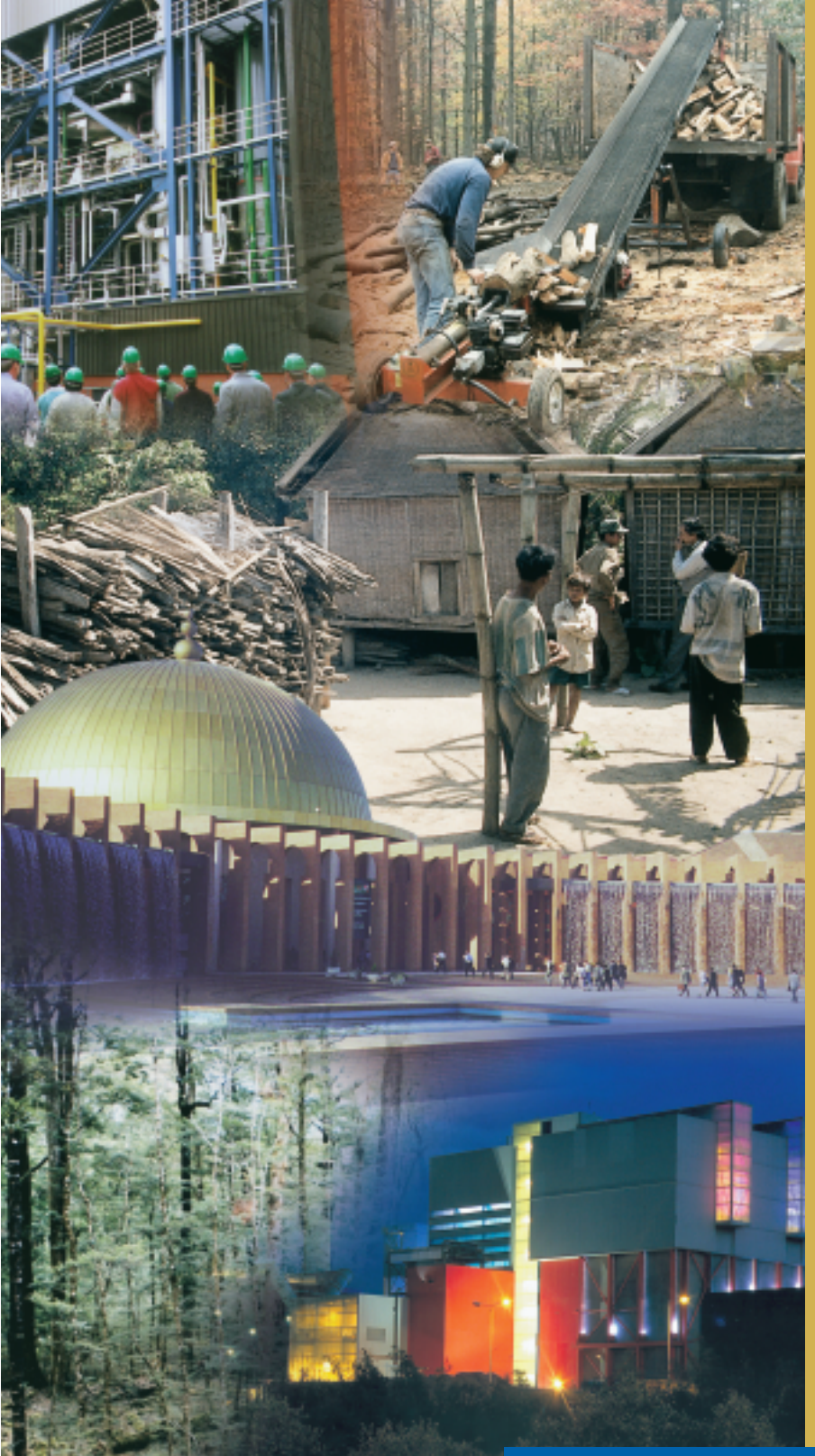


Annual Report 2000

IEA Bioenergy: ExCo: 2001:01

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, and thereby achieve a substantial contribution to future energy demands.

To: IEA Headquarters, Paris

IEA BIOENERGY ANNUAL REPORT 2000

The IEA Committee on Energy Research and Technology (CERT) has recommended that an Annual Report shall be submitted for each of the IEA Implementing Agreements.

This document contains the report of the IEA Bioenergy Executive Committee.

This year, we have presented a special feature of the bioenergy activities within Task 18 'Conventional Forestry Systems for Bioenergy'.

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

Josef Spitzer
Chairman

John Tustin
Secretary

Contents

Editor: John Tustin, IEA Bioenergy Secretary, Rotorua, New Zealand

Preparation, design and layout of cover and colour section: Jim Richardson and members of Task 18. Also Carlin Valenti Ltd, Mt Maunganui, and Brent Devcich, Tauranga, New Zealand.

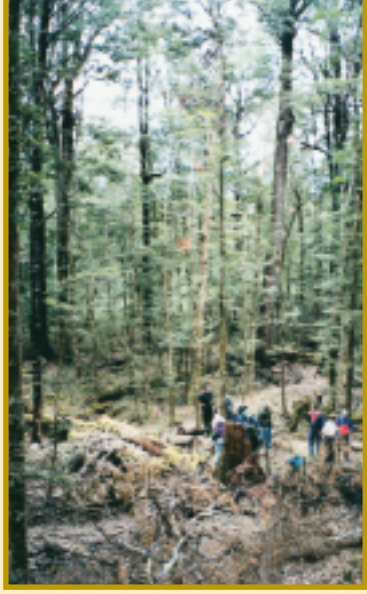
Preparation of text and tables: Rose O'Brien, Rotorua, New Zealand.

Further information on IEA Bioenergy can be obtained from the Executive Committee Secretary, see Appendix 5 of this Annual Report.

A list of country representatives in the Executive Committee is given in Appendix 6.

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

Conventional Forestry Systems for Bioenergy



Courtesy J. Richardson, Canada

An overview prepared by Jim Richardson, Task Leader and the collaborating members of Task 18.

Introduction

The forests of the world serve many purposes: they protect soils from erosion and help ensure a steady supply of water; they provide wood for an enormous variety of structural, domestic and industrial products, including housing, furniture, paper, cardboard and panelboards; they absorb carbon dioxide from the atmosphere and release oxygen, thus helping to keep greenhouse gas emissions in balance; and they provide habitat for countless plants and animals, thus conserving biodiversity as well as aesthetic, spiritual, cultural and traditional values.

Courtesy J. Richardson, Canada

Forests are also a source of energy. The woody biomass of trees can be converted into convenient solid, liquid or gaseous fuels for industrial, commercial or domestic use. In fact, much of the world's population relies on trees to meet daily energy needs for heating and cooking. IEA Bioenergy is concerned that the use of forests for energy be efficient, economic and environmentally sustainable. This has been a primary focus of the work of IEA Bioenergy since its inception and the particular concern of Task 18, 'Conventional Forestry Systems for Bioenergy' for the past three years. The work will be continued over the coming three years by Task 31, 'Conventional Forestry Systems for Sustainable Production of Bioenergy'.

Courtesy D. Mead, New Zealand

Conventional forestry systems are defined as including natural forests and plantations in which biomass for energy is a by-product alongside timber production, environmental conservation, and biodiversity. As such, conventional forestry systems do not include plantations dedicated to energy use, although there are obviously parallels. The primary purpose of the work is to develop guidelines for environmentally sustainable and economic production of biomass for energy from conventional forestry systems and to provide stakeholders with this information.

There are many facets to be considered:

- the extent, distribution and availability of the forest biomass resource;
- the means of producing fuel from the forest - silviculture, forest management, harvesting and transportation;
- the cost of forest fuel production, and the impact of various factors on the economics of the system;
- the need for environmental sustainability, and how forest fuel production can have a positive or negative impact; and
- the relationship between forest fuel production and people - the social and cultural aspects.

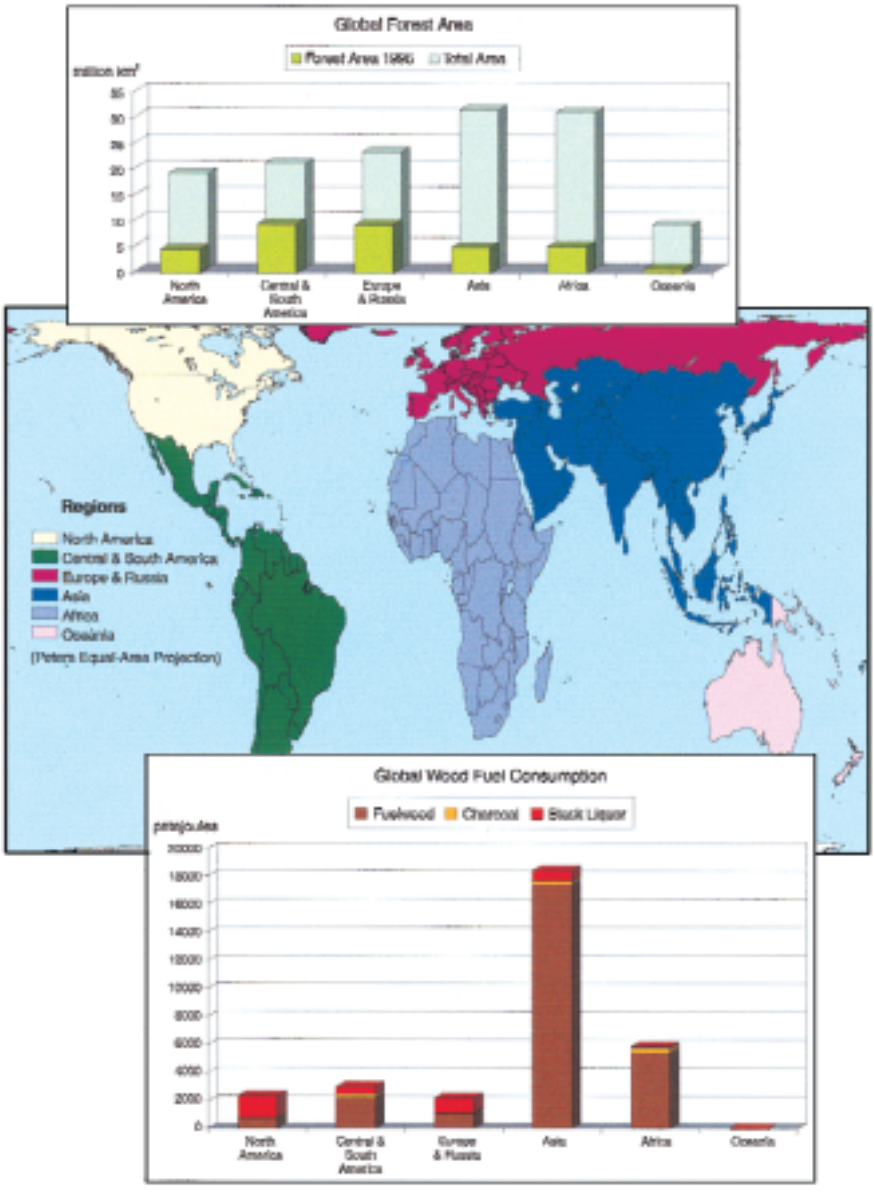
These considerations are all linked by at least one common principle - the idea of sustainability. Forest biomass can be a renewable source of energy, a valuable alternative to finite fossil-based energy sources, but it can only be truly renewable if the principle of sustainability is maintained in each of these five aspects of forest fuel production.

The Biomass Energy Resource

On a global level, the forest biomass resource potentially available for energy is vast. Statistics collected by the Food and Agriculture Organization (FAO) of the United Nations show that in 1995 the world had almost 35 million square kilometres of forest cover (see chart on next page). This represents about 24 percent of the total surface area of the world, excluding oceans. Particularly well-endowed are Central and South America, with 46 percent forest cover, the former USSR with 37 percent and Europe with 30 percent. As a result of various pressures, forest cover in some regions is on the decline, and in others it is increasing. There is no suggestion that all existing forest should be tapped for energy; all possible forest values and benefits must be considered in regard to any use of the resource.

FAO has also compiled revealing statistics on the total consumption of woody biomass for energy. The data are given in petajoules (PJ) of energy (one PJ is derived from about 100,000 cubic metres of wood). The figures show that in 1997, the vast majority (85 percent) of global consumption of woodfuel was in the form of fuelwood (firewood) or charcoal. The balance was primarily in the form of black liquor - the lignin-rich residue of the pulp and paper industry - used by the industry for process heat, steam and electric power generation. On a regional basis, there is a startling contrast between the developing countries of Latin America, Africa and Asia where collecting firewood is a major part of daily life for most people, and the industrialized countries of North America, Europe and Japan where industrial use of woody biomass represents nearly two-thirds of woodfuel consumption and very few people are involved.

Global Forest Biomass Resource and Woodfuel Consumption



Data from FAO, chart by Quillfire Communication Group, Canada

The regions where fuelwood and charcoal consumption are greatest (Africa and Asia) are also the regions where the proportion of forest cover is lowest. Although the figures do not show it, these are also the regions where forest cover is declining most rapidly. The need for sustainability in fuelwood production is certainly clear.

It is important to keep these figures in mind in any global discussion of forestry systems for bioenergy. Task 18, and its successor Task 31, focus on systems for use

in the western industrialized world, but the guiding principles have application elsewhere. Efforts are being made to reach out to partners outside the OECD, initially in South America.

Conventional forestry systems are not the only source of woody biomass for energy. Dedicated energy crops are often fast-growing short-rotation plantations of woody species such as poplar or willow, but can also be annual or perennial crops of grasses or other 'biomass species'. Municipal solid waste is also a valuable source of biomass for energy in the form of waste wood, demolition wood and other organic waste materials which can be burned or biologically converted into energy.

Production of Fuel from the Forest

A forest stand in a conventional forestry system passes through several stages, beginning with regeneration or stand establishment, continuing through the sapling stage of rapid height growth, the intermediate stage of steady growth in diameter and height, finally reaching maturity and harvest and returning to the regeneration phase. There are many variations on this basic cycle. The full cycle or rotation could last from 10 years to 200 or more, though it is typically between 30 and 80 years. The 'forest stand' to which it applies could be as small as the area of a single mature tree in a selection-managed mixed temperate rainforest, or as large as several hundred hectares of uniform, single-species, fire-origin forest in the boreal region.

Many forest operations present opportunities for recovering woodfuel as a by-product. In young dense stands, the trees which are cut in early thinning typically have no commercial value, hence the term 'pre-commercial thinning', but if they can be collected and removed, they could be used for energy purposes. Thinning in older stands normally yields products such as poles or pulpwood, but the tops and branches are a potential by-product for energy. Similarly, at final harvest tops and branches are available for woodfuel - in even greater quantities. Other circumstances, such as stand mortality caused by severe insect attack, disease or fire, may provide opportunities for recovering woodfuel from conventional forestry operations.

Courtesy D. Mead, New Zealand

Courtesy J. Ford-Robertson, New Zealand

Courtesy H. Kalaja, Finland

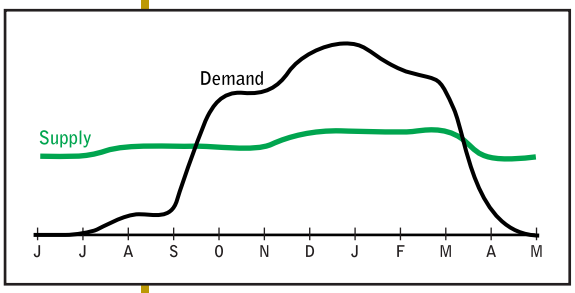
'Forest residues' (e.g. tops, branches) are a source of energy. However, whether they are produced from the tree at the stump where it was felled, or from collected whole trees felled and extracted to roadside, forest residues normally have very low density (and low value). Comminution and compaction are techniques employed to increase density and thus assist efficient handling and transportation. Comminution typically involves reducing the residues to small pieces with a chipper, grinder or flail device. A recently devised compaction technique tightly compresses the residues and cuts the resulting tied bundles into uniformly sized 'compact residue logs' (CRLs) which can be efficiently handled.

Courtesy P. Hakkila, Finland

Harvesting and collection of forest residues may be conducted at the same time as harvesting for the primary products, in an integrated operation. Alternatively, it may be postponed till a later date, by which time the residues have lost moisture and so become lighter in weight, and with a higher energy value. The most commonly used equipment and supply chains for harvesting and transportation have been developed in the Nordic Countries which lead the world in this field. The Nordic equipment is highly mechanized.

