IEA Bioenergy

Task 40

an international research collaboration under the auspices of the International Energy Agency

Sustainable International Bioenergy Trade: securing supply and demand

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Introduction

This leaflet introduces the work of an international working group dealing with International trade of biomass and bioenergy, its possibilities, implications and prospects. The working group is called Task 40, headed under the Bioenergy Agreement of the International Energy Agency.

Over the past decades, the modern use of biomass has increased rapidly in many parts of the world. In the light of the Kyoto greenhouse gas (GHG) reduction targets, many countries have ambitious targets for further biomass utilization. Also the recent increase of the oil price has strongly fuelled the interest in bioenergy. For example, at an oil price of over sixty dollars per barrel, it is a very attractive option to drive on bio-ethanol or bio-diesel instead of fossil fuel-based transportation fuels. However, especially in developed countries domestic biomass potentials are often used to a high degree, though in some countries still untapped potentials remain. On the longer term, the pressure on available biomass resources will increase. Also, biomass produced in developed countries can be associated with high production costs. Without the development of biomass resources (e.g. through energy crops and better use of residues) and a well functioning biomass market to assure a reliable and lasting supply, the often ambitious targets for biomass use may not be met. The development of truly international markets for biomass may become an essential driver to develop biomass potentials, which are currently under-utilized in many world regions (see e.g. Smeets et al., 2004 (Figure 1) and Hoogwijk, 2004). This is true both for available residues as well as possibilities for dedicated biomass energy plantations or multifunctional systems such as agro-forestry.

On the other hand, many developing countries have a large technical potential for agricultural and forest residues and dedicated biomass production, e.g. ethanol from sugar cane, wood or other crops. Given the lower costs for land and labor in many developing countries, biomass production costs are much lower, and thus offer an opportunity to export bioenergy.

The possibilities to export biomass derived commodities to the world's energy markets can provide a stable and reliable demand for rural communities in many (developing) countries, thus creating an important incentive and market access that is much needed in many areas in the world. For many rural communities in developing countries such a situation would offer good opportunities for socio-economic development.

Biomass is being loaded on a vessel for transportation. Courtesy of J. Douglas, Solidaridad

IEA Bioenergy is an international collaborative agreement, set up in 1978 by the International Energy Agency (IEA) to improve international cooperation and information exchange between national bioenergy research, development and demonstration (RD&D) programs. IEA Bioenergy aims to realize the use of environmentally sound and cost-competitive bioenergy on a sustainable basis, thereby providing a substantial contribution to meeting future energy demands.

IEA Bioenergy currently has 12 Tasks, all of which are supervised by the IEA Bioenergy Executive Committee. Each Task has a defined work program and is led by one of the participating countries (Operating Agent). A Task Leader, appointed by the Operating Agent, directs and manages the work program. In each country, a National Team Leader is responsible for the coordination of the national participation in the task. Each participating country pays a contribution towards the organizational requirements, and provides in-kind contributions to enable the participation of national experts in a Task.

