European Biomass Association
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AEBIOM Position

BIOENERGY 2030

EUROPEAN ENERGY ISSUES AND THE DEVELOPMENT OF BIOENERGY TOWARDS 2030

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EUROPEAN BIOMASS ASSOCIATION

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EUROPEAN BIOMASS ASSOCIATION

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Executive summary

This AEBIOM paper focuses on the development of the bioenergy sector until 2030 and explains the position of AEBIOM on a few important energy issues such as sustainability, efficiency, energy poverty, the future of residential heating, Carbon Capture and Storage (CCS) and $C0_2$ taxation.

At present, bioenergy with over 100 Mtoe covers more than 60% of all RES and has a potential to provide 300 Mtoe of gross inland energy consumption by 2030. This quantity coming from solid, liquid and gaseous biomass should also in the future be used for the supply of heat, electricity and transportation fuels (first and second generation transportation fuels and biomethane).

In order to exploit this potential, it is necessary to follow certain principles of biomass deployment and introduce appropiate policies that would help to ensure these principles and increase the production of biomass.

One important principle of the biomass use is related to conversion efficiency. It is implied that the bioenergy chains with high conversion efficiency should be favored, whenever it is possbile.

A second important principle is the sustainable production of biomass in the sense that the capability of nature to produce biomass in a permanent way is maintained and the carbon stock in soils and forests remains at least stable over time. This should be valid for indigenous biomass as well as for imported biomass.

Biomass is a decentralised resource, therefore, whenever it is possible, a regional approach for the development of bioenergy should be applied rather than imports of bioenergy in order to reduce transportation costs, to ensure be regional security of energy supply and provide new jobs in rural areas.

About 40% of the final energy in Europe is used in the residential and service sector, mainly in the form of heat. At present, around 90% of this heat demand is covered by fossil fuels and electricity. In the future, when the prices for oil and gas rise, this might cause an increasing problem of energy poverty. However, it takes a long time to change the energy system.

The available biomass technologies for heating and cooling offer good opportunities for “greening” this sector, however, the lack of capital and the long pay back period hold back this development. There is a need of at least 10 billion Euro annually to co-finance national programmes aimed to start a rapid restructuring of the heating sector.

A rapid introduction of biomass for heat would reduce the demand for electricity in this sector. The paper explains in detail that such an approach would reduce the $C0_2$ emissions at much lower costs for the society than with the CCS technology. Therefore, AEBIOM is against the promotion of CCS with public money coming from the European taxpayers.

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One proven tool to decrease GHG emissions of fossil fuels is the introduction of the $C0_2$ taxes. Such a carbon tax can be a powerful instrument to direct investments towards $C0_2$ neutral energy solutions and to make energy saving more attractive.

This paper also looks at the national renewable energy action plans (nREAPs) and proposes that these plans should be further developed and improved, so that they become reliable and consistent guidelines for the bioenergy industry.

With this paper, AEBIOM aims to contribute in a constructive way to the rapid deployment of bioenergy in Europe in order to achieve the European targets and create a sustainable, secure and environmentally friendly energy system.

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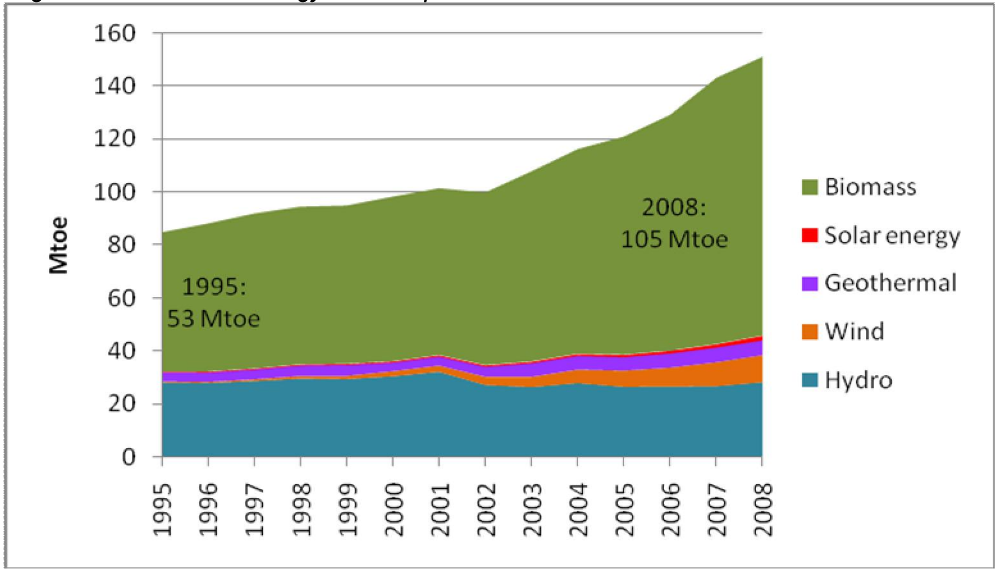
1. Contribution of biomass to the energy system – past and present

Over the last years bioenergy was - in absolute terms - the fastest growing Renewable Energy Source (RES) in the European Union. The contribution of biomass to the energy supply in terms of gross inland energy consumption increased from 53 in 2000 to 105 Mtoe in 2008. Bioenergy covers more than sixty percent of all RES. Therefore, the future development of bioenergy will be crucial to reach the RES and GHG reduction targets set to all EU member states.

Fig. 1: Gross inland energy consumption from renewables, EU 27, 1995–2008, Mtoe



Source: Eurostat

Biomass for energy is used in solid, liquid and gaseous forms. The feedstock is not homogenous. It can originate from agricultural crops and residues (rape, cereals, maize, sugar beets, straw, manure, short rotation coppices), from forestry (fire wood, chips, logs, branches, residues), from the wood processing industry (saw mill dust, chips, black liquor, bark) and from organic waste streams.

After conversion biomass delivers heat, electricity and transport fuels as final energy. In the European Union, in 2008, the final energy of biomass was delivered to 13% as biofuels, 11% as electricity and to 76 % as heat.

The biggest share of biomass is used for the heating sector. Heat from biomass can be delivered either directly via the combustion of wood, pellets, straw and other raw materials by the final consumer or in derived form (as heat or steam) from district heating or cogeneration plants.