Courtesy H. Kalaja, Finland

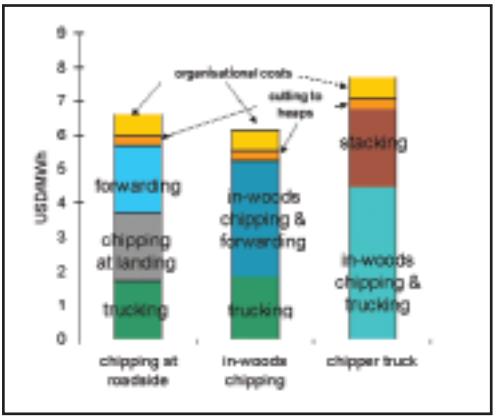
If the energy end-use of the residues is for heating, as it commonly is in the Nordic Countries, the material must usually be stored at some point. This is to allow the moisture content to be reduced, and to ensure an adequate supply is available when required. Residues may be harvested almost year-round, but the peak heating season is in winter. Storage may take place at the stump, in piles - comminuted or preferably uncomminuted - at roadside, at a central terminal, or at the energy plant. Storage and drying are strongly inter-related and must be carefully controlled to avoid excessive heating in piles - and possible fire risk - as well as dry matter losses and mould development - with concomitant health risks.



Courtesy R. Björheden, Sweden

Economics of Woodfuel Production

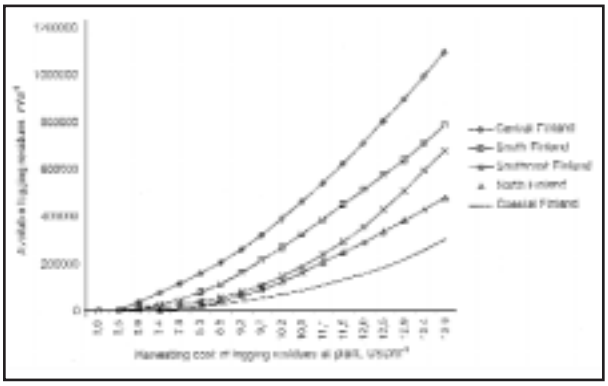
Woodfuel is a low value product. Compared with products such as lumber, veneer, pulpwood and poles, its commercial value is minimal. Therefore, for a forest residue harvesting operation to be economically viable, costs must be very carefully controlled.



Courtesy T. Oijala, Finland

The costs of fuelwood production may vary greatly from one system to another according to the elements present or absent in each. Typical cost elements include cutting, stacking, chipping, forwarding to roadside, truck transportation and administrative overhead.

The scale of woodfuel demand has a considerable impact on the cost of procurement, as can be seen in the example from Finland below, which shows how much logging residue a biomass power plant is able to obtain from harvesting operations at the given average cost of wood delivered to the plant in different regions of Finland. Plants located near the coast must procure their wood from within a semi-circular area away from the coast. Plants in the interior can procure wood from all around the mill. Also, forests near the coast are typically pine-dominated yielding less biomass in tops and branches than the spruce-dominated stands in central and eastern Finland.



Courtesy A. Asikainen, Finland

As a counter to the direct costs of producing woodfuel and the low price obtained for the material, there may be offsetting benefits which can have direct or indirect economic value. Removing residues from the harvesting site makes the site cleaner, thus facilitating access for subsequent site preparation and planting operations. It also reduces the risk of fire and attack from insect and disease pests which may find the residues a favourable base. It is important to consider these potential benefits in assessing the economic sustainability of a woodfuel project.

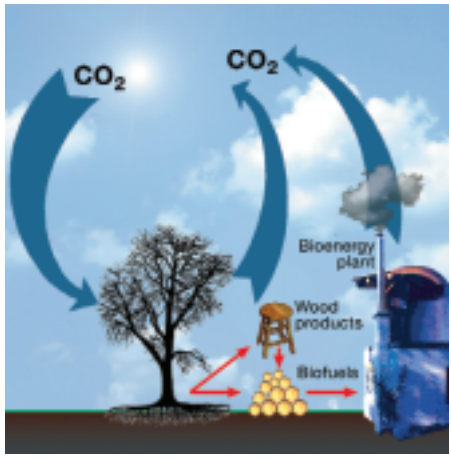
A final economic consideration is the policy context within which woodfuel production is undertaken. There are many types of regulations, laws, policies, subsidies and taxes which may hinder or foster woodfuel production. These include:

- Considerations relating to forest land availability
  - land use regulations
  - regional, agricultural, environmental and nature conservation policies
- Considerations relating to woodfuel from the forest
  - forest laws
  - site-specific restrictions on woodfuel harvesting
- Considerations relating to forest industry
  - waste disposal laws
  - regulations on wood fibre use
- Considerations relating to energy production from woodfuel
  - siting, zoning and land use laws
  - emission regulations
- Considerations relating to the energy market
  - subsidies and other financial incentives
  - energy and carbon dioxide taxes
  - guaranteed markets.

Environmental Sustainability of Woodfuel Production

Environmental sustainability is of vital importance for conventional forestry systems. At an appropriate level, the forest ecosystem must remain unimpaired for future generations and in essence the same principles apply to woodfuel production as to the production of conventional forest products.

The most important current issue related to energy and the environment is undoubtedly that of greenhouse gas emissions and carbon balances. This topic was reviewed in the 1998 Annual Report of IEA Bioenergy. It is evident that bioenergy systems, including those involving conventional forestry systems, offer significant possibilities for reducing greenhouse gas emissions when they are substituted for fossil fuel systems. Biomass utilization for energy can be considered as part of a closed



Courtesy IEA Bioenergy Task 25

carbon cycle, and thus effectively neutral with respect to carbon balance. The recognition of this benefit is presently one of the strongest driving forces behind the interest in wider adoption of bioenergy.

A commonly expressed concern about woodfuel harvesting is that it removes nutrient-laden biomass from the site, and so may create nutrient deficiencies for future forest growth. Although forest residues do contain much higher concentrations of nutrients than bolewood, studies in several parts of the world have shown that residues can be harvested without appreciable loss of site productivity, provided reasonable precautions are taken, such as not attempting to remove 100 percent of residues, avoiding particularly sensitive sites, and limiting removals to once per rotation. Swedish authorities have established a series of recommendations for forest energy harvesting that embody such principles.

Much of the concern regarding potential nutrient removals in residue harvesting can be alleviated if nutrients are returned to the forest. Where the woodfuel is used in a combustion system, the nutrient elements are concentrated in the ash from combustion. This is commonly spread back in the forest as a 'natural' fertilizer, generally following some treatment to make the ash easier to handle and less likely to spread beyond the intended site. However, ground-based spreading equipment must be able to negotiate relatively dense forest stands. Also it is not advisable to spread ash from co-firing combustion systems in which woodfuel is burned along with coal or other fossil fuels.

Courtesy P. Hakkila, Finland

Forest residues are also an important source of organic matter which is essential for maintaining key soil properties such as structure and aeration. Organic matter is critical for preserving the water-regulating properties of forest soils, in terms of both quantity and quality of water. Normal residue harvesting practices remove only a portion of the branches and tops, leaving all stump and root mass and sufficient above-ground biomass in the forest to conserve soil organic matter content as well as nutrients. Operational issues such as trying to minimize the removal of mineral soil and stones (which are hard on mechanical equipment) with the residues, allowing time for leaves or needles to drop from residues before extracting them, and the difficulty of extracting economically more thinly distributed residues, mean that in practice woodfuel harvesting is no less environmentally sustainable than conventional harvesting. With a few simple guidelines such as avoiding fuelwood harvesting on sites of high environmental value, leaving dead trees and snags, and reducing damage to soil and remaining live trees, the vast majority of forest values and benefits, including biodiversity, recreation and aesthetics, can be sustained.

Social Aspects of Woodfuel Production

At the most basic level, the purpose of woodfuel production is to produce energy for the direct or indirect benefit of people. People are required to operate the production system, and people other than producers and users of energy may be affected or have an interest in the system. In other words, there are considerations of employment, community and culture and public attitudes.

Woodfuel production provides direct and indirect employment. The impact varies with the scale of the operation. A farmer with a wood-fired heating system for his home and farm buildings will probably harvest his fuel supply from his own woodlot using his own labour and tractor. There are no wages involved, only 'sweat equity'. Most residue harvesting operations are conducted by contractors. One contractor with a few employees might provide the entire fuel supply for a small district heating plant. A large wood-using power generating plant will normally obtain supply from a number of contractors, with a larger number of employees in total, in turn creating a multiplier effect on other employment. However, as efforts are made to achieve efficiencies of scale in larger operations, including increased use of mechanization, the level of employment may not be directly related to the amount of residues harvested or energy produced. (With integrated systems for harvesting energy wood and conventional forest products, there may be little or no increase in the number of employees beyond the conventional system. However, operational hours may be greater).

Courtesy R. Björheden, Sweden

The employment impact is primarily in the rural areas. This is an important consideration where rural employment and rural depopulation are of concern. In many countries woodfuel production and use for heating and cooking have long been a strong part of the rural culture. This stems from earlier years when distribution systems for oil, gas and electricity were less universal and there was a need for families and small communities to be self-sufficient in energy using locally available natural resources.

Courtesy D. Mead, New Zealand

That need still exists and has become increasingly intense and difficult to satisfy in the developing world. In the industrialized world, the cultural tradition still remains, for example in the Nordic countries where the relatively strong place of woodfuel in the energy supply can be attributed at least in part to the continued interest in careful use of the environment to supply basic needs.

Courtesy J. Richardson, Canada

Sometimes the cultural traditions need to be revived. In the boreal forest region of Canada, many native communities have no year round road or electricity grid connection to the rest of the country. In many cases they are dependent for power - including for space heating - on generators using diesel fuel flown or barged in at very high cost. Yet these remote northern communities are often surrounded by forest which could provide woodfuel in a system that would at once make the community more self-sufficient, reduce costs, provide employment and be sympathetic to the forest-based culture of the native people. There are examples where a shift to locally produced bioenergy has been very successful.

Urban attitudes to woodfuel production are related to urban attitudes to conventional forestry systems in general and to broader concerns for nature and the environment. Among the renewable energy technologies, bioenergy tends to have a lower public profile than wind or solar energy, although it is considered a more mature technology and has a much higher level of use. Increasingly, the general public in the western world, led by the environmental movement, is seeking certification for forest management and forest products. It is to be expected that energy from conventional forestry systems will sooner or later be included.

Conclusion

Wood for energy as a by-product of the growth of natural forest stands and plantations is recognised and used worldwide. In some developing countries this use may not be sustainable due to pressures beyond the scope of IEA Bioenergy to address. However, guiding principles have been developed to help ensure the economic, environmental and social sustainability of woodfuel production systems. All aspects of the system must be considered, since operations, socio-economics and the environment are all inter-dependent.

A complete discussion of the guiding principles for the sustainable production of woodfuel for energy from conventional forestry systems will be found in the forthcoming book - 'Bioenergy from Sustainable Forestry: Guiding Principles and Practices' - produced by Task 18 and to be published by Kluwer Academic Publishers in 2001.

International Energy Agency

The International Energy Agency (IEA) is an autonomous body which was established in 1974 within the framework of the Organisation for Economic Cooperation and Development (OECD) to implement an international energy programme. It carries out a comprehensive programme of energy cooperation among its Member countries.

The basic aims of the IEA are:

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

A. Introducing IEA Bioenergy

Welcome to this Annual Report for 2000 from IEA Bioenergy!

IEA Bioenergy is the short name for the international bioenergy collaboration within the International Energy Agency - IEA. A brief description of 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 included in the collaborative research, as well as broader 'cross-cutting studies' on techno-economic aspects, environmental and economic sustainability, system studies, 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 2000, 19 parties participated in IEA Bioenergy: Australia, Austria, Belgium, Brazil, Canada, Croatia, Denmark, Finland, France, Italy, Japan, The Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States and the Commission of the European Communities.

IEA Bioenergy is now 22 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, ie 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.

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 fourteen ongoing Tasks during 2000:

- Task 17: Short Rotation Crops for Bioenergy
- Task 18: Conventional Forestry Systems for Bioenergy
- Task 19: Biomass Combustion
- Task 20: Thermal Gasification of Biomass
- Task 21: Pyrolysis of Biomass
- Task 22: Techno-Economic Assessments for Bioenergy Applications
- Task 23: Energy from Thermal Conversion of MSW and RDF
- Task 24: Energy from Biological Conversion of Organic Waste
- Task 25: Greenhouse Gas Balances of Bioenergy Systems
- Task 26: Biotechnology for the Conversion of Lignocellulosics to Ethanol
- Task 27: Liquid Biofuels
- Task 28: Solid Biomass Fuels Standardisation and Classification
- Task 29: Socio-economic Aspects of Bioenergy Systems

In addition, there is a special kind of Task (Task 16: Technology Assessment Studies for the Conversion of Cellulosic Materials to Ethanol in Sweden) involving two participants; USA and Sweden. This Task which began in the previous programme period, is the first effort within IEA Bioenergy to undertake a more market-orientated programme, with strong industrial involvement.

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 2000 is shown in Appendix 1.

A progress report for IEA Bioenergy for the year 2000 is given in Section B of this Annual Report.

B. 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 progress reports and accounts from the various Tasks within IEA Bioenergy.

The 45th ExCo meeting took place in Utrecht, The Netherlands, on 29-31 May 2000. Including observers, there were 40 participants at this meeting. The 46th ExCo meeting was held in Zagreb, Croatia, on 8-9 November 2000, with 25 participants.

During 2000, Josef Spitzer from Austria was Chairman of the ExCo and Kyriakos Maniatis from the CEC was Vice Chairman. At the ExCo46 meeting, these gentlemen were re-elected to the same positions for 2001.

The ExCo Secretariat moved to Rotorua, New Zealand under the new Secretary, John Tustin, in January 1998. At the same time, the fund administration for the ExCo and Task funds was also consolidated with the Secretariat, along with production of the newsletter and the website. This consolidation of the management of IEA Bioenergy has been very successful. It has now been decided that John Tustin will provide the Secretariat and Fund Administration service for the period 1 January 2001-31 December 2003. The contact details for the ExCo and Secretariat can be found in Appendices 5 and 6.

The work in the ExCo, with some of the achievements and issues during 2000 is described below.

The new programme for 2001-2003

During 2000, substantial time in the Executive Committee was devoted to the planning of Tasks for the period 2001-2003. Following submission of 'expressions of interest' and discussion at ExCo44, a tendering process was initiated for ten new programmes. There were also some existing programmes which carried forward into the new triennium. The list of Tasks which are active from 1 January 2001 with the relevant Operating Agent (OA) and Task Leader (TL) are as follows:

Task 28: Solid Biomass Fuels Standardisation and Classification

OA: The European Commission.

TL: Andy Limbrick; Email: greenland2.glr@dial.pipex.com

Task 29: Socio-economic Aspects of Bioenergy Systems

OA: Croatia.

TL: Julije Domac; Email: jdomac@eihp.hr

Task 30: Short Rotation Crops for Bioenergy Systems

OA: Sweden.

TL: Theo Verwijst; Email: Theo.Verwijst@Ito.slu.se

Task 31: Conventional Forestry Systems for Sustainable Production of Bioenergy

OA: Canada.

TL: Jim Richardson; Email: jrichardson@on.aibn.com

Task 32: Biomass Combustion and Co-firing

OA: The Netherlands.

TL: Sjaak van Loo; Email: s.vanloo@mep.tno.nl

Task 33: Thermal Gasification of Biomass

OA: USA.

TL: Suresh P. Babu; Email: suresh.babu@gastechnology.org

Task 34: Pyrolysis of Biomass

OA: UK.

TL: Tony Bridgwater; Email: a.v.bridgwater@aston.ac.uk

Task 35: Techno-economic Assessments for Bioenergy Applications

OA: Finland.

TL: Yrjö Solantausta; Email: yrjo.solantausta@vtt.fi

Task 36: Energy from Integrated Solid Waste Management Systems

OA: UK.

TL: Niranjan Patel; Email: niranjan.patel@aeat.co.uk

Task 37: Energy from Biogas and Landfill Gas

OA: Switzerland.

TL: Arthur Wellinger; Email: arthur.wellinger@novaenergie.ch

Task 38: Greenhouse Gas Balance of Biomass and Bioenergy Systems

OA: Austria.

TL: Bernhard Schlamadinger; Email: bernhard.schlamadinger@joanneum.ac.at

Task 39: Liquid Biofuels

OA: USA.

TL: Don Stevens; Email: don.stevens@pnl.gov

As previously reported, with the cooperation of USA and Canada, it was agreed to combine the work of the 'old' Tasks 26 and 27 into one comprehensive new Task 39 on 'liquid biofuels'. This was an excellent response to the initiative of the EUWP/REWP to coordinate all transportation related efforts in their Implementing Agreements.

