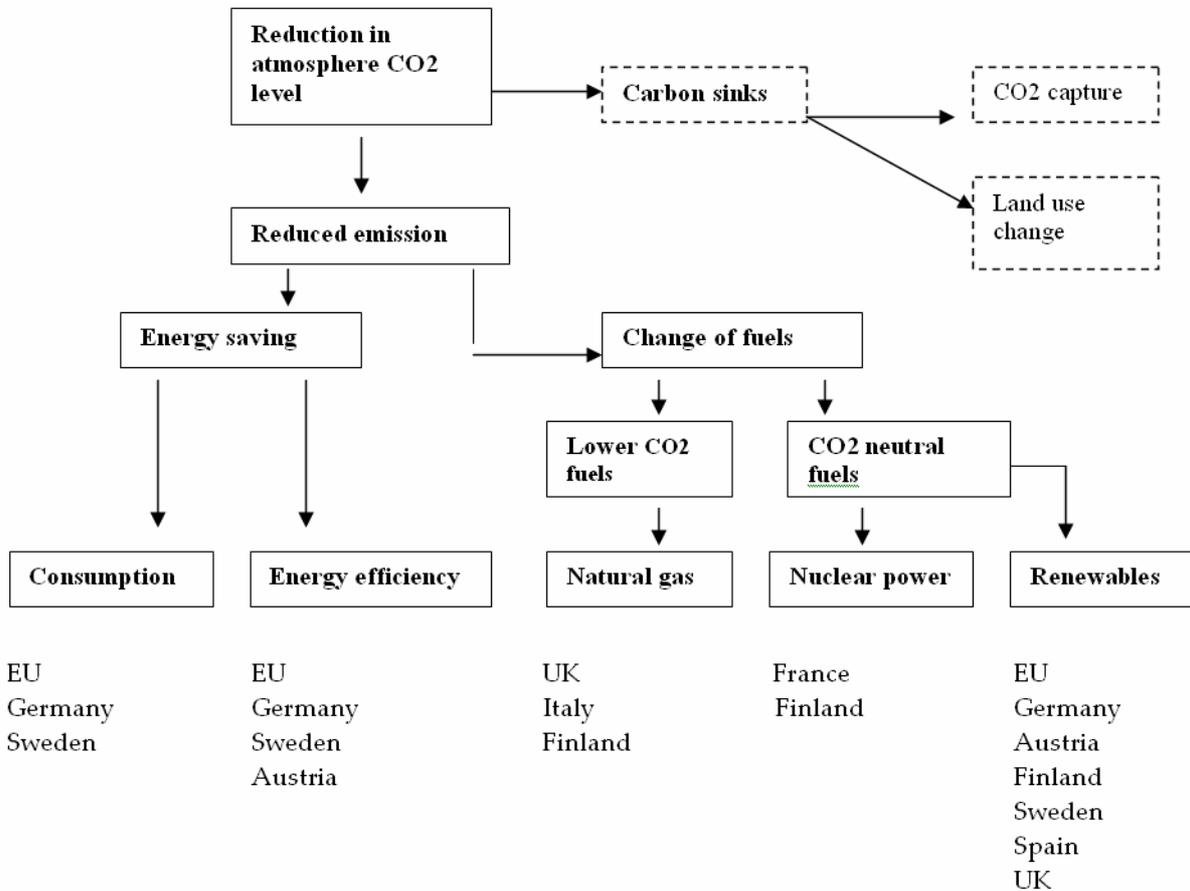
Steering instruments in energy politics within the European countries has a long tradition. Every nation has tried to protect and support its own supply of cheap and secure energy. However during the last decades a number of new steering instruments have been introduced, both in the context of the Union and at Member States (MS) level. The two prime aims have been to reduce emission of greenhouse gases (and other pollutants) and to minimise the dependence of imported fuels to the Union or to the individual MS. This has led to incentives focusing on developing and introduction of new renewable energy technology, enhancing energy efficiency and to energy saving activities.

The MS have chosen different strategies to do this mostly because of their different energy infrastructure, traditions, potential energy resources, climate and industrial infrastructure, but also political traditions. Countries with big forest resources and a dominating forest industry has focused on wood and its rest products, with already known and established technologies and countries with large agriculture have tried to focus on that. Some countries also have worked with developing and introduction of new energy technologies as well as with combinations of several strategies.

*The new Member States are far behind*

There are very big differences between ambitions and strength in the initiatives taken. Some countries have introduced quite strong economical steering instrument compared to others that so far have done very little. Especially the new MS are far behind in this.

Figure 51 : Some national strategies for reducing carbon dioxide emission among MS (note that this is not best practice according to AEBIOM)



Among the renewables, biomass has the strongest position and the biggest potential both for heat and electricity production at least in a foreseeable future.

*At present there is an extreme complexity of financial steering instrument in the various Member States*

But in principle four different principal main lines have been followed by the political decision-makers. These have then been realised in many types of roles and regulations in the different countries.

- Pricing as fixed price systems, feed-in tariffs or premiums is normally used for electricity and is a form of governmental dictate or environmental bonus. Differentiated taxation of fuels is a softer variant of fixed prices. The government has a big influence of the price, but the market determines the production volume. Fixed price systems, feed-in tariffs or premiums are normally used when the goal is to introduce new technologies on the market.

- Renewable Quota Systems. Tradable certificates and renewable obligations are leaving the price fluctuation to market mechanisms, but the government determines the targets (e.g. for RES-E) in form of quotas. These systems are normally used when the government wants to achieve a specified goal and are budget neutral.
- Investment support as subsidies, grants or different kinds of tax exemptions or favourable loans are ways of promoting new or mature energy technologies via the state budget often with a specific target in mind. Most of this kind of support is not budget neutral and has a tendency to disturb the market within the countries or between them.
- Research, Development and Demonstration together with information and awareness activities are indirect ways to promote development. This type of support often affects parts of the whole chain from fuel production to the final energy use.

*Access to electricity grids are not in place in all countries*

Additional to this there are numerous of actions, policies and measures that are very important for the development and the possibilities to achieve the overall goals. Access to electrical grid systems is still not in place in all countries. Fuel standardisation, technical safety standards licensing and testing are very important, but are still lacking in many countries.

*An objective evaluation of the effectiveness of the different national financial steering instruments and combinations of instruments among the Member States is hardly possible*

Compare financial steering instruments is a real challenge. Firstly at least 22 different types of instruments used in different ways were identified. Secondly the level and strength in their use differs a lot between the countries as well as the combinations among themselves. There are also many other diffuse parameters that effect the final effectiveness, use and their influence on investment decisions. Decisions taken by private users, industry, district heating companies and even official organisations are not always as objective as expected. They are influenced by expectations of future coal-, oil- and gas prices, personal interests, awareness and personal knowledge and traditions.

Figure 52 : Types of steering instruments at present used within the European Member States and their dominating use

	Heat	Electricity
3rd Party Financing		X
Bidding Systems		X
Capital Grants	X	X
Consumer Grants / Rebates		X
Excise Tax Exemptions	X	X
Fossil Fuel Taxes / CO <sub>2</sub> taxation	X	X
General Energy Policy	X	X
Government Purchases		X
Green Pricing		X
Guaranteed Prices / Feed in		X
Investment Tax Credits	X	
Property Tax Exemptions	X	X
Public Awareness	X	X
RD&D	X	X
Regional Policies	X	X
Regulatory and Administrative Rules	X	X
Sales Tax Rebates		X
Sales Taxes	X	X
Tax Credits	X	
Tax Exemptions	X	
Tradable Certificates		X
Voluntary Programmes		X

A comprehensive assessment for the individual countries (except for Cyprus, Estonia, Latvia, Lithuania Malta, Poland, Slovakia, Slovenia and Bulgaria) has been made by IEA and is available in a searchable database on the web<sup>87</sup>.

## 2.2. RES-heat production

*Taxation or exemption from taxation have together with subsidies been the most common ways to support bioenergy-heat*

For replacement of fossil fuels for heat production in the residential sector, the industry and in district heating a huge variety of steering instruments has been used among the MS. Investment subsidies or grants, research and support to development and demonstration, information and awareness programmes, energy saving

<sup>87</sup> ) <http://www.iea.org/textbase/pamsdb/search.aspx?mode=re>, last update in September 2004

activities, regulations. safety standard and fuel standardisation. Probably the most important has been investment support and taxation. The taxation instrument has been very effective in the form of strong energy and eco-taxation (CO<sub>2</sub> and S) of fossil fuels with exemption for biomass. Various forms of softer taxation instrument are quite common, like exemption from taxation on investments, differentiated VAT, deduction in income taxation etc. The taxation instrument is used both as a fiscal and as an environmental instrument and is normally differentiated between residential-, commercial-, industrial- and power generating sector as well as between different fuels, coal, oil and natural gas.

In the residential sector DK, SE and NL have the highest taxation, whereas BE, ES, FR, IE, EL and UK have chosen relatively low taxation. For process heat in the industrial sector SE, AT, FI, DE, DK and FI are in the top. The level of energy taxation differs up to ten to twenty times between the countries and can for individual countries reach more than 50% of the final fuel prices. A review over levels and differentiation between different users in Western Europe has recently been done by EuroGas<sup>88</sup>.

*Type of support seems to be less important than the level of support for single house heating*

For heat production in individual housings successful replacement of fossil fuels (and electricity for heating) has mostly been a result of taxation incentives (SE) and in combination with strong investment support (DE, LU), or in form of favourable credits and information, awareness programmes as well as licensing and testing (AT for pellets). Many Member States also show good progress without any steering instruments implemented in the domestic sector (IT, HU, LT, SK, SI). But some countries also show minor or negative progresses despite implemented incentives.

Substitution of fossil fuels for heat production in industry have met many obstacles, as national protection of the industries competitiveness, big investment costs in existing heavy industrial infrastructures. Incentives have mostly been used in the form taxation and R.D&D (FI). The introduction of renewables has been more successful in industrial heating in countries with a well established forest industry.

Successful development of biomass in district heating is often a result of high taxation of fossil fuels (SE, FI) and rules for obligatory grid connection and / or relevant investment support (DK, AT).

*Governmental policies can have a big impact especially on grid and building cost*

The energy tax approach and the subsidy approach were studied in the BIO-COST project 2002<sup>89</sup>. Twenty biomass district heating plants per country in DK, SE, AT and

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<sup>88</sup> Energy taxation in Western Europe as of 1<sup>st</sup> January 2004, EUROGAS

<sup>89</sup> Impact of Different National Biomass Policies on Investment Costs of Biomass District Heating Plants, Thermie B Action STR/1384/97-AT

FR were studied with the objective to analyse the impact of national biomass policies on investment cost. DK and SE have mainly high energy and eco-taxation as drivers, while AT and FR rely mainly on subsidy systems. The results showed that governmental policies can have a big impact on specially grid and building cost, affecting the overall costs of the plants. Also emission standards have an important effect on the costs.

*Both the taxation and subsidy approach can be effective promotion instruments*

However the results do not show any clear advantage of either the energy tax approach or the subsidy approach. In principle both the taxation approach and the subsidy approach lead to the same effect, i.e. the projects are calculated in such a way that they just meet economical breakeven. However this is not always the case when the projects are carried out for municipalities (the costs are sometimes higher than minimum needed i.e. nicer buildings and more advanced technology than necessary). The BIO-COST project identified a number of other objectives that affected the costs as, technical design of the plants, organisational structure, standardised tender documents, increased quality of feasibility studies etc. that all makes it very difficult to analyse the advantages of specific supporting measures. In industrial projects investment costs tends to be smaller, not only because of smaller grids, but also because of cheaper building cost. But on the whole the effect of implemented measures in the industry is even more difficult to analyse, due to non official economic data.

It seems so far reasonable to think that the amount of money spent either via the tax collective in form of investment support or direct by the end-user via energy and eco-taxation is more important for a positive development than the specific form of measure used. Naturally under the conditions of best practice used in design and reasonable technical criteria for the plants.

### **2.3. RES-electricity production**

*For generation of renewable electricity feed-in or premium tariffs are the most used promoting instrument in the Member States*

Most countries today operate some kind of feed-in or premium tariffs, or a free choice between the two. The government guarantees a certain price for production with a special technique during a defined period or a bonus added on the commercial price. Since most of the MS have introduced these regulations quite recently (after 2003), and the price level and permanence of the systems vary among the countries, the experiences regarding the effectiveness for bio-electricity promotion in most of the countries are relatively limited. So far however the feed-in prices seems to have been effective in DE and AT. In DE feed-in tariffs was introduced as early as 2000 and are

*BOOSTING BIOENERGY IN EUROPE*

relatively high and also guaranteed for a period as long as 20 years. In AT the tariffs were introduced later but are higher.

The feed-in prices in the Member States vary between 2,5 and 16,0 c€/kWh for electricity production from biomass.

*Tableau 30 : Feed in prices for biomass electricity in the Member States<sup>90</sup>*

	Feed-in tariffs introduced	Solid biomass cents/kWh	
Austria	2003	10,2-16,0	
Belgium	1995, 1998, 2003	6,5	Guaranteed minimum price for green certificates (Walloon region)
Cyprus	2004	6,3	
Czech Republic	2003	8,0	
Denmark	2003	4,0+1,0	Settlement price
Estonia	2003	5,2	1,8 times the residential price
Finland		-	
France	2001/2002	4,9	Premium up to 6,0
Germany	2000	10,0, 9,0, 8,6	Up to 500 kWh, 5MWp and 20 MWp respectively
Greece	1994	7,0-7,8	
Hungary	2003	6,0-6,8	
Ireland		-	
Italy		-	
Latvia		-	
Lithuania	2002	6,9	Average price
Luxembourg	1994	2,5	Up to 3 MW, 10 years
Malta		-	
Netherlands	2004	2,9, 5,5, 8,2	Mixed biomass and waste, Pure biomass large scale and small-scale<50 MWe respectively
Poland		-	
Portugal	2000	4,3-8,3	
Slovakia		-	
Slovenia		6,98 ; 6,76	Up to 1 MW above 1 MW respectively
Spain	1997	6,85	Free chose between feed in tariffs and premium price 3,32 on top of market price
Sweden		-	
United Kingdom		-	

<sup>90</sup> SEC(2004) 547 The share of renewable energy in EU, Country profiles, Overview of energy sources in the enlarged European Union

Pricing with feed-in tariffs or premiums is an effective measure for introducing new and innovative technology, but seems to be less cost effective for stimulating investments in conventional bio-electricity production.

*Feed-in tariffs or premiums is effective in protecting and developing new technology on the market*

The feed-in tariffs or premiums are by definition a way to protect a new technology from the market, normally with the help of national budget resources and they act as a protective mechanism. However there are, within the system, ways to at least partly overcome this protective mechanism. One way is by introducing over time decreasing tariffs. Such tariffs can however in practice be difficult to adopt, and there is a risk of overcompensating price differences of new technologies. Too many changes over time and instability of rules and regulations also have a tendency to create lack of confidence by the investors. Stability is one of the most important factors for successful development.

For an effective use of feed-in tariffs or fixed prices these need to be high enough and stable. The present price level seems too low in many countries to boost the bio-electricity development so far. For many new MS it is too early to make any deep and certain conclusion yet.

Some Member States have chosen not to use feed-in tariffs, but more market orientated incentives as some type of renewable energy quota systems.

*Green tradable electricity certificates has been proven to be very effective in creating large new bio-electricity capacities*

SE has introduced in 2003 a tradable certificate and quota system. The certificates are traded on an open market<sup>91</sup> with a present spotmarket price (June 2004) of about 22 € per certificate (the producer get one certificate per MWh renewable electricity). The price has been relatively stable since the introduction, but is slowly decreasing. The quotas will be increased every year from 7,4 to 16,0% until 2010. This quota system has already been proven to be very effective in that sense that it has already resulted in a huge amount of investment decisions for new bio-electricity capacity and replacement of coal and oil in old systems. It is state budget neutral, but leaves at present some minor administrative costs to the final electricity consumer. At present the system is under official evaluation and the exact payment capability for new capacity is not clear.

*A variant of the Swedish green-certificate system is the Renewable Obligation System that has been introduced in the UK*

UK has recently introduced a system with tradable Renewable Obligation Certificates (ROC) replacing the former not effective Non Fossil Obligation system.

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<sup>91</sup> <http://www.nordpool.no>

The ROC-obligation requires suppliers to source an annually increasing percentage of their sales from renewables. For each MWh of renewable energy generated, a tradable certificate called a Renewables Obligation Certificate (ROC) is issued. Suppliers can meet their obligation by either acquiring ROCs, paying a buy-out price of £30 per MWh, or a combination of ROCs and paying a buy-out price.

*Combination of quota regulations and tradable certificates is a cost effective way to reach bio-electricity targets*

Quota regulations in combination with certificates seem to be an effective way to set ambitious targets and to fulfil the aims in a cost effective way. The replacement of fossil fuels starts where it is most competitive and will expand to more expensive and new technologies in line with raising quotas. The raising prices and costs for the needed changes and development is taken by the users and not by the taxpayer-collective.

