

# The Availability of Biomass Resources for Energy

## Summary and Conclusions from the IEA Bioenergy ExCo58 Workshop

This publication provides the summary and conclusions from the workshop on 'Availability of Biomass Resources – The Likely Impact of Certification and Sustainability Criteria, and of the Kyoto and post-Kyoto Frameworks' held in conjunction with the meeting of the Executive Committee of IEA Bioenergy in Stockholm, Sweden, on 4 October 2006.

The purpose of the workshop was to inform the Committee about the likely impact of the development of certification and sustainability criteria and the impact of land-use related provisions in the Kyoto and Post-Kyoto Frameworks on the use of biomass for energy. This should allow the Committee to consider the implications for work within the Agreement, and the potential for the further development of bioenergy in both the short and long term.



## BACKGROUND

Biomass is already a major contributor to world energy needs, and there is scope for expanding this contribution in both developed and developing countries. However, the availability of additional biomass for energy purposes is a topical and controversial issue, particularly exemplified by the 'fuel versus food' debate.

Increase in bioenergy production and use is principally motivated by national and international efforts to reduce CO<sub>2</sub> and other emissions, but could also have beneficial impacts on fuel security and on balance of trade issues associated with imports of increasingly expensive fossil fuels. Unlike other renewable energy sources, the production and use of bioenergy is relatively labour-intensive and so potentially can play a positive role in maintaining and developing the rural economy. The use of agricultural and forestry by-products can provide additional income streams that can help the economy of these basic industries.

On the other hand, increasing use of biomass for energy purposes is likely to impact on land use and so has implications for a whole range of sustainable development issues including social development, and environmental impacts associated with land use change. The situation is further complicated because significant growth in biomass use is likely to depend on development of a substantial international trade in biomass raw material. The future will also be influenced by international climate change policy and mechanisms. But further development of bioenergy on a significant international scale is not just a matter of energy policy and economics; it also requires a more complex consideration of agricultural and forestry policy. Careful consideration of environmental and social welfare issues is also essential to ensure that a sustainable approach is developed.



Denmark – Avedøre 2's straw boiler burns 1200 bales per day. Courtesy Thomas Scott Lund, Energi E2, Denmark.



Sweden – Magnus Jansson, Lantmännen Agroenergi (left), and Bjorn Telenius discussing short rotation willow production. Courtesy S. Schuck, Australia.

The issues referred to above are already being considered in a number of Tasks within the Bioenergy Agreement, and particularly:

- Task 29 – Socio-economic Drivers in Implementing Bioenergy Projects
- Task 30 – Short Rotation Crops for Bioenergy Systems
- Task 31 – Biomass Production for Energy from Sustainable Forestry
- Task 38 – Greenhouse Balances of Biomass and Bioenergy Systems,
- Task 40 – Sustainable International Bioenergy Trade: Securing Supply and Demand

The Executive Committee has also commissioned a Strategic Paper titled 'Potential Contribution of Bioenergy to the World's Future Energy Demand' for which André Faaij, Associate Professor at the Copernicus Institute for Sustainable Development of the Utrecht University, the Netherlands, and Leader of Task 40, was the lead author.

The workshop agenda was developed to provide an opportunity to consider some of these complex interactions and to illuminate some of the key issues by considering the following topics:

- Implications of Land Use, Land Use Change and Forestry Provisions under the Kyoto Protocol
- Bioenergy in the Kyoto Protocol and the EU Emissions Trading Scheme
- Criteria for Sustainable Biomass Production
- A Market View of the Potential for Bioenergy Utilisation
- Estimates of Biomass Availability in Europe and Globally



Brazil – Harvesting sugar cane. Courtesy J.G. Darcie, Zillo Lorenzetti, Brazil

## PRESENTATIONS

The workshop consisted of eight presentations from invited speakers, mostly working outside the IEA Bioenergy Agreement. The main points made by the speakers are summarised below.

### **Presentation 1: 'The Role of LULUCF in the Kyoto Protocol, in Countries' Mitigation Efforts, and in Post-2012 Climate Policy' by Hans Nilsagard, Ministry of Industry, Division for Sustainable Development and Primary Industries, Sweden.**

Hans Nilsagard discussed how land use change and forest management are considered under the Land Use, Land Use Change, and Forestry (LULUCF) provisions under the Kyoto Agreement. Article 3.3 of the Kyoto Protocol deals with Reforestation, Afforestation and Deforestation (RAD), and places mandatory reporting requirements on changes in land use. Article 3.4 provides for voluntary reporting on forest management activities, crop- and grazing-land management, and revegetation.

Forest management is reported in terms of annual changes in relation to each country's negotiated cap. This has resulted in a range of situations in different countries, who, depending on the nature of their forests and indigenous social and economic factors, have decided whether to report on emissions or not. Reporting can have different potential consequences. Canada, for instance, is a high-risk country because of large stochastic events in their boreal forests. Sweden and Finland have similar forest types and conditions, but Sweden has included forest management reporting in the Protocol, whereas Finland has not.

Harvested wood products are included in order to incentivise the maintenance of carbon stocks in wood products, so reducing emissions. Reporting on the impact of Harvested Wood Products will not be required until the second commitment period (i.e., from 2012) although some reporting is already done on a voluntary basis under the UN-Framework Convention on Climate Change. Guidelines for reporting are currently under development.

Afforestation and reforestation are, in principle, permitted ways of reducing emissions under the Clean Development Mechanism (CDM). However, progress in developing guidelines and methods has been slow as this is a technically difficult process which can lead to high administrative costs. Currently the guidelines are under negotiation but little progress is expected before 2010. At present, afforestation and reforestation appear financially unattractive compared to other CDM projects. This is particularly because it is likely that projects would only receive an income when the emission reductions were happening. It is unlikely that there will be potential for financing at the time of planting, when the investment needs to be made.