Supervision of Ongoing Tasks. Review and Evaluation

The progress of the work within IEA Bioenergy is reported by the Operating Agents to the Executive Committee twice per year in connection with the ExCo meetings. As part of this process, at ExCo40 it was decided that some of the Task Leaders should be invited to attend each ExCo meeting to make the Task presentation on their progress and programme of work personally. The idea was to improve the communication between the Tasks and the Executive Committee and also to involve the ExCo more with the Task programmes. This has worked well and both the Task Leaders and the ExCo have been pleased with the outcome of this initiative.

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. IEA Bioenergy also participated in the major four-year review of Implementing Agreements which was recently completed and reported by the CERT to the IEA Governing Board. IEA Bioenergy was found to be a strong and well established programme with appropriate objectives and good management. It was also commended on its strategic plan and encouraged to continue to monitor and report successes. The latter was seen as an important means of securing support and resources. However, the review did identify a need to increase the strategic responsiveness of the renewable energy programmes as a whole. The main elements of the CERT's strategy for this are: increased emphasis on climate change, enhanced involvement of industry, dissemination of information on climate-friendly technologies to non-IEA member countries and increased attention by the CERT to communication with the Working Parties and Implementing Agreements.

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

Approval of Task and Secretariat Budgets

The budgets for 2000 approved by the Executive Committee for the ExCo Secretariat and for the Tasks are shown in Appendix 2. Total funds invoiced in 2000 were US$1,202,671; comprising US$143,050 of ExCo funds and US$1,059,621 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 value in financial terms.

For Task 16, the substantial budget is not handled by the IEA Bioenergy Fund Administrator and therefore these funds are not shown in Appendix 2. There are also considerable 'in-kind' contributions to this Task.

Fund Administration

The International Energy Agency, Bioenergy Trust Account, at the National Bank of New Zealand is functioning smoothly. In 2000 this account was accessed electronically by the New Zealand Forest Research Institute on behalf of the Secretariat. From January 2001, this function will be performed by the New Zealand School of Forestry at the University of Canterbury. The account is an interest bearing account denominated in US dollars. Details for making payments are:

Remit funds to:	Chase Manhattan Bank, New York, USA
	Swift Code: NBNZNZ22
For credit of account:	The National Bank of New Zealand Limited
	Head Office, 1 Victoria Street, Wellington,
	New Zealand
	Account number: 001-1-941473
Quoting:	IEABRS-USD00 plus the invoice number.

The currency for the whole of IEA Bioenergy is US dollars. The main issue faced in fund administration is slow payments from some member countries. As at 31 December, there were US$51,374 of financial contributions for 2000 outstanding.

KPMG is retained as an independent auditor. The audited accounts for the ExCo Secretariat Fund and Task Funds for the period 1 January 1999 to 31 December 1999, were approved at ExCo45. The audit provided an unqualified opinion that the financial accounts of the Trust account were a true and fair record.

Task Administration

New 'Guidelines for Accounts from the Tasks' were prepared and discussed during the year before being approved on 15 January 2001. These are expected to assist a consistently high standard of financial reporting by the Tasks.

At ExCo46, it was agreed that Task 28 'Solid biomass fuels standardization and classification' be prolonged to 30 September 2001. This was to provide time for an application for financial support from the European Commission's ENERGIE Programme to be finalised - a key issue for the current participants.

New Annex documents have been approved for the new Tasks.

Extension of the Implementing Agreement

At ExCo46, it was unanimously agreed that the Implementing Agreement be extended to 31 December 2004. The Secretary and Chairman now have the mandate to seek approval of this through the REWP and CERT.

Strategic Plan 1998-2002

The second Strategic Plan for IEA Bioenergy was distributed early in 1999 and is still current. During 2000 implementation of the Strategic Plan has been a priority item for the ExCo, Operating Agents and Task Leaders. Very good progress has been achieved.

New Participants

Interest from potential Member Countries continued to be strong in 2000. South Africa has continued to show strong interest following a Task 26 workshop in that country. Two observers attended ExCo45. Similarly, two observers from Slovenia attended ExCo46. Other countries showing active interest in 2000 included Ireland and Portugal.

Collaboration with FAO

Formal signing of a Memorandum of Understanding by Mr M. Hosny El-Lakany, Assistant Director-General of FAO's Forestry Department and Dr Josef Spitzer, Chairman of IEA Bioenergy took place early in 2000. This will facilitate collaboration on projects of mutual interest in the field of bioenergy and wood energy. The prime contact at FAO is Mr Miguel Trossero, Senior Forestry Officer (Wood Energy) of FAO's Forest Products Division. This move was foreshadowed in the IEA Bioenergy Strategic Plan. Of particular interest to FAO in the first instance have been Tasks 22, 25, 28 and 29. Progress with this collaboration in 2000 was very pleasing.

First World Conference on Biomass for Energy

The most important conference for IEA Bioenergy in 2000 was the 'First World Conference and Exhibition on Biomass for Energy and Industry' held from 5-9 June in Sevilla, Spain. More than 1000 participants from 61 countries attended the presentations, poster sessions and workshops. In addition, an exhibition of commercial products and services made the conference a global event by presenting the latest achievements in bioenergy research and deployment. The conference, which also constituted the 11th event in the European Biomass Conference series, was a joint undertaking by the European Commission, the US Department of Energy and Natural Resources Canada.

For IEA Bioenergy the conference was a special event for a number of reasons: Firstly, it was Ray Costello, the Executive Committee Member for the USA, who proposed the idea to join European and American biomass forces for a 'world millenium conference on bioenergy' in 2000. He made the suggestion to the organizing committee following the previous European Biomass Conference held in Würzburg, Germany in 1998. The idea was taken up enthusiastically but it still took some lobbying on both sides of the Atlantic to get the high level commitments necessary for such an event.

Secondly, IEA Bioenergy offered both technical and financial support as a co-organizer of the conference and contributed to the planning of the conference programme and the paper and poster selection process. There was an especially strong effort by some of the Task Leaders in this. Thirdly, ExCo Members and Task Participants gave well-received oral presentations in the plenary and technical sessions as well as visual presentations in the exhibition part of the conference. Some Tasks were involved in co-organising workshops on special topics and took the opportunity of many Task participants attending the conference to have their regular Task meetings in Seville.

The presence of high-ranking official representatives from the European Commission, the United States and Canada, signalled the high priority bioenergy has in the energy and environmental policy of these countries. It became evident that in most of the countries represented the biggest share of the planned increase in the use of renewables is assigned to bioenergy. Bioenergy was seen as the most promising source with respect to both the volume to be exploited and in economic terms.

The scope of the conference covered all aspects of the use of bioenergy including technical issues like biomass resources and conversion systems as well as socio-economic and environmental issues. On a number of occasions the importance of networking was emphasized. IEA Bioenergy is responding well to this by including these topics within its ongoing programme of work and new Tasks. Thus the results and conclusions of the conference may be taken as both a confirmation of the priorities and strategies of IEA Bioenergy and strong encouragement to continue its work.

Seminars and Workshops

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 3. Occasionally, seminars and workshops are also arranged by the Executive Committee.

Another major conference in 2000 was the "Progress in Thermochemical Biomass Conversion Conference", the fifth in a series organised by the leader of Task 21, Professor Tony Bridgwater. IEA Bioenergy was a sponsor and strong contributor at this meeting. For more details please see the progress report by Task 21.

Promotion and Communication

The ExCo has continued to show lively interest in communication of IEA Bioenergy activities and information. A new brochure on IEA Bioenergy has been prepared for the next triennium - with information targeted at audiences who are unfamiliar with this collaboration. There is a wide range of other promotional material available through the Secretariat. This includes the Strategic Plan 1998-2002, Annual Reports, the position paper 'The role of bioenergy in greenhouse gas mitigation', a brochure titled 'Short rotation forests for bioenergy', copies of the newsletters and a set of four conference posters on CD-Rom.

The 1999 Annual Report with the special colour section on 'Thermal gasification of biomass' was very well received. Only a few copies remain from the original print run of 1800. However, this report is also available through the IEA Bioenergy website.

The 'new look' newsletter IEA Bioenergy News remains popular. Two issues were published in 2000. 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. Because postage is a major cost item it is proposed that distribution via the IEA Bioenergy website will continue to be a major initiative. The contacts for the Newsletter Editor are provided in Appendix 5. In a new development, newsletter material is being provided to FAO for their Forest Energy Forum publication. In this way, information will be supplied to developing countries which are currently outside of the IEA Bioenergy membership.

In 2001, the website will be upgraded and more closely integrated with other communication activities. In the medium term, the website is viewed as a pivotal element in the IEA Bioenergy communication and marketing strategy.

In a new initiative, 'IEA Bioenergy Update' will be published regularly in the well known journal 'Biomass and Bioenergy'. This provides excellent access to active bioenergy researchers and finds a place in major libraries worldwide. It will include news from the ExCo, reports on events and meetings, progress reports from the Tasks, technical articles and report summaries. Another ExCo initiative is to produce 'position

papers' on topical items of key interest and debate. These will be short, well researched statements written in a largely non-technical style for use by a wide range of audiences. Communication with non-technical audiences, including policy makers, is seen as a key issue.

The recent CERT communication strategy has been welcomed by the ExCo and aspects of the 'code of conduct' have already been implemented.

Greenhouse Gas Mitigation

Task 25 has continued to be very active in this area. Please see the Task contribution in section B2 of this report.

Mr Koji Nakui, Chairman of the IEA Climate Technology Initiative (CTI), R&D Working Group, and also Director, Global Environmental Technology for the Ministry of International Trade and Industry (MITI), Japan attended the ExCo45 meeting. CTI is an organisation launched at the First Conference of the Parties (COP1) in March 1995. Its objectives are to accelerate technology assessment and transfer through a range of activities including research and development. Mr Nakui attended the ExCo meeting because his Working Group had decided to replace their bioenergy related projects with a new proposal and they recognised the need to coordinate this with IEA Bioenergy.

Following on from the attendance of Mr Nakui at ExCo45, there have been further discussions of a joint programme with IEA Bioenergy on biomass-based transportation fuels. Dr Spitzer has invited the CTI group to propose a new Task through the relevant ExCo members - The Netherlands, Finland and Japan. This Task could include all or part of the draft CTI Bioenergy project and build on the current programmes of existing IEA Bioenergy Tasks. The CTI R&D team are now developing a specific proposal. They have welcomed the close contact between the CTI R&D members and the respective IEA Bioenergy Members which should lead to the definition and implementation of a future collaboration in this field.

Interaction with IEA Headquarters

During 2000, the Chairman, Secretary and key Members of the Executive Committee have worked closely with the IEA Headquarters in Paris at both administrative and technical levels. Of special interest, is that in the last two years, the IEA Energy Efficiency, Technology and R&D Office (EET) under its Director Hans-Jorgen Koch has started a number of initiatives to increase the impact of renewable energy in the scope of activities of the IEA. IEA Bioenergy has participated actively in these. They include:

- Establishment of a 'Renewable Energy Unit' (REU) within the Energy Technology Collaboration Division of EET under Hanns-Joachim Neef. The REU is headed by Rick Sellers, bioenergy matters are dealt with by Johan Wide who is the IEA liaison person with the ExCo of IEA Bioenergy. Cooperation with the REU has developed very well assuring an adequate representation of bioenergy in the IEA's spectrum of interest.

- Enhancement of the interaction between the IEA Renewable Energy Working Party (REWP) and the Implementing Agreements (IA) under it, e.g. IEA Bioenergy. REWP Chairman Roberto Vigotti and Vice Chairman Gerhard Faninger are meeting with IA Chairmen regularly offering the opportunity to assure that the input from the Task work in the IAs is made visible and on the other hand to interact with the other IAs. The Chairman of IEA Bioenergy has used this opportunity by attending the two meetings held in 2000.

- Starting a 'Renewable Energy Market Initiative' whose goal it is to develop a 'strategy to realise renewables contribution to energy diversity'. The contribution of IEA Bioenergy to this has been with respect to technology options and economy of deployment provided by Kai Sipilä, the ExCo Member for Finland. Part of this initiative was the REWP workshop on 'Developing a New Generation of Sustainable Energy Technologies - Long Term R&D Needs' held on October 11, 2000 in Paris, with IEA Bioenergy represented by the Chairman.

These initiatives are an excellent response to an increased interest in renewable energy expressed by high level IEA bodies, including the annual 'Ministerial Meeting'. They also enable the IEA to provide input to the 'Task Force on Renewable Energy' established by the 'G 8 States' for its next summit meeting in June 2001. Mr Robert Priddle, Executive Director of IEA, is a member of the Task Force and the IEA provides the secretariat function.

ExCo members visiting the PUTO waste-to-energy plant near Zagreb, Croatia.

2. PROGRESS IN 2000 IN THE TASKS

TASK 16: Technology Assessment of Cellulosic Materials to Ethanol in Sweden

Overview of the Task

The objective of Task 16 is to develop technologies for the conversion of straw and wood to ethanol for transportation fuels. Interested organisations and the governments of Sweden and USA are working together to collect data on specific ethanol processes and develop a technical database to be used for the design of a commercial scale plant.

This is the first effort within IEA Bioenergy involving a more market-oriented Task and strong industrial participation. The project involves proprietary information and intellectual property, and necessary safeguards to protect the interests of industry have been put into place.

The participating countries are Sweden and the USA.

As in other Tasks, a Task Leader, appointed by the Operating Agent (USA) 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 16, please refer to Appendices 2-5 inclusive and www.ieabioenergy.com under 'Current Tasks' on the IEA Bioenergy website.

Progress in R&D

Work Programme

The Task was initiated in October 1997 and was originally envisaged as a comparatively short common effort between Sweden and the USA. The governments planned to work closely with industries in each country to gather data that would be used for designing a commercial biomass-to-ethanol facility.

The Task made excellent progress in 2000. Intellectual property issues, which had previously delayed the project, were resolved. All relevant documents and agreements were completed, and the industrial and government participants held a 'kick-off' meeting in Colorado in August 2000.

Experimental work is proceeding as planned. The initial effort in 2000 focused on the characterization of the biomass feedstocks (straw and wood residues) that will be converted to ethanol. Work on feedstocks from both Sweden and the USA is complete. The characterization studies demonstrated that the two sets of feedstocks are very similar. As a result, the participants decided to use material obtained in the USA for the ethanol production experiments. These are being undertaken at the NREL demonstration facility in Golden Colorado. Modifications of the facility were completed in December 2000, and the participants anticipate that this production testing will be completed in

May 2001. Final reports will include detailed analyses for the participants plus a non-proprietary summary for general distribution. All reporting will be completed in June 2001.

TASK 17: Short Rotation Crops for Bioenergy

Overview of the Task

The objective of Task 17 is to meet the need of bioenergy industries through technical improvement of biomass crop production technologies, through documenting and disseminating information on the potential environmental benefits of biomass crop production systems, and through developing information to enhance market development in collaboration with the private sector. The overall aim is to further develop the existing short rotation biomass production systems, to improve awareness of the bioenergy production potential of the concept, and to promote use of biomass for energy in participating countries. The intention is to strengthen the contact and cooperation between scientists, machine developers, entrepreneurs in the production chains, and end users, with the aim to improve understanding of the problems and to find means of solving them.

'Short rotation crops for bioenergy' means woody crops such as willows, poplars, *Robinia* and *Eucalyptus* with coppicing abilities as well as lignocellulose crops such as reed canary grass, switchgrass, *Miscanthus* and others.

The country participation in 2000 was Australia, Canada, Croatia, Denmark, Italy, The Netherlands, Sweden, UK, USA, and the Commission of the European Communities.

As in other Tasks, a Task Leader, appointed by the Operating Agent (Sweden) 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 17, please refer to Appendices 2-5 inclusive.

Progress in R&D

Task Meetings and Workshops

The Task was active in 2000. The fourth meeting was held 6-10 March in Albany, Western Australia. Representatives of each of the member countries presented country reports. There were also 'special topic' papers on sustainability and biodiversity, water and nutrient use efficiency, vegetation filters, pests and diseases and education and courses. These will be published in the proceedings of the meeting.

The fifth and last meeting of the Task was held on 11-14 December in Noordwijk, The Netherlands followed by a mini excursion to Sweden. The latter was arranged for those who were interested in large scale harvesting and transportation. The meeting theme was 'participation and community outreach to gain support for the implementation of integrated energy cropping systems'. Approximately 30 participants attended The

Netherlands section of the meeting which had two days of papers and discussions and two days of study tour. All the participating countries were represented except Canada, Italy and the CEC. The papers presented will be published in a proceedings compiled and edited by Lars Christersson and Leen Kuiper. This is expected to be published in Sweden during February 2001. Fifteen participated in the Swedish part of the meeting which focused on demonstration of various harvesting machines.

