IEA Bioenergy

Task 38
Task 40

Prepared by IEA Bioenergy Task 38 "Greenhouse Gas Balances of Biomass and Bio-energy Systems"

and

IEA Bioenergy Task 40 "Sustainable International Bioenergy Trade: Securing Supply and Demand"

# Options for Trading Bioenergy Products and Services

This feature article provides an overview based on the work of Tasks 38 and 40.
The opinions expressed are those of the authors.

## Executive Summary


International trade in biomass or energy carriers from biomass has only recently become part of the portfolio of energy companies and countries to increase the share of biomass in their fuel mix and to meet environmental objectives. This trade is growing rapidly and in the longer term a global market of renewable energy carriers derived from biomass may emerge. There are many potential advantages of such a market. For example, $CO_2$-neutral biomass resources are utilised efficiently on a large scale; new markets may generate substantial income sources for relatively poor world regions; and energy markets worldwide may become more stable due to a larger number of energy suppliers compared to the current situation. Most important may be that, given appropriate incentive structures, such a market may lead to development and sustainable use of the vast bioenergy production potential in many regions of the world.

Despite the rapidly developing international bioenergy trade (solid biomass and refined biofuels), physical trade of biomass (or energy carriers derived from biomass such as liquid fuels) is not always the optimal solution from both a cost and a GHG mitigation perspective. International logistics lead to higher costs and additional energy losses compared to local or regional utilisation of resources. Although with optimised chain design (e.g., involving large-scale transport, transport of high energy-density commodities) such additional costs and energy uses remain modest. Local use and subsequent trading of electricity, $CO_2$ credits or renewable certificates provide important alternatives.

All these options can contribute to building sustainable biomass markets and increasing the share of biomass in the global energy mix. The variety of products (physical biomass, electricity, carbon credits, and renewable energy certificates) allows countries to select the most efficient mechanism for each unique situation.


*Wood pellets being loaded in Canada for long-distance transportation.*

*Courtesy J. Douglas, Solidaridad*

*Wood chipper.*

*Courtesy ENOVA*

*Long-distance transportation of palm kernel shells from Indonesia to Italy.*

*Courtesy M. Wild, EBES AG*


Acknowledgements

*This article was prepared by B. Schlamadinger, A. Faaij, M. Junginger, S. Woess-Gallasch and E. Daugherty based on the work of Tasks 35, 38 and 40. Pages 1–10 are published in the IEA Bioenergy Annual Report 2005. Further information on the brochure topic can be found at the Task websites: www.ieabioenergy-task38.org, and www.bioenergytrade.org and also through the weblinks listed in the text.*

# Introduction

Bioenergy is increasingly utilised to reduce emissions of greenhouse gases (GHG). Various options exist for trading bioenergy and bioenergy services between countries. In this paper, trade in biomass fuels, electricity, renewable certificates, and $CO_2$ credits are presented as options for business and policy makers as they try to meet increasing energy demands, while at the same time addressing national and international commitments to reduce GHG ($CO_2$) emissions and increase renewable energy sources.

Bioenergy has the advantage that it is $CO_2$ neutral, if the biomass is sustainably produced; and biomass fuels can be stored until the energy is demanded by the user, therefore meeting both peak and baseline energy demands. Biomass can take various forms, such as residues from forestry, agriculture, and industry. It can be grown in dedicated woody or herbaceous energy crops, and can be transformed into various solid, liquid, and gaseous biofuels.

Biomass energy systems adequately designed and managed include the following services:

- Energy in the form of useful electricity, heat, or liquid/gaseous fuel.
- Reductions of net GHG emissions, thus addressing global climate concerns.
- Other benefits of renewable energy sources, such as job creation, reduction of local air pollution, reduced reliance on a limited resource, etc.

Estimates of the global potential contribution of bioenergy range from 100 to over 500 EJ during this century. In developed countries easily accessible and low-cost biomass potentials are often used to a high degree, though in some countries untapped potentials remain. Also, there is often a high production cost for biomass in developed countries. In the long term, the pressure on available biomass resources will increase. Without the development of biomass resources (e.g., through energy crops and better use of residues) and a well-functioning biomass market, the often ambitious targets for bioenergy use may not be met.

The development of truly international markets for biomass may become an essential driver for biomass production, as the potential is currently unrecognised in many regions of the world. Many developing countries have a large technical potential for agricultural and forest residues and dedicated biomass production, e.g., sugar cane, wood, or energy crops. Given the lower costs for land and labour in many of these countries, production costs are much lower, and thus offer an opportunity to export biomass.

Since biomass is an energy source that is present over large land areas, the need for collection and transport systems arises. Conventional thinking is that biomass should be used locally, perhaps transported up to a distance of 50–100 km, to strike the optimum between economies of scale of the conversion plant, and the variable costs of biomass transport.

