Conseil
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Sustainable Politics for the Use of Biomass

CSDD statement, 25th February 2008

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On 3 August 2007 the Minister for the environment requested a statement from the High Council for Sustainable Development (***Conseil supérieur pour le Développement durable,*** CSDD) on the topic of biomass production and utilization.

It was the opinion of the government that the following considerations should be a priority:

> The implementation of a sustainable development poses two key challenges for Luxembourg:
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> - To combat climate change and
> - To reduce dependency in the field of energy supply
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> In this context, the increased use of cultivation biomass from agriculture and forestry holds prospects as well as risks. On the one hand, the use of biomass for the production of electricity, heat and bio-fuels creates competition with the food production and, on the other hand, the perhaps more intensive cultivation of the arable lands and forest areas poses a threat to nature and the environment.

Definition of Biomass

In Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, the term 'biomass' is defined as "*the biologically degradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biologically degradable fraction of industrial and municipal waste*." Thus, biomass encompasses all food and raw materials from agriculture and forestry as well as their waste.

Going by this definition, the CSDD cast a critical look at the possible effects of the cultivation of biomass and its utilization in Luxembourg. In doing so, the European general conditions and the global connections between biomass cultivation and biodiversity as well as questions of global equity were taken into account.

In the opinion of the CSDD, the recommendations established thereupon ought to be incorporated into EU and Luxembourgish politics, in order for biomass utilization to contribute substantially to the two above mentioned challenges set by the government.

Structural Frame Conditions

Biomass is a limited resource. For its production 0.19 ha agricultural land are available worldwide per head of the world population. In Luxembourg the fraction is even higher with 0.25 ha available per inhabitant.

Half of Luxembourg's surface is used for agriculture (128.000 ha). A further third serves forestry (88.000 ha). With the exception of cereals, beef and milk, Luxembourg's agriculture

satisfies only a modest fraction of the food requirements of its soon to be 500.000 inhabitants. Overall, the degree of self-sufficiency is small.

Our present consumption of food, plant derived substances and other biomass necessitates double the amount of agricultural land currently available in Luxembourg. Notwithstanding this situation, the local agriculture, forestry and waste management's potential biomass contribution to the production of renewable energies was estimated at 5 to 7% of our overall future consumption (2020) (LUXRES). Thereby, 20% of the existing arable farm land as well as 25% of the forest surfaces (AEF), 20% of the manure slurry and dung accrual and 10% of the organic waste would serve to obtain the renewable raw materials to be converted into energy sources.

In Luxembourg, the necessary surface potential for the production of energy sources only ensues, however, if the surface expenditure for the production of food and plant derived substances is reduced.

A further national problem lies in the high energy consumption. The actual CO_2 emissions per capita amount to 30 t/a. The Kyoto reduction target prescribes a total maximum emission of 20 t/a per head for the time period 2008/12, whereas, worldwide, only 2 t/a are justifiable would one wish to stabilise climate change. With regard to these emissions Luxembourg rates first internationally. Sustainable development cannot be achieved without bold economy measures and substantial increases in the efficiency with which all raw materials and energy sources are acquired and utilized.

Not until these bold economy measures and increases in efficiency are fulfilled would it be sensible to use cultivation biomass for the generation of energy in Luxembourg.

Political Frame Conditions

The frame conditions for enhanced production of renewable energies by means of biomass are determined by the authority of international objectives and European laws:

