

# Developing Sustainable Trade in Bioenergy

## Summary and Conclusions from the IEA Bioenergy ExCo65 Workshop

This publication provides the summary and conclusions from the workshop 'Developing Sustainable Trade in Bioenergy' held in conjunction with the meeting of the Executive Committee of IEA Bioenergy in Nara City, Japan on 12 May 2010.

The purpose of the workshop was to provide the Executive Committee with perspectives on bioenergy trade in a world where there are progressively more quantitative targets for bioenergy deployment, including incentives for production of biofuels on a sustainable basis. The aim was to stimulate discussion between the Executive Committee and invited experts and thereby enhance the policy-oriented work within IEA Bioenergy.

**IEA Bioenergy**

IEA BIOENERGY: ExCo:2011:02



## INTRODUCTION

This workshop summary on sustainable trade is the latest in a series of publications from IEA Bioenergy. Workshops are a constructive way to deal with sometimes controversial energy topics and make the results available to interested parties in research, industry, and government.

The workshop on sustainable trade was organised in Nara City, Japan with the aim of informing the Executive Committee (ExCo) as well as invited guests from Japan and other East Asian countries. One of the reasons for holding this workshop in Japan was the centuries-old tradition of trade between Asian and European nations, with both continents now represented in the Agreement. Since World War II trade has tended to be dominated by technical equipment such as machinery and vehicles but is shifting today towards biomass for energy and associated technology. Along with this shift, not only has the product changed but also the distances to market, with the inclusion of South American countries such as Brazil.

## BACKGROUND

One of the important goals of IEA Bioenergy is to facilitate commercialisation and market deployment of environmentally sound, sustainable, and cost-competitive bioenergy technologies. Task 40 of the Agreement is entirely dedicated to this topic and Task 38 focuses on the calculation of sound systems through life cycle assessments (LCA).

There are a number of barriers to be overcome in order to achieve market driven, soundly-based trade. There are questions to be answered about market limitations, energy efficiency of transport and above all sustainable production, conversion, and application of the biomass. Over recent years the questions of food versus fuel and increased emissions resulting from land use change (LUC) have been heavily debated. Some groups, mainly NGOs, are arguing that worldwide markets in biomass should be limited if not prohibited, in order to save the available land solely for food production. The destruction of swamps and rain forests with naturally high carbon density should also be avoided, they say.

IEA Bioenergy therefore decided to invite market participants from Asian, American and European countries together with Task representatives to discuss the potential and limits of worldwide trade in bioenergy and highlight possible solutions.

Given this background the workshop set out the following questions that could possibly be answered by the different contributions:

- What are regional supply potentials, particularly for the Asia Pacific Region?
- What are current trade flows?
- What is the long term prospect for traded biomass (or will strong domestic markets for biofuels develop)?
- Are the biomass supplies sustainable?

- Are there significant barriers holding back market development?
- What role can IEA Bioenergy best play?

The five sessions in the workshop addressed the following topics (session facilitators in parentheses):

**Session 1** – Overview and Scene Setting  
(Yves Schenkel, Belgium)

**Session 2** – Trade in Solid Biofuels  
(Steve Schuck, Australia)

**Session 3** – Trade in Liquid Biofuels  
(Sandra Hermle, Switzerland)

**Session 4** – Sustainability Developments and Trade  
(Tat Smith, Canada)

**Session 5** – Discussion and Conclusions

The main points of the speakers and some of the questions raised during discussions are summarised below. The original contributions of the speakers can be downloaded from IEA Bioenergy's website [www.ieabioenergy.com](http://www.ieabioenergy.com).

## SESSION 1 – OVERVIEW AND SCENE SETTING

The first part of the workshop tried to answer the question – why has international biotrade become a topic of discussion and some controversy.

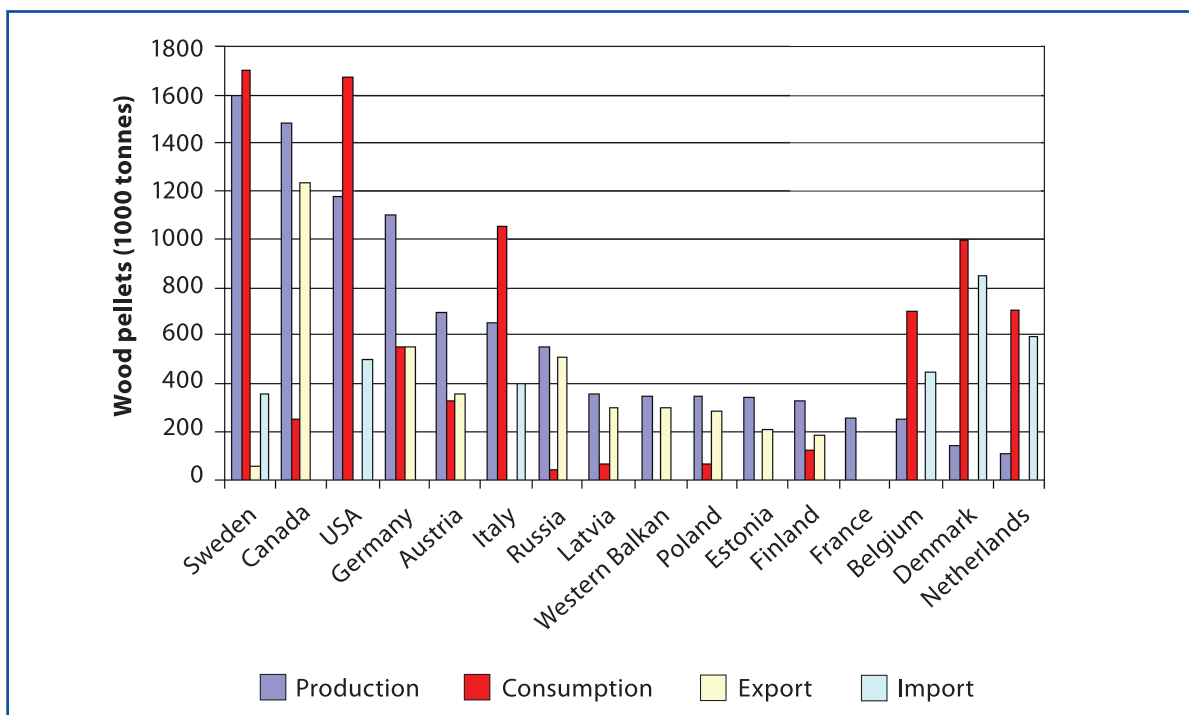
### **Overview of World Bioenergy Trade: IEA Bioenergy Task 40 – Kees Kwant, Operating Agent Task 40 and ExCo Member, NL Agency, the Netherlands**

The participants in Task 40 comprise 14 countries from Europe, North America, and Asia, plus the European Commission. Major themes in the Task's work programme include: securing sustainable biomass supplies; sustainability and certification; trade, market, and demand dynamics; transport, logistics, and trade; and outreach/dissemination.

**Trade:** Biomass trade is not a future system that needs to be developed – it is today's reality. A short historical review showed that trade in biomass has a long tradition e.g. between Japan and the Netherlands it started as early as 1600 when the first contract was signed. This contract concerned trade in spices. Today's contracts deal with biomass for energy. However, in both cases the products are of agricultural origin. Also the driver for trade opportunities remains the same: one country produces an agricultural product in excess that another country has a need for and is willing to buy.

Over time Japan changed from an exporter to an importing nation. Biomass, or first derivatives thereof, come most often from developing countries. The global potential for bioenergy is large, as was pointed out by the 'Bioenergy Review' (IEA Bioenergy, 2009<sup>1</sup>). Today, biomass comprises roughly one third of the world's energy consumption or about 300 EJ including, for example, 52.9 million tonnes of bioethanol; 10.6 million tonnes of biodiesel and 11.5 million

<sup>1</sup>IEA Bioenergy. 2009. Bioenergy – a sustainable and reliable energy source. A review of status and prospects. [www.ieabioenergy.com/LibItem.aspx?id=6479](http://www.ieabioenergy.com/LibItem.aspx?id=6479)



**Figure 1.** Pellet production and consumption in selected countries.

tonnes of wood pellets. The potential is far higher. It could be 400 EJ per annum according to a recent study by Task 40 (Dornburg et al., 2008<sup>2</sup>). The IEA World Energy Outlook 2009 indicated an even higher range of 600 to 1000 EJ per annum.

Biomass is grown around the world in areas with good climatic conditions and low population density (e.g. palm oil in Malaysia and Indonesia, wood in Nordic countries, corn in the USA, and sugarcane in Brazil). The USA with 26.8 million tonnes and Brazil with 21.3 million tonnes are the largest bioethanol producers but at the same time also the largest consumers with 28.4 million tonnes (4.6% has to be imported) and 16.5 million tonnes respectively. Together they cover 91% of the world production. The consumption in the EU amounts to 2.6 million tonnes, the largest consumers being France, Germany, Sweden, and the Netherlands.

From 2004 to 2008 the world biodiesel production increased six-fold from 1.8 million tonnes to 10.6 million tonnes. The EU produces about two-thirds of this (7.8 million tonnes), Germany, France, Italy and Spain being the top producers.

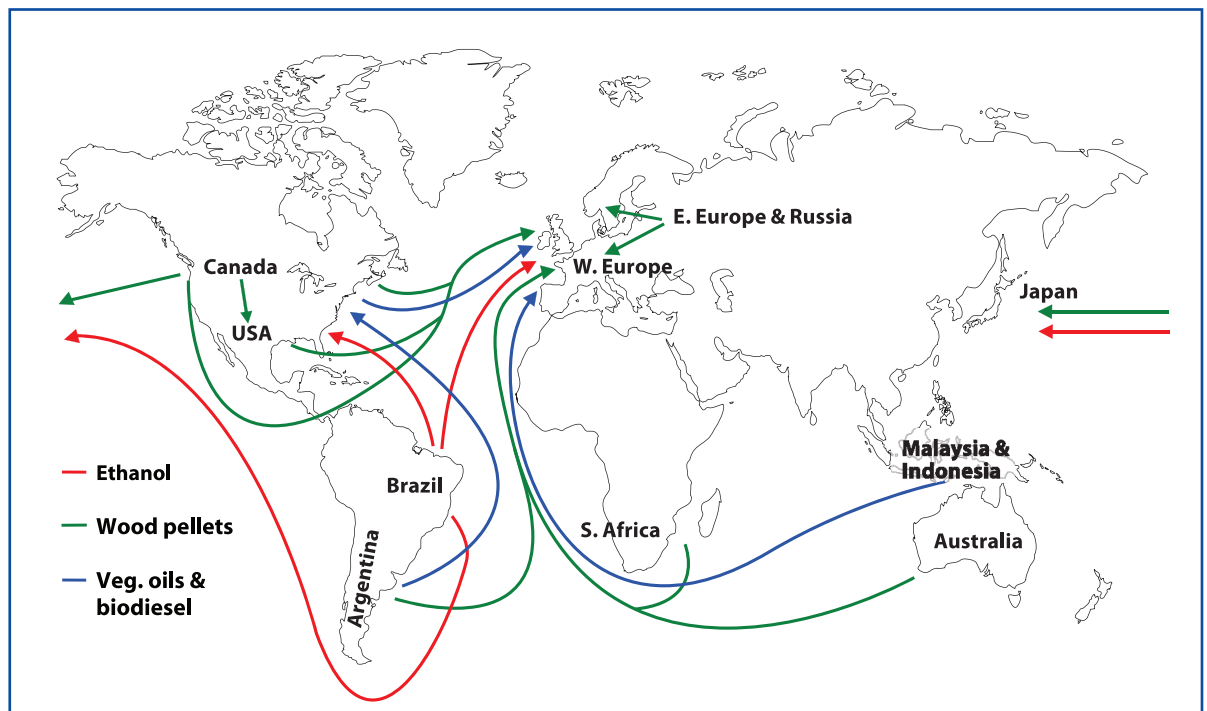
Production and trade is strongly influenced both by the climate (temperature and water) and by financial incentives. As a result of a new tax on biodiesel in Germany and a new financial incentive in Argentina, the production of biodiesel is shifting from the former to the latter, i.e. trade is increasing. EU production declined by 7% in 2009. The market is imbalanced as a result of such financial support and levies, and policy is not always working in the desired direction.