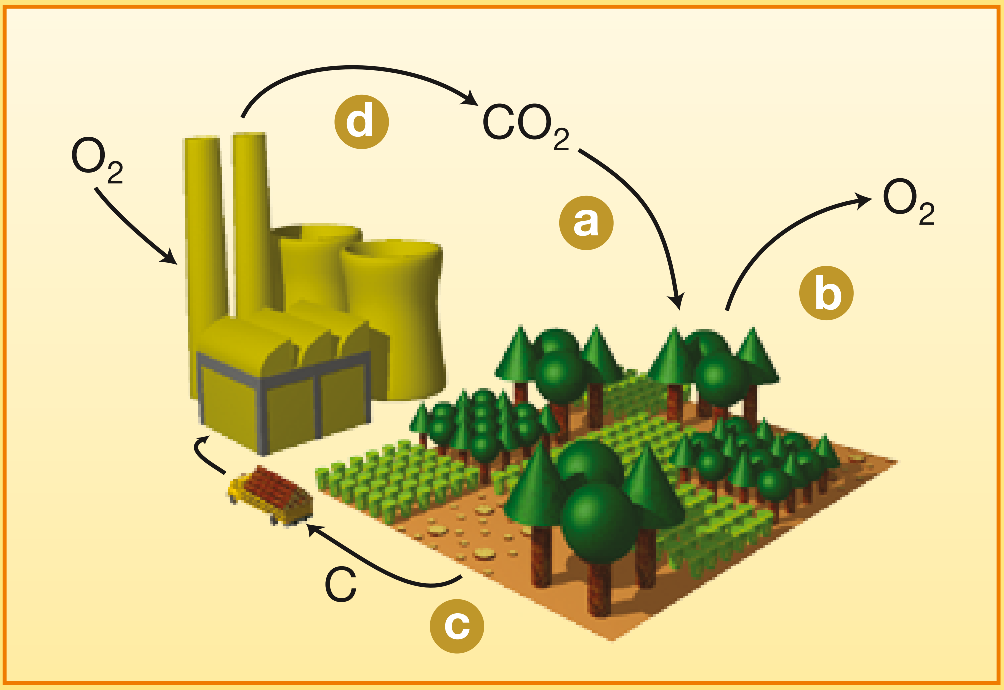



*Figure 1*

*Illustration of the recycling of carbon as biomass accumulates in energy crops and forests and is consumed in a power station.*

*a:*
*$CO_2$ is captured by the growing crops and forests;*

*b:*
*oxygen ($O_2$) is released and carbon (C) is stored in the biomass of the plants;*

*c:*
*carbon in harvested biomass is transported to the power station;*

*d:*
*the power station burns the biomass, releasing the $CO_2$ captured by the plants back to the atmosphere. Considering the process cycle as a whole, there are no or very low $CO_2$ emissions from burning the biomass.*

*Source: R. Matthews*

However, although many trade flows do take place between neighbouring regions or countries, increasingly trade is occurring over long distances. Examples are the export of ethanol from Brazil to Japan, EU, and the USA; palm kernel shells from Malaysia to the Netherlands; wood pellets from Canada to Sweden, etc. Also the European Commission is planning a communication on future prospects for biofuels reflecting on 'the question of measures to promote the production of biofuels, including such production in less developed countries'. This is happening despite the bulky and lower calorific value of most biomass raw material compared to most fossil fuel energy carriers. These examples and various analyses show that biomass can be economically transported over longer distances, provided that transport occurs in bulk (such as by train or ship), and that biomass can be increased in density to reduce its volume and make transport more cost-effective. Furthermore, analyses of bioenergy trade chains also show significant advantages in GHG reduction potential in comparison to fossil fuel chains.

One of the main drivers for increasing the use of bioenergy is to reduce $CO_2$ emissions. Biomass is a $CO_2$-neutral energy source to the extent that $CO_2$ uptake by plants for growth equals the release of $CO_2$ from the energy conversion (see figure 1). In national GHG inventories the use of biomass will result in less emission reported from using fossil fuels; $CO_2$ emissions from bioenergy are reported compared to the use of fossil fuels. Thus the relative benefit of biomass leads to an improvement in the national GHG inventory. When biomass is traded between countries, the exporter will experience a $CO_2$ flux from the atmosphere to his land, whereas the importer will experience a $CO_2$ flux from his energy system to the atmosphere, both roughly cancelling each other out. In cap-and-trade programmes of GHGs, gross $CO_2$ fluxes from biomass oxidation should not be counted in the GHG inventory of the consumer if a GHG incentive to use bioenergy is to be maintained. Technically, if biomass is produced sustainably (no net addition of $CO_2$ to the atmosphere), both producer and consumer experience a zero carbon stock change, and the consumer will experience a reduction in $CO_2$ emissions from fossil fuels in their inventory.

Demand for bioenergy is increasing as concerns about climate change lead to implementation of policy measures that favour renewable energy sources over their fossil-fuel-based competitors. Examples of such policy measures and mechanisms are renewable energy mandates, feed-in tariffs for electricity from renewables, trading of green certificates and cap-and-trade systems for GHG. Demand is also driven by price mechanisms such as subsidies and taxes. All of these mechanisms seek to internalise the externalities of fossil fuel use in terms of climate change and other impacts, and provide a more balanced energy choice.

There is not only a demand for useful energy, but also for 'climate friendly' energy systems and energy systems that bring with them all the other advantages of renewable energy. Biomass energy can help meet all three demands. It is noteworthy that the first benefit, useful energy, must usually be provided at the location of demand, whereas the other two types of services are less dependent on location. It does not matter where reduction of GHG occurs, because the atmosphere is well mixed globally and an emission (or reduction therein) will have an equal effect wherever it occurs. Similarly, many of the benefits of renewable energy (such as decreased use of limited fossil fuel resources) will not depend on where the biomass is used, although these benefits do occur locally.

This suggests that biomass may not have to be transported in all circumstances, especially where the demand is largely for climate friendly and renewable energy sources. Instead, it may be possible to convert biomass into electricity at the place where it occurs, and 'transport' the equal amount of electricity, to the location where these services are in demand, or possibly trade the nonmaterial services such as '$CO_2$ neutrality' or 'renewable features' under mechanisms such as those identified above.

*Pellets and briquettes made from sawdust are more suitable for transport than biomass raw materials which are often bulky and of low calorific value.*

*Courtesy BrikettEnergi, Sweden*

# Matching Supply and Demand for Bioenergy Services

*Energy supply and demand can be considered at different levels e.g., country, region, company, or individual projects. This discussion will refer for convenience to the location with energy demand as 'Country D' and to the location with surplus biomass supply as 'Country S'.*

## Trading Energy Carriers

### *Biomass Fuels*

Some world regions (for example Latin America and Eastern Europe) have a larger bioenergy production potential than others, a combination of large land areas with good crop production potential, low population density, and often extensive agricultural practices. Consequently, various countries may become net suppliers of renewable bioenergy to countries that are net importers of energy. For example, there is growing interest in exporting bio-ethanol from Brazil to Japan and the USA. In order for bioenergy to be available to importing regions, transport of biofuels over relatively long distances is necessary. This, however, implies extra costs, more complex logistics, and additional energy losses compared to more local utilisation.

The possibilities for exporting 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 of the world. For many rural communities in developing countries such a situation would offer good opportunities for socio-economic development.

Factors such as the biomass production method, the transport type, and the order and choice of pre-treatment operations are of importance. The design of the supply chain will influence the costs and energy efficiency, via a large number of variables, such as transport distance, dry matter losses, fuel prices, total volumes transported, and equipment performance.