- The **Kyoto protocol** as well as agreement 2002/358/EC of the Council of 25 April 2002 on burden sharing for the reduction of anthropogenic greenhouse gas emissions assign Luxembourg an emission reduction of 28% for the time period 2008-2012 (year of reference: 1990).
- The **commission proposal** of 23 January 2008 obligates Luxembourg to a CO_2 emissions reduction of 20% for the subsequent period to 2020 (year of reference: 2005).
- EU Directive 2001/77/EC on the promotion of **electricity production** from renewable energy sources in the internal electricity market prescribes a share of renewable electricity of 5.7% of the gross electricity consumption by the year 2010.
- The commission's above mentioned energy and climate package of 23 January 2008 sets the EU a binding objective of a 20% share of renewable energies of the final energy consumption for the year 2020. For Luxembourg, the proposal intends a mandatory 11% share of renewable energies. The creation of an EU market for 'renewable certificates' should permit member states to resort to the potential of other member states.
- Directive 2003/30/EC on the promotion of the use of biological motor fuels and other liquid bio-fuels obligates the countries to supply a minimum share of 5.75% of bio-fuels until 31 December 2010. According to a recent commission proposal, bio-fuels

should cover at least 10% of the consumption by 2010, on the condition that this respects "*the criteria for ecological sustainability*".

The challenge for Luxembourg consists in meeting the increasing demand for renewable raw materials using the existing silvicultural and agricultural land. The EU guidelines for the increased utilization of biomass are inevitably going to lead to an amplified global surface exploitation. The areas available for agricultural and silvicultural use are limited worldwide and several types of use which are vital for mankind (food production, protection of the environment, exploitation of natural resources, and generation of energy) start competing with one another. Moreover, the energy potential from waste exploitation is currently not being used extensively.

Not least because of the expected important expansion in cultivation biomass, the CSDD demands compliance with the following recommendations for the political strategies in this field.

Recommendations

1. **Adapting land use to global bio-capacity**

Political strategies in the field of biomass must not limit themselves to the needs of Luxembourg or those of the European Union. The planet's global bio-capacity must not be surpassed. The people's needs and rights in relation to food production, the preservation of biodiversity and the production of energy and raw materials must be harmonized.

The same rights of utilization apply to all people.

2. **No sustainable resource utilization without consumption reduction**

No matter how efficiently biomass is produced and used, to substitute it for fossil energy will only have a limited positive effect on the environment. Through the global expansion of agricultural land, possibly to the detriment of natural areas, this will lead to an increased global surface exploitation.

Therefore, the development of renewable energies must not be a pretext to defer energy economy measures and measures for the improvement of energy efficiency. The promotion of renewable energies must be accompanied by target directed energy saving programmes on all levels and in all areas.

3. **Optimizing material and energy flows**

The resource consumption caused by human activity must not surpass the production rate of renewable sources of raw materials and energy. Likewise, the rate of toxic emissions must not exceed the environment's capacity to absorb these toxins. Material and energy flows (wood or thermal discharge, for instance) are to be embraced specifically and must be exploited in an optimal way to prevent unnecessary losses as well as to avoid costs and damages to the environment in connection therewith. As a tool for early diagnosis, the compilation of substance and energy balances allows, for instance, the recording and the dispersing of the substance variations relevant to a region.

The registration and the evaluation of all material and energy flows should be implemented across all industries. In order to close material cycles, organic and mineral waste from any

type of biomass utilization are to be restored to the agricultural land in an environmentally friendly way.

The development of sectorial waste management plans ("*Plans sectoriels de gestions des déchets"*) should be seized as an opportunity to iron out administrative impediments to the peripheral recycling of biodegradable waste.

4. Sustainable agriculture

Agriculture must be redirected towards sustainability on an exhaustive scale, that is worldwide. Only when it is sustainable does agriculture present a significant potential - which goes beyond the production of biomass for energy purposes - to reduce greenhouse gas emissions as well as to reduce the consumption of energy and of raw materials. Above all, this entails a minimal use of production means (fertilizer, pesticides and fossil energy) as well as the preservation of soil fertility (optimized humus content, low intensity cultivation).

In accordance with the material flow optimizations cited at point 3, all agricultural, silvicultural, horticultural, viticultural and fruit-growing enterprises should establish balances for nutrients, energy, humus, biocides, medication, water consumption, greenhouse gas emissions, and agro-diversity.