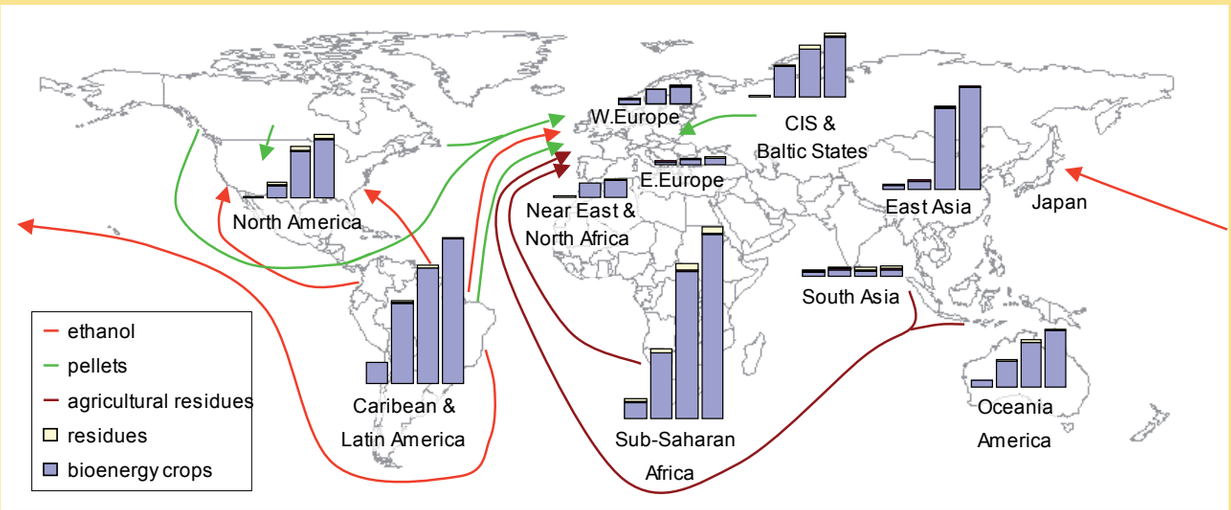

Figure 1: Theoretical biomass potentials per region (see Smeets et al, 2004) and examples of current trade routes. Inter-European trade is not displayed for clarity.

Palm kernel shells, an agro-residue produced in Southeast Asia (mainly Malaysia and Indonesia), which is currently exported to several European countries. Courtesy of J. Douglas, Solidaridad

Many trade flows take place between neighboring regions or countries, but increasingly trading is occurring over long distances. Examples are export of ethanol from Brazil to Japan, EU and USA, palm kernel shells from Malaysia to the Netherlands, wood pellets from Canada to Sweden, etc. This is happening despite the bulky and lower calorific value of most biomass raw material.

These trade flows may offer multiple benefits for both exporting and importing countries. For example, exporting countries may gain an interesting source of additional income and an increase in employment. Also, sustainable biomass production may contribute to the sustainable management of natural resources. Importing countries on the other hand may be able to fulfill cost-effectively their GHG emission reduction targets and diversify their fuel mix.

For stakeholders involved such as utilities, producers and suppliers of biomass for energy, it is important to have a clear understanding of the pros and cons of biomass energy. For example, investment in infrastructure and conversion facilities requires risk minimization of supply disruptions, in terms of volume, quality as well as price.

More important even, the long term future of large scale international biotrade must rely on environmentally sustainable production of biomass for energy. This requires the development of criteria, project guidelines and a certification system, supported by international bodies. This is particularly relevant for markets that are highly dependent on consumer-opinions, as it is presently the case in Western Europe.

Objectives

The future vision on global bioenergy trade is that it develops over time into a real “commodity market” which will secure long term and sustainable supply and demand of bioenergy.
The aim of Task 40 is to investigate what is needed to create a “commodity market” for bioenergy. Through the participation of interested parties e.g. industrialists, governmental bodies and NGO’s (producers and consumers), this task will contribute to the development of sustainable bioenergy markets on short and on long term, at different scale levels e.g. local, regional, international, to global. Task 40 planned activities take into account several stages of development of the biomass markets in different regions of the world.

Furthermore, the aim is that this platform can set the agenda and initiate a host of new activities relevant for developing biomass potentials worldwide. Key priorities of the task are:

1. Obtain an overview of current and future trading experiences and markets; monitor the development of biomass markets and trade over time.
2. Inventorise barriers for developing biomass markets at various levels and trade and strategies to cope with these barriers.
3. Provide new insights in the development of biomass resources and supplies in relation to market demand e.g. by applying various modeling tools.
4. Assess the performance and further development/ optimization of long distance supply chains, in particular sea transport.
5. Certification, standardization and terminology for sustainable biomass trade.

6. Sustainable long distance forest fuel-supply chains (e.g. North America and Russia).
7. Provide strategic advice on how to develop and support biomass trade, e.g. for the EC, IEA ExCo, FAO, etc.
8. Identify possibilities for pilot- and demonstration projects and aim for supporting their development, especially in developing countries.
9. Provide insights (e.g. through case studies and best practice examples) on the socio-economic and ecological impacts of biomass production and trading schemes and demonstrate how biomass trade can contribute to sustainable development targets.
10. Evaluate the market development of key biomass based energy carriers as ethanol, pellets and green electricity.
11. Improved communication, raising awareness, networking and information exchange on the fields covered by the Task.

