

Annual Report 2009

IEA Bioenergy

IEA Bioenergy is an international collaborative agreement set up in 1978 by the International Energy Agency (IEA) to improve international co-operation and information exchange between national bioenergy RD&D programmes. IEA Bioenergy aims to achieve a substantial bioenergy contribution to future global energy demands by accelerating the production and use of environmentally sound, socially accepted and cost-competitive bioenergy on a sustainable basis, thus providing increased security of supply whilst reducing greenhouse gas emissions from energy use.



Yves Schenkel, the Member for Belgium (left) with Chairman, Josef Spitzer.

To: IEA Headquarters, Paris

IEA BIOENERGY ANNUAL REPORT 2009

Under the IEA Framework for International Energy Technology Cooperation the Executive Committee of each Implementing Agreement must produce an Annual Report for IEA Headquarters.

This document contains the report of the IEA Bioenergy Executive Committee for 2009. This year, we have presented a special feature 'Bioenergy – a Sustainable and Reliable Energy Source: A review of status and prospects'. This article is the executive summary of a strategic, policy-orientated report jointly prepared for the Implementing Agreement by the Energy Research Centre of the Netherlands (ECN), E4tech, Chalmers University of Technology, and the Copernicus Institute of the University of Utrecht. The full report is available on the IEA Bioenergy website (www.ieabioenergy.com) and in hard copy.

The contributions from the Task Leaders and Operating Agents to this report are gratefully acknowledged.

Josef Spitzer
Chairman

John Tustin
Secretary

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Further information on IEA Bioenergy can be obtained from the Executive Committee Secretary, see back cover of this Annual Report.

The opinions and conclusions expressed in this report are those of the authors.

Bioenergy – A sustainable and reliable energy source

A review of status and prospects

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Executive Summary¹

Introduction

The supply of sustainable energy is one of the main challenges that mankind will face over the coming decades, particularly because of the need to address climate change. Biomass can make a substantial contribution to supplying future energy demand in a sustainable way. It is presently the largest global contributor of renewable energy, and has significant potential to expand in the production of heat, electricity, and fuels for transport. Further deployment of bioenergy, if carefully managed, could provide:

- an even larger contribution to global primary energy supply;
- significant reductions in greenhouse gas emissions, and potentially other environmental benefits;
- improvements in energy security and trade balances, by substituting imported fossil fuels with domestic biomass;
- opportunities for economic and social development in rural communities; and
- scope for using wastes and residues, reducing waste disposal problems, and making better use of resources.

This review provides an overview of the potential for bioenergy and the challenges associated with its increased deployment. It discusses opportunities and risks in relation to resources, technologies, practices, markets, and policy. The aim is to provide insights into the opportunities and required actions for the development of a sustainable bioenergy industry.

¹The full report 'Bioenergy – a Sustainable and Reliable Energy Source' is available on the IEA Bioenergy website (www.ieabioenergy.com) and in hard copy.

Biomass Resources

At present, forestry, agricultural and municipal residues, and wastes are the main feedstocks for the generation of electricity and heat from biomass. In addition, a very small share of sugar, grain, and vegetable oil crops are used as feedstocks for the production of liquid biofuels. Today, biomass supplies some 50 EJ² globally, which represents 10% of global annual primary energy consumption. This is mostly traditional biomass used for cooking and heating. See Figure 1.

There is significant potential to expand biomass use by tapping the large volumes of unused residues and wastes. The use of conventional crops for energy use can also be expanded, with careful consideration of land availability and food demand. In the medium term, lignocellulosic crops (both herbaceous and woody) could be produced on marginal, degraded and surplus agricultural lands and provide the bulk of the biomass resource. In the longer term, aquatic biomass (algae) could also make a significant contribution.

Based on this diverse range of feedstocks, the technical potential for biomass is estimated in the literature to be possibly as high as 1500 EJ/yr by 2050, although most biomass supply scenarios that take into account sustainability constraints, indicate an annual potential of between 200 and 500 EJ/yr (excluding aquatic biomass). Forestry and agricultural residues and other organic wastes (including municipal solid waste) would provide between 50 and 150 EJ/year, while the remainder would come from energy crops, surplus forest growth, and increased agricultural productivity. See Figure 2.

Projected world primary energy demand by 2050 is expected to be in the range of 600 to 1000 EJ (compared to about 500 EJ in 2008). Scenarios looking at the penetration of different low carbon energy sources indicate that future demand for bioenergy could be up to 250 EJ/yr. This projected demand falls well within the sustainable supply potential estimate, so it is reasonable to assume that biomass could sustainably contribute between

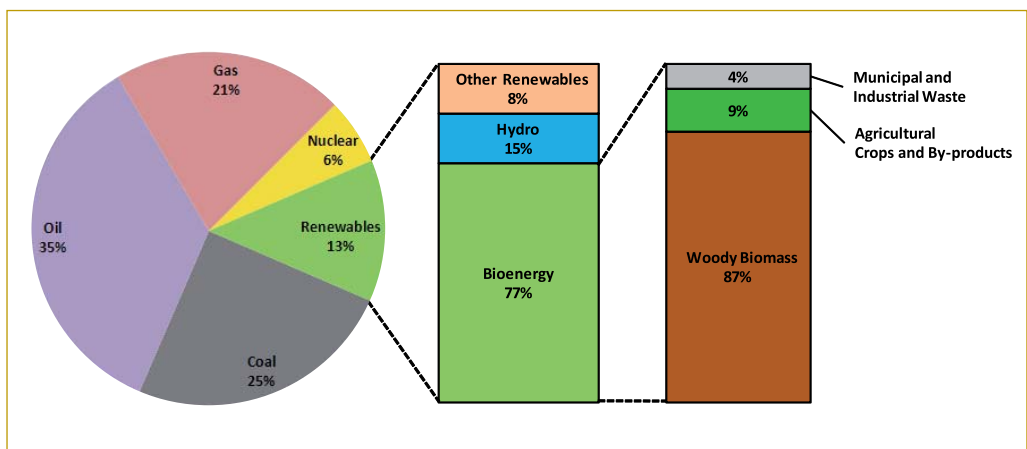


Figure 1. Share of bioenergy in the world primary energy mix. Source: based on IEA, 2006; and IPCC, 2007.

²¹ 1 EJ = 10¹⁸ Joules (J) = 10¹⁵ kilojoules (kJ) = 24 million tonnes of oil equivalent (Mtoe).

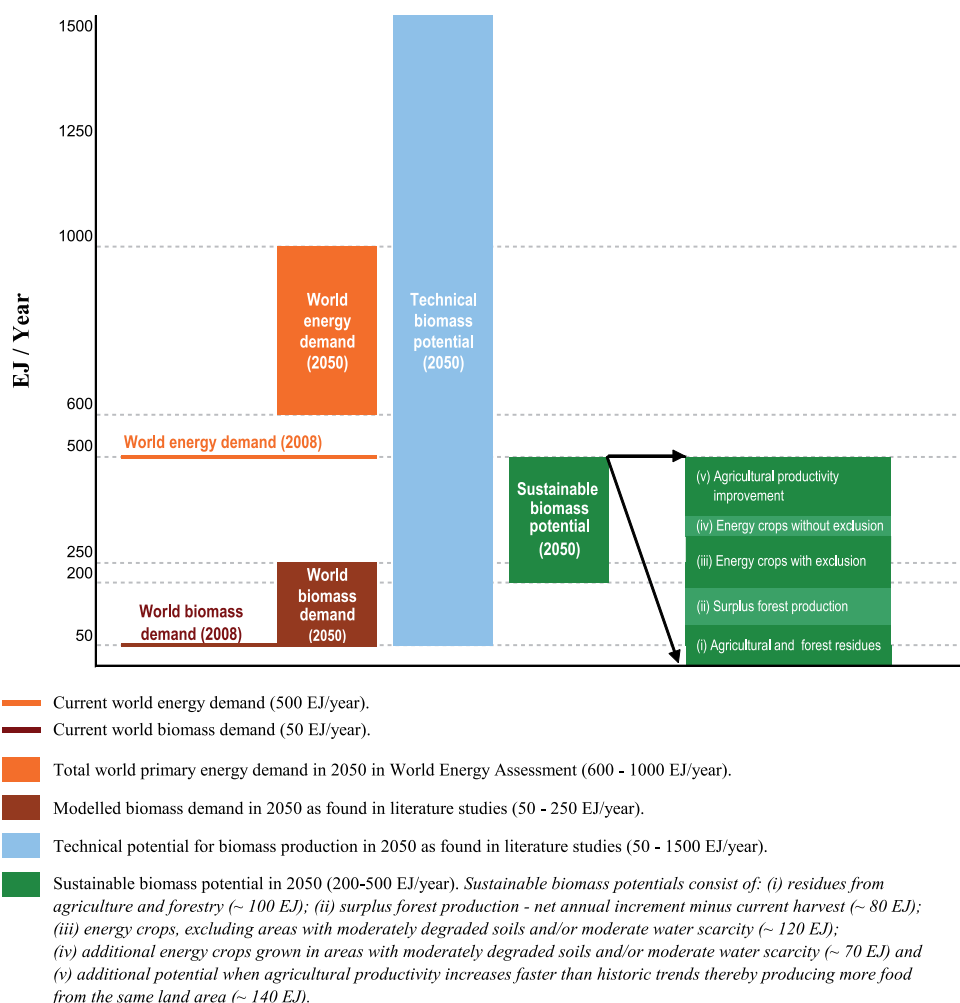


Figure 2. Technical and sustainable biomass supply potentials and expected demand for biomass (primary energy) based on global energy models and expected total world primary energy demand in 2050. Current world biomass use and primary energy demand are shown for comparative purposes. Adapted from Dornburg et al. (2008) based on several review studies.

a quarter and a third of the future global energy mix. See Figure 2. Whatever is actually realised will depend on the cost competitiveness of bioenergy and on future policy frameworks, such as greenhouse gas emission reduction targets.

Growth in the use of biomass resources in the mid-term period to 2030 will depend on many demand and supply side factors. Strong renewable energy targets being set at regional and national level (e.g. the European Renewable Energy Directive) are likely to lead to a significant increase in demand. This demand is likely to be met through increased use of residues and wastes, sugar, starch and oil crops, and increasingly, lignocellulosic crops. The contribution of energy crops depends on

the choice of crop and planting rates, which are influenced by productivity increases in agriculture, environmental constraints, water availability and logistical constraints. Under favourable conditions substantial growth is possible over the next 20 years. However, estimates of the potential increase in production do vary widely. For example, the biomass potential from residues and energy crops in the EU to 2030 is estimated to range between 4.4 and 24 EJ.

The long-term potential for energy crops depends largely on:

- land availability, which depends on food sector development (growth in food demand, population diet, and increased crop productivity) and factors limiting access to land, such as water and nature protection;
- the choice of energy crops, which defines the biomass yield levels that can be obtained on the available land.

Other factors that may affect biomass potential include the impact of biotechnology, such as genetically modified organisms, water availability, and the effects of climate change on productivity.

The uptake of biomass depends on several factors:

- biomass production costs – US\$4/GJ is often regarded as an upper limit if bioenergy is to be widely deployed today in all sectors;
- logistics – as with all agricultural commodities, energy crops and residues all require appropriate supply chain infrastructure;
- resource and environmental issues – biomass feedstock production can have both positive and negative effects on the environment (water availability and quality, soil quality and biodiversity). These will result in regulations restricting or incentivising particular practices (e.g. environmental regulations, sustainability standards, etc.).

Drivers for increased bioenergy use (e.g. policy targets for renewables) can lead to increased demand for biomass, leading to competition for land currently used for food production, and possibly (indirectly) causing sensitive areas to be taken into production. This will require intervention by policy makers, in the form of regulation of bioenergy chains and/or regulation of land use, to ensure sustainable demand and production. Development of appropriate policy requires an understanding of the complex issues involved and international cooperation on measures to promote global sustainable biomass production systems and practices.



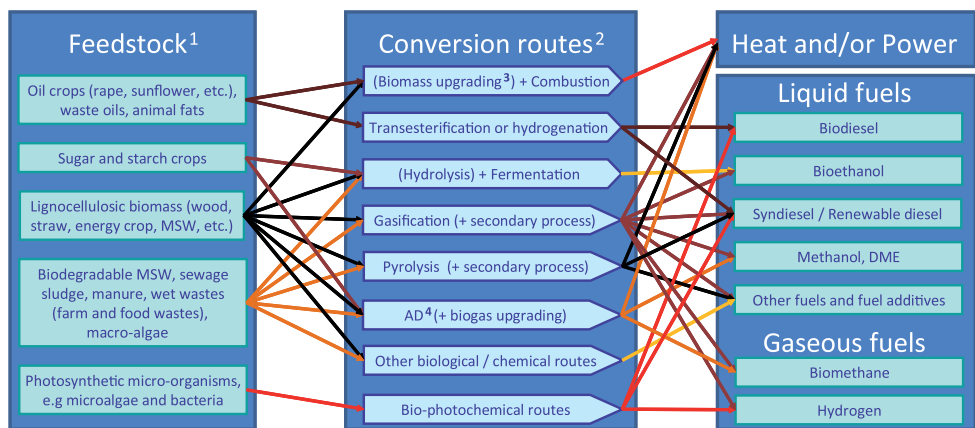
Ethanol pilot plant based on corn fibre and other cellulosic material, New Energy Company of Indiana, USA. (Courtesy DOE/NREL and W. Gretz)

To achieve the bioenergy potential targets in the longer term, government policies, and industrial efforts need to be directed at increasing biomass yield levels and modernising agriculture in regions such as Africa, the Far East and Latin America, directly increasing global food production and thus the resources available for biomass. This can be achieved by technology development, and by the diffusion of best sustainable agricultural practices. The sustainable use of residues and wastes for bioenergy, which present limited or zero environmental risks, needs to be encouraged and promoted globally.

Biomass Conversion Technologies

There are many bioenergy routes which can be used to convert raw biomass feedstock into a final energy product (see Figure 3). Several conversion technologies have been developed that are adapted to the different physical nature and chemical composition of the feedstock, and to the energy service required (heat, power, transport fuel). Upgrading technologies for biomass feedstocks (e.g. pelletisation, torrefaction, and pyrolysis) are being developed to convert bulky raw biomass into denser and more practical energy carriers for more efficient transport, storage and convenient use in subsequent conversion processes.

The production of heat by the direct combustion of biomass is the leading bioenergy application throughout the world, and is often cost-competitive with fossil fuel alternatives. Technologies range from rudimentary stoves to sophisticated modern appliances. For a more energy efficient use of the biomass resource, modern, large-scale heat applications are often combined with electricity production in combined heat and power (CHP) systems.



¹ Parts of each feedstock, e.g. crop residues, could also be used in other routes

² Each route also gives co-products

³ Biomass upgrading includes any one of the densification processes (pelletisation, pyrolysis, torrefaction, etc.)

⁴ AD = Anaerobic Digestion

Figure 3: Schematic view of the wide variety of bioenergy routes. Source: E4tech, 2009.

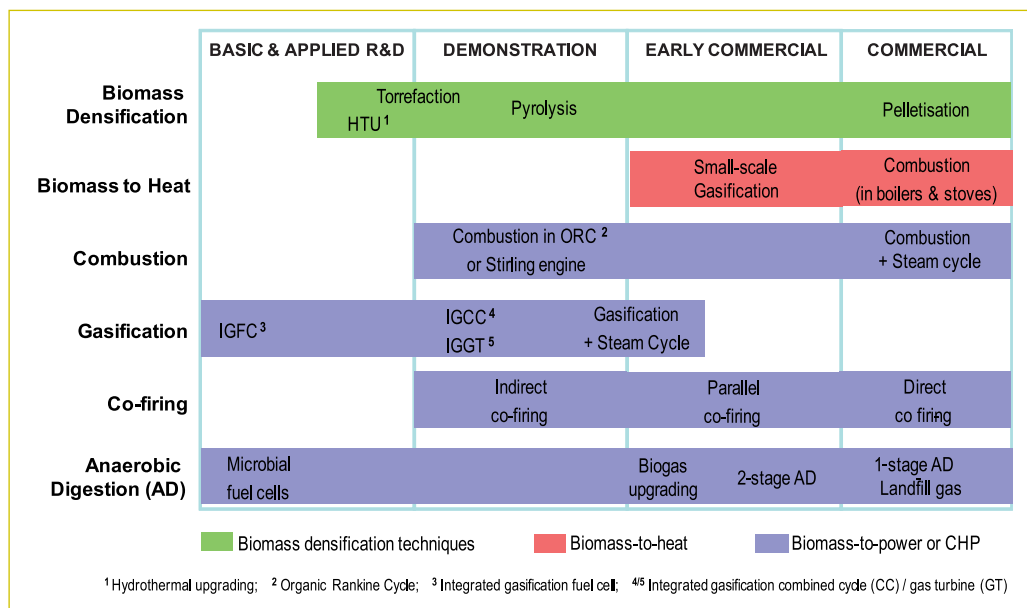


Figure 4. Development status of the main technologies to upgrade biomass and/or to convert it into heat and/or power. Source: E4tech, 2009.

Different technologies exist or are being developed to produce electricity from biomass. Co-combustion (also called co-firing) in coal-based power plants is the most cost-effective use of biomass for power generation. Dedicated biomass combustion plants, including MSW combustion plants, are also in successful commercial operation, and many are industrial or district heating CHP facilities. For sludges, liquids and wet organic materials, anaerobic digestion is currently the best-suited option for producing electricity and/or heat from biomass, although its economic case relies heavily on the availability of low cost feedstock. All these technologies are well established and commercially available.

There are few examples of commercial gasification plants, and the deployment of this technology is affected by its complexity and cost. In the longer term, if reliable and cost-effective operation can be more widely demonstrated, gasification promises greater efficiency, better economics at both small and large-scale, and lower emissions compared with other biomass-based power generation options. Other technologies (such as Organic Rankine Cycle and Stirling engines) are currently in the demonstration stage and could prove economically viable in a range of small-scale applications, especially for CHP. See Figure 4.

In the transport sector, 1st generation biofuels are widely deployed in several countries mainly bioethanol from starch and sugar crops and biodiesel from oil crops and residual oils and fats. Production costs of current biofuels vary significantly depending on the feedstock used (and their volatile prices), and on the scale of the plant. The potential for further deploying these 1st generation technologies is high, subject to sustainable land use criteria being met.

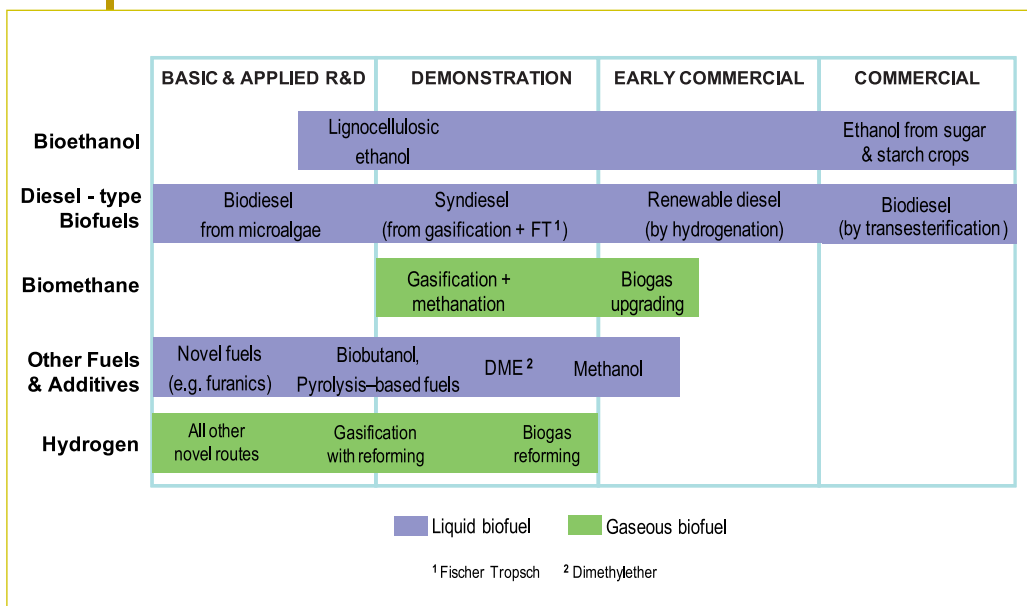


Figure 5. Development status of the main technologies to produce biofuels for transport from biomass. Source: E4tech, 2009.

1st generation biofuels face both social and environmental challenges, largely because they use food crops which could lead to food price increases and possibly indirect land use change. While such risks can be mitigated by regulation and sustainability assurance and certification, technology development is also advancing for next generation processes that rely on non-food biomass (e.g. lignocellulosic feedstocks such as organic wastes, forestry residues, high yielding woody or grass energy crops and algae). The use of these feedstocks for 2nd generation biofuel production would significantly decrease the potential pressure on land use, improve greenhouse gas emission reductions when compared to some 1st generation biofuels, and result in lower environmental and social risk. 2nd generation technologies, mainly using lignocellulosic feedstocks for the production of ethanol, synthetic diesel and aviation fuels, are still immature and need further development and investment to demonstrate reliable operation at commercial scale and to achieve cost reductions through scale-up and replication. The current level of activity in the area indicates that these routes are likely to become commercial over the next decade. Future generations of biofuels, such as oils produced from algae, are at the applied R&D stage, and require considerable development before they can become competitive contributors to the energy markets. See Figure 5.

Further development of bioenergy technologies is needed mainly to improve the efficiency, reliability and sustainability of bioenergy chains. In the heat sector, improvement would lead to cleaner, more reliable systems linked to higher quality fuel supplies. In the electricity sector, the development of smaller and more cost-effective electricity or CHP systems could better match local resource availability. In the transport sector, improvements could lead to higher quality and more sustainable biofuels.

Ultimately, bioenergy production may increasingly occur in biorefineries where transport biofuels, power, heat, chemicals and other marketable products could all be co-produced from a mix of biomass feedstocks. The link between producing energy and other materials deserves further attention technically and commercially.

Bioenergy Markets

The predominant use of biomass today consists of fuel wood used in non-commercial applications, in simple inefficient stoves for domestic heating and cooking in developing countries, where biomass contributes some 22% to the total primary energy mix. This traditional use of biomass is expected to grow with increasing world population, but there is significant scope to improve its efficiency and environmental performance, and thereby help reduce biomass consumption and related impacts. See Figure 6.

In industrialised countries, the total contribution of modern biomass is on average only about 3% of total primary energy, and consists mostly of heat-only and heat and power applications. Many countries have targets to significantly increase biomass use, as it is seen as a key contributor to meeting energy and environmental policy objectives. Current markets, growing as a result of attractive economics, mostly involve domestic heat supply (e.g. pellet boilers), large-scale industrial and community CHP generation (particularly where low cost feedstocks from forest residues, bagasse, MSW etc. are available), and co-firing in large coal-based power plants. The deployment of dedicated electricity plants has been mainly confined to low cost feedstocks in relatively small-scale applications,

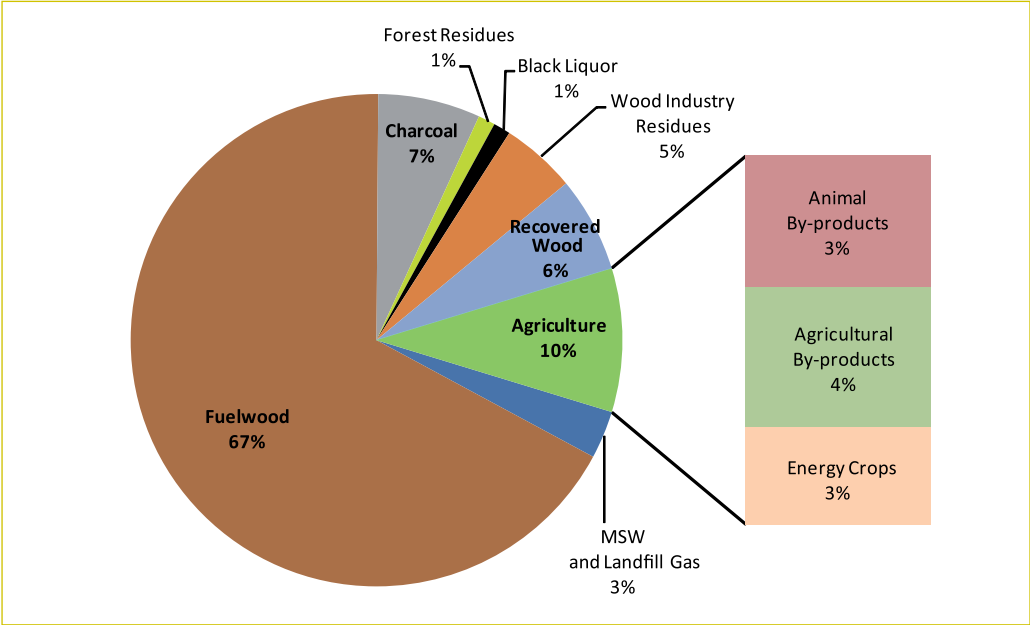


Figure 6: Share of the biomass sources in the primary bioenergy mix. Source: based on data from IPCC, 2007.

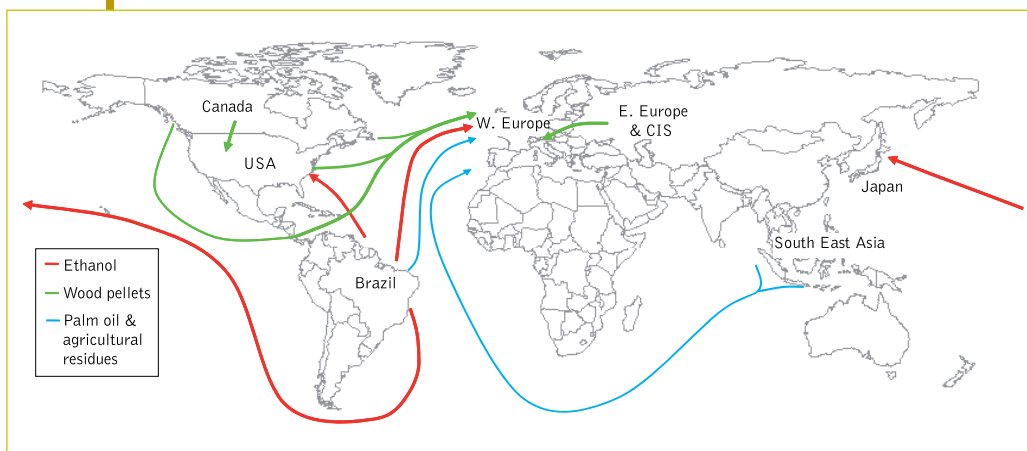


Figure 7: Main international biomass for energy trade routes. Intra-European trade is not displayed for clarity. Source: Junginger and Faaij, 2008.

such as the use of biogas and landfill gas from waste treatment. Globally, the use of biomass in heat and industrial energy applications is expected to double by 2050 under business-as-usual scenarios, while electricity production from biomass is projected to increase, from its current share of 1.3% in total power production to 2.4 – 3.3% by 2030 (corresponding to a 5 - 6% average annual growth rate).