Furthermore, the food production from and with ruminants must primarily be based on the use of permanent pastureland. Unlike arable crops such as maize, grains and soya, pastures and meadows do not compete for land with the vegetal food production. For the production of poultry and pork, the feeding of meat and bone meal from healthy slaughter animals has to be made possible again. Acreage which could provide food immediately accessible to human beings but which is instead used for fodder and renewable raw materials should be reduced. Throughout, dung and manure slurry should be fed into the production of biogas.

Thus, the regulatory statutes for the new agrarian legislation which are pending approval should be based on the sustainability criteria listed here above. The guidelines for subsidies in the domain of agriculture and the environment in particular must conform to these criteria.

5. Rethinking nutrition

At present, Luxembourg requires approximately double its surface area of agricultural land to feed its population. This is caused mainly by the intense consumption of animal products. Only a re-evaluation of our diets would, on a global level, free the necessary agricultural land for the sustainable production of raw materials and energy from biomass.

As well as addressing healthier diets, public nutritional awareness campaigns should broach the issue of sustainable food production and promote the restriction of surface-intense animal production.

However, this does not mean that the consumption of meat must be banned altogether. The consumption of beef as a by-product of a predominantly pastureland based milk production may be sensible and is, from a nutritional point of view, more valuable than beef obtained through feed based on maize, soybeans and cereals.

6. Preserving biodiversity

In the face of all our requirements, the worldwide protection of primary ecosystems such as primary forests and swamplands must not be ignored nor attenuated. Therefore, the direct or

indirect conversion of primary ecosystems into agricultural land - a process that is heightened by the production of biomass (including fodder) - must not occur.

The conversion of pristine forests into wood plantations of fast growing, generally habitat extrinsic tree species like eucalyptus or spruce, must be stopped. In Luxembourg, permanent pastureland must be preserved according to statutory EU-demands. Biomass cultivation for the generation of energy should promote biodiversity. Therefore, criteria must be introduced for the spreading of plants and species, for rotational diversity and cultural diversity as well as criteria for the elimination of pesticides and artificial fertilizer to the greatest possible extent. Conservation and agriculture must work together constructively. 'Cross-compliance' regulations are to be adjusted more purposefully, for example.

7. Biomass without genetic engineering

The necessary increases in efficiency in the production of food *and* of renewable raw materials are only possible through cultivation synergies, culture rotations and a continuous cascade use, of the by-products as well. It is just as indispensable to return the biomass waste from the diverse levels of use to the material flow. All this does not allow for different admission requirements for the same plant variety depending on the intended purpose.

As the risks arising from the use of genetically modified plants are still not being controlled and as the access to cultivation biomass increases these risks, the use of GMOs for the cultivation of biomass must not be an option, regardless of the purpose.

8. Respecting food sovereignty

The cultivation of biomass for energy purposes conflicts with the internationally recognised right to an appropriate and sufficient alimentation (UN-Civil Rights package 1966). The use of bio-energy must not lead to an international deterioration of the food situation. Furthermore, the promotion of biomass cultivation must not question food sovereignty, meaning every nation's right to develop independent agricultural and nutrition policies that factor in natural conditions as well as particularities in the culture and production techniques.

Concretely, food sovereignty encompasses for instance:

- the local farmers' prerogative to contribute to the feeding of the population;
- adequate access to production means such as water, land, seeds, and credit;
- the country's right to protect itself against cut-price imports in the domains of both food and bio-energy;
- cost covering prices for agricultural products from sustainable productions;
- production limitations to avoid structural surpluses;
- the population's participation in the decisions regarding food sovereignty.

The cultivation and import of bio-energy carriers must on no account threaten a country's food sovereignty. Therefore, Luxembourg should only import biomass for energy purposes when food sovereignty is respected by a certification of these imports.

9. Avoiding land conflicts

On an international level, the use of bio-energy must not lead to a further concentration of land and income, or to the exploitation of the rural population.

The global development of the production of biomass for energy purposes and the international trade that accompanies it will increase the pressure on marginalized rural

population groups. Additionally, bio-energy production holds the danger that agrarian structures become even more concentrated and that only a few people will participate in the accumulated wealth.