Reducing emissions by avoiding deforestation is of particular interest in developing countries, who could expect financial and technical assistance. This is not at present part of the Kyoto Protocol because of technical difficulties in determining methods to assess emissions. The 'Rainforest

Alliance' is looking for subsidies to maintain forested lands, but this could lead to further market distortions.

It is evident that the economic instruments being introduced are already having a significant national effect; e.g., high carbon taxes in Sweden have led to increased use of biofuels with a consequent increase in fibre prices. Looking forward to the Post-Kyoto period after 2012, some parts of the forest industry will benefit while others will not. For example some sectors will be badly affected by higher electricity and transport costs and by competition for feedstock with bioenergy producers. Others will benefit from higher demand for secondary products which can be used for energy production. Policies and incentives which encourage maintenance of the forest carbon sink may have an impact on forest industry raw material supply.

### Harvested Wood Products

- Rational: to introduce incentive to maintain carbon stock in wood products, thereby reducing emissions
- Reporting within the Convention reporting voluntary
- Accounting of Harvested Wood Products will not be included in national commitments until after 2012
- Alternative reporting methodologies included in IPCC 2006 Guidelines
- Common accounting principle still to be agreed, will affect the numerical value of future national commitments
- Different approaches to account for national carbon stock:
  - Stock-change approach, the carbon credit and the liability stays with the importing country when products are exported
  - Production approach, the carbon credit and the liability to the exporting country with the product
  - Atmosphere flow approach, the carbon credit stays in the exporting country - the liability to the importing country with the product
- May cause different type of trade distortions,
- The issue of biofuel needs to be especially addressed in this context



PowerPoint slide from Presentation 1. Source: H. Nilsagard.

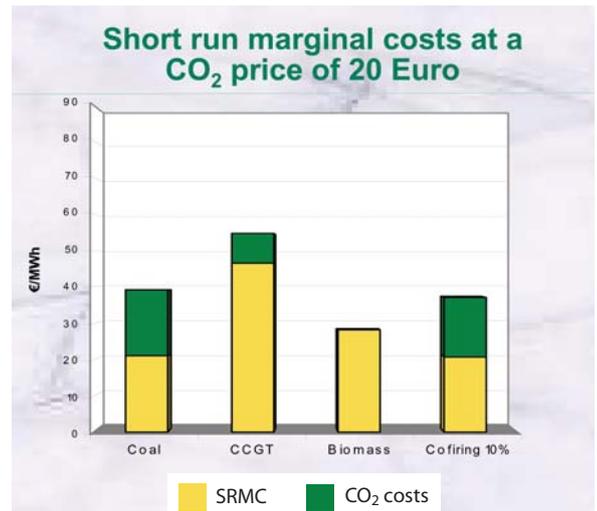


Finland - Roadside chipping of forest residues. Courtesy P. Hakkila, Finland

**Presentation 2: 'The Role of Bioenergy in the Kyoto Protocol, in the EU-ETS and in Future Climate Agreements' by Andreas Türk, Joanneum Research, Austria.**

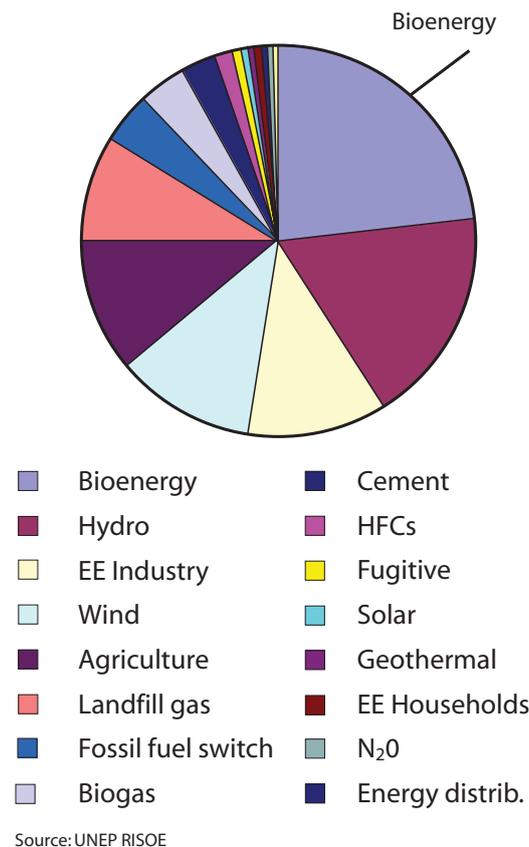
Andreas Türk discussed how the development of bioenergy was being influenced by the Kyoto protocol and the EU Emission Trading Scheme (EU-ETS) and considered the role it may play in future climate change agreements.

The increasing use of bioenergy is stimulated by rural development, energy security, employment and, of course, by the provisions of the Kyoto Protocol. Bioenergy projects – including those that involve the use of landfill gas, biogas, and biomass to produce heat and power – are currently providing a significant share of the 334 registered CDM projects. However, there is a current trend towards large industrial-scale projects which are saving other more potent greenhouse gases such as N<sub>2</sub>O, CH<sub>4</sub> and HFC<sub>23</sub>. Bioenergy projects are less competitive than these options and there is a risk that bioenergy projects will be 'crowded out' by these projects, at least in the short-term.



PowerPoint Slide from Presentation 2. Source: A. Türk.

**Bioenergy projects are the most popular among the registered projects**



PowerPoint Slide from Presentation 2. Source: A. Türk.

Emission trading arrangements in the European Union now cover nearly half of CO<sub>2</sub> emissions, leading to a market in permits which can be traded by the 12,000 large industrial

plants who are involved. The scheme sets limits on the emissions from these large users and, by allowing companies to buy and sell permits to release CO<sub>2</sub> ('allowances'), leads to the cheapest means of reducing emissions. This system increases the competitiveness of low carbon fuels, such as biomass which is more or less carbon-neutral. The aim is to effect reductions where the cost is least, and to encourage measures to switch to low-CO<sub>2</sub> fuel and climate friendly technologies. There is a large potential to increase the use of biomass in generating energy. Biomass used as a fuel for co-firing is competitive at a CO<sub>2</sub> price of €20, but new electricity producing plants which use biomass alone are not competitive at these prices and additional incentives will be required to stimulate investment.