*Loading logs for transportation by truck.*

*Courtesy UK Forest Research Photo Library*

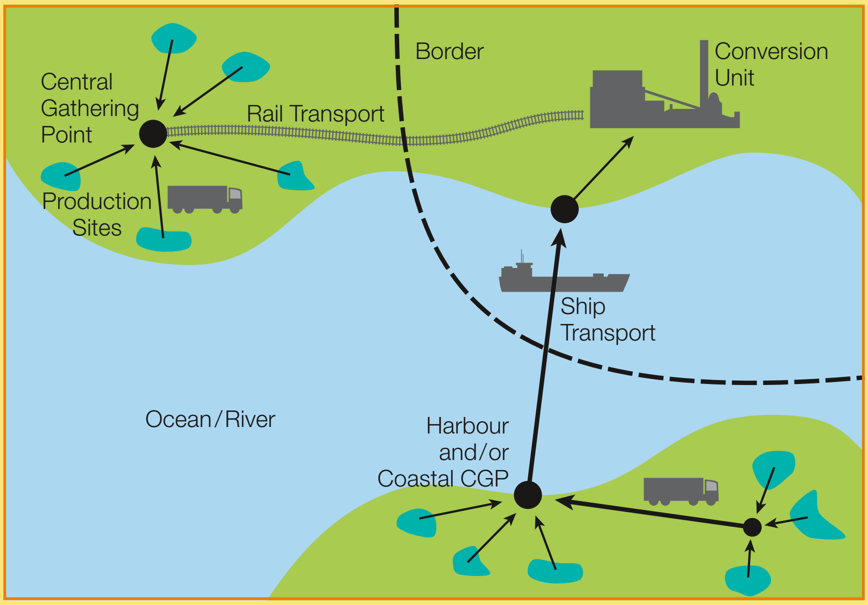



*Figure 2*

*International bioenergy logistics – schematic representation of possible biomass and bioenergy trade chains.*

*Source: Copernicus Institute*

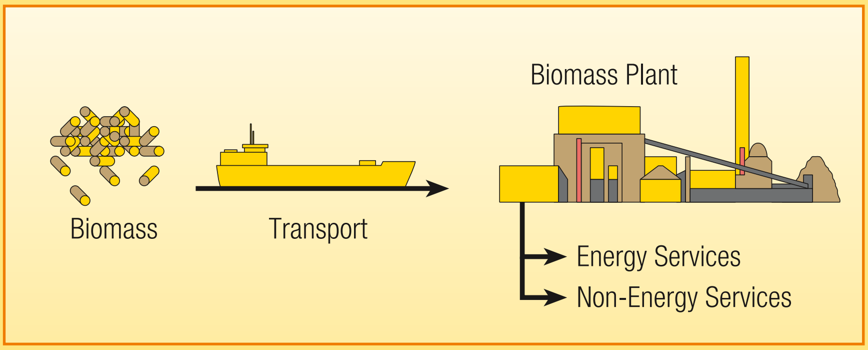



*Figure 3*

*International bioenergy trade can include direct transport of biomass materials (chips, logs, and bales), intermediate energy carriers (such as bio-oil or charcoal), or high quality energy carriers such as ethanol, methanol, Fischer-Tropsch liquids, and hydrogen.*

*Source: Joanneum Research*

Various drivers for international bioenergy trade can be distinguished:

- *Cost-effective GHG emission reduction.*

At present, the demand for biomass is growing due to climate policies of various countries. Where indigenous resources are insufficient at the required quality and cost, imported material may be an attractive alternative to local biomass supplies.

Use of proper reference systems is crucial: the GHG mitigation potential of biomass use is strongly affected by, for example, the carbon intensity of power generation in both the importing and exporting countries. This is true for bio-oil export from Karelia (Russia) to the Netherlands. The possibilities for using biomass for CHP in Karelia (as well as the relatively low distribution density of forest residues) and the relatively efficient power generation in the Netherlands indicate that local use of biomass resources may be preferred over export in this particular case. In the case of wood pellet export from Canada to the Netherlands and other Western European countries, the opposite is true.

- *Socio-economic development.*

Many institutions and much research have indicated the potentially strong positive link between developing bioenergy use and local development. For various countries, exporting bioenergy in the future may provide substantial benefits for their trade balances.

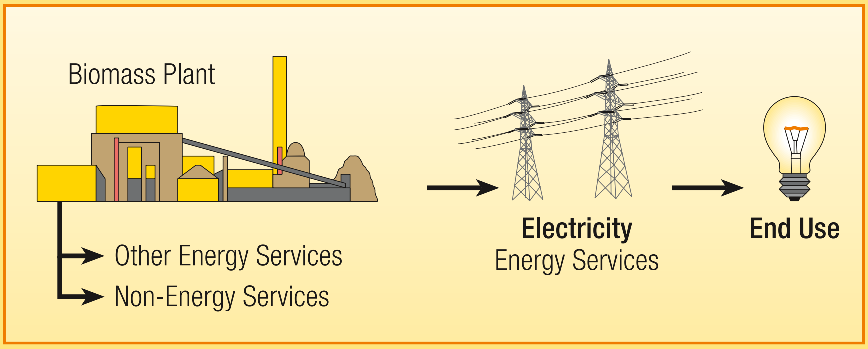
- *Sustainable management and use of natural resources.*

Large-scale production and use of biomass for energy will involve use of (additional) land. When biomass production can be combined with better agricultural methods, or restoration of degraded and marginal lands it can provide a sustainable source of income for rural communities.

- *Fuel supply security.*

Biomass may diversify the total portfolio of fuels used and imported by countries, thereby reducing the risks of supply disruptions in terms of both quantity and price, especially in the case of biofuels for transport since they replace oil imports.

*Figure 4*
*International trade in electricity produced from biomass.*
*Source: Joanneum Research*




## *Electricity*

International trading of electricity is already established. Electricity produced from biomass will usually be $CO_2$ neutral, and can be an effective means of meeting energy demands of the electricity importer while at the same time not adding to the $CO_2$ emissions of the exporting country. That is, neither the importing nor the exporting country experiences any GHG emissions from the transaction.