*No country has succeeded in developing a market with a single promoting policy*

As in the heating sector taxation has been a commonly used way to promote alternative production of bio-power. The highest taxes on natural gas are applied by AT, SE, DE and FR and for coal by AT and SE. The highest taxes for oil used in the power generation sector are levied by AT and UK followed by DE, SE, UK and FR. Most of these countries, except FR have been relatively successful in introducing renewables in the power producing sector.

But it must also be pointed out that no country has ever managed to develop a market for renewable electricity with just one policy. It needs among other things support schemes ensuring confidence for the investors, well functioning administration, often additional investment supports. Full grid access is also vital for successful introduction of bio-power.

## 2.4. Identified incentives and regulations on country level

### Renewable heat<sup>929394959697</sup>

#### AUSTRIA

A wide variety of steering instruments exist for heat and cogeneration in industries and agriculture not only on federal level but also at provincial level.

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<sup>92</sup> SEC(2004) 547 The share of renewable energy in EU, Country profiles, Overview of energy sources in the enlarged European Union

<sup>93</sup> <http://www.jrc.es/cfapp/eneriure/reports.htm>

<sup>94</sup> Rathbauer, J., 2002 Biomass survey in Europe, Country report of Austria, EUBIONET

<sup>95</sup> AEBIOM Questionnaire 2003 (not published)

<sup>96</sup> <http://www.iea.com>

<sup>97</sup> <http://www.eva.ac.at/enercee/pl/index.htm>

## *BOOSTING BIOENERGY IN EUROPE*

*Environmental support programme (dominating)*

*Investment subsidies, Implemented: 1993/97*

*Specific subsidies for conversion of heating from electricity, coal or oil exists*

*Austrian biofuel standards (ON M 7132 wood fuel, ON M 7133 classification, ON M 7135 pellets/briquettes, ON M 7136 logistics )*

*Taxation on fuel oil: 0.036 €/kg (2004)*

*Energy taxation: electricity 0.015 €/kWh (2004), natural gas 0.0436 €/kWh (2004)*

### **BELGIUM**

*Wallonian investment subsidy scheme (1500 € for new automatic biomass boiler)*

*Investment compensation scheme, implemented 1995, updates 1998, 2003, strict eligibility requirements for certain technologies*

*Green certificates (Wallonia) take heat use into account (see page 153)*

### **CYPRUS**

*Grant Scheme for Energy Conservation and the Promotion of the Utilisation of Renewable Energy Sources" (2003 to 2007) that provides governmental grants up to 30-40% of investments*

### **CZECH REPUBLIC**

*Exemption from property tax for five years for conversion of building heating systems from solid fuels to renewable energy*

*No exemption from VAT ratio 19% for biomass fuels.*

*Reduced VAT of 5% is paid by the final consumer only for heat from DHS.*

*A new renewable Energy act is in force since 1/8/2005 (does not encompass a heat).*

*Incentive subsidies for municipal biomass DHS do exist – via State Environmental Fund (SEF) or Operational Programme for Industrial Development.*

### **DENMARK**

Most of the favourable promotion schemas have been abolished since 2001. However relatively high CO<sub>2</sub>, energy and SO<sub>2</sub> taxation still promotes the use of biomass energy in heat.

*Eco-taxation of fossil fuels*

*Grants up to 30 MDKR is available for investments in biomass energy*

*Relevant subsidies for agricultural production to energy crops*

### **ESTONIA**

*Exemption from VAT in individual households.*

### **FINLAND**

*The main Finnish incentive has been effective national policy and a strong emphasis on R,D&D*

## BOOSTING BIOENERGY IN EUROPE

*Exemption from energy taxation (based on carbon content in the fuel), (relevant but may be insufficient)*

*Investment subsidies for wood based CHP and industrial heating can get up to 25% of investment cost.*

### FRANCE

*A tax rebate is available for individuals for the purchase of heating systems using renewable energy (max 15% of expenses) under special conditions.*

*The second "Programme Bois Energie (2000 to 2006) supports domestic wood heating with, quantitative aims, certification, raising awareness, promoting of best practice and communication*

*A low VAT rate (5,5%) for agricultural and forest products is applicable on wooden fuels for domestic use.*

*Oil used for heating has a national tax (TIPP, coal, peat and natural gas is not included in this tax). Otherwise there are no favourable taxation for biomass in domestic heating in France*

*Some investment grants are available for biomass heating and CHP*

*FIDEME (private found up to 25% of investment costs)*

### GERMANY

Decisions and strategies are taken on federal (national) and federal state level.

*Support as credits and investment grants exists both at federal and federal state level*

*Full exemption from mineral oil tax and eco-tax*

*VAT-tax rate for wood chips, wood pellets is reduced (7% compared 16%). Fuel oil and natural gas are taxed by eco- taxation.*

*Support for establishing energy crops on agricultural land.*

*Bonus for cogeneration within the feed in tariff system in the electricity sector*

### GREECE

*Since 1995 a law provides tax exemptions to households buying renewable appliances. 75% of the value is reduted from the individuals income.*

*Grants for investments in biofuel based energy production. New Operational Programme for Energy (2000-2006), 40% of project planning cost*

*Development Law 2601/1998, 40% of investment*

### HUNGARY

*No incentives for promoting biomass heat are in place.*

### IRELAND

No incentives for promoting biomass heat are in place, however.

*Some incentives for energy crops and energy forests exists as well as investment subsidies for biogas production in agricultural sector.*

ITALY

*A carbon dioxide tax with exemption for renewable was introduced 1999 (Law 448/98). Support programme and investment grants for production and use of energy crops and CHP from energy crops.*

LATVIA

No substantial incentives are in force at present, however.

*Some long time loans on favourable conditions exists for private households.*

LITHUANIA

No incentives are in force at present.

LUXEMBOURG

No relevant incentives for heat in individual housing are in force at present. However some exists in other sectors that might be used.

*Advantageous loans (SNCI). Investment support up to 25%.*

*Skelton law 27-7 – 1993 and Grand Ducal Regulation.*

MALTA

No incentives for heat in individual housing are in force at present.

NETHERLANDS

A number of direct subsidy schemes are available from national and some provincial governments. Wide extensive support for replacement of agricultural land to energy production

*An eco-tax on electricity and natural gas is in force, with exemption for biofuels*

*There is a possibility to obtain loans for investments at a rate 0.5% lower then commercial loans. In addition a number of direct subsidy schemes are available from national and some provincial governments.*

*Lower rate loans for investments 0.5% lower then commercial loans*

*Support for energy crops on agricultural land*

*Energy Investment Deduction (EIA since 1997)*

*Subsidy Regulations Energy Supply in Non Profit and Private Sectors (EINP since 1997) only for investments over 1 750 €. Non profit organisations up to 18.5%. Private Households up to 20%*

*Regulating Energy Tax (REB since 1997 changed 2003)*

POLAND

*Law on biofuels*

*Environmental funds supporting development of renewables with grants and soft loans.*

*An organisation called Eco-found also supports biomass projects.*

## BOOSTING BIOENERGY IN EUROPE

### PORTUGAL

*VAT reduction (from 17% to 12%) on investment in renewable equipment .*

*MAPE/POE-Programme (2000 to 2006) for official and private organisations Investment scheme for renewable electricity, energy management or cofiering up to 40% of investment costs*

*Favourable taxation on personal income (DL 442-A/88) since 2002. Up to 30% of investment in RES-technology*

### SLOVAKIA

No relevant supporting mechanisms are in place.

### SLOVENIA

No relevant supporting mechanisms are in place.

### SPAIN

*Biofuels are exempted from the special carbon taxation*

*Investment support advantageous loans, Linea ICO-IDEA (since 1999)*

*Standardisation of biofuels for domestic heating is under preparation (AENOR, CTN 164)*

### SWEDEN

A variety of measures has been introduced and are in force.

*High energy- and ecotaxation of fossil fuels with exemption for biomass (dominating and effective)*

*Fuel standardisation*

*Certification on boilers*

*Training and awareness programmes*

*RD&S programmes*

*Support to growing energy crops*

*Tax deduction and support for investment in modern biomass heating in residential and service sector*

### UNITED KINGDOM

Relevant initiatives for individual households with focus on countryside development, energy cropping, bioenergy infrastructure, trade and technical development.

*Community and households Renewables Scheme (capital grant scheme, 2001)*

*Community Renewables Initiative*

*Bioenergy Infrastructure Scheme (grant scheme, 2003)*

*Grants for establishing forest on agricultural land and different support to energy crops.*

### **Renewable electricity**

### AUSTRIA

## BOOSTING BIOENERGY IN EUROPE

A number of incentives has been taken today dominated by strong feed in tariffs.

*Feed-in tariffs implemented January 2003 (dominating and effective), contracting was stopped in December 2003 and lifted again in March 2004*

*Energy taxes on fuel oil, natural gas and electricity.*

*Austrian biofuel standards (ON M 7132 wood fuel, ON M 7133 classification, ON M 7135 pellets/briquettes, ON M 7136 logistics )*

*Ökostromgesetz (since 2003)*

*Law (2002) on electricity production on basis of renewable*

*Umweltförderungsgesetz UFG (since 1993 changed 2002) investment support 10 to 30% of investment*

*Elektrizitätsabgabegesetz (since 1996 changed 2000)*

### BELGIUM

*Green certificate/quotas (dominating but insufficient), Flanders since 2002, Wallonia since 2004, Brussels-capital not yet in operation*

*Guaranteed minimum price 2.5 ct/kWh higher tariff per kWh. Surplus of biomass electricity get an extra bonus of 3.4 ct/kWh.*

*Tax compensation scheme on investments since 1992*

*Energy taxes on electricity and natural gas*

*Investment support, depending on size Decree 15.12.1993 (1993 to 1999)*

### CYPRUS

*Feed in tariffs for biomass electricity 6,3 cents/kWh*

### CZECH REPUBLIC

*The Czech electricity market is partly deregulated and will be fully loose after 1.1.2007. Prices are now regulated by Energy Regulatory Office (ERO). ERO approves, among others, ceiling prices of heat, natural gas and electricity, incl. .*

*The electricity generated from biomass is in 2005 purchased for 8,4 ct/kWh, biogas for 8,1 ct/kWh. When biomass is co-incinerate then price differs according to the type of the biomass – the bonus (premium) ranges from 1,7 ct/kWh (saw dust, wood chips) to 3,0 ct/kWh (energy crops).*

*After 1.1.2006 there will be more tariffs and bonuses. It is expected that prices will range for biogas from 7,6 ct/kWh (landfill and water treatment) to 9,9 ct/kWh (municipal and agricultural biogas plants). Biomass will be probably purchased from 7,7 ct/kWh to 9,7 ct/kWh.*

### DENMARK

*Investment grants up 50% for converting from coal to biofuels*

*Feed in tariffs since 2003, 4,0+1,0 ct/ kWh*

*Taxation on fossil fuels*

*Fixed prices for biomass electricity until a market for green certificates is established*

*Grants for converting biofuel district heating to CHP*

## BOOSTING BIOENERGY IN EUROPE

*Relevant subsidies for replacement of agricultural production to energy crops*

### ESTONIA

*Electricity Market Act*

*Feed in prices since 2003, 5,2 ct/kWh, 1,8 times residential price*

### FINLAND

*Exemption from energy tax, based on carbon content in the fuel (dominating but insufficient)*

*Investment subsidies for wood based CHP and industrial heating can get up to 25% of investment cost. State Decision 29/99.*

*VAT is back paid to the consumer if the electricity is produced with wood fuels.*

*Biomasse support (<1 MWe) 0.42 ct/kWh*

### FRANCE

*Feed in prices (since 2001, <12 MWe) 4,9 ct/kWh, premium up to 6,0) (dominating but insufficient)*

*Biomass electricity delivered to the grid can get fixed prices during 15 years.*

*Producers of renewable electricity in some supported areas can get up to 70% of investment costs.*

*Some investment compensations are available for biomass heating and CHP*

### GERMANY

*Fixed Feed in tariffs for 20 years on federal level, in force since 2000, amended in 2004, declining 1,5% per year*

installed capacity	basic remuneration	Fuel bonus		cogeneration-bonus	technology-bonus
		biogas	solid biomass (forest wood)		
< 150 kW	11,5 c•/kWh	6 c•/kWh	6 c•/kWh	2,0 c•/kWh	2,0 c•/kWh
150 - < 500 kW	9,9 c•/kWh	6 c•/kWh	6 c•/kWh	2,0 c•/kWh	2,0 c•/kWh
500 kW – < 5 MW	8,9 c•/kWh	4 c•/kWh	2,5 c•/kWh	2,0 c•/kWh	2,0 c•/kWh
5 – 20 MW	8,4 c•/kWh	0	0	2,0 c•/kWh	0

*Some investment supports*

*Grants for biogas plants up to 70 kWe, 15 000€ per plant*

*Grants for stabilising of agricultural land to fuel production*

### GREECE

*Higher tariffs for bio electricity Law 2224/1994 and Law 2773/1999 (dominating but insufficient)*

*Grants for investments in biofuel based energy production. New Operational Programme for Energy (2000-2006), 40% of project planning cost,*

## *BOOSTING BIOENERGY IN EUROPE*

*Development Law 2601/1998, 40% of investment*

### HUNGARY

*Feed in tariffs since 2003 6,0-6,8 ct/kWh (dominating but insufficient)*

### IRELAND

*Some incentives for energy crops and energy forests*

*Investment subsidies for biogas production in agricultural sector*

*National auction for production of renewable electricity with feed in prices for accepted companies*

*Government guarantee maximum prices to consumer.*

### ITALY

*Some use of feed in prices. Law 9/91 and CIP provision 6/92, premium based on market prices.*

*Quotas since 1999 of 2.0% bioelectricity for user larger than 100 GWh per year (own use and export not included). Law 77/99*

*Carbon dioxide taxation*

*Support programme and investment grants for production and use of energy crops and CHP from energy crops*

### LATVIA

No incentives on bioelectricity

### LITHUANIA

*Procedure for promotion of bio electricity*

*Feed in tariffs from 2002 6,9 ct/kWh*

### LUXEMBOURG

*Feed in prices from national budget (CEGEDEL) Framework law 5-8-1993*

*Investment compensation schemes*

### MALTA

No relevant measures for bioelectricity.

### NETHERLANDS

Green renewable electricity is sold to the highest bidder. The consumer pays a higher price up to 3 cents/kWh. The higher price is founded for reinvestment in renewable electricity.

*Environmental quality of electricity production (MEP since 2003)*

*Energy tax on fossil fuels*

*Lower rate loans for investments 0.5% lower than commercial loans*

## *BOOSTING BIOENERGY IN EUROPE*

*A number of direct subsidy schemes are available from national and some provincial governments*

*Support for energy crops on agricultural land*

*Energy Investment Deduction (EIA since 1997)*

*Subsidy Regulations Energy Supply in Non Profit and Private Sectors (EINP since 1997) only for investments over 1 750 €. Non profit organisations up to 18.5%. Private Households up to 20%*

*Regulating Energy Tax (REB since 1997 changed 2003)*

### **POLAND**

No special incentives on bioelectricity, but some for renewables.

*Law on biofuels*

*Environmental funds supporting development of renewables with grants and soft loans*

*An organisation called Eco-found also supports biomass projects.*

### **PORTUGAL**

*Feed in prices implemented 2000, Decree-Law number 339-C/2001(updated of 168/99) 6.198 ct/ kWh (2003) follows consumer index.*

*MAPE/POE-Programme (2000 to 2006) for official and private organisations Investment scheme for renewable electricity, energy management or cofiering up to 40% of investment costs*

*VAT reduction (from 17% to 12%) on investment in renewable equipment.*

*Favourable taxation on personal income (DL 442-A/88) since 2002. Up to 30% of investment in RES-technology*

### **SLOVAKIA**

No relevant incentives for bioelectricity.