Collaboration

Apart from collaboration with other IEA Bioenergy Tasks; the Task has developed successful cooperation with both IUFRO and the International Poplar Commission (IPC). There are also members collaborating in current EU projects e.g. The Regrow project which includes The Netherlands, UK and Sweden. Papers of considerable value to the Task programme of work have stemmed from this collaboration.

The Task Leader participated in the ExCo45 meeting in Utrecht and gave a slide presentation of the programme and work of the Task. Also at this meeting, the new programme 'Short Rotation Crops for Bioenergy Systems' which is a continuation of Task 17 was presented by Professor Theo Verwijst.

The Task Leader participated in the IUFRO World Congress in Kuala Lumpur Malaysia, 7-12 August. He organised and chaired the section on 'Short Rotation Forestry for Biomass Production'. Also, in September, he participated in the 21st session of the International Poplar Commission (IPC 2000) in Portland USA and chaired one session. The new leader of the Task, Professor Verwijst, has replaced him on the board of IPC.

Deliverables

The deliverables from the Task in 2000 and 2001 include: minutes of business meetings; two progress reports to the ExCo; and the proceedings of two workshops held in Albany, Western Australia and Noordwijk, The Netherlands. In addition to these outputs, reports are also in preparation on priority topics including: sustainability, large scale implementation of biomass cultivation, vegetation filters and water and nutrient efficiency. Publication of these in scientific journals is envisaged. A final report from the Task for the triennium 1998-2000 will also be produced.

From January 2001, Task 17 will continue as Task 30: 'Short Rotation Crops for Bioenergy Systems' with Professor Theo Verwijst, Sweden, as the Task Leader.

TASK 18: Conventional Forestry Systems for Bioenergy

Overview of the Task

The objectives of Task 18 are to develop systems and guidelines for environmentally sustainable and economic production of biomass for energy from conventional forestry systems, and to promote their acceptance and use in relation to silviculture, forest management, harvesting and transportation.

The Task is developing and synthesizing information needed to design or implement sustainable forest management and harvesting systems for production of biomass for energy in conjunction with other forest products. Within the overarching theme of sustainability, Task collaborators evaluate productivity, environment, social, economic, and legal and institutional criteria, within the context of plantation and naturally regenerated forests in key forest regions of member countries. These criteria are common to the international processes defining sustainable forest management such as the Montreal Process.

Task collaborators envisage that, through their efforts, integrated assessments of forest management practices, environmental conditions and socio-economic factors will improve productivity, forest health and efficient utilization of forest resources, including biomass for energy from plantations and naturally regenerated forests in the major forest biomes. 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 in the Task in 2000 were Australia, Belgium, Canada, Denmark, Finland, The Netherlands, New Zealand, Norway, Sweden, the United Kingdom, the United States and the Commission of the European Communities. The Task was led by an international team from Canada, Finland, New Zealand and the United States. The national teams in participating countries comprise an extensive group of scientific and technical collaborators.

For further details, please refer to Appendices 2-5 inclusive and also the main IEA Bioenergy website at www.ieabioenergy.com

Progress in R&D

Task Meetings and Workshops

The final Task workshop was held in Coffs Harbour, New South Wales, Australia, 18-20 October. The theme was 'Bioenergy from sustainable forestry: principles and practices'. The objective of the workshop was to identify guiding principles for sustainable bioenergy production from conventional forestry systems based on state-of-the-art knowledge in three main topic areas:

- environmental sustainability, including biodiversity, soil quality and site productivity, carbon sequestration, and monitoring change at varying scales;
- silvicultural treatments and practices, including economic and social considerations; and
- harvesting and procurement, including quantity and quality of wood fuel and cost reduction.

Approximately 50 participants from nine countries took part in two days of field visits and three days of technical presentations. The workshop was organized locally by State Forests, New South Wales. The field visits in southeast Queensland and northeast New South Wales featured a variety of points of bioenergy interest and potential, including use of bagasse and urban wood waste for energy, use of woody weeds for bioenergy, rainforest ecology and management, hardwood plantation management and sawmilling

of native hardwoods. During the technical program, a total of 28 invited and volunteer papers and posters were presented. Most of the papers will be published in a peer-reviewed proceedings as a special issue of the New Zealand Journal of Forestry Science.

Following the workshop in Australia, there was an associated three-day study tour in the South Island of New Zealand in which 25 delegates participated. This tour included demonstration and discussion of nutritional management of radiata pine plantations and native beech forests, recycling biosolids to forests, pellet fuels, forestry in the South Island high country, sustainable management of indigenous forests for timber production, and harvesting of radiata pine.

Deliverables: Synthesis Publication

One of the primary Task outputs is a publication that synthesizes available ecological, physical, operational, social and economic information, and identifies gaps in knowledge related to sustainable biomass production and harvesting systems. The book is organized around the criteria for sustainable forest management: productivity, environment, social, economic, and legal and institutional framework. It emphasizes guiding principles and state-of-the-art knowledge in a concise and distilled form, rather than trying to provide a detailed 'how-to' handbook covering every possible situation. The scale of resolution for the information is primarily at the 'forest region' level. An attempt has also been made to provide information or interpretations on generalizable principles that span forest regions, such as effects of management on soil carbon. This Task output will be useful for regional or global modelling applications. The primary audience for the publication is forest resource managers and planners to enable them to evaluate the ability of specific forest regions to sustainably meet bioenergy production demands.

Writing for the publication which is titled 'Bioenergy from Sustainable Forestry: Guiding Principles and Practices' continued in 2000 through several drafts. A team of more than 25 authors and contributors have prepared individual sections of the ten chapters of the book. Almost all chapters have entered the review process which is being managed by the Task leadership team who are the editors of the book. The editors and Task Secretary met in Texas in April to plan the review and production phases, and again in October in Australia to review progress. The production phase of the project has been facilitated by the Task Secretary and the New Zealand Forest Research Institute Ltd. The completed manuscript will be delivered to the publisher, Kluwer Academic Publishers by 30 April 2001.

The proceedings of the second annual Task workshop which was held in Charleston, South Carolina, USA in September 1999 were published in a special issue of the New Zealand Journal of Forestry Science. The publication includes a total of 20 invited and volunteer papers on the theme of 'Integrating production of energy in sustainable forestry: guiding principles and best management practices'.

Communication and Promotion

Communication of the goals, activities and outputs of the Task is a vital element of the promotional aspect of the Task. A strong presence for the Task has been established on the Internet, through the main IEA Bioenergy website, and is being actively maintained. Most Task informational materials are available through this site, including workshop announcements and a list of collaborators.

The Task published the second in a series of Technical Notes, intended primarily to communicate to forest managers and practitioners valuable practical information emerging from Task activities. This issue was distributed through Task national team leaders in April. A third issue will appear early in 2001.

Following the field study tour in New Zealand in October 2000, an 'Industry Day' was held in Nelson, New Zealand. Hosted by the Forest Research Energy Project, this brought together international experts associated with the Task and personnel from New Zealand forest industry and energy companies to share their knowledge and experience of the issues and opportunities related to the production of energy from forest residues. Nearly 50 people took part in the event which stimulated lively discussion of bioenergy potential in New Zealand.

The Task was also responsible for preparing the text and illustrations for the special colour section in this Annual Report. It illustrates and summarizes the issues and opportunities in producing bioenergy from conventional forestry systems.

Collaboration with Other Tasks

Several other current IEA Bioenergy Tasks have objectives and interests that are complementary to those of Task 18. Strong links are maintained with these Tasks through sharing of information and, where possible, joint workshops. A joint workshop has been planned with Task 29 'Socio-economic aspects of bioenergy systems' to take place in Alberta, Canada in May 2001. This will involve the new Task 31 which succeeds Task 18. Discussions have continued with Task 17 'Short rotation crops for bioenergy' (and its successor) regarding a possible joint meeting, recognizing that there is no clear boundary between the biomass sources of interest to the two Tasks. There has also been on-going discussion and collaboration with Task 25 'Greenhouse gas balances of bioenergy systems' in relation to common interests and complementary expertise, particularly in carbon sequestration. Opportunities for collaboration and cooperation with other international researchers, organizations and activities are also pursued, particularly where there is involvement in issues of sustainability of forest ecosystems. This has included efforts to develop and capitalize on forestry contacts in Brazil with an interest in bioenergy.

TASK 19: Biomass Combustion

Overview of the Task

Task 19 builds on the work programme of the previous Biomass Combustion Activity within the 'old' Task XIII. Since combustion is well-established commercially and accounts for over 90% of the bioenergy conversion technologies in use, the scope of the work emphasises the expanded use of biomass combustion for heat and power generation, in close cooperation with industry. The main benefits of combustion compared with other technologies (i.e. gasification, pyrolysis, liquefaction) is that combustion technology is commercially available and can be integrated with existing infrastructure at both large and small scale. For further implementation, combustion technology should nevertheless

be continuously optimised to maintain competitiveness with improving gasification and pyrolysis technologies. In this final year of Task 19, more emphasis has been put on issues related to the co-combustion of biomass in coal-fired power plants.

The objective of Task 19 is to stimulate the use of biomass combustion for the production of heat and power on a wider scale. This objective will be achieved by generating and disseminating information on technical and non-technical barriers and solutions. Significant factors in Task 19 are industrial participation, interaction with other IEA Bioenergy Tasks and interaction with the relevant CEC programmes. Enhancement of the industrial participation can be realised by formulating joint projects between participating members and industry.

The emphasis of the activities in the Task is therefore on:

- market introduction for expanding the use of biomass combustion in the short term;
- optimisation of biomass combustion technology to remain competitive in the longer term.

The country participation in 2000 was Australia; Austria; Belgium; Brazil; Canada; Denmark; Finland; The Netherlands; Norway; New Zealand; Sweden; Switzerland; United Kingdom; USA and the Commission of the European Communities.

As in other Tasks, a Task Leader, appointed by the Operating Agent (The Netherlands) 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 19, please refer to Appendices 2-5 inclusive.

Progress in R&D

Task Meetings and Workshops

Two Task meetings were held in 2000. The fifth Task meeting took place during the First World Conference on Biomass for Energy and Industry, Sevilla, Spain on 5-9 June. The main topics at this meeting were the production of a handbook on biomass combustion and the collaboration with IEA Clean Coal Science Group (CCS) on co-combustion of biomass with coal and Task 28 on the characterisation of biofuels.

At the above conference, Task 19 coorganised a workshop on the constraints for co-combustion of biomass/waste in coal-fired power plants together with the IEA Clean Coal Science Group and an EU-project on this topic. Over 130 participants attended the seminar which incorporated both the results of two workshops held earlier in the EU-project as well as co-firing experiences and research activities in the USA. The report from this workshop and a brochure were distributed widely.

On 9 June, a Task 19 workshop on biomass combustion modelling was held. Of the 13 organisations that were invited on the basis of a questionnaire sent out earlier, 11 participated. The workshop provided a platform for developers of various biomass combustion models from different organisations and countries to exchange experiences and difficulties in an open setting, which was much appreciated. The report of this workshop has already been distributed to all participants and Task members.

The sixth meeting of Task 19 was held in Brisbane, Australia, 7-8 December, together with the 'Bioenergy Australia 2000' conference. At this meeting, the revised draft of a handbook on biomass combustion was discussed. Other important topics addressed were the current problems with co-combustion of biomass in coal-fired power plants and other developments related to combustion in member countries. Also, a workshop and discussion was held with experts from the Australian Biomass Taskforce on important issues related to biomass combustion in Australia. Finally, a Task evaluation was performed and proposals for Task activities under the new Task 32 'Biomass Combustion and Co-firing' were discussed.

Work Programme

Based on the priorities identified by the participating countries and discussions at the first Task meeting, work has been proceeding on seven projects. In 2000, 'co-firing' was added. Progress with these is summarised below.

- *Ash related problems during combustion - Co-ordinator: USA.* The work programme of this activity was presented at the 2nd Task meeting in Herning. Emphasis was put on the dissemination of results from research and demonstration projects related to co-combustion of herbaceous and woody biomass in coal-fired power plants. Insights gained with deposition and corrosion mechanisms were shared amongst the member countries.
- *Characterisation and utilisation of biomass ashes - Co-ordinator: Austria.* The proceedings of the workshop 'Ashes and Particulate Emissions from Biomass Combustion' were distributed amongst the Task members. This report contains guidelines for ash utilisation and the presence and removal of heavy metals from biomass ash. A Dutch report on options for the utilisation of ash from reject wood was translated into English and distributed amongst the member countries. Finally, an extensive database on the composition of ash from biomass combustion installations has been established. This database will be made available though the Task's internet site in 2001.
- *Classification of biofuels - Co-ordinator: The Netherlands.* A best practice list for analysing biomass fuels and ashes, prepared in the Netherlands, was distributed in 1999.

  At this time, a separate IEA Bioenergy Task 'Solid Biomass Fuels Standardisation and Classification' (Task 28) was initiated. This Task is restricted to biomass fuels and excludes biomass ashes. Members of Task 19 provided input to Task 28.

  Finally, a starting document was written for the initiation of a round robin test, focusing on the analysis of moisture content, ash composition and particle size from biomass fuels and ashes. This round robin should assess analysis problems and eventually lead to an IEA-standard. Regretfully, it was not possible to perform the test during the current triennium, since although the proposal was taken up in an EC biomass classification project, it was not accepted for funding.
- *Modelling - Co-ordinator: The Netherlands.* A questionnaire was sent out to 59 R&D organisations, manufacturers etc. in participating countries to evaluate the content and status of ongoing modelling projects. Thirty-eight questionnaires were returned. The results of the survey were evaluated and shared with the respondents.

After an evaluation of the questionnaires, a subset of 13 organisations with models with common focus was selected and invited to participate in a workshop, on the modelling of biomass combustion and the calculation of emissions. Eleven organisations were present at the workshop. Most of these models are on a process scale, describing wood combustion on a grate or in a fluidised bed. The majority of models were:

- still under development, validation or a detailed application,
- used for process design and meant for the calculation of emissions,
- CFD-based or dynamic physical, and
- about half include drying, pyrolysis and gasification prior to combustion.

This Task 19 workshop provided a forum for developers of various biomass combustion models from different organisations and countries to exchange experiences. It is anticipated that some of the problems identified during the discussions may be surmounted through future bilateral or multilateral cooperation. The report of this meeting was distributed through all interested organisations and the Task members.

- *CHP - Co-ordinator: Switzerland.* This project is solely implemented by Switzerland. A number of presentations have been given at meetings of Task 19 on the progress with decentralised CHP based on biomass combustion.
- *State-of-the-art combustion/Handbook - Co-ordinator: The Netherlands.* After preparation of a draft report by the Netherlands in 1999 on the state-of-the-art of biomass combustion, it was decided by the Task members to significantly broaden and deepen the contents of the report to the level of a 'Handbook of Biomass Combustion'. For this purpose, various chapter coordinators collated information supplied by individual Task members. During the fifth Task meeting in Sevilla, in June, a first draft of this handbook was discussed. After implementing a number of modifications, the second draft was discussed at the sixth Task meeting in December. It is expected that the handbook will be published in late 2001. An internet version will also be made available.
- *Co-firing - Co-ordinators: USA/The Netherlands.* This activity was initiated in 1999 after it was realised that in many member countries, biomass will be used increasingly in existing coal-fired power plants to substitute coal. Technical problems arise with regard to corrosion (in particular with biomass fuels containing concentrations of chloride) and ash deposition.

  In early 2000, a MoU was signed with IEA Clean Coal Science Group to exchange information related to co-combustion of biomass in coal-fired power plants. At the First World Conference and Exhibition on Biomass for Energy and Industry in Sevilla, Spain, a workshop was organised together with IEA CCS and an EU project on the technical and non-technical barriers for biomass co-combustion.

Collaboration with Other Tasks

The work of the Task is closely related to other IEA Bioenergy programmes, especially in the areas of biomass gasification, co-firing of biomass and techno-economic analysis. Co-ordination of the activities is stimulated by the exchange of meeting minutes and reports and the arranging of joint meetings.

Deliverables

The deliverables from the Task in 2000 included: facilitation of seven projects; organising and minuting two Task meetings; organising a workshop on biomass co-firing; organising a workshop on biomass combustion modelling; preparation of a 'Handbook of Biomass Combustion'; signing an MoU with the IEA Clean Coal Science Group and reporting to the Executive Committee.