Europe is the largest consumer of wood pellets with about 8.5 millions tonnes per year (Figure 1). It is therefore not surprising that most pellet production occurs in European countries, followed by USA and Canada. In 2008 about 8 million tonnes of pellets were produced in 30 European countries, 1.8 million tonnes in the USA, and 1.4 million tonnes in Canada. British Columbia exports all of its pellet production to the Netherlands, Sweden, and Belgium. However, Toronto decided recently to use more wood pellets domestically so it is expected that pellet trade will substantially change.

**Trade barriers:** Bioenergy trade is substantial today (Figure 2), however it could be even more significant in the absence of barriers to trade. An investigation by Task 40, including a questionnaire, showed that tariffs, technical standards, sustainability criteria, logistics, and phytosanitary measures are the strongest barriers. For ethanol, sustainability barriers are very important, but for biodiesel they are more of an opportunity than a barrier.

How will trade develop in the future? South America, Southern Africa, Asia, and Australia have the potential to grow far more biomass in future as is shown in Figure 17 (page 14), and could become future exporters. However, shipping might be a limiting factor. Task 40 is now doing a study on the implications for shipping of large scale bioenergy trade. Special focus will be given to whether it is better to transport raw material (such as grains, palm oil, or molasses) or final products like biodiesel and ethanol. It is undisputed, however, that for final refining in the importing country, the upgrading plant must be located at the port.

<sup>2</sup>Dornburg et al., 2008. Biomass Assessment of global biomass potentials and their links to food, water, biodiversity, energy demand and economy. [www.bioenergytrade.org/downloads/wabbiomassmainreportbiomassassessment.pdf](http://www.bioenergytrade.org/downloads/wabbiomassmainreportbiomassassessment.pdf)



**Figure 2.** Current main shipping lanes for biomass and biofuels for energy.

Land transport is prohibitive in terms of energy use and cost. Abengoa Bioenergy, one of the world's largest ethanol plant owners, is building a large plant in Rotterdam based on wheat as the feedstock.

**Sustainability criteria:** A literature search by Task 40 found that a total of 67 initiatives on certification and/or sustainability criteria are in place (van Dam, 2010<sup>3</sup>). The market is asking for sustainability criteria but no producer will start introducing measures before it knows what the market and/or governments really want. Producers need a firm and stable commitment. The presence of 67 schemes is more of a problem for, than a promotion of, sustainable production.

In the EU, by the end of 2010, Member States have to transpose the sustainability criteria for biofuels and bioliquids of the Renewable Energy Directive into national legislation; which in many cases will be done via the introduction of certification schemes. This may serve as a first move to reduce the number of individual schemes. Some countries impose the establishment of international accepted certification schemes. The Netherlands for example support biomass growers in developing countries with a total of €20 million for the certification of crops such as *Jatropha*, etc.

Besides the sustainability criteria for transport there are still a few methodological problems to be solved for the necessary LCAs, e.g. does the production of biogas from animal waste count as a local energy source or as imported because the fodder comes from outside the country? Or if ethanol is produced in Rotterdam from imported biomass and exported to other countries, how is this counted?

In conclusion, it can be said that bioenergy trade is significant today and is expected to continue to grow substantially. Sustainability standards have been developed but the huge choice of schemes desperately needs harmonisation. It is important that the development of bioenergy trade and sustainability standards go hand in hand.

#### Overview of Market Developments in Asia: Future Energy Demand in Asia – Shigeru Kimura, the Institute of Energy Economics, Japan

Primary energy consumption in the Asian region is already the highest in the world and models indicate that dramatic growth will continue. The Institute of Energy Economics, Japan (IEEJ) and the International Energy Agency (IEA) indicate that energy demand in Asia will increase at a rate of 2.5% per annum in comparison, the growth rate of energy demand in the entire world will decrease to 1.5% per annum. In 2035 energy demand will be twice as high as in 2007 growing from 3.6 to 7.1 billion toe (Figure 3). Non-OECD countries will represent 90% of the incremental growth of global energy demand by 2035.

The major driver for the increase in Asian energy consumption is the booming economies of China and India. China will double its energy consumption by 2035 from 1.8 to 3.5 billion toe; and India's energy demand will grow by a factor of 2.8 from 0.4 to 1.2 billion toe. Together, the two nations will account for 66% of the Asian primary energy demand. Japanese demand, on the other hand, will decline from 14% to 7% due to slower economic growth and decreasing population.

<sup>3</sup>van Dam, J. 2010. Background document from: van Dam et al (2010), from the global efforts on certification of bioenergy towards an integrated approach based on sustainable land use planning. [www.bioenergytrade.org/downloads/overviewcertificationsystemsfinalapril2010.pdf](http://www.bioenergytrade.org/downloads/overviewcertificationsystemsfinalapril2010.pdf)

**Fossil fuels:** Coal and oil will remain the major sources of energy in Asia until 2035. Coal consumption will increase by 1.8% annually until 2035 as compared to 5.2% from 1980 to 2007. The share of coal in the energy demand will drop from 52% to 43%, whereas oil will only drop from 31% to 29%. Natural gas on the other hand will increase its share from 11% to 16% mainly replacing coal for electricity production in order to reduce carbon dioxide emissions. In total, fossil fuels will reduce their share from 94% to 88%.

In 2007 about 85% of the electricity production in the ASEAN-6 countries was produced from fossil fuels: 46% natural gas, 28% coal, and 11% petroleum products. Hydro and geothermal contributed about 14%. Only Thailand used biomass (1%) (IEA, 2010<sup>4</sup>). The climatic conditions of most of the ASEAN States are favourable for production of solar energy with an average mean daily global solar radiation of up to 5 kWh per m<sup>2</sup>. However, so far virtually no solar electricity is produced, even though in 2009 China became the largest producer of PV cells.

Production of renewable energy in South East Asia is expected to grow more slowly than in Europe, according to the national plans. Hydropower will maintain a share of about 2%, despite the large scale projects in China. Total production from other renewable energies is expected to only increase from 1.3% to 4.1%.

**Drivers of energy consumption:** The main driver of increased oil demand is the growth of vehicles in both India and China. The stock of cars in Asia is around 200 million vehicles. Japan accounts for 39%, followed by China with 22% and India with 9%. The projection for 2035 is 620 million cars operated in the Asian region. China will increase to 254 million vehicles from 2007 to 2035 corresponding to 60%

of the total vehicle increase in Asia. The increase for India is predicted to be 19% resulting in some 80 million vehicles on the roads. Japan on the other hand will maintain the current number of cars or decrease slightly.

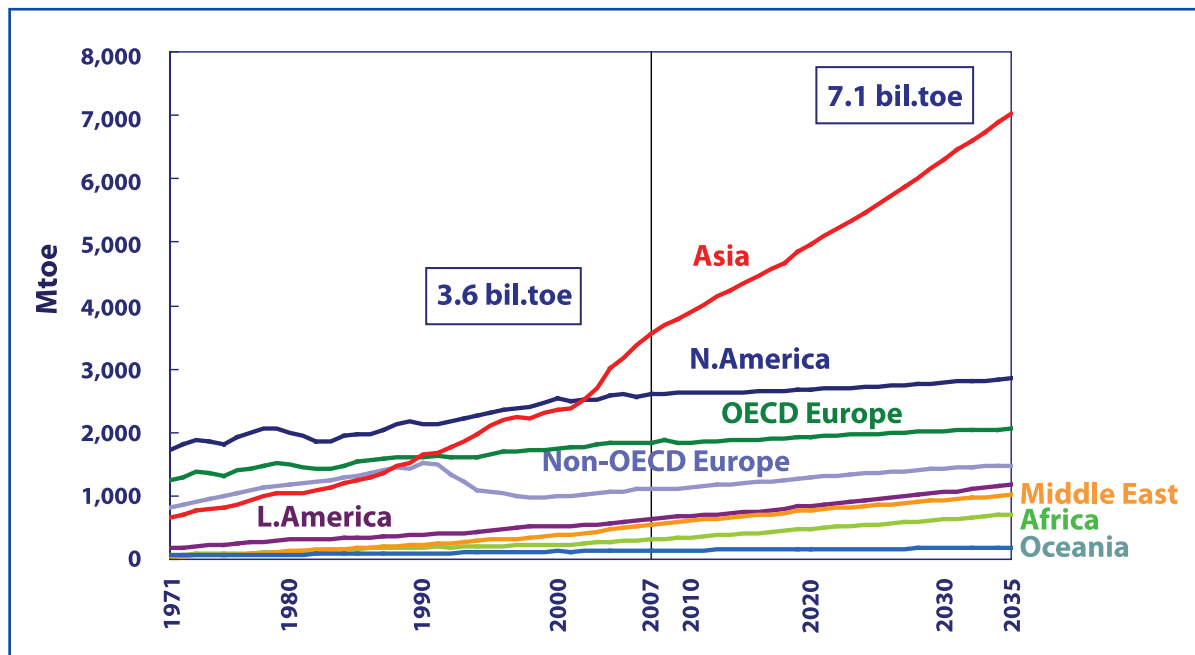
The fact that the efficiency of cars is being continuously optimised to reduce fuel consumption is not sufficient to counter-balance the increasing consumption driven by the large increase in new cars.

**Energy saving:** The energy analysis above prompted the leaders of the East Asia Summit (EAS), consisting of the 10 ASEAN countries plus Australia, China, India, Japan, Korea and New Zealand, to advance energy efficiency and conservation, and the use of biofuels. In 2007 political leaders signed a declaration on East Asian Energy Security (the Cebu Declaration) with the following goals:

- Set individual goals and formulate voluntary action plans for improving energy efficiency.
- Encourage collective efforts in intensifying the search for new and renewable energy resources and technologies, including research and development in biofuels.
- Encourage the use of biofuels and work towards a standard on biofuels used in engine and motor vehicles.

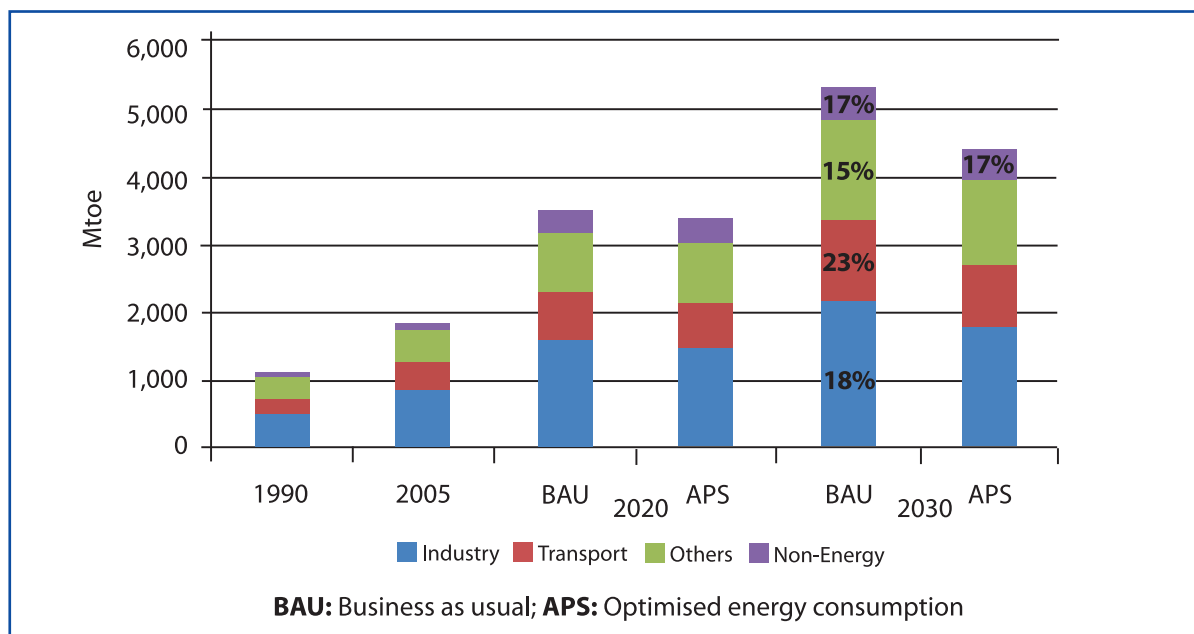
In response to this declaration, three working groups were formed led by the Economic Research Institute for ASEAN and East Asia (ERIA) to undertake studies on the 'Analysis of Energy Saving Potential', 'Sustainable Biomass Utilisation Vision', and 'Standardisation of Biodiesel Fuel for Vehicles'.

