

Annual Report 2007

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 accelerate the use of environmentally sound and cost-competitive bioenergy on a sustainable basis, to provide increased security of supply and a substantial contribution to future energy demands.



Leadership Recognised: The International Fuel Ethanol Workshop and Expo, held on 26-29 June 2007 in St. Louis, USA was attended by 5,300 registrants from over 23 countries. IEA Bioenergy had a stand and was recognised for its leadership in uniting the international bioenergy community with an award which was presented to Larry Russo.

To: IEA Headquarters, Paris

IEA BIOENERGY ANNUAL REPORT 2007

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 2007. An important issue has been the criteria for admission of new Member Countries. Please see page 20. This issue was raised in the 12th Status Report to the REWP (January 2008) and also by the Chairman at the REWP 52 meeting in Berlin.

This year, we have presented a special article 'Moving with the Times' by Adam Brown, the newly appointed Technical Coordinator.

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

Kyriakos Maniatis
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.

'Moving With The Times'

Reflections by the new Technical Coordinator,
Dr Adam Brown.



Introduction

I was very honoured when, at the end of 2006, I was invited, to take on the role of Technical Coordinator for the IEA Bioenergy Agreement.

I am taking the opportunity of writing this article to review how IEA Bioenergy has evolved to meet the changing environment since I was last fully involved. I also want to highlight the current and future priorities for IEA Bioenergy and some new initiatives.

The Changing Energy and Environment Context...

It is nearly 15 years since I was significantly involved with the Agreement, acting as the UK representative on the Executive Committee from 1984 to 1993 and was privileged to be Chairman from 1990-1993. Since then I have maintained my links with the bioenergy sector through my programme management and consultancy work and through involvement in commercial bioenergy projects.

How things in the energy scene have changed since 1993! Then oil was in plentiful supply, with oil prices slumping to around US\$17 a barrel, and energy security was not a serious issue. Global warming was under consideration, but not yet seen as a major call to action for renewables and other sustainable energy options. Bioenergy was under pressure to demonstrate that it could compete as a significant source of energy with low cost fossil fuels, and the future for bioenergy, along with most of the renewable energy technologies, looked rather bleak.

Now 15 years on, the situation is completely different. Energy security is a major concern in most countries, oil is over US\$100 a barrel, and climate change is top of many political agendas. Bioenergy is making an increasing contribution to energy supply right across the OECD and the technologies are seen to have the potential to make a major contribution to reducing the carbon emissions associated with energy use. The question is no longer whether bioenergy can play a role in future energy supply, but more the extent, timing, and cost of the contribution. And of course a major concern is the likely impact of a rapid growth in deployment levels. Biofuels is now a very topical subject!

...and the Changing Agreement

Broader Participation

Over the same period IEA Bioenergy has grown in terms of the number of countries that participate – increasing from 15 to 21. Participation from Europe has broadened and Australia, South Africa, and Brazil have also become Members. The technical scope has also broadened. Tasks on 'municipal solid waste', 'liquid biofuels' and 'anaerobic digestion', and most recently 'biorefineries', have been added to the portfolio.

Cross Cutting Issues

Additional focus has been given in the Agreement to cross cutting issues which have become increasingly important as the technologies have matured and approached commercialisation. There are now specific Tasks devoted to 'socio-economic drivers', 'greenhouse gas balances', and 'sustainable trade issues'. These new Tasks have broadened the scope of the Agreement considerably and extended participation from the original teams of foresters and energy technologists, to include environmental modellers, economists, and social scientists.

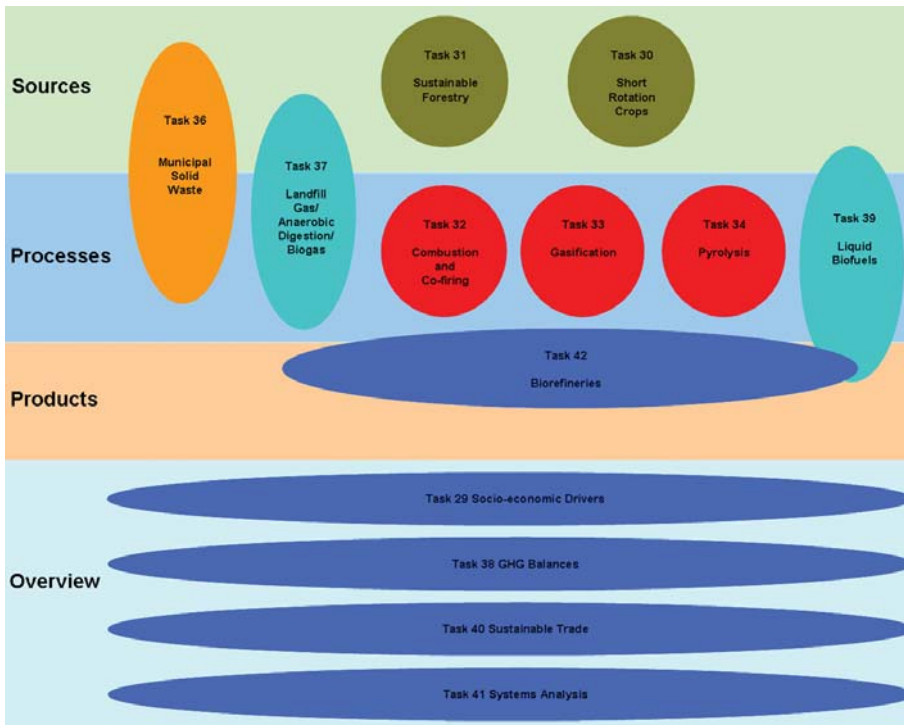


Figure 1: The Current IEA Bioenergy Task Structure

Workshops and Publications

IEA Bioenergy has also been working hard to address the technical and non-technical issues affecting the deployment of bioenergy through a series of workshops arranged in conjunction with each of the Executive Committee meetings.

Recognising the higher profile of bioenergy, and its unique ability to access leading expert opinion from across the OECD, the Agreement has been working to develop a series of documents which are intended to be useful to policy and decision makers. These are being developed through a 'special purpose Task' designed to tackle topical issues (Task 41). In addition a special budget (the 'Strategic Fund') has been established to develop an additional suite of strategic deliverables. One of my key roles as Technical Coordinator will be to identify topics which can be developed using this fund, and to manage production of the deliverables.

The Tasks - Current Priorities and Achievements

The main work is still carried out through the 13 Tasks. These are the vehicles which enable information exchange between the participants and develop specific Task-related reports and other deliverables. The management arrangements have been streamlined since the early days, when there were three Operating Agents who coordinated groups of Tasks and acted as an interface with the ExCo. The current arrangement is more direct and cost effective, and it allows closer interaction between the Task Leaders and the ExCo.

The Tasks cover issues around *developing and producing bioenergy feedstocks, conversion processes, and cross cutting* issues. The current focus of the work in each Task and their aims and priorities are summarised in the Table on pages 11-15.

The 'production' Tasks (Tasks 30 and 31) are looking at producing an energy component from sustainable forestry and at the production of energy from short rotation species such as willow, poplar and *Eucalyptus*, and at other cellulosic species such as red canary grass, *Miscanthus* and switch grass. Both Tasks have produced handbooks on best practice and are dealing with the environmental and socio-economic aspects of the deployment of these options.

The 'conversion' Tasks (Tasks 32, 33, 34, 36, and 37, 39, and 42) are dealing with the range of thermal and biochemical processes involved in converting biomass to useable energy. The technologies range from those which are fully commercialised – like combustion – through to those which are still at the development and demonstration stage – like pyrolysis and gasification. For the more mature technologies, like combustion, anaerobic digestion and the use of municipal wastes, the emphasis is on development and dissemination of best practice. The Combustion Handbook produced by Task 32 is an acknowledged primer in the field, and is now available in Chinese. For the less mature technologies the emphasis is on identifying opportunities for R&D collaboration and information exchange. Task 39, which is looking at liquid transport fuels, spans the field, with an activity focussed on policy

development aimed mostly at current conversion processes, as well as looking at future development of biological and thermochemical processes for cellulosic feedstock.

The 'cross cutting' Tasks (Tasks 29, 38, and 40) are looking at a range of complementary issues which are all very germane to the current debate over the sustainability of bioenergy – socio-economic drivers for bioenergy, the greenhouse gas balances and the sustainability of an international trade in biofuels.

Coordination and Joint Working

While each of the Tasks has a specific work programme and team of experts working on its main theme, there is of course enormous scope for collaboration across the themes, and this leads to many joint activities and meetings where several Tasks are represented. For example in October 2007, Tasks 29, 38 and 40 organised a joint workshop in Dubrovnik to discuss the sustainability issue and the experts from within these Tasks were joined by representatives from Task 30 and 31, as well as a number of international experts in the field. This led to a broad discussion of the issues and development of a summary paper for discussion by the Executive Committee.

New ExCo Initiatives

Workshops

As mentioned above, each Executive Committee meeting now includes a workshop session. This is one way of addressing some of the rapidly changing technical and non-technical issues affecting the deployment of bioenergy. World leading experts from outside the Agreement are asked to join in discussion with the ExCo, Task Leaders, and participants. This provides an excellent briefing for the ExCo, and allows the implications to be fed into the work of IEA Bioenergy. Recent workshops have focussed on 'The Biorefineries Concept' and on 'The Role of Innovation in Bioenergy Business Development'. The next workshop in April 2008 will focus on the debate about the sustainability of a significant growth in the use of bioenergy as a transport fuel.

Summary proceedings of each of these workshops are prepared for publication. Progress to date is:

- Liquid biofuels from black liquor – published
- Co-utilisation of biomass with fossil fuels – published
- Integrated waste management and utilisation of the products for energy – in preparation
- Availability of biomass resources – published
- The biorefinery concept – published
- Innovation in the field of bioenergy business development – in preparation



Policy-related Publications

So far the outputs from the Agreement have been primarily aimed at technical audiences, academics, and researchers. However, bioenergy is now expanding in the commercial sphere, as well as becoming increasingly important on political agendas.

Recognising the higher profile of bioenergy, and its unique ability to access leading expert opinion from across the OECD, IEA Bioenergy is working to develop a series of documents which are intended to be useful to policy and decision makers.

These 'strategic position papers' include:

- Sustainable Production of Woody Biomass for Energy
- Municipal Solid Waste and Its Role in Sustainability
- Benefits of Bioenergy
- Potential Contribution of Bioenergy to the World's Future Energy Demand
- Life-Cycle Analysis of Biomass Fuels, Power, and Heat – in preparation



The recent publication 'Potential Contribution of Bioenergy to the World's Future Energy Demand' has proved the most popular item on the IEA Bioenergy website. The abstract of this paper is reproduced below.

Potential Contribution of Bioenergy to the World's Future Energy Demand

Biomass is a versatile raw material that can be used for production of heat, power, transport fuels, and bio-products. When produced and used on a sustainable basis, it is a carbon-neutral carrier and can make a large contribution to reducing greenhouse gas emissions. Currently, biomass-driven combined heat and power, co-firing, and combustion plants provide reliable, efficient, and clean power and heat. Production and use of biofuels are growing at a very rapid pace. Sugar cane-based ethanol is already a competitive biofuel in tropical regions. In the medium term, ethanol and high-quality synthetic fuels from woody biomass are expected to be competitive at crude oil prices above US\$45 per barrel.

Feedstocks for bioenergy plants can include residues from agriculture, forestry, and the wood processing industry, as well as biomass produced from degraded and marginal lands. Biomass for energy may also be produced on good quality agricultural and pasture lands without jeopardising the world's food and feed supply if agricultural land use efficiency is increased, especially in developing regions. Revenues from biomass and biomass-derived products could provide a key lever for rural development and enhanced agricultural production. Certification schemes are already established to ensure sustainable production of forest biomass and could be adopted to guide residue recovery and energy crop production. Biomass utilisation will be optimised by processing in biorefineries for both products and energy carriers.

Given these possibilities, the potential contribution of bioenergy to the world energy demand of some 467 EJ per year (2004) may be increased considerably compared to the current 45-55 EJ. A range from 200-400 EJ per year in biomass harvested for energy production may be expected during this century. Assuming expected average conversion efficiencies, this would result in 130-260 EJ per year of transport fuels or 100-200 EJ per year of electricity.

Bioenergy Systems Analysis – Task 41

Some additional important topics are being tackled through a 'special purpose Task', designed to be flexible enough to address topical issues outside the normal three year cycle of the main Tasks.

The first project under Task 41 is to look at the interaction between expanding bioenergy markets and traditional forest industries and agricultural food production. The analysis will focus on the interdependence of bioenergy systems with other industries and policies, particularly those related to agriculture, forestry, and waste management. It will consider how bioenergy systems can best be designed to benefit from synergies with the traditional activities in these areas. Attention will also be given to constraints on the development of bioenergy systems, for example those stemming from competition with other activities. Biomass as an energy source may also be suitable as a raw material for pulping, and there can be competition between the use of arable land for energy and food production. The interaction between specific bioenergy systems and policies related to biodiversity and sustainable management of soil ecosystems will also be analysed.

The second project under Task 41 is an analysis and identification of gaps in fundamental research for the production of second generation liquid transportation biofuels. The work, which is being led by Mike Ladisch from Purdue University in the USA, will define research gaps and barriers currently not being addressed, that could hinder progress in the development of technologies for the production of liquid transportation biofuels.

The work will lead to a list of ranked research topic areas which will be communicated through a state-of-the-art report on the definition of biofuels and their production by thermo-chemical and biological process schemes. This work is scheduled for completion early in 2008.

The Strategic Fund

A 'Strategic Fund' has been established to develop an additional suite of deliverables. At ExCo60 in Munich the first round of these products was agreed – the production of a succinct review of the whole Bioenergy area, and the generation of a series of Country Reports, which will provide definitive information on the development and deployment of bioenergy in all its forms in each of the participating countries. These projects will be carried out with the help of specialist know-how which will be contracted to do the work. Proposals for the Bioenergy Review have been evaluated and the work is expected to commence early in 2008.