Transport biofuels are currently the fastest growing bioenergy sector, receiving a lot of public attention. However, today they represent only 1.5% of total road transport fuel consumption and only 2% of total bioenergy. They are, however, expected to play an increasing role in meeting the demand for road transport fuel, with 2nd generation biofuels increasing in importance over the next two decades. Even under business-as-usual scenarios, biofuel production is expected to increase by a factor of 10 to 20 relative to current levels by 2030 (corresponding to a 6 - 8% average annual growth rate).

Global trade in biomass feedstocks (e.g. wood chips, vegetable oils and agricultural residues) and processed bioenergy carriers (e.g. ethanol, biodiesel, wood pellets) is growing rapidly. Present estimates indicate that bioenergy trade is modest – around 1 EJ (about 2% of current bioenergy use). In the longer term, much larger quantities of these products might be traded internationally, with Latin America and Sub-Saharan Africa as potential net exporters, and North America, Europe and Asia foreseen as net importers. Trade will be an important component of the sustained growth of the bioenergy sector. See Figure 7.

The quest for a sustainable energy system will require more bioenergy than the growth projected under the business-as-usual scenarios. A number of biomass supply chain issues and market risks and barriers will need to be addressed and mitigated to enable stronger sustained growth of the bioenergy sector. These include:

- Security of the feedstock supply. This is susceptible to the inherent volatility of biological production (due to weather and seasonal variations), which can lead to significant variations in feedstock supply quantity, quality and price. Risk mitigation strategies already common in food and energy markets include having a larger, more fluid, global biomass sector and the creation of buffer stocks.
- Economies of scale and logistics. Many commercially available technologies suffer from poor economics at a small-scale, but conversely larger scales require improved and more complex feedstock supply logistics. Efforts are required to develop technologies at appropriate scales and with appropriate supply chains to meet different application requirements.
- Competition. Bioenergy technologies compete with other renewable and non-renewable energy sources, and may compete for feedstock with other sectors such as food, chemicals and materials. Also, the development of 2nd generation biofuel technologies could lead to competition for biomass resources between bioenergy applications, and potentially with other industry sectors. Support needs to be directed at developing cost-effective bioenergy routes and at deploying larger quantities of biomass feedstocks from sustainable sources.
- Public and NGO acceptance. This is a major risk factor facing alternative energy sources and bioenergy in particular. The public needs to be informed and confident that bioenergy is environmentally and socially beneficial and does not result in significant negative environmental and social trade-offs.

However, the industry is confident such challenges can be met as similar challenges have been addressed in other sectors and appropriate technologies and practices are being developed and deployed.

Interactions with Other Markets

Developments in the bioenergy sector can influence markets for agricultural products (e.g. food and feed products, straw) and forest products (e.g. paper, board). However, this impact is not straightforward due to:

- other factors, such as biomass yield variations and fossil fuel price volatilities influencing markets just as much or more than biomass;
- other policy domains, including forestry, agriculture, environment, transport, health and trade, also having influence on bioenergy policies; and
- a lack of transparency in many product and commodity markets, especially in forest products, making it difficult to assess the impact of bioenergy development.

While all forms of bioenergy interrelate with agriculture and/or forest markets through their feedstock demand, the impact of 1st generation liquid biofuels on food prices has been a topic of strong debate in recent years. Although different studies reveal a wide variety of opinions on the magnitude of these impacts, most model-based demand scenarios indicate

a relatively limited risk of biofuels significantly affecting the price of food crops. In general, markets can work to dampen these effects.

Markets will need access to monetary and physical resources, and will need to function efficiently and transparently in order to counteract the pressure of increasing demand. There is therefore an important role for policy in providing support to an increasingly efficient industry, for example in terms of yields, use of residues and wastes, and land use, while providing regulation to avoid negative impacts associated with the exploitation of physical resources. This requires active coordination between energy, agriculture and forestry, trade and environmental policies.

Bioenergy and Policy Objectives

Bioenergy can significantly increase its existing contribution to policy objectives, such as CO₂ emission reductions and energy security, as well as to social and economic development objectives.

Appreciating where bioenergy can have the greatest impact on GHG emissions reduction relies on both an understanding of the emissions resulting from different bioenergy routes and the importance of bioenergy in reducing emissions in a particular sector. Bioenergy chains can perform very differently with regard to GHG emissions. Substituting biomass for fossil fuels in heat and electricity generation is generally less costly and provides larger emission reductions per unit of biomass than substituting biomass for gasoline or diesel used for transport. However, the stationary bioenergy sector can rely on a range of different low carbon options while biofuels are the primary option for decarbonising road transport until all-electric and/or hydrogen fuel cell powered vehicles become widely deployed, which is unlikely to be the case for some decades. In the long-term, biofuels might remain the only option for decarbonising aviation transport, a sector for which it will be difficult to find an alternative to liquid fuels.

Land suitable for producing biomass for energy can also be used for the creation of biospheric carbon sinks. Several factors determine the relative attractiveness of these two options, in particular land productivity, including co-products, and fossil fuel replacement efficiency. Also, possible direct and indirect emissions from converting land to another use can substantially reduce the climate benefit of both bioenergy and carbon sink projects, and need to be taken into careful consideration. A further influencing factor is the time scale that is used for the evaluation of the carbon reduction potential: a short time scale tends to favour the sink option, while a longer time scale offers larger savings as biomass production is not limited by saturation but can repeatedly (from harvest to harvest) deliver greenhouse gas emission reductions by substituting for fossil fuels. Mature forests that have ceased to serve as carbon sinks can in principle be managed in a conventional manner to produce timber and other forest products, offering a relatively low GHG reduction per hectare.

Tyseley Waste-to-Energy plant, Birmingham, UK. Built in 1996, the 28 MW plant with a 2-stream incinerator has a combined capacity of over 350,000 tonnes per year of municipal solid waste and a fifteen year Non-Fossil Fuel Obligation Contract. An award winning lighting system illuminates the plant at night.



Alternatively, they could be converted to higher yielding energy plantations (or to food production) but this would involve the release of at least part of the carbon store created.

The use of domestic biomass resources can make a contribution to energy security, depending on which energy source it is replacing. Biomass imports from widely distributed international sources generally also contribute to the diversification of the energy mix. However, supply security can be affected by natural variations in biomass outputs and by supply-demand imbalances in the food and forest product sectors, potentially leading to shortages.

The production of bioenergy can also result in other (positive and negative) environmental and socio-economic effects. Most of the environmental effects are linked to biomass feedstock production, many of which can be mitigated through best practices and appropriate regulation. Technical solutions are available for mitigating most environmental impacts from bioenergy conversion facilities, and their use is largely a question of appropriate environmental regulations and their enforcement. The use of organic waste and agricultural/forestry residues, and of lignocellulosic crops that could be grown on a wider spectrum of land types, may mitigate land and water demand and reduce competition with food.

Feedstock production systems can also provide several benefits. For instance, forest residue harvesting improves forest site conditions for planting, thinning generally improves the growth and productivity of the remaining stand, and removal of biomass from over-dense stands can reduce the risk of wildfire. In agriculture, biomass can be cultivated in so-called multifunctional plantations that – through well chosen locations, design, management, and system integration – offer extra environmental services that, in turn, create added value for the systems.

Policy around bioenergy needs to be designed so that it is consistent with meeting environmental and social objectives. Bioenergy needs to be regulated so that environmental and social issues are taken into consideration, environmental services provided by bioenergy systems are recognised and valued, and it contributes to rural development objectives.

Lessons for the Future

As the deployment of many bioenergy options depends on government support, at least in the short and medium term, the design and implementation of appropriate policies and support mechanisms is vital, and defensible, particularly given the associated environmental benefits and existing government support for fossil fuels. These policies should also ensure that bioenergy contributes to economic, environmental and social goals. Experience over the last couple of decades has taught us the following.

- A policy initiative for bioenergy is most effective when it is part of a long-term vision that builds on specific national or regional characteristics and strengths, e.g. in terms of existing or potential biomass feedstocks available, specific features of the industrial and energy sector, and the infrastructure and trade context.
- Policies should take into account the development stage of a specific bioenergy technology, and provide incentives consistent with the barriers that an option is facing. Factors such as technology maturity, characteristics of incumbent technologies, and price volatilities all need to be taken into consideration. In each development stage, there may be a specific trade-off between incentives being technology-neutral and closely relating to the policy drivers, and on the other hand creating a sufficiently protected environment for technologies to evolve and mature.
- There are two classes of currently preferred policy instruments for bio-electricity and renewable electricity in general. These are technology-specific feed-in tariffs and more generic incentives such as renewable energy quotas and tax differentiation between bioenergy and fossil-based energy. Each approach has its pros and cons, with neither being clearly more effective.
- Access to markets is a critical factor for almost all bioenergy technologies so that policies need to pay attention to grid access, and standardisation of feedstocks and biofuels.
- As all bioenergy options depend on feedstock availability, a policy strategy for bioenergy should pay attention to the sectors that will provide the biomass. For the agricultural and forestry sectors, this includes consideration of aspects such as productivity improvement, availability of agricultural and forest land, and access to and extractability of primary residues. For other feedstocks, such as residues from wood processing and municipal solid waste, important aspects are mobilisation and responsible use.
- A long-term successful bioenergy strategy needs to take into account sustainability issues. Policies and standards safeguarding biomass sustainability are currently in rapid development. Due to the complexity of the sustainability issue, future policy making and the development of standards will need to focus on integrated



Biomass contributes 12% of total energy consumption in Denmark and straw from agriculture is an important element. Consumption of biomass for energy production is now 100 PJ/year which is two-thirds of the total technical potential of domestic biomass resources. (Courtesy J. Bunger, Denmark).

approaches, in which the complex interactions with aspects such as land use, agriculture and forestry, and social development are taken into account.

- Long-term continuity and predictability of policy support is also important. This does not mean that all policies need to be long-term but policies conducive to the growth of a sector should have a duration that is clearly stated and in line with meeting certain objectives, such as cost reduction to competitive levels with conventional technologies.
- The successful development of bioenergy does not only depend on specific policies which provide incentives for its uptake, but on the broader energy and environment legal and planning framework. This requires coordination amongst policies and other government actions, as well as working with industry and other stakeholders to establish a framework conducive to investment in bioenergy.

A Sensible Way Forward

Climate change and energy security are problems for which solutions need to be developed and implemented urgently. The scale of the challenge is such that it will require contributions from disparate sources of energy. Bioenergy already contributes significantly to addressing these problems and can contribute much further through existing and new conversion technologies and feedstocks. Furthermore, bioenergy can contribute to other

environmental and social objectives, such as waste treatment and rural development. However, policy makers and the public at large will need to be comfortable that this expansion is sustainable.

Bioenergy can result in many external benefits but also entails risks. A development and deployment strategy needs to be based on careful consideration of the strengths and weaknesses, as well as the opportunities and threats that characterise it.

- Current bioenergy routes that generate heat and electricity from the sustainable use of residues and wastes should be strongly stimulated. These rely on commercial technologies, lead to a better use of raw materials, and result in clear GHG savings and possibly other emission reductions compared to fossil fuels. The development of infrastructure and logistics, quality standards and trading platforms will be crucial to growth and may require policy support.
- Further increasing the deployment of bioenergy, and in particular of biofuels for transport in the short-term, should be pursued by:
 - paying specific attention to sustainability issues directly related to the biomass-to-energy production chain, and avoiding or mitigating negative impacts through the development and implementation of sustainability assurance schemes;
 - incentivising biofuels based on their potential greenhouse gas benefits;
 - considering potential impacts of biomass demand for energy applications on commodity markets and on indirect land use change; and
 - defining growth rates that result in feedstock demands that the sector can cope with on a sustainable basis.
- Development of new and improved biomass conversion technologies will be essential for widespread deployment and long-term success. Public and private funding needs to be devoted to research, development and deployment as follows:
 - for liquid biofuels - advanced technologies that allow for a broader feedstock base using non-food crops with fewer (direct and indirect) environmental and social risks, and higher greenhouse gas benefits;
 - for power and heat production - more efficient advanced technologies, such as gasification and advanced steam cycles, and technologies with improved economics at a smaller scale to allow for more distributed use of biomass; and
 - for novel biomass - upgrading technologies and multi-product biorefineries, which could contribute to the deployment and overall cost-competitiveness of bioenergy.
- As the availability of residues and wastes will limit bioenergy deployment in the long-term, policies stimulating increased productivity in agriculture and forestry, and public and private efforts aimed at development of novel energy crops, such as perennial lignocellulosic crops, and other forms of biomass, such as algae, are essential for a sustained growth of the bioenergy industry. These efforts need to be integrated with sustainable land use policies which also consider making efficient and environmentally sound use of marginal and degraded lands.

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International Energy Agency

The International Energy Agency (IEA) acts as energy policy advisor to 30 Member Countries in their effort to ensure reliable, affordable, and clean energy for their citizens. Founded during the oil crisis of 1973-74, the IEA's initial role was to co-ordinate measures in times of oil supply emergencies. As energy markets have changed, so has the IEA. Its mandate has broadened to incorporate the "Three E's" of balanced energy policy making: energy security, economic development, and environmental protection. Current work focuses on climate change policies, market reform, energy technology collaboration and outreach to the rest of the world, especially major producers and consumers of energy like China, India, Russia and the OPEC countries.

With a staff of around 190, mainly energy experts and statisticians from its Member Countries, the IEA conducts a broad programme of energy research, data compilation, publication, and public dissemination of the latest energy policy analysis and recommendations on good practices.

Objectives

- To maintain and improve systems for coping with oil supply disruptions.
- To promote rational energy policies in a global context through co-operative relations with non-Member Countries, industry and international organisations.
- To operate a permanent information system on the international oil market.
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use.
- To promote international collaboration on energy technology.
- To assist in the integration of environmental and energy policies.

Organisation

The IEA is an autonomous agency linked with the Organisation for Economic Co-operation and Development (OECD) and based in Paris. The main decision-making body is the Governing Board, composed of energy ministers from each Member Country or their senior representatives. A secretariat, with a staff of energy experts primarily from OECD Member Countries supports the work of the Governing Board and subordinate bodies. The IEA Secretariat is headed by an Executive Director appointed by the Governing Board. The IEA Secretariat collects and analyses energy data, organises high-level workshops with world experts on new topics and themes, assesses Member Countries and non-Member Countries domestic energy policies and programmes, makes global energy projections based on differing scenarios and prepares studies and policy recommendations for governments on key energy topics.

Members

Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the USA. The European Commission also participates in the work of the IEA.

Introducing IEA Bioenergy

Welcome to this Annual Report for 2009 from IEA Bioenergy!

IEA Bioenergy is the short name for the international bioenergy collaboration under the auspices of the International Energy Agency - IEA. A brief description of the IEA is given on the preceding page.

Bioenergy is defined as material which is directly or indirectly produced by photosynthesis and which is utilised as a feedstock in the manufacture of fuels and substitutes for petrochemical and other energy intensive products. Organic waste from forestry and agriculture, and municipal solid waste are also included in the collaborative research, as well as broader 'cross-cutting studies' on techno-economic aspects, environmental and economic sustainability, systems analysis, bioenergy trade, fuel standards, greenhouse gas balances, barriers to deployment, and management decision support systems.

The IEA Implementing Agreement on Bioenergy, which is the 'umbrella agreement' under which the collaboration takes place, was originally signed in 1978 as IEA Forestry Energy. A handful of countries took part in the collaboration from the beginning. In 1986 it broadened its scope to become IEA Bioenergy and to include non-forestry bioenergy in the scope of the work. The number of participating countries has increased during the years as a result of the steadily increasing interest in bioenergy worldwide. By the end of 2009, 22 parties participated in IEA Bioenergy: Australia, Austria, Belgium, Brazil, Canada, Croatia, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, South Africa, Sweden, Switzerland, the United Kingdom, the USA, and the European Commission.

IEA Bioenergy is now 32 years old and is a well established collaborative agreement. All OECD countries with significant national bioenergy programmes are now participating in IEA Bioenergy, with very few exceptions. The IEA Governing Board has decided that the Implementing Agreements may be open to non-Member Countries, i.e., for countries that are not Members of the OECD. For IEA Bioenergy, this has resulted in a number of enquiries from potential participants, and as a consequence new Members are expected. Three non-Member Countries currently participate in IEA Bioenergy – Brazil, Croatia, and South Africa.

The work within IEA Bioenergy is structured in a number of Tasks, which have well defined objectives, budgets, and time frames. The collaboration which earlier was focused on Research, Development and Demonstration is now increasingly also emphasising Deployment on a large-scale and worldwide.

There were 13 ongoing Tasks during 2009:

- Task 29: Socio-economic Drivers in Implementing Bioenergy Projects
- Task 30: Short Rotation Crops for Bioenergy Systems
- Task 31: Biomass Production for Energy from Sustainable Forestry
- Task 32: Biomass Combustion and Co-firing
- Task 33: Thermal Gasification of Biomass
- Task 34: Pyrolysis of Biomass
- Task 36: Integrating Energy Recovery into Solid Waste Management Systems
- Task 37: Energy from Biogas and Landfill Gas
- Task 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems
- Task 39: Commercialising 1st and 2nd Generation Liquid Biofuels from Biomass
- Task 40: Sustainable International Bioenergy Trade – Securing Supply and Demand
- Task 41, Project 3: Joint Collaboration Project with AMF
- Task 42: Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass

Members of IEA Bioenergy are invited to participate in all of the Tasks, but each Member is free to limit its participation to those Tasks which have a programme of special interest. The Task participation during 2009 is shown in Appendix 1.

A progress report for IEA Bioenergy for the year 2009 is given in Sections 1 and 2 of this Annual Report.



The ExCo63 study tour group at Rotterdam 'bioport'.

Progress Report

1. THE EXECUTIVE COMMITTEE

Introduction and Meetings

The Executive Committee acts as the 'board of directors' of IEA Bioenergy. The committee plans for the future, appoints persons to do the work, approves the budget, and, through its Members, raises the money to fund the programmes and administer the Agreement. The Executive Committee (ExCo) also scrutinises and approves the programmes of work, progress reports, and accounts from the various Tasks within IEA Bioenergy. Other functions of the ExCo include publication of an Annual Report, production of newsletters and maintenance of the IEA Bioenergy website. In addition the ExCo produces technical and policy-support documents, workshops, and study tours for the Member Country participants.

The 63rd ExCo meeting took place in Rotterdam, the Netherlands on 12-14 May. There were 64 participants. The 64th ExCo meeting was held in Liege, Belgium on 30 September – 2 October, with 57 participants. Representatives from IEA Headquarters attended ExCo63.

At the ExCo64 meeting, Josef Spitzer from Austria was re-elected Chairman and Birger Kerckow from Germany was re-elected Vice Chairman for 2010.

The ExCo Secretariat is based in Rotorua, New Zealand under the Secretary, John Tustin. The fund administration for the ExCo Secretariat Fund and Task funds is consolidated with the Secretariat, along with production of ExCo publications, the newsletter, and maintenance of the website. By decision at ExCo63, John Tustin will provide the Secretariat and Fund Administration service for the period to 31 December 2012. The contact details for the ExCo can be found in Appendix 7 and for the Secretariat on the back cover of this report.

The work in the ExCo, with some of the achievements and issues during 2009, is described below.

Implementing Agreement

Extension of the Implementing Agreement to 31 December 2014 was approved by the IEA Committee on Energy, Research and Technology (CERT) at its meeting in November 2009, following a review by the REWP. The End-of-Term Report prepared by the Secretary received positive comments. This report is available in the library on the website. The new Strategic Plan for the period 2010-2016 was also favourably received. The Chairman made a presentation at both committee meetings to achieve this outcome.

New Participants/Contracting Parties

Following ExCo62, Italy formalised its membership effective from 26 January 2009. Gestore Dei Servizi Energetici (GSE) is the designated Italian Contracting Party. They have joined Tasks 30, 32, 33, 36, 40, and 42. Mr Gerardo Montanino is the ExCo Member and Mr Vito Pignatelli is the Alternate Member.

Interest from potential Member Countries continued to be strong in 2009. Korea and Turkey participated as Observers at ExCo63 and ExCo64. They were invited to outline their national RD&D programmes in bioenergy. Accordingly, Dr Soon-Chul Park from the Korean Institute of Energy Research (KIER), and Dr V. Günhan Kaytaz from the TUBITAK Marmara Research Center, Energy Institute made presentations. Both Korea and Turkey subsequently received formal invitations to join the Implementing Agreement. Korea plans to join Task 39 in 2010 and also Task 32 in 2011. Turkey plans to join Tasks 32, 33, 37, and 42 in 2010.

For a complete list of the Contracting Parties to IEA Bioenergy please see Appendix 3.

Supervision of Ongoing Tasks, Review and Evaluation

The progress of the work in the Tasks is reported by the Operating Agents to the Executive Committee twice per year at the ExCo meetings. The ExCo has also continued its policy to invite some of the Task Leaders to each ExCo meeting so that they can make the presentation on the progress in their Task and programme of work personally. This has improved the communication between the Tasks and the Executive Committee and has also involved the ExCo more with the Task programmes.

The work within IEA Bioenergy is regularly evaluated by the IEA Committee for Energy Research and Technology (CERT) via its Renewable Energy Working Party (REWP) and reported to the IEA Governing Board.

Approval of Task and Secretariat Budgets

The budgets for 2009 approved by the Executive Committee for the ExCo Secretariat Fund and for the Tasks are shown in Appendix 2. Total funds invoiced in 2009 were US\$2,038,099; comprising US\$268,400 of ExCo funds and US\$1,769,699 of Task funds. Appendix 2 also shows the financial contributions made by each Member Country and the contributions to each Task. Very substantial 'in-kind' contributions are also a feature of the IEA Bioenergy collaboration but these are not shown because they are more difficult to recognise in financial terms.

Fund Administration

The International Energy Agency, Bioenergy Trust Account, at the National Bank of New Zealand is functioning smoothly. In 2009 this account was accessed electronically by Ms Jeanette Allen at the New Zealand School of Forestry, University of Canterbury on behalf of the Secretariat. The account is an interest bearing account denominated in US dollars. Details for making payments are:

Arrange an International Telegraphic Transfer/Swift Money Transfer (MT103) to:

Beneficiary Bank: The ANZ National Bank Ltd,

Beneficiary Bank Address: 215-229 Lambton Quay, Wellington, New Zealand

Swift/BIC Address: ANZBNZ22

Beneficiary: Bioenergy Research Services Ltd, for and on behalf of IEA Bioenergy.

Beneficiary Account Number: IEABRS-USD00.

Quoting: Invoice No.

Correspondent Bank: JPMorgan Chase Bank, New York, NY, USA. Swift code:

CHASUS33

The currency for the whole of IEA Bioenergy is US dollars. The main issues faced in fund administration are slow payments from some Member Countries and fluctuations in exchange rates. As at 31 December 2009, there were US\$142,820 of Member Country contributions outstanding.

KPMG is retained as an independent auditor for the ExCo Secretariat Fund until 31 December 2012. The audited accounts for the ExCo Secretariat Fund for 2008 were approved at ExCo63. The Tasks also produce audited accounts. These are prepared according to guidelines specified by the ExCo. The accounts for the Tasks for 2008 were also approved at ExCo63.

The audited accounts for the ExCo Secretariat Fund for the period ended 31 December 2009 have been prepared and these will be presented for approval at ExCo65.

Task Administration and Development

Task Participation

Participation in the Tasks has continued to increase. In 2009 there were 121 participations in 13 Tasks. Please see Appendix 1 on page 90 for a summary of Task participation in 2009.

Tasks for the new Triennium

The Tasks listed below have been approved for the new triennium 2010-2012.

- Task 29: Socio-economic Drivers in Implementing Bioenergy Projects
- Task 32: Biomass Combustion and Co-firing
- Task 33: Thermal Gasification of Biomass
- Task 34: Pyrolysis of Biomass
- Task 36: Integrating Energy Recovery into Solid Waste Management Systems
- Task 37: Energy from Biogas
- Task 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems
- Task 39: Commercialising Liquid Biofuels from Biomass
- Task 40: Sustainable International Bioenergy Trade: Securing Supply and Demand
- Task 41, Project 3: Collaboration with AMF
- Task 42: Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass
- Task 43: Biomass Feedstocks for Energy Markets

Annex Documents

As indicated above, there are 12 Tasks in the new triennium. New Annex documents will be prepared for these Tasks and these will be presented for approval at ExCo65. In order to retain a flexible mechanism for project work, the ExCo has already approved the prolongation of Task 41 'Bioenergy Systems Analysis' to 31 December 2012.

Strategic Planning and Strategic Initiatives

Strategic Plan

The fourth Strategic Plan for IEA Bioenergy for the period 2010-2016 was printed and distributed in November. Like the third plan it underpins a stronger emphasis on market deployment of technologies and systems for sustainable energy production from biomass. The drivers of this new Strategic Plan include:

- The increased emphasis on security of energy supply by Member Countries and the need to reduce dependence on fossil fuels.
- The increased emphasis on greenhouse gas mitigation through the use of bioenergy technologies by Member Countries.

- The need to develop sustainable, non-food biomass resources to be used in bioenergy applications that are environmentally sound and socially acceptable.
- The need for large-scale development and deployment of new or improved bioenergy technologies.
- The need to increase the strategic role of IEA Bioenergy and to support energy policy development.
- The need to enhance the support of IEA bodies in promoting their global energy and environment strategy.

Technical Coordinator

The Technical Coordinator, Adam Brown continued to be very active during 2009. The main areas he focused on were production of policy-related deliverables; planning and publishing the ExCo workshops; Task coordination; liaison with IEA Headquarters; and implementation of the communications plan.