To avoid land and water conflicts, the cultivation of renewable raw materials should primarily take place on agricultural land that has low productivity. Only in this case are support measures for energy crops permissible.

10. Privileging cascade use

Cultivation biomass presents an inefficient form of stored solar energy as only a small part of the radiated energy is actually used. The recycling and the following energetic utilization of biomass should if possible be preferred over a direct energetic utilization.

11. Promoting regional material cycles instead of imports

All available potentialities of the local power supply, the amelioration in efficiency and the economies in energy should be exploited first. The import and/or export of biomass should be secondary, to compensate for regional deficits. Certification is to be mandatory for the international trade. The elimination of custom duties and non-tariff barriers in the domain of biomass must not occur. It is unthinkable to separate regulations for agricultural products as bio-energy carriers from the regulations for food products.

In terms of sufficiency, material cycles should be closed regionally. The production and the usage of substances from waste flows (such as manure slurry, dung, sludge, compost) should preferably take place within a region. Only then does the scarce resource biomass make a substantial contribution to the efficient exploitation of materials.

12. Promoting local development through certified trade

The international trade in biomass requires certification schemes which are based on quantifiable and qualifiable criteria and which are traceable and verifiable at any given time. They need to create frame conditions that will lead to sustainable development in the cultivation countries, too. The certification criteria must be specified in a participative process of the parties concerned and the persons affected locally. Some of the criteria that need to be considered for such a certification scheme are for example: positive energy balances, sustainable agriculture, biodiversity, characteristics of the cultivation area, the distribution of added value, job balances, social repercussions.

To prevent the fragmentation of the world market, these certification criteria must be globalised. For Luxembourg, this entails that the substantial recourse to biomass imports for energy purposes (for example bio-ethanol from Brazil) should be eliminated as long as these criteria are not formulated and are not being applied worldwide. The Luxembourgish government should promote the establishment of these criteria on an international and EU level.

13. Energy balances must be positive

Only those production chains which harness at least half the gross energy contained in the initial product are sustainable and are to be encouraged specifically. Medium-term, higher overall efficiency is to be demanded.
Balances must be drawn up for biomass cultivation, conversion and usage in their entirety – and Luxembourg's support instruments must be adjusted adequately.

14. Bio-fuels are not worth supporting

The above mentioned EU commission's proposal of 23 January 2008 intends that by 2020, 10% of all fuels in the transport sector must originate from biomass. Even by taking into consideration second generation bio-fuels this decision is not sustainable under the deliberations listed here above (high demand for land, intensive production, socio-economical repercussions, poor potential to lower CO_2, poor energy efficiency, ...). Recent studies of the US Nature Conservancy and the US German Marshall Fund estimate that, depending on the initial materials (sugar cane, maize, cereals), the conversion of the rainforests, the swamplands, the savannahs, and the green areas of Brazil, South-East Asia and the USA, causes carbon dioxide emissions several times higher than those recovered by the use of bio-ethanol.

Furthermore, the European directive on bio-fuels does significant economic harm. The promotion measures and the tax relief for the market entry of bio-fuels devour more public funds than are retrieved through the counter value of the CO_2 reduction potential.

The Luxembourgish government should not support the proposal of 23 January 2008 which intends the obligation of a minimum bio-fuel share of 10% of the consumption and should push for the revocation of this obligation.
In regard to traffic, fossil fuels are presently to be preferred over bio-fuels because of their substantially lower energy expenses in terms of extraction, manufacturing and distribution (approx. 15% losses). At the same time the volume of traffic must see a significant reduction while the number of miles per gallon achieved must increase significantly.

15. CO_2 reduction targets on all fuels and all means of transportation

Considering that all energy carriers must be used in the most efficient way possible, it is necessary to treat all green house gas emissions equally, in particular those deriving from transportation facilities (including navigation and aviation).