The pilot phase of EU-ETS has shown a number of areas needing improvement. These include allocation methods, national emission caps, and methods to assess reductions and LCA analyses. Another shortcoming of the EU-ETS is that the system applies to large-scale projects above 20 MW only. Other incentives are needed for smaller facilities. Furthermore, the transport sector, with its high biofuel potential, is currently excluded from the scheme. However, the system has been successful in that over half the companies began to investigate the potential to reduce their own emissions.

For the Post-Kyoto commitment period, it is expected that similar systems will be able to interact with an increasing carbon market in Asia-Pacific and the USA. Common standards will be required if trading between the different schemes is to happen and if an open market is to be developed. Presently, different projections of biomass production and price give wildly divergent outcomes, an indication that the methodologies need substantial improvement.

There is currently a strong focus on agricultural offsets and on sequestration of carbon through afforestation. Concerns are being raised that increasing the use of biomass may lead to the depletion of carbon stocks, and that increased biomass use may not be biologically sustainable. A certification system could ensure this problem was avoided.

**Presentation 3: 'Criteria and Indicators for Sustainable Production of Forest Biomass for Energy - Forest Legislation, Forest Certification Standards, and Recommendations and Guidelines for Forest Fuel Extraction and Wood Ash Recycling' by Inge S. Moller, Forest and Landscape, Denmark.**

Inge Moller noted that while forest biomass is generally accepted as a potential source of renewable energy, it is important that its utilisation is in line with the principles of sustainable development, particularly as far as environmental, ecological, economic and social criteria are concerned. One main cause of concern has been the removal of nutrients with harvested fuel, and the subsequent consequences for soil fertility, soil and water acidification, and productivity. Another is the impact of reducing volumes of dead wood on biodiversity. Wood ash recycling has been suggested as one way of mitigating the potential for decreased soil fertility and acidification, but there are concerns over ash reactivity and the content of heavy metals and other eco-toxic components with subsequent consequences for soil pH, biodiversity, and quality of water, mushrooms and berries.

Recommendations and guidelines for forest fuel extraction and wood ash recycling naturally vary between countries according to the kind of forests and conditions faced by the specific country. There is as yet no consistent approach to the regulation of forest fuel extraction or wood ash recycling in either national or international standards. For example, the Swedish Forest Act includes advice on the preservation of the nutrient balance, wood ash recycling and nitrogen fertilisation, whereas in the Baltic countries, the forestry acts regulate fertilisation, but with no explicit reference to wood ash as fertiliser. According to the standard from Austria and Luxembourg, removal of residues should be avoided. In Sweden the opposite applies since the removal of small-size logging residues is encouraged.



*Extracting stumps for bioenergy. Courtesy I.S. Moller, Denmark.*

As far as biodiversity is concerned, the regulations call for the preservation of important elements – such as nature conservation areas, certain tree species, old trees, standing and fallen dead wood at different stages of decay and of varying dimensions, birds' nests, ant hills, etc. Less emphasis is given to issues such as soil organic matter for ecosystem functioning and carbon storage, probably because there is a lack of knowledge on these topics.

There is a trade-off between the measures needed for forest protection and the benefits to be derived from using the materials as fuel. Unnecessarily tight restrictions may restrict the availability of biomass for energy or inhibit recycling of wood ash directly or indirectly through increased measures which increase production costs. For example, a Danish wood ash regulation inhibits wood ash recycling by restricting the allowable dosages and by requiring fencing and signs which warn that mushrooms and berries should not be collected – all of which push up costs.



*Wood ash recycling. Courtesy I.S. Moller, Denmark.*

The criteria, indicators and thresholds in specific recommendations and guidelines are best developed with direct stakeholder involvement. In Sweden, the process of developing national recommendations has already gone through a number of iterations, and in Finland, an update of newly published recommendations is already planned. Work in these pioneering countries has created an environment which allows an increased use of forest biomass for energy with due regard to forest protection.

Further improvements leading to sustainable utilisation of forest biomass for energy should be possible through education and dissemination of information, mapping, local consultation, development of relevant standards to diminish transaction costs, technological and methodological developments, research, preparation of recommendations and guidelines, a clearly articulated forest-energy policy, and possibly legislative measures.

**Presentation 4: ‘Criteria for Sustainable Biomass Production in the Netherlands’ by Jacqueline Cramer, Energy Transition Task Force, Netherlands.**

Jacqueline Cramer’s paper was presented by Kees Kwant, who explained that biomass has significant potential as a source of renewable energy, with a multiplicity of potential uses in power generation, transport applications and as a chemical feedstock. It also could pose a number of risks to the environment and nature with associated negative social consequences for local communities. These impacts could be exacerbated as international trade in bioenergy commodities increases. The Netherlands is already a large-scale importer of biomass for power generation, and environmental groups have already expressed concern about the sustainability of this trade and in particular about the import of palm oil from Malaysia and of bioethanol from Brazil. It was therefore decided that sustainability criteria should be developed and eventually embodied in national legislation.

A project group was established to develop these criteria, taking into account a long-term vision for sustainable biomass production. They worked with a range of stakeholders to come up with testable criteria which can be used in policy instruments and in developing financial support mechanisms for biofuels and power production. The aim was to produce a generic set of criteria which were consistent with international initiatives and WTO regulations and which were valid for residues and cultivated biomass and did not distinguish between biomass produced in the Netherlands or elsewhere.