At ExCo64, the Chairman noted that the appointment of Brown had been a valuable addition to the Implementing Agreement's operational capability. He also noted that Task coordination needed to be enhanced in the new triennium. The committee agreed that 50% of the TC's time should be focussed on Task coordination and management in the new triennium. The effect of this is to substantially increase the TC's role with the Tasks. At the same time, it was unanimously agreed to extend the TC's contract to 31 December 2012.

Strategic Fund/Strategic Outputs

At ExCo53 it was agreed that from 2005, 10% of Task budgets would be reserved for ExCo approved work. The idea was that these 'Strategic Funds' would be used to increase the policy-relevant outputs of IEA Bioenergy. Initially the funds were distributed to the Tasks but it was decided that from 1 January 2008 these funds would be held by the Secretariat and distributed to the Tasks (or external contractors) for ExCo approved projects as they were undertaken. This allows uncommitted funds to be monitored more easily and implementation of the 'strategic' component of the work programme is facilitated. To date, the ExCo has committed these funds to specific outputs as follows.

Bioenergy Review: This was a major initiative in 2009. It provides a global perspective of the future potential for bioenergy, the main opportunities for deployment in the short and medium term, and the principal issues and challenges facing the development of the sector. It is aimed at policy and investment decision makers. Production of the review was managed by the Technical Coordinator with important inputs from the Tasks. The principal contractor was the Energy Research Centre of the Netherlands (ECN). Two publications, an executive summary and a main report 'Bioenergy – a Sustainable and Reliable Energy Source: a review of status and prospects' were published in hardcopy and are also available for downloading on the IEA Bioenergy website.

Handbook of Pellet Production and Utilisation: A comprehensive handbook is being prepared on pellet production, handling, transportation, and utilisation, by Task 32. This initiative is a joint project with Tasks 29 and 40 who have provided key inputs on biomass trade and socio-economic aspects. Production is on schedule with printing of the handbook planned for February 2010.

Bioenergy and Land Use Change: This project is co-financed by the Swedish Energy Agency and IEA Bioenergy. It is led by Goran Berndes, the Leader of Task 30. Task 40 is also providing input. The focus is on the climate benefit of bioenergy and how this can be affected by the possible direct and indirect emissions from converting land to bioenergy use. The deliverables will be one report written for the scientific community and one report for policy makers. Final approval is expected in May 2010.

Life Cycle Analysis Paper: A strategic paper 'Life Cycle Analysis of Biomass Fuels, Power, Heat, and Products as Compared to their Petroleum Counterparts and Other Renewables' is being produced by Task 38. Production was delayed so that significant new material could be incorporated. A final version is expected to be available in early 2010.

Better Use of Biomass for Energy: This was a joint project with the RETD Implementing Agreement. IEA Bioenergy contributed 'in-kind' support of expert information, in particular the 'Bioenergy Review' (see above), and co-financing. The final version of this strategic paper was presented at a side event of the COP15 meeting in Copenhagen. An electronic copy of the paper is available on the IEA Bioenergy website.

Two other strategic initiatives have been started in 2009. These are as follows:

Collaboration with AMF: A proposal from the AMF Implementing Agreement for co-financing of a joint project 'fuel and technology alternatives for buses' was accepted. Finland, Germany, and the European Commission have agreed to participate through Task 41, Project 3.

Collaboration with GBEP: The ExCo has agreed to explore how closer ties can be achieved with the Global Bioenergy Partnership (GBEP). A subgroup was convened to make recommendations. It concluded that this could be best achieved through joint results-oriented activities. It noted scope for information exchange between the organisations, and some immediate opportunities for the Tasks to collaborate with the GBEP Taskforce programmes. At ExCo64 there was unanimous support for an exchange of letters to cement a formal relationship with GBEP. The Technical Coordinator, Adam Brown will be the contact point for this collaboration.

ExCo Workshops

At ExCo53 it was decided to create time for strategic topics at ExCo meetings and to use the first day of each meeting for a technical workshop on a topic of high priority. Two very successful workshops on 'Bioenergy - The Impact of Indirect Land Use Change' (ExCo63)

and 'Algae – the future for bioenergy?' (ExCo64) were held in 2009. The presentations, summaries by the rapporteurs, and papers based on the presentations are available on the IEA Bioenergy website. A summary and conclusions publication is also produced for each workshop and this is also available on the website. The complete list is as follows:

- Liquid Biofuels from Black Liquor Gasification – IEA Bioenergy:ExCo:2007:03.
- Co-utilisation of Biomass with Fossil Fuels – IEA Bioenergy:ExCo:2006:02.
- Integrated Waste Management and Utilisation of the Products – IEA Bioenergy:ExCo:2009:02.
- Availability of Biomass Resources, Certification/Sustainability Criteria and Land-use and Bioenergy in the Kyoto and post-Kyoto Framework – IEA Bioenergy:ExCo:2008:02.
- The Biorefinery Concept.
- Innovation in the Field of Bioenergy Business Development – IEA Bioenergy:ExCo:2008:03.
- Biofuels for Transport – Part of a Sustainable Future? – IEA Bioenergy:ExCo:2008:04.
- Bioenergy - The Impact of Indirect Land Use Change (ILUC) – IEA Bioenergy:ExCo:2009:04.
- Algae – The Future for Bioenergy? (*In prep*)

Seminars, Workshops and Sponsorships

A large number of seminars and workshops are arranged every year by individual Tasks within IEA Bioenergy. This is a very effective way to exchange information between the participants. These meetings are described in the progress reports from the Tasks later in this Annual Report. The papers presented at some of these meetings are listed in Appendix 4. Seminars and workshops are also arranged by the Executive Committee.

In 2009 the Executive Committee approved two sponsorships. The first was to the 'IEA Bioenergy Multi-Task Conference' held in Vancouver, Canada in August (US\$15,000). The second was to the 'Thermochemical Biomass Conversion Science' conference held in Chicago, USA in September (US\$5,000).

Collaboration with FAO

The collaboration with FAO under the MoU signed in 2000 has continued. Both the Executive Committee and FAO are committed to capitalising on the opportunities provided through this initiative. Mr Miguel Trossero, Senior Forestry Officer was an Observer at ExCo64. He has been the long standing contact for the Agreement and took the opportunity to review progress. He indicated good success with joint meetings, workshops, and seminars; exchange of publications and newsletter material; and in joint studies. He said overall these results have been pleasing; however, there was scope for more active collaboration especially in the areas of political awareness, sustainability, and bioenergy market opportunities in developing countries.

Promotion and Communication

The ExCo has continued to show lively interest in communication of IEA Bioenergy activities and information. There is a wide range of promotional material available through the Secretariat. This includes Annual Reports, technical brochures, copies of IEA Bioenergy News, the current Strategic Plan, strategic papers, and workshop proceedings. The IEA Bioenergy website underpins this publishing activity.

The 2008 Annual Report with the special colour section on 'Biorefineries: Adding value to the Sustainable Utilisation of Biomass', prepared by Task 40 was very well received. Only a few copies of the Annual Report from the original print run of 900 remain with substantially increased distribution in electronic format.

The newsletter 'IEA Bioenergy News' remains popular. Two issues were published in 2009. The first issue featured bioenergy in the Netherlands and the second issue featured bioenergy in Belgium as special themes. A free subscription is offered to all interested and there is a wide distribution outside of the normal IEA Bioenergy network. The newsletter is distributed in June and December each year which follows the pattern of ExCo meetings. It is produced in electronic format so potential subscribers should ensure that the Secretary has their email address. IEA Bioenergy News is also available from the IEA Bioenergy website. Niki Carling, the Editor since June 2001, has decided to 'move on' after eight years in this role. Her friendly but professional approach and ability to meet deadlines makes finding a suitable replacement a challenging exercise.

Three contributions under the banner of 'IEA Bioenergy Update' were provided to the journal Biomass and Bioenergy in 2009. These covered news from the Executive Committee. This initiative provides excellent access to bioenergy researchers as the journal finds a place in major libraries worldwide.

A special initiative in 2009 was the 'IEA Bioenergy/Multi-Task Conference' held in August in Vancouver. The goals of the conference were to profile IEA Bioenergy 'to the world', target senior people, and showcase the expertise and activities within the various Tasks. Post-conference feedback indicates that these objectives were achieved. A total of 300 delegates attended and registration had to be closed two weeks prior to the conference. There were over 140 high-profile plenary and session speakers, and co-chairs. There were also over 40 quality posters. A feature of the conference was the strong participation by the Tasks and Task Leaders. The involvement of many of the ExCo Members before and during the conference was also invaluable. A conference publication 'Biofuels and Bioenergy. A changing climate' (80 pp) has been produced. Electronic copies can be downloaded from the Task website www.task39.org. Comments at ExCo64 from those that had attended this conference were extremely positive. There was a general view that this type of conference should be repeated.

Interaction with IEA Headquarters

There is continuing contact between the IEA Bioenergy Secretariat, and IEA Headquarters in Paris and active participation by ExCo representatives in relevant meetings.

The Chairman, Technical Coordinator, Secretary, and key Task Leaders have worked closely with Headquarters staff at both administrative and technical levels. The Chairman attended the REWP meeting in Stockholm and also the CERT meeting in Paris to make presentations relating to the extension of the Implementing Agreement. The appointment of Adam Brown as Technical Coordinator has greatly improved the capacity for liaison and collaboration with Headquarters. He has also been active in supporting the NEET initiative and attended the latest event in India. A comprehensive PowerPoint presentation on IEA Bioenergy has also been prepared in support of the NEET meetings.

Takatsune Ito and Ralph Sims attended ExCo63 in Rotterdam. This participation by Headquarters is appreciated by the Members of the ExCo and helps to strengthen linkages between the Implementing Agreement and relevant Headquarters initiatives. Pierpaolo Cazzola attended ExCo64 in Liege as a workshop speaker on 'Algae for biofuel production: process description, lifecycle assessment and some information on costs.'

Status Reports were prepared by the Secretary and forwarded to the Desk Officer and the REWP following ExCo63 and ExCo64. Information was also sent to Nils-Olof Nyland, Vice Chairman of the End Use Working Party (EUWP) for the Transport sector to assist the report he prepares for the autumn meeting of the EUWP. This forms part of the exchange of information between Implementing Agreements and the Working Party.

IEA Bioenergy Website

There are around 2,600 'bona fide' visitors to the website each month. On any day 87% of visitors have not been to the site prior to that day. The most popular areas of the website are the Library and the Media Centre. During the last three month period there were 7195 downloads. The most popular items downloaded recently have been:

- Executive Summary 'Bioenergy – a sustainable and reliable energy source'
- IEA Bioenergy News 21(1)
- IEA Bioenergy 2008 Annual Report
- IEA Bioenergy Strategic Plan 2010-2016
- ExCo56 workshop 'Integrated Waste Management and Utilisation of the Products.'
- ExCo61 workshop 'Biofuels for Transport – Part of a Sustainable Future?'
- Task 39/IEA Headquarters '2nd generation Biofuels – Full Report'.

Colleagues Recognised

Kees Kwant, the Member for the Netherlands, was recently recognised when he received the prestigious Platform Bioenergy Award 2009. The award was in recognition of his role as a promoter of bioenergy and as a matchmaker between the different stakeholders both in the Netherlands and internationally. Kwant is a firm advocate of the innovation which is needed to achieve cost-effective and socially accepted forms of bioenergy. His attributes of enthusiasm and diplomacy were highlighted.

Tony Bridgwater, former Leader of Task 34 and Professor of Chemical Engineering at Aston University's School of Engineering and Applied Science, has been awarded the Don Klass Award for Excellence in Thermochemical Conversion Science. The award was presented on 16 September at the international 'tcbiomass 2009' conference in Chicago, USA, in recognition of his extensive contributions to the field of bioenergy.

Changing of the Guard

At ExCo60 it was decided that Task Leaders should only serve for two triennia, or in exceptional circumstances three triennia. The idea was to create a change of leadership on a regular basis and at the same time provide more opportunity for wider Member Country involvement in Task leadership. It was hoped that such rotation would result in new ideas and stimulation of the Task work programmes. As a result of this decision some very experienced and dedicated Task Leaders have 'passed the baton' to new leaders for the upcoming triennium.

At ExCo64 Chairman Josef Spitzer paid tribute to the long and expert service from the outgoing Task Leaders: Jim Richardson, Task 31; Sjaak van Loo, Task 32; Suresh Babu, Task 33; Tony Bridgwater, Task 34; Niranjana Patel, Task 36 and Arthur Wellinger, Task 37. He expressed the appreciation of the Executive Committee for their expertise and commitment over the last decade and made a presentation to those in attendance.

2. PROGRESS IN 2009 IN THE TASKS

Task 29: Socio-economic Drivers in Implementing Bioenergy Projects

Overview of the Task

The objectives of Task 29 are to:

- achieve a better understanding of the social and economic drivers and impacts of establishing bioenergy fuel supply chains and markets at the local, regional, national and international level;
- synthesise and transfer to stakeholders critical knowledge and new information;
- improve the assessment of the above mentioned impacts of biomass production and utilisation in order to increase the uptake of bioenergy; and
- provide guidance to policy makers.

These objectives will be met through encompassing the results and findings obtained previously in the Task and also through the international state-of-the-art socio-economic evaluation of bioenergy programmes and projects. Activities will be expanded to include developing countries through the FAO and similar organisations. This will include the sharing of research results, stimulation of new research directions in national, regional, and local programmes, and technology transfer from researchers to resource managers, planners, and industry.

Participating countries: Austria, Canada, Croatia, Ireland, Japan, Norway, and the United Kingdom

Task Leader: Dr Keith Richards, TV Energy Ltd, United Kingdom

Associate Task Leader: Dr Julije Domac, North-West Croatia Regional Energy Agency, Croatia

Operating Agent: Mr Kieran Power, Department of Energy and Climate Change (DECC), United Kingdom.

The Task Leaders direct and manage the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 29, please refer to Appendices 2-6 inclusive; the Task website: www.task29.net, the biomass and bioenergy educational website: www.aboutbioenergy.info and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Task Meetings and Workshops

The Task organised two international events in 2009 alongside Task management meetings. The first was an international seminar and expert consultation 'Assistance Needs for Developing Bioenergy Strategies', held on 17-19 June in Rome, at the FAO Headquarters. That was the first Task event organised together with FAO but also a result of many years intensive cooperation. The main part of the event was dedicated to WISDOM - a methodological tool designed to provide a spatial representation of woodfuel demand and supply patterns. WISDOM was developed by the FAO's Wood Energy Programme, together with the Instituto de Ecología, National University of Mexico. At the seminar, experts from 17 countries reported on the opportunities offered by planning tools for the realisation of wood energy (and bioenergy) strategies, action plans and programmes integrated within forestry, agriculture, energy, and environmental policies. The potential for using the model to examine socio-economic parameters was also discussed. The Task was invited to work closely with the FAO to take this idea forward. In particular, there is the opportunity to work with Ms Erika Felix (Bioenergy Officer – FAO) who is leading a pilot project using WISDOM in Peru. The expectation is that the application of WISDOM will be explored in each of the participating countries.

The second event, organised jointly with Task 39 and others was the Multi-Task conference 'Biofuels and Bioenergy: A Changing Climate', held on 23-26 August at the University of British Columbia in Vancouver. This conference furthered the Tasks' work of collecting, synthesising, and sharing leading-edge science and technology that is driving the emerging biofuel and bioenergy sectors, as supported by the sustainable production of biomass for energy from naturally regenerated forests and plantations that integrate forest management, environmental conditions, and socio-economic factors. It provided an opportunity for resource managers, power industry representatives, bioenergy systems equipment manufacturers, energy production professionals, energy users, programme managers, educators, scientists and researchers to exchange information and discuss technical and policy aspects around biofuels and bioenergy, as well as issues around sustainable management, production and use of forest biomass for energy, with strong consideration given to the role of society in guiding these developments.

Both meetings were attended by all participating countries and a list of the presentations made is provided in Appendix 4.

Work Programme

The work programme in 2009 included the extension of a series of case studies from participating countries with particular emphasis on socio-economic components and specifically the drivers leading to a project and its impacts. The case studies illustrate opportunities for biomass use in both urban and rural communities, best practice

procedures and socio-economic drivers. The completed case studies are available as PDF files from the Task website. This was a prerequisite to producing an overall summary of case studies and best practice/lessons learned in a form of a scientific paper and a popular brochure. These may be a key deliverable of the Task in 2010.

The team also examined attitudes to working within the bioenergy industry with several in-country surveys being carried out. The majority of respondents actively sought to work within the industry and had a positive view of their work and the benefits derived by local communities. There remained much frustration concerning the slow growth of the industry and recognition that lack of profile may well be a hindrance to progress.

The team explored Stern's 'Value Belief Norm' theory which has been adopted for the SERVE eco-development in Ireland. (Analyses of whether personal drivers are altruistic, egoistical, based on traditional values, openness to change for example). Three groups were targeted. The population of the eco-village themselves, people receiving SERVE grants and finally those expressing an interest in the grants. A control group of people outside of the SERVE project will be looked at later. Recommendations from the work include focusing more on sustainable energy (as the study was wide ranging). The work shows that multiple interventions are needed to get change – money alone is not enough. What really affects personal motivation? Targeting altruism and personal obligation are thought to be one way forward.

The team also considered a further three year programme and undertook detailed planning for event-based meetings (conferences/workshops) over that time. Major themes will include working closely with the FAO on mapping of socio-economic benefits of bioenergy projects (developing countries and partner countries) as well as addressing fuel poverty and regionally specific issues affecting the wider introduction of bioenergy.

Collaboration with Other Tasks/Networking

The Task has collaborated on the production of a Pellet Handbook (Task 32) and was also an active participant in the Multi-Task conference in Vancouver.

Website

The Task website (www.task29.net) is periodically reorganised and updated and this will continue. All publications, including workshop proceedings and meeting minutes, Task brochures and posters, Task reports and papers, can be downloaded in PDF format. Several video files, explaining various socio-economic issues related to bioenergy, are available for downloading or online viewing. The visual identity of the website was recently redeveloped and additional material (including presentations from Task workshops, separate articles from Task proceedings, completed case studies, additional reports, and papers) has been made available for downloading.

Deliverables

Deliverables in 2009 included workshop presentations at the Multi-Task conference, invited papers published in recognised international journals, several papers presented at major international events, the two progress reports and an annual audit report to the Executive Committee, along with the biomass and bioenergy educational website.

TASK 30: Short Rotation Crops for Bioenergy Systems

Overview of the Task

Work in the current triennium is based on the premise that in many countries biomass demand for energy will enter a period of rapid expansion as a way to ensure sustainable and secure energy sources. Short Rotation Crops (SRC) can become a plausible energy source if production systems are economically and environmentally attractive. New science, tools, and technology must be developed to support this era of rapid expansion. Such developments will ensure that suitable production systems are established and can be relied on to help achieve the energy policy targets in many countries.

The objective of the Task is to acquire, synthesise, and transfer theoretical and practical knowledge of sustainable short rotation biomass production systems and thereby to enhance market development and large-scale implementation in collaboration with the various sectors involved. The Task also aims to improve the awareness of biomass production potential and to promote the use of biomass for energy in participating countries.

The work programme is confined to short rotation crops (SRC) that entirely or by means of residuals may provide biomass to the energy market, and comprises herbaceous and woody crops in farming systems and plantation forests grown on short rotations. Woody crops include coppice systems and also fast-growing single-stem plantations (rotation period 6 to 12 years). These short rotation systems usually employ willow, hybrid poplar, and Eucalyptus species and produce large quantities of biomass suitable for energy purposes. In many instances, they form an important component of nutrient cycling and thus may play an important role in environmental management.

Participating countries: Australia, Brazil, Canada, Italy, the Netherlands, New Zealand, Sweden, United Kingdom, and the USA.

Task Leader: Associate Professor Göran Berndes, Chalmers University of Technology, Sweden

Associate Task Leaders: Mr Ian Nicholas, Scion, New Zealand

Task Secretary: Mr Brendan George, NSW Dept of Primary Industries, Australia

Operating Agent: Dr Björn Telenius, Ministry of Enterprise, Energy and Communications, Sweden

The Task Leader directs and manages the work programme assisted by an international team. A National Team Leader (NTL) from each country is responsible for coordinating the national participation in the Task. During 2009, the Task capacity was further increased through the NTLs engaging support persons within their country. The aim was that all participating countries should have a closely collaborating national team consisting of participants actively supporting the NTL at the national level as well as engaged in Task activities at the international level.

For further details on Task 30, please refer to Appendices 2-6 inclusive; the Task website www.shortrotationcrops.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings

The Task was involved with several specific events in 2009. The NTL's have been engaged in sub-Task group working meetings in connection with Task events, and have been involved in relevant activities on the national level. The NTLs also achieve substantial outreach as part of their professional roles.

The Task organised and chaired the session 'Bioenergy production impacts on biogeochemistry' at the BIOGEOMON Conference held on 29 June-3 July in Helsinki, Finland. The session covered biogeochemical aspects (e.g. nutrient losses, leaching of dissolved organic carbon and nutrients) of intensive biomass harvesting for use as bioenergy. Short rotation crop production, whole tree harvesting, and logging residue operations were among the bioenergy systems covered. Seven oral presentations were given and poster sessions contained additional presentations that could not fit within the timeframe for the session.

Together with Task 31, the Task arranged the session 'Crops and Sustainable Forestry for Bioenergy' during the Multi-Task conference in Vancouver.

The end of triennium Task 30 conference 'Linking Technology with Biomass' took place on 1-4 December in Taupo, New Zealand. The conference which combined plenary sessions with poster presentations, presented good networking opportunities for the participants. The final day of the conference was dedicated to a much appreciated field trip visiting several relevant SRC operations as well as sites subject to SRC considerations, from the perspective of planned land use change to protect soil/water resources and the environment.

Following the conference, the Task arranged a side event at the Bioenergy Australia 2009 conference on 8-10 December in Gold Coast, Australia. The Task Leader also gave the

keynote address at the conference, drawing on Task 30 achievements as well as results presented in the IEA Bioenergy publication 'Bioenergy – a Sustainable and Reliable Energy Source'.

Work Programme

The work programme for the current triennium is set up to provide answers, from different perspectives, to the following questions:

- How can the Task further develop and implement short rotation biomass production systems on a large-scale and ensure socio-economic and environmental sustainability of these systems?
- What gains, with regard to productivity and environmental performance, can be obtained by technical improvements and how do these gains impact on deployment and market penetration of the systems?

The work is divided into five central themes:

- improving and optimising production systems;
- SRC: climate change and ecosystem services;
- linking producers and markets;
- competition for land and water resources; and
- energy, agriculture, and environmental policies for SRC implementation.

Systematic SRC knowledge transfer is achieved through the website, newsletters, a handbook, international collaboration, and IEA networks to educate and inform the bioenergy sector.

Website

The Task website (www.shortrotationcrops.org) designed with the objective of obtaining a wider Task 30 exposure is updated regularly. The site has a Task overview, links to key actors in each of the participating countries as well as sections for individual crop types. It contains most of the Task material that is produced including the latest Task newsletters and publications.

Collaboration with Other Tasks/Networking

2009 has involved less joint events with other Tasks compared to previous years. Task 30 collaborated with Task 31 in connection with the Multi-Task conference in Vancouver, and with Steve Schuck (Australian ExCo Member) in connection with the Bioenergy Australia 2009 conference.

Deliverables

References to published abstracts and papers are provided in Appendix 4. Most reports and publications are distributed electronically and can be downloaded from the Task website, or alternatively by contacting the Task Leader.

TASK 31: Biomass Production for Energy from Sustainable Forestry

Overview of the Task

The objective of the Task is to share, analyse, synthesise, disseminate, and promote scientific knowledge and technical information leading to the economically and environmentally sustainable production of biomass for energy from integrated forestry systems.

The work of the Task involves criteria for sustainable forest management of bioenergy production systems from multi-use forestry with primary production of traditional forest products. The scope is worldwide, including boreal, temperate, subtropical, and tropical forest regions. The work includes sharing and synthesis of research information, analysis of policy relevance, and dissemination of this information to help promote the sustainable development goals of national programmes in participating countries. The basis of the approach is an integrated concept of biomass production systems incorporating biological, economic, environmental, and social components. Multi-disciplinary partnerships of key research, government and industry stakeholders, and policy makers are fostered in forest biomass production research, planning, and operations. The programme and activities undertaken in previous Task periods are continued and enhanced.

The primary end users for Task outputs are forest managers, researchers and bioenergy planners, but Task outputs will also be useful for policy makers, NGOs and the interested public.

Participating countries: Canada, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, United Kingdom, and USA

Task Leader: Mr Jim Richardson, J Richardson Consulting, Canada

Operating Agent: Mr Ed Hogan, Natural Resources Canada, Canada

The Task Leader directs and manages the work programme assisted by an international team from Canada, Sweden, and the USA. A National Team Leader from each country is responsible for coordinating the national participation in the Task. The national teams in participating countries comprise an extensive group of scientific and technical collaborators.

For further details on Task 31, please refer to Appendices 2-6 inclusive, the Task website www.ieabioenergytask31.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Task Meetings and Workshops

The Task leadership team met with National Team Leaders from participating countries on 16-17 February in Hamburg, Germany. The purpose of this meeting was to review progress with Task activities and plan for the final year of the three-year Task period 2007-2009. Planning for the new Task period 2010-2012 was also discussed with input provided to a draft proposal for a new Task on 'Biomass feedstocks for bioenergy markets' in which the interests of Task 31 would be combined with those of Task 30 and expanded. A Task business meeting was also held on 6 October in Wershofen, Germany during the Task workshop there.

The final workshop of Task 31 took place on 5-8 October in Wershofen, Germany. A total of 56 participants from 11 different countries took part in two days of technical sessions and two days of field visits, organised by Jörg Schweinle, German National Team Leader of Task 31, and the Johann Heinrich von Thunen Institute. The theme of the workshop: 'Forests under Pressure?! Bioenergy – Forest Industry – The Public', was explored through 27 oral technical presentations and 15 poster presentations. The two days of field visits focused on the Rheinland Wood Competence Centre, a municipal biomass heating plant, and fuelwood supply from hardwood stands, as well as the Eifel National Park. Workshop presentations were made available to participants on CD. Formal publication of peer-reviewed papers will be undertaken.

Work Programme

The Task work programme includes annual international workshops and study tours for sharing of scientific and technical information; case studies and success stories; policy-oriented papers dealing with key issues related to sustainable forest biomass production; dissemination of new research knowledge; documentation of operational successes; and providing technical information to research, government, industry stakeholders and policy makers. It involves strong collaboration and information exchange with other IEA Bioenergy Tasks and other forestry and bioenergy organisations worldwide. The Task has limited funds for development of new technology, but is able to influence the direction of policy and research through development of white papers, state-of-the-art assessments, synthesis reports, and policy-related documents.