Countries may be importers or exporters of electricity for only parts of the year, parts of the day etc., depending on peak load demands, electricity price variations, and other factors. When electricity is traded, $CO_2$ emissions will be accounted for in the national GHG inventory of the country where the emission from electricity production occurs. Thus, it is conceivable to meet an emission reduction target by reducing domestic electricity generation and making up the shortfall through imports. This is most likely to occur where not all countries in a region are subject to emission limitation and reduction commitments.

Both biomass and electricity trade will lead to GHG emission reductions in the inventory of the importing country. The magnitude of reductions, and thus the viability of these two options, will depend on the GHG intensity of the energy system in the importing country, i.e., what type of energy carrier and conversion system is displaced (baseline scenario). Usually this will be a marginal power plant that would have gone into operation (or would have increased its level of output) in the absence of the electricity import. If this marginal production system is a rather inefficient coal-fired power plant, then the GHG reductions will be greater (by a factor as high as three) than if the marginal plant works on natural gas using state-of-the-art technology.

One of the key advantages of this trading option is that production of renewable energy can be optimised in power plants with better technologies and economies of scale that could not be realised without the increased flexibility and increased demand of trade.

Logically, electricity trading is limited to areas where the grid offers sufficient capacity and the effectiveness decreases with increasing distance. It is important to ensure that there is appropriate labelling when electricity from renewable sources is purchased.

## Trading Non-energy Services

'Non-energy services' include benefits from biomass energy that are unrelated to the energy as such. Examples are environmental, social, and emission reduction benefits compared to other energy sources. The emission reduction benefits are packaged in various forms and, for example, change their owner in emissions trading schemes. Industry tends to be supportive of emissions trading since it enables a given emissions target to be met at lower cost than with conventional regulations. The cost savings are possible because there is more flexibility in the choice of where emissions are reduced. Sources with low-cost reduction opportunities can implement larger reductions and sell their surplus reductions. Sources with high-cost reduction options can save money by purchasing surplus reductions from other participants instead.

*The Amer biomass co-firing power plant in the Netherlands.*
*Courtesy Essent, the Netherlands*

### *Renewable Certificates*

'Renewable certificates' can be used to meet the demand for the renewable energy, e.g., in the context of national renewable energy targets. The 'renewable certificates' represent the local services and benefits of the renewable energy, such as pollution abatement and jobs, but not necessarily the $CO_2$ emission reduction as this could lead to double counting, if for example $CO_2$ is covered by a cap-and-trade programme.

This option allows Country S to produce renewable energy above and beyond its own national targets and then sell the remaining amount in renewable certificates to Country D, while using the electricity in domestic markets. Country D in turn will be able to meet domestic targets of renewable energy sources by importing certificates to the extent that their national legislation on renewables accepts certificates from other countries. Policy makers in Country D may want to allow imported certificates only when Country S already meets any standards it may have domestically.

Much flexibility exists, as Country S could also sell the electricity without the renewable certificates separately (see 'Electricity' above). In any event, the renewable aspect of the energy must not be double counted. The renewable certificates of the energy can either be attached to the energy purchase, or removed and sold separately to those buyers that only need a renewable energy quota for their own portfolio. Flexibility also comes from the fact that both electricity and certificates can be sold to different purchasers at different times, so that maximum revenues can be achieved.

Green certificates are already traded within the EU. For example, utilities in the Netherlands have been importing significant amounts of green certificates for the last few years. Currently, certificates can be imported and sold as 'green electricity' in the Netherlands only from countries whose system of issuing Guarantees of Origin has been approved by the EU. Currently, these countries are Sweden, Finland, Denmark, Austria, the UK, and the Netherlands.

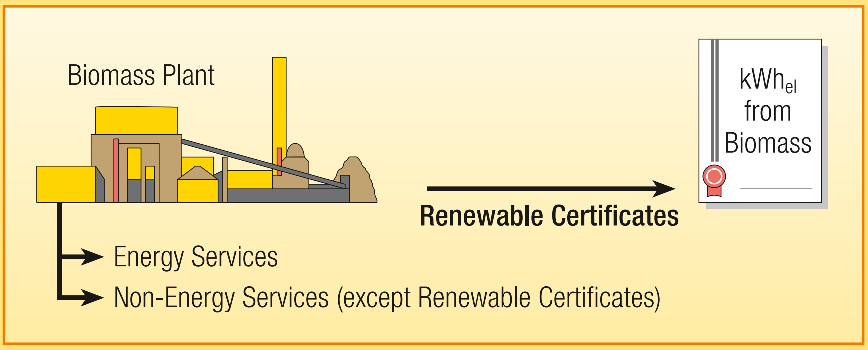



*Figure 5*
*Trading renewable certificates.*
*Source: Joanneum Research*

## $CO_2$ Credits

Concerns about global climate change have led to limits on emissions of GHG. One outcome of this concern is the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) which places limits on the emissions of industrialised nations in the period 2008–12 (the 'first commitment period').

The Kyoto Protocol foresees flexibility in meeting the targets, using the concept of emissions trading. For example, countries that over-comply with their targets can sell emission allowances to countries that would otherwise not meet their targets. $CO_2$ trading provides the flexibility of investing in those places where energy investments (either re-placement of existing facilities or investments to meet new energy demand) are due anyway, thus reducing the costs of $CO_2$ mitigation.

The Protocol also foresees that emission-reducing projects carried out in other industr-ialised nations (Joint Implementation – JI) or in developing countries (Clean Development Mechanism – CDM) can generate GHG credits that are tradable. Governments and private enterprises of industrialised countries with Kyoto commitments have begun to invest in JI and CDM projects, for example the Netherlands or Austria – see examples below.

In the case of bioenergy, trading $CO_2$ credits would mean that a biomass conversion plant is put in place in the 'seller' country and $CO_2$ credits are sold to the 'buyer' country. The amount of credits will depend on the baseline scenario in the 'seller' country that hosts the plant. That is, JI and CDM projects may be especially worthwhile where the marginal energy supply of the 'seller' country is very GHG intensive. It should be noted that for biomass projects outside the JI or CDM involving physical biomass or electricity trade, the baseline scenario of the 'buyer' country is of interest.