The working group on 'energy saving potential' is comprised of 16 experts from all the countries involved plus experts from IEEJ. As a first measure they established a methodology



**Figure 3.** Primary Energy Demand Projection in World. Source: IEEJ Energy Outlook 2009

<sup>4</sup>IEA 2010. Deploying Renewables in South East Asia – trends and potentials. [www.iea.org/papers/2010/Renew\\_SEAsia.pdf](http://www.iea.org/papers/2010/Renew_SEAsia.pdf)

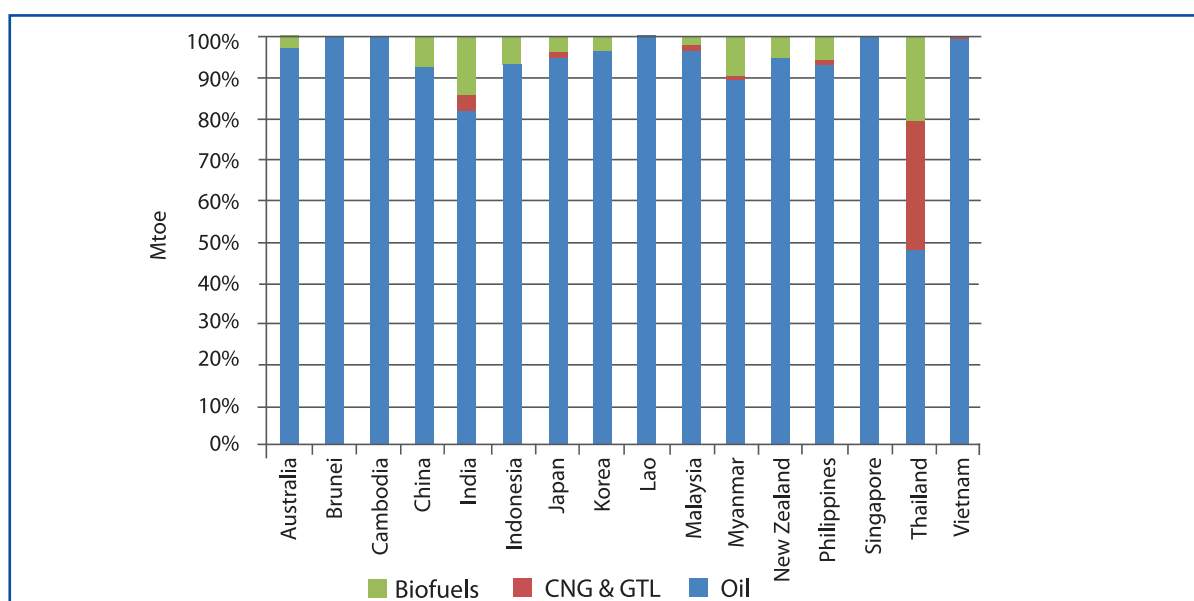


**Figure 4.** Primary Energy Supply 2030 in East Asia. Source: ERIA EEC WG Report 2010

to assess the potential for savings by defining energy consumption in a business as usual (BAU) scenario versus a more efficient energy utilisation (APS) scenario. The results showed that the energy efficiency and conservation policies could reduce the total primary energy supply (TPES) and total final energy consumption (TFEC), by 20% and 17% respectively (Figure 4). The highest reduction in TFEC was in the transport sector at 23%. It was noted however that these policies, despite the decreases in TPES and TFEC (which could reduce CO<sub>2</sub> emissions by 28%) would not be sufficient to reduce environmental emissions by 2030. The emissions would still be double that of 2005.

With regard to biofuel policies, five of the 16 EAS countries have no plan to use biofuels. Of the 11 countries with biofuels policies, nine plan to use biofuels at less than 10%

of their total road transport fuels by 2030 (Figure 5). Only two countries have more aggressive policies. India plans to displace 15% of road transport fuels with biofuels by 2030 and Thailand has a target of 20%. Thailand also aims to further reduce the share of oil in road transport to 50% by using compressed natural gas (CNG) and liquid fuels from natural gas. In terms of overall use of biofuels in EAS, the total share of biofuels in 2030 will be 8% of total road transport fuels or 67 mtoe – equivalent to three times the road transport consumption of Thailand in 2005. This is a significant amount indicating a large market for biofuels. In this regard, biofuels should be affordable, should not compete with food supplies, and have standard specifications to facilitate trade. On the policy side, removing subsidies from gasoline and diesel oil and providing incentives to biofuels suppliers will be important in increasing the use of biofuels.



**Figure 5.** Share of biofuels in the transport fuel mixture. Source: ERIA EEC WG Report 2010

## SESSION 2 – TRADE IN SOLID BIOFUELS

### Australian Pellet Export Outlook – David Smith, Willmott Forests, Australia

In total Australia has 163 million hectares of native forest producing 10 million m<sup>3</sup> of logs per annum. The plantation estate comprises 1 million hectares of hardwood plantations and 1 million hectares of softwood plantations. From these, 20 million m<sup>3</sup> of logs are produced per annum, increasing to 30 million m<sup>3</sup> by 2014. The plantations are located predominately in the south of the country, south of Perth, near the southern coast of South Australia and between Australia's major cities of Melbourne and Sydney.

Australia currently produces relatively little electricity from biomass, a mere 867 MW predominately from bagasse from the sugar industry via cogeneration (464 MW) and from black liquor in the pulp and paper industry (50 MW). However, other opportunities exist – the forest industry has an estimated 23 million tonnes of biomass resource available which could produce an estimated 1,500 MW.

Traditionally the softwood plantation industry in Australia has expanded on cutover native forest land, but more recently planting has extended to marginal farm land. All the wood produced from this 1 million hectare estate has been commercially utilised within a predominantly domestically focused timber industry. The core demand is for saw logs for structural timber and pulp logs for the paper and cardboard industry.

Currently the residues produced from harvesting operations are left in the forest. The volumes are in the order of 70 to 120 tonnes per hectare depending upon the prevailing pulpwood markets. The development of residue markets via the production of pellets would result in changes to the harvesting systems applied. These would include more 'whole tree' harvesting where the tree is skidded to a centralised landing for processing.

Pellet production in Australia is still in its infancy with only about 125,000 tonnes per annum produced at present. Today's production focuses primarily on plantation forestry woodchips and residues from sawmills. However there are opportunities to use residues from the plantations and from dedicated short rotation coppice crops.

There is a considerable potential for new plantations to be established for further biomass and pellet production. One such opportunity is located near Esperance in Western Australia (south east of Perth) with about 30,000 ha available. Esperance has:

- a port capable of taking cape size vessels;
- a modern road and rail infrastructure developed for Western Australia's mining industry with direct access to the port;
- an existing plantation industry of mainly Blue Gum (*Eucalyptus* spp.) woodchip plantations located in the higher rainfall zones;
- abundant land areas capable for plantation development with more than 450 mm of rainfall; and

- land prices in the order of €900 to €1200 per plantable hectare.

The immediately available pellet potential is via a consortium which includes Willmott Forests, AKD, and Hancock Victorian Plantations. The consortium has direct access to wood chips and residues from a combined total plantation estate of 220,000 hectares from which they expect to produce 300,000 tonnes of pellets per annum.

Due to their scale of operation the consortium has been able to acquire the most efficient harvesting equipment available – a new German bioenergy harvesting and chipping head. This has facilitated a major step towards full commercialisation of short rotation coppice plantations. Some important features of this equipment include a 400 HP machine that fells and cuts in one operation; it can operate for AUD560/hour but this is expected to reduce as they fine tune the harvesting process. The machine has the capacity to harvest at 5 km/hour which equates to around 90 tonnes per hour, but at present is operating at a rate of 2.5 to 3.0 km per hour, harvesting in the order of 40-50 tonnes per hour for a cost around AUD12 per tonne. Haulage costs are around AUD9 per tonne. The overall landed price e.g. in the case of *Casuarina* species should be AUD23 per tonne, with a range of AUD20-28 per tonne. This is half what has been quoted for conventional harvesting using a harvester, forwarder and chipper at AUD45-50 per tonne.

Australia has considerable potential for dedicated biomass plantations. The basic parameters for economic viability are:

- The plantation must be located near processing and/or export ports (e.g. 50-70 km).
- There is a trade-off between land prices and productivity (with preference to marginal land). Australia has suitable land available to achieve viability.
- The land needs to be flat and easy to cultivate.
- The minimal scale required is 10,000 to 20,000 hectares depending upon the productivity of the land.
- Upfront costs must be offset by tax deductions and/or carbon off-sets.

A typical cost structure could be as follows:

| Plantation Variables | <i>Casuarina</i> | <i>Eucalyptus</i> |
|----------------------|------------------|-------------------|
| Productivity         | 20 t/ha/yr       | 10 t/ha/yr        |
| Land prices          | €3,400           | €1,200            |
| Site preparation     | €190             | €130              |
| Weed Control         | €360             | €120              |
| Planting             | €880             | €660              |
| Maintenance          | €1,110           | €1,050            |
| Road construction    | €110             | €50               |
| Totals               | €6,050           | €3,210            |
| Real IRR             | ~ 10%            | ~ 10%             |

The market for pellets in Australia is extremely tight. Local prices are around AUD40 per tonne as compared to AUD173 per tonne in the Netherlands. There is thus a strong incentive to export the pellets instead of using the residues in the domestic market. However, there is a need to establish the export markets now with a long term view and good commercial relationships between producers and buyers. The environment is right for a sustainable market to be established.

A feasible cost structure for pellet export to Europe is shown in the table below.

|                                         |       |         |
|-----------------------------------------|-------|---------|
| CIF Europe                              | €130  | AUD220  |
| Shipping Costs (Australia to Europe)    | €43   | AUD72   |
| FOB Australia Price                     | €87   | AUD148  |
| Pelletising Costs                       | €27   | AUD45   |
| Pellet to green metric tonne conversion | €0.59 | AUD0.59 |
| Mill door delivered price – GMT         | €36   | AUD60   |
| Harvesting and haulage                  | €13   | AUD22   |
| Stumpage price                          | €23   | AUD38   |

The financial viability of pellet exporting is sensitive to shipping and exchange rates. Dedicated biomass plantations require a relatively high CIF pellet price. Investors need to understand that 'pellet plantations' are a long term investment with a number of drivers including European legislation, the ROC system, questions over sustainability, sovereign risk, infrastructure etc.

#### Wood Pellet Production – Ken'ichiro Kojima, Pellet Club, Japan

Wood pellet production and consumption in Japan is very low. This is part of the reason why the Pellet Club was founded in 2001 as an NGO to stimulate the use of pellets in housing and industry.

In the early eighties, as a result of the first oil crisis in 1979, pellets were imported from the USA. The first application was to heat greenhouses producing melons. In 1982 the first domestic production of pellets started and peaked in 1984 at 27,800 tonnes. However, the pellets were of poor quality because they were mainly produced from bark which yielded huge amounts of ash. In addition, the poor quality of the pellet burners resulted in low efficiency. Apart from greenhouses, the pellets were also used in hotels and hot spas.

Unfortunately, industry was not able to establish a steady pellet market, in part due to lack of support from government, but mainly due to quality problems with pellets and stoves. This was somewhat surprising because Japan had a long tradition of producing densified wood fuel called Ogalite. This is high-quality pressed wood in the form of hollow rods made from saw dust. Ogalite was used for heating the traditional Goemon-buro baths. Production reached a peak in 1969 with almost 1 million tonnes per year (Figure 6). In the seventies this production dropped very quickly leaving considerable potential for pellet production that was not immediately realised.

Since the foundation of the Pellet Club, pellet production has resumed. After reaching a first peak in 1994 it dropped to almost nil within a few years. However, since 2004 pellet production has increased steadily (Figure 7). Inland production by 50 larger mills rose to 39,000 tons in 2008 and imports (from USA and Canada) reached 60,000 tons in the same year. The steep increase was driven by the need for CO<sub>2</sub> reduction. Some 85% of the pellets are used in co-firing plants for electricity production. There are 17 co-firing plants in total with four using imported pellets.