In policy-related activity the Task continued to focus on criteria and indicators for sustainable woodfuel production systems, taking into consideration possible environmental, economic, and social effects of the use of biomass for energy from forests and trees outside forests. In collaboration with the Wood Energy Programme of FAO, a multi-author publication 'Certification of forest fuel production systems: a solution for sustainable use of biomass from forest residues for energy', is being developed. It explores the concept

of sustainability and tools for its assessment as applied to woodfuels, existing criteria and indicator schemes for sustainable woodfuel, and the environmental, economic, social, and cultural impacts, as well as the legal and institutional framework of woodfuel production in developing and developed countries. The publication develops a global set of principles, criteria, and indicators for sustainable woodfuels and discusses their practical implementation. So far the chapters have been reviewed internally in preparation for external review and publication, by FAO, in 2010. This project has generated a number of related papers and presentations to important international audiences.

Country reports prepared by Task participants to provide up-to-date information on the status of bioenergy generally in individual countries, and more specifically on national developments in sustainable biomass production for energy from forestry formed the basis of a synthesis paper comparing the drivers, challenges, and opportunities for bioenergy in selected countries in North America and Europe. This paper highlighted that a complex multi-directional network of drivers and challenges influence energy policy resulting in bioenergy deployment. There is a need for clear policy targets and economic incentives. Trade in wood biomass will likely grow, providing a key opportunity, but cross-sectoral issues are becoming significant. The paper has been honed through several presentations.

A technology report was presented to ExCo64 on the topic of 'Efficiencies of Nordic forest fuel supply-chains'. Based on current research information and practical experience in Finland and Sweden, the paper discusses supply systems and their costs for forest biomass from forest residues, small trees, and stumps, including the use of modern information and communication technology tools, biorefineries as potential new clients for woody biomass, and the energy balance and global warming potential of supply systems. The Nordic experience can have application in other countries. It is expected that the paper will be published by the ExCo.

One of the primary means of achieving Task goals and outputs is a series of annual workshops. These involve invited and volunteer scientific and technical experts who present papers and posters, contribute to assessments and discussions, and lead study tours. Successful applications of sustainable forest management for increased ecosystem productivity, forest health, and efficient utilisation of forest resources, including biomass for energy, are examined.

Communication of the goals, activities, and outputs is a vital element of the promotional aspect of the Task. A strong presence on the internet is actively maintained. The Task website is the primary vehicle for dissemination. It has a broad range of information, including events, reports and publications, photographs, country reports, and the newsletter. Complete coverage of publications of the current Task is provided, including the extensive output of past Tasks and activities. Basic Task information is also provided on the IEA Bioenergy website, where informational materials, such as workshop announcements, are available. Material is also contributed regularly to IEA Bioenergy News.

Industry involvement is important to the Task and particular efforts are made to involve industry participants in workshops and conferences. A technical seminar with Finnish industry participation was organised at the Finnish Forest Research Institute in Joensuu, Finland in May for a visiting mission of mainly industry representatives from the Canadian Bioenergy Association.

Collaboration with Other Tasks

Several Tasks have objectives and interests that are complementary to those of Task 31. Strong links are maintained with these Tasks through sharing of information and, where possible, joint workshops.

The Task participated actively in the Multi-Task conference in Vancouver, organising together with Task 30 one of the key technical sessions of the conference. A sub-chapter on the potential for pellet production in Europe was contributed to the Pellet Handbook being developed by Task 32. Proceedings of the joint workshop with Task 38 and Task 40 held in the UK in 2008 have been prepared for publication.

Opportunities for collaboration and cooperation with other international researchers, organisations and activities, particularly those involved in issues of sustainability of forest ecosystems, are also pursued. The major collaborative effort with the Wood Energy Programme of FAO on development of a joint multi-author publication on criteria and indicators for sustainable woodfuel production was noted above. In 2009, the chapters of this publication underwent detailed internal review and will be completed in 2010 following external review and final revision. The project was presented at the XIIIth World Forestry Congress in October in Buenos Aires where it received much attention.

Deliverables

Manuscripts making up the proceedings of the Task workshop held in Joensuu, Finland in 2007 have been submitted following peer review for publication as a special issue of Biomass and Bioenergy. Manuscripts based on presentations at the joint Task workshop held in Warwick, UK in 2008 have been submitted following peer review for publication as a special issue of Silva Fennica.

Proceedings of the Task workshop held in Wershofen, Germany in October 2009 have been made available to participants in a CD of workshop presentations. Manuscripts based on presentations at the workshop are being peer reviewed by workshop participants and Task colleagues prior to submission for publication as a special issue of either Silva Fennica or another appropriate journal.

Seven chapters have been contributed to the joint publication with FAO on criteria and indicators for sustainable woodfuels. The joint publication is under going external review

prior to publication by FAO in 2010. A journal paper on environmental factors affecting woodfuel production has been published providing the scientific underpinnings for one of the joint publication chapters, and another is in press. A flyer describing the publication was prepared for the XIIIth World Forestry Congress.

Five presentations were made by the Task at the Multi-Task conference in Vancouver. These are available on the Task 39 website at www.task39.org. During the XIIIth World Forestry Congress in Buenos Aires in October 2009, three presentations were given by the Task in a side-event on 'Sustainable management of woodfuel production' organised jointly with FAO. The Task also made presentations at the Congress during a plenary forum on 'Forests and Energy' and a sub-theme session on the same topic. Presentations at the Congress are available on the WFC website at www.wfc2009.org.

Country reports for Canada, Finland, the Netherlands, Norway, Sweden, and the UK are available on the Task website. In addition a synthesis paper has been developed based on the country reports and other information which compares the drivers, challenges, and opportunities for bioenergy in North America and Europe.

A number of presentations were given by the Task at other workshops and conferences, as listed in Appendix 4.

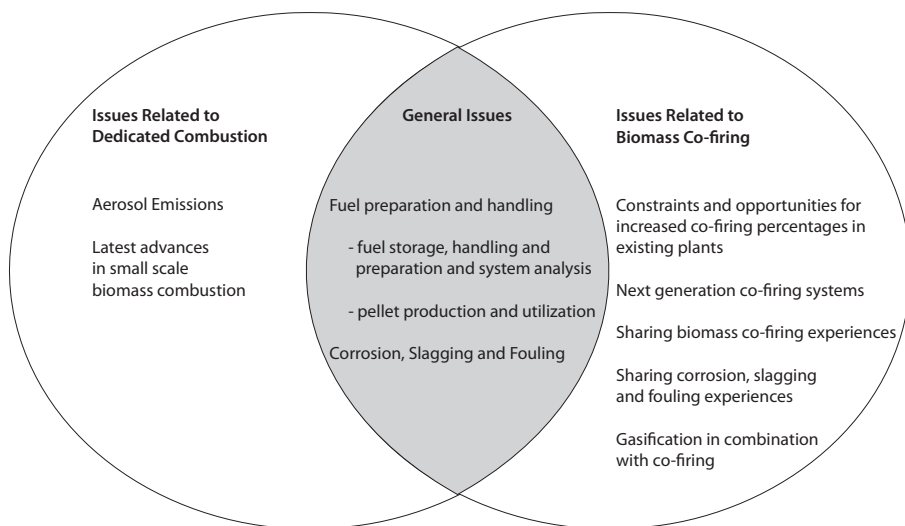
TASK 32: Biomass Combustion and Co-firing

Overview of the Task

The objective of the Task is to stimulate expansion of biomass combustion and co-firing for the production of heat and power on a wider scale. The widespread interest in the work of the Task illustrates the relevance of biomass combustion and co-firing in society. The focus can be broadly categorised as:

- General issues relating to both dedicated biomass combustion and co-firing.
- Issues specifically for dedicated biomass combustion systems.
- Issues related specifically to biomass co-firing.

The topics that received specific attention in the current triennium are shown in the figure below. In comparison to previous work done by Task 32, the focus on biomass co-firing has increased.



The specific actions for the Task involved collecting, sharing, and analysing the policy aspects of results of international/national R&D programmes that relate to these priorities. The results of these actions will be disseminated in workshops, reports, books, and databases etc. In addition, a number of specifically designed, strategic actions will be carried out by the Task to catalyse this process.

While most of the above actions are of a technical character, Task 32 also addresses non-technical issues on fuel logistics and contracting, environmental constraints and legislation, public acceptance and financial incentives. An overview of relevant policies is included in the new version of the Handbook of Biomass Combustion and Co-firing, which was made available in 2008. In addition, the Task produced a number of reports on harnessing the co-firing potential in both existing and new coal-fired power plants.

Of all the thermochemical conversion technologies available for biomass, combustion can be regarded as the most widely applied option, with a global market share exceeding 90%. When compared to gasification, pyrolysis, or liquefaction, it is observed that combustion technologies are in a further stage of development. Commercial availability is high and there is a multitude of options for integration with existing infrastructure on both large- and small-scale levels.

In most IEA Bioenergy Member Countries, the technical market potential for small-scale, biomass-fuelled systems is large because of the local availability of biomass and a substantial application potential in buildings, small industries and horticulture. The advantages of small-scale systems over large-scale systems include the lower costs for transportation and the potential for better overall efficiencies because of the increased potential for local use of the heat generated. However, the specific investment costs of

these small-scale power systems are high in comparison to larger-scale power systems, which is considered to be the main obstacle for further market introduction. Additionally, the small-scale facilities have much lower conversion efficiencies of fuel energy to electric power and have much higher operation costs.

Co-firing biomass with coal represents one combination of renewable and fossil energy utilisation that derives the greatest benefit from both fuel types. Co-firing capitalises on the large investment and infrastructure associated with the existing fossil-fuel-based power systems while requiring only a relatively modest investment to include a fraction of biomass in the fuel. When proper choices of biomass, coal, boiler design, and boiler operation are made, traditional pollutants (SO_x , NO_x , etc.) and net greenhouse gas (CO_2 , CH_4 , etc.) emissions decrease. Ancillary benefits include increased use of local resources for power, decreased demand for disposal of residues, and more effective use of resources. These advantages can be realised in the near future with low technical risk. However, improper choices of fuels, boiler design, or operating conditions could minimise or even negate many of the advantages of burning biomass with coal and may, in some cases, lead to significant damage to equipment. Task 32 targets its activities to direct co-combustion of biomass in existing coal fired boilers and the fireside issues related to co-combustion of producer gas from biomass gasification, pyrolysis oil or charcoal (not to the gasification, pyrolysis or carbonisation itself).

Participating countries: Austria, Belgium, Canada, Denmark, Finland, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, United Kingdom, and the European Commission.

Task Leader: Mr Sjaak van Loo, Procede BV, the Netherlands. From 1 January 2010, Ir. Jaap Koppejan will take over as Task Leader for the new triennium.

Co-Task Leader: Ir Jaap Koppejan, Procede BV, the Netherlands

Operating Agent: Ir Kees Kwant, NL Agency, the Netherlands

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 32, please refer to Appendices 2-6 inclusive; the Task website www.ieabioenergytask32.com and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

In 2009, Task 32 organised two internal meetings, a workshop and a two day field trip. The first meeting was held in Hamburg, Germany and the second in Ottawa, Canada. These internal meetings were used to monitor progress in different Task activities, reflect on Task-initiated workshops, share recent developments on application of biomass combustion in Member

Countries and plan for the next triennium. An important project in 2009 was preparation of the 'Handbook of Pellet Production and Utilisation'. In order to get more input from the other Tasks, the publication was postponed until early 2010.

Workshops are a proven concept to gather and disseminate information in a structured and effective manner. Invited speakers present latest insights on one aspect of biomass combustion and/or co-firing, and thereby provide expert information for the participants. These workshops are usually organised in conjunction with high profile bioenergy conferences to attract as wide an audience as possible. The results of the workshops are reported and published on the Task website, and key results are fed back to both the Task participants and the ExCo for evaluation and further dissemination.

The Task meeting held in June, in conjunction with the European Biomass Conference was mainly used to discuss progress in the preparation of the pellet handbook, to exchange country reports and to discuss the workplan for the next triennium. A workshop was also organised on 'Concepts for high percentage biomass co-firing in new coal-fired power plants'.

The second Task meeting took place in November. The meeting was mainly used to discuss progress in the preparation of the pellet handbook, and discuss proposals submitted by Task participants that addressed the priorities in the workplan for the next triennium.

In conjunction with the second Task meeting, a two day field trip was organised to several sites. The first was to one of the increasing number of greenhouses that has switched from fossil fuel to biomass. The next site was the 4,000 MW_e Nanticoke generating station of Ontario Power Generation was visited. OPG has been forced by the Ontario government to completely phase out coal consumption by 2014 in both coal-fired power plants, and is now considering how and to what extent biomass can substitute coal in both plants. In the Ottawa region, a visit was made to the CanmetENERGY lab, as well as one of the pellet manufacturing facilities.

Another workshop on 'Biomass Combustion and Co-firing' was organised as part of the Multi-Task conference in Vancouver.

The reports of Task meetings and workshops can be downloaded from the Task 32 website.

Work Programme

As described previously, the work programme in the current triennium is structured into three categories viz. General Issues; Dedicated Biomass Combustion Systems; and Biomass Co-firing. The detailed activities within this structure are as follows:

General Issue: Fuel Preparation and Handling

- A workshop on fuel storage, handling and preparation and system analysis was held as part of the European Biomass Conference in May 2007 to evaluate the types

of logistical chains available for different types of biomass and how most optimal combustion design is influenced by the costs and environmental aspects of the logistical chains for fuels.

- A comprehensive handbook is currently being prepared on pellet production, handling, transportation, and utilisation. This action is a joint activity by various IEA Bioenergy Tasks, with Tasks 29, 31 and 40 providing key inputs on biomass trade as well as socio-economic aspects. In 2007 and 2008, the contents of the handbook and contributions from other Tasks were agreed. In 2009 the content has been prepared and in early 2010 the book will be published.

General Issue: Corrosion, Slagging and Fouling

- An Energy Technology Essential (ETE) has been published on the occurrence and prevention of corrosion, slagging and fouling under different circumstances.

General Issue: Handbook on Biomass Combustion and Co-firing

- The second edition of the Handbook of Biomass Combustion and Co-firing was published by Earthscan in January 2008.
- In collaboration with the Chinese Academy of Agricultural Engineering (part of the Ministry of Agriculture), a Chinese edition of the Handbook was prepared, and published in April 2008.

Dedicated Biomass Combustion Systems: Aerosol Emissions

At present there is great political emphasis on the relevance of aerosols originating from biomass combustion devices. It is essential to properly understand and have reliable information on:

- the quantity of aerosols formed in different types of biomass combustion devices;
- the influence of the type of biomass fuel on the aerosol emission;
- how this can be influenced in a positive way;
- what the health impact is to society; and
- how aerosols can be reduced through end-of-pipe technologies.

Specific Task actions on this topic were:

- An inventory on aerosols from biomass combustion. Data from Task 32 participating countries were evaluated for aerosol emissions from different biomass combustion devices and fuels. This project yielded interesting results, showing geographic variations as well as the influence of furnace design, operation mode and measurement techniques used. Both a full report and a summary have now been published.

Dedicated Biomass Combustion Systems: Latest Advances in Small-scale Biomass Combustion Systems

Small-scale biomass combustion systems are an important source of energy but also of strong concern in terms of local environmental impact. Driven by requests for lower emission limits (particularly pm10) and competition for increasingly reliable, efficient, and

cost-effective combustion devices in a growing market, the technical and environmental performance of small-scale biomass combustion devices is still improving. A workshop was organised in 2008 to share information on recent progress in development of woodstoves as well as technologies for small scale particle removal.

Biomass Co-firing: Constraints and Opportunities for Increased Co-firing Percentages in Existing Plants

In order to operate co-firing facilities as profitably as possible, it is necessary to increase the biomass share to a maximum degree. There are however a number of technical and non-technical constraints related to ash impacts on boiler and catalyst performance and lifetime. A workshop was organised in October 2008 at the Amer power plant, the Netherlands, on the technical and non-technical constraints and opportunities for increased co-firing in existing plants.

Biomass co-firing: Next Generation Co-firing Systems

In the power sector 'multi-fuel concepts' are being developed aiming at maximum fuel flexibility and high biomass share. Approaches differ from combustion to co-gasification in IGCC, using entrained flow or fluidised bed. The market aiming at high efficiency, low CO₂ systems is multi-billion. In 2009 a workshop was organised at the European Biomass Conference in Hamburg on technology developments in relation to next generation co-firing, indicating the most promising technical concepts, their key figures, and their expected performance in relation to other developments on biomass for energy and CO₂ mitigation. A report was published based on the results of this workshop.

Biomass Co-firing: Database on Biomass Co-firing Experiences

In a collaborative effort of all Task participants, the database on the Task website on biomass co-firing experiences has been updated with recent experiences on biomass co-firing.

Biomass Co-firing: Corrosion, Slagging, and Fouling Experiences

Co-firing applications with enlarged biomass share or biomass composition differing significantly from fossil fuels are especially sensitive to corrosion, slagging, and fouling. The work in this activity is aimed at making the first steps in the development of models to predict the risk of operational problems. A technical paper has been produced in 2009 in which existing models and tools are evaluated for use in co-firing applications.

Biomass Co-firing: Gasification in Combination with Co-firing

A visit was made in October 2008 to the AMER9 power plant in Geertruidenberg, the Netherlands, where biomass gasification is applied as a pre-treatment route for co-firing with pulverised coal. At the European Biomass Conference in Hamburg in 2009, gasification options including IGCC concepts were discussed as an option for next generation co-firing systems.

Collaboration with Other Tasks/Networking

A key factor in the success of the Task is the wide industrial involvement with the work programme, and the interaction with other IEA Implementing Agreements, IEA Bioenergy Tasks, and the European Union. Industrial participation is also enhanced by the active involvement of ExCo Members in selection of Task participants, based on the active national programmes. A Memorandum of Understanding exists between IEA Bioenergy and the Coal Combustion Science group of IEA Coal Research to further enhance information exchange.

Effective coordination is achieved through joint events, and the exchange of meeting minutes and reports. A good example is the production of the pellet handbook, with Tasks 29, 31 and 40. A workshop on recent progress in biomass combustion and co-firing was organised as part of the Multi-Task conference in Vancouver.

Deliverables

The following milestones were achieved in 2009. Organising and minuting of two Task meetings. Organising and reporting of a workshop on 'Options for High Percentage Biomass Co-firing in New Power Plants'; organisation of a workshop on 'Biomass Combustion and Co-firing' in the Multi-Task conference in Vancouver, reporting to the ExCo including a Technical Report on the 'Current Market Implementation Status of Biomass Co-firing'; finalisation of the manuscript for the Handbook of Pellet Production and Utilisation; a technical evaluation paper on prediction of ash behaviour in biomass co-firing; updating of the international overview of initiatives for biomass co-firing; and maintenance of the Task website.

TASK 33: Thermal Gasification of Biomass

Overview of the Task

The objectives of Task 33 are to monitor, review and exchange information on biomass gasification research, development, and demonstration and to promote cooperation among the participating countries and industry to eliminate technological impediments to the advancement of thermal gasification of biomass. The ultimate objective is to promote commercialisation of efficient, economical, and environmentally preferable biomass gasification processes, for the production of electricity, heat, and steam, for the production of synthesis gas for subsequent conversion to chemicals, fertilisers, hydrogen and transportation fuels, and also for co-production of these products.

Participating countries: Austria, Canada, Denmark, Finland, Germany, Italy, the Netherlands, New Zealand, Sweden, Switzerland, USA, and the European Commission.

Task Leader: Dr Suresh P. Babu, Institute Fellow, Gas Technology Institute, USA. From 1 January 2010, Dr Richard Bain, NREL, will take over as Task Leader.

Operating Agent: Mr Paul Grabowski, Office of Biomass Programme, US Department of Energy, USA

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 33, please refer to Appendices 2-6 inclusive; the Task website www.ieatask33.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

The fifth Task meeting for the triennium was held from 13-15 May in Karlsruhe, Germany. The Task meeting was held on the first day, a workshop 'WS5 – Biomass Derived Raw Gas Clean-up, Gas Conditioning, and Synthesis Gas Conversion' was held on the second day along with a visit to the bioliq® pilot plant at FZK, KIT facilities. Day three was a visit to the Air-Liquide-Lurgi research laboratories near Frankfurt.

The sixth Task meeting was held from 2-5 November in Breda, the Netherlands. The Task meeting was held on the first day, a workshop 'WS6 – Operating Experience with Biomass Gasifiers: Research and Technology Development Needs to Improve Gasification Plant Operations' was held on the second day. Days three and four were devoted to visiting the NUON Buggenum (Shell) co-gasification and the Essent Co-firing (Lurgi) CFBG plants respectively. The plant visit on the fourth day was part of a special event organised by Essent at the plant site titled 'Technological Developments and Innovation in Biomass Gasification'.

Work Scope, Approach and Industrial Involvement

The scope of work for the current triennium is built upon the progress made in the previous triennia. In the previous years, information exchange, investigation of selected subtask studies, promotion of coordinated RD&D among participating countries, selected plant visits, and industrial involvement in technical workshops at Task meetings have been very effective. These remain the basic foundations for developing and implementing a programme of work that addresses the needs of the participating countries.

The Task monitors the current status of the critical unit operations and unit processes that constitute biomass gasification (BMG) process, and identifies hurdles to advance further development, operational reliability, and reducing the capital cost of BMG systems. The Task meetings provide a forum to discuss the technological advances and issues critical to scale-up, system integration, and commercial implementation of BMG processes. Generally,

these discussions lead to selection of subtask studies and/or technical workshops that focus on advancing the state-of-the-art technology and identify the options to resolve barriers to technology commercialisation.

The Task has continued the practice of inviting industrial experts to the Task meetings to present their practical experiences and to discuss the options for development of critical process components to advance state-of-the-art BMG systems. The interaction with industry provides the opportunity for the National Team Leaders (NTLs) to evaluate refinements to existing product lines and/or processes. Academic experts are also invited as and when the need arises to seek information and cooperation in order to address basic and support research needs.

Work Programme/Subtask Studies

The current work programme includes the following elements:

- Plan and conduct semi-annual Task meetings including workshops on subtask studies selected by the NTLs, and address matters related to the Task mission and objectives. Details are:

Meeting	Associated Workshop	Dates and Location
1 st Task meeting	WS1 'Prospects for Biomass Gasification in Future Energy Needs'	19-21 March 2007 Brussels, Belgium
2 nd Task meeting	WS2 'Procedures/Guidelines for Biomass Gasification Synthesis Gas Characterisation'	24-26 October 2007, Bergen/Petten, The Netherlands
3 rd Task meeting	WS3 'Health, Safety, and Environmental Impact of Small-scale Biomass Gasification Systems' (in co-operation with European GasNet/ThermalNet activity)	21-23 April 2008, Vienna, Austria
4 th Task meeting	WS4 'A Case for Biomass Gasification'	15-17 October 2008, Montreal, Canada
5 th Task meeting	WS5 'Biomass Derived Raw Gas Clean-up, Gas Conditioning, and Synthesis Gas Conversion'	13-15 May 2009 Karlsruhe, Germany
6 th Task meeting	WS6 'Operating Experience with Biomass Gasifiers: Research and Technology Development Needs to Improve Gasification Plant Operations'	2-5 November 2009 Breda, the Netherlands

- Survey the current global biomass and waste gasification RD&D programmes, commercial operations and market opportunities for BMG, and identify the technical and non-technical barriers to commercialisation of the technology. Use the survey results to prepare and update Country Reports for information dissemination.
- Conduct joint studies, conferences, and workshops with related Tasks, Annexes, and other international activities to address issues of common interest to advance BMG systems.

- Identify research and technology development needs based on the results from the work described above as a part of the workshop reports.
- Publish results of the work programme on the Task website (www.ieaTask33.org) for information dissemination. Maintain the website with Task updates.

Observations from WS5: 'Biomass Derived Raw Gas Clean-up, Gas Conditioning, and Synthesis Gas Conversion': CHOREN reported on preparations for commissioning the Carbo-V[®] β -plant. In the gasification process, the partially cooled raw gas at 5 bar is cleaned to remove entrained particulates, subjected to water-gas shift followed by Rectisol acid-gas removal, and cleaned further by ultra-gas cleaning to remove chlorine, sulphur compounds to S < 50 ppb and Cl < 10 ppb, and adjusting CO/H₂ ratio of half prior to compression (to 30 bar) for subsequent Shell FT synthesis to produce liquid fuels. The following observations were reported in comparing the planned 640 MWth Sigma (σ) plant gas conditioning process with that of the 45 MWth β -plant:

- Lower consumption of chemicals (primarily NaOH) for water wash stages (including HCl removal).
- Lower amount of concentrated chemicals (ex. NaCl) to dispose of.
- Use of a single gas compressor (lower CAPEX) for producing 30 bar gas for conditioning and synthesis. High pressures are more favourable for pressure swing cycle of the solvents (CO₂ absorption at high pressure and CO₂ desorption by solvent flash regeneration).
- Addition of hot N₂ regeneration to strip and produce H₂S-free solvent – to lower CAPEX and OPEX.
- Use of physical absorption solvents for CO₂ and H₂S removal followed by sulphur recovery to reduce CAPEX.

The bioliq[®] process development efforts involve a 2 MWth twin-screw Air Liquide/Lurgi pyrolysis and a 5 MWth, entrained slagging, oxygen-blown gasifier which converts pyrolysis liquid mixed with char slurry at about 70 bar and 1300-1400°C to synthesis gas. At these conditions, the gas is free of tar and dust and ready for conditioning and synthesis to produce MeOH and higher alcohols, DME, MeOH-to-Olefins (MTO), DME-to-Olefins (DTO), MeOH-to-Gasoline (MTG), and MeOH-to-Synfuels (MTS), or FT liquid fuels. An interesting advanced high-temperature gas cleaning support research for the bioliq process involves the use of additives such as trona followed by ceramic membrane filters to remove raw gas contaminants and the use of H₂ on activated Pt for tar and naphthalene decomposition.

BASF presented a description of the combined application in series of the R023 Puristar[®] gas purification catalyst (silica based catalyst with promoters and 0.25% of Pd and 0.25% Ag) and R3-15 Puristar[®] (alumina based catalyst with promoters and 40% CuO and 40% ZnO) which produces clean synthesis gas. R023 removes traces of oxygen and acetylene while R3-15 has high adsorption capacity for removal of biomass gasification impurities (including ethylene, sulphur, and metal compounds).