The Luxembourgish government needs instruments to internalise all socio-economic and ecological costs relating to and following from the production, the use and the disposal of *all* fuels. To achieve the most efficient CO_2 reduction for everyday transport and traffic, the government should stimulate measures such as surcharges or discounts, taxes, quotas and trade certificates (ETS) for *all* fuels on a European level.

16. Raising public awareness through individual CO_2-balances on all consumer goods

In a globally just world, every citizen holds the same rights and duties. This includes the entitlement and access to (natural) resources that are qualitatively and quantitatively the same. The awareness necessary for CO_2-conscious living and acting presupposes the knowledge of all of one's own, directly and indirectly induced emissions. Only then can everyone decide for themselves how to structure their requirements in terms of food, living, mobility, clothes and leisure in the best possible way in order to reach the maximal annual emission of 2 t CO_2 that appertains to every human being.

Individual CO_2-balancing must become mandatory for every single consumer item.

17. Sustainability requires control

The proposal of 23 January 2008 offers Luxembourg an important opportunity to structure the production and utilization of biomass sustainably. To this end we need appropriate instruments of control.

The following should be some essential elements of Luxembourg's plan of action for the promotion and use of biomass:

- Quantified targets and indicators,
- Definition of dates and report time periods,
- Project controlling,
- Creating balances of saved green house gas emissions as standard for energy productivity targets,
- Creating balances of the environmental repercussions of energy carriers and process chains based on ecological assessment observations (method of life cycle assessment),
- Investment in research programmes contributing to the development of the overall efficiency of the energy carrier biomass as well as the necessary instruments for its rating and controlling,
- A certification system based on the criteria listed below point 12 for imported biomass and its products, respectively.

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Appendix I:

Biomass and Carbon Cycle

Since the ***Intergovernmental Panel on Climate Change's*** (IPCC) latest report on the situation, climate change has become one of the most heeded topics of environmental policies. The central premise of effective climate protection is a significant reduction of green house gas emissions. Next to the increase in energy efficiency or the dismantling of high-consumption of consumer goods, this can also be achieved by substituting so-called renewable raw materials and energy carriers for fossil raw materials. Generally, a substantial potential (up to two thirds) is attributed to the employment of biomass.

This allegedly high potential for the averting of climate relevant gas emissions is only guaranteed if the frame conditions for the cultivation and the use of biomass plants adequately respect the relevant professional agricultural and environmental boundaries. The advantages held by the utilization of biomass as carrier of energy and raw materials are restricted by land availability and the compliance with elementary biological cycles.

Relevant to the climate discussion is **Carbon Dioxide** (CO_2), an important element in the cycles of both organic and inorganic substances. It originates from combustion and decomposition in the air or the fermentation of biomass of any type and origin under exclusion of air: during the respiration of human beings, animals and plants, in the internal combustion engines in cars, during the heating with and conversion to electricity of wood, oil, coal, and natural gas.

Also relevant to climate are **Methane** (CH_4), a gas emitted by bacteria during the digestion of organic matter under anaerobic conditions, as is the case in the rumen of ruminants, in rice fields, or in fens and marshes, as well as **Nitrous Oxide** (N_2O), which accrues in the soil through the conversion (mineralization) of nitrogen fertiliser. The climate effect of methane is 21 times higher, that of nitrous oxide 310 times higher than that of carbon dioxide. These three gases are summed up accordingly and their impact is expressed in **CO_2-equivalents**.

Plants are able to split carbon dioxide. The chlorophyll contained in plants metabolizes nutrients from humus (N, P, K,...) and water (H_2O), as well as atmospheric nitrogen (N_2) and the atmospheric carbon dioxide into vegetal biomass (= living matter) by means of – according to human discretion – infinite solar energy. The atoms carbon (C) and hydrogen (H) stemming from carbon dioxide and water constitute the framework of all living matter: the so-called hydrocarbon chains (CH-CH-CH-...-CH). Plants develop and grow and also produce the oxygen (O_2) so essential to the entire wildlife, flora and us humans. Thus, in a sense, plants convert solar energy into biomass. When it comes down to it, **they embody converted solar energy.** This process of photosynthesis (assimilation) is a kind of **perpetuum mobile**. It forms the basis of our life.