The ratio of coal in co-firing has been decreasing as requested by the government, but with increasing electricity consumption new plants are being installed based on coal only.

There is a large, untapped potential to source forest residues from local forests. But even though the value of standing trees has dropped dramatically timber production in Japan is

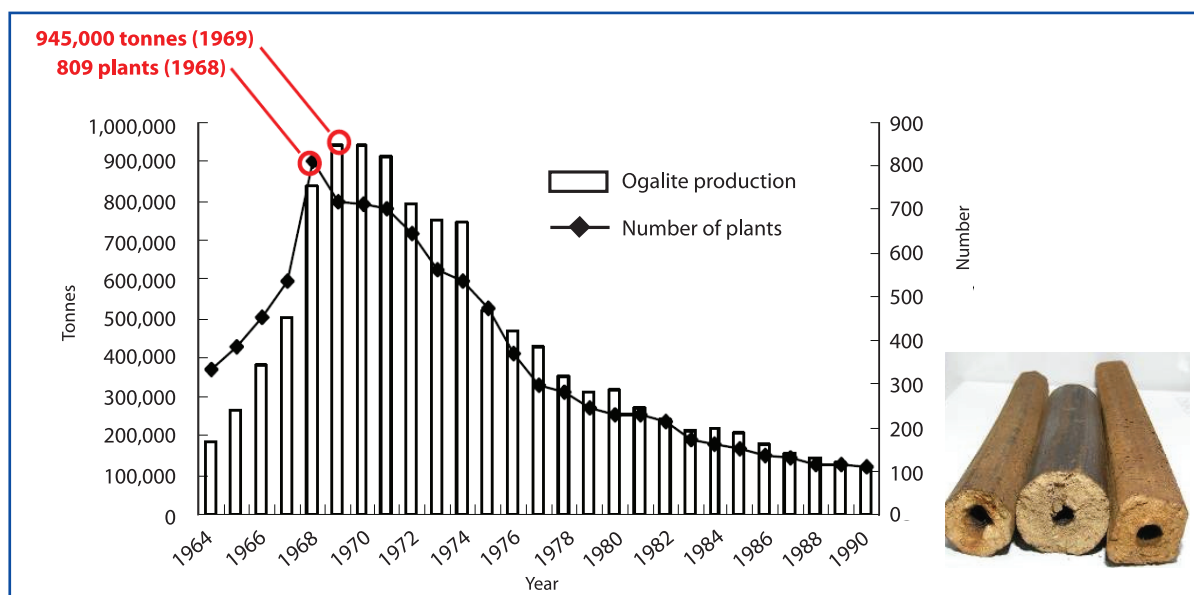
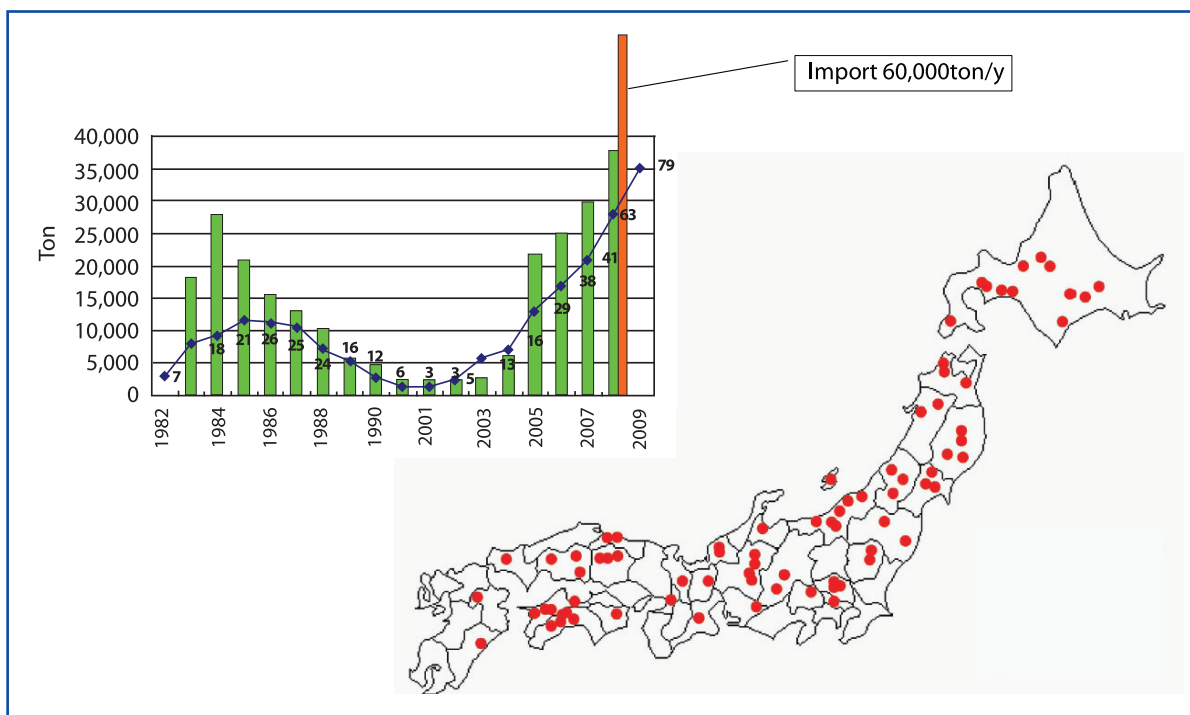


Figure 6. Ogalite (briquette) production in Japan



**Figure 7.** Wood pellet production in Japan. Source Pellet Club JAPAN, 2009

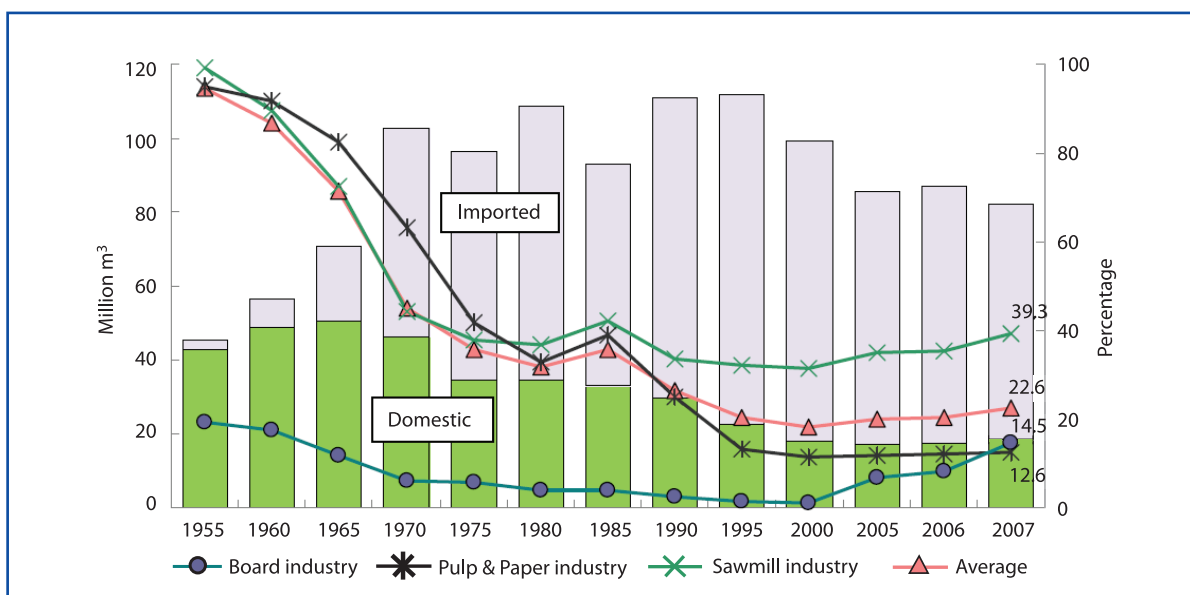
too expensive versus imported timber. The cost of processing timber in Japan comprises 70% of the total price. Hence, most of the timber is imported (Figure 8).

Without domestic timber production there is no sawdust or other wood residues for pellet production. The low value of the standing trees is also the reason for less planting of plantations. The wood industry expects some support from the government but there is a conflict of interest. NEDO, the funding agency, is entirely financed by a tax on coal and has little incentive to reduce its funding base. Unfortunately there is no environmental tax (on CO<sub>2</sub> or energy) in Japan. Hence the import of pellets will further increase. Mitsubishi

wants to import 1 million tons per year by 2012 for electricity production. To facilitate this, they have bought two sawmills abroad and invested in a pellet factory in Germany.

The price per ton for pellets is between 40,000 and 60,000 Yen (US\$450-670/ton) for private consumption and around 25,000 Yen (US\$280/ton) for large-scale power production.

In conclusion, despite the high costs of processing wood in Japan, domestic pellet mills have increased rapidly. They tend to be small scale for local production and consumption. In contrast, the power companies have increased their share of biomass co-firing on a large scale with imported pellets.



**Figure 8.** Timber import in Japan. Source: Forestry Agency, 2008

The effect has been to create two markets for pellets: firstly, domestic demand based on local production of relatively expensive pellets and secondly, large scale industrial demand from power companies based on cheaper imported pellets. For large scale application of domestic pellets a number of barriers have to be overcome including a lack of raw material (wood residues), a lack of political instruments, (environmental tax, etc), and a need for national quality standards for this industry.

## SESSION 3 – TRADE IN LIQUID BIOFUELS

### Ethanol Trading Flow in East and South East Asia – Shigeru Takemura, Ginga Petroleum (S) Pte Ltd, Singapore

Ethanol production in Asia is increasing every year but compared to the world market its share is still small. From 2006 to 2007 total production jumped from 46 to 73 billion litres. Only 4% of the world's production of fuel ethanol is produced in Asia, which is comparable to that of Europe (Figure 9). Currently, Asia is a net importer of ethanol. In USA the feedstock used is mostly corn while Brazil uses sugar cane, and the Asian countries use both sugar cane and corn.

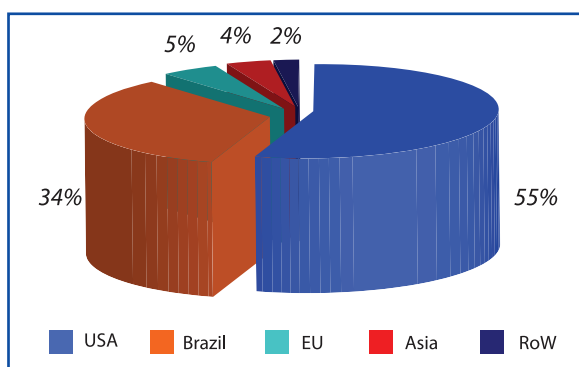


Figure 9. World fuel ethanol production in 2009.

There is a significant difference in ethanol consumption between East and South East Asian countries and the rest of the world. In Asia 70% of the ethanol is used by industry for beverages whereas in the rest of the world 76% of the ethanol is used as fuel.

The biggest ethanol exporters in East and South East Asia are China and Thailand. China is mostly exporting to Japan, Korea, and Singapore. Thailand is the main exporter to the EU.

The international ethanol market is extremely volatile. It is influenced by a number of parameters like feedstock prices (sugar cane, wheat, and maize); climate (rain/drought); oil price and the currency exchange rate (Brazilian Real). With increasing trade volumes security of the water-ways also becomes more important, as in the case of oil. These factors are directly linked to ethanol price and therefore trade flow.

For example, in 2008, Brazil's ethanol exports increased by 67% from 2007 while the EU and USA imports increased

60% and 90% respectively due to higher feedstock prices (corn and wheat). On the other hand, in 2009 there was a sugar cane crop failure in India and rain storms in Brazil that caused a sharp increase in sugar prices, and Brazilian sugarcane-based ethanol prices surged. Heavy rain was also a problem in Thailand (Figure 10).

In addition, a slump in crude oil prices provided an incentive for drivers to use more fossil gasoline than ethanol blended gasohol. As a result, the USA ethanol import volume reduced by around 70% to 700,000 m<sup>3</sup> and the EU imports decreased by 25% to 1.2 million m<sup>3</sup>.