Haldor-Topsoe described gas cleaning for biomass gasification, involving catalytic tar reforming, ammonia decomposition, sulphur management (hot gas cleaning, COS hydrolysis, ultra gas cleaning for fine desulphurisation), and additional gas conditioning including water-gas shift prior to synthesis gas conversion. H-T developed an effective single-stage catalytic (up to 95%) synthesis gas conversion to MeOH process. MeOH in turn could be dehydrated to produce DME and it can also be converted to EtOH or gasoline with high product selectivity. H-T is actively developing the TI-Gas process described as '... an improved version of the methanol-to-gasoline process, ... converting synthesis gas into gasoline in a single-loop process, thus eliminating the requirement for upstream methanol production and intermediate storage.' The process is undergoing tests for over 7000 hours in a 1 TPD demonstration pilot plant in Houston, TX, USA. It may be possible to use this process with N₂-containing synthesis gas (produced by air-blown biomass gasification) to produce fuels and chemicals. Other contributions included presentations on gas cleaning, synthesis gas conditioning and conversion at Air-Liquide/Lurgi, BASF, Uhde, NREL, VTT, ECN, ETC, Engler-Bunte-Institut, and TUV-PSI. These are posted on the Task website.

Observations from WS6: Operating Experience with Biomass Gasifiers: Research and Technology Development Needs to Improve Gasification Plant Operations:

The first and second commercial demonstration of the TUV-FICFB plants at Güssing (8 MWth) and Oberwart (~10 MWth) are in successful operation. The 60 TPD CHP plant at Oberwart built by ORTNER Bergenlaur includes ORC and bio-SNG production features. In general the TUV-FICFB process has been successfully scaled-up from laboratory to industrial scale within 10 years. The commercial demonstration plants are operating with >90% availability and with high electrical efficiency (> 30 % with combined gas engine and ORC systems). Over the years, plant operations have been improved to produce ash with <0.5% carbon, no liquid condensates, compliance with European emission requirements, and co-production of 1 MWth or 100 m³/h BioSNG and 1 bpd of FT liquids (BioFiT). Other useful operating details of the Güssing plant include:

- make-up olivine = 20 kg/hr;
- make-up RME=40 kg/hr or ~ 1 litre/MWth fuel;
- cold gas thermal efficiency with 15% moisture wood=80%;
- Jenbacher gas engine operates successfully with ~ 1g/N cu.m dust content;
- gas engine oil change once every 4000 hrs;
- after two years of fine tuning tar build-up is minimised in the raw gas HEX;
- most interruptions are with plugging of biomass feeders;
- gas engine could be restarted in ~ 10 min should there be an interruption; and
- biomass dryer is a must to reduce moisture content from 40% to ~15%.

With progress at Güssing and Oberwart, the scale-up and commercialisation of the TUV-FICFB should continue to provide useful insights into the design and operation of biomass gasifiers in general.

The 100 TPH coal-based IGCC Elcogas' Puertallano (Shell gasification) plant has conducted co-gasification with up to 10% by weight of biomass (olive wastes, almond shells,

waste wood, vine yard & grape wastes) for over 1130 hours. Besides biomass, the plant has also gasified slaughterhouse wastes. About 2% limestone is added with the feed to capture chlorine and avoid any high-temperature chemical corrosion. The plant has a dedicated biomass feed preparation system. The steam to carbon ratio is 0.15 kg/kg and the oxygen consumption for sustain entrained gasification is ~0.72 N Cum/Kg C.

METSON Power is exploring the retrofit option of installing the FICFB type of gasifier at CFBC plants. The combustor provides the hot-inert solids to sustain the operation of close coupled biomass gasifier. The concept is also being extended to operate a biomass fast pyrolysis plant integrated with the CFBC. Over the many years of operating CFBG plants at paper mills, dryer operation faced more problems than the gasifier. For biomass the KUV0 belt dryers, employing low-level waste heat, have been observed to be most efficient and economical. Metso has demonstrated success with 200 ceramic filters at the Varo paper mill; with such operational success METSO is now the prospective organisation to expand the Lahti co-firing operations. Based on pilot plant tests using the retrofit concept discussed earlier, Metso is considering to employ the TUV-FICFB/REPOTEC biomass gasification system for building a 100 MWth Bio-SNG plant (Gobigas project).

In summarising the experience with US biomass gasification projects, NREL highlighted problems with handling bagasse in the Hawaii RENGAS demonstration project. The bagasse Stake feeder was not appropriate; the project should have employed briquetted bagasse until an appropriate feeder was identified. The 1 to 3% sugar present in bagasse dust pyrolysed when it came in contact with hot surfaces promoting material build-up. The Minnesota alfalfa gasification project faced operational difficulties due to high-ash content (five times the design basis) leading to cracking of barrier filters and the 3% K in this feed lowered the ash softening temperature to 715°C limiting gasifier operation and the ability to achieve high carbon conversion. The SilvaGas biomass gasification demonstration plant, in Burlington, VT faced refractory loss problems due to lack of support rings inside refractory lines. Both Hawaii and Burlington problems have faced major set-backs by changing the engineering partners as a cost-cutting measure. The MTCI gasifiers built for black liquor gasification failed due to several problems by aggressively scaling-up the technology to 30 ft. deep fluidised beds with submerged pulse combustors; the pulsed combustors at the lower level collapsed due to the overburden.

Other WS6 presentations included contributions from Babcock Wilcox Vølund, Graz University, Carbona, and NRC, Canada. The workshop presentations will be posted on the Task website.

Collaboration with Other Tasks/Networking

Task 33 has collaborated with the IEA Hydrogen IA Annex 16: Hydrogen from Carbon Containing Materials, and European GasNet. The workshop (WS3) was organised as a joint effort in cooperation with European GasNet/ThermalNet activity.

Deliverables

The Task deliverables included planning and conducting six semi-annual Task meetings focused on the workshops selected by the Task participants, involving academic and industrial experts, the preparation and distribution of workshop reports; updating and publishing Country Reports; conducting joint studies, conferences, and workshops with related Tasks, Annexes, and other international activities to address mutually beneficial issues; and preparation of periodic progress, financial, technology, and annual reports as required by the ExCo.

TASK 34: Pyrolysis of Biomass

Overview of the Task

The objective of the Task is to improve the rate of implementation and success of fast pyrolysis of biomass for fuels and chemicals (where this complements the energetic considerations) by contributing to the resolution of critical technical areas and disseminating relevant information particularly to industry and policy makers. The scope of the Task is to monitor, review, and contribute to the resolution of issues that will permit more successful and more rapid implementation of biomass pyrolysis technology, including identification of opportunities to provide a substantial contribution to bioenergy. This will be achieved by a programme of work which addresses the following priority topics: norms and standards; analysis – methods comparison, developments, database formulation; country updates and state-of-the-art reviews; and fuels and chemicals from pyrolysis

Pyrolysis comprises all steps in a process from reception of biomass in a raw harvested form to delivery of a marketable product as liquid fuel, heat and/or power, chemicals and char by-product. The technology review may focus on the thermal conversion and applications steps, but implementation requires the complete process to be considered. Process components as well as the total process are therefore included in the scope of the Task, which covers optimisation, alternatives, economics, and market assessment.

The work of the Task addresses the concerns and expectations of the following stakeholders: pyrolysis technology developers; bio-oil applications developers; equipment manufacturers; bio-oil users; chemical producers; utilities providers; policy makers; decision makers; investors; planners, and researchers.

Industry is actively encouraged to be involved as Task participants, as contributors to workshops or seminars, as consultants, or as technical reviewers of Task outputs to ensure that the orientation and activities of the Task match or meet their requirements.

Task 34 has been reorganised under new leadership. There were four participants in 2009 as shown below. From January 2010 the Task will continue until the end of the triennium in December 2012.

Participating countries: Australia, Finland, Germany, and USA.

Task Leader: Douglas Elliott, Battelle Pacific Northwest, USA

Operating Agent: Paul Grabowski, Department of Energy, USA

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 34, please refer to Appendices 2-6 inclusive; the Task website www.pyne.co.uk and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meeting

A Task meeting was held on 15 September in Chicago, USA, in conjunction with the GTI International Conference on Science in Thermochemical Conversion of Biomass. It included a one day agenda of country reports, discussions of progress in norms and standards, website and newsletter developments, and future planning.

Work Programme and Progress in 2009

The work programme typically consists of Task meetings, workshops, and Task projects, in addition to the 'usual' Task management and ExCo support actions. However, during 2009 the work has focused on reorganising the Task and planning for the new triennium. It included:

- New Task participants were identified and have been interacting in preparation of the proposal for prolongation. Topic areas were identified and prioritised into a plan. Countries expressing interest at ExCo63 have been contacted to confirm participation in the upcoming triennium.
- Revision and updating of the website was completed. The contracting partner at Aston University was identified to maintain the site. Input to the revisions was provided by all the participants.
- Similarly, a pathway toward preparing and publishing an electronic newsletter was developed. The first issue from the reorganised Task has been posted on the website.
- The state-of-the-art of pyrolysis technology was evaluated in each of the participating countries using summary data spreadsheets. This was extended to countries outside the participants where possible.
- The standard development effort in USA and Canada continued forward. The Burner Fuel standard for fast pyrolysis bio-oil was approved by ASTM at both the subcommittee and the D02 committee level. Final editing and posting of the standard was completed as ASTM D 7544-09.

- A carryover project from the previous Task activities was publication of the results of the lignin pyrolysis round robin. The round robin involved 12 laboratories in 10 countries. The results have been under review since the completion of the effort in the summer of 2008. A draft report was submitted for journal publication.

Collaboration with other Tasks

The priority topics in the Task work programme can be formulated to provide projects that can be shared with other IEA Bioenergy Tasks. As an example, there is opportunity for a joint assessment of a fast pyrolysis-based biorefinery. In particular, the Netherlands has expressed interest in developing collaboration between Tasks 34 and 42 to facilitate pyrolysis-based biorefineries. The intent is to have a participant in Task 42 undertake an assessment of a pyrolysis-based biorefinery, probably based on lignin feedstocks. The Task 42 participant will interact with Task 34 to acquire needed input for the biorefinery study while also providing the results of the assessment back to Task 34.

Newsletter

The Task 34 newsletter continues the tradition of the PyNe newsletter and is an important vehicle for dissemination of relevant information. It is circulated to participants via the Task 34 website in electronic format. Issue 26 was published in December 2009.

Website/Dissemination

The Task 34 website is an important mechanism for information and technology transfer. It has been revised and updated from the pre-existing PyNe website.

Deliverables

Deliverables for 2009 were: reporting to the ExCo (Annual Report, progress reports, audited accounts and a technology report); continuation and updating of the Task website; one issue of the Task newsletter (electronic); organisation and minuting of one Task meeting; the presentations from the Task meeting held in 2009 have been published on the Task 34 website; and preparation of the proposal for prolongation of the Task for the next triennium.

TASK 36: Integrating Energy Recovery from Solid Waste Management Systems

Overview of the Task

The objective of Task 36 is to maintain a network of participating countries as a forum for information exchange and dissemination. The waste and energy sector world-wide is currently undergoing a period of intense legislative and institutional change. Keeping abreast of both policy and technology developments is a prime aim of the Task. The sharing of good practice

and/or new technology and techniques is also a major goal. The Task participants have chosen a number of key Topic Areas for inclusion in the work programme.

Within the EU the main driver for diverting waste from landfill is the Landfill Directive. The waste can either be recycled (so recovering its inherent energy value) or energy can be extracted directly from the remaining residual waste. In terms of meeting the Landfill Directive EU member countries fall into one of two groups: those that already meet the requirements of the Directive - because they have highly developed waste management infrastructure and so consign the minimum to landfill; and those that do not meet the Directive and so provide the greatest opportunity for energy recovery. The former group of countries include Germany, Denmark, and the Netherlands. The latter group includes the southern European nations, the Nordic Countries, the UK, and Ireland. Internationally, developed nations such as Canada, USA, and Australia continue to rely on landfill and do not as yet have policy measures such as the EU Landfill Directive. Rather, they rely principally on the economic driver for waste diversion. The potential for energy recovery in these countries is therefore high though institutional and other non-technical barriers pose considerable challenges.

The last decade has seen considerable efforts in research work on waste management – including policy development, environmental systems analysis, technology development, and economic drivers. Whilst this has assisted in the development of more sophisticated waste management systems in many cases it has also delayed deployment of energy recovery systems (specifically for residual wastes) in particular due to confused policy making, public awareness (and opposition) and uncertainty over environmental performance and technology performance.

Policy makers require guidance and information on all these aspects if waste and resource management systems that are environmentally and economically sustainable are to be developed. It is the aim of the Task to identify key work streams of relevance to the deployment of residual waste technologies and to produce a concise report to inform decision makers in the public and private sectors.

Participating countries: Canada, France, Germany, Italy, the Netherlands, Norway, Sweden, United Kingdom, and the European Commission.

Task Leader: Dr Niranjana Patel, Partnerships UK (PUK), United Kingdom. From 1 January 2010, Dr Pat Howes, AEA Energy & Environment, will take over as Task Leader.

Operating Agent: Mr Kieran Power, Department of Energy and Climate Change, United Kingdom.

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 36, please refer to Appendices 2-6 inclusive, the Task website www.ieabioenergytask36.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Task Meetings and Workshops

The Task held two meetings in 2009. The first took place on 11-13 May in Borås, Sweden. On 13 May, a seminar was held where invited experts, from SP Sweden's waste refinery, presented the results of on-going work and case studies. There were site visits to an AD plant and a waste fuel pre-treatment plant in Sobacken, a fluidised bed CHP plant in Ryaverket and an apartment complex in Gothenburg where they have tested a new technique to collect the organic fraction of the household waste. The technique stabilises the waste through a drying process. The second meeting took place on 18-24 November in Fukuoka, Japan. The meeting included a technical study tour of advanced waste treatment technologies. Task participants visited an advanced RDF plant and factory at Omuta, and waste to energy gasification plants at Koga-city and Munakata city. Invited speakers from Mitsui Engineering Systems gave presentations at the meeting.

Work Programme

The goal of the Task in the 2006-2009 triennium is to produce a final report, which addresses the key issues noted below. In the first instance each chapter will be a stand-alone document dealing specifically with the issue under consideration. Then the chapters will be compiled into a single report with a summary and conclusions section. The provisional list of chapter topics is as follows:

- The MSW resource – Chapter 1.
- Waste and resource management policy – Chapter 2.
- Environmental considerations – Chapter 3.
- Technology review – Chapter 4.

Progress on each chapter is summarised below.

The MSW Resource

This chapter will summarise the international and national policies impacting on the waste and resource management sector. It will consider:

- The resource available in Member Countries and some key non-Member Countries.
- The link between environmental and energy policy.
- The potential for energy recovery including impacts of source collection and mechanical separation
- The prospects for realising this potential over the period to 2020.
- The environmental gain that could be realised, e.g., contribution to greenhouse gas reduction, contribution to renewable energy generation etc.

The Chapter has been updated to include information from Italy, who joined the Task in 2009 and is now being updated for all countries to include any recently published data.

Waste and Resource Management Policy

This chapter will review the manner in which some countries have translated international and national commitments into local policy measures and the success of these policies in achieving the stated goals. It will consider:

- The policies adopted and their practical implementation.
- The effectiveness of the policy in achieving its stated goals over an agreed timeframe.
- The positive and negative impacts of the policy measure.

SenterNovem organised a workshop to create interaction between Task 36 participants and policy makers in Frankfurt, Germany and the results of the workshop were incorporated into the Chapter. The report 'Energy Recovery from MSW – one step further' was published in April 2009.

Lessons learned during the workshop are summarised below:

- In the countries assessed, the introduction of the Council Directive on the landfill of waste has resulted in a reduction of the amount of waste being sent to landfill and an increase in recycling and energy from waste (EfW).
- In the waste hierarchy recycling is given higher priority than EfW – EfW must complement and must not displace recycling activities.
- Drivers for the promotion of EfW (the landfill directive and the desire to reduce CO₂ impacts) are the same throughout the countries assessed.
- Barriers to EfW vary from country to country, as does the rate of EfW utilisation.
- Policies can change quicker than EfW project development time, thus frustrating projects.
- Policies need to address the tension in the market between solid recovered fuels (SRF), mechanical-biological treatment (MBT) and waste to energy (WtE).
- Political will on utilisation of waste heat is often high, but doesn't always lead to subsequent market development.
- Since waste management systems are capital investment intensive, long-term (contract) security is crucial.
- More consideration is required to spatial planning (i.e. making room for EfW) - the major underestimated policy element
- There is a lack of trust between the proponents of EfW and NGO's and interaction between them is often problematic.

This Chapter is now complete and is being prepared for publication.

Environmental Considerations

This chapter will review the environmental impacts (both positive and negative) associated with waste management activities. It will address:

- Lifecycle approach to determine waste management policy and in systems assessment.
- Indirect energy recovery impacts, e.g., inherent energy savings from the recycling of aluminium.

- Direct energy recovery impacts, e.g., energy recovered through the utilisation of residual waste as a fuel.
- Emissions from energy recovery process including: applicable standards and consequences for public health.
- Public awareness and perception of environmental impacts of waste management.

This Chapter is now complete and is being prepared for publication.

Technology Review

This chapter will review energy recovery technologies and provide concise factual data on:

- Technologies for treating individual (source segregated) waste streams.
- Technologies for treating residual waste streams.
- Technology status – number of reference facilities, years in operation etc.
- Technology performance – availability factor, mass and energy balances, efficiency etc.

The technologies have been chosen on the basis of having at least one full-scale commercial plant in operation although a distinction has been made on technologies operating in niche markets e.g. gasification/pyrolysis technologies operating in Japan. The Chapter is currently being re-drafted to be more easily readable by policy makers.

Collaboration with Other Tasks

The following speakers from Task 36 made presentations at the Multi-Task conference in Vancouver.

- Pat Howes: Energy from solid waste in IEA countries: policies and trends.
- Judith Bates: Comparing the environmental parts of residual waste management options.
- Timo Gerlagh: Energy Recovery from MSW – one step further.
- Juergen Vehlow: Residential waste – an often overlooked bioenergy source.

Deliverables

The deliverables for the Task in 2009 included: two progress reports to the ExCo; audited financial reports as required by the ExCo; a technology report 'Biogenic Waste to Energy' and technical reports as detailed in Appendix 4.

TASK 37: Energy from Biogas and Landfill Gas

Overview of the Task

The overall objectives of Task 37 are to review and exchange information on anaerobic digestion (AD), and to produce, upgrade, and utilise biogas as an energy source, digestate

(compost) as an organic fertiliser, and the anaerobic degradation process as a link in the chain of waste (water) treatment.

The scope of the work focuses on adoption of appropriate waste management practices, promotion of the commercialisation of biogas installations, improvement of the quality of the products, and improving environmental standards. Through the work of the Task, communication between RD&D programmes, the industry, and governmental bodies is encouraged and stimulated. Continuous education as well as specific information for decision makers and plant operators have been recognised as important topics.

To achieve the objectives, the Task maintains strong relationships with the governments of Member Countries, R&D institutions and industry. Partners are plant and equipment providers, actual and future operators and potential clients interested in the products of anaerobic digestion, i.e., fertiliser (digestate) and biogas.

Participating countries: Austria, Canada, Denmark, Finland, France, Germany, the Netherlands, Sweden, Switzerland, United Kingdom, and the European Commission.

Task Leader: Dr Arthur Wellinger, Nova Energie GmbH, Switzerland. From 1 January 2010, Dr David Baxter, European Commission, the Netherlands, will take over as Task Leader.

Operating Agent: Dr. Sandra Hermle, Swiss Federal Office of Energy, Switzerland. From 1 January 2010 Dr Kyriakos Maniatis, European Commission, will take over as Operating Agent.

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 37, please refer to Appendices 2-6 inclusive; the Task website www.iea-biogas.net and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

Two major Task meetings were held in 2009. The first meeting took place on 26-29 April in Jyväskylä, Finland. On 28 April, a seminar 'Biogas Technology for a Sustainable Energy Production' was organised together with the University of Jyväskylä and was sponsored by Innovation Jyväskylä, OSKE and TEKES. 130 participants from all over Finland followed the contributions of the Task participants and of the Finish partner organisations. After the seminar a business reception for the growing biogas industry was organised. As part of the business meeting, the Jyväskylä landfill which also operates a composting plant and a

separate collection of waste paper and demolition material site was visited. Of particular interest was a pilot size upgrading plant with a newly developed small-scale technology that was carefully monitored and improved as part of a PhD thesis by a student working for the Finish National Team Leader, Jukka Rintala. The seminar presentations and abstracts as well as the country contributions given during the business meeting, can be downloaded from the Task website www.iea-biogas.net/publicationspublic.htm.

The second meeting took place on 7-9 October, in Vienna, Austria. The second day of the business meeting included a half day research workshop dealing with 'Biogas Upgrading'. About 40 specialists from Austria and neighbouring countries followed the contributions of representatives from the Austrian gas industry and of Task participants. During the last day of the meeting, the group visited the biowaste digestion plant in Vienna that was built adjacent to the new Waste-to-Energy plant in the outskirts of Vienna. Both installations provide the heat produced to Vienna's district heating. A second plant was visited in Bruck with a new membrane upgrading system. It was developed, built and monitored as part of an Austrian research project. Again all documentation can be downloaded from the Task's website.

Work Programme

In 2008 the work programme consisted of the following Topics:

- Business meetings.
- Website: updating; maintenance; proceedings, country reports, etc.
- Work on brochure on energy crop, gas upgrading and fertiliser quality.
- Establishing answers to FAQ's.
- Updating the plant list on production and biogas upgrading plants.
- The seminar on 'Co-digestion for an optimised production of biogas and fertiliser'.
- Participation at the Task 38 seminar in Salzburg on 'Transportation biofuels: For greenhouse gas mitigation, energy security or other reasons?'
- Progress reports for ExCo61 and ExCo62.
- Technology report for ExCo62.

The progress made on each Topic is summarised below.

Business meetings

The Task met for two business meetings where major information transfer between the participating countries took place.

Website

The website (www.iea-biogas.net) was updated with news and meeting dates on a monthly basis. The country reports as well as the Task publications and proceedings of the workshops were made available along with important publications from the participating countries.

Gas upgrading

The brochure on 'Biogas upgrading technologies – developments and innovations' has been finished and published.

Energy Crop

The brochure entitled 'Biogas from energy crop digestion' has been published.

Fertiliser quality

A publication on the quality and application of digestate as fertiliser has been brought forward. A first internal report has been distributed for criticism and amendments.

Success stories

Two new success stories on the energy village Jühnde in Germany and the energy self-sufficient slaughterhouse in St.Martin, Austria have been placed on the website.

Seminar and Workshop

A seminar was organised during the business meeting in Jyväskylä, Finland as well as a research workshop during the meeting in Vienna, Austria.

Technology report

A technology report titled 'Digestion of energy crops' was prepared for ExCo64 in collaboration with IFA Tulln, Austria.

Planning of the next triennium

The Task has finished its planning of the programme of work for the period 2010-2012 after careful review with the national counterparts. A well balanced programme of work has been proposed to the ExCo by the new Task Leader David Baxter.

Collaboration with Other Tasks/Networking

Information exchange with Task 39 has been extended particularly for the algae work and the Multi-Task conference in Vancouver. A steady exchange of ideas is maintained with Task 36. The Task participated at the 17th International Biomass Conference in Hamburg.

A strong collaboration with the EU project Biogasmax as well as with the European Biogas Association (EBA) has been maintained.

Deliverables

The deliverables for the Task included: the website, two progress reports, a Technology report, minutes of the Task meetings, the country reports and the seminar contributions.

TASK 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems

Overview of the Task

The objective of the Task is to integrate and analyse information on greenhouse gases, bioenergy, and land use, thereby covering all components that constitute a biomass or bioenergy system. It focuses on the application of methodologies to greenhouse gas mitigation projects and programmes.

Participating countries: Australia, Austria, Belgium, Croatia, Finland, Germany, Sweden, and USA

Task Leader: Dr Neil Bird, Joanneum Research, Austria

Co-Task Leader: Dr Annette Cowie, University of New England, NSW, Australia

Operating Agent: Dr Josef Spitzer, Joanneum Research, Austria

The Task Leader directs and manages the work programme. The Task Leader is assisted by Susanne Woess-Gallasch (Joanneum Research) and Annette Cowie (University of New England). A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 38, please refer to Appendices 2-6 inclusive, the Task 38 website www.ieabioenergy-task38.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work:Tasks'.

Progress in R&D

Task Meetings and Workshops

In 2009, the Task organised one international workshop and one expert meeting. In cooperation with VTT, Tekes and Joanneum Research, Task 38 organised an international workshop on 'Land use changes due to bioenergy - quantifying and managing climate change and other environmental impacts' on 30-31 March in Helsinki, Finland. There were 57 participants representing many organisations from all over the world. The programme, presentations and a workshop summary are available on the Task website at: www.ieabioenergy-task38.org/workshops/helsinki09/. The workshop was followed by an excursion to the NESTE Oil Porvoo Biorefinery (NExBTL biodiesel process), on 1 April. The annual Task business meeting took place in Helsinki directly following the workshop and excursion.

A Task and Graz Group Expert meeting with some invited external experts was organised on 26-27 October in Graz, Austria. The topics of this meeting were policy related issues

in LULUCF and bioenergy. The object of the meeting was to draft short policy briefs for circulation at COP15 in Copenhagen. Three papers have been drafted.

In addition to the above, the Task Leader participated in several workshops and conferences as follows: the IEA Bioenergy ExCo63 workshop on 'Bioenergy – The Impact of Indirect Land Use Change', on 12 May in Rotterdam, the Netherlands; the 17th European Biomass Conference on 29 June-3 July in Hamburg, Germany, and gave a presentation on 'IEA Bioenergy Task 38 – Ten years of analysing the greenhouse gas balances of bioenergy systems' – this paper also appears in the proceedings of the conference; and he gave a summary at the Task 38 Helsinki Workshop on 'Indirect Land-Use Change (iLUC), a stakeholder debate on the science and policy impacts of sustainable biofuel production.' This meeting was organised by IPIECA in Lausanne, Switzerland.