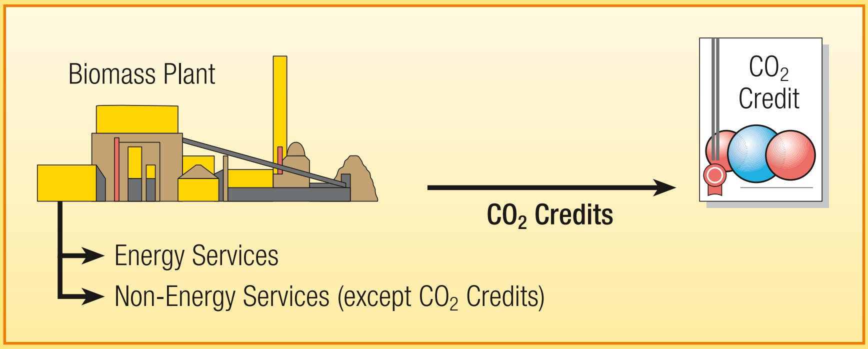
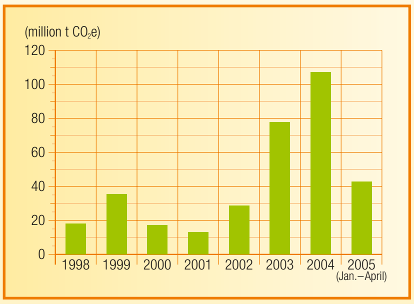



*Figure 6: Trading bioenergy $CO_2$ credits.*

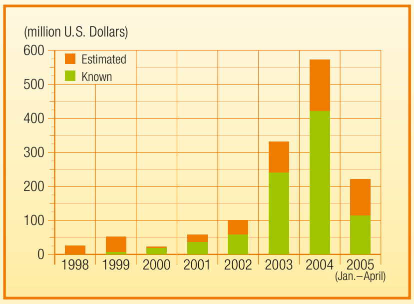
*Source: Joanneum Research*

There are several arrangements in which corporations, governments, or groups of these, purchase carbon credits either directly or indirectly through 'carbon funds'. Examples of the fund approach are the World Bank's Prototype Carbon Fund (PCF), the Community Development Carbon Fund and the Biocarbon Fund. For further details see www.carbonfinance.org.

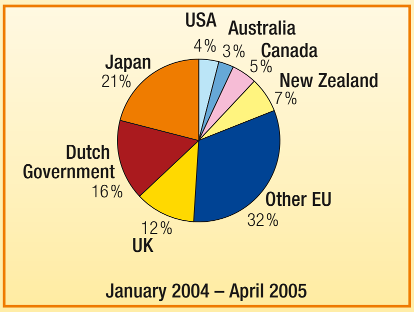
Another example is the European Emissions Trading System (ETS) which caps the emissions of combustion installations with a rated thermal input exceeding 20 MW, as well as those from other companies in the metal, mineral and pulp and paper industries above certain thresholds. The ETS also allows its participants to use credits from JI and CDM projects for companies, and thereby provides a link with the Kyoto Protocol Mechanisms.



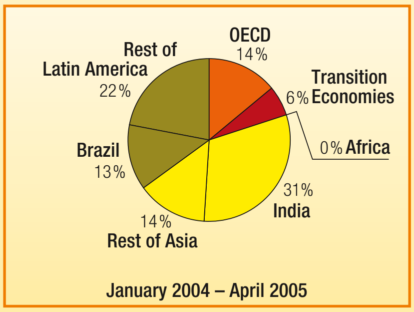

*Annual volumes (million t $CO_2e$) of project-based emission reductions traded up to 2012 vintages.*




*Estimated total market value per year in million US dollars, nominal.*




*Location of emission reduction projects and share of volume supplied.*




*Buyers of emission reductions and share of volume purchased.*

*Figure 7*

*Source: Lecocq, F. and Capoor, K. 2005. State and Trends of the Carbon Market 2005. Carbon Finance Business, World Bank, www.carbonfinance.org*

# Effectiveness of Trading Options

Policy and business decision makers will consider a host of criteria when determining the way to most efficiently reconcile supply of demand for renewable energy and carbon abatement. Questions to be addressed are whether a cost-effective biomass potential, and whether applications for biomass, exist domestically. If both biomass resource and applications are available locally then the trading options explained in this paper might be less attractive. However, if local resources are scarce but domestic applications exist then the biomass trading option might be of interest. If neither the resources nor the applications exist, then the purchase of renewable certificates and/or $CO_2$ credits is the only remaining option (except the consideration of other renewables).

Decision makers must also evaluate the environmental and social aspects of the different options. Biomass energy can, among other benefits, help diversify energy sources and supply local jobs. It is important that environmental, socio-economic, agricultural, energy, climate, and trade aspects are considered in policymaking.

Listed below are groups of criteria that may be important to policymakers, as well as decision makers in the energy sector, and the general public (energy users). This list is indicative, as there may be additional criteria that apply in specific situations, and some of the criteria below may not apply in all cases. For simplification, the term 'services' is used as a generic term to mean the energy content, $CO_2$ reductions, and other features of renewables.

**Criteria for the Decision Between Different Trading Options**

| | |
|---|---|
| **Supply Potential** | What is the technical and economic potential for a sustainable supply of 'services' of the exporting region? Consider factors such as competition with food production, other biomass uses, pressure on existing forests (e.g., deforestation) and local energy demand. |
| **Secure Demand** | How will demand for 'services' develop in the importing region e.g., competing (renewable) energy options, development of conversion capacity and indigenous biomass resources, future markets for certificates and credits. |
| **Logistical Capacity** | What logistical and conversion capacity is available in importing and exporting countries? Examples are transport infrastructure (harbours, roads), possibilities for co-fired systems, power lines etc. Another example is existing energy infrastructure in the importing country that may be more costly to change than importing certificates/credits. |
| **Reference Systems** | What is the reference energy system for importing and exporting countries? For example a low carbon intensity for importer and high carbon intensity for exporter indicate it may be better to use biomass locally and trade bio-electricity, credits, or certificates, or a combination. Similarly, the ability to use CHP in either location can enhance the amount of fossil fuel displaced. |
| **Sustainable Development** | What are the opportunities for matching 'services' production and export with rural and sustainable development? This includes issues of job creation, local air pollution etc. |
| **Diversification** | Is there a need for diversification of the energy supply mix in exporting and importing countries? |
| **Policies and Regulations** | Which trading options are favoured under existing policies such as renewable energy or $CO_2$ targets and regulations e.g., trade barriers, carbon accounting rules? |
| **Flexibility and Risks** | Which options allow more flexibility over time than others? For example, $CO_2$ credits and green certificates are traded at spot markets and will only be needed at the end of a longer period to close accounts, whereas physical energy carriers have to be imported at the time the demand occurs, i.e., on a continuous basis. |