### **SLOVENIA**

*Feed in tariffs for biomass electricity, (<1MW) 6,98 ct/kWh, (>1MW) 6,76 ct/kWh*

*Biofuels are exempted from the special carbon taxation*

### **SPAIN**

*Feed in tariffs up, to 50 MWe, Royal Decree 2818/1988 (since 1999), updated every year (dominating but insufficient) Feed in (2003) Energy crops 6.85 ct/kWh, Biomass 6.05 ct/kWh*

*Premium (2003) Energy crops, 3.32 ct/kWh, Biomass 2.51 ct/kWh*

*Biofuels are exempted from the special carbon taxation*

*Investment support advantageous loans, Linea ICO-IDEA (since 1999)*

### **SWEDEN**

*Electricity certificate trading (since 2003), quotas for renewable electricity, raising quotas every year, 7.4% 2003 up to 16.9% 2010 (dominating and effective)*

*High energy and eco-taxation on oil with exemption for biomass*

*Training and awareness programme*

*Research programme (1998 to 2004)*

*Certification on boilers*

*Support to growing energy crops*

*Certification on boilers*

## UNITED KINGDOM

*Tradable renewable obligation certificates (ROC) replacing the non fossil obligation system*

*Exemption from Climate Change Levy (CCL) 2000-2010, non private consumers have to pay. 0.63 ct/kWh additionally for electricity from fossil fuels*

*Investment support, mainly for use of energy crops and establishing of biomass CHP*

*New Opportunities Fund (since 1998)*

*Grants for establishing forest on agricultural land and different support to energy crops*

## 2.5. Advance support scheme

### 2.5.1. AEBIOM proposal

*There are new alternative ways to support bioenergy that excludes most of the disadvantages of the existing schemes*

It makes sense to think about a future taxation system based on CO<sub>2</sub> as CO<sub>2</sub> emission mitigation can be a common factor to all forms of energy production.

According to AEBIOM it is possible to introduce a common uniform fee/tax system, which allows different taxation levels with respect to various sectors and countries.

In this respect AEBIOM has in a Position paper from January 2002 discussed an innovative Flexible Carbon Dioxide Fee/Tax System<sup>98</sup>.

The basic idea is to apply a uniform carbon dioxide fee, a general deduction and a fiscal energy consumption tax as follows (*Figure 53*):

1. A carbon dioxide fee (C) depending on the content of carbon (emissions of carbon dioxide) in different fuels. A high fee level will give stronger economic incentives to choose fuels and systems with low emissions of carbon dioxide.
2. A deduction (D) proportionate to the amount of heat used for heating purposes and/or electricity produced. The levels for heat or electricity should be decided separately preferably with a higher level on electricity. The total deduction should be equal to the total carbon dioxide fee on a national basis. The carbon dioxide fee and the deduction create together a transfer system, where no money leaves the system.

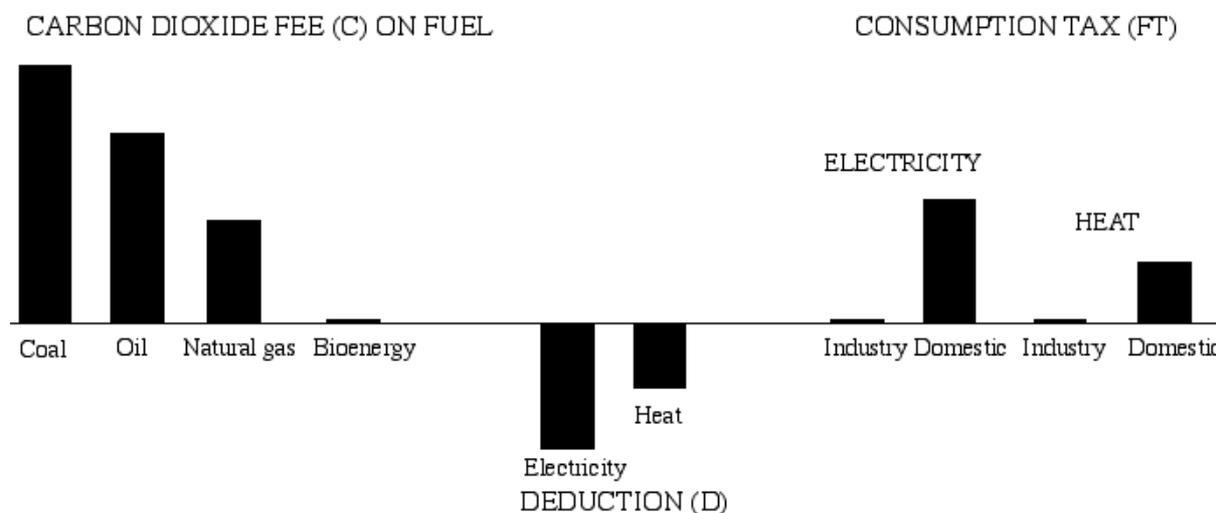
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<sup>98</sup> [www.aebiom.org](http://www.aebiom.org)

3. A fiscal energy consumption tax (FT) proportionate to used electricity or heat. The purpose of this tax is mainly fiscal and the level could be decided individually for heat and electricity as well as country depending on the desired state income from this sector. Of course the level will influence the total energy consumption. For reasons of competition the energy consumption tax could be reduced or omitted for the industrial sector (a strong steering effect can still be maintained by means of the carbon dioxide fee).

Figure 53 : Graphic illustration of the different components in the proposed carbon dioxide fee/tax system.

### A Flexible Carbon Dioxide Fee/Tax System in Europe



The carbon dioxide fee (C) is fuel related and is set proportionate to the content of carbon in different fossil fuels or agreed emission factors.

The deduction (D) is related to the energy production and proportionate to the amount of heat used for heating purposes and/or electricity generated. The deduction should be decided independently for electricity and heat generation. The deduction for generated electricity could be set at a magnitude twice as high as on heat, giving higher incentives for the more valuable electricity production.

The total deduction for heat and electricity should on a national basis be equal to the total carbon dioxide fee. That is the same principle as the Swedish NO<sub>x</sub> fee, which has successfully been practised for more than 20 years.

Thus these two parts of the system create a transfer of money from CO<sub>2</sub> polluters to energy producers (including producers effectively using fossil fuels).

The carbon dioxide fee will not be a tax since the deduction transfers the fee back to the producers.

Since the carbon dioxide fee is fuel related and the deduction related to generated heat or electricity this will create a strong driving force for higher conversion efficiency. By promoting higher conversion efficiency, the carbon dioxide emissions will be further lowered. The carbon dioxide fee and the deduction should be international harmonised.

The fiscal consumption tax (FT) is related to the energy consumption and will mainly be a national instrument for steering the magnitude of the total energy tax for end-users in the domestic sectors. The tax should be proportionate to the amount of heat or electricity used or sold to customers. The levels for heat and electricity could be set separately. The magnitude will mainly be set by national desires for state incomes. Although the purpose of this tax to a large extent is fiscal the level will influence the total energy consumption. Therefore and to show the higher value for electricity it is advisable to have a higher magnitude on electricity than on heat.

For reasons of competition neutrality, the energy consumption tax could be reduced or omitted for the industrial sector. The proposed fee/tax system makes it possible to maintain a lower taxation level for sectors exposed to international competition (industry and power sectors) in each country, without reducing the incentive for fossil fuel substitution or reduction in these sectors.

This system eliminates the disadvantages connected with traditional carbon dioxide taxes (often the choice stands between weakened competitiveness for the industry or weak incentives to reduce emissions of carbon dioxide). It gives equal incentives to reduce net emissions of carbon dioxide in all sectors of society. It maintains the competitiveness on the international market for the industry. It could be used as a solution for individual countries or as a solution for a common fee/tax system in the EU, and it can easily be adjusted to fulfil requirements for fiscal incomes to the society in the different countries in the EU.

This system may also be adopted for the transport sector. . Even in this case the deduction could be used as an instrument to differentiate the total tax depending on sector. The magnitude of the total tax will depend on the consumption tax and could be set at the same value as the existing taxes. In order to make it possible for renewable fuels to compete on the market the consumption tax could be (should be) alleviated for renewable fuels in the transport sector.

## 2.5.2. A nice example in Wallonia (Belgium)

*In Wallonia, 1 green certificates is 456 kg CO<sub>2</sub>*

The German EEG scheme contains a basic approach to link the feed in price of electricity with efficiency, through bonus paid for cogeneration (*Tableau 36*). But probably the most advanced scheme has been set up in the Walloon region (Belgium) since 2003<sup>99</sup>. This system of green certificates has the rare particularity to consider

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<sup>99</sup> [www.cwape.be](http://www.cwape.be)

the amount of *avoided* CO<sub>2</sub> (and not saved energy) compared to reference technologies on one hand, and to include in its scope CHP installations, on the other hand.

One green certificate is allocated for each 456 kg of avoided CO<sub>2</sub>. Indeed, the reference technology considered is a standard combined cycle gas turbine with an efficiency of 55 %, which emits this amount of CO<sub>2</sub> to generate 1 electric MWh.

More precisely, one green certificate (GC) is allocated for a produced amount of electricity corresponding to one MWh multiplied by the rate T of avoided CO<sub>2</sub>

$$1 \text{ GC} = 1 \text{ MWh}_{\text{elec}} \times T$$

Where :

$$T = (E_{\text{ref}} + Q - F) / E_{\text{ref}}$$

$E_{\text{ref}}$  : quantity of emitted CO<sub>2</sub> by the reference technology for the same electricity production (kgCO<sub>2</sub>/MWh<sub>electric</sub>).  $E_{\text{ref}} = 456 \text{ kg CO}_2$ .

$Q$  : only for CHP installations, quantity of emitted CO<sub>2</sub> by a reference heating installation producing the same amount of heat issued *and really used* from the CHP installation (kgCO<sub>2</sub>/MWh<sub>electric</sub>)

$F$  : quantity of emitted CO<sub>2</sub> by the green electricity installation

The following examples illustrate three different cases.

1. For a windturbine, which is not CHP ( $Q = 0$ ) and which generates no CO<sub>2</sub> ( $F = 0$ ),  $T = 1$ . It means that every MWh<sub>elec</sub> produced receives one green certificate.

2. Regarding bioenergy, the system only considers CO<sub>2</sub> from fossil resources. As the same amount of CO<sub>2</sub> is taken up by biomass to grow and emitted during its conversion into energy, this CO<sub>2</sub> is not counted. However, CO<sub>2</sub> emissions occurring during the preparation of biomass is taken into account. For example, according to literature surveys, the preparation of wood chips requires 23 kg CO<sub>2</sub>/MWh<sub>fuel</sub>.

Thus, for a bioelectricity plant fuelled with wood chips and having an efficiency of 35%, each MWh<sub>elec</sub> produced generates 0,86 green certificate, according to the following calculation :

$$T = [456 - (23/0,35)] / 456 = 0,86$$

3. For a CHP plant fuelled with willow energy crops (reference = 45 kg CO<sub>2</sub>/MWh<sub>fuel</sub>) with 35 % electric efficiency and a 50 % heat efficiency, where all the heat generated is really used to replace traditional heat production from natural gas (reference for gas = 251 kg CO<sub>2</sub>/MWh<sub>fuel</sub>) with 90 % efficiency, the situation is the following :

$$Q = (0,5 / 0,35) \times (251/0,9) = 398 \text{ kg CO}_2/\text{MWh}_{\text{elec}}$$

$$T = [(456 + 398 - ((1/0,35) \times 45)] / 456 = 1,59$$

Every electric MWh<sub>elec</sub> generates 1,59 GC.

*The only rule is the quantity of avoided CO<sub>2</sub>*

The green certificates system makes no technological distinction between installations. The only rule is the quantity of avoided CO<sub>2</sub>. This guarantees to support the best available technologies of the moment. But its effect, as one can see, is that the system strongly supports the combined heat and electricity produced from biomass.

In addition, references for different biomass fuels are adapted to their own CO<sub>2</sub> emissions. Biomass that would be transported on long distances (imported) will receive a higher reference value and would therefore be disfavored compared with another more environmentally friendly biomass.

*And it is successful*

The system might appear complicate but after 2 years experience the stakeholder find it very clever and successful. The number of allocated GC to producers has increased from 613000 GC in 2003 to 715000 in 2004 and 975000 are foreseen for 2005. Existing hydro power received the majority of the GC at the beginning but biomass is favored in new investments due to a higher potential and attractiveness (biomass got 36% of the GC in 2003 and should get 48% in 2005).

## **2.6. Steering instruments for liquid biofuels in Europe**

Promoting liquid biofuels in Europe is primarily carried out through a reduced tax. But the systems can be quite different from one country to another, as explained below.

The directive 2003/96 of the Commission allows member states to implement tax exemption on liquid biofuels, but preventing overcompensation of the extra costs involved in the manufacture of the products. This possibility has been exploited by all countries that have developed this market.

*Tax exemption is widespread*

The reduced tax is complete in AT, DE, HU, PO, ES and SE. It means that the advantage evolves according to the evolution of the taxation rate of transportation fuels. In the past the tax advantages were only allowed for pure biofuels in DE and AT, but the situation is more flexible now and tax advantages are now directly related to the volume percentage of biofuels. These maximum technical percentages are regulated by the fuel standards.

The tax exemption is only partial in FR and UK. In BE the fiscal advantage will be compensated by a higher tax on the remaining fossil fuels and only allowed for blends.

ETBE is considered separately in FR while other countries are considering the ethanol part of it. Pure plant oil is only eligible for tax exemption in BE and DE.

Tableau 31 : Reduced taxes on liquid biofuels in 2004 ( $\bullet/m^3$ )

	Biodiesel	Ethanol	ETBE
Austria <sup>1</sup>	290*		
Belgium <sup>2</sup>	365	592	
France	330	370	380
Germany	470*	654*	
Italy	405*		
Poland	245*	377*	
Spain	294*	390*	
Sweden	344*	520*	
United kingdom <sup>3</sup>	288 (20 p/l)	288 (20 p/l)	

\*. full tax exemption

1 : in Austria a complete reduction is allowed for pure liquid biofuels. Starting 1 January 2005, reduced tax of 28  $\bullet/m^3$  for diesel containing min. 4,4% biodiesel and, starting 1 October 2007, reduced tax of 33  $\bullet/m^3$  for gasoline containing min 4,4% ethanol.

2 : foreseen from 2005 onwards for biodiesel and pure plant oil, and from 2007 for ethanol.

3. tax reduction of 0,20  $\text{£}/l$  and 1,44  $\bullet/\text{£}$ .

### *Market derived volume or quota*

The way to allocate the tax advantage differs among countries. In DE the market is the limiting factor, with a maximum volume ruled by the standards (15% ETBE maximum, 5% biodiesel maximum within diesel).

In FR, IT (and soon in BE) quotas are determined with volumes allocated to production plants according to call for tender procedure.

### *Obligation*

In AT the oil companies have mandatory targets (2,5% at 1 October 2005, 4,3% at 1 October 2007 and 5,75% at 1 October 2008). In FR an additional tax (TGAP) has been introduced in 2005 to force oil companies to incorporate liquid biofuels.

### *Regulating imports*

Ethanol is produced at a much lower price in third countries like Pakistan or Brazil. Imports will lower the benefits of biofuels in Europe in terms of rural development, employment, agriculture impact. An infant European industry cannot stand competition with developing countries. In SE however the majority of the ethanol market comes from imports. Producers in DE have to compete with the Brazilian price increased by the entrance tariffs.

## 3. National case studies

### 3.1. Austria

#### 3.1.1. Current steering instruments and effectiveness

##### *Biomass important to reach Kyoto target*

Austria has actively participated in the negotiations for the Kyoto-protocol, both on UN-level and within the European Union, and has undertaken to reduce emissions of the six "Kyoto-greenhouse gases" by 13 % by the target period 2008 to 2012 as compared to the 1990 values.

In order to attain this ambitious goal the National Council adopted an "Austrian Climate Strategy 2008/2012", combining the efforts on the part of the Federal Government and the Lander into a co-ordinated strategy. In addition to the maximum exploitation of the existing energy saving potential Austria is expecting a significant contribution towards attaining the CO<sub>2</sub> emissions reduction target from the broadest possible exploration of renewable energy sources, in particular by stepping up the market penetration of biomass.

In Austria the public authorities support the promotion of RES on 3 levels:

- the federal level
- the regional level (Bundesländer)
- the community level (Gemeinden).

#### **Federal level**

The federal government supports renewables by different instruments such as :

- indicative goals for development
- legal regulations
- financial support programmes
- tax incentive programmes
- research and development.

#### **Indicative goal**

##### *30 % RES in 2010*

The indicative goal of the present Austrian government concerning development of RES is defined as follows: To increase the share of RES by 1 % per year from 23 % in 2003 to 30 % in the year 2010. This is not a binding political goal but an official

declaration that serves a signal for decision making in companies dealing with energy.

### Legal regulations

#### *Eco-power-act with attractive feed-in-tariffs*

The most important legal regulation is the Eco-power-act of 2002. This act defines feed-in-tariffs (Tableau 32) for electricity from solid biomass, biogas, wind, photovoltaics and small scale hydropower. The Eco-power-act also sets the target of reaching 78,1 % electricity from renewables of the total gross electricity consumption in the year 2010 - a goal set forth also by the European Union for Austria. This law explains the rapid growth of electricity from wind and biomass starting in the year 2003. The rapid development of RES electricity production in Austria since the year 2003 has led to an increase of the installed capacity from 206 MW<sub>el.</sub> in 2003 to estimated 1,150 MW<sub>el.</sub> in 2007.