*Oil palm plantation in Malaysia.*

The criteria to be included are indicated in the Table below. It has proved difficult to apply these criteria (except for those relating to CO<sub>2</sub>) as legal requirements and at the same time to meet the requirements of WTO. Therefore the use of voluntary instruments and bi-lateral covenants will need to be investigated and negotiated.

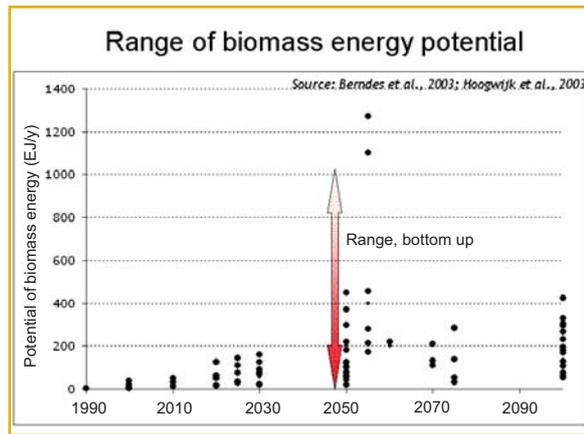
Criterion	2007	2011
Greenhouse gas balance	Net reduction in emissions compared with fossil fuels of at least 30% taking the whole supply chain into account	Net reduction in emissions compared with fossil fuels of at least 50% in 2007
Competition with food, local energy supply, medicines and construction materials	Reporting obligation based on a protocol	Compliance with specific indicators demonstrating no effect in reducing availability of these items
Biodiversity	No harm to protected areas or valuable ecosystems No plantations close to sensitive areas	Active protection measures
Prosperity	No negative impacts on regional or national economy	Active contribution to enhanced local prosperity
Welfare	No negative impact on well being of workers or the local community, taking account of Working conditions (SA 8000 in ILO), human rights (Universal Declaration for Human Rights), ownership and user issues (FSC/RSP0), social conditions and integrity (Business Principles for Countering Bribery)	Active contribution to improvement in social conditions
Environment	No negative environmental effects relating to waste management as defined by local jurisdiction Use of agro-chemicals in line with local and national jurisdiction Reporting of measures to prevent soil erosion and exhaustion  Preservation of the quality and quantity of ground water, with obligatory reporting  Compliance with local and national legislation relating to air emissions	Use of agro-chemicals in line with EU jurisdiction Compliance with specific measures to prevent soil erosion and exhaustion Preservation of the quality and quantity of ground water, with compliance with specific measures Compliance with EU legislation relating to air emissions

**Presentation 5: 'Global Biomass Availability: Assumptions and Conditions' by Monique Hoogwijk, Ecofys, Netherlands.**

Monique Hoogwijk discussed the factors which influence the availability of biomass for energy purposes. She noted that the worldwide biomass system is complex and so availability is difficult to quantify, particularly in light of the potential competition for biomass for food, fodder, materials and energy. The availability of biomass for energy will also be influenced by population growth, diet, water availability, agricultural density, and nature. Given all these factors a scenario approach is a helpful way to look into the future. Monique described an analysis which considered four scenarios with different assumptions about the rates of technology development and the levels of international trade in food along with different assumptions on population growth and diet. The projections of the volume of additional biomass that could be made available for energy purposes varied significantly with the scenarios as land use changed. One scenario included high population growth, a meat intensive diet with little improvement in agricultural intensity and high demand for biomass for competing uses or as a carbon sink. In this case the potential for additional energy use was low. By contrast, in the most optimistic scenario for bioenergy, where population growth is low, diet becomes less meat-intensive, agricultural intensity increases significantly (with a 100% increase in production per hectare) and there is less competition for resources, then bioenergy could increase very significantly, providing over 1000 EJ/year.

Based on a consideration of this more optimistic scenario for bioenergy, the following conclusions were drawn.

- There will be regional interdependence, because Europe will never meet its own demands and there will be a surplus in some regions such as Canada, Africa, and the former USSR. Therefore trade in biomass commodities will be required to sustain such an expansion.
- There is potential for supplying food from sustainable forms of agriculture which involve less intensive production, and



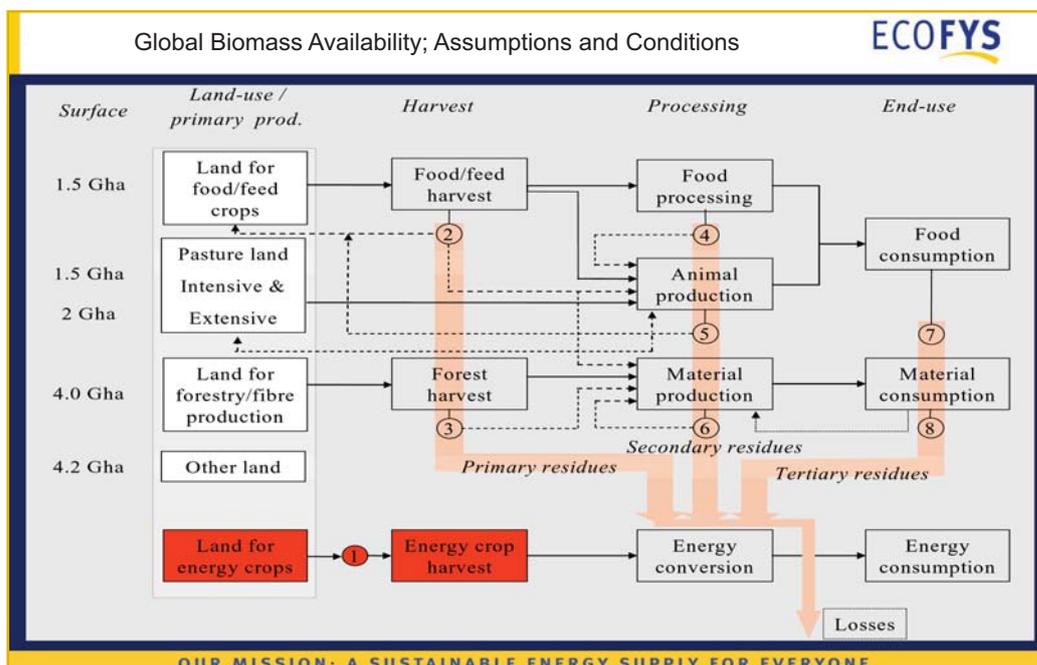
PowerPoint Slide from Presentation 5. Source: M. Hoogwijk.

there is a need for further study of the trade-off between increasing the areas dedicated to food and energy supply and to improving agricultural crop production on poorer quality land.