TASK 20: Thermal Gasification of Biomass

Overview of the Task

The objectives of Task 20 are to review and exchange information on biomass gasification research, development, and demonstration (RD&D); to promote coordinated RD&D among the participating member countries and to seek continuing interaction with industry experts with the ultimate aim of eliminating technological impediments to commercialization of thermal gasification of biomass.

The scope of work for this Task is focussed on promoting commercialization of biomass gasification for the production and direct utilization of clean-burning fuel gas as a substitute for conventional fuels in boilers, gas engines, and Stirling engines, for district heating, for co-generation and other power generation applications, for the production of synthesis gas for subsequent conversion to liquid fuels, chemicals, and commercial products and also to produce hydrogen for fuel cells and other applications.

In this Task, 'gas processing' means gas clean-up and further conversion of gas to hydrogen, chemicals, liquid fuels, and commercial products. 'Moving bed' gasifiers are synonymous with 'fixed bed gasifiers'.

The country participation in 2000 was Austria, Brazil, Canada, Denmark, Finland, Italy, Norway, Sweden, Switzerland, The Netherlands, UK, USA and the Commission of the European Communities.

As in other Tasks, a Task Leader, appointed by the Operating Agent (USA) 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 20, please refer to Appendices 2-5 inclusive.

Progress in R&D

Work Scope, Approach and Industrial Involvement

The scope of work for the Task for the period 1998-2000 is a continuation of the 'Thermal gasification' work programmes in previous trienniums. In these programmes, information exchange, coordinated RD&D, and industrial involvement have been very effective so these remain the basic foundations on which to implement the present work of this Task.

Biomass gasification can convert a variety of biomass materials to produce a flexible fuel form that could readily replace fossil fuels in many of the present energy conversion applications with significant environmental benefits. Air-blown gasification of biomass in moving bed gasifiers produces a low calorific value (LCV) fuel gas which has been used for district heating and on-site power generation. Examples include the BIONEER gasifier in Finland and the Pyroforce gasifier in Germany and Austria. LCV fuel gas produced from circulating fluidized bed (CFB) gasifiers, is now used as a clean burning fuel gas in boilers, lime kilns, and in co-fired pulverized coal boilers with many economic and environmental benefits. The Wisa Forest gasifier and the Lahti project gasifier in Finland are illustrative of these applications. The present generation of moving bed gasification and both low pressure and high pressure CFB and bubbling bed gasification systems are being developed to fully explore the benefits of biomass reactivity, to improve efficiency of power generation, and to improve system reliability, economics, and the overall environmental benefits. The pressurized, IGCC CFB Foster Wheeler-Alstrom Gasifier at Varnamo, Sweden has successfully demonstrated that it is possible to realize power generation efficiencies of more than 45%. Advanced integrated system designs utilizing treated waste water sludges as soil conditioner for short rotation forestry, high efficiency gasification of single and mixed feed stocks, high efficiency fuel gas energy conversion to electricity, recycling of gasification ash to energy plantations, and effective effluent treatment are the criteria for selection, design and implementation of the present biomass gasification demonstration projects. The ARBRE project in Yorkshire, UK is one such fully integrated biomass gasification project.

Biomass gasification fuel gases could be easily blended with natural gas for direct combustion and with minor equipment modifications biomass fuel gases could be exclusively used in most of the present natural gas and other fuel gas energy conversion devices. It is anticipated that biomass gasification and the development, demonstration, and optimization of biomass fuel gas energy conversion devices will become an essential part of global efforts to develop sustainable energy options to substitute for fossil fuels. Recognizing these benefits, many countries are actively developing biomass gasification technologies for on-site power generation, co-generation, and for the production of substitute fuel gases.

With increasing interest and commitment to 'green-energy' in many of the Western countries, emphasis in the work program has been given to identification of mature and near-mature small-, medium-, and large-scale gasification technologies that are proven to be ready for commercial applications. In addition, the participating national experts (PNEs) in the Task have identified critical technological impediments to commercial implementation of advanced biomass gasification processes. This exercise has also helped the PNEs to prioritize and develop their national RD&D plans. When successfully developed the results from these RD&D programs will collectively contribute to advancing the state-of-the-art of biomass gasification.

As in the previous trienniums, the Task reviewed a variety of technical issues related to advancement of biomass gasification, by electronic mail, faxes, letters and at the semi-annual Task meetings. In this process subtask studies were selected, prioritized, and a coordinator was assigned by consensus to lead the selected high priority subtask studies. Schedules were developed to undertake these studies and for publishing the results. The Task Leader in consultation with the PNEs has planned and conducted joint meetings with other national and international organizations to add value to the Task activities.

The Task has continued the practice of inviting industrial and academic experts to the Task Meetings, to promote interaction between these experts and PNEs. This interaction has been valuable in developing auxiliary technologies that improve overall system reliability and performance. The Task has continued to work with these experts, to develop reference protocols for process characterization, system evaluation purposes, and to identify critical technical issues. So far the effective interaction between industry and the PNEs have also led to cooperative RD&D projects in some of the participating countries. The Task has conducted semi-annual Task Meetings, focussed seminars, workshops, and round table discussions involving industrial experts and representatives from utilities and the distribution of resulting reports among the participating member countries.

Task Meetings

Task Meetings are generally linked to special topic workshops and seminars, and plant visits. The fifth Task meeting was held from 5-7 April in Enschede, The Netherlands. Plant visits were arranged to see the KARA/BTG moving bed gasifier and the AMERGAS co-firing plant.

The Task assisted the organizing committee of the First World Biomass Conference held from 5-9 June in Seville, to present oral and visual presentations on various aspects of biomass gasification RD&D and workshops on 'RD&D Needs' and 'Biomass Derived Fuels Energy Conversion Devices'. Several of the Task participants presented papers and chaired sessions at this conference.

The sixth and final Task Meeting was held from 4-6 October in York, UK. A one-day seminar on 'Fuel Gas Energy Conversion Devices' was organized with industrial and academia experts. A plant trip was arranged to visit the ARBRE demonstration project in Eggsborough, UK.

The Task acknowledges the support and help provided by many of the participating and host countries for the planning and running of Task meetings. In particular, the European Commission, Belgium; ESB, Ireland; VTT, Finland; NREL, USA; The World Bank, USA; NOVEM, The Netherlands; BTG, The Netherlands and AEAT, UK deserve special recognition.

Deliverables

Apart from the normal Task meetings, Task meeting minutes and special topic discussions, the deliverables from the Task in 2000 included conducting the following subtask studies and publishing the results:

- Update surveys, reviews, and evaluation of - national RD&D programs, national gasification projects, including pilot plants and demonstration plants. Subtask Coordinator: Kees Kwant, NOVEM, The Netherlands.
- The Tar Measurement Protocols, for the large scale and medium/small-scale systems were published in the Journal of Bioenergy. A report will be prepared from these publications for distribution to the Task participants and also to the ExCo members.

- Evaluation of large-scale gasification systems - Subtask Coordinator: Gert Huisman, Consultant, The Netherlands.
- Gas clean-up and gas processing - Subtask Coordinator: Richard Bain NREL, USA.
- A report on process waste water characterization - Coordinator: Henrik Christiansen, DEA, Denmark.
- Gas utilization and energy conversion - commercial gas utilization and energy conversion technologies - Subtask Coordinator: Nick Barker, AEAT, UK.
- Innovative systems and research needs - Subtask Coordinator: Kyriakos Maniatis, CEC, Belgium.
- A unified tar protocol - A multi national study in progress. Subtask Coordinator: John Neeft, ECN, The Netherlands.
- Procedure for measuring fuel gas heating value - Subtask Coordinator: Lars Waldheim, TPS, Sweden.

The end-of-Task deliverables will include reports from each of these subtasks and an overall end-of-Task report.

TASK 21: Pyrolysis of Biomass

Overview of the Task

The overall objective of Task 21 is to develop and extend the Pyrolysis Network (PyNe) that provides a forum for the discussion, evolution and dissemination of all aspects of biomass fast pyrolysis from preparation of feedstock through the fast pyrolysis process to utilisation of the liquid product for energy, electricity and chemicals production.

The specific objectives of PyNe are:

- to establish a forum for promotion and development of biomass fast pyrolysis,
- to establish good interactive and collaborative links between researchers, industry and policy makers,
- to actively contribute to the development of the science and technology and resolve major issues to enable the technology to be implemented more quickly and more effectively, and
- to ensure that the benefits and advantages of fast pyrolysis are communicated to as wide an audience as possible.

The activities in the Task are focussed on Subject Groups for development and evolution of science and technology which are discussed and reviewed at regular meetings. These meetings are held two or three times a year. Reports from all these activities are reported in the newsletter and are further disseminated via the website.

The Task is a joint programme between IEA Bioenergy and the CEC. The participating countries are: Austria, Belgium, Brazil, Canada, Denmark, the Commission of the European Communities, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, UK and USA.

As in other Tasks, a Task Leader, appointed by the Operating Agent (the Commission of the European Communities), directs and manages the work programme. In each country participating in Task 21 a National Team Leader is nominated, responsible for the coordination of the national participation in the Task.

For further details on Task 21, please refer to Appendices 2-5 inclusive and also the Task website: www.pyne.co.uk

Progress in R&D

Task Meetings and Workshops

The Task was very active in 2000. The fifth Task meeting was held in Semmering, Austria in February in conjunction with a workshop which was a joint meeting with Task 27, Liquid Biofuels. This was attended by 35 people. A Steering Committee meeting was also held.

A workshop was organised by PyNe during the First World Conference on Biomass for Energy held in Seville in June.

The sixth Task meeting was held in Birmingham in December 2000 with two themes. The first theme was to discuss the progress made in the Subject Groups and the second was to look at commercialization issues with speakers from UK regulatory bodies and companies offering pyrolysis technologies. Study tours were made to the Wellman 250 kg/h fast pyrolysis pilot plant in Oldbury near Birmingham and to Ormrod Diesels near Wigan. The latter are operating a 250 kWe engine in dual fuel mode on bio-oil.

Minutes for all of these meetings have been published and distributed.

Subject Groups

The technical and scientific focus of the Task is on the Subject Groups, which have been described previously in the 1998 Annual Report and also in the PyNe newsletter. The activities are now substantially completed and the final report is in preparation.

- *Analysis and Characterisation Group* - Dietrich Meier, IWC, Germany and Anja Oasmaa, VTT, Finland. The 'Round Robin' has now been completed and the results will be published in the final report.
- *Health, Safety and Environmental Group* - Philippe Girard, CIRAD, France. An application was made to the EC 5th Framework Programme for substantial funding to carry out toxicological tests on bio-oil in order to obtain formal authorisations. Unfortunately this was not successful, but another application will be made in 2001.
- *Implementation Group* - Max Lauer, Joanneum Research, Austria. Data has been collected from PyNe members and the competitivity of bio-oil has been evaluated around Europe. The results of the survey will be published in the final report.

- *Science and Fundamentals Group* - Jan Piskorz, RTI, Canada. A review of the activities of this group will appear in the final report together with a selection of papers from workshops held during the period.
- *Stabilization and Upgrading Group* - Stefan Czeernik, NREL, USA and Rosanna Maggi, UCL, Belgium. The work of this group is now completed and a review will be included in the final report.

Overall, the network has continued to be the leading source of up-to-date information on the science and technology of fast pyrolysis of biomass that includes production of bio-oil and applications for the products. All members have maintained a high level of commitment and participation at meetings by official members is at the high level of 95% with increasing participation by industry. The integration of this IEA Bioenergy Task with the EC sponsored network is working very well indeed and no problems have been encountered.

Collaboration with Other Tasks/Networking

A joint meeting was held with Task 27 Liquid Biofuels in Semmering in February 2000. A significant activity of the Task during the year was a major contribution to the conference on Progress in Thermochemical Biomass Conversion (PITBC) held in the Tyrol, Austria in September. This is reported in detail below.

The Task organised a workshop at the First World Congress on Bioenergy in Seville in June. The Task Leader also attended ExCo46 in Zagreb in November and presented the work of the Task to the Executive Committee.

PITBC Conference

The Progress In Thermochemical Biomass Conversion Conference (PITBC) was the fifth conference in the series of Thermochemical Conversion Conferences. This conference was again organised by the Task Leader, Tony Bridgwater. The PyNe newsletter, website and contacts played a major role in the conference.

The PITBC was sponsored by IEA Bioenergy, the Austrian Federal Ministry of Transport, Innovation and Technology, the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, Natural Resources Canada, the Department of Trade and Industry, UK, and VTT - Technical Research Centre of Finland.

This conference covered all aspects of thermal biomass conversion systems from fundamental research through applied research and development to demonstration and commercial applications reflecting the progress made in the last four years. The technical programme included formal presentations, posters, workshops and discussions. A wide range of papers were offered and they were grouped into three main topics: Combustion; Gasification; and Pyrolysis.

Of the 164 papers offered 126 were presented at the conference. There were 165 delegates from 29 countries around the world with a good representation from Asia and North America. All the papers have been peer reviewed and the proceedings will consist of 137 contributions to be published by Blackwell Science early in 2001.

Newsletter

The half-yearly newsletter is growing in popularity with continuing demand for copies which is very encouraging. Three thousand copies of each issue are printed and distributed all around the world. Much of the information, including back copies in PDF format, is available on the PyNe website. The ninth issue was published in March and the tenth issue in December. The delay in publication being due to the PITBC conference in September. Any request relating to newsletter circulation should be addressed to the Task Leader.

Website

The Task 21 website: www.pyne.co.uk has been launched independently on the Internet from Aston University. It is regularly updated and is proving to be very popular.

Deliverables

The PyNe-Pyrolysis Network has continued to be the leading source of up-to-date information on the science and technology of fast pyrolysis of biomass that includes production of bio-oil and applications for the products.

The deliverables from the Task in 2000 included: two Task newsletters; minutes of two Task meetings; minutes of one joint meeting; minutes of one steering group meeting; and a large selection of papers presented at the PITBC conference.

Due to the disparity in the timing of European Commission support and the IEA Bioenergy year, the final report will be published in March 2001.

TASK 22: Techno-Economic Assessments for Bioenergy Applications

Overview of the Task

The objective of Task 22 is to carry out site-specific prefeasibility studies. The aim is to help companies commercializing new bioenergy technologies promote their services. Together with industrial partners, the participants in Task 22 are studying selected bioenergy applications on a techno-economic basis. The technologies studied included power production from bagasse residues at a sugar mill site, and combined-heat-and-power production from wood biomass at a sawmill. The companies involved in the second phase studies were Magellan Aerospace Corp., Canada and Sermet Oy, Finland.

The Task was originally planned for one and half years with the last Task meeting to be held in connection with the Fourth Biomass Conference of the Americas in August 1999. However, at ExCo43, it was agreed that the Task would be prolonged to 31 December 2000, with new studies in the participating countries. Countries participating in the

second phase of the Task are Canada, Finland, Sweden, and the USA.

As in other Tasks, a Task Leader, appointed by the Operating Agent (Finland) 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 22, please refer to Appendices 2-5 inclusive and also the Task website: www.vtt.fi/ene/bioenergy

Progress in R&D

Task Meeting

A Task meeting was arranged on 17-18 September in connection with the 'Progress in Thermochemical Biomass Conversion' conference in Tyrol, Austria.

Work Programme

Two more case studies were prepared:

- Evaluation of bagasse fast pyrolysis, and utilisation of pyrolysis liquid in a gas turbine cycle.
- Evaluation of a small-scale power production concept using an Organic Rankine Cycle (ORC).

Canada: Fast Pyrolysis of Bagasse Residues

Orenda (a division of Magellan Aerospace Corp.), Missauga, Ontario, Canada is developing a gas turbine for pyrolysis liquid use. A comprehensive experimental program using pyrolysis liquids is being carried out. The current study dealt with the utilisation of sugar cane processing residues in pyrolysis, and subsequent use of the pyrolysis liquid product as a gas turbine combined-cycle fuel.

Bagasse is a waste biomass from the sugarcane refining process. Bagasse residues represent the largest quantity of industrial biomass waste available worldwide and are therefore a significant potential source of power produced from biomass. Figure 1 shows a comparison of the potential number of power plants by 2025 at 7 and 40 MW of electricity production for various biomass residues.