The Co-Task Leader participated in the joint Thai Ministry of Energy/IEA forum on 'Sustainable development of biofuels in ASEAN' on 7-8 September in Bangkok, Thailand. She gave a presentation on 'Global challenges for sustainability of biofuels: life cycle assessment of GHG emissions'. She also presented a summary of the current work of Task 38 to the Bioenergy Australia conference, held on 8-10 December, in Gold Coast, Australia, in a presentation titled 'Is Bioenergy Really Carbon Neutral? GHG balances of biomass and bioenergy systems.'

Work Programme

In 2009 the Task worked on:

- organisation of the Task 38 international workshop in Helsinki (March/April);
- participation in the IEA Bioenergy ExCo63 Workshop in Rotterdam (May);
- participation in the 17th European Biomass Conference in Hamburg, (June);
- participation in the joint MoEN-IEA Forum in Bangkok, (August);
- organisation of the Task 38 expert meeting in Graz (October);
- participation in IPIECA meeting in Lausanne, Switzerland (November);
- the planning and continuation of subprojects such as case studies;
- ongoing work on the Strategic Paper for the ExCo on 'Lifecycle Analysis of Biomass Fuels, Power, Heat, and Products as compared to their Petroleum-Based Counterparts and Other Renewables';
- a technology report on: 'Temporal Accounting of GHG Emissions from Bioenergy Systems';
- a paper on linking different Emission Trading Schemes;
- reply to a paper published by Searchinger et al. in Science;
- planning for the next triennium; and
- maintenance of the website.

Case Studies

Final amendments to case studies prepared in the 2004-2006 period were made.

Specifically:

- *Austria: Dedicated energy crops for biogas production in Austria.* The case study has been translated from German to English and the CO₂ emissions from direct land use change have been calculated. Currently the case study is under review and the brochure will be finalised in early 2010.
- *Australia: GHG benefits of using biochar as a soil amendment.* The case study will be finalised in early 2010

New case studies for the period 2007-2009 were:

- Austria: GHG and energy balance of a wood to bioethanol biorefinery concept in Austria.
- Finland and Sweden: GHG and energy balance for systems producing biofuels (DME and Fischer-Tropsch) from pulp and paper mill residues, black liquor and other biomass sources (harvest residues and peat).
- Germany: Harvested wood products (HWP) model for estimating the carbon storage potential in Germany (Demonstrating IPCC Tier 3 method, and applying the three proposed approaches (+ hybrid approach) to HWP estimation).
- Germany: Environmental assessment of liquid biofuels from woody biomass. Comparison of Fischer-Tropsch diesel to CHO renewable energy N-process based on short rotation coppice, post-consumer wood and industrial roundwood.

All case studies are under preparation, but have not been finalised.

Strategic Paper for the ExCo

Another draft of the paper 'Lifecycle Analysis of Biomass Fuels, Power, Heat, and Products as Compared to their Petroleum-Based Counterparts and Other Renewables' was presented in ExCo64. A new draft incorporating responses to review comments will be delivered by 4 January 2010.

Technology Report

A technology report titled 'Temporal Accounting of GHG Emissions from Bioenergy Systems' was prepared for ExCo64. This paper looks at various stabilisation targets for GHG emissions and investigates what effect they have on the time-value of emissions and emission reductions. The timing of emissions and emissions reductions has a significant impact that is largely ignored up to now. This topic will be further investigated in the next international Task 38 workshop, which will take place in Brussels, Belgium, from 8-10 March 2010.

Planning for the next triennium

The Task finalised, in cooperation with all National Team Leaders, the Task 38 programme for the period 2010-2012, which was approved at ExCo64.

Paper on linking different ETS

The draft paper on linking different emission trading systems with special regard to bioenergy has been restructured. The title of the paper is now 'The influence of linked emission trading systems on the bioenergy market'. The new draft is available and is planned to be finalised in early 2010. It analyses the incentives which emissions trading schemes have on the use of biomass. Furthermore, it assesses the effects on biomass use that occur when emissions trading schemes are linked.

Reply to Searchinger's article

The Task 38 participants of the expert meeting in Graz and other Task 38 associates have submitted a reply to the article entitled 'Fixing a critical climate accounting error' by Searchinger et al. published in Science (Vol. 326, 527 – 528, 2009). The reply has not been submitted under the Task 38 masthead, but as a reply by individuals. It is entitled 'On the accounting error in bioenergy'. At this time, it is not known if the reply has been accepted for publication.

Maintenance of the website

Website maintenance is ongoing. The presentations from the Helsinki workshop and new Task 38 papers and publications are available there.

Collaboration with Other Tasks/Networking

The Task collaborates widely with other IEA Bioenergy Tasks and also external organisations as detailed above. Through numerous EU-Funded projects outside Task 38, Neil Bird has developed networks such as COMPETE, RE-Impact and the newest CIFOR – BioSust. Annette Cowie is contributing to a report on monitoring and assessment of sustainable land management for the UNCCD, commenting on the interactions between the UNCCD and UNFCCC in relation to land used for bioenergy. She is also involved in the Biochar Researchers Network and International Biochar Initiative on approaches for ensuring sustainability of biochar, based on approaches developed for bioenergy. Kim Pingoud is participating as a lead author of the Bioenergy Chapter of the forthcoming IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation.

Technology Transfer/Communication

The Task website and the internal FTP site are continually updated. New publications and announcements are distributed through the 'climate change' mailing list and at national levels through National Team Leaders.

Deliverables

Apart from the wide range of deliverables mentioned above, the Task also produced progress reports and audited accounts for the ExCo. Other outputs were minutes of the Task meeting and updating of the website. Please see Appendix 4 for more details.

TASK 39: Commercialising 1st and 2nd Generation Liquid Biofuels from Biomass

Overview of the Task

The objective is to provide participants with comprehensive information to assist with the development and deployment of biofuels for transportation. The Task builds upon the successes of previous efforts to deal in a coordinated manner with both the technical and the infrastructure issues related to biofuels. To meet this objective, the Task is:

- providing information and analyses on policy, regulatory and infrastructure issues that will help participants encourage the establishment of the infrastructure for biofuels as a replacement for fossil-based fuels;
- catalysing cooperative research and development projects to help participants develop improved, cost-effective processes for converting lignocellulosic biomass to ethanol;
- providing information and analyses on specialised topics relating to the production and implementation of biodiesel technologies; and
- coordinating national/international information and its dissemination, outreach to stakeholders, and coordination with other related groups such as FAO, USDOE, etc.

The Task structure allows participants to deal with biofuels in a comprehensive manner.

Participating countries: Australia, Austria, Canada, Denmark, Finland, Germany, Ireland, Japan, the Netherlands, Norway, South Africa, Sweden, United Kingdom, USA, and the European Commission.

Task Leader: Dr Jack Saddler, University of British Columbia, Canada

Operating Agent: Mr Ed Hogan, Natural Resources Canada, Canada

The Task Leader together with three Subtask Leaders directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 39, please refer to Appendices 2-6 inclusive; the Task website www.task39.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

The Task was active in 2009. It hosted a special session titled 'International efforts to commercialise second generation biofuels' at the 31st Symposium on Biotechnology for Fuels and Chemicals on 4 May in San Francisco, USA. This session was attended by over 350

participants and was only limited to this number because of the size of the room. The Task also held a planning/business session for the upcoming triennium on 2 May, in conjunction with the Symposium. Most of the Task participants were present and the outcome of this meeting was reported in the summer newsletter of the Task.

The policy subtask (with considerable leadership from Manfred Wörgetter and colleagues) organised a technical session on 2-5 June in Dresden, Germany. This meeting was very successful and almost 200 participants were involved. Copies of the meeting presentations are available on the Task 39 website.

The Task was instrumental in organising the end of triennium Multi-Task conference which took place on 23-26 August in Vancouver, Canada. It was held at the University of British Columbia with many of the Tasks organising half day sessions. Adam Brown provided the overall coordination and there was good attendance by many of the ExCo Members. The original target capacity was 180 participants but this was greatly exceeded, with more than 250 attendees. The goal of the conference was not so much to talk to ourselves but to profile the work that IEA Bioenergy does to outside decision makers within the international community, government, industry and ENGO groups. By all accounts, this goal of profiling the work of IEA Bioenergy does seem to have been successful, with international participation from global industry groups (such as Nippon Oil, British Sugar, Novozymes, etc), and international ENGO's and senior government representatives, particularly from the US and Canada. A post conference tour (that was heavily subsidised by the British Columbia government) was organised for delegates to see the extent of the climate change mediated mountain pine beetle attack of BC's lodgepole pine forests and the bioenergy strategies that were being adopted. All of the presentations, conference proceedings and photographs of the meeting are available on the Task 39 website. See also page 30.

In 2010, the Task will begin the new triennium with a planning session to be held on 19-21 January in Cambridge, UK. At this meeting, the schedule for future Task meetings will be finalised, as will the workplan for the 2010-2012 triennium. There are also tentative plans to hold another session in 2010 which will likely be held in conjunction with the Australia Bioenergy's annual meeting (November/December). With the likely release of the Task 39 commissioned 'Algal Biofuels; Current Status and Potential' report in late March 2010, it is also probable that the Task will hold a business meeting and small technical session within the 32nd Symposium on Biotechnology for Fuels and Chemicals that will be held in Florida in April.

Work Programme

The work programme for the Task included the following elements.

Providing information on policy, regulatory, and infrastructure issues

The overall objective is to provide governments and policy makers with improved information

that will help them identify and eliminate non-technical barriers to liquid biofuels deployment. Work continued in the following areas:

Country-specific information on biofuels: The Task continues to compile country-specific information on biofuels including fuels usage, regulatory changes, major changes in biofuels policies, and similar items. The purpose of this effort is to maintain Task 39's role as a central source of relevant information on biofuels. An updated Implementation Agendas report was released in 2009, as was a report examining the role of algal biofuels. A report on the Dresden meeting was also published and is available on the Task 39 website, as are all presentations from this session. Two final reports, examining the impacts of biofuel implementation on forests and agriculture, and a vision for biofuel development, will be released in early 2010.

Case studies: The Task is focusing data-gathering exercises on demonstration and industrial-scale commercial facilities for biofuel production around the world. This information will provide a ready reference to the current state-of-the-art in producing biofuels. In the new triennium these case studies will focus on implementation issues. The first report, on implementation agendas, is readily available on the Task website under Task Outputs; the first in a series on demonstration plants is also available.

International trade of biofuels: The Task is considering issues related to the international trade of biofuels, including supply and demand for such fuels and regulatory issues involved in promoting and developing trade. In particular, the impact of fuel mandates (already present in the EC and in parts of North America) on international demand for biofuels is being considered. The Task continues to seek Task 40's input into these matters; Task 40 participated in two Task 39 meetings in 2009 (San Francisco and Vancouver).

Financial instruments: The Task continues to consider ways in which capital investment in the biofuels sector might be encouraged, given the unique circumstances of individual jurisdictions. A case study of successful policy instruments for promoting biofuel infrastructure in USA has been completed, as has a market-based analysis of biodiesel implementation.

Technical aspects of lignocellulosic biomass-to-ethanol processes

The Task provides an information exchange network for participants who are conducting research and development activities in the area of lignocellulosic biomass-to-ethanol. The working group in this area is focused on the technical and economic issues related to this technology option. The Task co-hosted a number of technical sessions at the Multi-Task conference in Vancouver and is working to complete final technical reports on 'biorefining' and on 'algal biofuel development'. The Task also completed a report examining the potential for improving the carbon balance of biofuels. Outputs are available on the Task website, and can be provided via CD on request.

Newsletter

The Task published two newsletters in 2009. These provided information about the Task activities and international events related to biofuels. The newsletters are available on the Task website or from the editor as detailed in Appendix 4.

Collaboration with Other Tasks/Networking

The Task has ongoing interactions with the other IEA Bioenergy Tasks, with IEAHQ and with external groups such as FAO, USDOE, Global Bioenergy Partnership (GBEP), etc. The Task is also working with various EC-funded and USDOE projects, as described earlier, to ensure effective information exchange. The Task continued discussions with Task 40 on biomass supply and international trade of biofuels, and interacted with many of the Tasks to prepare for the Multi-Task conference.

A major report, on '2nd generation biofuels' (organised and co-authored with IEAHQ) garnered a great deal of attention in 2009 and generated a number of spin-off publications. IEAHQ had this report as its lead article on its website for the first half of 2009 and the report apparently had a record level of citation.

The Task continues to liaise with other Implementing Agreements, particularly with the Advanced Motor Fuels Implementing Agreement (AMF) with Dr Axel Munack (NTL from Germany) acting as the liaison person and attending meetings of the AMF as an observer on behalf of IEA Bioenergy. Dr Munack has prepared meeting reports which have been distributed to the Task 39 country representatives and their ExCo Members. We have used this mechanism to ensure that AMF knew about Task 39's intention to publish a report titled 'Algal Biofuels: current status and potential' and we encouraged the authors of the AMF report on this topic to liaise with the USA/Australian authors of the Task report. A first draft of the Task report will be distributed to AMF to obtain their input in early 2010.

Website

The Task 39 website was redesigned and relaunched in 2008. It is heavily cited and generates many enquires that are handled daily by the Task coordinators and webmaster. New information is added on a regular basis and it can justifiably be considered a great success for the Task. Please visit www.task39.org.

Deliverables

The deliverables for the Task in 2009 included: two progress reports, one Technology Report and audited accounts as required by the ExCo. The website showing the location, size, approach, etc, of various second generation biofuel pilot/demonstration/commercial plants is constantly updated and has proven to be heavily cited. The Task produced two newsletters and three technical reports on the issues relating to biofuel implementation agendas, carbon

balance, etc. Reports on 'sustainability issues related to biofuels' and 'algal biofuels' were delayed but are now being finalised for release in early 2010. The full library of Task reports, websites, country specific reports, etc, are available through the Task website. These are detailed in Appendix 4.

TASK 40: Sustainable International Bioenergy Trade: Securing Supply and Demand

Overview of the Task

The objective is to support the development of sustainable, international bioenergy markets and trade, recognising the diversity in resources and applications. Through the international platform provided by IEA Bioenergy, combined with industry partners, government bodies and NGO's, the Task contributes to the development of sustainable bioenergy markets both in the short- and long-term and on different scales – from regional to global. Key aims are:

- to improve the understanding of biomass and bioenergy markets and trade;
- to analyse 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 for energy markets and trade by modelling 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 utilisation; and
- to provide a significant and ongoing contribution to market parties, policy makers, international bodies, as well as NGO's by providing high quality information on these topics.

The vision of the Task on global bioenergy trade is that it will develop into a real 'commodity market' which will secure supply and demand in a sustainable way. Sustainability provides the key ingredient for long-term security.

Participating countries and institutions: Austria, Belgium, Brazil, Canada, Finland, Germany, Italy, Japan, the Netherlands, Norway, Sweden, United Kingdom, USA, and the European Commission.

Task Leader (Scientific): Dr André Faaij, Copernicus Institute, Utrecht University, the Netherlands, assisted by Mr Martin Junginger Copernicus Institute, Utrecht University, the Netherlands

Task Leader (Administrative): Mr Peter-Paul Schouwenberg, Nidera Handelscompagnie B.V., the Netherlands.

Operating Agent: Ir Kees Kwant, NL Agency, the Netherlands

The Task Leaders direct and manage the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 40, please refer to Appendices 2-6 inclusive; the Task website www.bioenergytrade.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

During 2009, the Task co-organised or contributed significantly to five international workshops.

A Task meeting in January was followed by a workshop on 'Sustainability Certification for Biofuels and Bioenergy' in Brussels. Various initiatives exist to develop sustainability certification schemes for biofuels and bioenergy. European initiatives in the Netherlands, Belgium, UK, Germany, and Sweden have pioneered implementation of sustainability criteria for biofuels and bioenergy. This workshop provided the opportunity to learn more about various initiatives, not only in Europe but also globally. The focus of the discussions was implementation of sustainability schemes and criteria in practice, and the implications for energy and biomass producers. The target audience was biomass producers and traders, fuel and energy producers and other stakeholders involved in biofuels and bioenergy, such as governments, NGOs, and researchers. In total, there were over 80 participants. The presenters included policy makers (such as the European Commission), industry (e.g. Electrabel and SGS) and academia, and they covered the situation in Europe, North America (both Canada and USA) and Brazil. These presentations are available from the Task website.

The Symposium on 'Biotechnology for Biofuels and Chemicals', held on 3-6 May in San Francisco, provided the opportunity to organise a joint Task 39/40 workshop 'International Commercialisation of 2nd Generation Biofuels'. Task participations delivered two presentations in the session on sustainability and logistics. Andre Faaij provided a general overview of the work of Task 40 and focussed especially on the work of certification systems for sustainable biomass and their possible impact on biomass trade. Peter-Paul Schouwenberg presented on the international trade in lignocellulosic biomass. In addition, Martin Junginger presented preliminary results of the main barriers and opportunities for biomass trade and possible impacts on the feedstock supply for 2nd generation biofuels.

Task 40 and EUBIONET III organised a joint workshop during the 17th European Biomass Conference in Hamburg. During this workshop results were presented from several international projects focusing on European and global bioenergy trade. Special focus was on the development of solid biomass trade (mainly wood pellets, but also wood chips and agricultural residues). Stakeholders from industry, policy, and the science arena, were in attendance to hear current developments and opportunities for solid biomass trade, as well

as the main barriers hampering further growth. Speakers included industry participants from CHOREN (M. Deutmeyer), Dong (M. Nitschke), GEE (M. Gudera) and Foex (M. Sihvonen). These presentations are available from the Task website.

During the Multi-Task conference in Vancouver, Peter-Paul Schouwenberg, Kees Kwant, Doug Bradley, and Bo Hektor, contributed to a session on sustainable international bioenergy trade.

A third Task meeting was held on 25-26 October in Tsukuba, Japan. Task 40 and ERIA jointly organised a workshop. This event revealed that a lot of biomass trade is already going on in the region, especially solid biomass trade. In 2008, significant amounts of wood pellets were exported from British Columbia to Japan for co-firing purposes. Also South Korea has set ambitious targets for increasing the use of wood pellets both for small-scale domestic heating and large-scale co-firing, which will require the import of large amounts of wood pellets in the years to come. South Korea has already entered into agreements with Indonesia and Cambodia to grow the feedstock. Also Australia is rapidly becoming an exporter of wood pellets. While the first pellets produced in 2009 have been shipped to Europe, Australian companies are now monitoring developments in South East Asia with great interest. The liquid biofuels market is growing less rapidly at the moment mainly due to high feedstock prices and sustainability concerns. The presentations highlighted the status of ethanol and biodiesel production and trade in Thailand, Malaysia, Japan, and China. Especially in China, it is currently forbidden to use food crops for biofuel production, and local biodiesel production is limited to waste oil feedstocks. As there are no subsidies for biofuels in China, no import of liquids biofuels (or feedstocks to produce biofuels) is currently taking place. Malaysia and Thailand on the other hand are monitoring the global market for opportunities to increase exports of palm oil for biodiesel, and ethanol production. Overall, the workshop provided a great opportunity for participants from the industry, academia and policy arenas to exchange information. The Task plans to possibly organise a similar event in the future.

In addition to the activities reported above, the Task leadership also provided more than 20 presentations on the work of the Task at other international events. These are detailed in Appendix 4. Furthermore, André Faaij and Jeremy Woods combined to contribute presentations and discussions in Brussels. These included the various DG's of the European Commission that are involved in certification and biomass markets. The presentations included a keynote address titled 'Biofuels as part of sustainable development', and a contribution to an expert meeting titled 'Accounting for LUC/ILUC for the biofuel sector'.

Future Meetings and Workshops

The first meeting of the Task in 2010 will be held on 10 March in Rotterdam to kick-off the new triennium. Then on 11-12 March, CMT is organising a 'biomass power and trade' conference, also in Rotterdam. The conference aims to provide opportunities for future and existing biofuels and biomass industry stakeholders to network with other industry suppliers and technology providers, as well as utility executives, researchers, policy makers,

investors, and project developers. The Task will be contributing a large number of speakers on the biomass trade situation in various participating countries, sustainability certification, torrefaction developments and several other topics. For more information on the programme and how to register, see www.bioenergytrade.org and <http://www.cmtevents.com/eventposts.aspx?ev=100306&>

The second Task meeting and workshop is planned for the autumn of 2010, most likely in Italy. Further meetings and workshops in Austria and Brazil are scheduled for 2011.

Work Programme and Outputs

During the kick-off meeting in Utrecht in February 2007, ten areas of work were formulated for the 2007-2009 triennium. These formed the programme of work approved at ExCo58, viz.

- Forest Biomass Supply Systems.
- Country Reports and Updates.
- Development of Meaningful International Biomass Trade Statistics.
- Market Studies.
- Case Studies on Sustainable Production and Supply of Solid and Liquid Biomass for Energy.
- Review of Sustainability Criteria/Certification.
- Demand Analysis for Specific Technologies/Applications.
- Re-address Barriers.
- Impact of Policies.
- Modelling of Biomass Trade.

The progress achieved during 2009 is summarised below.

Forest Biomass Supply Systems

This topic has been covered by the sustainable forestry supply chain study carried out by Doug Bradley, for the Toronto Workshop in September 2007, and most recently during the joint workshop in Warwick in 2008. This was the main activity for this topic, and the presentations and the proceedings are the main deliverable. No further activities were performed in 2009.

Country Reports and Updates

As a major effort, 12 out of 13 Task participants have published comprehensive and up-to-date country reports. The country report by Japan is expected to be finalised in early 2010. These country reports contain a wealth of information on biomass production, trade, and consumption, and are among the most popular documents downloaded from the Task website.

International Biomass Trade Statistics

There is a clear need for more elaborate trade statistics for biomass commodities, which are increasingly traded and used for energy purposes, such as wood pellets, wood chips,

agricultural residues, ethanol, vegetable oils and biodiesel. Furthermore, the Task wanted to make an inventory of ongoing activities by different international bodies which collect these statistics. In February 2008, the Task organised an expert workshop with the following objectives:

- To bring together various institutions currently involved in collecting international biomass trade statistics (such as the IEA statistical and renewable energy divisions, Eurostat, FAO, UN ECE/Timber Section, the European Commission and others) for information dissemination and exchange; to summarise which data is currently collected, what is lacking, and what data would be required to fulfil various needs of industry, policy makers and academia.
- To explore the possibilities to set up a framework for the development of international biomass trade statistics and consistent mapping of international trade flows.

In total about 30 experts participated. The proceedings of the workshop and the resulting comprehensive paper (both available on the Task website) are the main deliverables for this topic and no further work was done in 2009.

Market Studies

In addition to various market studies published in 2007-2008, the Task has published three market studies in 2009 on biomass success stories; global vegetable oil markets; and on international shipping of biomass. These are the main deliverables for this triennium, including also the previous studies on ethanol and the global wood pellet and sawdust resource assessments (all of which are available on the Task website).

Currently, the Task participants are working on four new market studies as follows:

- A study on the possible impact of 2nd generation biofuels on lignocellulose markets.
- A study on the requirements for setting up a bioenergy trade fund, i.e. a fund dedicated to invest in bioenergy trade projects.
- A brief overview of torrefaction activities in the world, and the perspectives for long-distance trade of torrefied biomass.
- A paper, by Task participants, on several issues regarding the sustainability of biomass, e.g. food vs. fuel and land use change and related GHG emissions, and examples of links with international bioenergy trade.

The study on 2nd generation biofuels was finalised in December 2009. The results of the other three studies are expected to be finalised in the first half of 2010.

Several Task participants have also contributed significantly to the wood pellet handbook edited by Gerold Thek and Ingwald Obernberger (Task 32). The Task also delivered substantial contributions to the Bioenergy Review co-authored by Martin Junginger and Andre Faaij.

Case Studies on Sustainable Production and Supply

A variety of case studies are currently being set up in the participating countries. The Task will continue to monitor these developments, organise more workshops, and build towards a deliverable. UK, FAO, and Germany are envisaged as other key contributors. The aim was to report on ongoing developments by the end of 2009 but this will now be extended into the new work programme.

Review of Sustainability Criteria/Certification

A first major review of sustainability criteria and certification was made by Utrecht University (with contributions from FAO and Germany) and published in a special issue of Biomass and Bioenergy in August 2008 (Volume 32, Issue 8). All Task participants agree that these kind of studies, which provide a detailed and unbiased overview, should continue. These reviews should also provide an analysis of how different proposals conflict (e.g. methods of GHG accounting), and the implications for biomass trade in practice.

Through Utrecht University, the Task has been updating a list of existing systems, and has been developing comprehensive comparisons of the various systems under development including the views of NGOs. These results have been presented at several workshops, e.g. in Brussels, San Francisco and Campinas. An article is currently being finalised for publication in a peer-reviewed journal. Cooperation with GBEP has been initiated through a contribution to a GBEP workshop.

Demand Analysis: Co-firing, Heat, CHP, Liquid Biofuels

Due to limited funds, no new studies were started in 2009. The topic will be reviewed again in 2010.

Re-address Barriers

In 2008, it was decided that a more comprehensive effort was necessary to get an overview of current opportunities and barriers for international bioenergy trade. The aim was to get an up-to-date overview of what the market actors currently perceive as major opportunities and barriers for the current and future development of international bioenergy trade. The work will focus on three internationally-traded bioenergy commodities: bioethanol; biodiesel; and wood pellets.

An online questionnaire has been designed, mainly aimed at industry actors (e.g., producers, traders, consumers, and industry associations) and their views on opportunities and barriers for bioenergy trade. To a lesser extent, the questionnaire was also aimed at policy makers, NGOs, and experts from academia and other institutions. To reach a large number of stakeholders, cooperation was sought from UNCTAD. The questionnaire was closed in August 2009 and results were presented at conferences in San Francisco, Hamburg, and Tsukuba. The final deliverables will be a report and articles in industry journals and/or papers in scientific journals. These will be finalised during December 2009.

Impact of Policies

A presentation and paper were prepared for the Toronto workshop in 2007. No further activities are foreseen in this triennium.

Modelling Biomass Trade

A review study carried out by the Norwegian University of Life Sciences and Utrecht University was published as a major deliverable. No funding for further projects is available at present so the Task will review possible activities in 2010.

Dissemination

Dissemination of the work and results of the Task were actively pursued at a wide range of conferences and workshops in 2009 – see Appendix 4. In addition, the first edition of a Task newsletter was published in August. The aim is to disseminate the results from country reports and market studies more pro-actively. This will be pursued further in 2010, including the use of a professional distribution system.