Communication Strategy

These publications and deliverables represent a change in focus for IEA Bioenergy, adding political and industrial decision makers to the target audiences for the outputs of the Agreement. As part of these challenging first steps, the ExCo also agreed that we should take a more strategic view of the development of these products by preparing a communication strategy, which clearly identifies the target audiences for the work of the Agreement, and establishes how to best get messages to them. This will lead to a comprehensive communications strategy and plan.

Future Challenges

So, IEA Bioenergy has very significantly shifted its focus over the last 15 years in response to the changing external environment and the needs and interests of its Members. Broadening the base of the Agreement and introducing new and flexible ways of getting things done has brought a new energy to the work.

The focus will no doubt continue to shift and change in response to the new challenges that come as bioenergy supplies an ever growing share of world energy demand. The current pre-occupations are still with costs and future contributions of the technology. My expectation is that the current focus on sustainability issues will become even more important, and greater emphasis will be given to the development of best practice guidelines based on a growing number of successful case studies

In the light of this increased interest I see an opportunity for IEA Bioenergy to take a leading role in the strategic debates about bioenergy, based on its unique network of world class expertise drawn from right across the OECD, along with its well established collaborative mechanisms. Its expert international reach, positions the Agreement to make a well informed and impartial input to strategic debates, helping to broker a consensus about the major issues. Developing this facilitative and catalytic role is now the major challenge.

Over the last 15 years the Agreement has shown itself capable of responding to changes both in the content of its Tasks and in developing a broader range of collaborative mechanisms and outputs. Given the energy, enthusiasm, and expertise of the current participants, I feel confident that IEA Bioenergy can continue to play an increasingly important role in the development and the deployment of bioenergy technologies, and I am delighted to be involved once again.



The ExCo59 study tour group outside the ENREL visitor Centre, in Golden USA

Table: The Tasks - Current Priorities and Achievements

Theme: Production	
Topic	Short Rotation Crops – Task 30
Major Focus	<ul style="list-style-type: none"> • Woody crops like willows, poplars and <i>Eucalyptus</i> with coppicing abilities. • Lignocellulosic crops such as reed canary grass, <i>Miscanthus</i> and switch grass.
Current Aim	<ul style="list-style-type: none"> • Synthesise and transfer knowledge, enhance market development and facilitate large-scale implementation
Key Activities and Achievements	<ul style="list-style-type: none"> • Integration of production and environmental functions. • Research into barriers to large-scale implementation. • Studies of environmental consequences of short rotation biomass production. • Publication of a Short Rotation Crop Handbook.
Topic	Biomass for Energy from Sustainable Forestry – Task 31
Major Focus	<ul style="list-style-type: none"> • Sustainable production of an energy product as well as traditional lumber or pulpwood from forestry.
Current Aim	<ul style="list-style-type: none"> • Promote the market deployment of technologies and systems for sustainable biomass production for energy. • Analyse and disseminate scientific knowledge leading to economically and environmentally sustainable production of biomass for energy from integrated forestry systems.
Key Activities and Achievements	<ul style="list-style-type: none"> • Annual international workshops and study tours with published proceedings. • Case studies, success stories and policy-oriented papers dealing with forest biomass production and criteria for integrated and sustainable forest management. • Dissemination of new research knowledge and operational successes to stakeholders and policy-makers. • A book 'Bioenergy from Sustainable Forestry: Guiding Principles and Practice'

Theme: Conversion

Topic	Biomass Combustion and Co-firing – Task 32
Major Focus	<ul style="list-style-type: none"> • Combustion and co-firing of biomass for the production of usable energy.
Current Aim	<ul style="list-style-type: none"> • Stimulate further expansion of biomass combustion. • Generate and disseminate information on technical and non-technical barriers and solutions for dedicated biomass combustion systems and biomass co-firing in existing coal-fired power stations
Key Activities and Achievements	<ul style="list-style-type: none"> • Biomass Combustion Handbook (also available in Chinese) • Authoritative reports and workshops <ul style="list-style-type: none"> - International co-firing initiatives - Energy assessment of biomass combustion systems - Mitigation of aerosols - Biomass-based CHP plants - Impact of biomass on SCR plants - Efficiency and emissions for automatic combustion plants • Technical databases and tools.
Topic	Thermal Gasification of Biomass – Task 33
Major Focus	<ul style="list-style-type: none"> • Production of substitute fuel gases from biomass for utilisation in energy conversion systems.
Current Aim	<ul style="list-style-type: none"> • Exchange information and promote co-ordinated RD&D among the participants to eliminate technological impediments to the commercialisation of thermal gasification of biomass.
Key Activities and Achievements	<ul style="list-style-type: none"> • Road map and research needs identification, reports and publications. • A programme of international workshops viz.: <ul style="list-style-type: none"> - Role of BMG in future energy needs - Analytical protocols for characterising synthesis gas - Gas Cleanup - Health, safety and environment issues for small-scale BMG systems • Database of performance statistics

Topic	Pyrolysis of Biomass – Task 34
Major Focus	<ul style="list-style-type: none"> • The controlled thermal degradation of biomass in any form to derive energy and chemical products. The Task extends the European Pyrolysis Network (PYNE)
Current Aim	<ul style="list-style-type: none"> • Study biomass pyrolysis and its role in an integrated bioenergy scheme. • Provide a forum for all aspects of biomass fast pyrolysis including preparation of feedstock, the fast pyrolysis process and utilisation of the liquid product for energy, electricity and chemicals production.
Key Activities and Achievements	<ul style="list-style-type: none"> • Pyrolysis Handbook • Lignin pyrolysis round robin • Bio-oil toxicity assessment • Biorefinery case studies • International Workshops
Topic	Integrating Energy Recovery from MSW Systems – Task 36
Major Focus	<ul style="list-style-type: none"> • Conversion of Municipal Solid Waste (MSW) by thermal processes for the production of usable energy, including heat and electricity.
Current Aim	<ul style="list-style-type: none"> • Collate research and policy information and case study material to produce best practice guidelines for policy makers
Key Activities and Achievements	<ul style="list-style-type: none"> • Current focus of the Task is a comprehensive status report of the latest developments and deployment of conversion technologies for MSW covering: <ul style="list-style-type: none"> - MSW resource - environmental considerations - technology review - waste management policies - economics of waste and resource management systems
Topic	Energy from Biogas and Landfill Gas – Task 37
Major Focus	<ul style="list-style-type: none"> • Biological treatment of the organic fraction of municipal solid waste and the anaerobic treatment of organic rich industrial waste water to produce biogas and a digestate of high quality.
Current Aim	<ul style="list-style-type: none"> • Exchange and disseminate information on biogas production and energy utilisation and promote deployment of AD plants
Key Activities and Achievements	<ul style="list-style-type: none"> • Stimulate R&D on gas upgrading • Information for decision makers • Promote biogas inclusion in gas grid • Develop links with vehicle manufacturers to promote inclusion of biogas in vehicles

Topic	Commercialising Liquid Fuels from Biomass – Task 39
Major Focus	<ul style="list-style-type: none"> • Policy, market and implementation issues that must be address in commercialisation of biofuels and the technical challenges of 2nd-generation biofuel production.
Current Aim	<ul style="list-style-type: none"> • Identify and eliminate non-technical, environmental and institutional barriers. Identify remaining technological barriers to liquid biofuels technologies. Formulate a deployment strategy
Key Activities and Achievements	<ul style="list-style-type: none"> • Review of international policy developments. • Review biofuels markets. • Survey biomass availability for liquid fuel production. • Comparison of technological platforms. • Country strength appraisal
Topic	Biorefineries – Task 42
Major Focus	<ul style="list-style-type: none"> • Biorefinery as a facility that optimises the integrated production of materials, fuels, energy and chemicals and so maximises the value derived from the biomass feedstock.
Current Aim	<ul style="list-style-type: none"> • Assess the worldwide position and potential of biorefineries. • Gather new insights of the possibilities for the simultaneous manufacture of transportation fuels, added value chemicals, heat, power and materials.
Key Activities and Achievements	<ul style="list-style-type: none"> • Development of a common definition and classification system for biorefineries. • Country reports on current processing potential and mapping of existing plants. • Identification of biorefinery related RD&D programmes in participant countries. • Annual biorefinery seminar for stakeholders. • Linking of ongoing international activities through joint events and new initiatives

Theme: Cross Cutting Themes

Topic	Socio-economic Drivers for Bioenergy Projects – Task 29
Major Focus	<ul style="list-style-type: none"> Public opinion and attitudes to bioenergy, information flows.
Current Aim	<ul style="list-style-type: none"> Improve understanding of the drivers and impacts of establishing bioenergy markets at the local, regional, national and international level. Synthesise and transfer critical knowledge to stakeholders. Improve the assessment of impacts of biomass production and utilisation to provide guidance to policy makers.
Key Activities and Achievements	<ul style="list-style-type: none"> Increased understanding of the non-technical and socio-economic barriers to the uptake of bioenergy. Position papers, brochures, scientific papers, presentations, and posters An educational website www.aboutbioenergy.info. A series of case studies highlighting the socio-economic dimension including validation activities, workshops, seminars, site visits.
Topic	GHG Balances of Bioenergy Systems – Task 38
Major Focus	<ul style="list-style-type: none"> Investigation of all processes involved in the use of biomass and bioenergy systems on a full fuel-cycle basis to establish overall GHG balances.
Current Aim	<ul style="list-style-type: none"> Improve understanding of bioenergy and GHG issues. Develop and improve tools for assessing GHG balances. Disseminate best practice in biomass GHG reduction and aid decision makers in defining optimal mitigation strategies
Key Activities and Achievements	<ul style="list-style-type: none"> Development of methodologies for optimisation of GHG reduction strategies, e.g. carbon sequestration; and to 'mainstream' GHG benefits of biomass and bioenergy systems with other externalities Provide standards for GHG performance in bioenergy policies Linking Emission Trading Systems and bioenergy/land-based offset projects Case studies on novel biomass and bioenergy systems (e.g., biorefinery) Contributions to the work of IPCC/OECD/IEA.
Topic	Sustainable International Bioenergy Trade – Task 40
Major Focus	<ul style="list-style-type: none"> Supporting development of a sustainable international bioenergy trading system while recognising the diversity of resources and applications. Aims to review the development of biomass markets in various parts of the world and existing trade experiences.
Current Aim	<ul style="list-style-type: none"> Analyse the effects of existing markets (e.g., pulpwood) on bioenergy trade. Review the barriers hampering development of a global commodity market and identify strategies to overcome them. Identify sustainability criteria and their local influence on the biomass market.
Key Activities and Achievements	<ul style="list-style-type: none"> Analysis of trade, markets and market experience, e.g., ethanol. Case studies of biomass production and supply chains. Modelling and scenario analysis. Studies of sustainability quality and certification/standardisation. Development of best practice guidelines.

International Energy Agency

The International Energy Agency (IEA) acts as energy policy advisor to 27 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, publications, 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 IEA's 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 concrete policy recommendations for governments on key energy topics.

Members

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

Introducing IEA Bioenergy

Welcome to this Annual Report for 2007 from IEA Bioenergy!

IEA Bioenergy is the short name for the international bioenergy collaboration within the 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 2007, 21 parties participated in IEA Bioenergy: Australia, Austria, Belgium, Brazil, Canada, Croatia, Denmark, Finland, France, Germany, Ireland, Japan, the Netherlands, New Zealand, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States of America, and the European Commission.

IEA Bioenergy is now 30 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 within IEA 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 large number of inquiries from potential participants, and as a consequence of this, a number of 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 2007:

- 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
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- Task 40: Sustainable International Bioenergy Trade – Securing Supply and Demand
- Task 41: Bioenergy Systems Analysis
- 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 2007 is shown in Appendix 1.

A progress report for IEA Bioenergy for the year 2007 is given in Section 1 and 2 of this Annual Report.



The ExCo60 study tour group outside the HDG Bavaria Headquarters in Massing, Germany.

Progress Report

1. THE EXECUTIVE COMMITTEE

Introduction and Meetings

The IEA Bioenergy 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 59th ExCo meeting took place in Golden, USA on 25-27 April 2007. There were 44 participants. Observers from Korea and Turkey also attended. The 60th ExCo meeting was held in Munich, Germany on 29-31 October 2007, with 40 participants. A representative from IEA Headquarters attended ExCo59.

During 2007, Kyriakos Maniatis from the European Commission was Chairman and J. Peter Hall from Canada and Kees Kwant from the Netherlands were both Vice Chairmen. At the ExCo60 meeting, Bjorn Telenius from Sweden was elected Chairman and Kees Kwant was re-elected Vice Chairman for 2008.

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 ExCo57, John Tustin will provide the Secretariat and Fund Administration service for the period to 31 December 2009. 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 2007, is described below.

Implementing Agreement

The current term of the Agreement is to 31 December 2009. This was approved by the IEA Committee on Energy, Research and Technology (CERT) at its meeting in November 2004.

New Participants/Contracting Parties

Interest from potential Member Countries continued to be strong in 2007. At ExCo59 Korea and Turkey participated as Observers. 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 Professor Dr. Sibel Özdoğan from the Tubitak Marmara Research Centre, made presentations.

At both ExCo59 and ExCo60 there was a full and open discussion on the issue of new Contracting Parties in the Implementing Agreement. Some Members expressed opinions as follows:

- New Members should have a strong national RD&D programme in bioenergy and also in deployment of bioenergy.
- When new Members are 'net-takers' from the Agreement they should have special conditions on their membership.
- New Members who only join one or a few Tasks and 'free-load' on the national programmes of major players will dilute the effort of existing Contracting Parties.
- There is a need for a new level of membership which facilitates participation of countries with less than robust bioenergy programmes and limited involvement in the Task programmes.

With respect to potential changes in the Implementing Agreement, the Contracting Parties agreed that:

- If emerging countries met the conditions below, they would be welcome to join any Task.
- They would pay the normal Task fees and participate in Tasks as any other Contracting Party.
- They would not pay the fixed component of the Executive Committee Secretariat Fund fee but would pay the variable component (currently US\$1,000 per Task).
- They could attend ExCo meetings as an Observer – non-voting.
- At a later stage, by unanimous approval of the ExCo, they may become a full Member.