The conversion of biomass to electricity is based on different technologies depending on the size of the plant – on average 25 - 30% of the primary energy is transformed to electricity and the rest to heat. Therefore, plants without the possibility to use the heat are wasting around 70% of the primary energy.

The dominant transport fuels at present are biodiesel produced from oil plants and ethanol produced from starch or sugar containing plants. These plants deliver roughly 30-40% biofuels (by weight).The remaining 60-70%, however, are not wasted. It provides a valuable, rich in proteins feed for animals and therewith contributes to our food supply at the same time.

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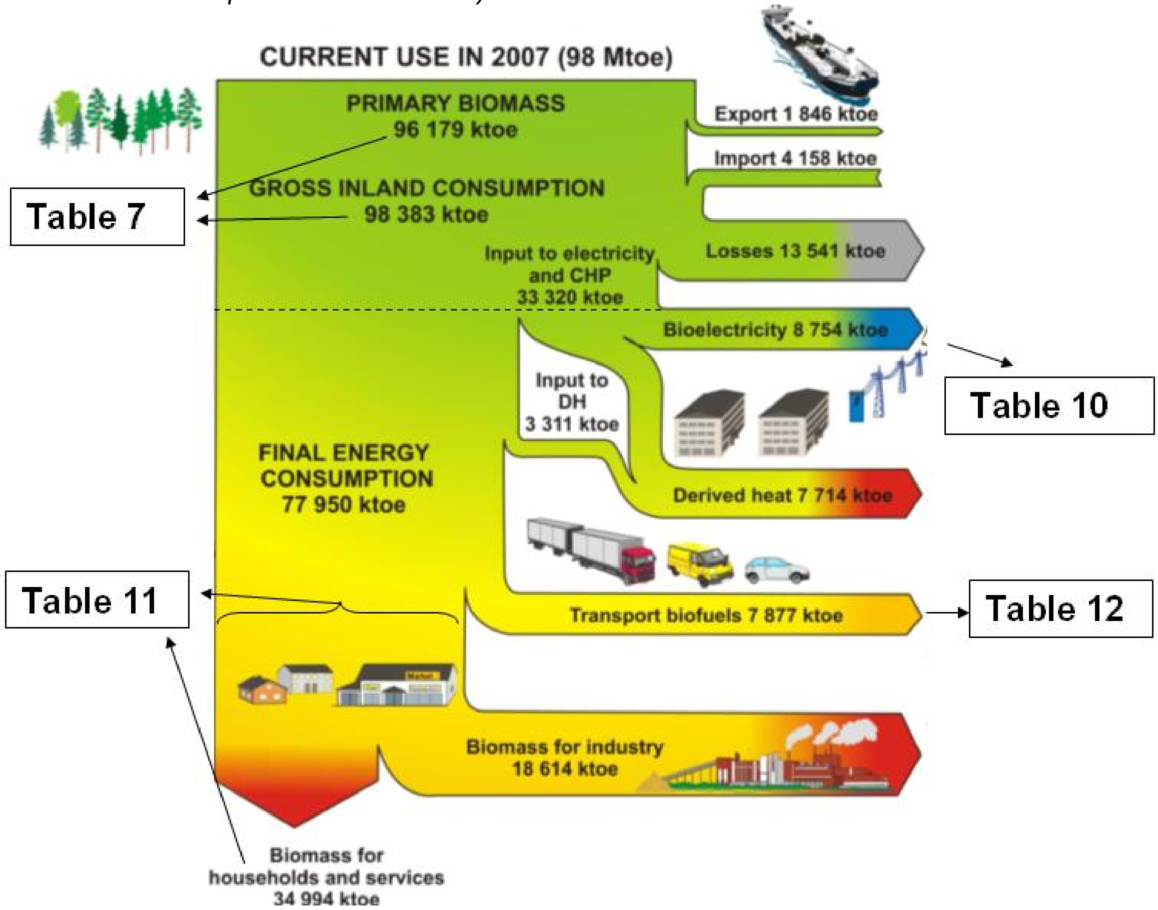
The transformation from primary biomass to final energy from biomass is shown in detail in graph 1.

Fig. 2: Biomass, Transformation from primary to final energy, EU 27, 2007, Mtoe (the number of the tables refer to the template for the NREAPs).



Sources: Eurostat, AEBIOM calculation, designed by VTT.

As experience shows, biomass for heat is competitive if compared to fossil fuels as far as the costs of the feedstock are concerned – the main barrier remains rather high investment cost to switch from a traditional fossil or electric heating system to a biomass heating system.

Biomass is a stored solar energy – and, therefore, is available 8760 hours per year. This explains why bioenergy offers high synergies in combination with other forms of renewable energy to supply the needed heat or electricity.

2. European bioenergy potential and targets for 2030

Many different studies exist on the future potential of biomass for the energy sector. AEBIOM estimates the quantity of biomass that can be brought to the European market in the coming decades, is as follows:

Past	2000	64 Mtoe
	2007	98 Mtoe

Future	2020	220 Mtoe
	2030	300 Mtoe

90% of this biomass could come from the EU and about 10% from imports, mainly from overseas and from the East part of Europe (Russia, etc.).

In the past 75% of the biomass originated from forests and the rest came from agricultural resources and waste streams. In the future it is expected that the production of all forms of biomass will be increased, but biomass from agriculture and waste will grow more rapidly than from forests; therefore the share of biomass coming from agriculture and waste streams will increase significantly.

Energy crops for the production of liquid, gaseous and solid biomass will gain importance and could cover 25 million hectares land that in the future will not be needed for food and feed production in Europe. The imports will mainly be liquid fuels, pellets and to a small degree wood chips and wood logs. All other forms of biomass will predominantly be produced and used in Europe.

AEBIOM supports a scenario for 2030 according to which roughly two thirds of the biomass is used for heat, 15% for electricity, mainly in cogeneration units and the rest for biofuels. Given the high degree of competitiveness and energy efficiency, it would make sense that heat remains the dominant energy output coming from biomass.