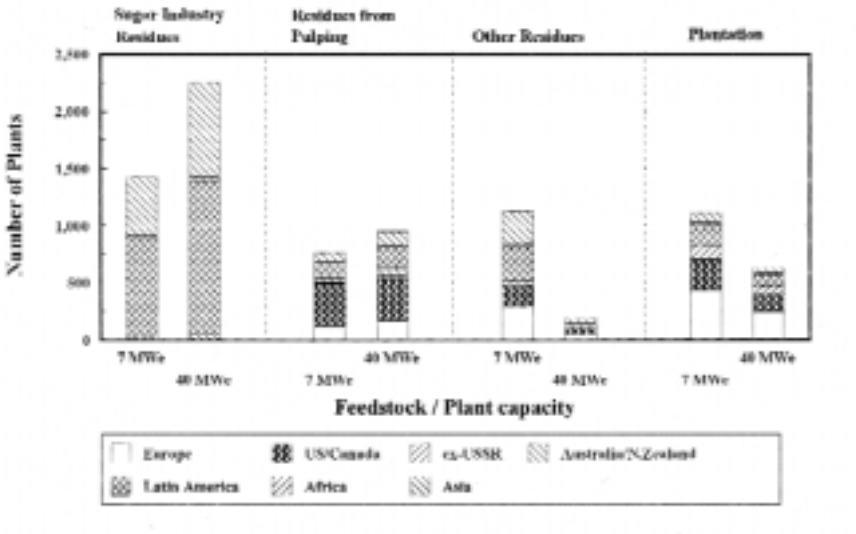


Figure 1: Number of potential power plants by 2025 for different industrial biomass residues

The Rankine power plant, which is the industrial technology, has a low power-to-heat ratio. Increasing the ratio would be desirable, as this would potentially lead to lower cost electricity, and a more efficient utilization of the bagasse. Alternatives to the Rankine cycle were studied. The first alternative was an Integrated-Gasification-Combined-Cycle (IGCC), which has a high efficiency. The second alternative was a pyrolysis combined-cycle (CC). Using the CC power plant, the operation time of the power plant may be extended beyond the time when bagasse is available by storing the liquid fuel.

In the production of sugar from sugar cane, cane stalks are harvested and transported to sugar mills for processing. The cane stalks are crushed to release the sugar-laden juice. The fibrous remains of the crushed cane, called bagasse, is burned wet in boilers to produce steam that is used in the various processes. The average sugar mill has a daily capacity of 5 000 to 25 000 tons of raw cane throughput per day. The harvest period is 150 to 180 consecutive days annually, and during this period the mills operate continuously. Many sugar mills also generate electricity for their own consumption using steam turbines. The amount of bagasse used to produce steam for sugar production can range from 60 to 90 percent of the total bagasse available, depending on the efficiency of the bagasse combustion/boiler system. For the purposes of this study, the integration of advanced bioenergy processes into a sugar mill considered processing only the amount of excess bagasse available. This was viewed as a more realistic approach to the energy integration as it would allow a mill to continue to use its current system of existing boilers to produce steam for the mill. The sugar mill operating conditions vary from one mill to the next. Each mill operates at different capacities for different periods of time and with different efficiencies of the existing bagasse combustion systems. Therefore average conditions were chosen to study the overall feasibility of the energy integration technologies.

It appears that retrofitting a sugar mill to integrate advanced bioenergy processes for only the excess bagasse available is not competitive at current electricity costs. The situation may be different, if a power plant is built to process all of the bagasse

available and integrated with the sugar mill's energy requirements. In this case, the overall energy system may be optimized both for sugar and power production, whereas now the sugar production is practically the only consideration. Such a project would almost certainly have to involve both a sugar company and a utility. Further study to consider integrating a power plant to process all of the bagasse available at a sugar mill is recommended. This study would be based on the actual conditions at a specific sugar mill.

At the small scale, 5-10 MWe, pyrolysis combined-cycle is competitive with the new Rankine cycle plant and could possibly be competitive with electricity produced by fossil fuels, depending on efficiencies and the economic factors of a specific sugar mill. Pyrolysis combined cycle also offers the advantage of storing bagasse derived fuel and the ability to operate the power plant longer than the sugar mill operating period.

At the 18 MWe capacity used in this study the IGCC power plant is not competitive. The technology is clearly better suited for large scale operation. Given the large amounts of bagasse available, it should be possible to identify locations, where a large capacity together with the high efficiency of the IGCC technology would counterweight the initial high investment cost.

Finland: Small Scale Power Production

The first BioPower Rankine co-generation power plant (0.9 MW power - 6 MW heat) suitable for sawmill and district heat operation, was commissioned by Sermet Oy, Kiuruvesi, Finland, during 1999. A comparison between the conventional steam boiler power plant and the case, where the steam cycle is replaced by an Organic Rankine Cycle (ORC), was carried out.

Two potential applications for small scale co-gen plants are sawmills and other industries with both heat and power consumption, and locations, where plants producing heat may be realised together with communities and industry. Typically power production capacity of these plants may be between 300 and 1 000 kWe.

In this study a sawmill was assumed. A sawmill presents an interesting application, as it typically has a constant heat load, which makes it possible to size the power plant with a long peak operation time (reducing the capital cost component in cost of electricity). Fuel is also at site without need for transport, reducing fuel costs. Finally, there is no need to transfer the electricity in grid, as it is used on-site.

The ORC had potentially a higher efficiency than the Rankine cycle, which is a distinct advantage in small scale. However, viability of the ORC has to be determined. Two ORC power plants using biofuel have recently been put into operation with capacities of 300 and 400 kWe. As small-scale power production is known to be relatively high cost, the interesting issue for a boiler/power plant manufacturer is whether the ORC can reduce the cost of electricity compared to an ordinary Rankine cycle.

Sweden: Pyrolysis Liquids as Boiler Fuel

The study, carried out in collaboration with Stockholm Energi Ab, Sweden, was completed during the first phase of the Task. A presentation was prepared based on the results for the PITBC conference during this second phase.

Deliverables

The first part of the Task was completed at the end of 1999. The second phase was carried out 1999-2000, and will be completed early 2001. The final report from the first period of the Task (1 January 1998 to 30 September 1999) has been published and is also available in electronic form at http://www.vtt.fi/ene/bioenergy.

The deliverables from the Task include; development and maintenance of the website at www.vtt.fi/ene/bioenergy; preparation of the 'summary report' including the national prefeasibility studies (Phase 1); one presentation and two poster presentations at the PITBC conference; and feedback to the IEA Bioenergy ExCo and others on the technical studies undertaken. The summary report including the national prefeasibility studies (Phase 2) will be completed early 2001.

TASK 23: Energy from Thermal Conversion of MSW and RDF

Overview of the Task

The objective of Task 23 is to produce a comprehensive status report of the latest developments in, and deployment of, conversion technologies for Municipal Solid Waste (MSW) and Refuse Derived Fuel (RDF).

Energy recovery utilising conventional systems (grate fired mass burn incineration) is an established mature technology and dominates the market. Over the last few years attention has focused on newer technology such as fluidised bed combustion and, even more recently, on gasification and pyrolysis based systems. A number of commercial scale facilities based on these newer technologies are currently under construction, or at an advanced stage of planning. Their performance may well impact on the nature of the energy recovery market.

In addition to technology development, waste management policies and practices have become ever more sophisticated and complex. In order to effectively progress with developing the waste management infrastructure it is vital that policy and decision makers have access to the latest information on the potential and application of technology and be aware of international trends in this sector. The work programme in this Task aims to provide such information.

The participating countries are: Australia, Canada, Finland, France, Japan, Norway, The Netherlands, Sweden and the United Kingdom.

As in other Tasks, a Task Leader, appointed by the Operating Agent (United Kingdom), directs and manages the work programme. In each country participating in Task 23 a National Team Leader is nominated, responsible for the coordination of the national participation in the Task.

For further details on Task 23, please refer to Appendices 2-5 inclusive.

Task Meetings

Two Task meetings were held in 2000. The first was held in Edinburgh Scotland 17-19 April, with a site visit to the DERL Energy from Waste Facility in Dundee. Speakers at the meeting included Professor Dhir of Dundee University who gave a presentation on 'Value added recycling of municipal solid waste and sewage sludge incinerator ashes' and Allan Dryer from the Scottish Environmental Protection Agency who presented the 'Waste Strategy for Scotland'.

The second meeting was held in Karlsruhe, Germany in November with site visits to the Thermoselect plant in Karlsruhe and the Forshungszentrum Karlsruhe test facilities for Thermal Waste Treatment TAMARA and THERESA (rotary kiln furnace). Speakers at the meeting included Dieter Reimann from Zweckverband Müllheizkraftwerk Stadt und Landkreis Bamberg who gave a presentation on 'Waste Management and Prospects for Energy from Waste in Germany' and Juergen Vehlow from Forschungszentrum Karlsruhe who gave a presentation on measures to overcome dioxin challenges.

Work Programme

The work programme for Task 23 consists of six topics as follows:

- the management of residues from thermal conversion,
- advanced conversion technologies for MSW treatment,
- fluidised bed combustion of MSW,
- co-firing of MSW,
- review of MSW management policies and technology deployment trends, and
- characterisation of MSW/RDF components and mixtures for combustion systems.

The Management of Residues from Thermal Conversion. A final report which reviews current practice in residue management, future trends and the focus of research and development activity, and reports on any barriers to the development of beneficial residue utilisation, will be available in March 2001.

Advanced Conversion Technologies for MSW Treatment. The objective of this topic is to compare the technical and economic performance of new Advanced Conversion Technology systems with modern grate-fired mass burn combustion systems. Owing to the shut down of one of the chosen plants, it was not possible to complete this work during 2000. It is expected this topic will be carried over into the new Task.

Fluidised Bed Combustion of MSW. Members of Task 23 visited and prepared techno-economic case studies for several fluidized bed incinerators worldwide. Among the plants evaluated were: the Robbins Resource Recovery Facility (Robbins, IL); the Toshima Incineration Plant (Tokyo, Japan); the Tirmadrid Plant (Madrid, Spain); the Valene Plant (Mantes La Jolie, France); the DERL Energy-from-Waste Facility (Dundee, Scotland); and the Lidköping Waste-to-Energy Plant (Lidköping, Sweden).

Various fluidized bed technology from several vendors was employed at these plants, including Kvaerner BFBs at the DERL and Lidköping plants; Foster Wheeler CFBs at the Robbins plant; Ishikawajima Harima (IHI) BFBs at the Toshima plant; Techniques Modernes de Chauffe (TMC) pyramidal fluidized beds (L4F) at the Valene plant; and Rowitec twin-interchanging fluidized beds (TIF) at the Tirmadrid plant. Rated electrical generation capacity from these plants ranged from 7.8 to 50 MWe, with waste feed capacities of up to 1450 tonnes/day.

Case studies prepared examined operation of and problems with the feed preparation and combustion technology, environmental control system, and residue recovery and disposal. Additionally, fuel characteristics, mass and energy balances, and environmental performance were evaluated. Finally, capital, operating and maintenance costs, and the sociological background for each project were examined.

A summary of information from the six case studies, comparing and contrasting, where available, the project drivers and the effectiveness of the selected technology has been completed by David Granatstein of CANMET and has been circulated to members for review. This summary will also be presented at the 16th International FBC Conference in Reno, Nevada in May 2001.

Co-firing of MSW. The objectives of this topic were: to review the processing technologies and/or systems that can be used to isolate the various MSW components either for direct utilisation or for the production of RDF; to investigate and report on the technical aspects of the co-firing technologies; to investigate and report on the economic and environmental performance of the co-firing technologies and to produce a status report detailing the findings of the study. The final report is now available and will be published in March 2001.

Review of MSW Management Policies and Technology Deployment Trends. A report reviewing the waste management practices in member countries will be published in March 2001.

Characterisation of MSW/RDF Components and Mixtures for Combustion Systems. This topic reviewed work on thermal characterisation of MSW/RDF components and investigates and reports characteristic behaviour of different types of paper, plastics and multi-material components such as beverage cartons during pyrolysis. Proximate analysis and determination of higher heating value is also included. The report also investigates and reports detailed characterisation of NO emission during combustion of single particles. The report will be published in March 2001.

Deliverables

Deliverables from Task 23 in 2000 included: the Lidköping Case Study (final report); the case study of the Toshima Incineration Plant Tokyo; a report on Characterisation of MSW/RDF Components and Mixtures for Combustion Systems; the final report for Co-firing of MSW and RDF; the case study of the Madrid FBC Facility; the case study of the Valene waste recovery facility in Mantes la Jolie France; and a summary of the six case studies titled 'Techno-economic Assessment of Fluidized Bed Combustors as Municipal Solid Waste Incinerators'.

TASK 24: Energy from Biological Conversion of Organic Waste

Overview of the Task

The objective of Task 24 is to provide information exchange and promote the use of anaerobic digestion of municipal and industrial solid wastes to generate energy, reduce pollution and recycle organic matter and nutrients.

Energy recovery from organic wastes using anaerobic digestion to process particular wastes (sewage treatment, industrial wastewaters, landfill gas) is an established mature technology and dominates these specific markets. However, there are sites where appropriate deployment of anaerobic digestion has not been made in these established markets and demonstration of the benefits needs to be made. Also, many other organic wastes that are appropriate for energy recovery through anaerobic digestion are not exploited and thus have the potential of additional unnecessary pollution. Over the last few years attention has focused on the environmental impact of landfill and incineration of organic wastes and newer systems have been developed to recover the energy from 'solid' organic waste and to recycle the organic matter. A number of commercial scale facilities based on these newer technologies have been built and the number of facilities is increasing. However, market penetration is still low.

The participating countries are: Denmark, Finland, Sweden, Switzerland and the United Kingdom.

As in other Tasks, a Task Leader, appointed by the Operating Agent (the United Kingdom), directs and manages the work programme. In each country participating in Task 24 a National Team Leader is nominated, responsible for the coordination of the national participation in the Task.

For further details on Task 24, please refer to Appendices 2-5 inclusive.

Progress in R&D

Task Meetings

Two meetings were held in 2000. The first was held in Utrecht in the Netherlands on the 24-26 May, with site visits to the Lelylstad Anaerobic Digestion Plant and the Nuenen Biogas Upgrading Plant. The second meeting was held in Aadorf, Switzerland on 9-11 October, with site visits to the ROM plant in Frauenfeld, the Otelfingen Kompogas System, the Rümlang Kompogas Compact System, and the Almig BRV plant in Baar. Observers from Austria, Belgium, the Netherlands and 16 members of the Swiss Biogas Association attended the Aadorf meeting.

Work Programme

The work programme for Task 24 consists of six topics as follows:

- revision and editing of systems and markets report,
- biogas upgrading technologies,
- source separation technologies of organic wastes,
- quality management of digestate,
- sanitisation workshop, and
- plant database.

Revision and Editing of Systems and Markets Report. It is planned to edit and re-issue the very successful booklet of 'anaerobic digestion' systems in the spring of 2001. Discussions on the revised contents of the booklet were discussed at Aadorf. The final draft is expected in March 2001.

Biogas upgrading. A review of biogas upgrading technologies has been completed. This review forms part of the assessment of advanced biogas utilisation. The report details the current state of biogas upgrading technology for improving biogas quality to be used either in pipeline distribution or as a vehicle fuel. This technology will also be important in the future for advanced gas use applications such as fuel cells where high conversion efficiencies are expected.

Source separation of organics. A review of source separation systems for the collection of organics from households will be completed by March 2001. The programme of work covers:

- The rationale for when source separation would be used, concentrating on the products that could be produced (high quality, agriculture, land restoration/energy crops) compared to those that would be more difficult to produce and the reasons why this would be so.
- The issues that require consideration in the choice of system e.g. sacks or bins, range of materials to collect, frequency etc.
- The impact of source separation on the anaerobic digestion system.

This report will be published in March 2001.

Quality management. The programme of work for this Task includes: feedstock control (screening, heavy metals issues, etc.), process control, sampling, digestates, measurement techniques - referring to the earlier protocol study. The report will be published as a chapter of the biogas brochure. This report will be completed in March 2001.

Review of Biogas Flare Technology and Suppliers. The action of micro-organisms upon organic matter under anaerobic conditions produces biogas which is typically a mixture of methane and carbon dioxide as well as a many trace gases and vapours. This action is harnessed within a number of anaerobic bioprocesses such as anaerobic digestion (AD)

and landfill for the stabilisation of polluting organic matter contained with a range of solid wastes and wastewaters.

Within the anaerobic conversion of organic material over 90% of energy available in the organic pollutant is retained within the biogas as methane - very little is used to form sludge and this is a major benefit when compared with aerobic bioprocesses. A consequence of this is that the methane rich biogas has a high calorific value and can be used as a fuel. There are also serious safety and environmental considerations associated with biogas because methane is a potent greenhouse gas and forms explosive mixtures when mixed with air.