Imports of ethanol from Brazil into Japan, Korea, and India totalled 1.2 million m<sup>3</sup> in 2009. Trade in ethanol within East and South East Asia is shown in Figure 11. China is the biggest exporter (107,000 m<sup>3</sup>), followed by Indonesia (46,000 m<sup>3</sup>) and Thailand (32,000 m<sup>3</sup>). Over 95% of the volume traded to or within Asia is non-fuel grade.

Recently, alternative feedstocks such as tapioca have been gaining interest in Thailand. In 2009 Thailand became the third biggest tapioca producer producing 28.5 million tons, and was the world's largest tapioca ethanol exporter with around 4.2 million tons (Figure 12). Seven new plants with additional capacity of 1.97 million litres per day will be completed by the end of 2010.

Within South East Asia, only the Philippines has mandatory blending with 5% ethanol, since February 2009. The blending percentage will increase to 10% in February 2011. Parallel to increasing the blending mixture, production capacity is increasing. It will reach 640,500 m<sup>3</sup>/yr when all the planned ethanol plants are operational. However, most of these projects are delayed, and therefore the Philippines needs to import ethanol. The Philippines consumed 135,000 m<sup>3</sup> of fuel ethanol in 2009 of which 100,000 m<sup>3</sup> was imported. Once the projects are finished, the Philippines might shift from an importer to an ethanol exporter after 2014. The main goals of the ethanol mandate are to reduce oil dependency, and

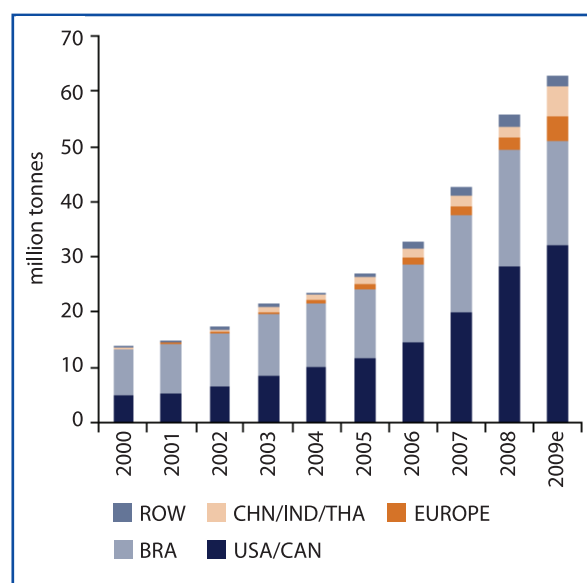
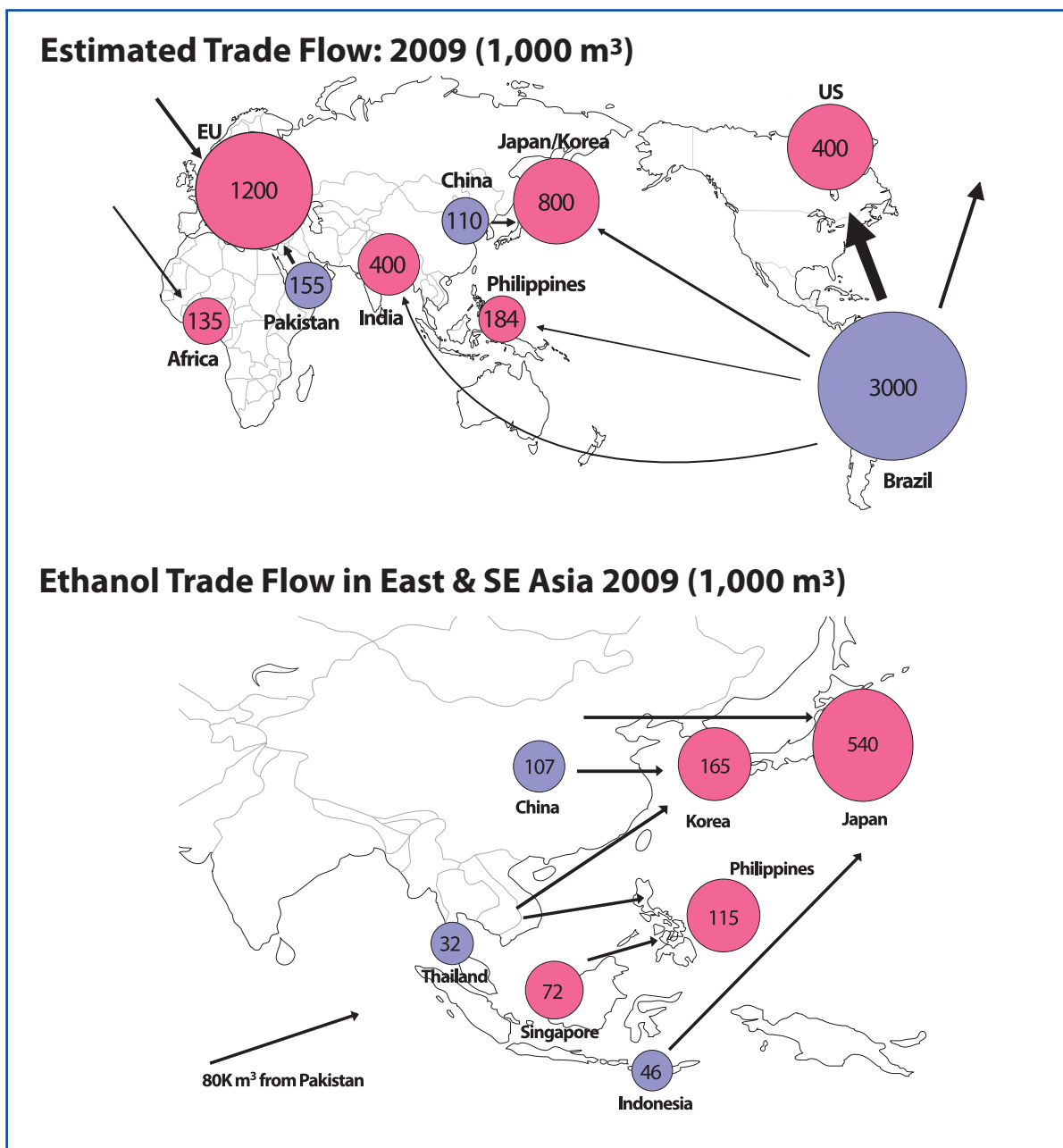


Figure 10. Global bioethanol production. Source: OECD-FAO



**Figure 11.** Estimated trade flows in 2009 (1,000m³). Source: Ginga Petroleum

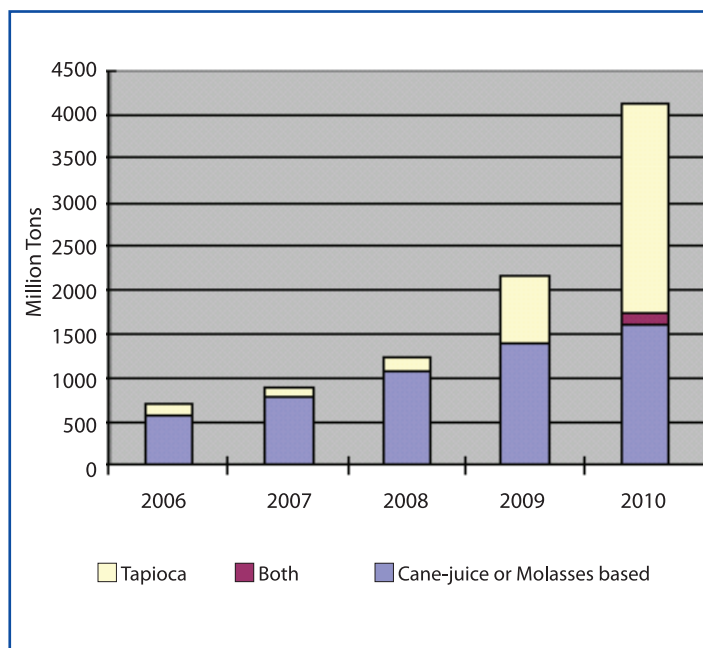
to enhance incomes in rural areas by producing sugarcane-based ethanol domestically.

China launched an ethanol programme in 2002 to increase the country's energy security, reduce pollution, and increase farmers' incomes. China has been the biggest producer and exporter of ethanol in East and South East Asia with current fuel-ethanol production capacity of around 2 million m³ per year mainly based on corn. Barriers to further increases in production are inadequate supplies of feedstock and arable land. The target production volume was set at 2.5 million m³ by 2010 and 12.5 million m³ by 2020. Even though China is the second largest corn producer in the world, corn consumption for feed is increasing and in the 2009/2010 season, domestic corn consumption exceeded domestic production. So China is likely to be an ethanol importer in the future.

#### **Palm Oil as Feedstock for Biodiesel: Production and Exports from Malaysia – Puah Chiew Wei, Malaysian Palm Oil Board, Malaysia**

Malaysia and Indonesia are the world's largest producers of palm oil with a market share of 85% of global production which is around 50 million tonnes. Malaysia is also the world's largest exporter of palm oil with production reaching 17.56 million tonnes. Exports of palm oil and its products generated an export value of RM 49.59 billion (US\$15 billion) in 2009.

Total land area in Malaysia is 32.86 million hectares. The area planted in oil palm has gradually increased from 0.7 million hectares in 1976 to 4.69 million hectares in 2009, covering 14% of the available land (Figure 13). Since 1990 no native forest has been cut down to increase palm oil production. Most of the land planted in oil palm has involved



**Figure 12.** Ethanol production in Thailand.

conversion from existing crops such as rubber plantations. In addition, effective plantation management and an increasingly mature resource have helped to meet national demand for palm oil, and at the same time facilitate a developing export market.

One means to increase yield is careful plantation management as promoted by the Malaysian Palm Oil Board (MPOB), comprising:

- Good agriculture practices (soil conservation; zero burning policy for replanting; optimum use of fertilisers and chemicals; planting of leguminous cover crops).
- Integrated pest management (use of natural predators).
- Utilisation of oil palm biomass (recycling of organic matter, production of biofertilisers, etc.).

These practices are to ensure the production of good quality and sustainable palm oil. In addition, extensive



**Figure 13.** Oil palm plantation.

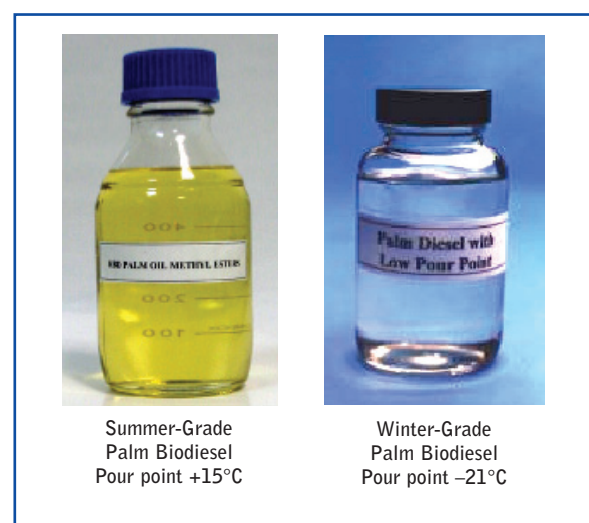
research and development is being conducted in zero waste and zero emission approaches. These include development of innovative technologies such as reduction in the use of chemicals, water and cost; waste management, such as treatment of solid and liquid waste; as well as utilisation of by-products such as oil palm biomass. Oil palm biomass such as the empty fruit bunches and palm oil mill effluent have potential for the generation of renewable energy.

In Malaysia, 80% of the palm oil produced is used in food applications. About half of all manufactured products contain at least minor quantities of palm oil, e.g. ice cream, cookies, chocolate, and margarine. Palm oil is extremely stable to heat and oxidation which makes it an excellent cooking oil, highly desired in Asian and African kitchens. Besides cooking, palm oil is used for the oleo-chemical industry for the production of non-food products such as personal care products, detergents, and candles.