This situation has raised the need to explore new ways to handle applications from emerging countries. A key issue to emerge has been that any Contracting Party from an OECD Member Country must have at least as many rights as OECD non-Member Countries who participate in IEA Bioenergy. This means that under the current rules, the ExCo cannot invite emerging countries to join the Agreement until a new category of membership is agreed with IEA Headquarters. IEA Bioenergy will continue to work

through the REWP, CERT, and with IEA Headquarters personnel to seek a solution so that countries such as Korea and Turkey can join the Agreement.

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 2007 approved by the Executive Committee for the ExCo Secretariat Fund and for the Tasks are shown in Appendix 2. Total funds invoiced in 2007 were US\$1,709,960; comprising US\$220,000 of ExCo funds and US\$1,489,960 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 2007 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 The ANZ National Bank Ltd, Head Office, 1 Victoria Street, Wellington, New Zealand. Swift/BIC Address: ANZBNZ22 for the credit of Bioenergy Research Services Ltd, for and on behalf of IEA Bioenergy. Foreign Currency Account Number: IEABRS-USD00. Quoting the Invoice Number.

The ANZ National Bank Ltd's US Dollar Correspondent Bank is JPMorgan Chase Bank, New York, NY, USA Swift code: CHASUS33 with Federal Wire Number 021000021.

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 2007, there was US\$29,000 outstanding.

KPMG is retained as an independent auditor for the ExCo Secretariat Fund. The audited accounts for the ExCo Secretariat Fund for 2006 were approved at ExCo59. The Tasks also produce audited accounts. These are prepared according to guidelines specified by the ExCo. The accounts for the Tasks for 2006 were approved at ExCo59 and ExCo60.

The audited accounts for the ExCo Secretariat Fund for the period ended 31 December 2007 have been prepared and these will be presented for approval at ExCo61.

Task Administration and Development

Task Leader Tenure

At ExCo60 there was discussion on the leadership of the Tasks. It was agreed that leadership should change from time to time to bring in new ideas, to facilitate adoption of new methods of working and to stimulate the work programme through seizing new opportunities. Change was also desirable to avoid complacency and stereotyped approaches in how the Tasks operated. There was general agreement that Task Leaders should only serve for two triennia in the normal situation and in exceptional circumstances for one more triennium based on guidelines which would be prepared by the ExCo. This decision would be implemented at the end of the current triennium.

Annex Documents

There are 13 Tasks in the current triennium. The Annex document for Task 29 runs to 31 December 2008. New Annex documents for Tasks 30, 31, 32, 33, 36, 37, 38, 39, 40 and 42 for the period 1 January 2007 to 31 December 2009 were prepared and approved. The Annex document for Task 34 was due to expire on 31 December 2007. At ExCo60 it was prolonged to 31 December 2008. The Annex document for Task 41 was due to expire on 31 December 2007. At ExCo60 it was prolonged to 31 December 2008 with no extra budget.

Participation in the Tasks has continued to increase. In 2007 there were 115 participations in 13 Tasks. Please see Appendix 1 on page 79 for a summary of Task participation in 2007.

Strategic Plan

The third Strategic Plan for IEA Bioenergy for the period 2003-2006 was approved at ExCo50 and extended at ExCo52 to 31 December 2009. It underpins a stronger emphasis on market deployment of technologies and systems for sustainable energy production from biomass.

Technical Coordinator

The new Technical Coordinator, Adam Brown, took up his appointment on 1 January. He has been very active since that time. The need for this position arose from the rapidly increasing requests from IEA Headquarters and also the need to provide a coordinating mechanism between the Tasks and the Executive Committee and a link between Tasks for projects where more than one Task was contributing. The main areas he focussed on in the first year included: Task coordination; identification of policy-related deliverables including setting up a comprehensive Bioenergy Review; attendance at the IEA Technology Fair and linking with key Headquarters staff; coordinating the organisation of ExCo workshops; and developing a communication strategy. At ExCo60 it was unanimously approved that the Technical Coordinator's contract should be extended for two years to 31 December 2009.

Strategic Fund/Strategic Outputs

At ExCo53 in Lucerne it was agreed that from 2005, 10% of Task budgets would be reserved for ExCo specified work. The idea was that these 'strategic funds' would be used to increase the policy relevant outputs of IEA Bioenergy. The ExCo has since moved to commit these funds to specific outputs. It was decided that the first priority would be to produce a strategic position paper 'Potential Contribution of Bioenergy to the World's Future Energy Demand'. This was completed in September and published in hardcopy (IEA Bioenergy ExCo:2007:02) and on the website.

The ExCo also decided that a second strategic position paper 'Life Cycle Analysis of Biomass Fuels, Power, Heat, and Products as Compared to their Petroleum Counterparts and Other Renewables' should be produced by Task 38. A draft has been produced and is currently being revised following review.

In addition to these ExCo initiatives, major publications are being produced by the Tasks. For example, Task 32 has produced a second edition of the Handbook of Biomass Combustion and Co-firing. This was published by Earthscan in December 2007. The Task also signed a license agreement with the Chinese Academy of Agricultural Engineering (part of the Ministry of Agriculture) for the preparation of a Chinese edition of the Handbook and publication is expected in early 2008. This Task is also preparing a Handbook of Pellet Production and Utilisation supported by the Strategic Fund.

To date the Strategic Funds have been distributed to the Tasks and this continued in 2007. However, at ExCo60, it was decided that from 1 January 2008 these funds will be held by the Secretariat and distributed to the Tasks for specific ExCo approved projects. This will allow uncommitted Strategic Funds to be monitored without difficulty and implementation of the Technical Coordinator's programme of work will be facilitated.

Workshops

Following the decision at ExCo53 to create time for strategic topics at ExCo meetings it was decided to use the first day of each ExCo meeting for a technical workshop on a topic of high priority to the work of the ExCo. Very successful workshops were held at ExCo59 on 'The biorefinery concept' and at ExCo60 on 'Innovation in the field of bioenergy business development'. External contributions from technology developers, industrial practitioners, policy advisors and others provided a strong platform for discussion. The presentations, summaries by the rapporteurs, and papers based on the presentations are available on the IEA Bioenergy website. The goal is to publish formal proceedings of each workshop. The current status of this work is as follows.

ExCo54 Workshop 'Liquid Biofuels from Black Liquor Gasification': The 'summary and conclusions' publication has been produced – IEA Bioenergy ExCo:2007:03 – and hard copies are available on request.

ExCo55 workshop 'Co-utilisation of Biomass with Fossil Fuels': The 'summary and conclusions' publication has been produced – IEA Bioenergy ExCo:2006:02 – and hard copies are available on request.

ExCo56 workshop 'Integrated Waste Management and Utilisation of the Products': A draft text of the 'summary and conclusions' publication has been produced. This was reviewed by the editorial committee and is undergoing modification. The work is in progress.

ExCo57 workshop 'Planning for the New Triennium'): The summary record for internal use has been completed. It is available on the IEA Bioenergy website in the Members Area under ExCo57. It is not a public document.

ExCo58 workshop 'Availability of Biomass Resources, Certification/Sustainability Criteria and Land-use and Bioenergy in the Kyoto and post-Kyoto Framework': The 'summary and conclusions' publication has been produced – IEA Bioenergy ExCo:2008:02 – and hard copies are available on request.

ExCo59 workshop 'The Biorefinery Concept': The 'summary and conclusions' publication has been produced by BCS Incorporation, under contract to USDOE. Electronic copies are available at www.ieabioenergy.com/DocSet.aspx?id=5476.

ExCo60 workshop 'Innovation in the Field of Bioenergy Business Development': A committee of ExCo Members with Bjorn Telenius as Convenor has been formed to produce the 'summary and conclusions' publication. The work is in progress.

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 MoU. Current initiatives between the Tasks and FAO include:

- Task 31 has a major collaborative effort with the Forest Energy Programme of FAO to produce a publication 'Certification of forest fuel production systems: a solution for sustainable use of biomass from forest residues for energy'. This is being developed by exploring existing forest management certification programmes and the environmental, economic, social and cultural impacts, and legal and institutional framework of woodfuel production in developing and developed countries. The project will also culminate with an international workshop.
- Task 39 has worked with the FAO on two projects designed to explore the potential of forest biomass as a feedstock for liquid biofuel production. The first of these was a paper written for the FAO's Committee on Forestry for a meeting in March 2007. It focused on opportunities for developing countries. The second was a report written for a Special Event on Forests and Energy, held in November 2007. It focused on forests and energy in OECD countries. These projects have helped the Task communicate to the rest of the world, the potential impacts of liquid biofuel development on the forest resources of Task 39 participants. Each project resulted in presentations at international meetings arranged by the FAO/OECD in addition to the written outputs.
- Task 40 has been working closely with FAO. In May, Ingmar Juergens gave a key presentation at the workshop on biomass sustainability criteria and their impact on international bioenergy trade. FAO collaborators are among the key authors of the Task deliverable on sustainability criteria and certification systems. Also, the German and Dutch NTLs have been heavily involved in the FAO-BEFS project (biomass and food security) and BIAS project (targeting environmental impacts of biomass production). For BEFS, an analytical framework was developed to calculate the effect of policy decisions on the food security of a country. In 2008 and 2009, this framework will be field-tested in three countries – Peru, Thailand and Tanzania, and the results will provide key case studies.

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.

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 2006 Annual Report with the special colour section on 'Biomass Pyrolysis' was very well received. This coloured section was also produced as an independent booklet. Only a few copies of the Annual Report from the original print run of 700 remain with substantially increased distribution in electronic format. This is available from the IEA Bioenergy website.

The newsletter IEA Bioenergy News remains popular. Two issues were published in 2007. The first issue featured bioenergy in USA and the second issue featured bioenergy in Germany 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. The contacts for the Newsletter Editor are provided on the back cover of this Annual Report. The newsletter is produced in electronic format so potential subscribers should ensure that the Editor has their email address. IEA Bioenergy News is also available from the IEA Bioenergy website.

Ten contributions under the banner of 'IEA Bioenergy Update' were provided to the journal Biomass and Bioenergy in 2007. These covered news from the Executive Committee, events, and Tasks Technology Reports. This initiative provides excellent access to bioenergy researchers as the journal finds a place in major libraries worldwide.

Interaction with IEA Headquarters

There is regular contact between the IEA Bioenergy Secretariat, and IEA Headquarters in Paris and active participation by ExCo representatives in relevant meetings. During 2007 the Chairman, Technical Coordinator, Secretary, and key Members of the Executive Committee have worked closely with the IEA Headquarters in Paris at both administrative and technical levels. The appointment of Adam Brown as Technical Coordinator has greatly improved the capacity for liaison and collaboration with Headquarters. Nobuyuki Hara,

Desk Officer, Renewable Energy Unit, attended ExCo59 in USA. 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.

Chairman, Kyriakos Maniatis, attended the REWP 52 meeting in Berlin in October to present the work and progress of IEA Bioenergy. This was a new mechanism for the REWP and IEA Bioenergy was the first Implementing Agreement to be invited. He used the opportunity to raise some important issues. Overall, the REWP was very satisfied with IEA Bioenergy and with the changes the ExCo has made in recent years, especially those related to policy-orientated outputs and quality publications. Items discussed included the issue of 'affiliate membership' for new Member Countries; the need for a communication plan; the importance of sustainability issues; publication of ETE Briefs; and possibilities for project collaboration.

Status Reports were prepared by the Secretary and forwarded to Headquarters and the REWP following ExCo59 and ExCo60. A questionnaire from Peter Finckh, Vice Chairman of the End Use Working Party (EUWP) for the Transport sector was completed to assist the report he prepares for the autumn meeting of the EUWP. This report forms part of the exchange of information between Implementing Agreements and the Working Party.

ExCo Members and the Tasks provided comments and input to various IEA Headquarter's publications including the report 'Renewable Energy Heating and Cooling - untapped Potential'.

A comprehensive slide presentation on IEA Bioenergy was developed by the Technical Coordinator and Secretary for use at high-level meetings and workshops including the Networks of Expertise in Energy Technologies (NEET) workshops in China and Brazil.

The ExCo were supportive of the opportunity to publish material in the new four page technical fact sheet series Energy Technology Essentials (ETE's) in conjunction with Headquarters, especially as these will be used at IEA Ministerial meetings and other policy-type meetings, including G8 gatherings and NEET initiative workshops. At the direction of the ExCo 10 draft ETE's were prepared by the Tasks. These will be reviewed and edited under the guidance of the Technical Coordinator and then passed to Headquarters for publication.

IEA Bioenergy Website

A new version of the IEA Bioenergy website was launched in 2006. It provides improved functionality and flexibility and some useful new features such as improved maintainability, adaptability for the future, and statistical reporting functionality. There are over 11,000

visitors to the website each month. 80% of the visitors come directly to the site which suggests that most visitors know of the site and are using it. On average there are 370 sessions per day. The most popular areas of the website are the Library and the Media Centre. The 'contact us' feature generates about 12 enquiries per month. These are often quite technical and the Task Leaders have been very helpful in providing replies. The most popular items downloaded are the publications titled: Potential Contribution of Bioenergy to the World's Future Energy Demand; Black Liquor Gasification: Summary and Conclusions from the ExCo54 Workshop; Benefits of Bioenergy; Sustainable Production of Wood Biomass for Energy; and Thermal Gasification of Biomass.



The ExCo60 meeting in Munich, Germany.

2. PROGRESS IN 2007 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, Energy Institute Hrvoje Pozar, Croatia.

Operating Agent: Mr Gary Shanahan, Department of Business, Enterprise and Regulatory Reform (BERR), United Kingdom. (From January 2008, Mr Trevor Raggatt will take over as the Operating Agent)

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.iea-bioenergy-Task29.hr, 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

An International Workshop titled 'Biomass Supply Issues and Solutions' was organised on 14-16 May in Bregenz, Austria, together with Land Vorarlberg and Energieinstitut Vorarlberg. The meeting was attended by all participating countries. In addition, participants from Italy, Germany and Romania were also in attendance. A list of the presentations given is shown in Appendix 4. The Task participants agreed that this was the most successful and useful of the workshops held since it involved local activists and operators supplemented by the team presenting new findings and conclusions. As a result, new ideas were generated for future Task work. In addition, it was seen as a positive step to get new countries engaged in the activity.