Table 1: Expected biomass and bioenergy, 2020, 2030 (Mtoe, EU 27)

all figures in Mtoe	2007	2020	2030
Primary biomass	96,18	200	270
Imports	4,16	20	30
Exports	1,95	-	-
Gross inland consumption	98,38	220	300
Input to Electricity and CHP	33,32	65	80
Input to DHC	3,31	10	20
Input to Biofuels 2G/Biorefineries	0	5	10
Biomass use by households and services	34,99	80	115
Biomass use by industries	18,61	30	35
Total electricity (in TWh)	8,75 (102)	20 (227)	35 (404)
biomass for heat (direct use)	53,61	110	150
Bioheat (derived heat)	2,31	14	32
Total biomass for heat (direct and derived)	53,92	124	182
Total biofuels	7,88	32	45
Total Final energy consumption from biomass	77,95	175	261

Source: Renewable Heating and Cooling Technology Platform

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3. Strategies for an increased production of biomass for energy

So far, a big share of biomass for energy comes from the forest sector. There is still a significant potential to increase the contribution of forest biomass for the energy sector in a sustainable way. But a considerable part of the European forests, especially small and private owned forests are not managed and harvested regularly. Missing infrastructure such as forest roads, regional markets and skilled labour, as well as the missing capital for the mechanization are the reasons for the low production of forests in many parts of Europe. A strong policy of national governments to develop a modern, sustainable forest industry is needed, an industry that is/would be able to supply the saw mills, the paper and pulp industry and the energy sector.

The agricultural sector can increase its share by better using the by-products such as manure, straw, but also by using up to 25 Mio ha land to grow new energy crops such as energy grasses, short rotations forests like poplars and willows, traditional agricultural plants for bioethanol, biodiesel and biogas. The economic incentives have to be developed so that these crops would become attractive to farmers, e.g. by using especially the second pillar of the Common Agriculture Policy.

The third important source for bioenergy comes from the energetic use of by products and waste. This is of particular importance for the biogas technology but also for biomass CHP-plants (especially waste wood) and transportation fuels (e.g. fats).
Finally a certain quantity of biomass will be imported such as biofuels and pellets.

Table 2: AEBIOM Supply SCENARIO of biomass 2030 (Mtoe)

Origin	2007	2020	2030	Difference 2030-2007
Agriculture	14	63	110	96
Forestry	72	105	120	48
Waste	10	32	40	30
Imports	2	20	30	28
Total	98	220	300	202

The expected strong increase of biomass coming from agriculture can be explained by millions of hectares of energy crops – one million hectares lignocellulosic crops can produce 4 -5 Mtoe per year - for solid biomass production, for biogas and for biofuels but also the increased use of by-products such as straw, manure and fruit biomass.

The additional biomass from forestry could especially come from forests in those parts of Europe, where the management of forests was not well developed so far.

4. Basic principles for the future development of biomass

Biomass offers many different opportunities in terms of production, conversion and final use. Therefore, it is helpful to develop guiding principles for the future promotion of biomass for energy such as:

- Efficiency
- Sustainability
- Competitiveness

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- Security of supply, strengthening biomass from Europe as compared to imports
- Bioenergy as regional energy source
- Priority for the food production

4.1. Efficiency

The available biomass should be used in such a way that the primary energy in the feedstock is converted to as much final useful energy as possible.

Biomass CHP as an example

In the case of heat and electricity production the conversion efficiency should be above 60% in the long run. Higher conversion efficiency is desirable but often not possible, due to the missing heat demand especially in the summer time. In an intermediate period, solutions with lower efficiency might be better than continuing use of fossil fuels, especially coal for producing electricity. After an intermediate period, however, new plants producing electricity and co-firing plants using biomass should be introduced only if a significant part of the excess heat can be used. This requires a new approach towards district heating and a consideration of efficiency issues in support schemes with increasing requirements on the performance.

The losses of energy in generating electricity in power stations are very high, therefore the CHP technology is given here as an example. But certainly, high efficiency should also be a criterion for heat production only, meaning that gradually only highly efficient combustion boilers should be left in operation.

This efficiency principle should be applied to the use of fossil fuels in the same manner.

Accelerated construction of district heating&cooling systems

The production of electricity in power plants using fossil fuels or biomass goes always along with the production of heat. In many regions of Europe this excess heat is seen as an unavoidable loss. All together these losses reach almost 400 Mtoe per year in Europe, a quantity representing more than a double of the total contribution of RES !

One of the most promising ways to reduce these losses would be the accelerated construction of district heating and cooling systems combined with the switch from single house heating systems to district heating in densely populated areas or the use of the heat in industrial processes. This would be a far reaching and powerful measure to improve the efficiency of the total energy system. Yet, for a company operating a power plant near a city without a district heating grid, it is more profitable to waste the heat than to build and operate a district heating system due to high additional investment costs. In such case, a financial support with public funds for the construction of district heating and cooling grids would make it profitable for private companies to use this excess heat.

AEBIOM is strongly in favour of a generous public support for the construction of district heating and cooling systems.

4.2. Sustainability

The original meaning of the word sustainability in this context means a production and utilization of biomass without harming the nature – the water, the soils, the biodiversity, the carbon stock of biomass - and to maintain the capability of the nature to produce biomass in a permanent way in the future. In

Europe this form of sustainable production is ensured through the forest and agricultural policies, and its implementation by the public authorities. In the case of biofuels, additional criteria such as a minimum saving of CO_2 emissions as compared to fossil fuels was introduced in the RES directive 28/EC/2009.

AEBIOM sees at present no necessity to introduce additional mandatory schemes for the certification of solid/gaseous biomass produced in Europe. But in view of future imports from countries outside the EU that sometimes have loose environmental regulations, an adapted and coherent framework for the EU will be progressively necessary. It should take the concerns of all parties into account.

It is recommended that the sustainability rules should be similar for all member states.

4.3. Competitiveness

Due to an easy-to-apply but modern technology and the comparable low costs for the utilization of local biomass recourses the running costs for the production of heat using biomass are lower than those using fossil energy or electricity. The main obstacle for an increased use of biomass for heat lies in the high capital investment necessary in the beginning to switch from fossil or electrical heating to biomass heating.

As still huge amounts of fossil fuels are used to deliver heat, it makes sense from an economic and technical standpoint to promote as a priority the thermal use of biomass and the heat driven CHP (combined heat and power) production of electricity.