Collaboration with Other Tasks/Networking

As described above, events were organised jointly with Tasks 39, EUBIONET III and the ERIA network. At these events, the work of the Task was disseminated via presentations. The Task's work was also presented to a large number of other audiences during 2009. One of the more diverse of these events was the international conference on 'Biofuels: Enhancing Development or Increasing Food Insecurity?' organised by 2iE and CIRAD in Ouagadougou, Burkina Faso. André Faaij, the Task Leader was on the organising committee and he also chaired a roundtable on 'international bioenergy and biofuels markets and trade and the relevance for Africa', which was very well attended, with representatives, including several Ministers, from numerous African countries. The Task aims to continue this outreach and collaboration in the coming triennium. Collaborations with Task 32 and 38 are planned for 2010.

Website

The Task website is a key tool for dissemination of information. It was developed during 2009 and is updated regularly. Visitor numbers have varied between 4000 and 9000 per month. The amount of monthly downloaded data increases continuously, and varies between 7-10 gigabytes. Each month at least 10 documents are downloaded over one hundred times. All Task deliverables (e.g., country reports, market studies, etc.) and the presentations given at the Task workshops are available for downloading.

Deliverables

In summary, deliverables in 2009 included five workshops, various types of reports e.g. 13 country reports, several market studies, a newsletter, three Task meetings minutes, two progress reports to the ExCo; plus over 50 presentations to various workshops and conferences.

TASK 41: Bioenergy Systems Analysis

Overview of the Task

The objective of the Task is to supply various categories of decision makers with scientifically sound and politically unbiased analyses needed for strategic decisions related to research or policy issues. The target groups are particularly decision makers in Ministries, national or local administrations, deploying agencies, etc. Depending on the character of the Projects some deliverables are also expected to be of direct interest to industry stakeholders. Decision makers, both public and private, have to consider many aspects, so the Task needs to cover technical, economic, and environmental data in its work. The Task's activities build upon existing data, information sources, and conclusions. It does not intend to produce new primary scientific data.

The Task differs from the other Tasks in that it does not have networking as one of its prime objectives. Nor do the Task's activities have continuous and repeating components, e.g., biannual meetings, country updates, etc. The work programme has a pronounced Project emphasis with each Project having very specific and closely defined objectives.

Because of its special character in terms of participation, financing and cross-cutting orientation, the Task aims to become a valuable resource and instrument to the ExCo serving the ExCo with highly qualified resources to carry out Projects, involving several parties (e.g., other Tasks and organisations) as requested by the ExCo. Due to the close contact with the other Tasks, Task 41 is intended to develop into a platform for joint Task work and a catalyst for proposals from the Tasks to the ExCo.

A Project Leader directs and manages the work of each Project. For new projects an appropriate Project Leader is appointed by the Project participants acting through the Executive Committee. The ExCo Member from each participating country acts as the National Team Leader and is responsible for coordinating national input to the Projects undertaken.

For further details on Task 41, please refer to Appendices 2-6 inclusive; and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Work Programme

The work programme is comprised of a series of Projects. Each Project has its own budget, work description, timeframe, and deliverables and is approved by the participants. The focus is on the needs of the participants by way of Project outputs. Three projects have been initiated to date. viz.

Project 1: Bioenergy – Competition and Synergies

Participating Countries: Germany, Sweden, United Kingdom, USA and the European Commission

Project Leader: Mr Sven-Olov Ericson, Ministry for Sustainable Development, Sweden

Operating Agent: Dr Björn Telenius, Ministry of Enterprise, Energy and Communications, Sweden

Status: Completed in December 2008

Project 2: Analysis and identification of gaps in fundamental research for the production of second generation liquid transportation biofuels

Participating Countries: Finland, the Netherlands, Sweden, United Kingdom, USA and the European Commission

Project Leader: Dr Michael Ladisch, Purdue University, USA

Operating Agent: Mr Paul Grabowski, US Department of Energy, USA

Status: Completed in July 2008

Project 3: Joint project with the Advanced Motor Fuels Implementing Agreement, Annex XXXVII 'Fuel and Technology Alternatives for Buses: Overall energy efficiency and emission performance'

Participating Countries: Finland, Germany and the European Commission

Project Leader: Professor Kai Sipilä, VTT, Finland

Operating Agent: Professor Kai Sipilä, VTT, Finland

Status: The project commenced in January 2009 and will have a duration of 2½ years.

The objective of this high profile Task is to bring together IEA expertise to access overall energy efficiency, emissions, and costs, both direct and indirect costs, of various technology options for buses. City buses are amongst the most coherent vehicle fleets. Procurement of bus services is often handled by municipalities or state in a centralised manner. The impact of city buses on urban air quality is huge, and fuel efficiency is crucial for operational costs. Biofuels will have a major role in the test programme.

The project is of interest to seven Implementing Agreements, including IEA Bioenergy, all of which have transport-related activities. The participants from IEA Bioenergy are co-financing the project at the level of €75,000. The total budget is €1,075,000. A final report is planned for July 2011.

Deliverables

The deliverables may consist of progress reports and financial accounts to the ExCo, and a final report on each project – see details in Appendix 4.

TASK 42: Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass

Overview of the Task

The aim of the Task is to initiate and actively promote information exchange on all aspects of the biorefinery concept. The information exchange (and cross fertilisation) will include biomass feedstock, conversion and fractionation technologies, integration of processes and the use of side-streams, products, energy efficiency, economic, socio-economic and environmental performance, as well as sustainability issues (impact on food production schemes, water use and quality, changes in land-use, access to resources, biodiversity, and the net balance of greenhouse gases). The work of the Task should minimise fragmentation in this multi-disciplinary field. It will also result in cross-thematic synergies, identification of gaps and overlaps, and definition of priority research needs and infrastructure. The following activities have been identified and agreed by the participants:

- Prepare a common definition of biorefineries, including a clear and widely accepted classification system.
- Gain better insights into the processing potential of existing biorefineries in the participating countries.
- Assess biorefinery-related RD&D programmes in participating countries to help national governments define their national biorefinery policy, goals, and related programmes.
- Prove the advantages of biorefinery concepts over more conventional single product processes by assessing and comparing their financial, economic, and ecological characteristics.
- Bring together key stakeholders normally operating in different market sectors (e.g., transportation fuels, chemicals, energy, etc.) in multi-disciplinary partnerships to discuss common biorefinery-related topics, to foster necessary RD&D trajectories, and accelerate the deployment of developed technologies.
- Identify the most promising added-value chemicals, e.g., functionalised chemicals and platform chemicals (building blocks), to be co-produced with energy to optimise overall process economics and minimise the overall environmental impact.
- Co-operate with ongoing national and international activities and programmes, e.g., other Tasks, Implementing Agreements, and EU Technology Platforms.
- Disseminate knowledge, including teaching material to make students familiar with the integral concept-thinking of biorefineries.

The Task was initiated in 2006, and kicked-off in January 2007.

Participating countries: Australia, Austria, Canada, Denmark, France, Germany, Ireland, Italy, the Netherlands and the European Commission.

Task Leader: Dr Ed de Jong, Avantium Technologies BV, the Netherlands

Assistant Task Leader: Dr Ing. René van Ree, WUR-AFSG, the Netherlands

Operating Agent: Ir Kees Kwant, NL Agency, the Netherlands

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

For further details on Task 42, please refer to Appendices 2-6 inclusive; the Task website www.IEA-Bioenergy.Task42-Biorefineries.com, and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

The Task organised two meetings in 2009. The fifth meeting on 25-26 March in Dublin, Ireland, and the sixth meeting on 15-17 September in Worms, Germany. Both meetings were coupled to national workshops in which interested stakeholders met with the Task participants to discuss biorefinery-related topics.

At the Dublin meeting the national Task representatives gave presentations on biorefinery activities within their specific countries, and then Irish (industrial) stakeholders gave presentations on their specific biorefinery activities.

At the Worms meeting a one day session with German (industrial) stakeholders was organised dealing with general biorefinery aspects, technological aspects, and biorefinery concepts and commercial plants. Part of the Task meeting also included an excursion to the Sudzucker sugar refinery plant and a joint meeting with ERA-NET Bioenergy on identification of major biorefinery-related RTD issues.

Together with the EC FP6 IP Biosynergy the Task prepared a Biorefinery course. This half-day course was attended by about 50 participants at the RRB5 conference in Genth, Belgium on 12 June.

All presentations given at the workshops and the Bioenergy course can be found on the Task website: www.IEA-Bioenergy.Task42-Biorefineries.com.

Work Programme

The work programme of the Task is based on a prioritisation of activities agreed at the kick-off meeting in Amsterdam as follows:

- Building and operating a Task website.
- Development of a common definition and classification system on biorefineries.
- Identification of the current processing potential, and mapping of existing biorefineries in participating countries. Small, medium, and large-scale initiatives are assessed.
- Identification of biorefinery-related RD&D programmes in participating countries.
- Assessment of financial, economic, and ecological advantages and disadvantages of biorefinery-based co-production over single product processes. Integration of biorefinery processes in existing industrial infrastructures are part of this assessment.

- Fostering multi-disciplinary partnerships of key stakeholders normally operating in different market sectors to discuss common biorefinery-related topics (platform function).
- Assessment of biorefinery-based co-production of chemicals and secondary energy carriers, addressing for example, favourable functionalised chemicals and platform chemicals (building blocks) to be co-produced, and market compatibility aspects.
- Co-operation with ongoing international activities.
- Dissemination of Task knowledge and results.

The progress achieved is described below.

Definition and Classification System

The Task has developed the following definition for biorefinery 'Biorefinery is the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, and/or materials) and bioenergy (biofuels, power, and/or heat)'. This means that biorefinery can be a concept, a facility, a process, a plant, or even a cluster of facilities.

A main driver for the establishment of biorefineries is the sustainability aspect. All biorefineries should be assessed for the entire value chain on their environmental, economic, and social sustainability. This assessment should also take into account the possible consequences due to the competition for food and biomass resources, the impact on water use and quality, changes in land-use, soil carbon stock balance and fertility, net balance of greenhouse gases, impact on biodiversity, potential toxicological risks, and energy efficiency. Impacts on international and regional dynamics, end-users and consumer needs, and investment feasibility are also other important aspects to take into consideration.

A biorefinery is the integral upstream, midstream and downstream processing of biomass into a range of products. In the classification system the Task has differentiated between mechanical pre-treatments (extraction, fractionation, separation), thermochemical conversions, chemical conversions, enzymatic conversions, and microbial (fermentation both aerobic, anaerobic) conversions.

A biorefinery can use all kinds of biomass including wood and agricultural crops, organic residues (both plant and animal derived), forest residues, and aquatic biomass (algae and seaweed).

A biorefinery should produce a spectrum of marketable products and energy. The products can be both intermediates and final products, and include food, feed, materials, and chemicals; whereas energy includes fuels, power, and/or heat. The main focus of near future biorefinery systems will be the production of transportation biofuels. The selection of the most interesting biofuels is based on the possibility that they can be mixed with gasoline, diesel, and natural gas, reflecting the main advantage of using already existing infrastructure in the transportation sector. The Task has defined that both multiple energetic and non-energetic outlets need to be produced to become a true biorefinery. The volume and prices of present and forecasted products should be market competitive.

Generally, both 'energy-driven' and 'product-driven' biorefineries can be distinguished. In energy-driven biorefineries the biomass is primarily used for the production of secondary energy carriers (biofuels, power and/or heat); process residues are sold as feed (current situation), or even better are upgraded to added-value bio-based products, to optimise economics and environmental benefits of the full biomass supply chain. In product-driven biorefineries the biomass is fractionised into a portfolio of bio-based products with maximum added-value and overall environmental benefits, after which the process residues are used for power and/or heat production, for both internal use and sale to national grids.

A biorefinery is not a completely new concept. Many of the traditional biomass converting technologies such as the sugar, starch and pulp and paper industry used aspects connected with a biorefinery approach. However, several economic and environmental drivers such as: global warming, energy conservation, security of supply and agricultural policies have also directed those industries to further improve their operations in a biorefinery manner. This should result in improved integration and optimisation of all the biorefinery subsystems.

The background for the proposed biorefinery classification system is the current main driver in biorefinery development, i.e., efficient and cost-effective production of transportation biofuels, to increase the biofuel share in transportation sector, whereas for the co-produced bio-based products additional economic and environmental benefits are gained.

The classification system is based on a schematic representation of full biomass to end products chains, distinguishing: raw materials, primary conversion processes, main biomass constituents (carbohydrates, lignin, proteins, fats), secondary conversion processes, platform intermediates conversion processes, and end-products.

The platforms (e.g. C5/C6 sugars, syngas, biogas, bio-oil) are intermediates which are able to connect different biorefinery systems and their processes. The number of involved platforms is an indication of the system complexity of the biorefinery facility/concept. The two biorefinery product groups are energy (e.g. bioethanol, biodiesel, synthetic biofuels, power, heat) and products (e.g. chemicals, materials, food, and feed). The two main feedstock groups are 'energy crops' from agriculture (e.g. starch crops, short rotation forestry) and 'biomass residues' from agriculture, forestry, trade, and industry (e.g. straw, bark, wood chips from forest residues, used cooking oils, waste streams from biomass processing).

In the classification system the Task has differentiated between four main conversion processes, including: biochemical (e.g., fermentation, enzymatic conversion), thermochemical (e.g., gasification, pyrolysis), chemical (e.g., acid hydrolysis, synthesis, esterification), and mechanical processes (e.g., fractionation, pressing, size reduction).

The biorefinery processes/concepts can be classified as:

A <specific platforms concerned> platform biorefinery for the production of <final products produced> from <name raw materials used>

Some examples of classifications are:

- A C6 sugar platform biorefinery for the production of bioethanol and animal feed from starch crops
- A Syngas platform biorefinery for the production of FT-diesel and phenols from straw
- A C6 & C5 sugars and syngas platform biorefinery for the production of bioethanol, FT-diesel and furfural from sawmill residues

This classification system will be further extended and finalised, resulting in some kind of Biorefinery-Complexity-Index, in 2010.

Country Reports

A detailed country report has been prepared by the national representatives of the participating countries. The report was finalised in 2008 and will be published in early 2009. The abstract of the country report is shown below to illustrate its contents.

'This report has been developed by the members of IEA Bioenergy Task 42 on Biorefinery: Co-production of Fuels, Chemicals, Power and Materials from Biomass. This report contains an overview of the biomass, bioenergy and biorefinery situation, and activities in the Task 42 Member Countries: Austria, Canada, Denmark, France, Germany, Ireland, and the Netherlands. The overview includes: national bioenergy production, non-energetic biomass use, bioenergy related policy goals, national oil refineries, biofuels capacity for transport purposes, existing biorefinery industries, pilot and demo plants, and other activities of research and development (such as main national projects and stakeholders). Data are provided by National Task Leaders (NTLs), whose contact details are listed at the end of the report.'

Multi-disciplinary Partnerships

In 2007 it was decided that the National Team Leaders would be responsible for the creation of 'stakeholder forums' at national level. For example, in the Netherlands WUR-AFSG is doing this by organising a variety of biorefinery-related activities within the framework of the National (Dutch) Platform on Biorefineries. International knowledge exchange between the Task and these stakeholder forums will take place frequently, for example by inviting them to Task-related workshops, and will be reported to the other participants at the Task meetings.

New Work Programme 2010-2012

Three events per year are planned. Two of these events will be comprised of an open workshop for national stakeholders plus an internal meeting of the Task participants, organised in one of the participating countries. The other event will be an annual 'biorefinery' seminar coupled to an international biorefinery event. This will preferably be jointly organised with another Task, e.g. Task 39. During this seminar, information on specific projects and implementations will be exchanged. These events will potentially be coupled to specific site visits, further increasing the knowledge transfer. To minimise

long-distance travelling, and to accommodate as many stakeholders as possible, the use of video conferencing will be encouraged. In between, Task management and country representatives will prepare necessary documents, and maintain a website. The emphasis on specific objectives and preferences for assessments can only be fixed once there is certainty over country participation and their stakeholders, especially industrial parties.

The following activities have been identified:

- Developing a biorefinery complexity index, similar to what they use in the petroleum industry (Nelson complexity index), based on the classification system. The classification system developed in the 2007-2009 period will be further extended and fine tuned in the 2010-2012 period.
- Identifying the most promising bio-based products, i.e., food, feed, added-value materials (e.g., fibre-based) and chemicals (functionalised chemicals and platform chemicals) to be co-produced with bioenergy, to maximise overall process economics and environmental benefits.
- Assessing the current status and development potential of both energy-driven biorefineries (including biofuels) and product-driven biorefineries. These assessments will be based on a 'full value chain' approach, covering raw materials issues (crops, residues, algae), conversion processes, and final product applications in an integrated approach. The work on biofuel-driven biorefineries will be undertaken in co-operation with Tasks 33, 34 and 39, and the Advanced Motor Fuels Implementing Agreement (e.g., algae-based biorefineries).
- Providing a review of approaches and developing a guidance document for sustainability assessment, including economic, environmental, and social acceptance aspects of biorefineries. National activities and case studies in participating countries will be taken as a point-of-departure for methodology development and assessment. This activity will be performed in close co-operation with Tasks 29 and 38.
- Preparing a summary paper 'Adding value to the sustainable utilisation of biomass on a global scale – biorefinery'. Recommendations provided in this paper on biorefinery-related technical, social, environmental, and economic issues should assist governmental organisations in developing their policies in this area.
- Disseminating biorefinery knowledge
 - Between participating countries by the organisation of bi-annual Task meetings, workshops inviting national stakeholders, and visits to demonstration and commercial facilities.
 - Between Task 42 and other related Tasks, and also European, Canadian and Australian technology platforms (Suschem, Sustainable Forestry, Biofuels) by organising joint stakeholder workshops/seminars addressing biorefinery issues.
 - Between Task representatives and their national stakeholders by inviting them to bi-annual Task meetings, related workshops, and informing one another on the latest developments within the biorefinery field (minutes, bi-annual Task meetings, newsletters).

- External knowledge dissemination in general will be done through the Task website (including linkages to many other websites), and distribution of a bi-annual Task newsletter. Part of the website will be an open database with key data concerning biorefinery pilot, demonstration and commercial plants within the participating countries, short films on the biorefinery concept (for the general public), a focussed dialogue forum to discuss biorefinery-related issues, and a list of biorefinery-related publications.
- Internal knowledge dissemination will be done by means of an intranet-site coupled to the Task website.
- The Task will bring together key stakeholders normally operating in different market sectors (e.g., agriculture and forestry, transportation fuels, chemicals, energy, etc.) in multi-disciplinary partnerships (stakeholder forums) to discuss common biorefinery-related topics, to foster necessary RD&D trajectories, and to accelerate the deployment of developed technologies.
- Updating the country reports on biorefinery and biorefinery-related RD&D programmes to help national governments to define their national biorefinery policy goals and related programmes.
- Developing and delivering a broad biorefinery training course to enable students, policy makers, and industrial stakeholders to become familiar with the integral concept-thinking of biorefineries.

Task Website

The Task website (*www.IEA-Bioenergy.Task42-Biorefineries.com*) consists of a 'public' area and a 'members' area (extranet). In the public area all the deliverables in the 2007-2009 triennium are available. In late 2009 a start was made with the preparation of a more advanced website. This revamped website is expected to become operational in early 2010. It will contain general IEA Bioenergy and Task 42 information, a contact address, links to other related sites, newsletters, publications, training courses, a FAQ section, an agenda for biorefinery events, sustainability aspects, definition and classification, mapping (database) of both energy-driven and product-driven biorefineries, and country-specific biorefinery information.

Collaboration with Other Tasks/Networking

Co-operation was established with ongoing international activities, e.g. other IEA Bioenergy Tasks, European-based Technology Platforms, Specific Support Actions, Integrated Projects, Networks-of-Excellence. This co-operation will be enhanced by organising joint events, e.g., workshops and meeting regularly with ongoing EU-initiatives. In 2009 the following activities took place:

- Preparation of the 'biorefinery' part of SRA and TDD of the EC Technology Platform Biofuels.

- Presentation of the Task at a variety of national and international workshops and conferences.
- Presentation of the Task at a variety of EC Biorefinery RTD project meetings (Biosynergy, Bioref-Integ, Starcolibri).
- Discussion on biorefinery-related RTD aspects with ERA-NET Bioenergy at the Worms Task meeting.

The work of the Task is closely related to other Task activities, especially Tasks 33, 34 and 39. Effective coordination is achieved through joint events, and arranging the exchange of meeting minutes and reports. This will get additional focus in activities planned for the next triennium.

Deliverables

Deliverables in 2009 included: organising and minuting of two Task meetings; national workshops in Ireland and Germany; contributions to the two ExCo meetings; maintenance of the Task website; preparation of a general definition of 'biorefining'; a biorefinery classification system; country reports on biorefinery mapping; a leaflet on the activities of the Task; a scientific paper 'Towards a common classification approach for biorefinery systems' for BioFPR; and a brochure on biorefineries.

IEA BIOENERGY TASK PARTICIPATION IN 2009

TASK	AUS	AUT	BEL	BRA	CAN	CRO	DEN	FIN	FRA	GER	IRE	ITL	JAP	NEL	NZE	NOR	SA	SWE	SWI	UK	USA	EC	Total
29: Socio-econ		•			•	•					•		•			•				⊗			7
30: SRC	•			•	•							•		•	•			⊗		•	•		9
31: Forestry					⊗		•	•		•				•		•				•	•		9
32: Combustion		•	•		•		•	•		•		•		⊗		•		•	•	•		•	13
33: Gasification		•			•		•	•		•		•		•	•			•	•		⊗	•	12
34: Pyrolysis	•							•		•											⊗		4
36: MSW					•				•	•	•	•		•		•		•		⊗		•	9
37: Biogas		•			•		•	•	•	•				•				•	⊗	•		•	11
38: GHG	•	⊗	•			•		•		•								•			•		8
39: Biofuels	•	•			⊗		•	•		•	•		•	•		•	•	•		•	•	•	15
40: Trade		•	•	•	•			•		•		•	•	⊗		•		•		•	•	•	14
41(3): AMF								⊗		•											•	•	3
42: Biorefineries	•	•			•		•		•	•	•	•		⊗								•	10
Total	5	8	3	2	10	2	6	9	3	11	3	6	3	9	2	6	1	9	3	8	7	8	124

⊗ = Operating Agents • = Participant

IEA BIOENERGY TASK PARTICIPATION IN 2010

TASK	AUS	AUT	BEL	BRA	CAN	CRO	DEN	FIN	FRA	GER	IRE	ITL	JAP	NEL	NZE	NOR	SA	SWE	SWI	UK	USA	EC	Total
29: Socio-econ					•	•				•										⊗			5
32: Combustion		•			•		•	•		•	•	•		⊗		•		•	•	•			12
33: Gasification		•					•	•		•		•	•	•	•	•			•		⊗		11
34: Pyrolysis					•			•		•										•	⊗		5
36: MSW					•				•	•		•				•				⊗			7
37: Biogas		•		•	•		•	•	•	•	•			•		•		•	•	•		⊗	14
38: GHG	•	⊗	•	•				•		•				•				•			•		9
39: Biofuels	•	•		•	⊗		•	•		•			•	•	•	•	•	•		•	•		15
40: Trade		•	•	•			•	•		•		•	•	⊗		•		•		•	•		13
41(3): AMF								⊗		•												•	3
42: Biorefineries	•	•			•		•		•	•	•	•		⊗						•	•	•	12
43: Feedstocks	•				•		•	•		•	•	•			•	•		⊗		•	•		12
Total	4	7	2	4	8	1	7	9	3	12	4	6	3	7	3	8	1	7	3	9	7	3	118

⊗ = Operating Agents • = Participant

BUDGET IN 2009 – SUMMARY TABLES

Budget for 2009 by Member Country (US\$)

Contracting Party	ExCo Funds	Task Funds	Total
Australia	11,700	76,800	88,500
Austria	14,700	108,500	123,200
Belgium	9,700	41,500	51,200
Brazil	8,700	29,300	38,000
Canada	16,700	138,620	155,320
Croatia	8,700	26,000	34,700
Denmark	12,700	82,000	94,700
Finland	14,700	136,873	151,573
France	9,700	41,820	51,520
Germany	16,700	164,693	181,393
Ireland	9,700	40,500	50,200
Italy	12,700	82,120	94,820
Japan	9,700	43,000	52,700
Netherlands	15,700	126,620	142,320
New Zealand	8,700	26,800	35,500
Norway	12,700	85,320	98,020
South Africa	7,700	16,000	23,700
Sweden	15,700	128,120	143,820
Switzerland	9,700	39,000	48,700
UK	14,700	113,620	128,320
USA	13,700	106,300	120,000
European Commission	13,700	116,193	129,893
Total	268,400	1,769,699	2,038,099

BUDGET IN 2009 – SUMMARY TABLES

Budget for 2009 by Task (US\$)

Task	Number of participants	Annual contribution per participant	Total Task funds
Task 29: Socio-economic Drivers in Implementing Bioenergy Projects	7	12,000	84,000
Task 30: Short Rotation Crops for Bioenergy Systems	9	14,300	128,700
Task 31: Biomass Production for Energy from Sustainable Forestry	9	14,500	130,500
Task 32: Biomass Combustion and Co-firing	13	12,500	162,500
Task 33: Thermal Gasification of Biomass	12	12,500	150,000
Task 34: Pyrolysis of Biomass	4	20,000	80,000
Task 36: Energy Recovery from Municipal Solid Waste	9	15,320	137,880
Task 37: Energy from Biogas and Landfill Gas	11	14,000	154,000
Task 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems	8	14,000	112,000
Task 39: Liquid Biofuels from Biomass	15	16,000	240,000
Task 40: Sustainable International Bioenergy Trade: Securing Supply and Demand	14	15,000	210,000
Task 41(3): Joint Project with the AMF Implementing Agreement	3	18,373	55,119
Task 41: Bioenergy Systems Analysis, Project 2	6	0	0
Task 42: Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass	10	12,500	125,000
Total			1,769,699

CONTRACTING PARTIES

Rural Industries Research and Development Corporation (Australia)

The Republic of Austria

The Government of Belgium

The National Department of Energy Development of the Ministry of Mines and Energy (Brazil)

Natural Resources Canada

The Energy Institute 'Hrvoje Pozar' (Croatia)

The Ministry of Transport and Energy, Danish Energy Authority

The European Commission

Tekes, Finnish Funding Agency for Technology and Innovation

L'Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME) (France)

Federal Ministry of Food, Agriculture and Consumer Protection (Germany)

The Sustainable Energy Authority of Ireland

Gestore dei Servizi Energetici – GSE (Italy)

The New Energy and Industrial Technology Development Organization (NEDO) (Japan)

NL Agency (The Netherlands)

The New Zealand Forest Research Institute Limited

The Research Council of Norway

Department of Minerals and Energy (Republic of South Africa)

Swedish Energy Agency

The Swiss Federal Office of Energy

Department of Energy and Climate Change (United Kingdom)

The United States Department of Energy

LIST OF REPORTS AND PUBLICATIONS

The Executive Committee

Final Minutes of the ExCo63 meeting, Rotterdam, the Netherlands, May 2009.