Tableau 32 : Feed-in tariffs in Austria according the Eco Power Act

Technology	Tariff (Cent/kWh)
<b>PV systems</b>	
< 20 kW <sub>peak</sub>	60.00
> 20 kW <sub>peak</sub>	47.00
<b>Wind energy</b>	7.80
<b>Geothermal energy</b>	7.00
Solid biomass (e.g. woodchips, straw)	
< 2 MW	16.00
2 MW – 5 MW	15.00
5 MW – 10 MW	13.00
> 10 MW	10.20
<b>Waste with large biogenic fraction</b>	
< 2 MW	10.40 – 12.80
2 MW – 5 MW	9.75 – 12.00
5 MW – 10 MW	8.45 – 10.40
> 10 MW	6.63 – 8.16
Waste with large biogenic fraction, specially defined fuels	2.70
Hybrid- and Co-firing plants	3.00 – 6.50
<b>Liquid biomass</b>	
< 200 kW	13.00
> 200 kW	10.00
Biogas	
without co-fermentation	
< 100 kW	16.50
100 kW – 500 kW	14.50
500 kW – 1 MW	12.50
> 1 MW	10.30
with co-fermentation	
< 100 kW	12.38
100 kW – 500 kW	10.88
500 kW – 1 MW	9.38
> 1 MW	7.73
<b>Sewage and landfill gas</b>	
< 1 MW	6.00
> 1 MW	3.00

However, the instrument is so far only effective for new installations which got all permissions by December 2004 and which will be finished before the end of 2007. At the end of 2004 the feed-in tariff system was stopped, so that at the moment new plants, which didn't get their permissions until the end of December 2004, can not get a feed-in tariff based on the Eco Power Act.

### Financial promotion programmes – subsidies

#### *60 M• per year especially for bioheat*

In Austria there is a huge variety of financial support programmes in the form of subsidies to private investors (farms, companies, others) that set up biomass installations e.g. small wood heating systems (logwood, woodchips or pellet heating systems), biomass district heating plants, small biomass CHP plants, small biogas plants. This support reaches 20 – 40 % of the total costs of investment. Federal and regional authorities spend per year about 60 M• for support programmes.

### Tax policy

#### *Stronger measures for the heat market are needed*

In the last years the federal government increased the taxes on natural gas and heating oil remaining biofuels tax free. By doing so the competitiveness of biomass was improved as compared to fossil energy carriers.

Energy and mineral oil taxes in Austria are shown in Tableau 33, Tableau 34, Tableau 35. Biofuels like logwood, woodchips and wood pellets are free from energy taxes<sup>100</sup>. It has to be mentioned that compared to countries like Sweden or Italy energy taxes on fuels for heating purposes in Austria are much lower. So it is not surprising that within the last years a lot of new oil and gas heating systems were installed in Austria. Between 1994 and 2002 the number of oil and gas heating systems in Austria increased by 330000 installations. In the same period of time the number of biomass heating systems decreased by 61000 installations. Therefore especially for the heat market further activities and stronger measures have to be undertaken to make bioenergy more competitive.

*Tableau 33 : Energy taxes and mineral oil taxes on heating oil, natural gas, coal and electricity in Austria*

Fuel	unit	tax level, 1.1.2005 <sup>101</sup>
Heating oil, extra light	Cent/l	9.80
Natural gas	Cent/m <sup>3</sup>	6.66
Coal	Cent/kg	5.00
Electricity	Cent/kWh	1.50

#### *New taxation favouring liquid biofuels*

<sup>100</sup> 10 or 12 % value added tax on biofuels.

<sup>101</sup> For end-consumers 20 % value added tax additional.

*BOOSTING BIOENERGY IN EUROPE*

The Austrian Parliament has enacted legal provisions for the implementation of the biofuel directive. Tax exemption and indirect constraint of admixture shall force the use of biofuels strongly. 100 % pure biofuels for transportation are free from mineral oil tax. Mixed biofuels have lower taxes than fossil fuels. The exact figures are shown in Tableau 34, Tableau 35. From 1 October 2005 the mineral oil tax for fossil diesel with low sulphur content and blended with more than 4,4 % biodiesel will be lower by 0,028 •/l compared to fossil diesel without blending. From 1 October 2007 the mineral oil tax for gasoline and gasoline super with low sulphur content and blended with more than 4,4 % biofuel (bioethanol etc.) will be lower by 0,033 •/l compared to fossil gasoline and gasoline super (Tableau 35).

*Tableau 34 : Taxation on fossil transportation fuels in Austria*

Transportation fuel		Mineral oil-tax per litre		
		per 1.10.2005	per 1.10.2005	per 1.10.2007
Gasoline	sulphur content more than 10 mg/kg	• 0.432		• 0.445
Gasoline super	sulphur content more than 10 mg/kg	• 0.504		• 0.517
Diesel	sulphur content more than 10 mg/kg	• 0.317	0.325	

*Tableau 35 : Taxation on fossil transportation fuels blended with biofuels in Austria*

		Mineral oil-tax per litre		
		per 1.1.2005	per 1.10.2007	Difference to fossil fuels
Gasoline	low sulphur content, minimum 4,4 % biofuel		• 0.412	- • 0.033
Gasoline super	low sulphur content, minimum 4,4 % biofuel		• 0.484	- • 0.033
Diesel	low sulphur content, minimum 4,4 % Biodiesel	• 0.297		- • 0.028

Within the next years, the installation of both, a big bioethanol plant as well as a big biodiesel plant, are expected to be built up. Anyway, starting with autumn 2005,

fossil diesel will be blended with minimum 4,4 % of biodiesel generally, with autumn 2007, the same share of fossil petrol will be substituted by bioethanol.

This new taxation system favouring biofuels to be introduced into the transport sector seems to be a very strong incentive to bring forward liquid biofuels and to fulfil the goals of the EU directive on RES transportation fuels.

### **Regional and community level**

#### *Biomass as chance for regional development*

The measures of the federal government are supported by various programmes of regional governments and communities.

### **Financial support programmes**

#### *Private house owners as main target group*

Also regions offer financial programmes for investments in bioenergy or solar collectors. Their target group are mainly private house owners that switch from fossil systems to renewable systems. In some regions general subsidies for the construction of new housing facilities depend on installation of renewable energy systems.

### **Good example policy**

#### *Bioheat for public buildings*

Some regions and communities decide to install renewable energy systems for heating purposes in public buildings as soon as a new heating system has to be installed.

### **Information, consulting, training, education**

#### *For a sustainable energy system*

Regional and federal authorities spend money for training programmes and information activities concerning renewables, climate change and the future energy system. These instruments of the Austrian authorities are supported by various initiatives of the European Union. But also many non governmental organisations (NGOs) and also the policy for climate protection support the development of RES. Thus there is a complex network of formal and informal players who work together to create step by step a new sustainable energy system.

### 3.1.2. Proposal for improvements/new steering instruments

#### Drawbacks, obstacles

*Goals are ambitious, but...*

Despite numerous promotional instruments, the velocity of the deployment of RES only partly corresponds to the ambitious goals set forth by the government and the European Union.

#### Where are the problems?

*A stronger focus on bioenergy is needed*

- From pioneers to a mass movement: To reach a share of 30 % renewables in the energy system requires, that not only a few pioneers but a considerable part of the society is engaged in renewable energy. The switch from fossil systems to renewable systems, particularly in houses is expansive and difficult. The existing instruments and incentives are not sufficient.
- The oil and gas companies oppose strongly the change in the energy system. Their marketing work and their information policy hinders the ambitious goals of the renewable energy development.
- Stability and reliability of the programmes: The support programmes mentioned are not always certain and guaranteed. Lack of money, new decision makers, the influence of the oil and gas lobby sometimes lead to the interruption of programmes and in the following to a less of confidence in the public support for renewables. This uncertainty and instability is one of the main obstacles to a more rapid progress of RES.
- Tax policy: Although the federal government increased the taxes recently, the taxes on fossil fuels still are much lower in Austria than in the Scandinavian countries or Italy. Especially the Northern European countries demonstrate that high taxes on fossil fuels for heating purposes facilitate the fuel switch in a most effective way.

#### Proposal of new instruments

##### Electricity sector

*Continue the successful feed-in-tariff system*

In the electricity sector it should be guaranteed that the very successful feed-in tariff system will be continued within the next years. Especially for small CHP plants based on solid biomass and for biogas plants the feed-in tariffs should be at the same level as till now.

## **Biofuels for transportation**

### *On the right track*

There are no new measures necessary to be introduced. The existing measures, which shall come into force on 1 October 2005 and 2007, should be realised.

## **Heat sector**

### *New measures are proposed*

In Austria further initiatives to boost bioenergy are especially necessary for the heat sector. The most important obstacle for replacing fossil heating systems by biomass heating systems is the high investment costs. Therefore two main instruments to support the replacement of fossil heating systems by biomass systems are proposed, which could be realised alternatively:

- Austrian Support Programme for biomass heating systems or
- Eco-Heat-Laws

### **a. Austrian Support Programme**

#### *40 % investment subsidy*

An Austrian Support Programme for the replacement of fossil heating systems in single and multi-family houses by biomass heating systems should be co-ordinated by the Austrian ministry of economy. The support should be granted as a subsidy, which should be 40 % of the investment costs (about 5,000 •/system). The budget needed for the first 100000 heating systems is estimated with about 480 M •. With this support programme a total investment of about 1200 M• could be realised.

### **b. Eco-Heat-Law**

#### *Trading system with eco-heat-coupons*

The second proposal is an Eco-Heat-Law, which should be realised in each of the nine Austrian provinces. A proposal for the province of Styria has already been prepared and is now in discussion with the politicians. The idea of such a law is that especially private households installing a biomass or solar heating system get eco-heat-coupons according to the installed heat capacity. On the other hand companies selling oil, gas and coal for heating purposes in Styria are obliged by the proposed law to buy these eco-heat-coupons. The obligation would depend on the amount of oil, gas or coal the company has sold in the last year. Companies which do not fulfil the obligation would have to pay a fee of 1200 • per missing coupon. So the average price of a coupon is estimated to be between 800 and 1000 •. If a private house owner for example installs a pellet heating system with about 20 kW he would get three coupons (2400-3000 • support). The advantage of such a system would be that the province would not be involved with their budget, because the system is self-financing.

### 3.1.3. New instruments for Austria

In Austria renewables are supported by different instruments such as indicative goals, legal regulations, financial promotion and tax incentive programmes as well as research and development. The Austrian government defined the goal to increase the share of RES by 1 % per year from 23 % in 2003 to 30 % in 2010. The most important legal regulation is the Eco-power-act of 2002 defining feed-in-tariffs for RES electricity. This law has led to a rapid growth of electricity production from wind and biomass. Furthermore a huge variety of financial support programmes in the form of subsidies supported the development of bioenergy especially in the heat market within the last decades. In the last years Austria increased energy and mineral oil taxes, but compared to countries like Sweden or Italy energy taxes on fuels for heating purposes are much lower

Improvements and new instruments are proposed to speed up bioenergy :

- **Electricity sector** : it should be guaranteed that the very successful feed-in tariff system will be continued within the next years. Especially for small CHP plants based on solid biomass and for biogas plants the feed-in tariffs should be at the same level as till now.
- **Biofuels for transportation** : no new measures are necessary. The existing measures, which shall come into force on 1 October 2005 and 2007, should be realised.
- **Heat sector** : further initiatives to boost bioenergy are especially necessary for the heat sector. The most important obstacle for replacing fossil heating systems by biomass heating systems is the high investment costs. Therefore two main instruments to support the replacement of fossil heating systems by biomass systems are proposed, which could be realised alternatively: Austrian Support Programme for biomass heating systems or Eco-Heat-Laws.

## 3.2. Belgium

### 3.2.1. Current steering instruments and effectiveness

#### a. Federal support measures

*Support to improve energy efficiency, energy use of biomass and waste, use of renewable energy*

A tax-exemption is given for an amount equal to a percentage of the investment. Investment support is available for any type of investment, but for energy saving investments, the investor can obtain up to 10% extra in support. In 2004 the available tax-exemption for energy saving investments amounted to 14,5%. Technologies considered are subject to a number of restrictions and conditions. In essence, they

must lead to : improvement of energy efficiency, energy use of biomass and waste, use of renewable energy<sup>102</sup>.

## b. Flemish support measures

### *Renewable energy certificates and cogeneration certificates*

**Ecology support**<sup>103</sup> : companies may obtain a subsidy of maximum 20% of their investment cost if the investment is considered environmentally friendly (based on a number of “ecological criteria”). Only technology compliant with specific criteria is available. These criteria cover : reduction of raw material use, energy efficiency, quality control, reduction of pollution and safety. Ecology support is available for :

- installations generating energy resulting from the incineration, pyrolysis or gasification of biomass;
- installations generating energy resulting from the incineration, pyrolysis or gasification of waste, as far as recycling or any other preferred method is unavailable;
- installations generating energy resulting from anaerobic fermentation of biomass.

**Investment support for demonstration projects**<sup>104</sup> : the financial support amounts to maximum 50% of the costs of the innovative part of the new technology (excluding VAT and with a maximum of 250 000 Euro). The demonstration project should fit within the context of the annual priorities, set forth by the Flemish Government. The current priorities are :

- rational use of energy in industry and services with special attention to process integrated, source oriented techniques;
- renewable energy sources (biomass).

**IWT grants**<sup>105</sup> : the IWT (fund for research and development) awards grants for research and development projects.

**Renewable energy certificates (REC)**<sup>106</sup> : on 1 January 2002 a system of renewable energy certificates was put into place in the Flemish Region. The system was implemented in support of the Flemish target to obtain a percentage of its energy supply from renewables. Flanders has set out a target of 2% share of renewables in the energy supply for 2004, to be increased to 6% by 2010. The system builds upon two pillars :

- on the one hand, the *green energy producer* is granted tradable RECs for the energy produced based on renewable energy sources (including biomass);
- on the other hand *electricity suppliers* are under a duty to submit each year a number of REC (defined as a % of their electricity supplies in the Flemish Region) to the Flemish regulatory authority.

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<sup>102</sup> [www.mineco.fgov.be](http://www.mineco.fgov.be)

<sup>103</sup> [www.gom.be](http://www.gom.be)

<sup>104</sup> [www.vlanderen.be](http://www.vlanderen.be)

<sup>105</sup> [www.iwt.be](http://www.iwt.be)

<sup>106</sup> [www.vreg.be](http://www.vreg.be)

The electricity supplier can meet his (annually increasing) obligation to surrender RECs either by producing his own “green electricity” (in this case he will receive RECs) or by buying RECs on the market.

Non-compliance with the aforementioned duty is sanctioned by a fine. These fines are fed into the Renewable Energy Fund, used by the Flemish Government to promote renewable energy.

Although the market sets the price of the REC, the Government provides for a minimum price. It was noted that given the lead time associated with the production of RECs, the start up phase of the System was characterised by a storage of supply of RECs leading to rather high prices (nearing the amount of the fine).

**Cogeneration certificates**<sup>107</sup> : after long debates, a system of cogeneration certificates saw light in the Flemish Region on 5 March 2004. The system is comparable to the REC system : on the one hand, the granting of cogeneration certificates to producers and on the other hand the obligation imposed on electricity suppliers to submit certificates to the Flemish regulatory authority. As with the RECs, non-compliance is fined. The obligation begins 1 January 2005. The number of certificates to submit will increase annually. So far, percentages have been set until 2013 in the decree.

### c. Walloon support measures

#### *Green certificates to encourage producers of green electricity*

**Investment support for RE&D projects**<sup>108</sup> : recoverable advance in applied research, development and demonstration, for the SME and big companies. For SMEs, the amount of the advance is 50 to 70% of project’s cost. For big companies, the amount is 50% of project’s cost. The advance reimbursement is made only if the results of the research is developed.

**Support to basic industrial research - universities** : supported activities are in the field of basic industrial research related to new knowledge acquisition or better understanding of science and technology, in the frame of universities (and organisations of similar status). The Energy Division (Walloon Ministry) supports the projects especially dealing with energy. 100% of the research cost is supported.

**Support to basic industrial research - industry** : supported activities are in the field of basic industrial research related to new scientific and technical knowledge acquisition, likely to be developed as industrial applications used in Wallonia. The beneficiaries are SMEs and big companies. For SMEs, the amount of the subsidy is 50 to 70% of the project’s cost. For big companies, the amount is 50%.

**Financial support** in the field of “green energy” use for **companies**.

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<sup>107</sup> [www.cogenvlaanderen.be](http://www.cogenvlaanderen.be) or [www.vreg.be](http://www.vreg.be)

<sup>108</sup> <http://energie.wallonie.be>

**New economic expansion law** (under negotiation) : support will be applied to the cost difference between the real investment and a reference plant (to be determined).

**Financial support** in the field of “green energy” use for **public authorities**.

**Local action Program for energy management** (PALME program) : support program for cities developing actions in the field of energy (RES, rational use of energy, ...).