There are several factors which need further consideration in discussing these estimates.

- Will water availability be the same as today, or will it be limited?
- Biomass utilisation should be done in a balanced and integrated way, looking at systems which optimise the production of food and fodder as well as fuel.
- There may be potential to develop aquatic biomass (algae) as a new resource in the oceans.
- In the modelling, priority is given to the supply of food, but economic considerations are not taken into account, and if the price of bioenergy created competition between food and energy supply it would possibly affect food supply.

It was concluded that aiming to increase the contribution from biomass from the current level of 35 EJ/year to 200 EJ/year in 2050 would be a realistic but still challenging goal (IEA Bioenergy, 2007).



PowerPoint Slide from Presentation 5. Source: M. Hoogwijk.

### Presentation 6: 'Market Driven Utilisation of Bioenergy Potentials' by Tomas Kaberger, Tall Oil, Sweden.

Tomas Kaberger presented an industrial perspective. From a commercial viewpoint it is clear that the potential of biomass as an energy source is large compared to the present use. In order to realise this potential it was suggested that the most promising approach was to use the lowest cost biomass feedstocks, residues and by-products, which have the potential to provide one-third of the current global energy use (i.e., 150 EJ of 450 EJ).

However, there are challenges in realising this potential, including:

- Competition for materials which are increasingly being reused in the originating industry, which is looking for highest value and efficiency of raw material utilisation.
- Ecological challenges in ensuring that nutrient balances are maintained and that impacts on nature and on the environment are minimised.
- Social challenges, including the need to encourage rural economic development as an aid to poverty reduction and a need to tackle the issue of poverty among those without land.

In order to realise the potential there is a need to develop an innovative and entrepreneurial approach. However, entrepreneurs face administrative barriers and high transaction costs in establishing the new supply chains that will be needed to provide raw material of the right quality and at the right cost. Industry is concerned if transaction costs are likely to increase as measures such as Certification of Origin for residues are introduced, especially as this is difficult to establish reliably. Similarly, over-complex VAT and Custom-duty regulations act as a disincentive to innovation.

At present regulations for bioenergy are often based on models which have been developed for other products – for example fossil fuels or food. It would be beneficial to develop regulatory approaches which are specifically designed for biomass and bioenergy, and recognise the special characteristics of the supply chain. This should lead to some simplification and the development of certification and environmental labelling systems which would be easier for industry to adopt.

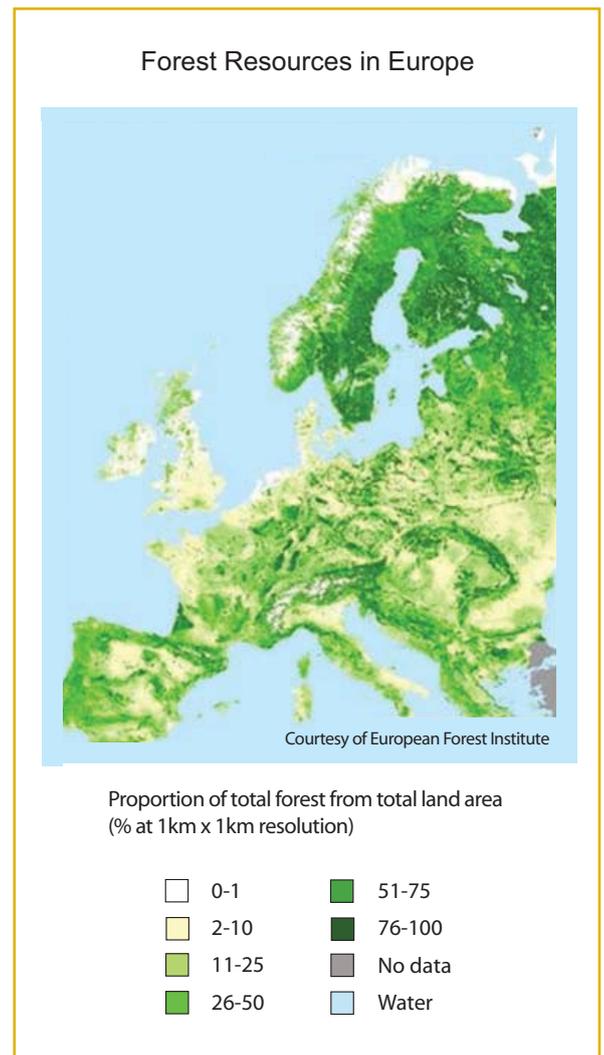
The availability of residues was discussed. It was felt that increasing demand for biomass products will increase the amount of available residues, and any intensification of agricultural production will also increase supplies. Some products can be manufactured from a wide variety of raw materials – for example particle board can be based on virgin wood, waste wood, or straw. Diversification of resources and the increased use of wastes are desirable. Existing biomass-based industries are already seeking to maximise the value of their raw materials and in many cases this includes the use of residues to provide energy needed in the production process.

### Presentation 7: 'Biomass Potential in Europe' by Matti Parikka, SLU, Sweden.

Matti Parikka made a presentation about biomass potentials, with a special focus on Europe, and included some discussion on the conditions, drivers, and barriers that would have an impact on the extent to which this potential is exploited.