Final Minutes of the ExCo64 meeting, Liege, Belgium, October 2009.

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Anon. IEA Bioenergy Annual Report 2008. IEA Bioenergy ExCo:2009:01.

Anon. Energy from Waste. Summary and Conclusions from the IEA Bioenergy ExCo56 Workshop. IEA Bioenergy ExCo:2009:02.

Anon. IEA Bioenergy Strategic Plan 2010-2016. IEA Bioenergy ExCo:2009:03.

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Anon. Bioenergy – A Sustainable and Reliable Energy Source. A review of status and prospects. Executive Summary. IEA Bioenergy ExCo:2009:05.

Anon. Bioenergy – A Sustainable and Reliable Energy Source. A review of status and prospects. Main Report. IEA Bioenergy ExCo:2009:06.

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Bird, N. Indirect Land Use Change Due to Bioenergy Production.

Woods, J. Bioenergy and Indirect Land Use Change.

de Nie, D. Effect of Land Use change on Biodiversity and Livelihoods.

Petersen, J.E. Bioenergy and Land Use: Background Drivers, Marginal Effects and Analytical Options.

Eickhout, B. Evaluating the Impacts of ILUC.

Witzke, P. Comparison of Available Modelling Approaches for ILUC assessments related to Biofuels.

Nelson, R. Assessing Land Uses and Possible Sustainable Transition Paths to Biofuels Development.

Fritsche, U.R. The ILUC Factor: A Simplified Approach to Assess GHG Implications of Indirect Land Use Change from Bioenergy.

Desplechin, E. ILUC in the Bioenergy Sector: A view from Brazil.

Opal, C. Ensuring that Biofuels Deliver on their Promise of Sustainability – Charlotte Opal, Roundtable for Sustainable Biofuels, EPFL, Switzerland.

Hodson, P. Legislation on ILUC: An EU Perspective – Paul Hodson, European Commission, Belgium.

Courtis, J. The Californian Low Carbon Fuel Standard – John Courtis, Air Resources Board, California, USA.

Anon. IEA Bioenergy ExCo64 Workshop Presentations 'Algae – the Future for Bioenergy?'. October 2009.

Darzens, A. The promises and challenges of algal-derived biofuels.

Cazzola, P. Algae for biofuel production: process description, lifecycle assessment and some information on costs.

Stanley, M. Fuel from the Sea?

Bjork, S. BIOTREMA - a collaboration on biogas.

Benemann, J. Algae biofuels: challenges in scale-up, productivity and harvesting.

van den Dorpel, P. Algae growing systems.

Wijffels, R. Microalgae for production of biofuels and bulk chemicals.

Van Aken, M. Algae production systems: open or closed – lessons learned from the last 3 years.

Fritsche, U and Kampman, B. Better Use of Biomass for Energy. Joint position paper of IEA RETD and IEA Bioenergy. 4 December 2009.

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TASK 29

Minutes of the Task meeting in Rome, Italy/FAO, June 2009.

Minutes of the Task meeting in Cavtat, Croatia, October 2009.

Progress report for ExCo63, Rotterdam, the Netherlands, May 2009.

Progress report for ExCo64, Liege, Belgium, October 2009.

Technology report 'Woodfuel Integrated Supply/Demand Overview Mapping – WISDOM: Overview and Application Examples ' for ExCo64, Liege, Belgium, October 2008.

Anon. Papers presented at the International Seminar and Expert Consultation Assistance Needs for Developing Bioenergy Strategies, held in Rome, Italy at FAO Headquarters, 17 - 19 June 2009.

Segon, V. Wisdom Croatia: GIS analysis of bioenergy in Croatia – How to model socio-economics.

Guest, C. Sustainable Energy in the Rural Village Environment, Tipperary, Ireland.

Richards, K. Strategic and policy developments in the UK.

White, B. Recent Bioenergy news from Canada.

Hohle, E. Promoting and increasing the production and use of Bioenergy in the Innland Region of Norway through theoretical and practical education and training of the Bioenergy network.

Lunnan, A. A short orientation concerning a new Bioenergy initiative in Norway.

Anon. Papers presented at the international conference Biofuels and Bioenergy: A Changing Climate, Vancouver, Canada, August 23-26, 2009.

Przulj, I. Progress in biomass utilization in the North-West Croatia.

White, B. Assessing drivers for bioenergy: An economics perspective.

Please also visit the Task website: www.task29.net

TASK 30

Minutes of the Task 30 meeting, Taupo, New Zealand, December 1 and 5 2009.

Progress report for ExCo63, Rotterdam. The Netherlands, 12-14 May 2009.

Progress report for ExCo64, Liege, Belgium, 30 Sept-2 Oct 2009.

Technology report 'Bioenergy and land use competition' for ExCo64, Liege, Belgium, 2009.

Anon. Proceedings of the Short Rotation Crops International Conference in Taupo, New Zealand, December 2-4 2009.

Verwijst, T. Technical Review No. 1: Improving the efficiency of production systems for short-rotation bioenergy crops.

Nicholas, I. Technical Review No. 2: Identification of potential co-products from short-rotation crops grown as an energy source.

James, A. Simpson, J., Picchi, G., Gordon, A., Thevathasan, N., Stanturf, J. and Nicholas, I. Technical Review No. 3: Environmental benefits associated with short-rotation crops.

Weih, M. Technical Review No. 4: Willow short rotation coppice commercially grown on agricultural land in Sweden – possibilities for improvement of biodiversity and landscape design.

Please also visit the Task website: www.shortrotationcrops.org. Several additional publications are now in the finalisation stage and will be available on the Task website in early 2010.

TASK 31

Minutes of the Task meeting, Hamburg, Germany, 16-17 February 2009.

Minutes of the Task meeting, Wershofen, Germany, 6 October 2009.

Progress report for ExCo63, Rotterdam, the Netherlands, May 2009.

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Berch, S.M., Bulmer, C.E., Curran, M.P., Titus, B. and Finvers, M. The framework for sustainable harvest of forest biomass in British Columbia. Presentation to IEA Bioenergy Multi-Task Conference, Vancouver. August 2009. Available on IEA Bioenergy Task 39 website (www.task39.org).

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FAO, and IEA Bioenergy. Criteria and Indicators for Sustainable Woodfuel. Flyer prepared for distribution at XIII World Forestry Congress, Buenos Aires, Argentina, October 2009. 2 p.

Gan, J., Asikainen, A., Björheden, R., Smith, C.T. and Richardson, J. Chapter 5. Economic sustainability of woodfuels. *In*: Richardson, J., S. Rose, C.T. Smith and M. Trossero (eds.). 2009. Criteria and indicators for sustainable woodfuel. [Tentative title] FAO Forestry Paper. UN/FAO, Rome. (In review).

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IEA Bioenergy Task 31. Sweden Country Report 2008. 7p. Available on the Task website: www.ieabioenergytask31.org/IEA_Bioenergy_Task_31/IEA%20Task%2031%20country%20report%20Sweden%202008.pdf

IEA Bioenergy Task 31. United Kingdom Country Report 2007. 3p. Available on the Task website: http://www.ieabioenergytask31.org/IEA_Bioenergy_Task_31/Country_Reports.htm

Lattimore, B. Global principles, criteria and indicators for sustainable woodfuels. Presentation to Side-event on Sustainable Management of Woodfuel Production, XIII World Forestry Congress, Buenos Aires, Argentina, October 20, 2009. Available on World Forestry Congress website (www.wfc2009.org).

Lattimore, B. and Richardson, J. Chapter 1. Introduction. *In*: Richardson, J., S. Rose, C.T. Smith and M. Trossero (eds.). 2009. Criteria and indicators for sustainable woodfuel. [Tentative title] FAO Forestry Paper. UN/FAO, Rome. (In review).

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Lattimore, B., Smith, C.T., Titus, B.D., Stupak, I., and Egnell, G. Environmental factors in woodfuel production: risks, and criteria and indicators for sustainable practices. *Biomass & Bioenergy* (2009), doi:10.1016/j.biombioe.2009.06.005. (Available online, In press).

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Mola-Yudego, B., Röser, D., Selkimäki, M. and Prinz, R. Potentials for the development of pellet production in Europe. Contribution to IEA Bioenergy Task 32 Pellets Handbook. (In review).

Ralevic, P., Karau, J., Smith, T. and Richardson, J. IEA Bioenergy Task 31 Country Report: Canada. 40p. Available on the Task website: www.ieabioenergytask31.org/IEA_Bioenergy_Task_31/IEA%20country%20Report-%20Canada%202008-%20Dec.%202008%20Final.pdf

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Progress report for ExCo64, Liege, Belgium, October 2009.

Koppejan, J., Technology report 'The current market implementation status of biomass co-firing' for ExCo64, Liege, October 2009.

Pfeiffer, E., Koppejan, J. (Eds.) Report from the workshop 'Options for High Percentage Biomass Cofiring in New Power Plants', Hamburg, June 2009.

Kristensen, T. Amager #1 of Vattenfall.

Maaskant, E., Torrefaction by Topell.

Pfeiffer, E. Fluid bed combustion and gasification.

Kiel, J. Ash related topics in high percentage cofiring.

Livingston, W.R., Direct cofiring.

Stam, A.F., Livingston, W.R., Cremers, M.F.G. and Brem, G., Report on Corrosion and Slagging and Fouling Experiences with Co-Firing.

Cremers, M.F.G. (Ed.) Technical status of biomass co-firing. IEA Bioenergy Task 34 – Delivery 4. August 2009.

Please also visit the Task website: www.ieabioenergytask32.com

TASK 33

Minutes of the fifth Task meeting held in Karlsruhe, Germany, May 2009.

Minutes of the sixth Task meeting held in Breda, the Netherlands, November 2009.

Progress report for ExCo63, Rotterdam, Netherlands, May 2008.

Progress report for ExCo64, Liege, Belgium, October 2009.

Technology Report on 'Summary of Selected Presentations on Raw Gas Clean-up and Conditioning' at the International (Biomass) Thermochemical Conversion Science Conference (itc) 2009, for ExCo64, Liege, October 2009.

Anon. Technical Presentations from fifth Task 33 workshop 'WS5: Biomass Gasification Raw Gas Cleaning, Conditioning, and Conversion.' May 2009.

Arnold, U. Fuel Production from Biomass-derived Syngas within the Bioliq®-process.

Bacovsky, D. Overview of 2nd Gen Biofuels.

Bain, R. Syngas Cleanup at NREL.

van der Drift, B. Two Worlds Meet.

Gerbart, R. Gasification and Syngas Upgrading Projects at ETC.

Bogild Hansen, J. Syngas Conditioning and Conversion.

Kasper, M. Syngas Conditioning by Lurgi Rectisol.

Kurkela, E. Gas Cleaning R&D at VTT.

Leibold, H. Dry HTHP Syngas Cleaning - Status and Results.

von Morstein, O. Applied Technologies.

Rauch, T. Latest developments in FT Synthesis and Methanation at the Gussing biomass CHP Plant.

Schaub, G. Hydrocarbon Synthesis Research.

Schulze, O. Advanced Gas Cleaning for Biomass Gasification.

Schwab, E. BASF - Technologies for Syngas Purification.

Anon. Technical Presentations from sixth Task 33 workshop WS6 'Operating Experience with Biomass Gasifiers: Research and Technology Development Needs to Improve Gasification Plant Operations' November 2009. *Available in early 2010.*

Please also visit the Task website: www.ieaTask33.org

TASK 34

PyNe Newsletter No. 26, December 2009.

Progress report for ExCo63, Rotterdam, Netherlands May 2009.

Progress report for ExCo64, Liege, Belgium, October 2009.

Anon. Technical Report No. 1: Lignin Fast Pyrolysis: Results From An International Collaboration.

Please also visit the Task website: www.pyne.co.uk

TASK 36

Progress report for ExCo63, Rotterdam, the Netherlands, May 2009.

Progress report for ExCo64, Liege, Belgium, October 2009.

Technology report 'Residential Waste: Definition, Generation, Characterisation, Management – An often overlooked bioenergy source' for ExCo64, Liege, Belgium, October 2009.

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The publications are available from Grace Gordon (*Email grace.gordon@aeat.co.uk*).

TASK 37

Minutes from the Task meeting in Jyväskylä, Finland. April 2009.

Minutes from the Task meeting in Vienna, Austria. October 2009.

Progress report for ExCo63, Rotterdam, The Netherlands. May 2009.

Progress report for ExCo64, Liège, Belgium. September/October 2009.

Technology report 'Energy Crop Digestion' for ExCo64, Liège, Belgium. Sept/Oct 2009.

Anon. Country reports of the Task Member Countries and the EC. April 2009
www.ieabiogas.net/publicationsreports.htm

Anon. Presentations from the joint Task 37 and University of Jyväskylä seminar 'Biogas Technology for a Sustainable Energy Production', Jyväskylä, Finland, April 2009.

Wellinger, A. Biogas for a sustainable future.

Lehtomäki, A. Biogas in Finland.

Baxter, D. Policies to promote biogas in the EU.

Weiland, P. Biogas in Germany: 1200 MW biogas electricity today and tomorrow?

Braun, R. Energy crops for biogas production - Experiences of large scale use.

Holm-Nielsen, J.B. Processing digestate to valuable products.

Lukehurst, C. Developing the use of digestate in UK.

Petersson, A. Use of biogas as vehicle fuel.

Dumont, M. Biogas in The Netherlands – experiences and visions.

Anon. Presentations from the Task 37 workshop on “Upgrading of biogas”. Tulln, Austria, October 2009.

Wellinger, A. Welcome & Introduction to the Topic.

Harasek, M. New Developments in Biogas Upgrading.

Petersen, A. Long Term Experience with Biogas Upgrading.

Weiland, P. Status of Biogas Upgrading in Germany.

Rauch, R. Gas Upgrading from Thermal Gasification.

Kirchmayr, R. Sources and Potential of Biogas.

Schöberl, P. Advances in Grid Injection.

Wellinger, A. ‘Algal biomass – does it save the world’. Summary report for ExCo63.

The publications are available on the Task website: www.iea-biogas.net or from Arthur Wellinger, Nova Energie GmbH, Châtelstrasse 21, CH-8355 Aadorf, Switzerland.

TASK 38

Minutes from the Task meeting in Helsinki, Finland, April 2009.

Progress report for ExCo63, Rotterdam, the Netherlands, May 2009.

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Technology report ‘Temporal Accounting of GHG Emissions from Bioenergy Systems’ for ExCo64, Liege, Belgium, October 2009.

Workshop Report: Land Use Changes due to Bioenergy: Quantifying and Managing Climate Change and Other Environmental Impacts. Summary. Helsinki, Finland 30 March – 01 April 2009.

Anon. Presentations from Task 38 at the IEA Bioenergy Task 38 International Conference 'Land Use Changes due to Bioenergy - Quantifying and Managing Climate Change and Other Environmental Impacts', Helsinki, Finland, March 2009.

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Cowie, A. Direct effects of bioenergy systems on soil carbon: implications for climate change benefits of bioenergy.

Van Stappen, F. Direct and indirect LUC issues in European sustainability initiatives.

Bird, N., et al. IEA Bioenergy Task38 – Ten years of analysing the greenhouse gas balances of bioenergy systems. Published in: Proceedings of the 17th European Biomass Conference, 29 June – 3 July 2009, Hamburg, Germany.

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Pingoud, K., Cowie, A., Bird, N., Gustavsson, L., Rueter, S., Sathre, R., Soimakallio, S. and Woess-Gallasch, S. "On the accounting error in bioenergy". Submitted for publication in Science, November 2009.

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TASK 39

Ackom, E. (Ed.) IEA Bioenergy Task 39 Newsletter. Volume 23. August 2009.

Ackom, E. (Ed.) IEA Bioenergy Task 39 Newsletter. Volume 22. February 2009.

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Progress report for ExCo64, Liege, Belgium, October 2009.

Technology report 'Update on demonstration initiatives' for ExCo64 Liege, Belgium, October 2009.

Ackom, E. Algal biofuels: developments and relevant publications. IEA Task 39 Report T39-TR4.

Anon. Biofuels & Bioenergy A Changing Climate. Conference Programme ad Abstracts. August 2009.

Mabee, W., Neeft, J., and Van Keulen, Bregje. Update on biofuel implementation agendas 2009: A review of Task 39 Member Countries. IEA Task 39 Report T39-P1 (updated). 2009.

Sims, R.; Taylor, M., Saddler, J. And Mabee, W. From 1st- to 2nd-Generation Biofuel Technologies: An overview of current industry and RD&D activities (A joint Task 39 and IEAHQ Report).

(S&T)2 Consultants Inc. An examination of the potential for improving carbon/energy balance of ethanol. IEA Task 39 Report T39-TR3. 2009.

The publications are available on the Task website: www.task39.org

TASK 40

Minutes from the Task meeting in Brussels, Belgium, January 2009.

Minutes from the Task meeting in San Francisco, USA, May 2009.

Minutes from the Task meeting in Tsukuba, Japan, October 2009.

Progress Report for ExCo63, Rotterdam, Netherlands, May 2009.

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Technology report 'A global overview of vegetable oils, with reference to biodiesel' for ExCo64, Liege, Belgium, October 2009.

Bradley, D. Canada report on bioenergy 2009, Climate Change Solutions, July 2009, p. 45.

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Cocchi, M., Capaccioli, S. and Vivarelli, F. Country report Italy, 2009. ETA Florence, September 2009, p. 33.

Fritsche, U., Hennenberg, K., Hünecke, K., Thrän, D., Witt, J., Hennig, C. and Rensberg, N. Country report Germany, 2009. Energy & Climate Division Öko-Institut, Darmstadt Office and Bioenergy Systems Division, German Biomass Research Centre, July 2009, p. 58.

Guisson, R. and Marchal, D. Country report Belgium, 2009. VITO/ CRA-W, September 2009, 105pp.

Hektor, B. Country report Sweden, 2009, p.35.

Heinimö, J. and Alakangas, E. Market of biomass fuels in Finland. Lappeenranta University of Technology, Institute of Energy Technology, Research Report 3, August 2009, 35 pages + app 1 p. Report for IEA Bioenergy Task 40 and EUBIONETIII.

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Junginger, M., Faaij, A. and Schouwenberg, P-P. IEA Bioenergy Task 40 Newsletter - Issue 1 -2009, August 2009, p. 3.

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Kranzl, L., Diesenreiter, F. and Kalt, G. Country report Austria 2009. Energy Economics Group (EEG), Vienna University of Technology, September 2009, 39pp.

Perry, M. and Rosillo-Calle, F. Country report, United Kingdom, 2009. Centre for Environmental Policy (CEP), Imperial College London, June 299, 39pp.

Rosillo-Calle, F., Pelkmans, L. and Walter, A. A global overview of vegetable oils, with reference to biodiesel. VITO, UNICAMP, Imperial College London, June 2009, 89pp.

Trømborg, E. and Leistad, Ø. Country report Norway, 2009. Norwegian University of Life Sciences / Enova, July 2009, p. 20.

Walter, A. and Dolzan, P. Country report Brazil, 2009. FEM-NIPE, UNICAMP, August 2009, 66pp.

In addition, Task 40 participants provided numerous presentations on the work of Task 40 at international events. Presentations which addressed key themes of Task 40 and that were given in a variety of settings are:

Faaij, A. Methodology and Results of Global Biomass Assessment, Workshop on Potential for Sustainable Production of 2nd Generation Biofuels, organised by the International Energy Agency, Paris, February (Invited Speaker).

Faaij, A. What we know and don't know about sustainable bioenergy resource potentials, Potsdam Institute for Climate Impact Research, Potsdam, Germany, February (Invited Speaker).

Faaij, A. Drivers for Sustainable Use of Bioenergy on a Global Scale and the 2nd International Conference of Kyoto Global COE Programme: In Search of Sustainable Humanosphere in Asia and Africa. Kyoto Japan, March (Invited Speaker).

Faaij, A. Sustainable biofuels: Finding the Right Indicators and Performance Levels. International Energy Farming Congress, Papenburg, Germany, March (Keynote Speaker).

Faaij, A. Bioenergy, food and indirect displacement effects. World Biofuels Market Congress: Sustainable Agriculture and Biofuels Certification Forum, Brussels, Belgium, March (Invited Speaker).

Faaij, A. Implications of sustainability requirements for bioenergy; are we well underway? EUROFORUM: De Markt voor Energie uit Afval & Biomassa, Amsterdam, March (Invited speaker).

Faaij, A. Global Biomass Potentials; state-of-the-art. International Conference on Biomass in Future Landscapes: Sustainable Use of Biomass and Spatial Development, Berlin, March (Invited Speaker).

Faaij, A. Sustainability and biofuels; key conditions for developing a sustainable bioenergy market, Panel discussion at the Sustainable Bioenergy 2009: New Opportunities in Biomass, Biogas and Sustainable biofuels, London, April (Invited Panellist).

Faaij, A. Land Use Changes and Biofuels Production. Presentation at the 2nd Ethanol Summit in São Paulo, Brazil, June (Invited Speaker).

Faaij, A. Towards more Sustainable Agriculture: Conflict or Concord between Fields for Feed, Food and Fuels. Presentation at the Agri Vision 2009 Programme 'Shifting horizons: Inspiration, Innovation and Impact in the feed to food chain', Noordwijk, Netherlands, June (Keynote Presentation).

Faaij, A. Prospects for Sustainable Biofuels: Resources, Technologies and Energy System Issues. Presentation at the International Symposium on Application of Bioenergy and Forestry Resource, organised by Experimental Forest. Sitou, Taiwan, June (Keynote Speaker).

Faaij, A. A global market for sustainable biomass resources; what does it take?

Presentation at the XVI Conferencia Internacional Sobre Palma de Aceite. Cartagena, Colombia, September (Keynote Presentation).

Faaij, A. Development of the energy potential of the forestry sector and wood energy in a sustainable way. UNECE/FAO Policy Forum: The Forest Sector in the Green Economy, Geneva, Switzerland, October (Invited Speaker).

Faaij, A. Full impact analysis of biomass energy systems; linking the field to macro level. International Conference on Biofuels: Enhancing Development or Increasing Food Insecurity? Ouagadougou, Burkina Faso, November (Invited Speaker).

Faaij, A. Recommendations on International bioenergy and biofuels markets and trade and the relevance for Africa. At the International Conference on Biofuels: Enhancing Development or Increasing Food Insecurity? Ouagadougou, Burkina Faso, November (Rapporteur).

Faaij, A. and Woods, J. Biofuels as part of sustainable development, Organised by The Centre, Brussels, Belgium, May (Keynote presentation).

Faaij, A. and Woods, J. Accounting for LUC/ILUC for the biofuel sector, Expert meeting organised by DG-TREN. DG-AGRI, DG-ENV, DG-Trade, Brussels, Belgium, May (Invited experts).

Faaij, A., Hoefnagels, R. and Banse, M. Analysis of the Economic Impact of Large-Scale Deployment of Biomass Resources for Energy and Materials in the Netherlands, Presentation at the Ministry of Economic Affairs, The Hague, February (Invited Speaker).

Junginger, M. Global sawdust potentials and pellet supply chains, World Sustainable Energy Days, Wels, Austria, February (Invited Speaker).

Junginger, M. State of biomass trade and barriers to overcome, EUBIONETIII workshop 'Bioenergy for Industry', Brussels, Belgium, March (Invited Speaker).

Junginger, M. International pellet trade. Pellets@las Final workshop, Brussels, Belgium, November (Invited Speaker).

Junginger, M. Initiatives regarding sustainability of biofuels in Europe and their potential impacts on trade. Brazil CTBE workshop on the impact of new technologies on the sustainability of the sugarcane/bioethanol production cycle, Campinas, Brazil, November (Invited Speaker).

In addition, presentations from Task 40 workshops and conference delegates are available to be downloaded from the Task website: www.bioenergytrade.org.

TASK 41

Anon. Final Report for Task 41, Project 1: 'Synergies and Competition in Bioenergy Systems'. IEA Bioenergy: T41(1): 2008:01

Ericson, S-O. Summary and Conclusions.

Nylander, B.N., and Nilssen, S. Part A: Identifying synergies and competition in forest-based bioenergy in selected countries.

Thrän, D., Seidenberger, T. and Zeddies, J. Part B: Agricultural sector.

Ladisch, M. (Lead Author). Gaps in the research of 2nd generation transportation biofuels – Final report from Task 41, Project 2. IEA Bioenergy: T41(2): 2008:01.

The publications are available on the IEA Bioenergy website: www.ieabioenergy.com

TASK 42

Minutes of the Task meeting, Dublin, Ireland, March 2009.

Minutes of the Task meeting, Worms, Germany, September 2009.

Progress Report for ExCo63, Rotterdam, Netherlands, May 2009.

Progress Report for ExCo64, Liege, Belgium, September/October 2009.

Technology report 'Definition, Classification and Market Initiatives' for ExCo64, Liege, Belgium, October 2009.

Anon. Task 42 Country Reports.

Anon. Brochure on biorefineries and the role of Task 42.

These publications will be available on the Task website www.IEA-Bioenergy.Task42-Biorefineries.com.

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Sweden	Kenneth Möllersten	Swedish Energy Agency
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TASK 39 — Commercialising 1st and 2nd Generation Liquid Biofuels from Biomass

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Subtask Task Leader: (Implementation)	Manfred Wörgetter, Federal Institute for Agricultural Engineering, Austria. For contacts see Appendix 6.
Subtask Task Leader: (Policy, EU)	John Neeft, NL Agency, the Netherlands For contacts see Appendix 6.
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TASK 41 — Bioenergy Systems Analysis

- Project 3:** Joint Project with AMF Annex XXXVII project 'Fuel and Technology Alternatives for Buses: Overall energy efficiency and emission performance
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TASK 42 — Biorefineries: co-production of fuels, chemicals, power and materials from Biomass

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