**Grants for private owners** : for example, there is a grant of 1 500 Euros related to the purchase of an automatic biomass boiler.

**Green certificates** (see detailed description also at point 2.5.2.) : a mechanism of green certificates exists in the Walloon Region since 1 October 2002. Green certificates are given to the producers of green electricity on the basis of the economy rate in CO<sub>2</sub> performed by the production chain used. In the Walloon Region, one certificate is attributed for an economy of 456 kg CO<sub>2</sub>. The electricity suppliers can obtain, on payment, green certificates from producers of green electricity at a price fixed according to a supply and demand process. The suppliers have to give to the CWAPE (Walloon Commission for Energy) a quota of green certificates depending of the amount of their sales. The certificate gains a marketable value (indeed, in case of non respect of the quota, the supplier has to pay a penalty [from 75 • to 100 • per missing certificate]). Then, the green electricity producers will have two sources of income : one from their electricity sale, and the other from the sale of green certificates on a virtual market. A mechanism will be implemented to guarantee a minimum value of the green certificate during the paying off period of the green production.

#### **d. Brussels-Capital support measures**

*Just a few grants in the field of “green electricity” use*

**Supports for public authorities, companies and private owners** (just a few grants in the field of “green energy” use)<sup>109</sup>.

**Green certificates** : the Brussels-Capital Government has implemented a mechanism of green certificates (edict of July 19, 2001 and precisions in the 6 May 2004 order). In the Brussels-Capital Region is attributed for an economy of 271 kg CO<sub>2</sub>. The principle is the same than in the Walloon Region.

### **3.2.2 Proposal for improvements/new steering instruments**

In Belgium, there is a necessity to boost bioenergy, especially for the heat sector. The most important obstacle for replacing fossil heating systems by biomass heating systems is the high investment costs, in industry and for the householders. Then,

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<sup>109</sup> [www.ibgebim.be](http://www.ibgebim.be)

new instruments are needed to support the replacement of fossil heating systems by biomass systems :

- specific grants for the householders who want to buy a new wood heating systems or to replace an old fossil fuel one by a wood heating system;
- in the industry sector, a system of “green certificates” for heat production from biomass.

Other propositions are mentioned here after (some of them were mentioned in a recent report<sup>110</sup>).

- analysis of RES-H&E potential in industry and dedicated technological developments ;
- RD&D on new and advanced options of biomass to energy conversion ;
- to develop a labelling system of imported biomass resources ;
- to develop public acceptance of energy use of biomass ;
- to develop new systems to support bio-energy projects (third investor, ...) ;

Regarding liquid biofuels ValBiom is satisfied with the current (November 2005) proposal of the government. However the Belgian proposal is still blocked at the Commission (DG State Aid). ValBiom recommendations are the following :

- Harmonize fiscal advantages and calculation method at European level
- Authorize all relevant liquid biofuels (ethanol, biodiesel and vegetable oil)
- Implement fiscal advantage at various blending percentages (current legislation is limited to ETBE – 7% ethanol, 40% maximum biodiesel).

### 3.2.3. Other actions needed

Several other key actions are proposed by ValBiom :

- a new fossil CO<sub>2</sub> tax in Belgium ;
- to develop a labelling system of biomass heating systems (wood stoves, wood boilers, ...) ;
- to increase grants for the householders who are interested by purchasing wood heating systems ;
- to improve the biomass resources knowledge (to implement a permanent inventory of biomass resources in Belgium) ;
- to develop actions to promote the use of pellets for stoves and boilers ;
- to implement or encourage training for professionals in the field of energy use of biomass ;
- develop a market for ethanol (high blends E10 and E85, ethanol in diesel) as the incorporation of ETBE only will not be sufficient to match the production capacity ;
- implement balance administrative procedures for liquid biofuels producers especially at small scale ;

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<sup>110</sup> Palmers et al., 2004

### 3.2.4. New instruments for Belgium

In Belgium, renewables are supported by different instruments (legal instruments, incentives, grants, ...).

Improvements and new instruments are proposed to boost bioenergy:

- a new fossil CO<sub>2</sub> tax in Belgium ;
- to develop labelling systems for biofuels and biomass heating systems ;
- to improve the biomass resources knowledge (to implement a permanent inventory of biomass resources in Belgium) ;
- to develop actions to promote the use of pellets for stoves and boilers ;
- to set up a system of "green certificates" for heat production from biomass.

## 3.3. Bulgaria

### 3.3.1. The reform is to be implemented

In the energy sector, Bulgaria is confronted with a series of major challenges stemming from both objective causes and circumstances and the delay in carrying out the reforms during the years of transition.

*Only national reserves of bad quality lignite and dependency on Russia for the remaining 70%*

Bulgaria is heavily dependent on energy as it imports more than 70% of its primary energy sources. The only significant domestic energy source is low-quality lignite coal with high content of sulphur. Bulgaria is mainly reliant on energy sources from Russia : oil, natural gas, high-quality coal and nuclear fuel. This structure of the energy balance causes concern in terms of the security of energy supply. The European Union whose dependence on imports is less (about 40%, but with a trend towards increasing this share up to 70% in 20 years' time) is making strenuous efforts in two key areas :

- Reduction in specific energy intensity per GDP unit in economy; and
- Utilization of local renewable energy sources (RES).

*A country with heavy energy transit*

Along with that, a significant potential for improving the security of supply lies in the growing mutual dependence in the context of using Bulgaria's key geographic location for the increasing transit of Russian and Asian resources (natural gas, oil and electricity) to the west and south, as well as of the opportunities for diversification of energy sources and suppliers.

*Bioenergy was always promoted but lack of market mechanisms undermined its development*

Despite its scarce domestic energy potential, Bulgaria's economy differs from other economies (both developed and Central and Eastern European economies in transition) in what can be called energy extravagance. That is why the key strategic objective of the economy and, more specifically, of the energy sector should be

rational use of energy sources, the most important of them is biomass. This objective is evident and has always been declared as a priority, even back in the times of planned economy. However, the absence of market mechanisms has not made it possible so far to achieve marked results, although significant scientific and technical potential has been mobilized for the attainment of this objective. Energy consumption and energy balance can only be streamlined under competitive economy and energy market. Endorsing this vision, the Government in its Program for Governance has declared the establishment of a competitive energy market as a top priority for the energy sector.

*A better market oriented energy system is required*

However, the establishment of an up-to-date and RES market-oriented energy sector calls for a series of prerequisites that have been missing up to this date, namely:

- Normalization of energy prices in line with the justified full economic costs and phasing out of the subsidies for generators;
- Financial recovering and establishment of energy companies operating on a commercial basis
- Properly functioning regulatory authorities and mechanisms
- Market rules and structures
- Appropriate legal framework.

*And this is not ready yet*

Integrated actions need to be undertaken in the above areas in order to compensate for the backlog, or, to put it briefly, the reform in the energy sector is yet to be implemented.

### **3.3.2. Current steering instruments**

*World Bank and the Global Environment Fund are key financial bodies*

Establishment of a mixed-ownership energy efficiency fund is among the most important instruments for achievement of these goals. A modern form of partnership between the public and private sectors was found with the assistance of the World Bank and the Global Environment Fund. The two institutions have decided to contribute 10 MUS\$ to that fund as an initial deposit for establishment and launching of the fund.

*A nice tax exemption for renovated buildings*

The second group of instruments provided by the bill is creation of financial stimuli for energy efficiency measures. The solution proposed is to exempt from taxation, for a 5 to 10 years' period, buildings that have been completely rehabilitated and that has been supported by documentary evidence resulting from an energy audit as provided by a separate law regulation to the bill.

*Restructuration in under way*

Within the framework of discussing the bill, the Ministry of Economy declared its consent to merge the Energy Efficiency Centre at the Ministry of Economy and the Executive Agency for Energy Efficiency at MEER into one administrative body. That is part of the optimization of administration and a very important step towards focusing the efforts for promotion renewable energy sources, so that real results can be expected from enforcement of that Act.

*A Fund with identified incomes supports bioenergy*

The main objective of the energy efficiency Fund is to manage financial resources provided for energy efficiency investment projects, based on the RES (biomass, wind, solar systems, hydro energy). Revenues to the Fund will come from grants made by international financial institutions and funds, Bulgarian and foreign natural and legal persons, financial income from interest on current accounts or bank deposits of the Fund, loans or other financial instruments of a credit character from international banks and other receipts. The resources of the Fund will be spent for credit financing of energy efficiency development projects, provision of guarantees for credits from financial/crediting institutions issued within energy efficiency projects and for support of the Fund.

A review is made of the specific energy efficiency measures aiming at reduction of energy consumption and improved energy efficiency. According to the bill, an energy efficiency evaluation shall be performed at the design phase on the terms and by the procedure of the Territorial Development Act in conformity with the technical regulations and rates for annual energy consumption by various types of facilities.

*Large energy consumers will be subject to energy audits*

Energy users with significant annual consumption shall be subject to energy efficiency audits. These audits will provide actual information about the consumers responsible for the most significant share of energy consumption in the country.

**Trade funding (bank loans)**

*Banks do not fulfil their roles*

Financial system efficiency of Bulgaria is still low (despite its stability) or with other words, so far the financial system does not fulfil effectively its main functions of mediator between the savings and investments in the real economy. The local banks are still doing cautious credit policy.

*Local banks are appropriate for RES*

As the necessary financing for efficient projects and for RES requires comparatively small capital investments, the credit loans by local banks for such projects will be easier, than for the larger energy projects. It is of big importance for the successful contracting of such credit that convincing financial proposals to the potential creditors are given.

Since the introduction of the currency board in Bulgaria the bank system is stable and slightly takes the main role to deliver capitals for the country economy. If the

environment keeps up to be so stable during the next years at given conditions the local trade banks could be important source for financing of energy efficiency and RES projects.

From other side the energy efficiency and RES projects have some specialties and usually require special experience from the side of the bank for their estimation and for determination of the credit scheme and the conditions.

### **Environmental funds**

#### *Bioenergy project are also eligible for Environmental funds*

Energy efficiency and RES theme is closely related to the environmental protection. That is why, possible source of funding can be also some environmental funds, which exists in the country.

#### *NTEF fund is financed by Switzerland*

**National Trust Eco- Fund (NTEF)** : NTEF is established by swap agreement on the scheme “Debt against environmental” signed between the government of Switzerland and Bulgaria and its main purpose is to manage finances, aimed to environmental protection in Bulgaria. Among the fund priorities are included also:

- Air pollution reduction : fragments, sulfur dioxide, nitrogen oxide, leaden and other poisonous chemical substances, greenhouse gases – CO<sub>2</sub>, methane (incl. replacement of fuels);
- Waters protection : municipal and industrial water cleaning stations.

Many of the projects, related to the energy, especially those for RES usage, are directly connected with the above given priorities, so they could be applicable for NTEF application. The potential projects must answer to many requirements, among which is the co-financing by other sources.

#### *GEF is a partnership between UN and World Bank*

**Global environmental fund (GEF)** : GEF is financial mechanism, which offers donations or concessions to the receiving countries, for projects and activities aimed at global environment protection. The mechanism priorities are preservation of the bio-diversity, climate changes, waters and ozone layer protection. GEF activity is implemented by trilateral partnership of the UN Development Program, UN Environmental Program and the World Bank, called executive agencies.

#### *Project's budgets take into account the size of the operators*

Mechanism is acting for projects amounting of 5,5 MUS\$ and implementation term for several years. In 1996 is approved middle-scale projects procedure, as the amount to be funded by GEF is not more than 1 MUS\$, for national project is maximum 50.000 US\$ and for regional ones – 25.000 US\$.

#### *All projects developers are eligible for GEF*

Since Bulgaria is a side (from 1994) in the UN framework convention for climate changes and respectively – admitted for applying on GEF, it is possible for a country projects to apply for such funding if they are supported by the government. Projects

can be submit to the GEF, not only by the Bulgarian government, but also from other national institutions, local communities, NGOs, academic and international organizations, academic and international organizations, as well as from the private sector.

### **Pre-accession financial means of the European Union**

EU programs could be important source for co-funding of investments for projects on energy efficiency and RES utilization, as well as for guarantee of technical assistance.

#### *PHARE and SAPARD are outstanding support EU programme for EU applying countries*

Of interest are the three existing national programs of EU, which are pre-accession financial instruments for the ten countries, applying for membership in EU, among which is also Bulgaria, namely:

- **PHARE** (institutional building, investment support); PHARE is continuation and widening of Program 1999, with main purpose – focusing on the priorities, marked in the Programs for accession of the given applicant countries. The Bulgarian priorities are : environment; energy sector; other medium-term and long-term priorities.
- **SAPARD** (agriculture and rural areas development); SAPARD program for Bulgaria is focused on the air quality – desulphurization of the power stations, waters quality – water purification facilities and waste management – harmful wastes, municipal wastes.

### **EU energy programmes**

#### *Bulgaria is already eligible for the Intelligent Energy fort Europe programme*

On April 2002 the European commission proposed new multi-annual program for actions in the area of the energy “Intelligent Energy for Europe”, which will be continuation of the present programs ALTENER, SAVE and SYNERGY, covered by Energy framework program, because of their completion in the end of 2002. The new proposal is for a 4 year program (2003-2006) with total budget of 215 M•. “Intelligent Energy for Europe” will implement the strategy, described in the Green book for the energy security of supply, based on RES and the energy saving. The Commission proposes:

- Support for the promotion of RES (ALTENER): 86 M•;
- Support for the energy saving promotion (SAVE): 75 M•;
- Support for the RES and energy saving promotion in developing countries (COOPENER) similar to the present at the moment SYNERGY program: 19 M•;
- New wrap of measures, concerning the transport energy aspects (STEER): 35 M•;

The European commission aims at focusing its efforts on the specific activities with high surplus value, which to allow the management of the EU dependence by external energy sources and implementation of the Kyoto obligations for the climate changes.

### 3.3.3. Proposal of new instruments

#### *Improved financing possibilities through various sources*

EUBA is proposing a review of the State budget towards ;

- Municipal budgets – by target subsidies and own revenues;
- Credits by financial institutions, including international ones;
- Private sector investments;
- Combinations of the above possibilities.

Co-funding guarantee should be not only in quantity, by also in time, i.e. there must be ensured relevance between the financial flows of EU and the schedule of the incoming by the sources of co-funding for the beneficent country.

### 3.3.4. Other actions

EUBA is also proposing :

- financial restructuring : establishment of financially viable commercialized companies
- institutional changes : enhancement of the role, autonomy and influence of the regulatory body (SERC)
- commercial restructuring : transition from administration to regulation and introduction of clear regulatory rules for the RES market players
- deregulation : introduction of clear and sustainable market rules and a clear schedule for the opening of the internal and external market to competition, including delegation to SERC of RES to enforce market rules
- legal changes : discussion and adoption of a new energy law which would ensure a legal framework for the successful implementation of RES of the above areas of the reform
- privatization : transfer of ownership aiming to attract investments and to bring the management practice in line with up-to-date standards.

#### *Green certificates for electricity are proposed*

In accordance with Directive 2001 /77/ of EU that supports RES power, and based on the market mechanisms in the draft of the Energy law, measures for promotion and sustainable RES usage should be implemented like green certificates introduction, which are compatible with the liberalized electricity markets, assisting the RES project funding. Traded green certificates lead to economically beneficent generation of power from RES. Different possibilities exist, but all are based on the same basic principles:

- The price of the power generated by RES has two components.
- “The green value” is divided by the electric power. The systems of traded green certificates determine the market value of the certificates for covering the additional costs of the power generation from RES.

- The certificates can be sold separately from the electric power
- The customer may be not physically connected (in the network) with the producer
- As distinction of the energy power with the certificates the moment of their trade may not coincide with the power generation..

*It leaves room for competition and efficiency improvement*

Traded green certificates give possibility for competition and growth of the market efficiency – the producers are motivated to reduce prices of the power in the RES basis (as distinction of the application of preferential tariff).

With adoption of the Energy law and the ordinance, given by the Minister of energy and energy resources for the conditions and the order for issue and trade with green certificates will be promoted a real accelerated development of the RES, used for electric power generation as well.

### **3.3.5. New instruments for Bulgaria**

The major improvements proposed by EUBA are the following :

- Improving the energy efficiency
- Renewable energy sources, promotion of their utilization in accordance with the programs of the EU for sustainable development
- Legislative regulation of the fund "Energy efficiency"
- Harmonization of the Bulgarian legislation with the European one, including in the field of the energy efficiency and renewable energy sources
- Special accent on the energy efficiency development
- Ensuring financial support for development of the energy efficiency in Bulgaria
- Implement green certificates for the power sector

## **3.4. Finland**

### **3.4.1. Current steering instruments**

#### **Energy Taxation**

*Biomass important to reach Kyoto target and EU directives*

Finland has actively participated in negotiations for the Kyoto-protocol, both in UN-level and within European Union. The targets of Kyoto-protocol and EU Directives concerning energy has been expanded many times and thoroughly by Finnish Government and Parliament. Hence National Energy and Climate Strategy should follow up those targets. Government has budgeted a lot of money for technology development work for bioenergy and also investment in RES-projects during last

years. Tax policy is slightly beneficial for bioheat but not for bioelectricity – or as much as in some other EU member states. There is no green certificate national electricity system or market or feed-in tariff systems in Finland like in Sweden or Germany.