# Examples of Different Trading Options

## The Netherlands

In the Netherlands, several of the different trade options described above are currently used simultaneously. Regarding the physical import of biomass, in 2004 the Netherlands produced approximately 4.9 TWh renewable electricity, of which about 3 TWh were produced from biomass. In turn, of these 3 TWh roughly 1 TWh was produced from imported biomass (e.g., pellets, palm oil, and agro-residues). Most of these biomass streams were imported from Canada and South-East Asia. The Copernicus Institute (the Task 38 team of the Netherlands) carried out a case study on 'GHG Balances of Biomass Import Chains for Green Electricity Production in the Netherlands. For further information see: www.ieabioenergy-task38.org/projects/task38casestudies/netherlands-brochure.pdf. Results of this case study are presented below.

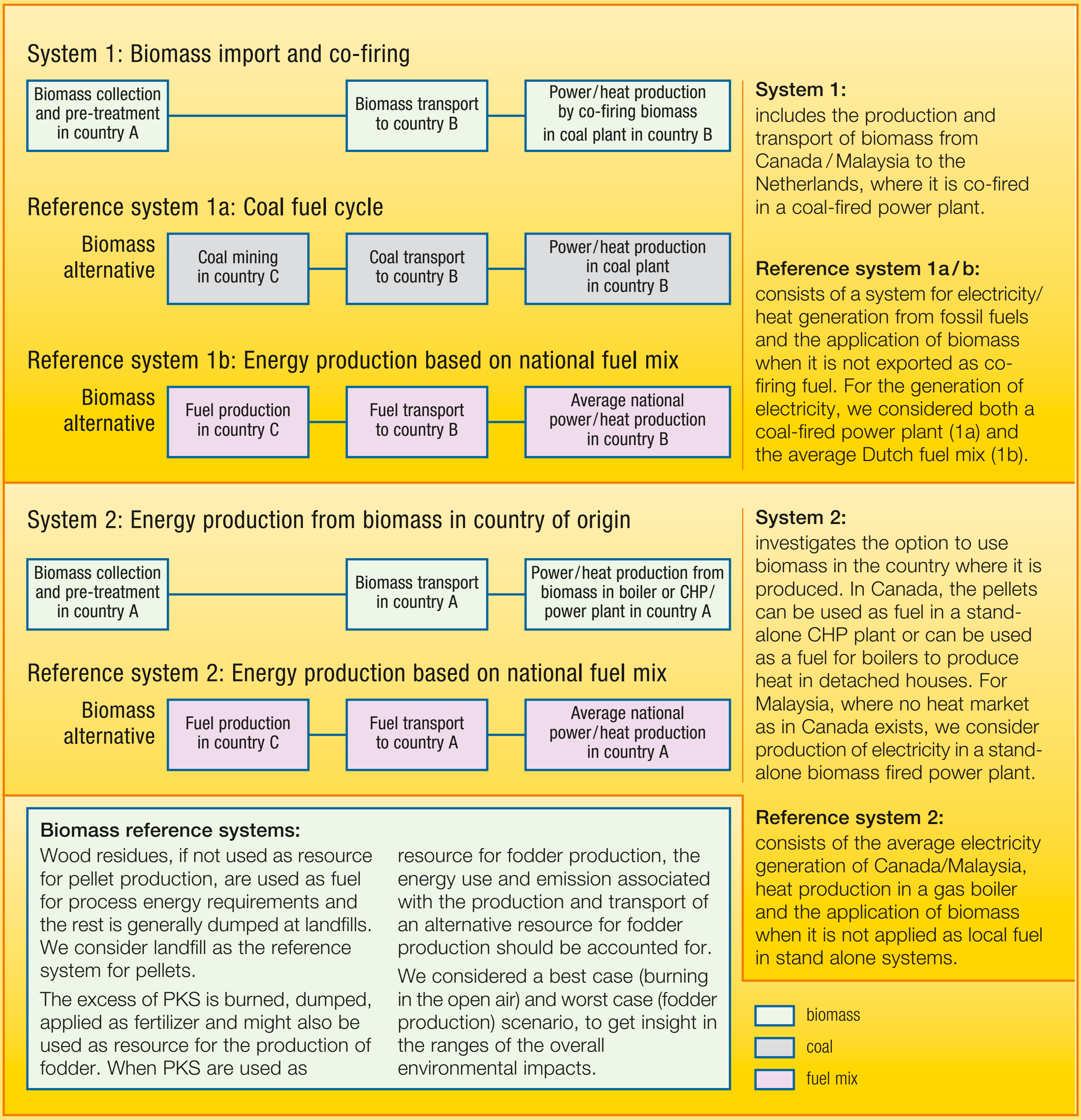



*Figure 8: Biomass chains versus reference system as documented in the Task 38 case study for the Netherlands.*

*Source: Kay Damen and André Faaij: GHG Balances of Biomass Import Chains for Green Electricity Production in The Netherlands. IEA Bioenergy Task 38, Graz, Austria, February 2005*

In terms of physical import of electricity, the Netherlands is a net importer of electricity. In 2003, the Netherlands imported about 17 TWh of electricity, mainly from Belgium and Germany, probably from coal-fired and nuclear power plants. Regarding the trade in renewable electricity certificates, the Netherlands have imported large amounts of certificates over the last few years. The Dutch demand side support for renewables was relatively generous from 1999 onwards, causing the number of households using renewable electricity to surge to over two million. As domestic renewable electricity production cannot cover this demand, in 2004 the Netherlands imported approximately 10 TWh of renewable electricity certificates, of which about 75 % was from biomass, mainly originating from Finland and Sweden.