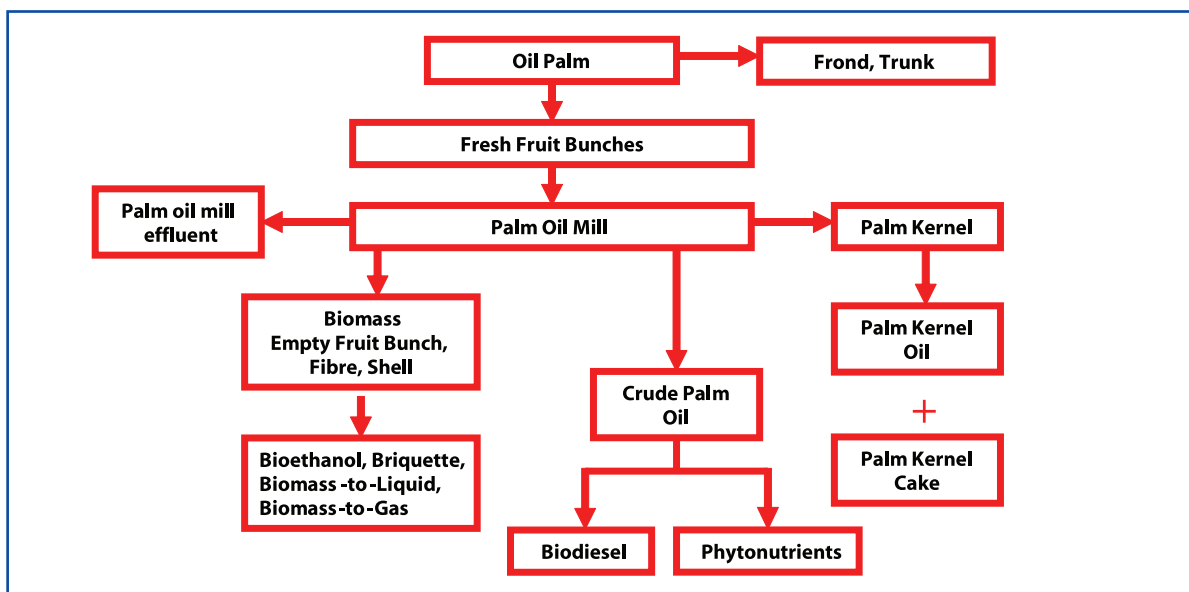
Only recently has palm oil started to be used as a fuel in the form of biodiesel. In 2006 the Malaysian government released the National Biofuel Policy. The five strategic thrusts of the policy outline the use of biofuel for transport, the use of biofuel for industry, development of home grown biofuel technologies, production of biofuel for export and biofuel for a cleaner environment.

In 1985 the first MPOB biofuel pilot plant was in operation with an annual production of 3,000 tons. Since then home-grown palm biodiesel production technologies, including winter grade biodiesel have been successfully developed and commercialised (Figure 14).

Both summer and winter grade biodiesel are exported to the EU, USA, Taiwan, and others. Palm biodiesel meets the international standards EN 14214 and ASTM D6751. MPOB patented biodiesel production technology is now



**Figure 14.** FAME from palm oil.



**Figure 15.** Potential sources of renewable energy from oil palm.

commercialised with plants in Malaysia, South Korea and Thailand. The domestic consumption of palm biodiesel will increase sharply as the government has decided to introduce a mandatory blend of 5% biodiesel starting in June 2011 (B5 programme).

A life cycle assessment (LCA) study for the production and use of palm biodiesel had been completed by MPOB and the report had been accepted by the external review panels. The results of the LCA study demonstrate that palm biodiesel produced from Malaysia can contribute to more than 50% GHG emission saving as compared to petroleum diesel. As such, it meets the sustainability requirement under the EU Renewable Energy Directive.

Renewable energy can also be produced from oil palm biomass. The solid biomass includes empty fruit bunches, shell, fibre, fronds and the trunk (Figure 15). Currently, all oil palm mills in Malaysia use shell and fibre to generate power to be used in the mills. As such, all mills in the country are self-sufficient in energy. Palm oil mill effluent is another source of alternative renewable energy. About 28 m<sup>3</sup> of biogas can be produced from one tonne of palm oil mill effluent with an average methane content of 65%. Other research and development being conducted includes conversion of oil palm biomass into second generation biofuels such as bioethanol.

## SESSION 4 – SUSTAINABILITY DEVELOPMENTS AND TRADE

### Sustainable Biomass Utilisation in East Asia – Tomoko Konishi, National Institute of Advanced Industrial Science and Technology, Japan

In East Asia the primary energy supply and CO<sub>2</sub> emissions are increasing faster than in most other countries of the world. At the same time East Asia is favoured with a climate which allows high productivity from a wide variety

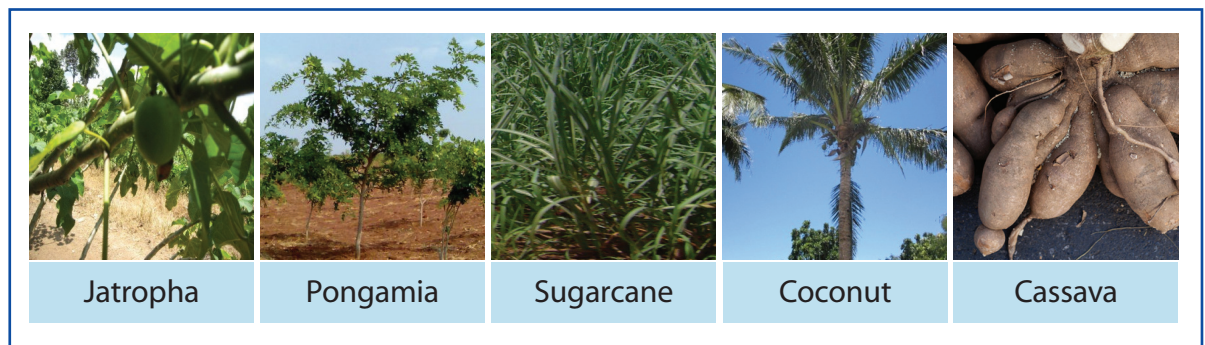
of biomass crops (Figure 16). However, biomass production needs to be undertaken in a sustainable way.

The East Asian Summit (EAS) – a highly ranked political structure at ministerial level, including 16 countries (ASEAN, Australia, China, India, Japan, Republic of Korea, and New Zealand) – decided during its summit in 2007 to create an Energy Cooperation Taskforce on biofuels for transport and other topics. Two working groups were initiated, one on 'Benchmarking of biofuel standardisation in East Asia' and one on 'Sustainable biomass utilisation in East Asia'. These working groups are led by the Economic Research Institute for ASEAN and East Asia (ERIA). The work of the groups is closely linked to political decisions. All studies carried out are presented at summits and other political meetings and decisions on continuation are supported by the decision makers.

In 2008, the ERIA working group on sustainable biomass utilisation provided a first report 'Sustainable Biomass Utilisation Vision in East Asia'. In addition, the working group provided scientific background for the adoption of 'Asian Biomass Energy Principles' by the Energy Ministers Meeting in August 2008 in Bangkok. There are six major principles:

- Ensuring quality
- Respect for natural diversity
- Compatibility with food supply
- Compatibility with environment
- Stable supply of biomass energy
- Cost efficiency

As a result, the Energy Ministers requested ERIA to develop a methodology for assessing environmental, economic, and social sustainability in the production and utilisation of biomass. In 2009, the working group published 'Guidelines to Assess Sustainability of Biomass Utilisation in East Asia' ([www.eria.org](http://www.eria.org)). The report recommended that an expert team from the East Asian region should be formed to deal with activities on standardisation in the rest of the world, such as the guidelines of ISO, GBEP, and other



**Figure 16.** There is a wide choice of biomass crops for energy that can be grown in East Asian countries.

similar international organisations, while implementing and enforcing their own policy framework developed for biomass utilisation. The ERIA group leader, Dr Masayuki Sagisaka, presented the first data at one of the GBEP Taskforce meetings. The group intends to exchange information also with the ISO working group.

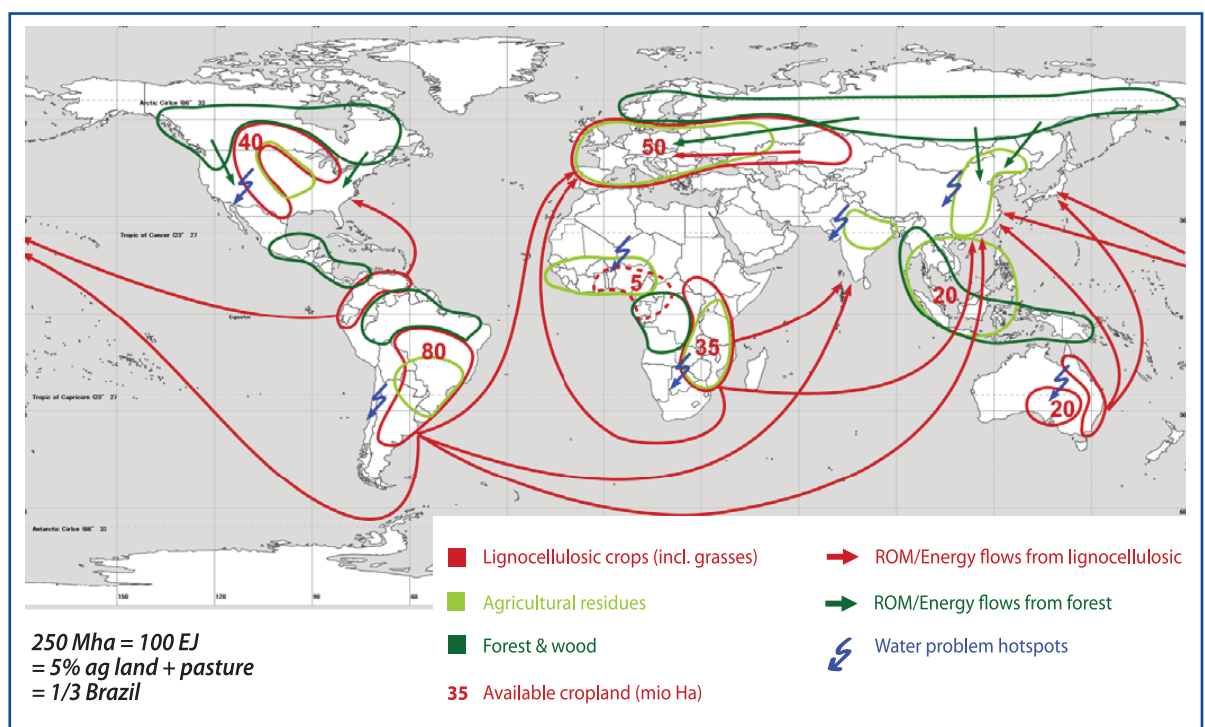
It was suggested that a team of specialists in standardisation procedures for East Asian countries be formed to discuss the relevant issues including the development of a common database as a resource for a standardised LCA.