He noted that bioenergy is currently the major source of renewable energy in Europe and has the largest potential for increase. The standing volume of forest biomass in the EU is increasing. However, the EU's target will not be met from existing forest resources and by-products, and waste products and new energy plantations will need to be mobilised. Resource availability differs across Europe since there are large standing volumes in Scandinavia and high forest productivity in central European countries. This contrasts with the special conditions found in Southern Europe with its limited and fragile forest resources.

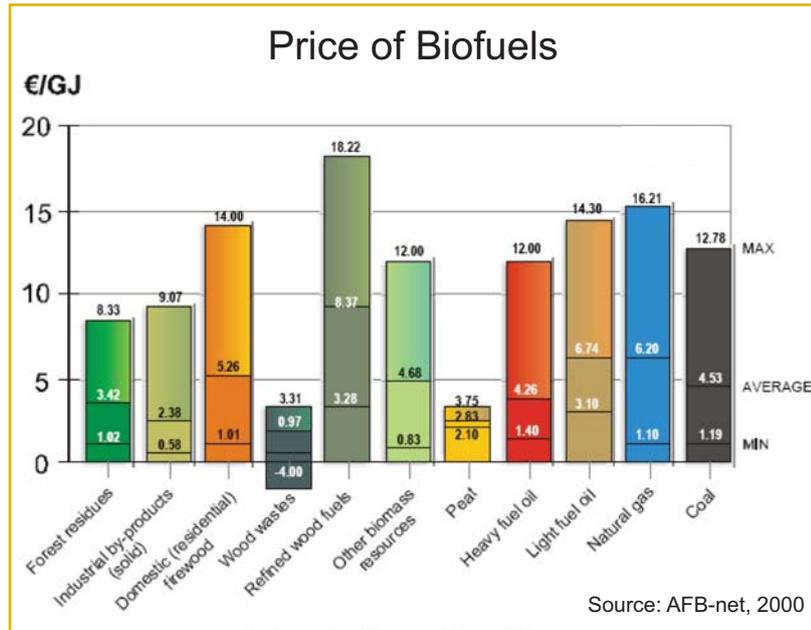
Land use strategy has to consider objectives relating to both production and conservation. Conservation issues are already a major issue influencing land use and biomass utilisation strategies. In future, when demand for feedstock increases, conservation issues, such as biodiversity, will become even more important and influence the accessibility of the



PowerPoint Slide from Presentation 7. Source: M. Parikka.

resource, along with other factors such as national forest management regulations, Common Agricultural Policy (CAP), etc.

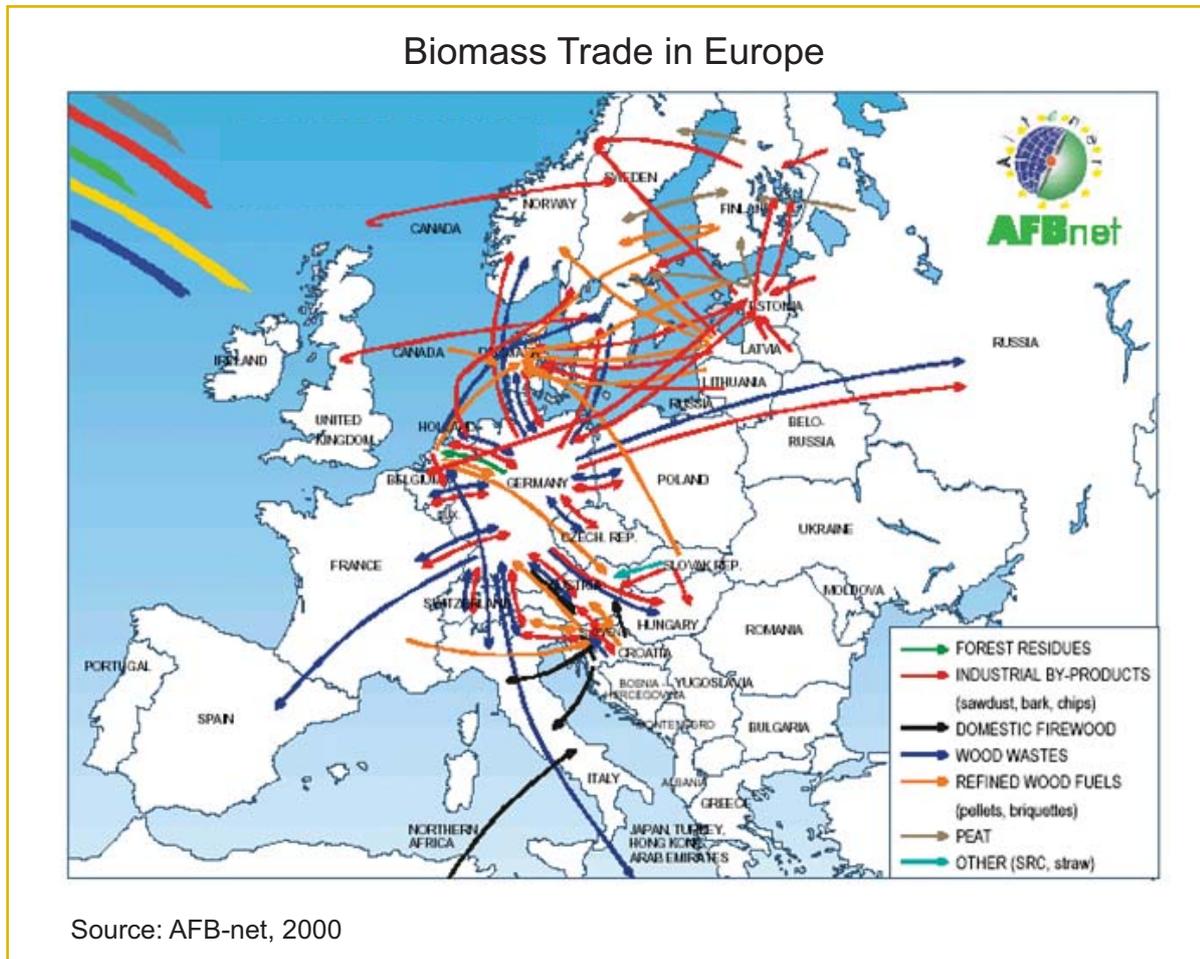
More and more bioenergy is becoming a product which is traded regionally or internationally. For example, biomass trade in northern Europe is now well established with an estimated 50 PJ traded annually. There are large variations within Europe (and globally) with respect to conditions for feedstock production, as well as transport/import opportunities. An AFB-net study estimated the potential practical availability of biomass in the EU at 5.2 EJ. There are 480 million cubic metres of stem wood used for industrial purposes and 40% of this ends up in by-products in a primary or secondary process and may be used for energy purposes.