Long-distance palm kernel shell transport from Indonesia to Italy. Courtesy of M. Wild, EBES AG

Examples of Task 40 Outputs

Country reports

Each of the task members provides a country report. The country reports for each participating country of the task offers:

- Background information on the general energy system and on bioenergy systems
- A description of bioenergy policies
- Data on traded biomass volumes and prices (if available)
- Detailed information on country-specific drivers and barriers for biomass trade

The driving forces and rationale behind the development of trade in bio-energy can be structured as described below. In most cases these factors appear in combination.

(1) Raw material/biomass push. These drivers are found in most countries with surplus of biomass resources. Ethanol export from Brazil and wood pellets export from Canada are examples of successful push strategies.

(2) Market pull. Import to the Netherlands is facilitated by the very suitable structure of the leading big utilities. This makes efficient transport and handling possible and leads to low fuel costs compared to users in other countries where these conditions are less favorable.

(3) Utilizing the established logistics of existing trade. Most of the bio-energy trade between countries in Northern Europe is performed in integration with the trade of forest products. The most obvious example is the bark, saw dust and other residues from imported round wood. However, also other types of integration have supported bio-energy trade, such as use of ports and storage facilities, organizational integration, and other factors that kept transaction costs low also in the initial phases. Import of residues from food industries to the UK and the Netherlands are other examples in this field.

(4) Effects of incentives and support institutions. The introduction of incentives based on political decisions increased the strength of the driving forces and triggered an expansion of bio-energy trade. However, the pattern proved to be very different in the various cases, partly due to the nature of other factors, partly to the fact that the institutions related to the incentives were different. It seems obvious,

that institutions fostering general and free markets, e.g. CO_2 taxes on fossil fuels are more successful than specific and time restricted support measures.

(5) *Entrepreneurs and innovators*. In countries like Austria and Sweden, individual entrepreneurs and innovators have had a leading role for the development of bio-energy trade. It has led to a more diversified pattern compared to e.g. Finland, where bio-energy is handled by mature industries especially within the forestry sector.

(6) *Unexpected opportunities*. Storms, forest fires, insect attacks, etc. may lead to short term imbalances in the supply. Technical failures and other reasons for shut down cause disturbance in the user and in distribution systems. Such short term opportunities has often led to new trade patterns, some of which may remain also when the conditions return to normal. For example, the last year's hurricanes in the Eastern part of USA led to a short term trade of wood chips to Europe. Probably this will also occur after the recent hurricanes of September 2005.