Biofuels including biomethane should not be underestimated – they are not competitive yet but their promotion is necessary to improve the security of supply in the transport sector as they are the only existing alternative to fossil fuels for the transport sector available on the market in significant quantities.

4.4. Security of supply and bioenergy imports: priority to biomass from Europe

One important argument for the promotion of RES in general and bioenergy in particular is the improved security of energy supply. Without RES, Europe is getting increasingly dependent on energy imports. This dependence weakens the economic and strategic position of Europe, especially in times of international tensions.

Therefore, AEBIOM proposes to improve the security of supply in Europe by integrating biomass from Europe into the European energy system. No specific legislation should be implemented to exclude imports but the regional supply of biomass to the market should be favoured to the benefit of the European producers.

However, it should not be forgotten, that some parts of Europe do not have the potential to increase their biomass production to reach the RES targets. On the other hand, specific forms of biomass such as biofuels, pellets and to a lesser extent wood chips are becoming globally traded commodities. It is expected that these imports will increase but this trade should not be promoted at the expense of the development of the indigenous biomass potential. This would mean that the security of supply as an important goal of the European energy policy is neglected. Therefore, an integrated agricultural, forestry and energy policy for Europe is recommended in order to improve the competitiveness of biomass from Europe. This is of specific importance for biofuels to secure a minimum level of domestic production.

4.5. Bioenergy as a regional energy source

Most forms of biomass have a low energy density and hence high costs of transportation. Therefore, the first priority of of biomass use should be the utilization in the region where it is produced. As many examples shows, new small and medium sized regional companies would develop to use the regional biomass, if the framework conditions favour this kind of development. Such a policy has a strong positive impact on the regional job creation based on the biomass deployment.

Obviously, in many largely unpopulated rural regions much more biomass can be produced than is needed for the local supply. This can be the case for biofuels as well as for solid biomass. These rural regions, dominated by agriculture or forestry, have big potentials to supply urban agglomerations or industries nearby with the raw material. Over longer distance, mainly pellets and biofuels will be the basis for an international trade.

4.6. Priority for food production

The production of food should have priority as compared to the production of biomass for energy. Yet, the principle of food security has a European and a global aspect. European agriculture was characterized by overproduction of milk, cereals, sugar and other commodities. Set aside programs to leave land idle, quotas to limit the production and subsidized exports helped to solve the problem of over production. The reduction of the European food production solved partly the problem of overproduction and sets land free for the energy production. In addition, these subsidized exports hampered the local agriculture in many developing countries in its development.

Our vision cannot be that Europe feeds the world based on subsidized exports but that Europe spends more money and provides its' know-how to develop the agricultural infrastructure in these developing countries like the ones in Africa. Furthermore, with the production of biomass for energy even in developing countries, the related investments into the infrastructure and agricultural systems could revitalize the production of food in these countries again. Many models can be suggested, such as producing food and using the by-products and residues for energy, or to grow energy crops and food plants in rotation, to grow food plants between energy crops (so called "inter-cropping"), etc.

Applying these concepts it is possbile to increase the biomass production without harming the food security.

5. Bioenergy and energy poverty

How to avoid the problem of energy poverty in the future?

Energy serves basic needs of the society such as cooking, warm rooms and warm water. Almost 40% of the final energy is used for these purposes.

Therefore energy, especially in the form of heat should be affordable for all groups of the society. Yet, this will not be the case in the future if the upcoming scarcity of fossil fuels causes strong increases of the prices of oil and gas and if these energy carriers remain the main source for the supply of domestic heating. A doubling of the oil price might increase the heating bill for a household, depending on the size

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of the living place, by 1000 to 3 000 EUR per year. In addition, we should bear in mind that heating fuels have lower associated taxes and therefore increases will have stronger social impacts than in the case of transport fuels.

According to Eurostat 21% of household are unable to keep their home at adequate temperature. If this situation prevails in the coming decades more and more families will not be able to finance the energy bill for heating their houses or flats and be confronted with the problem of energy poverty. This might create severe social turmoils in some parts of Europe. To avoid these negative impacts on the society a strategy has to be developed years before this price surge starts with the objective to reduce the dependency on fossil fuels in the heating sector. The better insulation of the buildings and the switch to heat from renewables such as biomass, solar thermal, geothermal and district heating are the strategies to avoid the problems of energy poverty in the future. The restructuring of the heating system takes many years and needs large investments.

Therefore, AEBIOM supports policies restructuring the heating sector now in order to avoid energy poverty in the future.

6. The restructuring of the energy system in the residential and service sector

Why there are no European programmes focused on residential heating, the largest part of the energy system?

The public debate on energy focuses heavily on the electricity production, nuclear power industry, transport sector, new infrastructure for gas and oil, on carbon capture and storage (CCS). Yet, about 40% of the final energy in Europe is used in the residential and service sector, mainly in a form of heat. This sector represents an important part of the total energy system with growing opportunities to become more independent on the international energy companies.

At present the basic energy needs of this sector such as space heating, warm water, electricity for light and information technologies, are mainly covered by energy coming from the big fossil fuels or nuclear power suppliers. In the future this sector using new innovative technologies will be able to produce a big share of the energy needed using its own or regional renewable energy resources and could even become a producer/supplier of electricity to the public grid.

The following examples prove this statement:

- warm water produced with solar collectors instead of electricity or fossil fuels,
- space heating partly with solar heat, partly with biomass or district heating instead of oil, gas or electricity,
- electricity from photovoltaic installations placed on the roof of private houses or in the future with micro CHP based on pellets or wood chips,
- reduced heat/cooling needs by ensuring a better insulation of the dwellings etc.

All these technologies are available on the market except the micro CHP based on biomass. They could help the final consumers to save money for the energy bill and thus reduce the problem of energy poverty, improve the security of supply and reduce the green house gas emissions. In the cases of electricity from photovoltaic, heat from solar thermal and reduced consumption by better insulation, the

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systems operate almost without running costs, they have high capital expenditures only once - for the initial investment.

The main obstacle for the rapid deployment of these new technologies in the private sector is the lack of capital and the long pay back period. This problem is aggravated by the lack of efficient European programs to support this sector to change its energy system. This is surprising as this private sector sums up to almost half of the energy consumption and could become – in combination with biomass – to a large extent its own energy producer based on renewable, sustainable energy sources.