The Task participated in the 15th European Biomass Conference on 7-11 May in Berlin, Germany. A paper 'First Results of IEA Bioenergy Task 29 (2006-2008): Socio-economic Drivers in Implementing Bioenergy Projects' was an invited presentation. Task members Bill White and Biljana Kulisic also presented a paper titled 'Assessing Drivers for Bioenergy: An Economist's View'. This explored the social and economic drivers that influence bioenergy use.

Task 29, together with Tasks 38 and 40 organised an International Expert Consultation on Sustainable Biomass on 25-26 October in Dubrovnik, Croatia. The event was organised so that the maximum time was provided for interactive technical discussions in 2-3 working groups of 5-10 participants each. This was preceded by a few short and targeted presentations to 'set-the-scene' and to stimulate discussion. Working groups were used for discussions on specific topics and to draft a text summarising the outcomes and conclusions from the meeting. The workshop aimed to assess the state of knowledge and to discuss the following:

- In what terms can sustainability be defined? What tools are there to ensure sustainable biomass: certification, etc.?
- GHG sustainability (carbon stock changes, efficient land use, transport emissions with biomass trade, emissions from fertilisers, all LCA aspects).
- Environmental sustainability (biodiversity, water, nutrients, leaching, desertification).
- Socio-economic sustainability (local jobs, out-competing local uses of biomass in case of exports, child labour, etc.).

Work Programme

The Task work programme in 2007 included completion 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. Five case studies are now completed. They are presented in a common format and are available on the Task website.

Details of these are:

- The Living Rainforest, Berkshire, UK;
- Total management approach to forest biomass utilisation by local government in Yamaguchi prefecture, Japan;
- Slough Heat and Power, Berkshire, UK;
- The bioenergy district heating plant at the Oslo airport, Norway; and
- The Energy Farm, Norway.

Four further case studies are currently in preparation as follows:

- Curridge School boiler plant and ESCO, UK;
- Private Estate boiler plant in Oxfordshire as a key part of a hybrid sustainable energy solution, UK;
- Bioenergy use at Sundre Forest Products, Canada; and
- Socio-economics of sustainable charcoal industry, Croatia.

Another important activity was the preparation of a special issue of the Elsevier Energy Policy Journal 'Modelling Socio-economic Aspects of Bioenergy Use'. This is the outcome of a Task initiative aimed at identifying and fostering the state-of-the-art and body of scientific literature on the socio-economic modelling of aspects of bioenergy production and use. This special issue contains a collection of 12 papers that focus on different methodologies, case studies and policy aspects of socio-economics covering a wide range of countries – Austria, Croatia, France, Greece, Norway, Slovenia, Sweden, UK, and the USA. The collection comprises model-based quantitative empirical studies, mainly using (spatial) partial equilibrium, cost minimisation, systems analysis, input-output, and Keynesian multiplier models, but also less formalised interdisciplinary empirical work, (participatory) multi-criteria evaluation and/or decision-aiding studies, and conceptual studies. It was published in December 2007 - Volume 35(12), Pp 5965-6558.

Canadian and Croatian researchers are collaborating to write a paper that investigates the social and economic drivers that influence bioenergy use. The article will investigate this from an economics point of view whilst analysing the behaviour of all agents in the economy whose actions can affect the uptake of bioenergy use. These groups include households, firms, and governmental organisations and their actions will be examined with respect to both the supply of, and the demand for, bioenergy. Building on this paper the researchers are also developing a survey of Member Countries to learn what drivers are most important to households, firms, and governments when deciding to use, produce or support bioenergy. A presentation on the proposed survey was given at the International Expert Consultation noted above to provide details to Member Countries on survey design, cost and expected outputs.

Other activities consisted of planning and organising the Task workshops and events, the publication of workshop proceedings and preparation of future meetings and activities.

Collaboration with Other Tasks/Networking

The Task has actively collaborated with Tasks 38 and 40. In addition a contribution to the Task 32 publication 'Handbook of Pellet Production and Utilisation' is planned for 2008.

Website

The Task website (www.iea-bioenergy-task29.hr) 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 all Task proceedings, completed case studies, additional reports and papers) has been made available for downloading.

Deliverables

Deliverables in 2007 included the special issue of the Elsevier Energy Policy Journal, workshop proceedings, case studies, 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 progress with the biomass and bioenergy educational website.

TASK 30: Short Rotation Crops for Bioenergy Systems

Overview of the Task

Work in the current triennium will be 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 can be optimised economically and environmentally. New science, tools, and technology must be developed without delay 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 Task is confined to short rotation crops 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, The Netherlands, New Zealand, Sweden, United Kingdom, and the USA.

Task Leader: Dr Göran Berndes, Chalmers University of Technology, Sweden.

Associate Task Leaders: Mr Ian Nicholas, Scion, New Zealand and Mr Bryce Stokes, USDA, USA

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

Operating Agent: Dr Bjorn Telenius, Swedish Energy Agency, Sweden.

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

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 participants met on 12-17 August in Guelph, Canada. The first Task business meeting was held on 14 August, preceded by a workshop, and followed by field tours to investigate (primarily) willows and poplar trials. A second Task business meeting was held on 17 August.

The Task was represented by the Canadian and UK National Team Leaders at the 'Sustainable Biomass' expert consultation organised by Tasks 29, 38, and 40 on 25-26 October in Dubrovnik, Croatia. The Task was also represented at the Bioenergy Australia 2007 Conference, held on 26-27 November in Queensland, with a presentation by the Australian National Team Leader.

Work Programme

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

- How can we 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 to reduce costs and offer flexibility to be more responsive to local conditions, markets, and regulations.
- SRC for energy production in relation to ecosystem services; development of multipurpose systems to address different markets.
- Linking producers and markets; cost efficient implementation paths to stimulate near term growth of SRC biomass on the market and promote long term growth of bioenergy through end use technology options and best practice case studies.
- Efficient use of biomass in relation to addressing central policy objectives of climate change mitigation, competition for land and improvements in energy security.
- Energy, agriculture and environmental policies for SRC implementation (policies, incentives, commercial arrangements).

Finally, 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 was updated regularly during 2007. 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 produced including the latest Task newsletters.

Collaboration with Other Tasks/Networking

A project proposal – ThermalNet 2 – was developed and submitted within the EU IEEA 2007 Programme. Through ThermalNet 2, Task 30 links with the biomass conversion Tasks 32, 33, and 34. The project intends to further develop the established ThermalNet network on combustion, gasification, and pyrolysis of biomass by reviewing and prioritising the technology opportunities and closely relating them to biomass feedstock resources, technology and product market opportunities, and policy requirements for more rapid and successful implementation into the European market.

Task 30 has exchanged information with the International Union of Forest Research Organisations, International Poplar Commission, and International Solar Energy Society.

Deliverables

The 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.

TASK 31: Biomass Production for Energy from Sustainable Forestry

Overview of the Task

The objective of the Task is to share, analyse, synthesize, 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 involving 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, the United Kingdom, and USA.

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

Operating Agent: Dr J. Peter Hall, Canadian Forest Service, Canada. (From January 2008, Mr Ed Hogan will take over as the Operating Agent)

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 7-9 March in Umeå, Sweden. The purpose of this meeting was to discuss plans for the new triennium. Considerable progress was made in relation to past and future Task workshops, country reports, case studies from participating countries, collaborative activities with other organisations, and technology transfer and communications.

A Task business meeting was held on 31 August in Joensuu, Finland during the annual Task workshop. About 50 participants from eight countries took part in the workshop held from 29 August to 3 September. The workshop was organised by the Finnish Forest Research Institute (Metla), and also benefited from sponsorship by the Wood Energy Network (Wenet) and Northern Woodheat. The theme of 'Sustainable forestry systems for bioenergy: integration, innovation and information' was addressed over one and a half days of scientific and technical sessions, a half-day 'Meet the Industry' event and two full days of field visits. In total, 24 presentations were given. A CD has been produced and distributed, containing all the presentations given at the conference. Formal publication of some of the technical papers is also planned in an international peer-reviewed journal.

Work Programme

The Task work programme includes annual international workshops and study tours; case studies and success stories; policy-oriented papers dealing with key issues; 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 knowledge and 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 certification of sustainable forest fuel production systems as a tool to satisfy concerns about the possible environmental, economic, and social effects of greatly increased use of biomass from conventional forestry systems for energy. In collaboration with 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 exploring existing forest management certification programmes and the environmental, economic, social and cultural impacts, and legal and institutional framework of woodfuel production in developing and developed countries. Two key chapters of this publication are presently under review.

Case studies analysing specific local situations are being prepared by participants to provide illustrations of the general principles involved in sustainable forest biomass production for energy. Study topics include social-economic-environmental issues relating to forest biomass production for energy in North Scotland, and development and implementation of forest biomass production sustainability regulations in Sweden.

A synthesis report was drafted on the topic of 'Sustainable forest fuel production' covering aspects of processes, woodfuel procurement and status, costs, and potential and barriers. This succinct overview is aimed at high-level policy makers and is intended for publication in the Energy Technology Essentials series published by IEA Headquarters.

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 highlighted.

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 contains 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 related past Tasks and activities. Basic Task information is also provided on the IEA Bioenergy website, where informational materials, such as workshop announcements, are available.

Industry involvement is important to the Task and particular efforts are made to involve industry participants in workshops and conferences. The workshop in Finland included a half-day 'Meet the Industry' event focusing on 'Bioenergy technology in Finland: local solutions for global problems'. A number of Finnish forest machine and boiler manufacturers as well as other forest energy-related businesses participated in this event.

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 was well represented and made several contributions at an 'Expert Consultation on Sustainable Biomass' organised jointly by Tasks 29, 38 and 40. A joint workshop with the latter two Tasks is planned for September 2008 in the UK. A close level of collaboration also exists with Task 30 – the proceedings of a joint workshop with that Task

in Western Australia in 2005 were published during the year, and the Task Leader and an Associate Leader participated in the Task 30 workshop in Guelph, Ontario in August.

Opportunities for collaboration with international researchers, organisations and activities, particularly those involved in issues of sustainability of forest ecosystems, are also pursued. The major collaborative effort with the Forest Energy Programme of FAO on certification of forest fuel production systems was noted above. This project will culminate in a joint, multi-author publication and an international workshop. Opportunities for collaboration with other international researchers, organisations and activities, particularly those involved in issues of sustainability of forest ecosystems, are also pursued.

Deliverables

The proceedings of the workshop held with Task 30 in Western Australia in August 2005 has been published as a special issue of Biomass and Bioenergy. It included nine invited and volunteer papers.

The proceedings of the workshop held with Tasks 29 and 39 in Vancouver, Canada in August 2006 has been submitted for publication as a special issue of Biomass and Bioenergy.

The proceedings of the Task workshop held in Joensuu, Finland in August-September 2007 have been made available to workshop participants on CD. Manuscripts based on the workshop presentations are under peer review for a special issue of Biomass and Bioenergy.

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

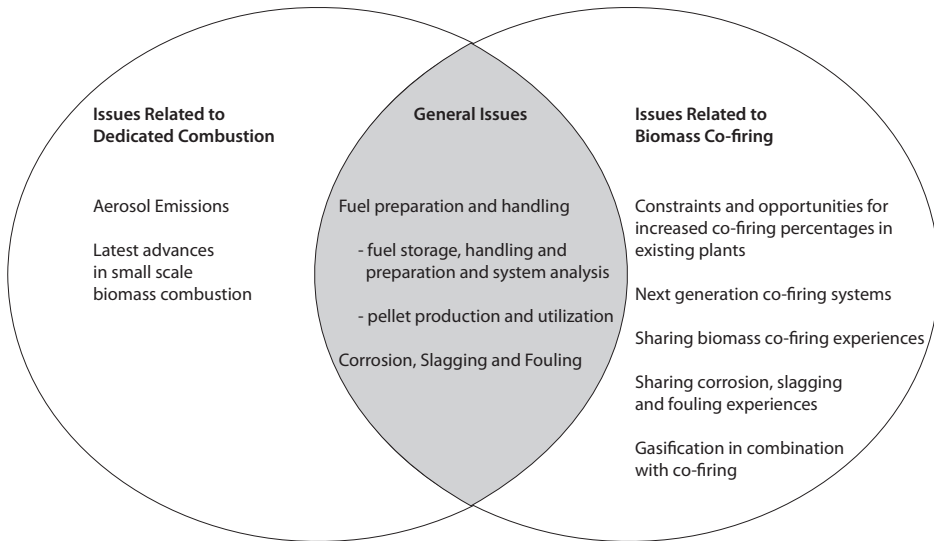
TASK 32: Biomass Combustion and Co-firing

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 work programme for the current triennium was initially derived from the priorities set by the previous Task participants and was then updated after consultation with the ExCo. 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 will receive specific attention in this triennium are shown in the figure below.



The work programme is similar to that of the previous triennium but with more emphasis on co-firing of biomass in coal-fired power plants. 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, acceptance by the public and financial incentives. An overview of relevant policies is included in the new version of the Handbook of Biomass Combustion and Co-firing, which is now available. In addition, the Task will produce a position paper illustrating the potential importance of the technology and barriers that need to be overcome to harness this potential.

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 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 operating 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 (CO₂, CH₄, 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, the Netherlands, Norway, Sweden, Switzerland, United Kingdom, and the European Commission.

Task Leader: Mr Sjaak van Loo, Procede BV, the Netherlands.

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

Operating Agent: Ir. Kees Kwant, SenterNovem, the Netherlands.

Alternate Operating Agent: Dr Arjan Wierda, Ministry of Economic Affairs, 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.ieabcc.nl and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Task Meetings and Workshops

In 2007 the Task organised two internal meetings as well as two workshops; the first in Berlin, Germany and the second in Jyväskylä, Finland. The internal meetings were used to monitor progress in different Task activities, reflect on Task initiated workshops, plan future activities and share recent developments on application of biomass combustion in Member Countries. A topic of continuing importance was finalisation of the second edition of the Handbook of Biomass Combustion and Co-firing. This was published in December 2007.

The first Task meeting was held in May, at the 15th European Biomass Conference in Berlin. As part of the meeting, a field trip was organised to two recently built CHP plants fired with wood chips and waste wood. The meeting was mainly used to discuss details of the work programme and to exchange country reports. The second Task meeting took place in September in Jyväskylä, Finland. A significant part of this meeting was used to discuss the draft results of an inventory study done by Switzerland on 'aerosols from biomass combustion' and to discuss progress in different Member Countries.