Finally, regarding the trade of emission reduction certificates, the Netherlands is actively involved in JI and CDM projects. Carbon credits (see www.carboncredits.nl) buy emission reductions for the Dutch government via JI and CDM, and their portfolio includes 23 JI and CDM projects. The total contracted volume was 16 million tonnes of $CO_2$ in November 2005. Current JI projects in the Dutch programme include mainly wind energy, biomass energy, hydroelectricity, and landfill gas utilisation. The market price is between 6 and 12 Euros per tonne of $CO_2$, depending on contractual details.

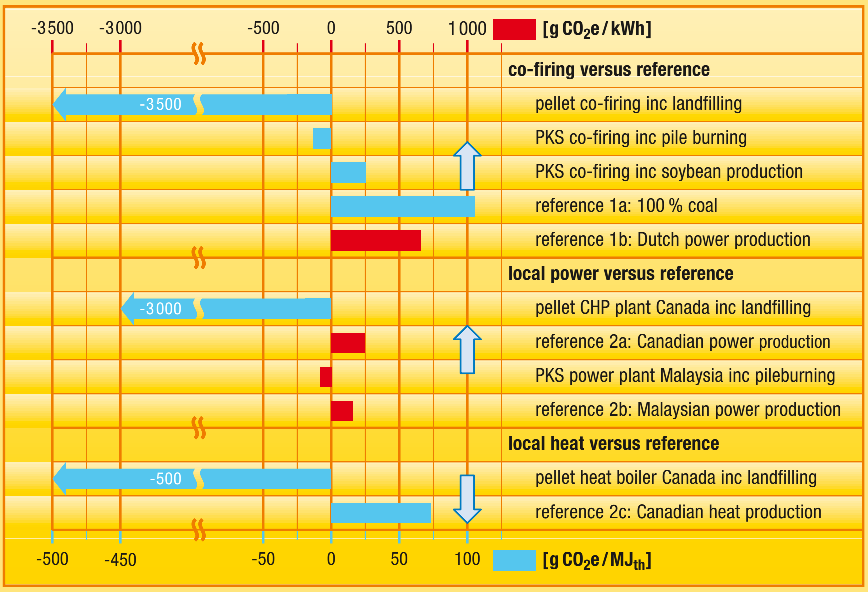



*Figure 9*

*GHG emissions of pellets and palm kernel shells (PKS) import and co-firing and use as a fuel in stand-alone combustion systems in country of origin versus reference power/heat production.*

*Axis above:*
*$CO_2$ equivalents for electricity systems (g $CO_2$e / kWh).*

*Axis below:*
*$CO_2$ equivalents for heat systems (g $CO_2$e / MJ the).*

*Source:*
*Kay Damen and André Faaij:*
*GHG Balances of Biomass Import Chains for Green Electricity Production in The Netherlands.*
*IEA Bioenergy Task 38, Graz, Austria, February 2005*

## Biomass Activities in the Austrian JI and CDM Program

The amount of biomass energy imported and exported is rather small. Austria has large forest resources. In 2003 2.5 PJ of fuel wood were imported, and 0.9 PJ exported. As well, 4.5 PJ of biofuels were imported, and 6.9 PJ exported. The Austrian Government has also started its JI and CDM programme (see www.ji-cdm-austria.at). One of the 13 JI projects under contract so far is a biogas plant in Hungary. Of the other 35 JI projects that are being assessed, three deal with biomass. Also six of the 24 CDM projects under contract are biomass power plants based on agricultural residues in India and Malaysia. Another 17 biomass-based CDM projects are being assessed as of December 2006.

**JI and CDM Biomass Projects Contracted by Austria**

| Type of Flexible | Title of Project | Country | Technology | Emission Reductions Mechanism by 2012 (t $CO_2$e) |
|---|---|---|---|---|
| **JI** | Palhalma Biogas Plant | Hungary | Biogas Plant (Digester) | 163,000 |
| **CDM** | APCL Mustard Crop Residue Power Plant | India | Biomass Power Plant | 244,000 |
| **CDM** | JCT Biomass CHP Plant Using Rice Husk | India | Biomass Power Plant | 147,000 |
| **CDM** | RSCL Bagasse CHP Plant | India | Biomass Power Plant | 455.000 |
| **CDM** | JCT Biomass CHP Plant | India | Biomass Power Plant | 120.000 |
| **CDM** | Ajbapur Bagasse CHP Plant | India | Biomass Power Plant | 252.000 |
| **CDM** | Bumibiopower Biomass CHP Plant | Malaysia | Biomass Power Plant | 285.000 |

*Source:*
*Kommunalkredit*
*Public Consulting GmbH*

# IEA Bioenergy Task 38 and Task 40 Workshop

## Summary of a workshop in Trondheim, 5–6 APRIL 2006 on Greenhouse gas credits trade versus biomass trade – weighing the benefits'

*This international workshop was jointly organized with ENOVA. The following summary has been published in the IEA Bioenergy Newsletter (Volume 18, Number 1, July 2006):*

Trade in biomass fuels, electricity from renewable resources, renewable certificates and $CO_2$ credits provide options for business and policy makers to use biomass available in other parts of the globe to reduce GHG emissions, increase renewable energy and meet increasing energy demands.

The main objective was to address the advantages and disadvantages of biomass trading possibilities, and to assess the necessary accounting rules and criteria to select the most efficient mechanisms under varying circumstances. It provided a forum for government, business and academic representatives to exchange and gain information on the status of the various biomass-carbon trading and certificate trading markets.

Session one on international biomass trade and greenhouse gas accounting covered examples of biomass trade from countries such as Norway, Canada, Belgium and the Netherlands. While Norway clearly is at the beginning of developing (inter-)national bioenergy markets, Canada on the one hand and Belgium and the Netherlands on the other have exported/ imported several 100 ktonnes of wood pellets based on mill residues over the last years, and this trend is continuing to rise. In Canada, large amounts of forest are affected by the mountain pine beetle. A case study revealed exporting wood pellets from these forests to the Netherlands for electricity production could result in net GHG emission reductions of over 200 ktonnes of $CO_2$ Eq per year. In the importing countries Belgium and the Netherlands, the overall sustainability of the biomass import schemes are of increasing importance. This in particular includes the overall GHG and energy balances of (imported) biomass and use. For example, in Wallonia, the number of green certificates issued for producing electricity from biomass is coupled to the GHG emissions during the production and transport of the biomass and the accounting system is embedded in a law.