General cost calculations for new heating systems until 2030. An example:
The capital requirements are considerable as the following example shows. The investment to change a heating system of a private house based on solar thermal and pellets in combination with electricity from PV is about 30.000 EUR. The costs for the introduction of a district heating systems per unit are similar. The refurbishment of 5 million private houses per year would mean that within a period of 20 years more than 50% of all residential living places in Europe could be transformed to a sustainable heating system. The annual investment based on prices of 2010 of 30.000 EUR/house would sum up to 150 Billion EUR per year, if 5 million houses are refurbished every year. The costs for the better insulation are not included.

Specific calculation for new biomass heating systems until 2020
This calculation can also be broken down into the period from 2010 to 2020 for biomass installations only, based on the figures presented in table 2. In this period it is proposed to add additional 50 Mtoe biomass to heat directly and about 5 Mtoe to derived heat. On the assumption that one residential unit needs 1,5 toe heat per year it can be concluded that the heating systems in 36 Million houses have to be changed to bring 55 Mtoe biomass to the heating sector. Given the investment of 14.000 EUR per unit for a biomass heating system (10 kW at 1400 EUR/kW) this sums up to 504 Billion EUR until 2020, which corresponds over a 10 year period to 50 Billion EUR per year total investment costs. Such an investment programme could to a large extent be financed by private capital and create many additional jobs, if sufficient incentives are in place (see chapter 13!)

AEBIOM, therefore, proposes a new European program of at least 10 Bn EUR annually to co-finance national programmes in favour of the restructuring of the heating sector by supporting district heating and individual heating based on biomass. This fund could be increased to 20 Bn EUR to include solar thermal and geothermal heating and better insulation of houses in the private and residential area.

7. Carbon capture and storage (CCS) and the use of electricity in Europe

Carbon Capture and Storage is a new technology that aims to sequester the CO_2 released in burning carbohydrates. It is of significant importance for the coal industry, because the reserves of coal are vast, the CO_2 emission per unit energy high and the increased use of coal is considered as indispensable for the future energy supply.

The technology consists of 3 steps: first the separation of CO_2 from other parts of the flue gases, then the conversion of the gas into liquid form and then the transport in pipelines to storage places, where the liquefied CO_2 is injected under pressure into the under ground. The quantities of CO_2 to be removed are immense. A medium sized coal fired power plant with 400 MWel power produces per day (24 hours) around 10.000 tons of CO_2. This huge quantity of CO_2 is the result of the combustion process: one kilogram carbon combines with oxygen to 3,67 kg CO_2. Therefore the separation of CO_2 as the main product of the combustion of hydrocarbons is much more costly and complicate than the separation of Sulphur or NOx. The technology is not only expensive, but also energy intensive. 20 to 30% of the electricity produced in such a power plant is needed to operate the CO_2 sequestration. In classical coal fire power plants without the use of heat the efficiency falls below 30%. The costs of CO_2 mitigation per ton range between 60 to 90 EUR/t. Even if the technology is further developed, only a small portion of the produced CO_2 of power plants in Europe can be stored because of the lack of underground sites.

This brief description of the CCS technology leads to the question:

How do we use the electricity produced In Europe?
Do we need CCS?

In 2006, 3.354 TWh electricity were produced, 55% in conventional power plants 30% in nuclear power plants and the rest using renewables.

Table 3: Gross electricity generation EU 27 (2006, TWh)

	detailed data	sums
Coal	960	
Oil	132	
Gas	707	
Other	40	
Total conventional thermal		1839
Nuclear		990
Pumped storage		36
Hydro	309	
Wind	82	
Biomass	90	
Solar	2	
Geothermal	6	
Total renewable		489
Total		3354

How is this electricity used?

There are no detailed statistics available. Based on different country studies it can be estimated that roughly 30% of the electricity produced, 800 – 1000 TWh, is used for the heat sector, partly for residential heating and warm water, partly for industrial processes. This corresponds to 200.000 MW capacity in conventional thermal power stations. Certainly one part of this electricity, used for residential heating and warm water, can be replaced by district heat, solar thermal or biomass. A replacement of 200 TWh would mean, that 40.000 MW thermal power plants could be saved in the future, reducing the CO_2 emissions much more than ever possible with CCS and at a much lower cost for the society. Yet the necessary investments in district heating, solar installations, bioenergy and in changes of the heating systems to replace 200 TWh electricity is in a size of 150 - 200 billion EUR. These investments have to be financed by the private sector and medium sized companies and not by large utilities.

Look at the following example to realize the tremendous possibilities to save public money, if you go for rerewable heat instead of electricity and CCS:

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An Example: Given 11 Mio houses/apartments using each 22 MWh electricity for space heating and warmwater; in total 242 TWh per year.

Now let us assume in these 11 Mio houses the systems for heating and warm water supply are changed to biomass heat (district heat, individual heating systems) at investment costs of 14.000 EUR per unit, in total 154 Bn EUR. These renewable systems are in operation 24 years and are financed 20% by EU funds, 20% by national supports and 60% by private capital. The public support requires 62 Bn EUR. Broken down over the time of 24 years this sums up to 2,6 Bn EUR per year.

After this change these apartments only need 4 MWh electricity per year, 18 MWh per unit are saved, in total 198 TWh.

And now the comparison:
If 198 TWh electricity are produced in coal fired power plants, the $C0_2$ emissions are in the size of 200 Mio tons.

If you avoid these 200 Mio tons emissions by reducing the demand for electricity in the above mentioned way, you need 2,6 Bn EUR per year, the cost per ton $C0_2$ reduction are 13 EUR.

In the case of CCS: The annual cost per ton $C0_2$ captured and stored are around 75 EUR, the cost in total for the sequestration are in the size of 15 Billion EUR per year.

These are costs due to additional investments that have to be paid finally by the society, be it the tax payer or the consumer.

As this example shows: The option renewable heat instead of electricity and CCS reduces the cost of $C0_2$ reduction by more than 80%!!!

If this change of the 11 Mio heating systems is to be done within ten years, a public support of 6,2 Bn/year is needed, and no additional costs in the following 14 years.