Workshops are a proven concept to gather and disseminate information in a structured and effective manner. Selected 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.

Two workshops were organised in 2007. The first was on 'Fuel storage, handling and preparation and system analysis of biomass combustion systems', held as part of the European Biomass Conference in Berlin. The second was an expert workshop on 'Aerosols from biomass combustion', held at the BIOENERGY2007 conference in Jyväskylä, Finland.

Future workshops in the current triennium will be:

- Next generation, small-scale biomass combustion systems (2008);
- Increasing co-firing percentages in existing power plants (2008);
- Next generation co-firing systems (2009).

The reports of Task meetings and workshops can be downloaded from the Task 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 will be prepared on pellet production, handling, transportation, and utilisation. This action is a joint activity with various IEA Bioenergy Tasks, with Tasks 29 and 40 providing key inputs on biomass trade as well as socio-economic aspects. In 2007 the contents of the handbook and contributions from other Tasks were agreed.

General Issue: Corrosion, Slagging and Fouling

- A workshop will be held in 2008 to share both theoretical insights and practical experiences with corrosion, slagging and fouling when burning single biomass streams or mixes of different fuels in different types of combustion systems.
- Based on the information obtained from this workshop and other information collected, a technology report will be written on the occurrence and prevention of corrosion, slagging and fouling under different circumstances.

General Issue: Handbook on Biomass Combustion and Co-firing

- The Task continued the preparation of a second edition of the Handbook of Biomass Combustion and Co-firing in 2007. This was published by Earthscan in December 2007.
- The Task also signed a license agreement with the Chinese Academy of Agricultural Engineering (part of the Ministry of Agriculture) for the preparation of a Chinese edition of the Handbook. A draft version was reviewed by the Task, and publication is now expected in early 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 are:

- An inventory on aerosols from biomass combustion was undertaken in 2007, coordinated by Switzerland. National data were evaluated concerning 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. The report is now available.

- In September, a workshop was held specifically on aerosols from biomass combustion to summarise recent R&D work done on the formation and health impact of aerosols from different types of biomass combustion devices and biomass fuels, as well as the cost effectiveness of both primary measures and secondary measures for emission reduction, such as electrostatic precipitators (ESP's). This served as a follow-up to the workshops organised earlier by the Task in Zürich (June 2001) and Graz (March 2005).

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

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. This is true for both domestic woodstoves, and pellet and wood chip fired boilers. A workshop will be organised in 2008, together with the Netherlands Association of Stove Producers to share information on the above issues.

Biomass Co-firing: Introduction

Over the past decade co-firing of biomass has become a well established way of bioenergy generation, making optimal use of existing assets, mainly replacing coal. The main questions for the coming decade are twofold:

- How can the biomass share be increased in power plants that were initially not designed to use biomass/fossil fuel packages?
- How can new power plants be designed and optimised in advance to use biomass in the best way possible?

In this triennium, additional support has been offered by the Dutch Research Programme on Co-firing. KEMA coordinates the co-firing issues within the Task.

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 will be organised in 2008 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. A position paper on technology developments in relation to next generation co-firing will be made 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.

Biomass Co-firing: Database and Expert Tool on Biomass Co-firing Experiences

The existing database on the Task website on biomass co-firing experiences will be upgraded in 2008-2009. It is planned to extend this database with a quick scan expert tool on co-firing. The expert tool will provide advice on the possibility of co-firing a certain biomass in a certain application, generating a YES, a NO, or a DOUBTFUL answer.

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. Existing models and tools will be evaluated for the use in co-firing applications. The results of this work will be reported in 2008.

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

Depending on mutual possibilities, a joint workshop is anticipated with Task 33 on opportunities for biomass gasification as a pre-treatment route for co-firing.

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.

The Task 32 programme is closely related to other IEA Bioenergy Task activities, especially Task 33: Thermal Gasification of Biomass and Task 36: Integrating Energy Recovery into Solid Waste Management Systems. Effective coordination is achieved through joint events, and the exchange of meeting minutes and reports.

Deliverables

The following milestones were achieved in 2007. Organising and minuting of two Task meetings. Organising and reporting of two workshops 'Fuel storage, handling and preparation and system analysis'; and 'Aerosols from Biomass Combustion'; reporting to the ExCo including a Technical Report on Ash-related Issues in Biomass Combustion; updating of the international overview of initiatives for biomass co-firing (by the Netherlands); maintenance of the Task website; and publication of the second edition of the Handbook on Biomass Combustion and Co-firing.

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, the Netherlands, New Zealand, Sweden, Switzerland, USA, and the European Commission.

Task Leader: Dr Suresh P. Babu, Consultant, Gas Technology Institute, USA

Operating Agent: Mr Paul Grabowski, 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.gastechnology.org and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work: Tasks'.

Progress in R&D

Task Meetings and Workshops

The first Task meeting for the triennium was held from 19-21 March in Brussels, Belgium. A workshop 'WS1 – Prospects for Biomass Gasification in Future Energy Needs' was held during the first two days of the Task Meeting. The third day was allotted for plant visits to Xylowatt in Charleroi, Belgium.

The second Task meeting was held from 24-26 October in Bergen and Petten, the Netherlands. This included a one day workshop, 'WS2 – Procedures/Guidelines for Biomass Gasification Synthesis Gas Characterisation.' The third day was devoted to visiting ECN laboratories and pilot plants in Petten, the Netherlands.

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 at Task meetings have been very effective. These remain as 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 a 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 process components to advance state-of-the-art of 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
1st Task meeting	WS1 'Prospects for Biomass Gasification in Future Energy Needs'	19-21 March 2007 Brussels, Belgium
2nd Task meeting	WS2 'Procedures/Guidelines for Biomass Gasification Synthesis Gas Characterisation'	24-26 October 2007 Bergen/Petten, The Netherlands
3rd Task meeting	WS3 'Health, Safety, and Environmental Impact of Small-scale Biomass Gasification Systems' (in co-operation with European GasNet/ThermalNet)	21-23 April 2008 Vienna, Austria (Tentative)
**The scope and objectives of the remaining workshops will be developed in future semi-annual Task meetings		

- 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.

Observations from WSI 'Prospects for Biomass Gasification in Future Energy Needs: Situation Analysis of Biomass Gasification and Hurdles to Technology Commercialisation'

Almost all types of biomass with less than 50% moisture can be gasified with air, enriched air, or oxygen to produce a fairly uniform quality fuel or synthesis gas that could readily substitute for fossil fuels and fossil fuel-derived products. Although BMG has a long history, the present commercial uses in Europe are limited to CHP and in Europe and North America for co-firing applications. These plants employ both large (about 15 MWth) and small-scale (about 250 KWe or about 1 MWth) BMG plants. A large number of intermittently operated BMG plants are deployed in India, China, and other Asian and Southeast Asian countries for a wide variety of thermal applications, albeit at small-scale (below about 250 kWth), and a limited number for power generation. BMG can play an important role in mitigating greenhouse gas emissions while producing high efficiency power in combined cycles (40+%) and even higher efficiencies when integrated with gas turbines and high-temperature fuel cells (50+%). BMG can produce a tailored synthesis gas for manufacturing fertilisers, chemicals, and fuels. In countries such as the Netherlands and Switzerland, the current interest in exploiting BMG for energy security and climate control also includes producing synthetic or substitute natural gas. At present, BMG and the subsequent commercial utility of the product gas for high-efficiency power or value-added fuels and chemical plants are expensive to build and operate, and they require significant policy driven incentives for market entry.

While measures to legislate appropriate policies and incentives are being deliberated, it is generally agreed that BMG can play an important role in implementing the recent decisions to enforce mandatory GHG reduction targets in Europe and some parts of North America. Furthermore, the essential involvement of rural communities in all aspects of a BMG industry, from feedstock supply to ash recycling, would stimulate local economies while setting-up the essential foundations for a sustainable future for biomass-based renewable energy. Against this backdrop, in March, about 15 participants in Task 33, and 30 members of the European ThermalNet/GasNet conducted back-to-back technical workshops on 'Situation Analysis and Success and Visions for BMG'. A combined summary of the proceedings from the two workshops was submitted as a draft ETE Brief to the ExCo and is available on the Task website.

Observations from the Workshop WS2 'Procedures/Guidelines for Biomass Gasification Synthesis Gas Characterisation'

This workshop was developed to recognise the importance of reliable and precise characterisation of BMG synthesis gas. The proceedings of this workshop are vital to the successful performance of large-scale biorefineries of the future. The workshop included expert presentations from industry, academia, and selected Task participants. The workshop presentations are available on the Task website.

Haldor Topsoe, of Denmark presented an overview of commercial synthesis gas conversion processes to produce fuels and chemicals. The presentation has also identified the raw gas contaminants that poison the catalysts employed in these synthesis processes.

At present, industrial scale synthesis gas is produced primarily from natural gas or coal in different types of reformers or gasifiers. The type of fuel and reformer and operating conditions will influence the raw synthesis gas composition, especially the H₂:CO ratio.

A summary of the gas composition from selected reformers and gasifiers is given in the following table:

Major Components of Synthesis Gas from Selected Gasifiers and Reformers

Gas Components	Steam Reforming	Auto Thermal Reforming	Dry Coal Gasification	Coal Slurry Gasification	Biomass Gasification
H ₂	75%	66%	27%	36%	15-35%
CO	15%	27%	68%	47%	20-45%
CO ₂	8%	7%	3%	17%	12-25%
CH ₄	2%	-	-	- *)	0.4-16%

*) E-Gas claims that they can produce high CH₄ (~7%)

At present, the most widely employed synthesis gas conversion processes are for the production of ammonia, hydrogen, and methanol. Haldor Topsoe supplies the following synthesis gas conversion technologies: Ammonia; Hydrogen; Methanol; Formaldehyde; DME; SNG; TIGAS

In these processes, catalysts normally have useful lives of 2-5 years. The key technical challenge for development of synthesis gas conversion processes is prevention of catalyst deactivation by contaminants such as sulphur, halogen, nitrogen, and tar compounds. While almost all of the contaminants are removed in most gas cleaning processes, their presence even in ppm or ppb concentrations are poisonous to many catalysts. Besides these poisons, improper temperature distribution, hot spots, heat-up rates, and pre-treatment /regeneration in the synthesis gas reactor can significantly reduce the lifetime of a catalyst.

The methods of deactivation by catalyst poisons are summarised as follows:

- Sulphur compounds deactivate 'active centres' on catalyst surfaces

- Halogens corrode catalysts
- Nitrogen compounds promote amine formation (e.g., in methanol synthesis) and adds undesirable odour to the product
- Tars coat, cover, and deactivate catalyst surfaces by gum formation

The remainder of the workshop presentations, from NREL, ITC-CPV FZK, TUV, VTT, GTI, ECN, PSI, and KTH focused on the different analytical methods employed to characterise synthesis gas. Since the contaminants that are produced and carried through a BMG and the follow-on gas cleaning process may not be totally removed, emphasis was given to identifying or developing on-line analytical techniques to measure and monitor them at very low concentration levels. Furthermore, to advance the state-of-the-art of the overall technology, it is desirable to develop analytical capabilities for automated sampling in potentially hazardous process areas at elevated temperatures and pressures. For full details on the existing special analytical capabilities for characterising synthesis gas that were presented at the workshop please visit the Task website (<http://www.gastechnology.org/webroot/app/xn/xd.aspx?it=enweb&xd=iea/publications.xml>)

Discussion of Next Steps from WS2: The workshop confirmed that the analytical techniques to measure major gas components, H₂, CO, CO₂, N₂, O₂, CH₄ and other hydrocarbons are well established. However, with current plans to explore the use of biomass derived synthesis gas to produce fuels and chemicals, it is essential to measure with precision the quantity of sulphur, halogen, alkali, and nitrogen compounds contained in gaseous streams. Based on the proceedings from this workshop, the next logical step could be to assemble a team of organisations to participate in a Round Robin test programme to evaluate selected analytical methods for measuring the contaminant compounds. The Round Robin test results should show the reliability of reproducing results and also the need for standard analytical guidelines.

Collaboration with Other Tasks/Networking

Task 33 continues to collaborate whenever possible with selected IEA Bioenergy Tasks, plus the IEA Hydrogen IA Annex 16: Hydrogen from Carbon Containing Materials, and European GasNet. The workshop, WS3, is being organised as a joint effort in cooperation with European GasNet/ThermalNet activity.

Deliverables

The Task deliverables include 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 Country Reports; a report on biomass gasification activities in all the participating countries of the Task; 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, and annual reports as required by the ExCo.

TASK 34: Pyrolysis of Biomass

Overview of the Task

Task 34 started in January 2004 and will finish in December 2008. By agreement between the EC and IEA Bioenergy, it is integrated with the EC Pyrolysis Network, which is part of the ThermalNet project that started in January 2005 and will now finish at the end of June 2008 after being granted a 6 month extension. The Task has been granted an extension of one year to the end of 2008. An application to continue ThermalNet has been made to the European Commission, which if successful should enable ThermalNet and PyNe to continue without interruption. The technical focus of PyNe is through a set of Tasks that are firmly integrated with the other two complementary networks on biomass gasification (GasNet) and combustion (CombNet).

The main activities of Task 34 will continue to focus on resolution of technical issues to aid commercial implementation of fast pyrolysis, information exchange and dissemination by:

- dedicated and focused regular meetings centred on technologies and tasks that will advance the state-of-the-art through critical reviews and commissioning of specialist material,
- collation and dissemination of relevant information through the regular PyNe newsletter, the PyNe website, and direct contact between Task participants and invited guests through the planned programme of meetings, workshops, and conferences,
- a focus on biorefineries to reflect the rapidly growing interest in this area in both Europe and the USA, and
- organising a Round Robin on lignin pyrolysis and processing involving 14 laboratories in Europe and the USA.

Participating countries: Germany, Norway, USA and the European Commission

Task Leader: Professor Tony Bridgwater, Aston University, United Kingdom.

Operating Agent: Dr Kyriakos Maniatis, European Commission, Belgium.

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'.

Task Meetings and Workshops

Two meetings were held in 2007: in Salzburg, Austria in March and Vicenza, Italy in October. The presentations have been published on the PyNe/ThermalNet websites for all participants.