Therefore for reasons of safety and in order to realise the full environmental benefit from these anaerobic bioprocesses the biogas must be collected and burned with the energy recovered. Energy recovery schemes may be direct where the gas is used to provide heat to meet a local demand or indirect where the biogas is utilised within engines to raise power or drive machinery or vehicles. Biogas flares are used to safely burn biogas that is surplus to the demand of energy recovery plant or where recovery plant fails. They may also provide the only means of safely disposing of biogas produced by anaerobic bioprocesses where the economics of energy recovery have not proved viable. This report reviews the technology of flares as applied for the combustion of biogas and summarises the suppliers and costs of flare equipment and is awaiting printing and will be published in March 2001.

Plant Database. A database of anaerobic digestion plants and contacts has been maintained and distributed electronically to the participating members. The collection of data is an ongoing activity in the Task and the database will be updated regularly. This database will also be used to update the information in the highly successful brochure from the last anaerobic digestion Activity (Task XIV).

Deliverables

Deliverables in 2000 included a second draft of the Plant Database Listing and the report 'Review of biogas flare technology and suppliers'. Further deliverables by March 2001 will be the 'Source Separation Report', 'Quality Management Report' and the 'Biogas Systems and Markets Review Update'.

TASK 25: Greenhouse Gas Balances of Bioenergy Systems

Overview of the Task

The objective of Task 25 is to analyze, on a full fuel cycle basis, all processes involved in the use of bioenergy systems, with the aim of establishing overall greenhouse gas balances.

The participating countries are Australia, Austria, Canada, Croatia, Finland, New Zealand, Sweden, the United Kingdom, and the United States.

As in other Tasks, a Task Leader, appointed by the Operating Agent (the Republic of Austria), directs and manages the work programme. In each country participating in Task 25 a National Team Leader is nominated, responsible for the coordination of the national participation in the Task.

For further details on Task 25, please refer to Appendices 2-5 inclusive and also the Task 25 website at www.joanneum.ac.at/iea-bioenergy-task25/

Progress in R&D

Task Meetings and Workshops

The first Task workshop in 2000 took place on 22-26 May in Croatia. It was jointly organised by the Energy Institute, 'Hrvoje Pozar', Croatia, EKONERG Holding, Croatia and Joanneum Research, Austria. The topic was 'Modelling Workshop: Bioenergy, Greenhouse Gases and Carbon Sequestration'. It included a half-day business session where among other things, the continuation of the work in a new Task beyond the year 2000 was discussed, three and a half days of workshop sessions with participants experimenting with various carbon accounting and energy analysis models, and a one-day study tour. The models demonstrated included CAMFOR, GORCAM, CO2fix, ERGO and GEMIS. CAMFOR is a forest carbon accounting model that looks at above-ground and below-ground biomass; soil carbon; forest floor debris, and wood products. GORCAM has been developed to calculate the net fluxes of carbon to and from the atmosphere associated with land use, land use change, bioenergy and forestry projects. CO2fix is a tool which quantifies the C stocks and fluxes in the forest (whole tree), soil organic matter compartment and the resulting wood products. The Model ERGO has been developed for estimating energy and emissions budgets of bioenergy and it is a tool that can be used to compare different systems of bioenergy production. GEMIS (Global Emission Model for Integrated Systems) determines full life-cycle environmental and cost impacts of energy, transport, and material. More detail of each of the models presented can be found on the Task website.

The second workshop took place in September at Joensuu, Finland, when the Task organised a joint Task 25/COST E21 session in collaboration with the European Forest Institute (EFI). It was titled 'Land Use, Land Use Change and Forestry: the Road to COP6'. A fast track summary of this session was produced within two weeks of the conference and can be found on the Task website. The full proceedings (including overhead presentations) and videos of some presentations are also on the website. A proceedings of the other sessions during this week ('Woody Biomass as an Energy Source - Challenges in Europe) is being prepared by EFI with the Task Leader as a co-editor. The joint workshop session in Joensuu was an important milestone in the collaboration between COST E21 and Task 25. COST E21 (a European networking activity titled 'Contribution of Forests and Forestry to Mitigate Greenhouse Effects') also held separate sessions from which papers are published at: www.bib.fsagx.ac.be/coste21/report/2000-09-28.html

Planning began for the next Task workshop, which is to be an 'end of Task 25 workshop' and at the same time marks the beginning of Task 38. Topics for the workshop will be: carbon accounting, emissions trading, and COP6 negotiations related to bioenergy, wood

products and carbon sequestration. The workshop will be held in Canberra, Australia on 26-30 March 2001. More information can be found at: www.joanneum.ac.at/iea-bioenergy-task38/announcement.doc

Website

The Task 25 homepage has been continuously updated and extended. It now also includes: information on selected projects, models and other activities in the participating countries; information about Australia, the new member of Task 25; and a searchable experts list.

Contributions Relating to International Work on Climate Change

Several of the individuals involved in Task 25 contributed as lead authors to the IPCC Special Report on 'Land Use, Land-Use Change and Forestry'. including M Apps., J.Ford-Robertson, H.Kheshgi, T. Karjalainen, W. Kurz, B.Schlamadinger, and G. Marland. The report was completed and published in May 2000.

The paper on 'baselines'; titled ' Project-based greenhouse gas accounting guiding principles with a focus on baselines and additionality' was completed and published in Energy Policy.

A 'Frequently Asked Questions' paper addressing bioenergy, greenhouse gases and carbon sequestration was drafted, and is planned to be distributed at the resumed session of COP6 in June/July 2001.

The Task contributed an article to IEA Bioenergy News (Vol. 12, No 2, Dec. 2000) on the UNFCCC negotiations on land use, land use change and forestry, titled 'The Hague did not live up to expectations'.

The Task has initiated a email discussion list on carbon accounting for harvested wood products in conjunction with the International Institute for Sustainable Development (IISD). The Task Leader, Bernhard Schlamadinger, will be moderating this discussion list. Please contact him (email: bernhard.schlamadinger@joanneum.ac.at) if you would like to participate.

Other Deliverables

The proceedings of the Gatlinburg Workshop 'Bioenergy for mitigation of CO2 emissions: the power, transportation and industrial sectors', was published in January 2000 and can be found at the Task website.

A book chapter, 'Wood Products and Bioenergy' was written for a IUFRO (International Union of Forest Research Organisations) book on the role of forestry in the carbon cycle.

A proposal and workplan for the new Task 38, 'Greenhouse Gas Balances of Biomass and Bioenergy Systems' was prepared and distributed. An evaluation of the current Task's performance and how it can be improved for the next period, was distributed to participants in September and results indicate that the Task has performed well as a networking and collaboration activity and in future participants would like to focus on joint projects appying methodologies developed by the Task.

Communication and Promotion

The Task was active in communicating its activities in 2000. Presentations were made at the World Biomass Conference in Seville, at the workshop on 'Integrating biomass energy with agriculture, forestry and climate change policies in Europe', held at the Imperial College, London; during the Task study tour in New Zealand, and also at ExCo45 in Utrecht.

A series of eleven posters summarising the work of the Task has been distributed to participants. These emphasise the research being undertaken in the member countries. A set of transparencies for use by participants has also been developed and distributed. These provide general Task information and specific research results. Finally, a CD containing the Task website, the IEA Bioenergy website and the Task 25 posters was produced. This was distributed to Task participants, other interested parties and at international conferences throughout the year.

TASK 26: Biotechnology for the Conversion of Lignocellulosics to Ethanol

Overview of the Task

The main objective of Task 26 is to promote the establishment of biomass-to-ethanol demonstration plants which are championed and funded by industry. Specific goals within the 3 year time-scale of the Task have been formulated and these are detailed below.

The participating countries are Canada, Denmark, Finland, the Netherlands and Sweden.

As in other Tasks, a Task Leader, appointed by the Operating Agent (Canada) directs and manages the work programme. For each participating country, a National Team Leader is nominated who is responsible for coordinating the national participation in the Task.

For further details on Task 26, please refer to Appendices 2-5 inclusive and www.ieabioenergy.com under 'Current Tasks' on the IEA Bioenergy website.

The participants have R&D programs within their countries in order to meet the above objective and carry out cooperative research based on their national programs. The work of the Task is structured around the following goals.

- To provide a forum for participating countries interested in developing biomass-to-ethanol processes.
- To communicate progress in the commercialization of biomass-to-ethanol processes.
- To continue the exchange of the technical and economic assumptions and the models used in various techno-economic modelling efforts of participating groups.
- To catalyze or initiate 'special projects' funded by additional funding outside of the IEA.

Progress towards these four goals is reported below.

To provide a forum for participating countries interested in developing biomass-to-ethanol processes

Gatlinburg Meeting. The Task 26 network sponsored a special topic discussion group on 'Commercialization of Biomass to Ethanol'. This was held within the larger Gatlinburg Symposium on 10 May. The workshop had 70 participants from 11 countries and represented academia (30 participants), the public sector (19), consultants (5) and the industrial sector (15). The goal of this workshop was to show participants that the network is close to demonstrating the technical viability of an integrated biomass-to-ethanol process and that progressive technical advances and policy decisions will likely greatly enhance the economic attractiveness of the process. Nine individuals presented material with questions after each presentation.

Copenhagen Meeting. This meeting was held in association with the end of the Nordic Bioenergy Programme which had been running since 1995 concentrating on ethanol from lignocellulosics. There were over 50 participants from 5 countries presenting their research findings. The meeting provided a good forum for information exchange on state-of-the-art research techniques for the various aspects of an ethanol from lignocellulosics process. A listing of the abstracts for this meeting is contained in Issue 8 of the IEA Bioenergy Task 26 newsletter.

Hawaii Meeting. This consisted of two sessions of the PACIFICHEM American Chemical Society conference. It was a technical meeting with 12 presentations. A listing of the presenters and the title of their presentations is included in Appendix 3. The abstracts of the presentations will be included in the next Task 26 newsletter.

External collaboration and technology transfer. The recent newsletters and symposia (Anaheim and South Africa) facilitated participation by European (Sweden, Finland, The Netherlands, Norway, Denmark, Russia), North American (USA and Canada), South American (Brazil), Asian (Japan) and African (South Africa) countries. The Task has continued to receive inquiries for information on lignocellulosics-to-ethanol processes from researchers and consultants in countries such as Argentina, Australia, South Africa, China, Cuba, Mexico, UK, Croatia, Hungary, India, Indonesia, Pakistan, Phillipines, Spain and Italy. These latter enquiries often result in discussions about other IEA activities and the individuals becoming observers or presenters at the symposia and workshops.

Collaboration with other Tasks. The newsletters have been very successful at transmitting information to both participating and non-participating countries. A copy of the newsletter is also sent to a number of the other IEA Bioenergy Task members.

A representative from Task 26 presented biomass-to-ethanol information at the Gatlinburg meeting of Task 25. Mr Donald O'Connor discussed some of the Task 26 modelling efforts in his presentation titled 'Full Fuel Cycle Analysis of Greenhouse Gas Emissions from Biomass Derived Ethanol Fuel in Canada'.

There has been an exchange of newsletters and meeting arrangements between Task 26 and Task 27 to assist the newsletter editors with transmitting information to the general membership of each Task. For the next triennium, Tasks 26 and 27 will be joined to form Task 39 'Liquid Biofuels'. At the end of November, there was a joint meeting of

the new subtask leaders (Don Stevens, Jack Saddler and Manfred Worgetter) in Vancouver to discuss the best way to effectively link and expand the various activities of the 'old' Tasks.

To communicate progress in the commercialization of biomass-to-ethanol processes

Progress in commercialization of biomass-to-ethanol processes has been communicated through both the newsletter and the symposia. The two issues of the newsletter (nos. 7 and 8) that were published this year have been sent to all of the past participants in the biomass-to-ethanol network, and participants in the current Task. The newsletters have provided a forum to accomplish a number of the Task's goals. The Task has continued to update and expand the newsletter mailing list. Feedback from the newsletter dissemination has continued to exceed expectations. They are providing appropriate information on the upcoming events and international perspectives on the global status of technology associated with the lignocellulosics-to-ethanol process. Each newsletter has been added to the IEA Bioenergy website by sending a copy to the IEA Bioenergy webmaster.

To continue the exchange of the technical and economic assumptions and the models used in various techno-economic modelling efforts of participating groups

Following a survey of the various techno-economic modelling groups, the Task is continuing to document the UBC model to provide a comprehensive package for distribution to other participating IEA Bioenergy 'techno-economic' modelling groups.

To catalyze or initiate 'special projects' funded by additional funding outside of the IEA

The current interest in GHG reduction opportunities associated with a lignocellulosic-to-ethanol process has attracted many different interest groups from various countries including industrial and investing partners. This bodes well for the potential to develop a number of special projects. For example, projects that include joint country and industrial partnerships with the parties wanting to combine and develop technologies associated with lignocellulosic-to-ethanol processes. The Task Leader has also had discussions with past participating countries and preliminary discussions with non-member countries about collaborating in the programme of the Task.

TASK 27: Liquid Biofuels

Overview of the Task

The objective of Task 27 is to identify and eliminate non-technical barriers that impede the deployment of liquid fuels. To meet this objective, participants are conducting information exchange and analysis activities to provide governments, policy makers, and stakeholders with improved information on non-technical issues related to biofuels.

The participating countries are Austria, Canada, Sweden, the USA and the Commission of the European Communities.

As in other Tasks, a Task Leader, appointed by the Operating Agent (USA), directs and manages the work programme. In each country participating in Task 27, a National Team Leader is nominated, responsible for the coordination of the national participation in the Task.

For further details on Task 27, please refer to Appendices 2-5 inclusive and also the Task 27 website at www.joanneum.ac.at/iea-bioenergy-task27

Progress in R&D

Task Meetings

The Task held its first working group meeting in Washington D.C. in January 1999. Working meetings were also held in Stockholm, Sweden during May 1999, and in Brussels, Belgium in October 1999. In 2000, working group meetings were held in Semmering, Austria in January; Seville, Spain in June; and in Vancouver, Canada in November.

The Task held a second joint workshop with the 'Pyrolysis' Task in January. This featured an industry-driven seminar on biofuels.

The work programme for the Task includes the following elements:

Providing Information for Governments and Policy Makers

The overall objective of this component is to provide governments and policy makers with improved information that will help them identify and eliminate non-technical barriers to liquid fuels deployment. During 2000, work was performed in the following areas:

- *Taxation, regulatory, and policy issues.* The Task performed a comprehensive analysis of the effects of government policies and tax incentives on the implementation of biofuels. Task participants initially identified the primary tax incentives and policy considerations that impact on biofuels usage in North America and Europe. Based in these initial findings, the Task requested that more detailed analyses be performed on a regional basis by consultants. This project was successfully completed by year end. It provides detailed information on the nature of taxation and regulatory policies in countries throughout North America and Europe and also provides information on current biofuels usage. Implementation is effective

in those locations were policies account for the cost differences between biofuels and their petroleum counterparts. However, biofuels are not being implemented in locations were there are no such policies. The project also identified possible scenarios for 'moderate' and 'extensive' expansion of biofuels use and noted probable implications of these scenarios.

The consultants' reports were completed and reviewed in 2000, and a final report will be completed in early 2001. The project is providing useful information about potential mechanisms to assist in expanding the use of biofuels.

- *Business-related issues.* The Task examined business-related issues such as the difference in price between ethanol in North America and that in Europe. The price of ethanol in Europe is about double that in North America. The Task completed a preliminary analysis of the reasons for this difference, including scale factors, differences in animal feedstock markets, labor costs, and other factors.
- *Fuel properties and standards.* The Task briefly examined existing standards for biofuels such as B5, B20, B100, E10, E20, E85. The objective of this effort was to determine if current specifications are adequate, or if additional standards are needed to help the biofuels market. The Task concluded that common standards do not exist, that development of standards would be useful, but that the current absence of such standards is not presently a major impediment to biofuels. Such standards should be developed by industry and related groups specifically established for that purpose, rather than IEA Bioenergy.
- *Life-cycle analyses (LCAs).* The Task is compiling biofuels LCAs produced in the participating countries in an effort to make these studies more readily available. Further comparison of the results of the existing studies will be conducted if needed. This compilation will be available by the end of the Task.

Involving Stakeholders in the Task

The objective of this effort is to identify and involve potential liquid biofuels stakeholders in the Task. The industrial and trade associate stakeholders are very important to the development of biofuels. Providing better access to those people and organizations will help the participants by making each of them aware of stakeholders outside of their own particular region. In 2000, the Task met with various industries, trade representatives, and other stakeholder interests to obtain insight into the broad base of issues related to biofuels.

Collaboration

The Task is coordinating its work with other related activities including IEA Bioenergy Tasks 16, 22, 25 and 26; the IEA Alternate Motor Fuels Agreement, and others. In the new triennium, Task 26 and 27 have agreed to merge their programmes and become Task 39 'Liquid Biofuels'.