As a result, coal, crude oil, and natural gas also form stored solar energy. The only difference is that, unlike the utilization of biomass, their present, massif combustion does not occur almost simultaneously with their formation.

The active as well as the passive utilization of biomass consist in a more or less direct reverse of its formative process: directly - during humus reduction through the decomposition of dead plants

and floral remains, or – indirectly – through ingestion by herbivores and, further along the food chain, ingestion by carnivores and their excrements or even through the combustion of straw and wood, for example. In this process, the original, elementary nutrients, the carbon dioxide as well as the previously bound solar energy are released again to a large extent.

Energy and CO_2 reduction potential from biomass

The production of biomass for the purpose of energy and raw materials is only sensible when the population is provided for with food from Luxembourg's agriculture or, as the case may be, from an equal surface it is entitled to in exchange for other products to the greatest possible extent. Otherwise the increased production of biomass taking place in these parts, which is specifically intended for the purpose of energy and raw materials, will additionally promote the import of food and animal fodder. This is of no avail to the climate.

Through photosynthesis the plant cultivation presently taking place on Luxembourg's 128.000 ha of arable farm land binds a gross energy of roughly 5.230 GWh und 2 million tons of CO_2 a year. Additionally, 0.9 million tons of oxygen are emitted. Roughly a third of this gross energy is used up by agricultural production including the imports of production means. This expenditure of resources and energy is substantially smaller for pastureland. For field cultures like rapeseed and particularly maize, the necessary cultivation effort can consume up to half the gross energy produced from the field.

The harvesting, transport, storage and the conversion of the total biomass accrual yet again devour precious energy. In the fermentation process this is about 20%, during gasification roughly 30% and during combustion for unilateral heat extraction approximately 40% of the energy contained in the initial product. During the subsequent utilization of the solid, liquid and/or gaseous energy carriers, further substantial losses become manifest. The lowest losses occur during the combustion of solids like firewood and straw in Combined Heat and Power Units (15%). The highest losses (an average of 85%) occur during the combustion of so-called bio-fuels.

The well-to-wheel-efficiency of bio-fuels rarely amounts to more than 2% of the gross energy (say converted solar energy) contained in the harvested plants. So-called 2nd generation bio-fuels do not fundamentally change this extremely weak overall efficiency. The apparently enhanced efficiency of 2nd generation bio-fuels results from the generally wrong evaluation of the conversion efficiency of 1st generation bio-fuels – by omitting the energy potentials of their residues and by-products such as oil cakes, bran, slurry, marc, ... 2nd generation bio-fuels increasingly use lingo-cellulose present in biomass and indigestible to human beings and through unilateral utilization result in a higher surface efficiency for bio-fuels but only a limited higher overall efficiency.

If we determine the losses during production, harvest, transport and storage to average at 33% and calculate an additional average of 33% losses for the conversion of raw biomass into solid, liquid or gaseous energy carriers, **then Luxembourg's theoretical maximum of available useful energy from agricultural biomass amounts to 2.300 GWh/a** (5.230 GWh/a – 33% - 33%). **Viewed accordingly, forestry can provide a further output of about 1.500 GWh/a.** If we were to use today's overall agricultural and silvicultural yields exclusively for the generation of power, we could cover about 15% of our local final energy consumption (without fuel tourism) according to our own calculations.

Hence, all social and economic activities, at home, at work, in industries, for transport, and for leisure must consume no more available carbon (fossil or regenerative) and release it in form of carbon dioxide, methane and nitrous oxide than can be processed by plants. Thus alone may the

atmospheric CO_2-content be stabilized. This constitutes the necessary starting point for sustainable development. It is called a ***Low*** or even ***Zero Carbon Economy.***

The CSDD biomass statement aims in this direction.

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Appendix II:

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