The next and final meeting will be held in April 2008 in Vienna, Austria in association with the Task 33 Gasification seminar.

Work Programme

The work programme for the ThermalNet project has been published and reported previously. The special PyNe activity on biorefineries provides a focus for PyNe activities and members and has a session at each PyNe meeting. This is led by the USA. Definitions, specifications, and RD&D requirements for biorefineries have been published in the PyNe newsletter as a result of the workshop held in Glasgow. Of particular interest is a Round Robin on lignin pyrolysis in which 14 laboratories around the world are participating. This is proving a most successful way of developing science and technology and improving cooperation between members.

Newsletter

The PyNe newsletter continues to be an important vehicle for dissemination and is circulated to Member Countries for distribution. The last issue was published in September 2007 and the next issue will be published in March 2008. The PyNe newsletters are now integrated into a combined ThermalNet newsletter that includes GasNet and CombNet to minimise duplication of circulation lists and also to reach a wider audience. These have a circulation of around 5000.

Website/Dissemination

The PyNe website is an important mechanism for information and technology transfer. There is an ongoing programme of maintenance, revision, and updating.

Deliverables

Progress Reports to the Executive Committee were produced in May for ExCo59 in Golden, USA, and in October for ExCo60 in Munich, Germany. The presentations from the Task meetings held during 2007 – Salzburg in March and Vicenza in October have been published on the ThermalNet and PyNe websites. A draft ETE Brief on 'pyrolysis' was produced for ExCo60.

The proceedings from the Bio€ Workshop in Salzburg have been published as a CD which contains all the presentations, the papers and posters and workshop reports.

Two further issues of the PyNe newsletter within the ThermalNet newsletter have been published in July and September. Electronic copies are available on both the PyNe and ThermalNet websites.

Presentations and representations have been made in South Africa where there is growing interest in pyrolysis.

TASK 36: Integrating Energy Recovery into 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 worldwide 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, the Netherlands, Norway, Sweden, United Kingdom and the European Commission.

Task Leader: Dr Niranjan Patel, Partnerships UK (PUK), United Kingdom.

Operating Agent: Mr Gary Shanahan, Department of Business, Enterprise and Regulatory Reform (BERR), United Kingdom. (From January 2008, Mr Trevor Raggatt will take over as the 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 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'.

Progress in R&D

Task Meetings and Workshops

The Task held two meetings in 2007. The first took place on 30-31 May in Arnoldstein, Austria. There was a site visit to the TBA Arnoldstein Waste to Energy Plant in Austria. At the meeting there were invited speakers from Martin GmbH. The second meeting took place on 12-14 November in Lille/Calais, France. There were site visits to Lille Métropole Communauté Urbaine and SEVADEC, Syndicat d'Élimination et de Valorisation des déchets du Calais. This was a joint meeting with Task 37: Energy from Biogas and Landfill Gas.

Work Programme

The goal of the Task in the current 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
- Economics of waste and resource management systems – Chapter 5

Progress on each chapter in 2007 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.

Discussions at the Task meeting in Austria focussed on which statistics should be included in the report, i.e., household waste, municipal solid waste, and whether commercial and industrial waste should be included. It was agreed that this chapter should include as much data as possible. A template with data for the UK has been drafted and will be distributed to participants to complete for their own countries.

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, e.g., by understanding the cost-benefit impact.

A case study approach will be undertaken whereby the policies implemented by a few countries are examined to discern common approaches and best practice measures. It is also proposed to define a new generic framework that could be adopted to further optimise resource recovery from MSW.

SenterNovem are organising a workshop to create interaction between Task 36 members and policy makers. The workshop will be held on 14 April 2008 in Frankfurt, Germany and will be titled 'Opportunities for energy recovery from waste, the ideal policy framework'.

Environmental Considerations

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

- Life cycle 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.

At the meeting in Austria there was a discussion on the LCA models available and it was suggested that the WRATE model as developed by the UK Environment Agency could be the most appropriate model to use. It has been agreed that an expert on the WRATE model will lead this chapter.

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.

Sinter Energy Research from Norway will lead this chapter which will comprise of technical reports on three or four systems. The systems identified in chapter 3 will be used as a starting point for this chapter. The technologies chosen will have at least one commercial plant in operation (although plants operating in Japan will not be used as a reference for plants in Europe).

Economics of Waste and Resource Management Systems

This chapter will review the economics of waste and resource management in selected countries to discern any common themes in developing cost-effective management infrastructure. It will aim to understand:

- The market and principal economic drivers impacting on waste management.
- The potential for resource recovery systems in the prevailing market conditions.
- The reasons for any disparity in costs of systems between countries.

At the meeting in Austria Task participants agreed that this was the most difficult chapter and that it may be too complex to do a study on a country-by-country basis. It was agreed that given the amount of work involved in chapters 1-4 the Task will initially focus on chapters 1-4 and the inclusion of chapter 5 will be considered at a later date.

Collaboration with Other Tasks

There was a joint site visit and meeting with Task 37 on 12 November 2007 in Lille/ Calais France.

Deliverables

The deliverables for the Task in 2007 included: two progress reports to the ExCo; audited financial reports as required by the ExCo; minutes of the Task meetings, a draft ETE Brief 'Energy from Municipal Solid Waste' 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.

Operating Agent: Mr Bruno Guggisberg, Swiss Federal Office of Energy, Switzerland.

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'.

Task Meetings and Workshops

Two major Task meetings were held in 2007. The first meeting took place on 8-9 May in Berlin alongside the 15th European Biomass Conference. On 8 May, a very successful workshop was organised by the Task titled 'Biogas: energy throughout the whole world'. Thanks to the established collaboration with the EU project Cropgen and to the quality of the Task participants, the workshop provided an excellent overview of the production and utilisation of biogas from energy crops. There were 50 participants, even though a number of other parallel sessions were held at the same time. The presentations and abstracts can be downloaded from the Task website <http://www.iea-biogas.net/publicationspublic.htm>.

The second meeting took place on 12-13 November, in Lille, France. The first day was a joint study tour and meeting with Task 36. The participants visited the two solid waste digestion plants operated on source separated waste in Lille and Calais. In Lille the gas is upgraded and used in gas buses for public transport. The bus depot with slow filling stations is just adjacent to the digestion plant, where the gas is compressed and mixed with natural gas if necessary. In Calais the biogas is used for the production of electricity. The business meeting welcomed the new Member from Canada. The major focus of the meeting was the questions of grid injection of electricity and of biomethane, i.e., biogas upgraded to natural gas standard.

The country contributions from both meetings can be downloaded from the Task website <http://www.iea-biogas.net/publicationsreports.htm>.

Work Programme

In 2007 the work programme consisted of the following Topics:

- Business meetings.
- Website: update; maintenance; proceedings.
- Work on brochure on source separation.
- Success stories.
- Update of plant list on biogas upgrading plants.
- The Workshop on 'Biogas – energy throughout the whole world'.
- Progress Reports for ExCo59 and ExCo60.
- ETE Brief for ExCo60

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 Member Countries.

Industry forum

Preparatory work was accomplished to change the site of the industry forum into a FAQ page with plant operators as a major target group.

Success stories

Three new success stories (one from Sweden and two from Austria) and two new industry stories (both from Austria) have been published on the website.

Gas upgrading and gas vehicles

An addition to the upgrading brochure published in December 2006 is under preparation as is an upgrade of the biogas cleaning units (plant list). Both will be published early 2008 on the website.

Workshop

As part of the research exchange programme, a workshop was organised alongside the 15th European Biomass Conference in Berlin.

ETE Brief

Instead of a Technology Report, the ExCo accepted an ETE Brief to be published by IEA Headquarters. It was titled 'Energy from Anaerobic Digestion'.

Collaboration with Other Tasks

Early in the year a biofuel group was initiated under the guidance of Kyriakos Maniatis. Tasks 33, 34, 37 and 39 met for the first time in Brussels, with Task 39 leading the group. A first exchange of ideas was also organised with the AMF Implementing Agreement. It is planned to organise a common workshop during the ExCo61 in Oslo. Task 37 also organised a joint meeting and site visit with Task 36 in Lille/Calais, France.

Deliverables

The deliverables for the Task in 2007 included: the website, two progress reports, an ETE Brief, minutes of the Task meetings, the country reports, three success stories, two industry stories and the workshop abstracts and contributions.

TASK 38: Greenhouse Gas Balances of Biomass and Bioenergy Systems

Overview of the Task

The objective of Task 38 is to integrate and analyse information on greenhouse gases, bioenergy, and land use, thereby covering all components that constitute a biomass or bioenergy system. The current Task focuses on the application of methodologies to greenhouse gas mitigation projects and programmes.

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

Task Leader: Dr Bernhard Schlamadinger (until 30.10.2007), Dr Neil Bird, Joanneum Research, Austria.

Co-Task Leader: Dr Annette Cowie, New South Wales Department of Primary Industries, 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 (NSW Department of Primary Industries). 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 May the Task organised in cooperation with the German Federal Research Centre for Forestry and Forest Products and with the coordinators of the 15th European Biomass Conference the following meetings in Berlin, Germany:

- An international Task workshop on 'Policies and instruments to promote bioenergy and bio-products for GHG mitigation' as an official side event on 11 May. The programme and presentations can be found at: <http://www.ieabioenergy-task38.org/workshops/berlin07/>
- The final Task business meeting for the period 2004-2006 on 12 May, and the first Task meeting for the new triennium on 14 May.

In cooperation with Tasks 29 and 40 the Task organised an expert consultation meeting on 'Sustainable Biomass' on 25-27 October in Dubrovnik, Croatia. After a sequence of presentations for stimulation of the discussions, substantial time was allocated to interactive discussions in two working groups, one on 'global GHG sustainability', and the other on 'local environmental and socio-economic sustainability'. The goal of the meeting was to create statements on the sustainability of bioenergy and to foster links and cooperation between the Tasks. The programme, presentations, and the final statement can be found at: <http://ieabioenergy-task38.org/workshops/dubrovnik07/>.

Work Programme

In 2007 the Task worked on:

- the organisation of one Task meeting and the international workshop in Berlin, Germany, and the joint Task expert consultation on 'Sustainable Biomass' in Dubrovnik, Croatia;
- the planning and continuation of special projects such as case studies;
- the preparation of the strategic ExCo paper on 'Life Cycle Analysis of Biomass Fuels, Power, Heat, and Products as Compared to their Petroleum-Based Counterparts and Other Renewables';
- preparation of an ETE Brief for the ExCo;
- updating of the website to provide an easy-to-use guide for GHG analysis of biomass and bioenergy systems;
- development of an online calculation tool to calculate the GHG impact of different transport biofuel systems compared to fossil fuel systems.

Case studies

Work on case studies to analyse specific bioenergy and carbon sequestration projects continued. The goal is to assess and compare the GHG balances of such projects in the participating countries, and to make recommendations for optimisation of these systems.

Progress with the case studies selected in the previous triennium is as follows:

- Austria/Croatia: Dedicated energy crops for biogas production in Austria and JI assessment for such a plant in Croatia. The Austrian part – in German – is completed and the English version of this will be available in 2008. The Croatian part was not started, and funds set aside for this will be transferred to the new case studies.
- Australia: Impact on GHG balance of utilising char as a soil amendment. This will be finalised in 2008.
- Canada: GHG impacts of pellet production from woody biomass sources in BC, Canada. This is completed, see www.ieabioenergy-task38.org/projects/.
- Denmark: Alternative applications for thermal energy arising from biomass fired cogeneration plants: The case of a South African CDM project with an additional socio-economic analysis. Denmark left the Task and the case study was not completed. The funds set aside for this will be transferred to the new case studies.
- Ireland: GHG benefits of using MSW as a fuel in a thermal treatment plant in Ireland. This is completed, see www.ieabioenergy-task38.org/projects/.

- USA/Netherlands: Greenhouse gas balance of biofuels produced via gasification. This was not started, the Netherlands left the Task. The funds set aside for this will be transferred to the new case studies.

Planning for new case studies in the current triennium has commenced. Selection of the specific case studies will be undertaken at the next Task meeting in Salzburg, Austria, on 7-8 February 2008.

Strategic Paper for the ExCo

The Task produced a draft of the strategic paper on 'Life Cycle Analysis of Biomass Fuels, Power, Heat, and Products as Compared to their Petroleum-Based Counterparts and Other Renewables' for ExCo60. Given the variety of processes leading to bioenergy, and the controversial discussion of the 'net benefit', it is informative to consider results from Life Cycle Assessments (LCA) (limited to energy and GHG balances) to analyse the processes in detail. Similar analyses are available for most of the fossil competitors and also for some of the alternative renewable options. The aim of this position paper is to summarise key LCA outcomes for bioenergy, including results for the most important bioenergy chains in comparison to their fossil and renewable competitors.

Energy Technology Essential (ETE) Brief

The Task prepared a draft of an ETE Brief on the topic 'Bioenergy: the Relationship with Greenhouse Gases in Agriculture and Forestry' for ExCo60. This paper looks at land-use and CO₂ neutrality issues of different bioenergy production schemes, also in connection with CDM projects and herein developed methodologies on 'renewable biomass'

Collaboration with Other Tasks/Networking

The Task collaborates widely with other IEA Bioenergy Tasks and also external organisations. The Task organised in cooperation with Tasks 29 and 40 an expert consultation meeting on 'Sustainable Biomass' in Dubrovnik, Croatia.

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.

The 'methodological toolbox' function on the website has been substantially updated to provide an easy to use guide on how to perform greenhouse gas emission reduction assessments for biomass and bioenergy systems. This is aimed at those who have some technical expertise and provides information on Defining the System; Methodologies; Software Tools; Data and Case Study Examples. The website also provides information about international climate change policy.

The Task finished work on a simple online calculator for biomass CHP and heating systems. The development of this tool was done in cooperation with an EU project called ENFA (European Non Food Agriculture, contract no: SSPE-CT-2005-00658). This tool allows comparison of different bioenergy systems with fossil fuel systems and calculates greenhouse gas emission reductions. This is now available on the website.