It does not take into account the increase price to be paid by consumers for electricity based on CCS, because more coal is needed par GWh electricity due to the lower global efficiency.

The replacement of electricity in the low temperature market by renewables and excess heat has several advantages compared to the promotion of new power plants with CCS:

- a much higher efficiency in the energy system
- less emissions at lower costs than applying CCS
- better security due to lower imports of fossil fuels
- increased share of RES in the supply
- savings for the final consumer in their energy bill

AEBIOM believes electricity as a high quality energy form should mainly be used for high quality services and AEBIOM suggests the creation of financial programmes to substitute the consumption of electricity in the low temperature market. AEBIOM is against the promotion of CCS with public money coming from the European taxpayers. The companies should develope the best solutions for a $C0_2$ reduction on a market basis.

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8. Carbon taxes

Burning fossil fuels is the main reason for the increasing concentration of GHG in the atmosphere. One proven tool to decrease these emissions is the introduction of taxes on the quantity of CO_2 released by burning fossil fuels. Such carbon tax can be a powerful steering instrument to direct investments towards CO_2 neutral energy solutions and to make energy saving more attractive.

The carbon tax should be based on tons of CO_2 released by burning fossil energy carriers. It can be introduced at a rather low level and gradually increased. The revenue should be used by the governments to reduce other taxes (on employment for example), or to help develop renewables.

As compared to certification schemes carbon taxes have the advantage that private investors as well as companies know in advance the additional tax burden they would have to carry, if they invest in fossil energy solutions. Therefore, carbon taxes are a preferred method for serious companies since the tax gives predictable investment conditions. It is a method to enhance efficient research, development and investments in many companies.

Carbon taxes should be introduced in addition to the existing taxes and should comprise all fossil fuels used for transportation and heat production. Due to the different existing taxations and income patterns in member states individual adaptation for member states would be necessary.

AEBIOM strongly supports an EU wide legislation for a minimum taxation of CO_2 emissions caused by burning fossil fuels. Such taxation is seen as an indispensable instrument to reduce the CO_2 emissions and to accelerate the progress towards a low carbon economy.

9. Climate protection by increased use of biomass: on land use change and forest management

Closed carbon cycle

Sometimes it is argued that the combustion of biomass releases CO_2. This is true but this CO_2 does not increase the net concentration of greenhouse gases. The basic difference between burning fossil fuels and biomass lies in the origin of the carbon. Plants are taking the carbon from the atmosphere by photosynthesis to build up the plant's matter, by burning this biomass the carbon is given back to the atmosphere in a closed cycle. Therefore, as long as the annual used biomass is lower or equals the annual produced biomass, the carbon released by the combustion of biomass is part of the natural carbon cycle and does not increase the net concentration of greenhouse gases in the atmosphere.

Sometimes it is also argued, that the biomass in form of wood could remain in the forests and thus increases the carbon stock of the forests. This is the case for young, growing forests, which build up a wood stock and thus increase the carbon stored per hectare as long as the growth of the trees is bigger than their decay. Yet, it is not possible to increase the stock of wood indefinitely on a given area of land.

As soon as forests reach a mature stage, the annual uptake of CO_2 from the atmosphere and the annual release equals. Trees like all other plants are releasing CO_2 by breathing as long as they live. Finally they perish and then the carbon stored in the biomass is released to the atmosphere due to decomposition by micro-organisms. In forests not influenced by human activities the CO_2 uptake by

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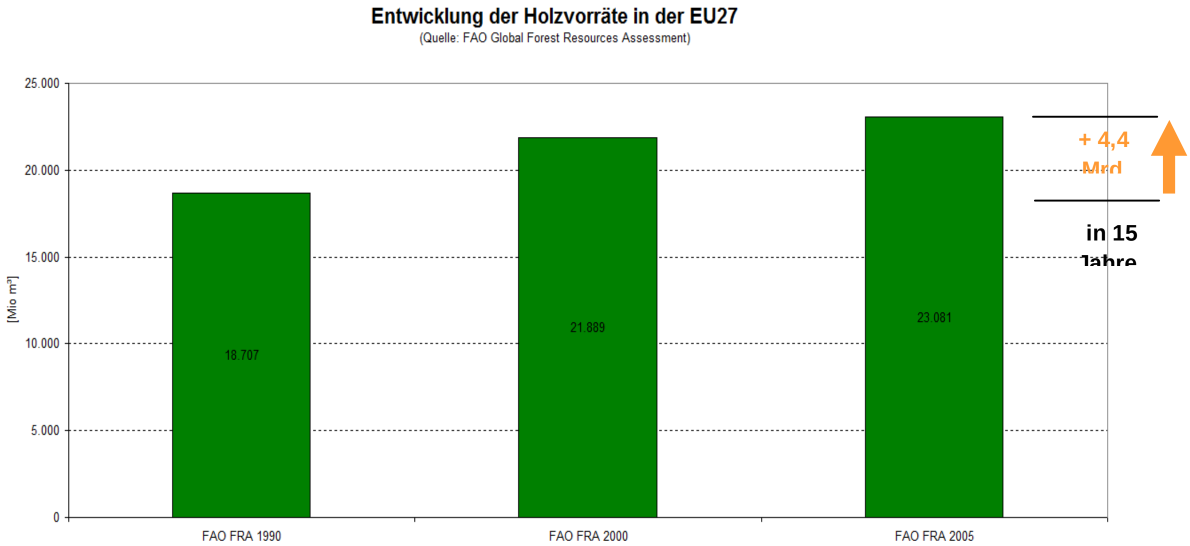
assimilation (photosynthesis) and the release by breathing and decay are in balance. Such forests are stable carbon stocks like the rain forests but are not additional carbon sinks.

The biggest contribution of biomass to the reduction of CO_2 emissions can be achieved if the forests are well and sustainably managed, storing up to 500 tons CO_2 equivalent per ha and producing a considerable quantity of biomass per year and this biomass is harvested and used to replace fossil fuels instead of leaving it in the forests and thus increasing the CO_2 release of the forests. Depending on the quality of the soil, the climate and the managing methods, the annual harvest of wood for energy in Europe can range between 200 up to 8000 litres oil equivalent per hectare and year. This wide range underlines the importance of a high quality forest management.