PowerPoint Slide from Presentation 7. Source: M. Parikka.

With the exception of Asia, the harvest of biomass in most parts of the world is clearly below the potential. The potential volumes are enormous, but the degree to which these volumes may be exploited is the limiting factor. The extent

of exploitation for energy purposes is already leading to concerns about environmental and other impacts. There is an urgent need for reliable data and information for decision-makers and those responsible for biomass harvesting.



PowerPoint Slide from Presentation 7. Source: M. Parikka.

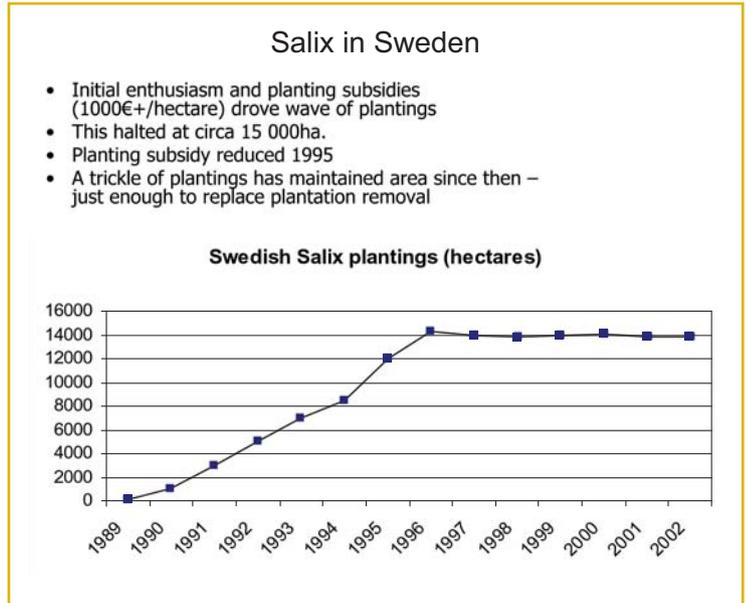
**Presentation 8: 'The Common Agricultural Policy and Bioenergy: Driver or Barrier' by Philip Peck, Lund University, Sweden.**

Philip Peck provided an overview and discussed the background to the Common Agricultural Policy (CAP), and also to the Biomass Action Plan (BAP). In particular he analysed the role of CAP as a driver for the establishment of new feedstock supply structures, noting that the BAP indicates that agricultural systems may play a major role as biomass providers for energy purposes.

CAP was originally developed in order to stimulate high levels of food production. We are now in a transition period and leaving behind the objectives and mechanisms developed earlier on. The most important current change is that subsidy has been decoupled from production – which may stimulate energy crops and other land uses. The set-aside scheme also gives energy crops an advantage. However, there are no specific drivers for 'energy optimal systems' in CAP since the same rules apply to all crops. Non-food crops currently play a very small role within CAP.

Through its major impact on crop profitability CAP has had a major impact on land use strategy. The objective of CAP is to secure farmers' income, thereby protecting Europe's cultural landscape. This leads to a conflict of interest between agricultural policy and energy policy. Agricultural policy normally aims for a high income for farmers, whereas energy policy strives for low fuel production cost and a high input/output energy ratio.

Swedish experiences with willow as an energy crop show that the development of energy crops depends on how well the crop performs compared to the alternative crops available to farmers. However, a large number of other non-technical



PowerPoint Slide from Presentation 8. Source: P. Peck.

aspects also influence the farmers' choice of crops. The Swedish experience also showed that there were unrealistic estimates of the potential yields and of the rate of future growth. The negative experience of the first generation of growers badly affected the reputation of the crop. For perennial crops like willow - the type of crop that is most energy efficient and has the lowest production cost – stability in long-term policies affecting both supply and demand is vital. Despite some unfavourable experience, willow is still probably the cheapest feedstock fuel from a dedicated crop.

Scale is important in reducing the cost and ensuring success and also affects the policy areas which have the biggest impact. Small-scale applications involve consumption of feedstock at farm level, and agricultural policy is the main influencer. Energy policy is more significant at a larger scale. Economic profitability and perception of risk are central issues

in farmers' decision-making processes. Short-term subsidy levels are not the strongest drivers for farmers to plant energy crops – a long-term contract with a buyer may be a more significant factor. Establishing a major supply industry for agricultural feedstock will require support from policy sectors other than CAP, but coherence in policies between different sectors will be difficult to achieve.

Philip Peck drew the following conclusions from the case studies involving the agricultural policy.

- Use subsidies, in particular to promote planting of new and perennial crops.
- Political and policy stability is vital.
- Information exchange and effective dissemination of experience from demonstrations are essential.
- Agricultural co-operatives can play an important role in the development of new crops by reducing risks and sharing costs.