Deliverables

Apart from the wide range of deliverables mentioned above, the Task also produced progress reports and the Final Report for the period 2004-2006. 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 of this Task is to provide participants with comprehensive information to assist with the development and deployment of biofuels for motor fuel use. The Task is building 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
- providing for information dissemination, outreach to stakeholders, and coordination with other related groups.

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: Dr J. Peter Hall, Natural Resources Canada, Canada. (From January 2008, Mr Ed Hogan will take over as the Operating Agent)

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 2007. On 15-16 January, a Task business meeting and planning session was held in Peterborough, UK. This meeting was used to discuss the Task work programme and assign specific projects to Task participants and consultants. A second business meeting to confirm details of the work programme was held in conjunction with the 29th Symposium on 'Biotechnology for Fuels and Chemicals' in Denver, USA on 28 April. On 1 May, the Task organised a 'special session' at the Symposium which highlighted activities in seven of the participating countries, for an international audience of over 300 people. The Task is currently preparing to co-host a number of sessions at the 6th European Motor Biofuels Forum. This will be held on 9-10 January 2008. Details on these events are provided on the Task website.

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. New reports on barriers to biodiesel and ethanol production and use have been commissioned. This work will continue throughout the new triennium.

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. These data are readily available on the Task website under Task Outputs.

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 will work closely with Task 40 on these issues in this triennium.

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 is currently preparing to co-host a number of technical sessions at the 6th European Motor Biofuels Forum. For further information please contact Warren Mabee or Jack Saddler. Outputs from this session will be made available on CD.

Newsletter

The Task published three newsletters in 2007. 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 related groups. The Task is working with various EC-funded projects as described earlier to ensure effective information exchange. The Task also continued discussions with Task 40 on biomass supply and international trade of biofuels. In addition, the Task participated in a meeting with FAO experts which broadened Task communication to experts from developing countries and contributed to both FAO and OECD reports released in 2007.

Website

The website has been redesigned and was re-launched in 2007 to improve access to the information produced by the Task. New information is being added on a regular basis. Please visit www.task39.org.

Deliverables

The deliverables for the Task in 2007 included: two progress reports, one Technology Report and audited financial accounts as required by the ExCo. The Task produced three

newsletters and three technical reports on the issues relating to EU biofuel policy, biodiesel production (particularly technology providers), and biofuel implementation agendas. Reports on sustainability issues related to biofuels and updated implementation strategies are being finalised. The full library of Task reports is 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 of the Task 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 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: Belgium, Brazil, Canada, Finland, Germany, the Netherlands, Norway, Sweden, the United Kingdom and the USA (from January 2008).

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

Task Leader (Administrative): Mr Peter-Paul Schouwenberg, Essent Energy, the Netherlands.

Operating Agent: Ir Kees Kwant, SenterNovem, the Netherlands.

Alternate Operating Agent: Dr Arjan Wierda, Ministry of Economic Affairs, 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 2007 the Task organised four joint workshops. The first was a joint workshop with EUBIONET 'Biomass Policies and Trade' on 19-20 February in Rotterdam, the Netherlands. The aim was to look for improvement in bioenergy policies in Europe by discussing issues that had arisen and by learning from experiences in other countries. The workshop topics included: trade of solid biomass and trends in the market; sustainability certification for bioenergy and chain management; new developments in bioenergy policies; and the potential for energy from biogenic waste. The workshop also included a tour of the harbour of Rotterdam and a study tour to the Essent Amer power plant, where large quantities of biomass are co-fired. Of the 60 participants in the workshop, more than half came from abroad. The presentations and a summary of the main outcomes are available on the Task website.

The second workshop was a half-day side-event at the 15th European Biomass Conference in Berlin. The aim was to highlight developments which ensure increasing and sustainable biomass production, and their importance for international bioenergy trade. It featured eight speakers – six from Task 40, plus one from UNEP and one from WWF. More than 100 participants representing industry, policy makers, NGO's and academia participated in the event. The presentations and a summary are available on the Task website.

The third workshop was organised in September in Canada. The aims of this two day conference were to explore domestic biomass energy options and the potential for bioenergy trade; highlight progress in Ontario; and undertake a one day study tour of the world's largest bio-oil plant and biomass co-firing at the 4000 MW Nanticoke coal-fired power plant. The workshop was hosted by the Canadian Bioenergy Association (CANBIO), Task 40, and Bioenergy Focus Ontario. In total, over 155 representatives from industry, academia and policy makers attended the workshop. The presentations will be available on the Task website in 2008.

Finally, the Task joined forces with Tasks 29 and 38 to organise an 'expert consultation' on 25-26 October in Dubrovnik, Croatia. The workshop aimed to collate the state of knowledge and answer/discuss the following:

- In what terms can sustainability be defined? What tools are there to ensure sustainable biomass: certification, etc?.

- GHG sustainability (carbon stock changes, efficient land use, transport emissions with biomass trade, emissions from fertilisers, all LCA aspects).
- Environmental sustainability (biodiversity, water, nutrients, leaching, desertification).
- Socio-economic sustainability (local jobs, out-competing local uses of biomass in case of exports, child labour etc.).

The 'expert consultation' was limited to around 40 international participants in order to allow efficient discussion. The experts were invited from specialised international institutions such as UNIDO, the European Commission, WWF, IIASA and various research institutes. The presentations will be available on the Task website in 2008.

The Task also had three formal internal meetings in 2007, in conjunction with the workshops in the Netherlands, Germany, and Canada. During these meetings, various deliverables were finalised and the ongoing work on the first deliverables for the new triennium were discussed.

Future Meetings and Workshops

Three workshops are scheduled for 2008:

- On 25 February 2008, a workshop will be held at IEA Headquarters, on international bioenergy statistics. Key experts will be invited to identify bottlenecks and to set up strategies to develop meaningful statistics for international bioenergy trade.
- On 29 May 2008, a workshop will be held during the World Bioenergy 2008 Conference and Exhibition in Jönköping, Sweden. The theme will be 'The effects on trade from expected incentives based on more ambitious political targets and visions'. Presentations will include: 'The Swedish Free Trade Policy', and specific trade issues for ethanol and pellets. Producer push incentives will be compared with demand pull support measures. Also technology drivers will be addressed.
- In September 2008, a joint workshop with Tasks 31 and 38 will be held in the UK. The theme is still to be determined.

Internal Task meetings will be held in conjunction with the above workshops.

Work Programme and Outputs

During the kick-off meeting in Utrecht in February 2007, ten areas of work were formulated. These are based on the programme of work approved at ExCo58.

- 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

Work commenced in 2007 on several of these topics. At the Task meeting in September, detailed prioritisation, timetables, and deliverables were agreed upon as described below.

Forest Biomass Supply Systems

The first deliverable in this triennium will be the sustainable forestry supply chain study carried out by Doug Bradley. The workshop in September also covered this topic at great length, covering the supply potential of various types of biomass (mill residues, forest floor biomass, mountain pine beetle, etc.) and opportunities for export. This report and the summary from the workshop are prime outputs for this topic. However, there are still a lot of potential issues to be covered, such as logistics, local use vs. export, establishment of commodities for forest energy products, optimal densification solutions and the lack of market transparency. The Task aims to organise a joint workshop with Task 31 in the UK in 2008 to cover some of these topics. It is anticipated that Task participants will be able to apply for funding from their national programmes for further work on this topic.

Country Reports and Updates

Country reports were prepared by all of the Task participants in the first triennium. These are now being updated. The aim is to publish them at the end of each year.

International Biomass Trade Statistics

A discussion paper has been written by Utrecht University. The aims were to identify who is currently collecting statistics on bioenergy trade; and secondly to identify the various bottlenecks and problems with collecting bioenergy trade statistics. This paper will be further elaborated, and will form the basis for a small expert meeting at IEA Headquarters, with 20-25 experts from various national and international statistical departments. This will be held in February 2008.

Market Studies

In 2007, the ethanol and pellets and sawdust resource assessments were published. As limited funds are available, no new studies will be started in 2008. The topic will be reviewed at the next meeting in Jonkoping.

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-up a deliverable by the end of the triennium. The aim is to write an interim report, providing an overview of ongoing developments by the end of 2008, with a final report in 2009. This topic is lead by the Netherlands with the UK, Germany, and FAO as the other key contributors.

Review of Sustainability Criteria/Certification

The review of sustainability criteria and certification has been finished, and will be published in a special issue of Biomass and Bioenergy. The Task has plans to continue this kind of work to provide an objective and neutral overview. In mid-2008, it will carry out a major update of this study, taking into account the latest developments in the EU, Canada, the UK and other countries.

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

Due to limited funds, no new studies will be started in 2008. The topic will be reviewed at the next meeting in Jonkoping.

Re-address Barriers

In the previous triennium, the Task made an inventory of opportunities and barriers based on developments in the participating countries. For this triennium, the aim is to make a broader overview. The Task will set up a questionnaire for industry and governmental stakeholders, to identify current bottlenecks and barriers hampering global biomass trade; and the requirements to take biomass trade to the next level (e.g., internet trading platforms etc.)

Impact of Policies

Utrecht University prepared a presentation and a paper for the Canadian workshop based on a literature review.

Modelling Biomass Trade

A review study carried out by the Norwegian University of Life Sciences and Utrecht University was published as a main deliverable. No funding for further projects is available at present so the Task will review ongoing activities in 2008.

Dissemination

Dissemination of the work and results of the Task were actively pursued at a number of conferences and workshops in 2007. In August an updated full-colour leaflet on the Task activities was published.

Collaboration with Other Tasks/Networking

As described above, events were organised jointly with Tasks 29 and 38, Eubionet2, the Canadian Bioenergy Association (CANBIO), and Bioenergy Focus Ontario. At these events, the work of the Task was disseminated via presentations. The work of the Task was also presented to a number of other audiences including:

- Fachtagung Holzbrennstoff-Logistik: Rohstoffbereitstellung – Qualitätsstandards – Märkte im Rahmen der LIGNA+, Hannover 2007, Hannover, Germany, May 2007.
- MARE FORUM Investments 2007, Athens – Vouliagmeni, Greece, May 2007.
- International conference on biofuels, UNIDO/MPOB, Kuala Lumpur, Malaysia, July 2007

- Bioenergy Australia 2007, Sustainable Energy in a Carbon Constrained World, November 2007

The Task aims to continue this wide collaboration in 2008. A joint workshop with Task 30 is scheduled for May 2008 in Jönköping, Sweden, and a joint workshop with Tasks 31 and 38 is planned for September in the UK. Other joint workshops are envisaged, including a joint workshop on international pellet trade with the EU-funded Pellets@las project.

Website

The Task website is a key tool for dissemination of information. It was developed continuously during 2007. Visitor numbers have steadily increased and are currently around 5000 per month. Also the amount of monthly downloaded data increases continuously. In 2007, the top 10 documents were each downloaded over one hundred times per month. As well as the Task deliverables (e.g., country reports, logistic chain studies, market studies, etc.), the presentations given at the Task workshops are available for downloading.

Deliverables

In 2007 a number of deliverables were published including: a comprehensive pellet and sawdust resource assessment; a global market evaluation of future fuel ethanol production and trade prospects; a study evaluating the suitability of various models for analysing international trade of biomass and bioenergy products' and an analysis of Canadian forestry fuel supply chains for biomass export. Furthermore, various presentations and summaries of workshops were made available on the Task website. Finally, the usual formal deliverables included Task Progress Reports and minutes of the Task meetings were completed. See Appendix 4 for more details.

In 2008, a special issue of Biomass and Bioenergy will be published containing a number of the key deliverables from the 2004-2006 triennium. Also, a new set of country reports is scheduled, as mentioned above.

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, economical, 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.

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

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

Operating Agent: Dr Björn Telenius, Swedish Energy Agency, Sweden

The Task Leader directs and manages the Project work. 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

A systems analysis is taken as the starting point, aiming at illustrating unique possibilities and options related to bioenergy as well as explanation of limitations and obstacles to development and deployment of bioenergy. Among these limitations and obstacles are sometimes significantly lower acceptances and less factual understanding among the general population. These have been suggested as causative explanations for less public recognition for bioenergy than for other competing types of renewable energy. The work programme for the Task has been developed with the aim of bringing more clarity and up-to-date multi-disciplinary facts and discussion regarding the potential resource supply, markets, and environmental issues for bioenergy.

The work programme is intended to be 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 deliverables.

The first Project commenced in 2005. Initially it was intended that a team would be formed with experts nominated by the sponsors. It was later decided to develop the methodology for formation of Project teams including a tendering procedure. After the partners agree on the general direction of a Project more detailed specifications are developed and experts nominated by the partners in the Task. When quotations from experts on a whole or part of a study are received, the team leader is to finalise the Project description and propose to the partners the details of the work including expert(s) to contract for the work.

A proposed strategic future item of work has been prepared and proposed: 'Strategies in future research and development of bioenergy systems – a tool for prioritizing the most resource efficient pathways and integration of biomass based fuels'.

Project 1 'Bioenergy – Competition and Synergies'

The approach outlined above has been applied to this Project. In the proposal Germany nominated the Institute für Energetik und Umwelt gGmbH and the Institut für Landwirtschaftliche Betriebslehre of Universität Hohenheim (UHOH) as candidate contractors for the agricultural part of the work. Sweden nominated Professor Nippe Hylander with AF-Process in Stockholm and Professor Sten Nilsson at the Institute for Applied Systems Analysis, Laxenburg, Austria for the analysis related to synergies and competition related to forestry and forest-based industries.

The project has as one focus, issues regarding competition of bioenergy production with other activities and ambitions which could limit the realisation of bioenergy's potential. The other focus is synergies, multiple benefits, and added values that bioenergy could offer relative to current conventional systems. It will aim to illustrate unique possibilities and options related to bioenergy as well as explanations of limitations and obstacles to the development and deployment of bioenergy. The study presents examples of competition and synergies relevant to successful development of bioenergy systems. The examples contribute to the understanding of competition situations that limit bioenergy development and offer analysis and discussion on lessons learned and the possibilities for various synergies between bioenergy and other conventional practices.

The result on agriculture does indicate that historically and presently the use of agricultural land and products for energy purposes has had limited impact on availability and price of food commodities. However it concludes that for the future the situation will be an effect of the combined development of productivity, available land, and demand for food and feed products.