Long-Distance Biomass Supply Chains- Performance, Development and Optimization

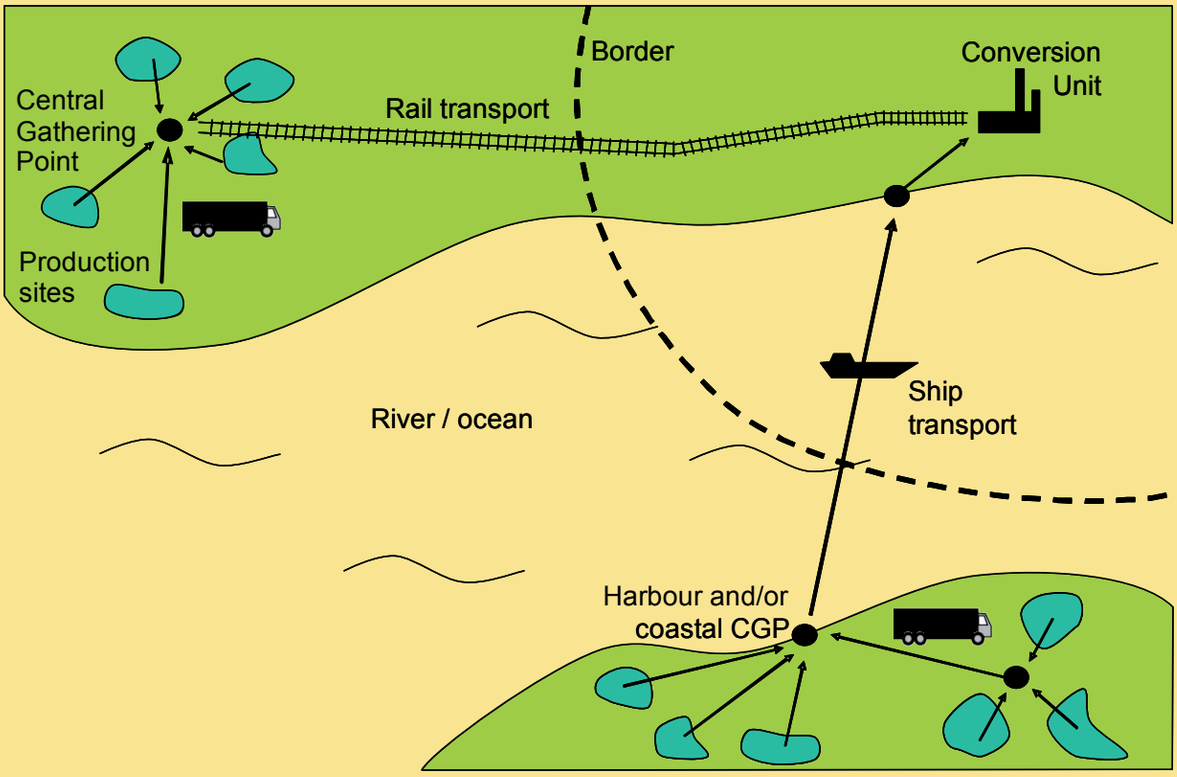

Figure 2: Schematic examples of international biomass supply chains.

A team from Canada, Norway, Finland and the UK examine supply chains for biomass, including raw biomass (forest chips, bundles), fuel pellets, and bio-oil. The study addresses supply chain components based on existing chains or existing knowledge, and from new studies in 2005.

In one study, Lappeenranta University of Technology and YTI Research Centre will identify fuel procurement areas and terminals, examine forest chip potential and integrate fuel production with marine transportation. Stakeholders supply key data, with results being applicable to northern forest zones like Russia, Baltic countries and Canada.

In Norway, a project funded by Enova examines efficient logistics chains for biomass transport from production sites to storage sites in Norway to evaluate the impact of market volumes on chain efficiency, and to recommend a path to establishing a chain demonstration.

Canada has recently completed a national inventory of mill residues to determine potential development zones, and the Canadian Bioenergy Association compiles an inventory for forest floor biomass. Wood pellet supply chains are now being enhanced in British Columbia (BC), and the costs of production and transport will be reviewed for pellets in both BC and the East. BioOil will also be evaluated, which is just now being ramped up to full production at the world's largest BioOil plant in Ontario.

The UK, in collaboration with UK- Renewable Energy Association, will establish the scale, origin and destination of grain for ethanol production and fuels for co-firing. It will carry out prototype evaluations of energy and GHG balances for these supply routes. Additional supply chain information is expected for raw biomass from Russia and ethanol from Brazil. An evaluation may be carried out on the potential for biomass supplied from developing countries (including African and Far Eastern).

Arrival at the end-user: the Amer power plant in the Netherlands and the biomass logistic terminal, built in 2004, with a storage capacity 20000 m³, unloading capacity 600 kton/yr and a quay for 2 ships (courtesy of Essent).

Evaluation of markets / ethanol

The focus of the research is on evaluating markets for fuel ethanol trade and, more specifically, on the Brazilian experience on large-scale fuel ethanol production and exports. The research covers the historic analysis of ethanol production in Brazil, the prospective analysis of the domestic fuel ethanol market up to 2015, and a prospective analysis of the international market, including (i) identification of driving forces for growing fuel ethanol consumption; (ii) perspectives for Brazilian producers; and (iii) identification of barriers.

The requirements to accomplish the forecasted markets, considering land availability, the required expansion of the capacity of production and of logistics, the required investments are investigated, as is the expansion of the ethanol industry from the sustainability point of view, considering multiple aspects (energy security, land availability, water use and consumption, reduction of GHG emissions, job creation, etc.).

The main conclusions so far are (i) due to a set of reasons (environmental, security of supply, economic, social, etc.) the ethanol market is growing fast; (ii) the perspectives for the international market of fuel ethanol are promising; but, so far, (iii) only two countries are using ethanol fuel in a large commercial scale (USA and Brazil) and (iv) in the short-run, just Brazil is in condition to produce and to export ethanol in large-scale. (vi) a large-scale production of ethanol, together with sustainable international trade, could bring benefits (social, economic, environmental and political) that will help the consolidation of this international market.