To test the guidelines, the East Asian Energy Ministers Meeting requested the implementation of pilot studies in 2009/2010. A new working group was established comprising 11 researchers from seven East Asian countries and each participating country formed local research teams for the four pilot studies defined:

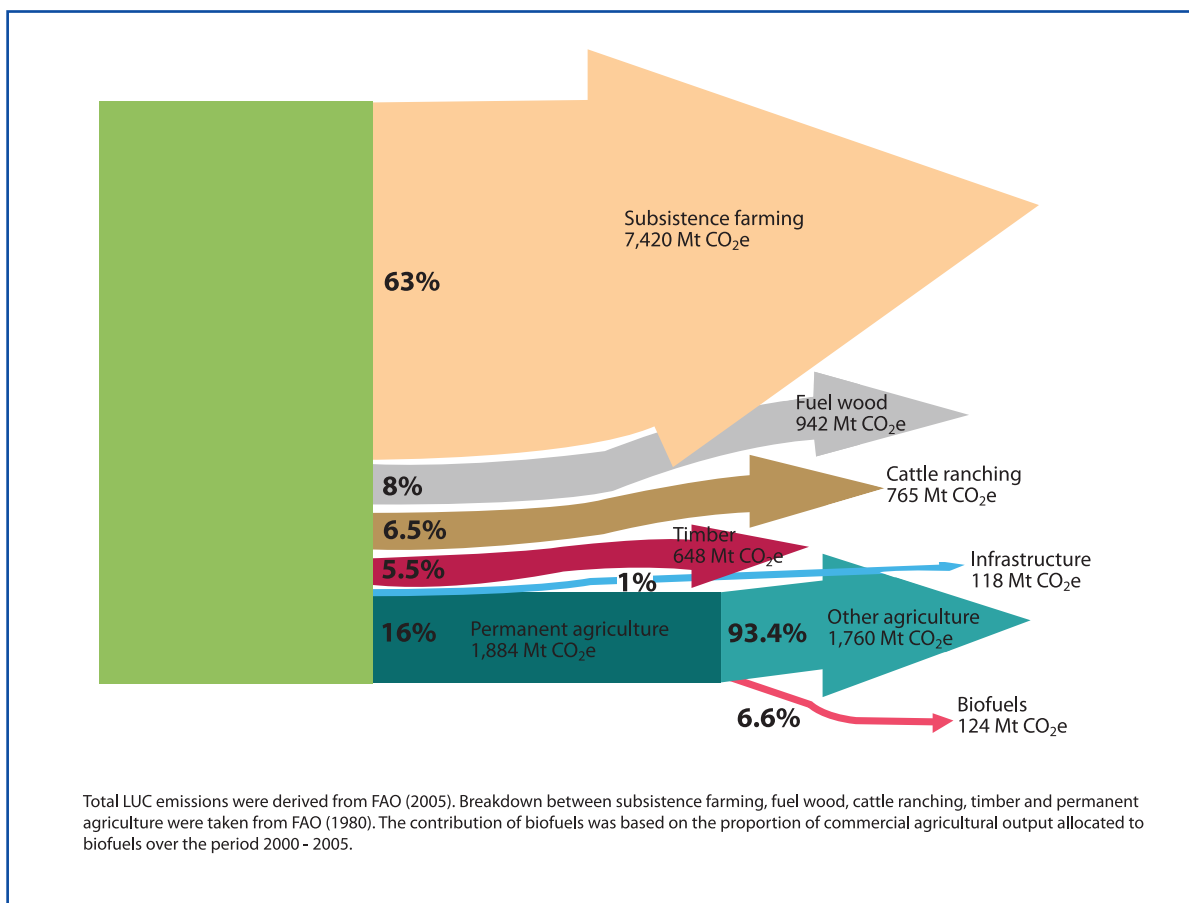
- Bioethanol from cassava, biodiesel from *Jatropha* at Lampung in Indonesia

- Biodiesel from coconut oil at Los Banos in the Philippines
- Bioethanol from sugarcane at Khon Kaen in Thailand
- Biofuel production from *Jatropha*, *Pongamia* and Neem at Andhra Pradesh in India

Methodologies were developed to assess the sustainability of the biomass produced under environmental, economic, and social criteria. The purpose of the four pilot studies is to adapt existing methods to East Asian biomass utilisation case studies, and to get feedback for more in-depth results. The corresponding report 'Sustainability Assessment of Biomass Energy Utilisation in Selected East Asian Countries' will be published later in 2010 and will be available on the website ([www.eria.org](http://www.eria.org)) by the end of 2010. In order to introduce the outcomes from the case studies and to discuss the methodologies for sustainability assessment, an ERIA International Workshop was held on 1 December 2010 in Jakarta, Indonesia in parallel with the 7<sup>th</sup> Biomass Asia Workshop.



**Figure 17.** Potential trade flow in near future.



**Figure 18.** Contribution to land use change.

### Scientific Needs and Market Impacts of Securing Sustainability of Bioenergy - Andre Faaij, Copernicus Institute, Utrecht University, the Netherlands

Today the utilisation of bioenergy does not coincide with the location of biomass production. Although Asia and Europe have high potentials for the production of biomass and its conversion into bioenergy, they are not highly developed due to a lack of technology development or high production costs compared to other countries. The result is intensive international trade in ethanol, wood pellets, palm oil, and biodiesel. For example, the major trade flow of ethanol is from Brazil to Asian and European countries and parts of the USA. Palm oil is mainly derived from Malaysia. Biodiesel, originally 80% produced in Germany, is now increasingly exported from Brazil. Pellets are increasingly exported by Australia, Argentina, and Canada. This pattern might change even faster with the increasing production of bioenergy by other countries. Brazil will remain a major exporting country, whereas Europe will remain a net importer. But other regions in the world will increase their net production of biofuels, e.g. South East Africa and South East Asia (Figure 17).

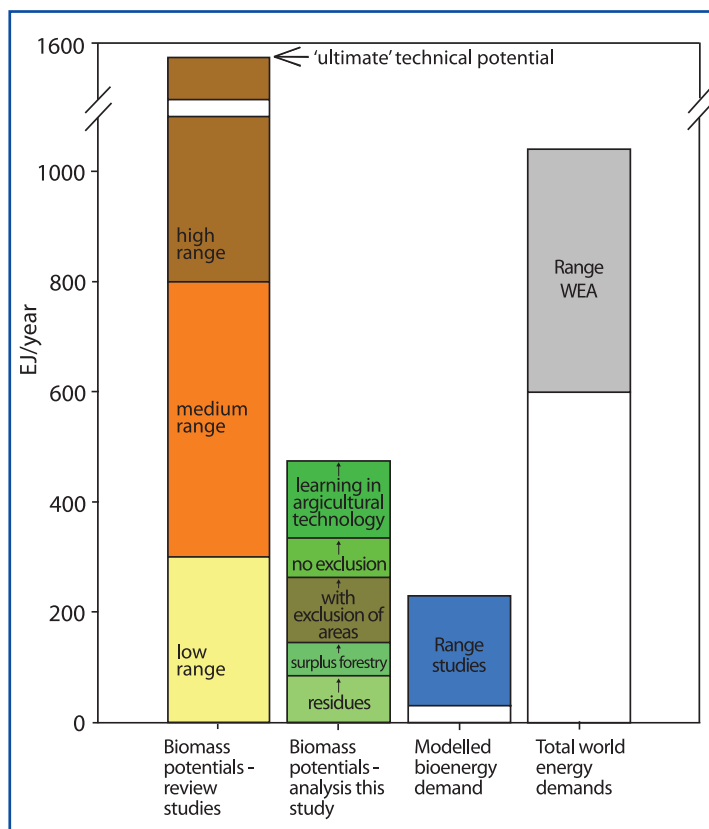
While the application of and trade in biofuels is increasing, their reputation has diminished. Originally promoted by the press as the 'saviour' of our energy system (which meant that nobody wanted to reduce consumption) it became the dilemma. Supposedly, it was bioenergy's fault that for the last six or more decades the rain forests were destroyed. In 2008, when food prices started to increase, everybody blamed

the energy crops. Subsequently studies demonstrated that bioenergy most probably added less than 10% to the increase. Even though some studies showed a contribution of more than 70%, most remained in the range of 3 to 10%.

There is no doubt that we need increasing amounts of protein for food. Existing farming methods are often a threat to biodiversity, greenhouse gas emissions, and high water consumption. Agriculture and poverty are interlinked. More than 70% of the world's population live in rural areas and agricultural productivity is extremely low in many areas. To achieve improvement we need better education of rural populations in order to improve agricultural practices and to generate more investment, which will ultimately lead to better yields and efficiencies. But all this has nothing to do with biofuels. There is even the prospect that sustainable bioenergy production might lead to new investments and ultimately to education and welfare. All we need to make sure of is that part of the investment remains in the rural areas.

Subsistence farming is also a major source of emissions from land use change (Figure 18). Again, education could greatly improve this situation.

Indirect land use change (iLUC) has become a hot topic over the last few years. New research however, with a global, macro-economic approach showed that its effect has been overestimated by a factor of approximately three. Detailed regional studies showed that the rate of iLUC depends almost



**Figure 19.** The potential of biomass as energy source.

entirely on the improvement of agricultural practice and livestock management. However, whereas older studies are retrospective there are newer studies which look ahead to 2030 and beyond.<sup>5,6</sup> Unfortunately there is no unanimity in the results. They range from serious land use change to almost no land use change, depending on the assumptions and the level of 2<sup>nd</sup> generation infiltration.<sup>7</sup>

The advanced technologies or utilisation of marginal degraded land are not considered in these models. IEA-ETP predicts that 2<sup>nd</sup> generation biomass will displace 1<sup>st</sup> generation in 5 to 10 years if everything goes well, in which case these models would be completely out-dated.

Waste and residues are hardly considered, even though they are key short term resources. New advanced scenarios must also include policy decisions. These types of tools will help to predict the effects of political decisions and hopefully lead to long term stable development.

A recent study by Dornburg et al. (2010<sup>8</sup>) came to the conclusion that biomass can play a major role in the world's energy supply (Figure 19) even when land for bioenergy is limited so as to reduce potential land use change. The good news from this work is that the world is really starting to be concerned about the environment and is taking

remedial measures. Task 40 has provided an overview of existing initiatives to guarantee sustainability of biomass. In total, they found 67 initiatives, i.e. either regulations or systems – 27 of them cover criteria for the sustainability of biofuels. The bad news is that the population in most parts of the world is concerned about food security and the socio-economic impact of bioenergy production. However, these concerns are most often not included in the 67 initiatives cited.

Another negative aspect is that the large variety of sustainability initiatives is leading to confusion in the market. Consequently, there is a risk of abuse of the standards because every country will choose the model that requires the least change in existing policy.

In conclusion, there are only a limited number of key parameters defining the sustainability of bioenergy – land use, management system, crop selection (Table 1). This makes it possible to steer sustainability in regions with proper bio-based chains and governance. In depth analyses of the impacts on market development and trade require more sophisticated tools.

**Table 1:** The most important factors determining biomass potential

| Issue/effect                             | Importance |
|------------------------------------------|------------|
| <i>Supply potential of Biomass</i>       |            |
| Improvement agricultural management      | ***        |
| Choice of crops                          | ***        |
| Food demands and human diet              | ***        |
| Use of degrade land                      | ***        |
| Competition for water                    | ***        |
| Use of agricultural/forestry by products | **         |
| Protected area expansion                 | **         |
| Water use efficiency                     | **         |
| Climate change                           | **         |
| Alternative protein chains               | **         |
| Demand for biomaterials                  | *          |
| <i>Demand Potential of Biomass</i>       |            |
| Bioenergy demand versus supply           | **         |
| Bioenergy demand versus supply           | **         |
| Learning in energy conversion            | **         |
| Market mechanism food-feed-fuel          | **         |

<sup>5</sup>Hiederer R. 2010. Biofuels: a New Methodology to estimate GHG emissions from Global Land Use Change. EUR 24483EN. Luxembourg: Office for Official Publications of the European Communities.150 pp.

<sup>6</sup>Havlik, P., Schneider, U. A., Schmid, E., Böttcher, H., Fritz, S., Skalský, R., et al. 2011. Global land-use implications of first and second generation biofuel targets. Energy Policy, In press.

<sup>7</sup>Berndes, G., Bird, N. and Cowie, A. 2010. Bioenergy, land use change and climate change mitigation. IEA Bioenergy: ExCo:2010:03.

<sup>8</sup>Dornburg et al. 2010. Bioenergy revisited : Key factors in global potentials of bioenergy. Energy & Environmental Science, 2010(3), 258.

## PANEL DISCUSSION AND CONCLUSIONS

Trade in agricultural goods between Asian countries and Europe has a long tradition spanning several centuries and continuing to the present day. In earlier times it was food (herbs, spices, rice, etc.) that was traded from the East to the West. Today trade is increasingly in biomass for energy (e.g. wood pellets) flowing into some of the East Asian countries.

New biomass producing countries have entered the market, in particular Brazil. The trade in biomass for energy is now quite substantial. Of the total volumes produced, 8% ethanol, 25% biodiesel and 13% of pellet production are now traded. In the near future trade flows will not only increase but also change in direction as new countries with high growth potential such as East Africa and South East Asia enter the market.

With increasing trade, the reputation of bioenergy has suffered as 'hot topics' such as sustainability, food versus fuel, and land use change became more visible than the positive effects of bioenergy, including CO<sub>2</sub>-reduction and the potential to replace fossil fuels.

As well as discussion about the production and utilisation of bioenergy in East Asian countries, the limits and barriers of biomass growth and trade were of major concern during the workshop, not only in the presentations but also in the discussion after each session.