Furthermore, two studies were presented evaluating physical trade of biomass from Brazil, Mozambique and Sweden to the Netherlands. Main findings were that transportation distances are of minor importance, but that reference systems in both exporting and importing countries have a major impact on the consideration physical trade vs. trade in $CO_2$ certificates. Also land use change (included in CDM, excluded in physical trading), accounting rules and the timeframe considered have influence on the results.

Session two focused on the use of biomass under emission trading and certificate trading schemes. In Finland the EU Emissions Trading System (EU ETS) has increased the average price of fuel and the amount of biomass available for bioenergy. The increase in price has meant that board manufacturers have reduced production and price may also impact on the pulp and paper industry indicating it is important to look at national policy to avoid such occurrences. Norway has a green certificate system whereby a unit of renewable energy (hydro, wind or biomass) generates a separate green certificate, which can be sold independently of the electricity. Biomass is more complicated to certify than other renewable energies due to the use of renewable and non-renewable primary energy. To facilitate international trade internationally harmonised systems are required.

CDM was the focus of a number of presentations from a range of perspectives. An overview of CDM projects was presented and indicated that biomass energy projects were the most common CDM projects among renewables, with an expected installed capacity of 2511 MW, largely from cogeneration of bagasse and agricultural waste. A common theme running through presentations was the need for biomass CDM projects to contribute to local sustainable development and other local objectives eg job creation and also have a monitoring or certification system that proves the sustainability of the biomass resource for local use or international trade. International trade in biomass may be in competition with the local use of biomass.

The workshop concluded that the various trading options for biomass and emission credits produced by biomass have various pro's and con's for buyers and sellers, depending on the potentials, markets and timeframes considered. Nevertheless, trading options strongly enhance the use of biomass altogether, because supply and demand for energy, $CO_2$ emission reduction and other benefits of biomass can be matched where this was previously not the case. Furthermore, developing proper and workable GHG accounting systems and overall sustainability evaluations (e.g. for biofuel production and trade) are needed, but could be developed in conjunction with the lessons (being) learned for CDM bio-energy projects. This is a very important field for market parties, policy makers and the teams of IEA Bioenergy Tasks 38 and 40 that will certainly be addressed in future work.

The PowerPoint presentations of this event you find under the workshop websites:

- www.ieabioenergy-task38.org/workshops/trondheim06
- www.bioenergytrade.org/activities2006/norway.html

# IEA Bioenergy

**IEA Bioenergy** (www.ieabioenergy.com) 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.

## Task 40

Sustainable International bioenergy Trade: Securing Supply and demand

The core objective of **IEA Bioenergy Task 40** is to support the development of sustainable, international bioenergy markets and trade. Key aims are ▪ to improve the understanding of biomass and bioenergy markets and trade; ▪ to analyze the possibilities to develop biomass resources and exploit biomass production potentials in a sustainable way, including supply chains and required logistics; ▪ to perform coherent analyses of biomass markets and trade by modeling and scenario analysis; ▪ to evaluate the political, social, economic and ecological impact of biomass production and trade, and develop frameworks to secure the sustainability of biomass resources and utilization, and ▪ to provide high quality information on these topics to market parties, policy makers, international bodies and NGO's.

## Task 38

Greenhouse Gas Balances of Biomass and Bioenergy Systems

**IEA Bioenergy Task 38** brings together the work of 13 participating countries on greenhouse gas (GHG) balances for a wide range of biomass systems, bioenergy technologies and terrestrial carbon sequestration. The key objectives are ▪ to increase the understanding of GHG outcomes of bioenergy and carbon sequestration on a LCA basis, focussing on new bioenergy technologies, and on interaction of key technical and methodological issues; ▪ to develop, improve, compare and make available models for assessing GHG balances including economic efficiency, energy security, environmental and socio-economic issues; ▪ to disseminate best practice in biomass-based GHG emission reduction and support implementation of GHG mitigation projects; ▪ to aid decision makers in selecting mitigation strategies that optimize GHG benefits.

# Task Coordination


**André Faaij**
**Copernicus Institute for Sustainable Development, Utrecht University**
Heidelberglaan 2
3584 CS Utrecht, The Netherlands
Phone: +31 30 2537-643
Fax: +31 30 2537-601
a.faaij@chem.uu.nl

**Bernhard Schlamadinger**
**Joanneum Research Forschungsgesellschaft mbH**
Elisabethstrasse 5
8010 Graz, Austria
Phone: +43 316 876-1340
Fax: +43 316 8769-1340
bernhard.schlamadinger@joanneum.at

**Peter-Paul Schouwenberg**
**Biofuels Commodities & Development, Essent**
Willemsplein 4
5211 AK – 's Hertogenbosch
The Netherlands
Phone: +31 73 8531-733
Fax: +31 73 8531-578
peter-paul.schouwenberg@essent.nl

**Kimberly Robertson**
**New Zealand Force Consulting**
444 Pukehangi Rd.
Rotorua,
New Zealand
Phone: +64 7 343-9559
Fax: +64 7 343-9557
kimberlyrobertson@xtra.co.nz


# Assisted by


**Martin Junginger**
**Copernicus Institute for Sustainable Development, Utrecht University**
Heidelberglaan 2
3584 CS Utrecht, The Netherlands
Phone: +31 30 2537-613
Fax: +31 30 2537-601
m.junginger@chem.uu.nl

**Susanne Woess-Gallasch**
**Joanneum Research Forschungsgesellschaft mbH**
Elisabethstrasse 5
8010 Graz, Austria
Phone: +43 316 876-1330
Fax: +43 316 876-1320
susanne.woess-gallasch@joanneum.at


**www.ieabioenergy-task38.org**
**www.bioenergytrade.org**


oefpbf06018

IEA Bioenergy: T38: 2006: 02
This folder was designed and published on behalf of IEA Bioenergy Task 38 and Task 40
by JOANNEUM RESEARCH Forschungsgesellschaft mbH, Steyrergasse 17, 8010 Graz, Austria. December 2006.