Task 40 will continue with assessing other commodities, like pellets, vegetal oils, bio-oil or electricity.

Strategic advice

Based on the entire Task work program and events, a strategic review document is compiled, covering an inventory of barriers (technical, logistic, economic, organisational, regulatory, etc), strategies to cope with those barriers and opportunities for developing international bioenergy markets. The strategic advice may also serve as input for strategic advice to IEA Bioenergy, as well as other bodies.

Workshops

Task 40 is closely related to other IEA Bioenergy activities, most notably IEA Tasks 30 and 31 (on Short Rotation Crops for Bio-energy Systems and Biomass production for Energy from sustainable forestry), IEA Task 38 (Greenhouse Gas Balances of biomass and bioenergy systems) and IEA Task 29 (Socio-economic drivers in implementing bio-energy projects). Collaboration with those tasks is implemented by organizing joint activities and compiling joint publications.

In March 2005, a joint workshop with IEA task 29 was held in Washington D.C., aimed at exploring the links between international bioenergy trade and socio-economic development and how sustainable bioenergy production for the world market could be realized. This included experiences with developing the use of bioenergy in a sustainable development setting, the socio-economic implications and benefits (Task 29) and how international biotrade could contribute and secure sustainable development (Task 40). A special issue of the Journal Energy for Sustainable Development covering this field is published during the spring of 2006.

In December 2005 a joint workshop was organized in Brazil with IEA tasks 30 and 31, to assess the ecological impacts of large scale biomass production systems and how the sustainability of biomass production could be secured, e.g. by means of certification. Also, a business forum on sustainable international bioenergy trade was organized, specifically focused on Brazilian industry (e.g. forestry and ethanol).

In april 2006, a joint activity is held with IEA Task 38 in Trondheim, Norway, covering the possibilities of and comparing pro's and con's of physical biomass trading, emission trading schemes and how to maximize GHG mitigation impacts of different schemes.

Examples of Task 40 publications

- H. Risnes, Bioenergy in Norway - status 2004 and measures to secure future fuel supply and demand, Country report for the IEA Bioenergy Task 40, Enova, October 2004.
- T. Ranta, J. Heinimö, International Bioenergy Trade: Experience in Finland, Lappeenranta University of Technology, Finland, October 2004.
- D. Bradley, Canada Biomass-Bionergy Report. Country report for IEA Task 40. Climate change solutions, September 2004, p.20.
- A. Faaij, M. Junginger, et al., Opportunities and barriers for sustainable international bioenergy trade: towards an strategic advice. Proc. of the 14th European Biomass Conference & Exhibition Biomass for Energy, Industry and Climate Protection, Paris, France, 17-21 Oct. 2005, p. 4.
- E. Smeets, A. Faaij, I. Lewandowski, A quickscan of global bio-energy potentials to 2050 - an analysis of the regional availability of biomass resources for export in relation to underlying factors, Prepared for the FairBioTrade Project, NOVEM and Essent, Copernicus Institute - Utrecht University, NWS-E-2004-109, March 2004. Pp. 67 + App..
- I. Lewandowski, A. Faaij, Steps towards the development of a certification system for sustainable biomass trade - analysis of existing approaches. Report prepared in the context of the FairBioTrade Project for NOVEM and Essent, Copernicus Institute for Sustainable Development - Utrecht University, NWS-E-2004-31, July 2004. Pp. 56 + App..
- A. Faaij, R. Remmers, M. Wagener, K. Kwant, Launching a new Task under the IEA Bio-Energy Agreement; Sustainable International Bio-energy Trade: Securing Supply and Demand. In: Proc. of the Second World Biomass, May 10-14, 2004, Rome - Italy, W.P.M. van Swaaij, T. Fjällströ.
- M. Junginger, A. Faaij, IEA Bioenergy Task 40 Country report for the Netherlands. Copernicus Institute for Sustainable Development - Utrecht University, NWS-E-2005-31, July 2005. Pp. 56 + Appendices.

All publications are available on the Task 40 website: www.bioenergytrade.org

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Task 40

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