The following topics were central to the discussions:

- Trade and trade barriers
- The potential of biofuels
- Sustainability issues

The main points from the sessions are summarised below.

### Trade

The main drivers for trade in biomass are demand on one side, determined by policies (tariffs, regulations, incentives) and economics (oil and coal prices), and supply on the other side, determined by the availability of fossil fuels (peak oil) and of biomass (productivity, logistics and fuel standardisation). Trade is still extremely volatile due to the inconsistency of political support schemes. Unfortunately, policy does not always work in a desirable or sustained direction.

With more regions around the world providing bioenergy for export, such as South America, South Eastern Africa, Asia, Australia, and Canada, the supply side becomes more stable because extremes in climatic conditions can be better balanced. With the introduction of biomass support schemes in an increasing number of countries, such as feed-in tariffs or mandatory blending of liquid fuels, demand will also become steadier. Even so, trade may still change rapidly. So far, Asian politicians have not set high targets for biomass as

fuel. Once they decide to do so, and on a cooperative basis, the biomass flow might change significantly.

With increasing biofuel demand, as projected in the BLUE Map Scenario of IEA's Energy Technology Perspectives<sup>9</sup>, both feedstock and biofuel trade will play an important role in supplying sufficient volumes of biofuels to the key demand regions North America, the EU and developing Asia. In the short-term, trade will mainly comprise conventional biofuels, but with commercial-scale advanced production plants coming online after 2015, lignocellulosic feedstock trade is likely to grow and supply large biofuel plants built in coastal locations. Latin America might supply biomass and biofuel to the USA, the EU, and Japan; South East Asia and Australia might become suppliers to China and other developing Asian countries; and African countries could play an increasing role in the longer term, exporting feedstocks and/or biofuels to European, Asian, and North American markets.

Certain biomass and biofuel trade routes will grow for a limited period only, until either domestic supply in the importing region is sufficiently developed, or demand within the exporting region increases. In particular, this might be the case when biofuel demand in non-OECD countries increases.

### Trade barriers

An investigation carried out by Task 40 showed that the major trade barriers are tariffs and other support schemes, sustainability criteria, logistics, and phytosanitary measures. Some of the factors are not specific to bioenergy but correspond to general (hidden) import and export barriers such as taxes or levies. Sustainability criteria might sometimes be a driver (e.g. biodiesel) or a barrier (e.g. ethanol).

Since existing subsidy schemes are not a long term option, other policy measures need to be developed to create a stable international framework that encourages investment into expanding biofuel and feedstock trade. This includes the reduction of tariff and logistical barriers, as well as the alignment of technical standards for biofuels. Politicians need to provide an environment which encourages long term investment by industry.

Sustainability criteria could certainly be an opportunity for enhanced trade; however the 67 regulatory frameworks cited by Task 40 are more of a barrier. Politicians, investors, and biomass producers are willing to meet sustainability criteria but the world community needs to try and find a common standard. It is acknowledged that the harmonisation of standards is not an easy job as is shown by the discussions of the GBEP which aims to develop voluntary indicators, or in ISO/PC/248 'Sustainability Criteria for Bioenergy' developing ISO Standard 13065. However, once agreed internationally, indicators or even standards could become a major driver for the deployment of bioenergy. Certification models need to be field tested in pilot schemes to ensure they are practicable as is being done in the East Asian countries. The first test of sustainability criteria including GHG

<sup>9</sup>IEA. 2010. Energy Technology Perspectives. [www.iea.org/techno/etp/etp10/English.pdf](http://www.iea.org/techno/etp/etp10/English.pdf)

balances for biofuels and bioliquids on a commercial scale will take place when the sustainability requirements of the EU Renewable Energy Directive have to be implemented by Member States in December 2010.

Phytosanitary controls are also a hurdle, especially for island nations such as Australia and Japan, where sometimes transfer of plant material even from one province to the next is limited.

The experience of forestry has shown that the introduction of certification schemes can take years. Despite several decades of effort, only about 10% of the global wood supply is certified to date.

### The Potential of Biofuels

In its low development scenario, (assuming limited policy support; slow technological progress in both the energy sector and agriculture; profound differences in development between OECD and developing countries; high fossil fuel prices; and high demand for biofuels for energy security affecting food markets) with increased biomass demand partly covered by residues and wastes, and partly by annual crops, Task 40 expects a total contribution of bioenergy of about 100 EJ by 2050.

Task 40's high development scenario assumes well functioning sustainability frameworks and strong policies, well developed bioenergy markets, progressive technology development with biorefineries, new generation biofuels, and successful utilisation of degraded lands. Energy price (notably oil) increases would be moderated due to strong increases in supply of biomass and biofuels. Under these preconditions Task 40 expects some 300 EJ of bioenergy delivered by 2050 – 35% from residues and wastes, 25% from marginal/degraded lands (500 million ha), and 40% from arable and pasture lands (300 million ha).

Asia (including Oceania) could play a major role in the production of biomass for energy. However, bioenergy is currently exploited in only a minority of countries. In most places clear policy is missing. Some countries even continue to subsidise fossil fuels (oil and coal). Australia, as an example, has the potential to produce 10 times the volume of wood pellets than at present, but due to low fossil fuel prices the pellet price remains under pressure and constrains future development. The potential can only be reached if exports are increased, at least in locations in the vicinity of a harbour (60 km radius). The market potential in some of the South East Asian countries, e.g. in Japan, is significant. By 2012 Mitsubishi plans to import 1 million tonnes of pellets for co-firing in coal-fired power plants to reduce CO<sub>2</sub> emissions. They currently pay around US\$250 per tonne. There is a comparable situation in Korea where there are not enough forests to cover their needs.

Malaysia and Indonesia are the largest palm oil producers globally. Together they produce more than 80% of the world market. However, only a small amount of the palm oil is dedicated to energy. About 80% of Malaysian palm oil goes into the food industry, and this share is increasing with the growth in convenience foods. Palm oil is used in more than half of processed foods such as cakes, cookies, ice cream, chocolate fillings, margarines, soups, etc.

Malaysia has steadily increased its area of oil palm plantations from 2 million ha in 1990 to 4.2 million ha in 2006, making the country theoretically independent of transport fuel imports. The oil palm business has become an important income earner with exports worth US\$13 billion in 2007 and 500,000 people employed. The expansion of oil palm plantations was primarily achieved by reducing the area of rubber plantations by around 50% and utilising degraded forests reclassified as agricultural land by the government. The total increase in agricultural land over the last 20 years has been around 1.2 million ha or 27% of the total agricultural area.

Thailand is the third largest palm oil producer in the world, with half a million hectares and also the second largest ethanol producer from sugar cane (1 million ha) and cassava (1.2 million ha). The oil palm plantation area has been steadily increasing to reach 0.5 million ha in 2010. Cassava production has recovered after a low in 2002, whereas the land area in sugar cane has remained constant. The government plans to increase production of biomass further, having passed a Renewable Energy Sources Bill in 2009.

### Sustainability Issues

The presentations by Asian colleagues and the ensuing discussion confirmed that the biomass producing countries have elected to follow the sustainable route. They acknowledge that only sustainable production of bioenergy will reduce GHG emissions and allow for the creation of a stable market over an extended period of time. However, there is still much research to be undertaken.

In Malaysia the government has decided to reserve 50% of the total land surface as virgin natural forest, so expansion of intensive biomass production will only be allowed on existing agricultural land and degraded forests with less than 50% biomass remaining. Even though the definition of 'degraded' land is a little weak (e.g. when the forests were 'degraded' and what 'degraded' really means is not defined) the political will to maintain 50% of their land surface as virgin forest is an excellent decision for the future.

In Thailand preservation of the environment and abatement of GHG are strictly coupled to the development of RES by a governmental decision. For example, oil palm is mainly planted on acidic soils<sup>10</sup>. Again, there is a clear political will even though it is not supported by a strong definition, e.g. acidic soils might be just another term for wetlands.

<sup>10</sup>IEA Workshop 'Sustainable feedstock supply for bioenergy and biofuels, Paris, September 2010. [www.iea.org/work/workshopdetail.asp?WS\\_ID=471](http://www.iea.org/work/workshopdetail.asp?WS_ID=471)

A good model for sustainable land management for sugar cane production is demonstrated by the Brazilian government, which has introduced an agro-ecological zoning with designated areas where sugar cane production can be expanded without restrictions. These zones have either been used for agricultural production for a longer period of time or they are degraded. Production in the three Amazonas regions is not permitted and preference is given to areas with limited irrigation and slopes of less than 12%, allowing mechanical harvesting to avoid fire risk. Suitable areas have been mapped and equal 64 million ha or 7.5% of the arable land. In comparison, sugar cane for ethanol production covers 4.2 million ha or 1% of arable land.

Another positive approach has been demonstrated by the ERIA working group, initiated by the East Asian Summit that developed a sustainability assessment method. The method has been tested on four pilot projects. Practice showed, however, that the guidelines were too theoretical and complex for real life application and the questionnaires were too laborious. Focusing strictly on a few GHG criteria and on social factors will make the method easier to use.

The need for more R&D was also expressed by Task 40. For example, the water consumption of energy crops is poorly covered in most existing models, but on the other hand, the influence of LUC has been overestimated due to lack of data. LUC emissions over the last few decades were mainly created by subsistence farming (63%) of food crops followed by fuel wood and cattle ranching. The effect of modern biofuel production is marginal.

The same holds true for iLUC that seems to depend primarily on efficient livestock management. The newest studies indicate that the iLUC factor is only 30% of the earlier findings and is approaching the results of the very first EC studies in the REFUEL project. There are indications that with best practice agriculture these factors can ultimately be reduced to 15%.

A draw back for woody biomass is that so far, the emissions (or sequestration) from harvested wood products are currently not included in the EU Renewable Energy Directive, nor in any other regulations. There is a good chance that agreement on the inclusion of harvested wood products in carbon accounting will be made at the COP17 meeting planned for Durban, South Africa in December 2011. It is likely that the 'Production Approach' in which producing countries receive a credit for woody biomass converted to wood products, will be accepted.<sup>11</sup> Harvested wood products included round wood, lumber, boards of various types and paper. The impact of this decision may increase the competitiveness of use of virgin forest for purposes other than bioenergy and may drive wood-based bioenergy more in the direction of residues. As a result emphasis may be placed on cascading systems that provide both harvested wood products and bioenergy.

## Implications for IEA Bioenergy

IEA Bioenergy has been involved in the development of a sustainable biofuel industry and the corresponding trade for many years<sup>12</sup>. Several Tasks are contributing expertise directly (Tasks 38, 40 and 43) or indirectly (Tasks 37, 39 and 42)<sup>13</sup> towards the international coordination of sustainability criteria.

This workshop demonstrated possible additional fields of activity for the Agreement as a whole:

- Coordination of the different standards and certification schemes is an urgent requirement for the development of sustainable bioenergy production and trade. Therefore the Agreement should at least maintain if not increase the collaboration with GBEP and ISO (as far as bioenergy is concerned) and develop greater technical know-how.
- So far the schemes have been mainly either producer (i.e. market) or consumer driven. With the multitude of existing schemes, governmental action and decisions are needed based on the internationally harmonised indicators. GBEP is not replacing governmental regulations but provides guidelines and methodological frameworks. Based on the expected GBEP outputs in 2011 and on results from the Tasks, IEA Bioenergy could organise workshops and policy advice to inform governments on how to incorporate these results into new or existing laws and regulations.

<sup>11</sup>S. Rüter, Task 38, Germany Pers. Comm. 'Domestically consumed wood products will be handled differently from traded wood products, however the difference is not important in this discussion.'

<sup>12</sup>IEA Bioenergy Workshop 'The Impact of Indirect Land Use Change (iLUC). [www.ieabioenergy.com/DocSet.aspx?id=6214](http://www.ieabioenergy.com/DocSet.aspx?id=6214)

<sup>13</sup>IEA Bioenergy Tasks. [www.ieabioenergy.com/OurWork.aspx](http://www.ieabioenergy.com/OurWork.aspx)

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Arthur Wellinger, the Technical Coordinator from 1 May 2010, took over Adam Brown's role and also convened an editorial group to prepare drafts of the text. John Tustin, the Secretary, facilitated the editorial process and arranged for final design and production.

## IEA Bioenergy

### Further Information

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