#### *Stronger tools for electricity markets are needed*

In the 1997 energy tax reform input fuels to electricity production were exempted from fuel tax. Instead an electricity tax was introduced. In Finland electricity is taxed at its consumption stage. The fuels used for *power production are tax-free for CO<sub>2</sub> or other greenhouse gas* for energy producers. Finland has *environmental taxes (CO<sub>2</sub>) on fossil fuels and for peat only in the heating sector*. The environmental tax for fuels is based solely on the carbon content of fuels thus improving the competitiveness of renewable fuels.

To compensate the disadvantage for renewables in electricity production a refund system was introduced which provides for a tax refund equal to the electricity tax to wind power, small scale hydro power and electricity produced by wood or wood-based fuel. The tax by the consumer on the electricity produced with wood-based fuel will be refunded as subsidy to the producer. Likewise the tax is refunded to the producers of wind - and small-scale hydropower. Nowadays subsidy for electricity produced from renewable sources is 4,2 •/MWh, except for wind power and wood residues 6,9 •/MWh and RDFs 2,5 •/MWh

#### *Two electricity tax levels*

The electricity taxation system in Finland is based on the taxation on consumption of electricity. The system has two separate electricity tax levels. Industrial customers and greenhouses pay 0,44 cent/kWh while others pay a higher rate of 0,73 cent/kWh. There is also a Precautionary Stock Fee of 0,013 cent/kWh for all customers.

#### *Surtax for fuels*

*Surtax* is collected on oil products and other fossil fuels. The surtax on fuels is determined according to their carbon content. From 2003 onwards the surtax on fuels has been EUR 18.05 per carbon dioxide tonne. Natural gas is an exception to this with its 50% reduction in the surtax, as well as peat, whose tax is not based on the carbon content. The tax on electricity (for consumers) is divided into two classes, of which the lower, class II, tax is paid by industry and professional greenhouse cultivation (4.2 euros per MWh). Other consumers pay the higher class I tax (7 euros). In Finland the share of bioelectricity is absolute and relatively the biggest in the EU (20%). However, in electricity production there are “open markets laws”: the cheapest fuels win the play. It can say that’s not the best system for renewables if we try to increase the use of biofuels and other renewables. The fossil fuels and today especially coal are cheap enough in the trade market corresponding the biofuels.

#### *VAT is still 22%*

Value Added Tax has been in effect in Finland since August 1986. The current rate is 22 % and is recoverable by industrial customers. Private customers has to pay 22% VAT on all energy, fuels and energy investments. VAT is still 22% also for renewables.

## **Electricity Markets**

*Common Nordic electricity markets but no common electricity policies or support tools within countries*

Electricity markets are common with other Nordic countries. In Finland no license is required for generating or selling electricity. Distributed electricity generation is basically competing in the same conditions as any electricity, but there are some tax relieves for electricity generated from renewable energy sources.

During the last 1,5 years rather low electricity prices has been increased and came unstable and difficult to forecast. Nord Pool electricity stock market causes market effects over prices and electricity business. Electricity companies are fighting with each others over their market shares and increasing profitability's. EU's Emission Trading Markets has caused troubles also to biofuels and especially to peat power production which has decreased one third in 2005. There are high pressures to buy Emission Stocks from abroad: thus money is away also from new biomass or RES plant investments. Also a new nuclear power unit (5<sup>th</sup>, 1600 MW) will start to operate in 2009. Debate for planning another one has started.

Due to the low price of fossil fuels (no environment taxes in power production), new investments have become partly unprofitable, affecting also distributed generation like small-scale biomass CHP. New technologies are needed to allow high power-to-heat ratios in CHP plants, to make smaller CHP plants competitive and to provide low emission levels and to facilitate operation and maintenance of private consumer applications. Sweden took Green Certificate system for its national electricity market on May 2003. Finland has not that kind of system (although the same Nordic free electricity market). Experiences about green certificate system or feed-in tariff system, fossil environmental taxes and other administrative tools might be important in Finland, too, for increasing the use of RES.

## **Heat markets**

*Heat markets are growing*

Heat markets are local, and biomass is widely used in Finland. In heat generation, no tax is levied on wood fuels, biogas and RDF. The new CO<sub>2</sub> tax as of the year 2003 is 18,1 euros per ton CO<sub>2</sub>. Heat prices include the environmental taxes. However, no "national RES-H" exists. That is one of FINBIO's target. Also public investment money for private houses for to change fossil fuel systems to RES, are not available yet. FINBIO has demand it especially for pellets.

## **Liquid biofuels for transport markets**

*National target still missing*

In Finland quite a little efforts and public decisions has been done over this case. At last in the beginning of the year 2004 biogas and liquid biofuels (except biodiesel) came tax-free in Finland, when earlier they have heavy extra taxation (20-fold compared diesel). Biodiesel still have the extra taxation. Same odd taxation was over biogas cars. In the beginning of the year, the taxation for those cars came “normal”, but the government put technical demands over bioenergy cars (EuroNorm5) which are demanded in other EU countries in the year 2008.

There are no state investment money for ethanol or biogas production plants or new infrastructure.

FINBIO’s target and demand is that also Finland will fulfill the EU’s directive 2003/30/EC: 5.75% in 2010.

### **EU’s CO<sub>2</sub> Emission Trading 2005**

#### *Risk that bioenergy investment funds decrease*

EU started CO<sub>2</sub> emission trading in the beginning of 2005. Reduction of greenhouse gas emissions offers also new possibilities for companies to increase their business. But for instance in Nordic countries there is a risk, investment money for renewables and modern technologies will fly away from national markets to lower energy technology countries. Consequences might be: national money shortage for bioenergy R&D, investments etc.

#### **R&D**

#### *Finland supports strongly bioenergy research work*

Intensive and well-pointed national and international R&D-work is the basic tool for practical success. Reasonable amounts of public and companies money has been put for the bioenergy R&D&D –work during last decades. Results are especially good. A new national (and international) large Bioenergy Technology program should put in motion.

### **Investment Support and subsidies**

#### *Max. 40% subsidies for RES, but total invest money for bioenergy should increased strongly*

The Finnish Parliament allocates yearly funds for investment support directed towards investments in RES. Support is 30% maximum of the investments costs, in exception wind power plants, solar energy, new technology concerning RES and energy efficiency, which can be supported up to 40%. The value of energy subsidies granted annually during last years is 32,5 M€, of which approximately 1,3 M€ were supported by the European Regional Development Fund (ERDF). Subsidies granted by Employment and Economic Development Centres totalled 6,5 M€, while those granted by the Ministry of Trade and Industry totalled 26 M€. The sums were nearly the same since 2002. Altogether 43% of the decisions pertained to renewable energy sources, while the remaining 57% concerned energy conservation and efficiency. In financial terms, about 85% of the total allocation was used for renewable energy

sources. The Energy Department of Trade and Industry Ministry usually handles projects involving state-of-the-art technology as well as particularly large projects. The Employment and Economic Development Centres mainly deal with small, conventional technology projects and energy conservation audits.

In the future state support scheme for investment is aimed to be kept at least at the present level which is not enough for the biofuel targets.

In addition, subsidies are granted for the management of young forests and for the harvesting of energy wood. *The Finnish Ministry of Agriculture and Forestry* (MAF) is supporting forest owners for harvesting of young forests. In these stands the production costs are higher than harvesting of merchantable wood. Naturally, conservation projects also aim at lower energy costs, and renewable energy sources involve aspects of employment and secure supply.

## Energy grants and aids

### *Grants for RES available*

The objectives of energy aid, projects supported, aid intensities and other general terms are defined in the Government Decree. This Government Decree is premised on the Community guidelines on State aid for environmental protection 2001/c 37/03. The aid scheme aims at development of energy economy to a more environment-friendly direction, promotion of the take-up new technology and enhancement of the security and versatility of energy supply.

The aid may be granted for supporting investment and feasibility projects promoting energy savings, improved efficiency of energy production or use and production and use of renewable energy, as well as for projects reducing environmental hazards resulting from energy production or consumption and for projects otherwise enhancing the security and versatility of energy supply. Priority will be given to projects promoting the commercialisation of new technology. Aid is not granted in a situation where the aid applicants try to adapt themselves to the compulsory regulations in force.

Energy aid is granted in the form of a grant. The maximum aid intensity of eligible cost, according to project-specific considerations, may be as follows:

- 40% in energy audits, analyses and other feasibility projects;
- 40% in investment projects promoting the production of wind and solar energy;
- 40% in investment projects promoting efficient energy production or use, or production of use of renewable energy including new technology

- 30% in investment projects promoting efficient energy production or use, or production of use of renewable energy, or projects reducing the environmental hazards of energy production or use;
- 25% in other investment projects promoting the security and versatility of energy supply.

### 3.4.2. New instruments for Finland

The most important target for bioenergy use in Finland is to ensure that NAPRES 2003-2010 (National Action Plan for Renewables) will continue in full targets, and Parliament will make the clear lines and milestones for RES when handling and making decisions about Finnish new Energy and Climate strategy.

CHP and co-combustion technologies should be the first demands when giving public funds for investment in power plants.

RES-H is one missing puzzle piece in the RES supporting system in Finland and EU. New public investment funds and support tools are needed for the small-house owners for supporting them to change from fossil heating systems into RES-heating technologies. Also tax-repay-system and/or lower value added taxes for technologies and biofuels would be efficient boosting tools with concrete information campaigns.

There is an urgent need for boosting biofuel production for the traffic purposes, supply systems and the use of biofuel cars, too. Parliament should agree the EU directive and put national target into 5,75% in the year 2010. Still existing administrative barriers have to be kicked away, new tax system is also needed and technology transfer projects and demonstrations between countries in large scale.

The new large Biomass technology program is needed with efficient international network and co-operation.

## 3.5. Germany

### 3.5.1. Current steering instruments and effectiveness

#### *The development of bioenergy markets has political support*

Several taxes, incentive programmes or regulations affect the market development of renewable energies sources. There is for instance a reduced VAT rate of 7% for agricultural products and therefore for renewable resources (e.g. forest wood), compared to conventional fossil fuels (16%).

*Eco taxation not always favourable for market development*

Since April 1999 the government implemented the Ecological Tax Reform (Eco Tax) to gain a steering effect on the energy demand. Fossil fuels as well as electricity are taxed within the Eco Tax. Heat produced with mineral oil is taxed with 0,2 c•/kWh<sub>th</sub>, produced with natural gas with 0,37 c•/kWh<sub>th</sub>, and electricity used for heating is taxed with 2,05 c•/kWh<sub>th</sub>. As Renewable Energy Sources are not taxed on the heat and transport sector they gain a relative price advantage<sup>111</sup> on these markets. But unfortunately on the electricity market only electricity is taxed no matter how it is produced. In consequence even electricity generated by RES is being taxed by the Eco Tax so that the above mentioned advantage is only true for the heat and transportation market. Quite the contrary the Eco Tax burdens the price for RES-E and hampers the market development of an ecologically sound electricity generation.

*More effective Instruments fill the gap*

With these instruments being not far reaching enough overcoming the disadvantages in competition with fossil fuels the Federal Government implemented purposive support programmes and steering instrument, out of which the most important and effective are the “Act on granting priority to renewable energy sources (Renewable Energy Sources Act, EEG)”, the “Programme to promote Renewable Energies (Market Incentive Programme, MAP)” and the exemption from the mineral oil tax for biofuels for transportation.

**Act on granting priority to renewable energy (Renewable Energies Source Act EEG)**

*EEG – a clever polluter pays principle on the electricity market*

The “Renewable Energy Sources Act” (EEG) of 29 March 2000 and its amendment in July 2004 is a pivotal element to reach the national aims in the electricity market as it is seen as a key element of climate protection, environmental protection and sustainable development. It is an instrument of price regulation and obligates the nearest grid operator to a RES-E plant to purchase electricity generated from biomass, solar power, hydropower, wind power and geothermal energy and to pay certain minimum remuneration rates for it according to the extra costs of the corresponding RES technology. The grid operator himself passes the compensation payments on to the transmission grid operator (high voltage grids) with the obligation to a nation-wide equalisation of unequally distributed burdens. Finally the utility companies which supply electricity to the end-user shall be obliged to purchase the corresponding proportion of RES-E. This allows regionally varying burdens to be distributed nation-wide which leads to an average increase in the purchasing costs of electricity for the end user.

*EEG gives long term security for investments*

Costs for renewable energies hinge largely on investment security which is also guaranteed within the EEG with its fixed compensation rates. If an investment is high risk, banks demand high interest rates for the loan and the investor demand

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<sup>111</sup> BEN Bioenergie Niedersachsen: Fördermöglichkeiten für Bioenergie. Göttingen. Stand Januar 2005.

high-risk mark-ups. Since the structure of the EEG guarantees a particularly high investment security, credit interest rates and risk mark-ups are low compared with other instruments.

*A diversified stock of biomass resources and innovative technologies is mobilised*

In the case of electricity generation with biomass the related, so-called Biomass Ordinance, determines which substances qualify as biomass in the sense of the EEG, which technical procedures for generating electricity from biomass are covered by the EEG's scope of application and which environmental requirements are to be complied with. In the minimum remuneration rates to the parties feeding biogenic electricity into the grid, the level of remuneration depends on the type and size of the plants, the utilised biomass resource, the applied technology and the combined use of heat and power. Planning and investment security is guaranteed by fixed cent amounts per kWh fed into the grid, and a maximum duration of 20 years. The rate also depends on the date of commissioning; the later an installation begins operation, the lower the tariff (degression) to create the incentive to foster technology development and efficiency. Therefore the EEG ensures the increased use of environmentally friendly renewable energies, not through subsidies but through apportioning the costs.

*Regular evaluations guarantee cost effectiveness*

Regular reviews of the remuneration rates for new installations are made every two years to see if the compensation rates still cover the extra costs and finally to adopt their level if necessary as it happened in June 2004 e.g. with higher and more differentiated compensation rates for bioenergy plants considering different technologies, capacity sizes and resources such as renewable raw materials and biogenic residues and wastes:

Tableau 36 : Remuneration rates for biomass in the amended EEG<sup>112</sup>

installed capacity	basic remuneration	Fuel bonus		cogeneration-bonus all biomass	technology-bonus all biomass
		biogas	solid biomass (forest wood)		
< 150 kW	11,5 c•/kWh	6 c•/kWh	6 c•/kWh	2,0 c•/kWh	2,0 c•/kWh
150 - < 500 kW	9,9 c•/kWh	6 c•/kWh	6 c•/kWh	2,0 c•/kWh	2,0 c•/kWh
500 kW – < 5 MW	8,9 c•/kWh	4 c•/kWh	2,5 c•/kWh	2,0 c•/kWh	2,0 c•/kWh
5 – 20 MW	8,4 c•/kWh	0	0	2,0 c•/kWh	0

For bioenergy therefore the amended EEG provides in addition to the minimum compensation rate some additional fees (bonuses), if the electricity is exclusively

<sup>112</sup> Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): Act on granting priority to renewable energy sources. Berlin. July 2004.

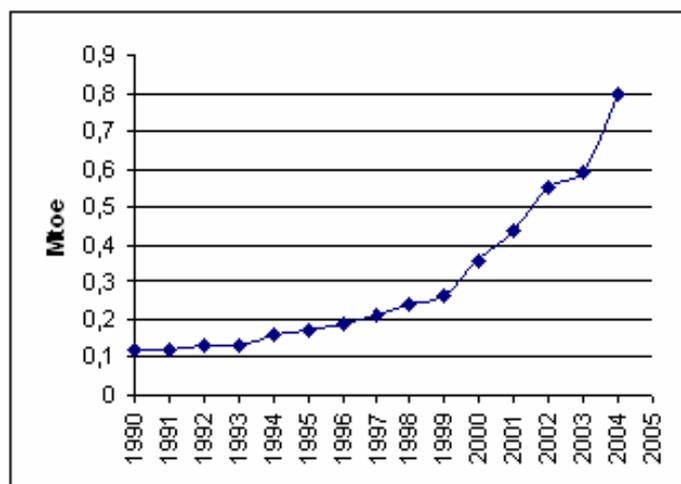
generated from self-regenerating raw materials, combined heat and power or if the biomass was converted using innovative technologies (e.g. thermal chemical gasification, fuel cell, gas turbines, organic Rankine systems, Kalena cycle plants or Stirling engines). The bonuses can be used cumulatively.