With respect to forestry, significant synergies are identified when bioproducts from traditional forest industries find use as energy products with added value. Synergies of this kind can preferentially be developed and integrated with forest industries developing towards 'biorefineries'. The major challenge for Europe is concluded to be mobilisation of the unutilised production capacity of sustainable growth and yield from the forest land.

As at January 2008, a draft project report in two parts has been prepared for review. viz.

- Part A: 'Identifying Synergies and Competitions in Forest-based Bioenergy' by Bengi Nippe Hylander, and Professor Sten Nilsson; and
- Part B: 'Bioenergy – Competition and Synergies: Part B: Agricultural Sector' by Daniela Thrän, Thilo Seidenberger, Jürgen Zeddies

It is expected that this report will be finalised and distributed in 2008.

Project 2 'Analysis and Identification of Gaps in Fundamental Research for the Production of Second Generation Liquid Transportation Biofuels'

Project 2 was initiated on 13 January 2006 based on a proposal by Larry Russo (Office of Biomass Program, US Department of Energy) to the Executive Committee. Dr Michael Ladisch (Laboratory of Renewable Resources Engineering, Purdue University) is the Project Leader. He has been working with the Participants (Finland, the Netherlands, Sweden, UK, USA, and the EC) to develop a global view of gaps in research that need to be filled to address production of second generation liquid biofuels. A series of conference calls, coupled with a survey of the literature and discussion and review with experts within IEA Bioenergy, have been the mechanisms used.

Translational efforts that put the bio-molecules or thermally processed renewables into the fuel tank complement the fundamental research on these fuels, and may involve chemical, thermal, biochemical, and/or biological processing applied to a range of feedstocks. Project 2 addressed research barriers, trends, and gaps in the production and use of lignocellulosic ethanol, P-series fuel, liquid Fischer Tropsch fuels, or dimethyl ether (DME), from synthesis gas and upgraded pyrolysis bio-oils. P-series fuels are a blend of methyl-tetrahydrofuran, ethanol, and natural gas condensates (C4 to C5).

Gaps in fundamental research, identified to date, include biomass pre-treatment for cellulosic materials, as well as the ability to ferment a range of sugars (both hexoses and pentose) to ethanol or butanol. While significant strides have been made in enzyme (cellulose) hydrolysis, further improvements in activity of the enzymes, enzyme activity with respect to hemicelluloses, and resistance to inhibition are needed. In the case of thermal processing, a research gap appears to be the clean-up of the synthesis or producer gas that results from biomass sources, particularly particulates, and other metallic components (ash) that may poison Fischer Tropsch catalysts.

Co-processing of fuels (i.e., first generation biofuels and fossil fuels) or integrating second generation biofuel technologies in suitable industrial applications (i.e., to reduce capital cost) can be considered as one solution for accelerating biofuel production. Co-processing and integration will push efforts to develop commercial scale biorefineries capable of using a variety of feedstocks while offering product flexibility. In the long term, it is essential to promote the fundamental research in order to continuously improve the technical and economical feasibility of second generation biofuels.

Common denominators in gaps for the different fuels and the bio- or thermochemical processes used to produce them are given by three main areas:

- ***Biocatalyst (or catalyst) Discovery and Development.*** Research is needed to achieve more robust, versatile, and cost-effective catalysts that are less subject to inhibition and are stable in the presence of chemically complex feedstocks derived from biomass materials. In the case of bioprocessing, the gaps lie in economic enzyme production, reduction of enzyme inhibition, development of pentose utilizing and cellulase producing micro-organisms, feedstock preparation, and inhibitor removal. In the case of thermochemical systems, the list is analogous except the term 'catalyst' replaces 'enzyme' or 'micro-organism'.
- ***Feedstock Preparation.*** Pre-treatment of cellulosic materials so that they are more efficiently converted to fermentable sugars is one form of feedstock preparation, and should be viewed as a research gap. Clean-up of gases derived from biomass before the gases enter a catalytic step is another important research gap.
- ***Systems Integration.*** Systems integration and the melding of bioengineering with chemical engineering for cost effective production and use of second generation fuels is another research gap. Infrastructure for delivering second generation fuels, and policies that would catalyze their introduction to the market place also present gaps.

A progress report on the Project was provided at ExCo59, and an abstract was submitted for an oral presentation at the Annual Symposium on Biotechnology for Fuels and Chemicals at Denver in April. More recently, the final report 'Analysis and Identification of Gaps in Research for the Production of Second Generation Liquid Transportation Biofuels' dated January 2008 has been approved and will be distributed at ExCo61 and published on the IEA Bioenergy website.

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

Overview of the Task

The major objective of the Task is to assess the worldwide position and potential of the biorefinery concept and to gather new insights that will indicate the possibilities for new competitive, sustainable, safe and eco-efficient processing routes for the simultaneous manufacture of transportation fuels, added-value chemicals, (CH)₄power, and materials. 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 to 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. The emphasis in 2007 was to:

- get a clear overview of the current status and developments of biorefineries in the participating countries;
- prepare a common definition on Biorefineries, including a widely accepted classification system;
- set-up an international stakeholder platform;
- co-operate with ongoing national and international activities and programmes; and
- disseminate knowledge.

Participating countries: Austria, Canada, Denmark, France, Germany, Ireland, the Netherlands and the European Commission. (Finland and Sweden were observers in the Task in 2007 but decided not to participate)

Task Leader: Dr Ir 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, SenterNovem, the Netherlands.

Alternate Operating Agent: Dr Arjan Wierda, Ministry of Economic Affairs, 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.biorefinery.nl/ieabioenergy-task42/ and the IEA Bioenergy website www.ieabioenergy.com under 'Our Work:Tasks'.

Task Meetings and Workshops

In 2007 the Task organised two internal meetings, the first on 15-16 March in Amsterdam, the Netherlands, and the second on 4-5 October in Vienna, Austria. The second meeting was linked to a workshop in which Austrian stakeholders met the international stakeholders of the Task to discuss biorefinery-related topics.

The first meeting was the 'kick-off' meeting of the Task in which the work programme was finalised and agreed to by the participants. A first concept definition on biorefinery was developed, and a first overview of the current status of biorefineries in the participating countries was presented.

At the second meeting the biorefinery concept definition was finalised and agreed. The necessity for a classification system for biorefineries was discussed, and it was concluded that there was a need for a clear and widely accepted classification system. The development of such a system, however, will take some time, and is scheduled for the first half of 2008. The National Team Leaders presented a first template of the 'Country Reports'. This included main national biorefinery-related data, such as current national biomass use, biomass-related policy goals, a map of existing biorefineries in different market sectors, RTD-activities (projects, pilot-initiatives and demonstration plants), major national stakeholders, and national programme funding. These country reports will be finalised and published in 2008.

At the workshop the Task and its activities were presented to the Austrian stakeholders. The Austrian stakeholders presented a variety of biorefinery-related activities taking place in Austria, such as green biorefinery-related activities; co-products in pulp and fibre processing; environmental evaluation of biorefinery concepts; the role of gasification in biorefineries; bioethanol-based biorefineries; and the role of biogas production as key technology within biofuel oriented biorefineries.

The reports on the Task meetings and workshop are available on the Task website.

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 will be 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 will be 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 knowledge.

Progress achieved in 2007 is described below.

Definition and Classification System

Biorefinery is the sustainable processing of biomass into a spectrum of marketable products and energy. This definition includes the following aspects:

- Biorefinery: concepts, facilities, plants, processes, clusters of industries.
- Sustainable: maximising economics, minimising environmental impact, taking into account social aspects, fossil fuel replacement, closed-cycles.
- Processing: upstream processing, transformation, fractionation, thermochemical and biochemical conversion, extraction, separation, downstream processing.
- Biomass: wood and agricultural crops, wood, straw, organic residues, forest residues, aquatic biomass
- Spectrum: multiple energetic and non-energetic outlets.
- Marketable: a current market exists or a future market is expected to become available, taking into consideration both market volumes and prices.
- Products: both intermediates and final products, i.e., food, feed, materials, and chemicals.
- Energy: fuels, power, and heat.

Based on this definition a variety of biorefinery concepts are distinguished in literature, such as:

- Conventional Biorefineries.
- Advanced Biorefineries.
- First, Second, Third Generation Biorefineries.
- Green Biorefineries.
- Whole Crop Biorefineries.
- Lignocellulosic Feedstock Biorefineries.
- Two Platform Concept Biorefineries.
- Thermochemical Biorefineries.
- Marine Biorefineries.

The concepts are classified on different grounds now, i.e., based on technological (implementation) status, types of raw materials used, and the main types of conversion processes applied. A useful and clear classification is still lacking but this will be developed within the Task in 2008.

Country Reports

Concept country reports in PowerPoint format have been prepared by the national representatives of the participating countries, in which the following items were addressed: current national biomass use, biomass-related policy goals, a map of existing biorefineries in different market sectors, RTD-activities (projects, pilot-initiatives, and demonstration plants), major national stakeholders, and national programme funding. These country reports will be finalised and published in 2008.

Multi-disciplinary Partnerships

At the second Task meeting in Vienna 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 Task 42 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.

Task Website

A Task website with an external internet part and an internal extranet part was built and operated in 2007. The address of the website is: www.biorefinery.nl/IEABioenergy-Task42. This website is linked to the IEA Bioenergy website.

Collaboration with Other Tasks/Networking

Co-operation was established with ongoing international activities, e.g., other 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, with other Tasks, and meeting regularly with ongoing EU-initiatives. The results of these activities will be reported in the bi-annual Task Progress Reports. In 2007 the following activities took place:

- Involvement in joint European TP Task Force on Biorefinery.
- Preparation of the 'biorefinery' part of SRA and TDD of the EC TP Biofuels.
- Presentation of the Task at a variety of national and international workshops and conferences.

The work of the Task is closely related to other Task activities, especially Tasks 33, 34 and Task 39. Effective coordination is achieved through joint events, and arranging the exchange of meeting minutes and reports. In 2007 first contacts were initiated.

Deliverables

Deliverables in 2007 included: organising and minuting of two Task meetings and a national Austrian workshop; contributions to two ExCo meetings, the setting up and maintenance of a Task website, development of a general definition of 'biorefinery', and concept Country Reports on biorefinery mapping and the funding of national programmes. All reports are available on the Task website.

IEA BIOENERGY TASK PARTICIPATION IN 2007

TASK	AUS	AUT	BEL	BRA	CAN	CRO	DEN	FIN	FRA	GER	IRE	JAP	NEL	NZE	NOR	SA	SWE	SWI	UK	USA	EC	TOTAL
29: Socio-econ		•			•						•	•			•				⊗			7
30: SRC	•			•	•								•	•			⊗		•	•		8
31: Forestry					⊗		•	•		•			•	•	•				•	•		9
32: Combustion		•			•		•	•		•			⊗		•			•	•		•	12
33: Gasification		•			•		•	•		•			•	•	•			•		⊗	•	11
34: * Pyrolysis										•					•					•	⊗	4
36: MSW					•			•		•			•		•				⊗		•	8
37: Biogas		•			•		•	•		•			•					⊗	•		•	11
38: GHG	•	⊗				•		•		•								•		•		8
39: Biofuels	•	•			⊗		•	•		•	•	•	•		•			•	•	•	•	15
40: Trade				•	•			•		•			⊗		•				•	#		9
41: Systems								P2		•			P2						•	•	•	5
42: Biorefineries		•			•		•		•	•	•		⊗								•	8
TOTAL	3	7	3	2	10	2	6	7	3	11	3	2	9	2	7	1	10	3	9	7	8	115

⊗ = Operating Agents

• = Participant

P2 = participate in Task 41, Project 2 (EXCo Project)

* = Actual participation is higher because this is a joint programme with EC participants.

= USA will join Task 40 in 2008.

BUDGET IN 2007 – SUMMARY TABLES

Budget for 2007 by Member Country (US\$)

Contracting Party	ExCo Funds	Task Funds	Total
Australia	8,000	44,300	52,300
Austria	12,000	93,500	105,500
Belgium	8,000	41,500	49,500
Brazil	7,000	29,300	36,300
Canada	15,000	138,620	153,620
Croatia	7,000	26,000	33,000
Denmark	11,000	82,000	93,000
Finland	12,000	98,500	110,500
France	8,000	41,820	49,820
Germany	16,000	126,320	142,320
Ireland	8,000	40,500	48,500
Japan	7,000	28,000	35,000
Netherlands	14,000	126,620	140,620
New Zealand	7,000	26,800	33,800
Norway	12,000	85,320	97,320
South Africa	6,000	16,000	22,000
Sweden	15,000	128,120	143,120
Switzerland	8,000	39,000	47,000
UK	14,000	113,620	127,620
USA	12,000	81,300	93,300
European Commission	13,000	82,820	95,820
Total	220,000	1,489,960	1,709,960

BUDGET IN 2007 – SUMMARY TABLES

Budget for 2007 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	8	14,300	114,400
Task 31: Biomass Production for Energy from Sustainable Forestry	9	14,500	130,500
Task 32: Biomass Combustion and Co-firing	12	12,500	150,000
Task 33: Thermal Gasification of Biomass	11	12,500	137,500
Task 34: Pyrolysis of biomass *	4	10,000	10,000
Task 36: Integrating Energy Recovery into Solid Waste Systems	8	15,320	122,560
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: Commercialising 1 st and 2 nd Generation Liquid Biofuels etc.	15	16,000	240,000
Task 40: Sustainable International Bioenergy Trade: Securing Supply and Demand	9	15,000	135,000
Task 41: Bioenergy Systems Analysis, Project 1	5	0	0
Task 41: Bioenergy Systems Analysis, Project 2	6	0	0
Task 42: Biorefineries: Co-production of Fuels, Chemicals, Power and Materials from Biomass	8	12,500	100,000
Total	115		1,489,960

*Norway and the European Commission pay directly. Actual participation is higher than indicated because this is a joint programme with the European Commission.

CONTRACTING PARTIES

Stephen Schuck and Associates Pty Ltd (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

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

SenterNovem (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 for Business, Enterprise, and Regulatory Reform (United Kingdom)

The United States Department of Energy

LIST OF REPORTS AND PUBLICATIONS

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Progress report for ExCo59, Golden, USA, April 2007.

Progress report for ExCo60, Munich, Germany, October 2007.

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