As a study of FAO demonstrates, the wood stock in the European forests is increasing. This is the result of a sustainable forest management in Europe.

Fig. 3: Wood stock in the European forests



Quelle: FAO – FRA 1995/2000/2005

Land use change

The change of land use can increase or decrease the carbon stock per unit land. In Europe the forest area is growing and, therefore, it can be assumed that in these young forests in the coming decades additional carbon will be stored until the forests allow balanced sustainable harvest. Such a harvest can be possible in the case of short rotation coppices only after a few years, and after a few decades in other new forest plantations.

The farmer or forest owner can influence the carbon stock of his land by his management methods. It makes sense to encourage the land operator via incentives to increase the carbon stock on his land, yet without limiting his market orientated production program.

Indirect land use effects are, however, not under the control of a producer. An individual producer cannot quantify which indirect effects might occur in a third country. Adding an additional financial burden on biofuels, the burden that individual producer cannot influence, does not improve the use of biofuels but supports the continued use of fossil fuels. The sustainable use of arable land and forests comes with an increased wealth and a functional legal administration within a country. By reducing poverty and investing in a sustainable way in developing countries deforestation and claims on undisturbed natural grasslands will be reduced significantly. The EU development aid should be directed to sustainable development of agriculture and bioenergy in the third world countries.

Considering all these issues AEBIOM is in favour of:

- a further increase of the area with trees in Europe by several million hectares – be it traditional forests or short rotation coppices,
- a sustainable forest management with the aim to increase the annual wood production per hectare,
- an increased use of wood for the wood industry and the energy supply to replace fossil fuels, and
- incentives to influence the carbon stock on the used agricultural land in a positive way.

10. Technological progress in the use of biomass and biogas

A strong support for research and demonstration activities is necessary to develop the potential of bioenergy for all sectors of the energy system.

AEBIOM sees as main areas for activities:

Production, feedstock:
Introduction of new energy crops to the farming communities by using incentives, new farming methods (several crops on one area, several harvests), improved collection and harvesting methods, new feedstock for pellets production, and improved technologies for the production of pellets in small decentralized and large scale units.

Heat, electricity:
CHP based on biomass, mainly wood chips and pellets, gasification, combustion with higher efficiency and lower particle emissions, combustion of agro-biomass, CHP technologies, pellets for heat and electricity in large scale units, improved district heating technologies.

Biogas:
Cleaning, upgrading, process management, new feed stocks, injection into the gas grids.

First and second generation fuels:
Improved efficiencies in biodiesel and ethanol, biomethane, second generation fuels, algae, bio-refineries.

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11. Future energy strategies: low carbon or increased RES

Different concepts are being discussed today concerns the best strategy to comply with the challenges of energy security and climate change. One strategy is in favour of a low carbon energy system based on a rapid additional deployment of nuclear energy and CCS. The alternative strategy favours to cease building new nuclear power stations, not to introduce commercial installations of CCS but instead a consequent and rapid deployment of all RES, increased energy saving and an improved energy efficiency. This second alternative makes it possible to reach more than 50% of RES in Europe by 2030 and an energy system completely based on RES by 2050. Biomass, by 2030, could contribute about 25% of the final energy consumption given the frame work conditions to foster the efficient and sustainable production and use of biomass.

AEBIOM is clearly in favour of a strategy towards a RES based energy system in the middle of this century and an accelerated effort to push all RES. The reduction of the support for CCS and nuclear power and fossil fuels could save big amounts of capital that should be directed towards RES!

12. Emission trading systems (ETS): European ambitions and global responsibility

The trading of rights for CO_2 emissions became in the last years a world wide accepted tool in the fight against global warming. Yet, sometimes it is neglected that this tool only targets CO_2 emissions and not the issue of security of energy supply. The concept deals, so to say, with the symptom of a problem and not with the origin of the problem. A strategy to reduce the use of fossil fuels and to replace them by renewables solves the problem at its roots and, therefore, improves the security of energy supply and reduces the $C0_2$ emissions.

A country A, for example, that continues its high utilization of fossil fuels and compensates the high CO_2 emissions by buying emission certificates for a couple of years is spending a big amount of money for buying these certificates but does not improve its security of energy supply.

Another country B, that introduces a CO_2 tax and replaces fossil fuels with RES improves its security of energy supply, creates new jobs, and as an additional effect reduces its CO_2 emissions. This country B does not need to buy emissions rights and saves public money. After a given period of time this country B will be much better off than country A in terms of employment, reduced $C0_2$ emissions, security of energy supply and saved public money.

The only permanent solution to the problem of greenhouse gas emissions is the replacement of fossil fuels in Europe and elsewhere and not the trading of hot air. The overemphasis of the trading schemes is the consequence of a wrong analysis in the sense that the origin of the emission problem and the endangered energy security is the same: the fossil energy system. A strategy that solves the problem at the root by steadily replacing the fossil energies is obviously better than a strategy that only addresses the symptoms of the problem, the emissions.

The main justification for the trading system is the financial support for developing countries. This support is necessary but, in the future, CO_2 reductions in other countries should not be counted as a CO_2 reduction in European countries. In addition, experience shows that carbon taxes have several advantages as compared to ETS system in reducing the emissions.

Therefore, AEBIOM is in favour to switch from the global emissions trading system towards a change of the energy system in Europe through a carbon tax. Europe should support CO_2 reducing investments outside its borders without counting these reductions as part of a European reduction.

13. Job creation and investment programmes until 2030

The accelerated change of the energy system towards RES not only concerns biomass but all RES. In many cases important synergies can be realized by combining different RES technologies at one place such as biomass, solar thermal and PV.

In order to present detailed figures on the impact of a change in the heating system on the labour market, specific data are presented for the proposed implementation of 55 Mtoe biomass within the heat market until 2020.

As already mentioned the assumptions are:

- Number of apartments/houses switched to biomass heating: 36 Mio units
- Cost /unit: 14.000 EUR, total cost 504 Bn EUR, Cost per year 50 Bn EUR.

Based on experience it is calculated, that one Million EUR for investment creates 11 jobs per year. This gives 55.000 jobs per year.