*EEG is boosting bioelectricity generation*

The EEG has proven to be a highly effective mechanism for the expansion of renewable energy sources because it supports the continued expansion of the individual renewable energy segments. From 1999 to 2004 the volume of electricity generated from renewable energies supported by this act increased from around 8 TWh to 56 TWh. The contribution of bioenergy to the electricity generation could be tripled in the same period. In conjunction with the Biomass Ordinance, it is expected that the EEG will trigger a similar momentum for the use of biogenic fuels as has been achieved with wind power. In 2002 the total remuneration for biogenic electricity generation under the terms of the EEG (that means without the biogenic fraction of waste) summed up to 132 M•<sup>113</sup>.

The impact of the amended EEG cannot be specified in detail at the moment but it is obvious that it will boost the electricity generation with biogas where a growth rate of 80 % in 2005 is seen to be likely<sup>114</sup> as well as the amendment will favour the utilisation of forest wood in facilities with an installed capacity of up to 5 MW<sub>el</sub><sup>115</sup>.

Figure 54 : Development of the biogenic electricity generation 1990 – 2004<sup>116</sup>



**Mineral Oil Tax Exemption**

*Detaxation of biofuels stimulates regional economies*

<sup>113</sup> Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): Renewable energy sources in figures – national and international development. Berlin. March 2004.

<sup>114</sup> German Biogas Association

<sup>115</sup> German BioEnergy Association

<sup>116</sup> BMU 2005

The Directive 2003/30/EC stipulates the target of 5,75 % minimum portion of liquid biofuels by 2010. To facilitate this target the German Bundestag (Lower House of Parliament) resolved within the context of its legislation on the ecological tax reform in June 2002 to exempt all biofuels from the mineral oil tax between January 2004 and 31 December 2009. This resolution was further reinforced by the financial committee of the Bundestag with a more extensive resolution in November 2003.

The tax exemption gives biofuels a relative price advantage of 0,47 •/l (compared with diesel) respectively 0,63 C•/l (compared with petrol). Under consideration of by-products (e.g. glycerine) and incentives to heighten regional economic cycles instead of detracting money out of the national economy for fossil fuel imports lower costs on the labour market due to new jobs and higher tax revenues by an increasing biofuel industry compensate mineral oil tax losses for the most part (biodiesel up to 60 – 80 %<sup>117</sup>).

#### *Overcompensations are being avoided*

For bioethanol this exemption is limited to undenatured alcohol with more than 99 % ethanol content. Further on it is clarified that the exemption aims at compensating the extra costs of biofuel production compared with conventional fuels. Hence the tax exemption mustn't lead to an over compensation of the production costs. Accordingly the production costs both of mineral and biofuels have to be verified every year and the tax exemption to be adopted to that effect.

#### *Mineral Oil Tax exemption has proven to be the best for a biofuel market development*

The exemption from the mineral oil tax is also valid for the part of blended biofuels. According to the DIN EN 590 standard for diesel fuels biodiesel can be blended up to 5 %<sub>volume</sub> for petrol according to the DIN EN 228 standard blends of up to 5 Vol % bioethanol or 15 %<sub>volume</sub> ETBE are allowed. This possibility of blending is actually being picked up by the mineral oil industry leading to a high increase in biofuel demand.<sup>118</sup>

The exemption of biofuels from the mineral oil tax boosted the market for biofuels for transport in Germany. Actual the capacities of the biodiesel production facilities jump up from 1,2 m tons today to expected 2 m tons until 2006, all brought to the market.<sup>119</sup> In the same period the capacities for bioethanol will reach an amount of approximately 0,6 m tons, more facilities are being planed so that it is likely that until 2010 as well about 2 m tons of bioethanol are on the market and Germany will fulfil its obligation within the EU Directive.

### **Programme to promote Renewable Energies (Market Incentive Programme MAP)**

#### *MAP gives investment subsidies to small heating systems*

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<sup>117</sup> IFO Institute for economic research: macroeconomic evaluation of rape cultivation for biodiesel production in Germany. Munich 2002.

<sup>118</sup> Fachagentur Nachwachsende Rohstoffe e.V. (FNR): Information sheet Liquid Biofuels – German Framework. Gülzow.

<sup>119</sup> Union for the Promotion of Oilseed and Protein Plants UFOP

The Market Incentive Programme for Renewable Energy Sources (MAP) promotes the growth of renewable energy sources especially in the heating sector. The programme's budget is funded from parts of the revenues of the taxation of electricity produced with RES in the Eco tax and depends in its extent from the annual budget negotiations of the German Government. The programme supports renewable heating systems with grants, long-term and low-interest loans and/or partial release of debts and had a budget of 200 M€ in 2004 which is expected to be increased to 230 M€ to the end of 2006.

On 1 January 2004 updated guidelines entered into force which enhanced the framework for a market entry for biomass heating systems as well as electricity facilities and biogas plants. The main focus however is on the small scale heating systems in the heat sector. Within the terms of the MAP manually operated wood log gasifier are supported in a range from 15 kW<sub>th</sub> to 100 kW<sub>th</sub> installed capacity with a grant of 50 €/kW, at least 1500 € for systems with an efficiency of 90 % whereas automatically operated central heating systems are supported in a range from 8 kW<sub>th</sub> to 100 kW<sub>th</sub> installed capacity with a grant of 60 €/kW, at least 1700 € for systems with an efficiency of 90 %. Additional stoves with a 90 % efficiency gain at least 1000 €.

*MAP is the most important instrument for large scale applications as well*

Automatically operated wood heating systems >100 kW<sub>th</sub> installed capacity are supported with low-interest loans and a partial release of debts amounting to 60 €/kW, max. 275000 € per plant. Furthermore automatically operated biomass cogeneration systems are supported with low-interest loans and a partial release of debts amounting to 250 €/kW, max. 62500 € per plant. District heating systems gain an additional debt release amounting to 50 € per meter, when a disposal of 1,5 MWh per year and meter is verified, max. 600000 €.<sup>120</sup>

*55 M€ have been given to support 32000 small scale heating systems*

Due to the MAP the market for biomass boilers up to 100 kW<sub>th</sub> has grown continuously in recent years, particularly wood pellet systems experienced a high surge. Since 1999 about 32000 small scale wood heating systems <100 kW<sub>th</sub> have been supported with grants amounting to 55 M€, most of them wood pellet systems and wood log gasifier. It is assumed that most of the supported wood log gasifier replace elderly wood heating systems and therefore don't lead to a real market growth than to a refinement of efficiency and environmental benefits.<sup>121</sup>

Tableau 37 : The support of the MAP facilitates a competitive investment in small scale biomass boilers<sup>122</sup>:

	Oil	Natural gas	Wood pellets	Wood logs
Investment [€]	10.402	9.185	12.307	9.077
Support [€]			- 1.700	- 1.500

<sup>120</sup> Programme to Promote Renewable Energies

<sup>121</sup> Center for Solar Energy and Hydrogen Research ZSW: Evaluation of Actions for the utilisation of Renewable Energies over the period of January 2002 to August 2004. Karlsruhe 2004.

<sup>122</sup> German Association for wood pellets, Deutscher Energie-Pellet-Verband DEPV, <http://www.depv.de>

Sum [•]	10.402	9.185	10.607	7.577
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Under consideration of investment costs, fuel prices and running costs a price for heat generation in private households of 8,3 c•/kWh for oil boilers, 8,6 c•/kWh for natural gas and 8,1 c•/kWh for wood pellets respectively 6,1 c•/kWh for wood logs can be calculated<sup>122</sup>

### *282 boilers could be realised with MAP support*

From January 2002 to June 2004 about 282 boilers > 100 kW<sub>th</sub> with a total capacity of 128 MW have been supported by the MAP. A third of the installed capacity is provided by systems with more than 1 MW<sub>th</sub>. Despite of six cogeneration facilities almost all of these supported boilers are exclusively heat generation facilities. The supported boilers are predominantly operated in the wood processing industry because of the availability of low priced residues and a high and continuous heat demand.

On closer examination of the biogas market about 60 % of the installed biogas plants gained a support within the MAP. Despite the compensation rates of the EEG the support within the MAP gave the initial impulse for investments in those technologies, especially for small scale biogas plants. The MAP support is thereby vital for the calculation of profitability of biogas plants.

Within the period from January 2002 to June 2004 subsidies amounting to 38,2 M• have been requested for bioenergy, subdivided into 20 M• for small scale heating systems < 100 kW<sub>th</sub>, (thereof 92 % in the private sector), 8,2 M• for facilities > 100 kW<sub>th</sub> and 10 M• for biogas plants. The outcome of this is a quota of support on the total investment amounting to 10 % for small scale heating systems, 14 % for facilities > 100 kW<sub>th</sub> and 6,6 % for biogas. Hence the MAP initiated total investments on bioenergy technologies of about 410 M• in total. In relation to the total requested subsidies for all renewable energy sources within the MAP amounting to 163 M• in the same period biomass had a share of 23,4 % on the subsidies of the MAP.<sup>123</sup>

### *MAP has to be decoupled from budget negotiations*

The Market Incentive Programme is therewith the most important instrument to support the renewable heat sector in Germany. But due to its limited budget and a low recognition in public it can only stimulate a market growth on a low level and is not suitable to utilise the huge biomass potential in the heat market. Contrariwise it is doubtful how long it will be maintained as a consequence of in deficit budgets of the Federal Government. Furthermore the yearly negotiations about the programmes budget don't lead to the necessary planning security and confidence to the market that an offensive investment in the bioheat market seems to be unlikely. As a conclusion **an additional steering instrument independent from governmental budgets to foster the renewable heat market is vital for a continuing and significant market development of biomass in the heat sector.**

<sup>123</sup> Center for Solar Energy and Hydrogen Research ZSW: Evaluation of Actions for the utilisation of Renewable Energies over the period of January 2002 to August 2004. Karlsruhe 2004.

### 3.5.2. Proposal for improvements and new steering instruments

In the bioenergy sector the electricity and traffic markets have developed well in recent years due to beneficial steering instruments. But in spite of its immense potential the biogenic heat market remains almost static. So to foster the use of biomass for energy an effective steering instrument for the heat market is vital in addition to the existing “Renewable Energies Promotion Programme (MAP)”, which indeed has initiated an increase in demand for small scale wood heating systems but on a selective and low level. Furthermore the budget of the Promotion Programme is limited and depends in its extent from the annual budget negotiations of the German Government.

Hence an area-wide and from governmental budget items independent steering instrument to cover the costs of biogenic heat production ought to be implemented. This also includes the definition of binding targets which lack is one reason for a minor cognition in politics and in public.

One proposal aims at an obligation for new dwellings to realize a quota, e.g. 10 % (to be defined), of renewable heat within an ordinance as it is successfully carry out in some municipalities (to boost the market for solar thermal systems). But despite of questions of juridical feasibility and a huge impact of the Government on the people it won't foster biomass applications as it is hardly possible to fulfil just a 10 % quota with biomass. In contrast a full heat supply is more likely and to be suggested due to high investment costs. So an ordinance for dwellings will lead to investments in biomass systems of those already convinced and not to a real boost on the bioheat market.

Further on only new dwellings usually with a low energy demand were effected typically heated by natural gas whereas the huge stock of existing dwellings and old heating systems – mostly based on oil – would remain unaffected and thereof the environmental benefit is much lower. Ahead a decreasing population and a declining building industry as recognisable in Germany shrink the market potential of renewable energy applications in general. Thereof another model taking the requirements of biomass more into account is crucial.

#### *Certification of bioheat use could be one solution*

Accordingly an apportionment procedure could be a more promising model which allocates the costs of an increasing quota on renewable heat production to e.g. retailers of fossil fuels in the heat market. This instrument should guarantee a necessary minimum biomass share on the heat market while lowering national subsidies. With rising prices for fossil fuels it is the aim to contradict swelling burdens of the economy's and costumers' budgets, to create several thousands of new jobs, to support innovation in SME companies and to combat climate change. With a **certificate trading systems for renewable heat** it will be possible to combine the advantages of competition with the support of renewable energies sources. But it is important to keep transparency and being bureaucratically feasible.

*Retailers of fossil fuels in charge*

This model obliges retailers selling fossil fuels to customers to attest a defined quota of renewable heat in their portfolio by certificate. Based on the contribution to CO<sub>2</sub> emissions of their traded fossil fuels the related CO<sub>2</sub> emissions are balanced with substituted emissions by renewable heat whereas biogenic fuels are calculated with zero emission. Operators of renewable heat installations have a privilege on tradable CO<sub>2</sub> mitigation certificates requested by the obliged retailers. The charge of the CO<sub>2</sub> mitigation and therewith the amount of certificates can be referred to a defined running time of a newly installed RES-H system linked with its effectiveness, but also the concrete support demand of a special technology can be a point of reference to set an incentive. The certificates are tradable; their value results out of offer and demand, a minimum price for the amount of certificates necessary to fulfil the defined quota can also be considered to set an incentive.

*Existing Infrastructure guarantees low bureaucracy*

Distributor of the certificates and the control board for the fulfilment of the quota are the finance authorities as they already review the companies' data including trade balances for taxation. The authorities run a data base balancing the obliged CO<sub>2</sub> mitigation of the retailers and all distributed respectively already converted certificates. If an obliged retailer doesn't fulfil his quota he has to pay a levy per missing CO<sub>2</sub> certificate higher than their market price on the trading floor.

*Bioheat quota stabilises energy prices*

Despite heat prices will raise in short-terms of about 0,5 % by an increase of 2 to 3 % renewable heat supply this effect will be equalled in medium-terms by raising prices for oil and natural gas. In contrast a quota on renewable heat will contribute to more steady heat prices. Further on due to competition and the ability of customers to choose their fuel/heat supplier a high pressure on the demand side can lower costs. An increasing quota on RES-H will also lower expenditures for fossil fuel imports and therefore heighten investments in local economies with the consequence that tax losses resulting from a decreased sell of fossil fuels are being compensated by lower costs on the labour market by reason of thousands of new jobs created with the investments in renewable energy systems and higher tax revenues by an increasing RES industry.<sup>124</sup>

### **3.5.3. Other actions**

In 2004 the amended EEG could loosen the "investment brake" in the bioenergy industry and leads now to a dynamic market growth in particular on the biogas and CHP-facilities markets. In order not to endanger the current and future projects, the validity of the EEG must remain untouched in medium terms and be enhanced (next evaluation of EEG by 31.12.2007).

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<sup>124</sup> Helmut Lamp, MdB: Main Features of a Renewable Energies Heat Act. Berlin 2004.

The preferential treatment of biofuels for transportation within the Mineral Oil Tax has enabled large investments in biodiesel and bioethanol production facilities as well. Their market share on the final energy consumption for transportation in 2004 was 1,6 %. To reach the 5,75 % target in time more facilities have to be built especially in the bioethanol sector. For that an extension of the preferential treatment in the Mineral Oil Tax beyond 2009 will be essential giving a necessary security for the high investments.

A clear expansion of the R&D activities on the range of bioenergy is indispensable. Along the entire creation of the bioenergy value chain it applies to realize potentials for optimization and into innovative bioenergy technologies corresponding to real market conditions. It applies to expand the budgets for FuE activities within the range of the promising bioenergy key technologies substantially.

#### 3.5.4. New instruments for Germany

An apportionment procedure could be a promising model for the bioheat market which allocates the costs of an increasing quota on renewable heat production to e.g. retailers of fossil fuels in the heat market. This instrument should guarantee a necessary minimum biomass share on the heat market while lowering national subsidies. With rising prices for fossil fuels it is the aim to contradict swelling burdens of the economy's and costumers' budgets, to create several thousands of new jobs, to support innovation in SME companies and to combat climate change. With a **certificate trading systems for renewable heat** it will be possible to combine the advantages of competition with the support of renewable energies sources. But it is important to keep transparency and being bureaucratically feasible.

This model obliges retailers selling fossil fuels to customers to attest a defined quota of renewable heat in their portfolio by certificate. Based on the contribution to CO<sub>2</sub> emissions of their traded fossil fuels the related CO<sub>2</sub> emissions are balanced with substituted emissions by renewable heat whereas biogenic fuels are calculated with zero emission. Operators of renewable heat installations have a privilege on tradable CO<sub>2</sub> mitigation certificates requested by the obliged retailers. The charge of the CO<sub>2</sub> mitigation and therewith the amount of certificates can be referred to a defined running time of a newly installed RES-H system linked with its effectiveness, but also the concrete support demand of a special technology can be a point of reference to set an incentive. The certificates are tradable; their value results out of offer and demand, a minimum price for the amount of certificates necessary to fulfil the defined quota can also be considered to set an incentive.

Distributor of the certificates and the control board for the fulfilment of the quota are the finance authorities as they already review the companies' data including trade balances for taxation. The authorities run a data base balancing the obliged CO<sub>2</sub> mitigation of the retailers and all distributed respectively already converted certificates. If an obliged retailer doesn't fulfil his quota he has to pay a levy per missing CO<sub>2</sub> certificate higher than their market price on the trading floor.