**CAP – Aid for Energy Crops**

- An aid of 45€/ha is available to farmers producing energy crops on agricultural land (not on set aside land).
- Limit for this scheme of 1.5 Mha.
  - Approximately 1.3 Mha of this taken up 2006
  - consideration to increase to 2 Mha
- Proposals to extend aid for cultivating energy crops to all member states
- 8 countries (new members) do not qualify for 45€/ha

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the international institute for industrial environmental economics  
  
Lund University, Sweden

PowerPoint Slide from Presentation 8. Source: P. Peck.

## DISCUSSION OF KEY POINTS

In discussion the following key points were highlighted.

- There is a wide range of estimates for future biomass potentials - from about 10% of today's fossil energy use up to 100%, depending on the scenario assumptions employed. While it will be difficult to arrive at a definitive estimate of potential, an important and robust conclusion is that there is enough biomass for a substantial increase in bioenergy use compared to today's utilisation levels – however, probably at higher feedstock price levels.
- Because of geographic difference between areas with high production potential and current energy use, significant growth of the use of bioenergy at a global scale will require decoupling of production and use, and therefore a substantial growth in trade and transport of biofuels.
- Exploring these higher levels of the potentials on a national basis (e.g., in expanding the use of forest resources in Sweden and Finland), and particularly where international trade is involved, will make sustainability assurance a critical issue, and development of standards needs to be tackled vigorously and urgently.
- All scenarios showing a significant growth in bioenergy rely on using arable land for fuel production and increased productivity in the longer term. If we are to explore and develop these potentials the agriculture industry has to be involved. Agricultural policy needs to recognise the importance of energy as a new crop, whereas today these policies are not really constructed with energy objectives in mind. Indeed, agricultural policy, which aims to secure income for farmers, may work against the need to produce low cost fuels.
- A whole range of policies and regulations affecting agriculture, forestry, and the environment have been developed without taking the growth of bioenergy into account. There is a need to adapt and harmonise these measures in the light of the potential growth of bioenergy. Competition for biomass feedstock with current and future non-energy uses (food/feed production, wood products, pulp and paper) will play an important role in this process.
- The Kyoto Framework has a substantial influence on the development of bioenergy schemes, both in terms of replacing fossil fuels and in terms of storing carbon in the biosphere. It may be expected that Post-Kyoto Frameworks will be developed for the time after 2012 which will offer similar incentives for the development of bioenergy.

## IMPLICATIONS FOR IEA BIOENERGY

While technological and economic issues of biomass conversion to end-use energy are fairly well understood, feedstock related issues seem to be growing in importance. Future work of IEA Bioenergy should therefore address the implications of the following issues:

- **Range of utilisation options:** there are several routes for using biomass for energy purposes – producing heat, electricity, or transport fuels. IEA Bioenergy should set out the merits, benefits and challenges associated with each of these routes to allow optimal and rationale choices, and develop a strategy to ensure these messages reach key policy makers, investors, and influencers.
- **Competition:** Traditional non-energy uses of biomass, such as materials for construction, pulp and wood products as well as the food/feed production chains need to be assured while biomass for energy is increased. Bioenergy technologies can play a complementary role in these primary industries (e.g. gasification of residues within the paper industry) and the Agreement should highlight such niche opportunities.
- **Sustainability:** Increased production and harvesting of biomass has to be in line with sustainability requirements. IEA Bioenergy should establish links with and participate in international efforts to develop sustainability standards (for example with the Roundtable for Sustainable Biofuels). It should engage vigorously in the debate about the sustainability of biofuels and bioenergy, and play a leading role in harmonising initiatives in certification.
- **Kyoto:** The Kyoto Framework and post-Kyoto Frameworks will be developed for the time after 2012 providing significant stimulation for bioenergy as a way of reducing carbon emissions, and bioenergy projects are already playing an important role. The Agreement could assist in this process by facilitating the development of methodologies for liquid biofuels developments within the CDM
- **Trade issues:** Current national and international regulations related to trade of biomass (for food/feed and wood products) need to be analysed and adapted to include biomass for energy production, and the Agreement should build on work undertaken so far in Task 40.
- **Land use and productivity:** With the expected increase of biomass production, it will not be sufficient to cultivate marginal land for bioenergy feed stock. To produce biomass at competitive cost, arable land has to be used without jeopardising non-energy needs. Therefore the productivity of land currently used has to be increased, and the Agreement should review and broaden its work on crops grown specifically for energy purposes.
- **Equity:** The fact that developing countries may become major suppliers of biomass used in developed countries, means that there needs to be a fair distribution of the economic benefits of bioenergy use between the two groups of countries

## REFERENCES

The presentations are available at [www.ieabioenergy.com](http://www.ieabioenergy.com) under 'Workshops'.  
Visit [www.ieabioenergy.com/DocSet.aspx?id=5331&ret=dss](http://www.ieabioenergy.com/DocSet.aspx?id=5331&ret=dss)

**IEA Bioenergy. 2007.** Potential Contribution of Bioenergy to the World's Future Energy Demand. IEA Bioenergy: ExCo:2007.02.  
Visit [www.ieabioenergy.com/MediaItem.aspx?id=5586](http://www.ieabioenergy.com/MediaItem.aspx?id=5586)

## ACKNOWLEDGEMENTS

Josef Spitzer, the Member of the Executive Committee for Austria, took the lead in organising the workshop with the support of Bernhard Schlamadinger, Kees Kwant, Jim Richardson, and Keith Richards, who kindly provided assistance in arranging Sessions 1, 2, 3, and 4 respectively. ExCo Members Kees Kwant, Kyriakos Maniatis, Bjorn Telenius and Peter Hall acted as rapporteurs. The contribution of the external participants in the workshop is gratefully acknowledged.

Josef Spitzer also convened an editorial group comprising the rapporteurs, the Technical Coordinator (Adam Brown) and the Secretary (John Tustin) to prepare and review drafts of the text. John Tustin and Adam Brown facilitated the editorial process and arranged for final design and production.

## IEA Bioenergy

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