In addition to the jobs related to investments, additional jobs are being created by the production, supply and operation of the biomass heating systems. It can be calculated that per 1 Mtoe biomass 4100 jobs are created. Therefore, additional 225.000 permanent jobs are created to supply and operate the heating systems.

These figures concern the biomass heating sector only.

As it is shown in table 2, it is also proposed to use additional 30 Mtoe biomass for the electricity production; this would create another 120.000 jobs for the production and supply of the feedstock and operation of the plant.

Obviously, many more jobs would be created if the deployment of all Renewables and the thermal insulation would be accelerated.

The European funds, such as the regional funds or other programmes should partly be reoriented especially to support national programs for the change of the energy systems in the private sector, because this sector will play a key role in the building of a new sustainable energy system in Europe.

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14. Synergies between biomass and solar technologies in the winter period

Biomass is stored solar energy. This is one important advantage of biomass and offers many synergies with solar technologies. The fact is sometimes overlooked.

An example demonstrates better than many words the point:

An example:
Family house, central Europe, data measured between July 2009/June 2010.
Size 230 m², construction year 1982, heat demand per m² 80 kWh, 20 m² solar collectors, 32m² PV installation 4kwp.

Total heat demand in this 12 months period		*18.600 kWh.*
Hereof in winter (Nov – February):		*12.800kWh (69%)*
Rest of the year (March – Oct):		*5.800 kWh (31%)*
Production solar panel, heat total:	*7955kWh produced,*	*4985 kWh used.*
Hereof winter (Nov – Feb):		*820kWh (16%)*
Herof rest of the year(March – Oct)		*4165kWh (84%)*
PV Electricity total production:		*3910 kWh*
Hereof winter (Nov – Feb)		*510 kWh (13%)*
Rest of the year (Mar – Oct)		*3400kWh (87%)*

<u>Solar panels and pellets</u>
In the winter period the solar panels only cover 6,4% of the heat demand, whereas in the rest of the year they cover almost the total heat demand. In most parts of Europe the solar radiation is rather weak during winter, yet the heat demand is very high. The combination of a biomass heating system with solar panels is an elegant solution to this problem. The stored solar energy in biomass is used during the time with low solar radiation. In the rest of the year biomass can be saved and the heat demand covered by solar radiation. For millions existing houses with an average heat demand this combination brings true synergies and solves the problem of storage of solar energy in an elegant way.

<u>Heat pumps and biomass systems</u>
Heat pumps are well proven technologies to use the ambient energy available in the air, in the ground or the water. In average the energy output of a heat pump origins to 70 % from the ambient energy and to 30% from electricity. Therefore heat pumps can be seen as truly renewable energy systems, if also the electricity comes from renewable sources.

It is obvious that the demand for electricity to operate heat pumps goes up as the outside temperature is declining. This increasing demand for electricity during cold winter days should be reflected by higher prices of the electricity thus creating additional incentives to produce renewable electricity in wintertime. Yet, this peak demand for electricity on cold winter days can be avoided in an elegant way by the combination of additional biomass heating systems (tilt oven, pellets stoves) with heat pumps. Combining these two technologies make it possible to take advantage of the comfort of the heat pump and the solar energy stored in firewood or pellets.

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AEBIOM is, therefore, in favour of solutions that combine solar technologies with biomass to develop an efficient and cost competitive energy system.

15. Improved framework conditions for the development of biomass

As experience of different countries proves there are a few key measures to promote RES in general and bioenergy in particular, such as:

- A steadily increasing CO_2 tax on fossil fuels combined with a parallel increased taxation of electricity and exemptions for sectors facing gloal competition.
- A legislation on feed-in tariffs for electricity from RES, in the case of electricity from biomass and biogas clear incentives for the use of the excess heat should exist. As alternative green certificates with the same effect also proved successful in several countries.
- Financial support programs for the construction of new DH systems, for the installation of heating systems based on biomass, solar thermal in private houses and companies.
- A proactive policy for biogas, for the use of biofuels by a combination of tax reliefs, mandatory blending rules and clear rules for injecting biomethane in the gas grid.
- A combined program for agriculture and forestry to increase the production of biomass for energy.

16. The National Renewable Energy Actions Plans (NREAPs) as guideline for the bioenergy industry

On the 30 June 2010, all 27 member states of the European Union were supposed to submit their National Renewable Energy Action Plans (NREAP) to the Commission.

In these plans, based on the template published by the Commission one year ago, the member states have to explain in detail their sectoral targets for renewable electricity, heat and fuel and the measures they are going to implement to achieve these targets.

By 20th of September the national action plans of 20 countries have already been published on the website of the Commission, the data of those countries have been evaluated and compared in the field of biomass.

This analysis showed, that in several of these plans the data about the supply of biomass (table 7, 7a) and the data on the final production of electricity, heat and biofuels from biomass (table 10,11, 12) are not consistent. In general, it can be noticed, that much more solid biomass (wood) would be needed than presented to reach the defined sectoral production targets for final energy from biomass.

Therefore, AEBIOM proposes that in an interactive process between the Commission, the member states and the biomass associations these plans are further developed and improved, so that they become reliable and consistent guidelines for the bioenergy industry.

17. Summary and recommendations

AEBIOM analyses in this paper different issues concerning the future of biomass for energy and some aspects of the general energy policy in relation to renewables. As a result, AEBIOM makes the following conclusions:

- New targets for 2030: 300 Mtoe gross inland consumption of biomass.
- Improved programs to mobilize the production of biomass within agriculture and forestry in Europe, a new approach to sustainability and certification for solid biomass, in order to avoid the deforestation in countries outside of Europe that want to export solid biomass to Europe.
- A better policy in favour of the first generation biofuels coming from Europe.
- More emphasis on the issue of security of supply from biomass coming from Europe instead of following without limitations the global liberalisation of the markets.
- New financial support programs for the implementation of RES: it is proposed to create an annual budget of 10 Bn EUR to co-finance national programs that aim to change the heating systems in the residential and service sector from electricity or fossil fuels to biomass. This program could be increased to 20 Bn EUR if all other renewable heating technologies are included.
- A European carbon tax.
- A strong reduction of all public programmes for CCS.
- Research for new technologies in the production, conversion and final use of biomass (heat, electricity, biogas, biofuels).
- A concept against energy poverty by restructuring the heating system in the residential sector.

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