Despite heat prices will raise in short-terms of about 0,5 % by an increase of 2 to 3 % renewable heat supply this effect will be equalled in medium-terms by raising prices for oil and natural gas. In contrast a quota on renewable heat will contribute to more steady heat prices. Further on due to competition and the ability of customers to choose their fuel/heat supplier a high pressure on the demand side can lower costs. An increasing quota on RES-H will also lower expenditures for fossil fuel imports and therefore heighten investments in local economies with the consequence that tax losses resulting from a decreased sell of fossil fuels are being compensated by lower costs on the labour market by reason of thousands of new jobs created with the investments in renewable energy systems and higher tax revenues by an increasing RES industry<sup>125</sup>.

## 3.6. Sweden

### 3.6.1. Current steering instruments and effectiveness

#### Energy taxation<sup>126</sup>

##### *Different and complex types of taxations is the main policy*

Energy taxation has been the basic steering instrument in the Swedish energy politic. It can be roughly divided up into fiscal taxes and those intended to achieve environmental objectives. This latter group of taxes includes the carbon dioxide and sulphur taxes, while the general energy tax is essentially a fiscal tax. However, there is no strict boundary between the types, as both groups have an environmental effect as well as a fiscal function. The general energy tax, which has existed for several decades, and with varying purposes, is levied on most fuels, and is not only dependent of their energy content. The carbon dioxide tax, which was introduced in 1991, is levied on the emitted quantities of carbon dioxide from all fuels except biofuels and peat. In 2004, the general level of carbon dioxide tax is 10 c• (SEK 0,9) per kg CO<sub>2</sub>. A sulphur tax was introduced in 1991, and is levied at the rate of 3,3 • (SEK 30) per kg of sulphur emission from coal and peat, and at 2,97 • (SEK 27) per m<sup>3</sup> for each tenth of a percent of sulphur by weight in oil. The environmental levy on the emission of NO<sub>x</sub> was introduced in 1992, at a rate of 4,4 • (SEK 40) per kg of NO<sub>x</sub> emissions from boilers, gas turbines and stationary combustion plant supplying at least 25 GWh per year. However, it is intended to be fiscally neutral, and is repaid to plant operators in proportion to their energy production so that only those with the highest emissions are net payers.

##### *Different fuel and different final energy use is taxed in various ways*

<sup>125</sup> Helmut Lamp, MdB: Main Features of a Renewable Energies Heat Act. Berlin 2004.

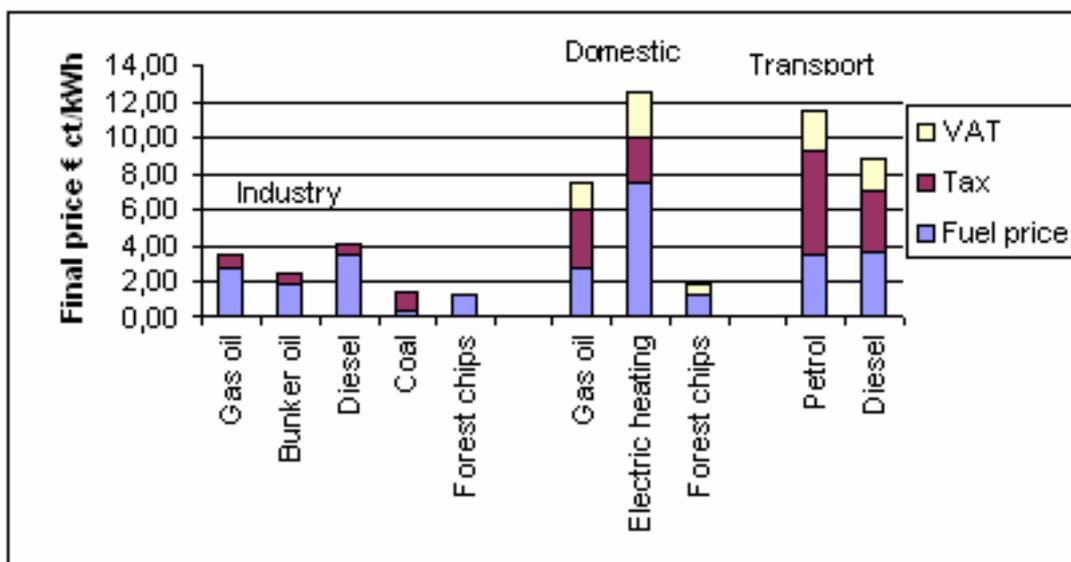
<sup>126</sup> Main source of information and figures in this chapter is the Swedish Energy Agency, Energy in Sweden 2004

Fuels used for heat production pay energy tax, carbon dioxide tax and, in certain cases, sulphur tax, as well as the NOx levy. The use of heat, however, is not taxed. In principle, biofuels and peat are tax-free for all users, although the use of peat attracts the sulphur tax. The taxation for simultaneous production of heat and electricity (CHP) has been changed with effect from 1st January 2004, so that the tax on the fuels used for heat production in such plants is taxed at the same rate as on these fuels when used in industry.

Fuels that are used for electricity production are exempt from energy and carbon dioxide tax, although they are subject to the NOx levy and sulphur tax in certain cases. However, the use of electricity is taxed, at rates that vary depending on in which part of the country the electricity is used, and on what it is used for.

As a result of the complex taxation the final fuel prices vary a lot whether the fuel is used in industry, transport or for domestic use (Figure 55).

Figure 55 : Final fuel prices for various customers 2003<sup>127</sup>



In 2003, revenues from energy taxes raised over 6 835 M• (62200 MSEK), making up 10,2% of State revenue or 2,5% of GNP.

<sup>127</sup> Swedish Energy Agency, Energy in Sweden 2004

Tableau 38 : Overview over Swedish taxation of biomass chains on different fuels.

		VAT	Energy /oil tax	NOx	S	CO2- tax	El certificate	El-tax
Individual households	Electricity	x					x	x
	Fossil	x	x					
	Biomass	x						
Industry heat	Electricity						x	x (EU min)
	Fossil			x	x	(21% of x)		
	Biomass			x				
District heating, heat	Electricity						x	x
	Fossil			x	x	x		
	Biomass			x				
Industry electricity	Fossil			x	x			
	Biomass			x			-x	
District heating, electricity CHP	Fossil			x	x			
	Biomass			x			-x	
Electricity utilities	Fossil			x	x	x		
	Biomass			x			-x	

### Electricity certificate system

#### *A functioning market for green electricity certificates has been introduced*

On 1 May 2003, a new support system for renewable energy was introduced, based on trading in electricity certificates for renewable electricity. In 2003, the proportion of renewable electricity that affected users were required to buy was 7,4% of their use. This proportion will be progressively increased year by year, so that it will have reached 16,9% in 2010, by which time the trading system should have resulted in about an extra 10 TWh/year of electricity production from renewable sources.

#### *The green electricity certificate system has resulted in investments that seems to more than double the generation of bio-electricity in the near future*

The certificate system has already been proven to be very effective. According to an investigation within the forest industry, made by SVEBIO<sup>128</sup>, the industry is on the whole positive to the introduced system. The main objection to the system is that it interferes in the competition for raw material. The certificate system is the main reason for investments in new installed effect of 430 MWe, resulting in a expected raise of bio-electricity production equal to 2,3 TWh. The technical potential is estimated to 11,0 - 12,7 TWh.

<sup>128</sup> Swedish Bioenergy Association, 2004, Effects on electricity production in the Paper and Pulp Industry, Internal report (in Swedish)

Within the district heating (CHP) the operators estimate a raise in bio-electricity production equal to 4,8 TWh<sup>129</sup> as a result of the certificate system. The majority of these installations are planned to be built between 2005 and 2008. The reason that no major investments are planned after 2008 is explained by the actors with insecurity in stability of the certificate system.

The price of the certificates is relatively stable and is about 22 • per MWh today<sup>130</sup>.

### **Taxation to encourage sustainability**

#### *General policy to raise taxation on energy and emissions and to reduce taxation on employment*

It was decided in the spring of 2000 that a total of 3206 M• (30 000 MSEK) taxation revenue should be transferred to encourage sustainability over a ten-year period. This means that taxes on energy use and emissions will be increased, offsetting a corresponding reduction in taxes on employment.

### **The energy efficiency improvement programme**

#### *Energy saving and energy efficiency in the industry can give tax rebate on electricity*

An energy tax on the electricity used in manufacturing industry, agriculture, forestry and fisheries was introduced on 1 July 2004, at a rate equivalent to the minimum required tax rate as set out in the Energy Taxation Directive. This means that, where manufacturing industry previously paid a zero tax rate on electricity, it must now pay an electricity tax of 0,055 c• (0,5 öre) per kWh. In June 2004, the Government put forward a bill setting out an energy efficiency improvement programme, with the intention that the programme should come into force on 1 January 2005. From that date, companies participating in the programme can receive a full rebate of the energy tax on electricity.

### **The climate investment programme (KLIMP)**

#### *Investment support for renewable energy and energy savings*

The programme has run since 2003, and is a continuation of earlier local investment programmes (LIP). These were programmes under which grants amounting to about 275 M• were awarded between 1998 and 2002 for long-term climate research and investments. The continuation programme (KLIMP) is part of the work of achieving Sweden's climate objectives. In 2003, 33 M• in investment subsidies were allocated to 14 programmes calculated to reduce carbon dioxide emissions by 114 000 tonnes carbon dioxide equivalents per year and to reduce the energy use with about 23 Gtoe per year. The support programme is primarily directed to regional official

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<sup>129</sup> Swedish Bioenergy Association and Swedish District Heating Association, 2005, Co-generation in the Swedish district heating industry and the certificate system Internal report (in Swedish)

<sup>130</sup> [www.nordpool.no](http://www.nordpool.no)

organisations. The climate investment programme also includes a subsidy (income tax exemption of max 1 300 •) for investment in bioenergy heating in new private housings 2004-2006.

### 3.6.2. Proposal for improvements and new steering instruments

#### Heat

##### *Especially conversion from heating with direct electricity still needs investment support*

The potential for substitution of direct electricity heating with biofuels is still large, both in residential and non-residential buildings as well as for further connection to district heating.

Most important is to keep the taxation of fossil fuels in housing sector high and to go further with the already introduced raising energy taxation and a corresponding reduction in taxes on employment. For single housings the bioenergy systems still needs investment support when converting from direct electricity. The need for support is lower when converting from oil with water piping systems.

There is also a strong need for better technically operating small-scale systems. The goal must be that these systems are almost as easy to handle and clean as oil and electricity systems, this could be a suitable challenge. Heat pumps are not a good alternative as long as their electricity need is supplied with imported coal condenses power, consequently heat pumps should not be supported of environmental reasons.

Since introduction of natural gas is a threat to sustainable renewable biomass heat in the industry and in district heating the taxation on natural gas should be increased.

Introduction of a trading system with heat certificates should be investigated.

#### Electricity

##### *Decisions on prolongation of the electricity certificate system after 2010 is needed*

The presently introduced electricity certificate system needs to be prolonged after 2010. Decision about its prolongation has to be taken as soon as possible to make the investors more secure about the future and the stability of the system. It must also be made more clear what kind fuels that are and will be accepted in the system. The electricity certificate system should be introduced in the rest of the Union.

#### Liquid biofuels

##### *Ten percent blending of ethanol in petrol and ten percent FAME in diesel must be accepted by the Union*

The main strategy in Sweden has been blending of petrol with ethanol. The oil companies already blend most 95- octane petrol with 5 percent ethanol. This level

should be raised to at least 10 percent ethanol. But that has to be accepted by the Union. Low percent blending is a very cost-effective way to lower the carbon dioxide emission in transport sector. Parallel to the low percent blending in petrol there is a need to enhance the number of vehicles using E85 fuel. The most effective way to encourage flexi-fuelled cars is to improve the distribution net and speed up the installation of pumps for renewable fuels at the petrol stations, such proposals has been made in the Swedish parliament.

There are also a number of other incentives, for promotion of renewable transport fuels that seems to be very effective, such as free parking in the cities and exemption from the different fees for traffic reductions that is planned in some of the bigger city centres. It should also be obligatory for official institutions to use “green” vehicles for their own transportation work.

The exemption from energy taxation for the ethanol fraction in E85 fuel must be kept, and an introduction of green certificate within the transport sector should be investigated.

### **3.6.3. Other actions needed**

#### *More focus and resources on targeted research and information*

The Swedish Energy agency runs numerous information activities aimed at improving awareness of energy efficiency in industry, through such ways as the development of energy auditing systems and environmental management systems. At local authority level, energy advisers play an important part in bringing information to the general public. But there is still a need for more information and promotion of bioenergy to ordinary citizens, not only to show the economic and environmental advantages, but also to push the issue of bioenergy as a modern sustainable way of living.

The research, development and demonstration projects, especially for black liquor gasification and large scale gasification must be given long-time stable economic conditions.

Technology procurement is a guide measure intended to encourage the development of a new technology. This should be seen as a process, rather than a project, consisting of a number of phases (actions) with several different groups and types of parties involved. The various phases involve execution and establishment of feasibility studies, purchaser groups, performance specifications, tendering procedures, evaluation, dissemination and further development. It forms a complete tendering process, with the aim of encouraging and accelerating the development of new technology, and is often carried out in the form of a competition between manufacturers.

For optimising the steering instruments it might be possible to combine marked orientated systems like electricity certificates with feed in prices for developing technologies which are not yet commercial.

### **3.6.4. New instruments for Sweden**

Contradictory to most other Member States, Sweden has successfully used different kinds of relatively high energy- and Eco-taxation parallel to financial support, legal regulations, promotion and awareness programmes and research and demonstration support to promote renewables and energy savings. Feed in tariffs for green electricity has not been used except for wind power. A trading market with green electricity certificates has been very successfully introduced 2003.

#### **Heating sector**

In the residential sector investment costs and not enough convenient technical solutions are main obstacles. The income tax exemption for investment in bioenergy heating in new private housings must be prolonged after 2006. Technical development of small scale bioenergy heating systems must be supported, preferably by targeting easy handling and low emission systems. The taxation of fossil fuels and electricity for heating should be kept at the same level as now.

#### **Electricity sector**

Investors must get long time insurance's of the stability of the green certificate system after 2010. A European wide electricity certificate trading system might be a strategic goal for the European energy policy. The market orientated system with electricity certificates can be combined with feed in prices for development technologies which are not yet commercial.

#### **Liquid biofuels**

The Union must accept a level of at least 10 percent blending with ethanol in petrol and 10% FAME in diesel. The installations of pumps for renewable fuels at larger petrol stations must be supported with binding regulations. Incentives like free parking, exemption from traffic jam taxation and favourable taxation for cars fuelled with liquid biofuels etc. must be realised and improved.

#### **Others:**

The research, development and demonstration projects for black liquor gasification and large scale gasification must be given long-time stable economic conditions. Present policy raising taxation on energy and emissions parallel with lowering taxation on labour must continue.

Develop new steering instruments supporting energy production from farmlands.

## Acronyms, abbreviations, units

### Country acronyms

#### EU 15

AT	Austria
BE	Belgium
DE	Germany
DK	Denmark
EL	Greece
ES	Spain
FI	Finland
FR	France
IE	Ireland
IT	Italy
LU	Luxembourg
NL	Netherlands
PT	Portugal
SE	Sweden
UK	United Kingdom

#### EU+10 (New EU member states)

CY	Cyprus
CZ	Czech Republic
EE	Estonia
HU	Hungary
PL	Poland
LT	Lithuania
LV	Latvia
MT	Malta
SI	Slovenia
SK	Slovakia

#### Candidate Countries

BG	Bulgaria
RO	Romania
TR	Turkey

### Further acronyms and abbreviations

CAP	Common Agricultural Policy
CHP	Combined Heat and Power
DH	District Heating
ETBE	Ethyl Tertiary Butyl Ether
GHG	Greenhouse Gas
kWh	kilowatthour
kWh <sub>el</sub>	kilowatthour of electricity
RES	Renewable Energy Source
RES-E	Renewable Electricity
RES-H	Renewable Heat

### Units

1 toe = 11,63 MWh = 41,868 GJ  
 1 ktoe = 11,63 GWh = 41,868 TJ  
 1 Mtoe = 11,63 TWh = 41,868 PJ

k – kilo : 10<sup>3</sup>  
 M - méga : 10<sup>6</sup>  
 G – giga : 10<sup>9</sup>  
 T - tera : 10<sup>12</sup>  
 P – péta : 10<sup>15</sup>  
 E – exa : 10<sup>18</sup>

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## **Annex**

We would enjoy to receive your comments and remarks, particularly on the following questions. You can use this sheet for notes and send an e-mail afterwards.

Do you think the proposed objectives are realistic and achievable ?

Do you think the measures proposed could be implemented ?

Any other comment or suggestions ?