Website

The Task has constructed a website to improve access to the information developed by the Task. The address is: www.joanneum.ac.at/iea-bioenergy-task27

TASK 28: Solid Biomass Fuels Standardisation and Classification

Overview of the Task

The objectives of Task 28 are to:

- develop a set of standards for Solid Biomass Fuels to be used by efficient and economical energy conversion systems;
- promote the standardization of the specification and classification for Solid Biomass Fuels by international standards bodies such as ISO;
- help create an international Solid Biomass Fuels market in which Solid Biomass Fuels can be traded amongst producers (farmers, foresters, fuel companies) and users (utilities, district heating companies, industries, etc.) with quality assurance and guarantees. The solid Biomass Fuels market will help to promote bioenergy in general, assist in the penetration of biomass conversion technologies into the energy market and provide a stable framework for all stakeholders; fuel producers, equipment manufacturers and end users. This will assist IEA Bioenergy Member countries in attaining the Kyoto Protocol objectives.

The participating countries are the Commission of the European Communities, Denmark, The Netherlands, Norway and the USA.

This Task is a joint programme between IEA Bioenergy and the CEC. As in other Tasks, a Task Leader, appointed by the Operating Agent (the Commission of the European Communities), directs and manages the work programme.

For further details on Task 28, please refer to Appendices 2-5 inclusive.

Progress in R&D

The necessary pre-normative, preparatory work to develop a set of standards for solid biomass fuels (or solid biofuels) was carried out in 1999 in a Working Group (BT/WG108) established by CEN (the organisation responsible for the production of European Standards). The pre-normative work included:

- a review of the status of existing national and international standards for solid biofuels;
- consideration of the borderline between biofuels and wastes, and its impact on the standardisation work;
- the production of a draft work programme for the development of standards for solid biofuels that could be adopted by a CEN Technical Committee.

The third meeting of CEN/BT/WG108 was convened in Brussels on 8th February 2000. The main objective was to agree and adopt the work programme. After further vigorous debate about the scope of the work, it was generally accepted that the scope should

follow that of the proposed Standardisation Mandate to be issued by the EC, which was expected to be as follows:

- products from agriculture and forestry
- vegetable waste from agriculture and forestry
- vegetable waste from the food processing industry
- wood waste, with the exception of
  - wood waste that may contain halogenated organic compounds or heavy metals as a result of treatment
  - treated wood originating from building and demolition waste
- cork waste.

It is important to note that peat is not included in the scope for the time being. The above scope follows the draft description of materials that are exempt from the proposed EC Directive on the incineration of waste. That has the effect of excluding much municipal, commercial and industrial waste from the scope of the standardisation work. (Note: the final version of Directive 2000/76/EC on the incineration of waste was published in December 2000, with some minor changes to the wording for exemptions.)

After some minor amendments to the text, CEN/BT/WG108 adopted the work programme in which 24 Standard documents are proposed under the following main headings:

- Terminology, definitions and description
- Fuel specifications, classes and quality assurance
- Sampling and sample reduction
- Physical/mechanical tests
- Chemical tests

The work programme was then sent to CEN Technical Board with a proposal to create a Technical Committee (CEN/TC335) on solid biofuels to carry out the work described. By the voting deadline of 5th April 2000, the votes cast showed a clear majority in favour of the proposal.

The inaugural meeting of CEN/TC335 took place in Stockholm on 30th May 2000, and was attended by delegations from 12 CEN member countries. The secretariat provided for CEN/BT/WG108 by the Swedish standards body STG was maintained, but a new Chairman was appointed; Dr Birgit Bodlund of Vattenfall, a large Swedish power generation company. The meeting formally approved the title and scope of the Technical Committee, and approved the work programme developed by CEN/BT/WG108. External liaisons with the European Commission, IEA Bioenergy and AEBIOM were also formally approved. This formal liaison with IEA Bioenergy lasts for three years.

The main task of the meeting was to appoint convenors for five Working Groups (WGs) who will take on the responsibility of drafting the standard documents listed in the work programme, as follows:

- WG1 Terminology, definitions and description: Germany/DIN/Martin Kaltschmitt
- WG2 Fuel specifications, classes and quality assurance: Finland/SFS/Jan-Erik Levlin

- WG3 Sampling and sample reduction: UK/BSI/Andy Limbrick
- WG4: Physical/mechanical tests: Sweden/STG/Nina Haglund
- WG5: Chemical tests: Netherlands/NEN/Herman van der Staak

Involvement of personnel from Task 28 in the Working Groups is as follows:

- WG1 - Andy Limbrick and Torbjorn Okstad (Members); Kyriakos Maniatis and Larry Baxter (Corresponding Members)
- WG2 - Andy Limbrick and Larry Baxter (Corresponding Members)
- WG3 - Andy Limbrick (Convenor); Pieter Kofman and Torbjorn Okstad (Members); Kyriakos Maniatis and Larry Baxter (Corresponding Members)
- WG4 - Pieter Kofman (Member); Andy Limbrick and Larry Baxter (Corresponding Members)
- WG5 - Andy Limbrick and Larry Baxter (Corresponding Members)

Members are expected to attend Working Group meetings and to work closely with the convenor on the drafting of documents. Corresponding Members assist by providing information and critical reviews of draft documents. The UN Food and Agriculture Organisation has also been joined to WG1 through Task 28.

The second meeting of CEN/TC335 took place in Copenhagen on 7 December 2000, and was attended by delegations from 10 CEN member countries. Reports were received from the five Working Groups, all of which had met for the first time. Working Groups 1 to 3 all expect to present substantial draft standard documents to CEN/TC335 in 2001.

It is also important to note that CEN Technical Board decided in April 2000 to establish a CEN Task Force for solid recovered fuels (CEN/BT/TF118), with the objectives of reporting on the state-of-the-art of the industry in Europe, and the production of a work programme for the development of standards for those materials. It is intended that there will be a full exchange of information between CEN/TF118 and the Technical Committee for solid biofuels. Task 28 presently keeps a watching brief on solid recovered fuels. The first meeting of CEN/TF118 took place on 27th September 2000 in Brussels and involved delegates from 10 CEN Member countries. Secretariat is provided by the Finnish standards body SFS. Mr Martin Frankenhaeuser of Borealis Polymers was elected Chairman. CEN/TF118 will consider solid fuels made from non-hazardous, mono- and mixed wastes, excluding those fuels which are included in the scope of CEN/TC335. It aims to adopt a work programme by mid-2001 and then proceed with the drafting of European Standards, subject to the approval of the European Commission.

TASK 29: Socio-economic Aspects of Bioenergy Systems

Overview of the Task

The overall objective of Task 29 is to promote the use of biomass for energy over fossil based competitor fuels in the participating countries through achieving a better understanding of the social and economic impacts of bioenergy systems at the local,

regional, national and international level. The key priority is the analysis of the economic and social aspects and the net overall benefits of bioenergy use, and the development and promotion of tools and guidelines for their determination.

Although the Task is focussed at the local/regional level, full account is taken of the overall national and international framework, within which the region must operate. This has particular relevance when considering such issues as tariffs, taxes, government incentives, regulations, organisational structures, and similar matters. Special attention is given and linkage has been made to ongoing and planned projects which relate closely to the work programme. These include projects undertaken by the European Commission, IPCC, UNDP, World Bank, etc. Such linkages benefit the Task participants by drawing in additional expertise and experiences, thereby 'gearing up' the efforts whilst ensuring there is no unintentional duplication of activities.

The country participation in 2000 was Austria, Canada, Croatia, Japan, Sweden and the United Kingdom. In addition, close cooperation with the FAO was established through a MoU between the Executive Committee and the FAO Forestry Department.

As in other Tasks, a Task Leader, appointed by the Operating Agent (Croatia) directs and manages the work programme. In this case, an Associate Task Leader (from the UK) has also been appointed. 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 2-5 inclusive and also the Task website: www.eihp.hr/task29.htm

Progress in R&D

Task Meetings and Workshops

A preparatory workshop was held in Zagreb, Croatia, 5-6 July 1999 to define the programme of work. Presentations were made by each participating country on the state-of-the-art of socio-economic work relating to bioenergy. Contributions were also received from Belgium and New Zealand. This was followed by presentations from all participants on ideas for future work. These were subsequently embodied in the work programme of the Task.

The 'kick-off' workshop was held in Växjö, Sweden, 3-4 February, with the aim of planning and discussing the Task activities in more detail. This workshop included an invited presentation by Dr Erik Ling titled 'Competitiveness of Bioenergy - One Issue Different Logics' and a study tour to the SODRA forest company and the biomass fired CHP plant of Växjö Energy.

The Task participated actively in the First World Conference on Biomass for Energy and Industry 5-9 June held in Seville. A poster was presented and targeted promotional material was disseminated. During the event the Task met twice and discussed current developments and next actions. At a meeting with FAO representatives, it was agreed that they would support one developing country to participate in Task activities.

The main Task event in 2000 was the workshop held in Brighton, UK during the World Renewable Energy Congress, 1-7 July. The workshop followed up actions from the first meeting in Sweden. In particular, it focused on addressing the issues involving

'breaking the circle' of area selection/data availability/model evaluation. During the workshop a preliminary review of data needs as well as an overview of tools/models was carried out. All participating countries were represented at this event. Other participants were an FAO representative and observers from New Zealand, Greece, India and Slovenia.

The next meeting of the Task team will take place in Canada, 28-31 May 2001. The meeting will consist of a half-day business session, one-day international scientific workshop and a half-day joint session with the Task 31 'Conventional Forestry Systems for Sustainable Production of Bioenergy' international workshop. A key part of the meeting will be a two-day study tour involving community consultations and discussions with aboriginal peoples. The meetings will explore to what extent bioenergy might make a difference to peoples' lives through social, environmental and economic benefits.

Work Programme

The Task has made a promising start at giving detailed consideration to the value of bioenergy when viewed in the broader context of society, environment and economy. The boundaries of the Task have been kept deliberately broad in order to be as inclusive as possible without becoming unmanageable.

A two pronged approach of 'analysis with modelling' and 'community testing with feedback' is now commencing and the year ahead is likely to prove a most interesting one. Current trends at the international (IEA and European Commission) through to the local level would indicate that the importance placed on this kind of work, in a sense placing bioenergy 'in context', is immense. Increasingly, new developments will be expected to demonstrate LA21 and/or socio-economic benefits in a tangible way. Hopefully, the work of this Task will prove to be an important contribution to showing the multiplicity of benefits that can be derived from sustainable bioenergy and hybrid renewable energy (where bioenergy plays a significant role) solutions for communities, and in partnership with those communities.

An important additional part of the programme, referred to above, is the cooperation with FAO which was successfully launched in the first year of the Task. FAO nominated Professor Elizabeth Remedio as its representative and the Philippines was chosen as the developing country to be sponsored by the FAO in the Task activities.

Another important initiative proposed by the Task Leader and agreed by the National Team Leaders, was to sponsor one student for each participating country from the Task budget in order to assist the overall programme. These people will participate in data gathering, data analysis and the application of models to the regions. They will also participate in the final Task workshop in the year 2002. This initiative will provide an excellent opportunity for young people from the communities under study to participate and exchange ideas. They should provide a 'living link' to the work and actively demonstrate Task commitment.

Deliverables and Promotion

International linkage and Task promotion is seen as an important part of Task activities. A variety of presentations (leaflets, posters or invited oral presentations) have been made during the following events and occasions:

- XVI Croatian national agricultural conference 'Zrnko 2000', Stubičke toplice, Croatia, 18-21 January 2000.
- COMPAQ Company renewables event, Reading, UK, March 2000.
- Sustainable Development Workshop, Cambridge University, UK, May 2000.
- 1st World Conference on Biomass for Energy and Industry, Sevilla, Spain, 5-9 June 2000.
- World Renewable Energy Congress VI, Brighton, UK, 1-7 July 2000.
- Renewable energy assessment and target setting for the south east of England introductory seminar. Guildford, UK, 6 September 2000.
- International Conference 'Littoral 2000', Cavtat-Dubrovnik, Croatia, 13-17 September 2000.
- Renewable energy assessment and target setting for the south east of England stakeholder seminar. Reading University, UK, 29 September 2000.
- FEDARENE seminar. Brussells, Belgium, 18 September 2000.
- International Congress 'Energy and Environment 2000', Opatija, Croatia, 25-27 October 2000.
- Austrian national information circulars regarding news related to Task 29 activities (4 times per year).
- Austrian expert group on bioenergy semi-annual meetings ('Fachgespräche Bioenergie').
- Swedish Biomass Association (SVEBIO) meetings and events (4-6 per year).

Collaboration

At ExCo45 in Utrecht, a meeting between the Task Leader and Mr Miguel Trossero representing the Wood Energy Programme of FAO, agreed that within the framework of overall cooperation between IEA Bioenergy and FAO, FAO would choose Task 29 as one of the Tasks for special collaboration. It was clear that both groups had a very similar approach to the socio-economics of bioenergy systems, especially as this applies to regions. Further activities will be targeted towards: exchanging experience, data and knowledge; participation of FAO representatives in Task activities; involving developing countries in Task activities; and collaborating to run an internet conference during 2001.

The Task is linked to a European Commission SAVE II initiative to establish a cluster of three local energy management agencies in the UK, Spain (Region of Murcia) and Bulgaria (Obstina Rousse). The expectation is that the UK agency based in the Thames Valley region (a study region for the Task) will act as a focus for collaboration. Since the agencies work closely with the local communities they will provide an excellent linkage for data gathering, model testing, community consultation and partnership with events.

TABLE 1 - IEA BIOENERGY TASK PARTICIPATION IN 2000

Task	AUS	AUT	BEL	BRA	CAN	CRO	DEN	FIN	FRA	ITA	JAP	NEL	NOR	NZE	SWE	SWI	UK	USA	CEC	Total Participants in Task
16. Tech. assessment of cellulosic materials to ethanol in Sweden															●			●		2
17. Short rotation crops for bioenergy	●				●	●	●			●		●			●		●	●	●	10
18. Conventional forestry systems for bioenergy	●		●		●		●	●				●	●	●	●		●	●	●	12
19. Biomass combustion	●	●	●	●	●		●	●				●	●	●	●	●	●	●	●	15
20. Thermal gasification of biomass		●		●	●		●	●		●		●	●		●	●	●	●	●	13
21. Pyrolysis of biomass				●	●													●	●	4*
22. Techno-economic assessments for bioenergy applications					●			●							●			●		4
23. Energy from thermal conversion of MSW and RDF	●				●			●	●		●	●	●		●		●			9
24. Energy from biological conversion of organic waste							●	●							●	●	●			5
25. Greenhouse gas balances of bioenergy systems	●	●			●	●		●						●	●		●	●		9
26. Biotechnology for conversion to ethanol					●		●	●				●			●					5
27. Liquid biofuels		●			●										●			●	●	5
28. Solid biomass fuels standardization and classification							●					●	●					●	●	5*
29. Socio-economic aspects of bioenergy systems		●			●	●					●				●		●			6
Total Task Participation	5	5	2	3	11	3	7	8	1	2	2	7	5	3	12	3	8	10	7	104

*Actual participation is higher because these are joint programmes with CEC participants.

BUDGET IN 2000: SUMMARY TABLES

Table 2: Budget for 2000 by Member Country ($US)

Member country	Total ExCo funds	Total Task funds	Total funds
Australia	6,250	57,264	63,514
Austria	8,750	48,784	57,534
Belgium	4,900	20,283	25,183
Brazil	5,350	23,501	28,851
Canada	12,650	114,282	126,932
Croatia	4,900	33,661	38,561
Denmark	10,050	69,319	79,369
European Commission	10,050	43,879	53,929
Finland	7,600	90,744	98,344
France	4,450	15,320	19,770
Italy	6,800	14,596	21,396
Japan	5,600	27,320	32,920
Netherlands	10,050	69,799	79,849
Norway	7,250	52,421	59,671
New Zealand	5,350	34,166	39,516
Sweden	8,950	119,522	128,472
Switzerland	5,350	28,741	34,091
UK	10,700	90,922	101,622
USA	8,050	105,097	113,147
Total	**143,050**	**1,059,621**	**1,202,671**

BUDGET IN 2000: SUMMARY TABLES

Table 3: Budget for 2000 by Task ($US)

Task	Number of participants	Annual contribution per participant	Total Task funds
Task 16: Tech. Assessment of cellulosic ... etc.	2	in kind	0
Task 17: Short rotation crops for bioenergy	10	7,778	77,780
Task 18: Conventional forestry systems ... etc.	12	13,200	158,400
Task 19: Biomass combustion	15	7,083	106,245
Task 20: Thermal gasification of biomass	13	6,818	88,634
Task 21: Pyrolysis of biomass	4*	9,600	28,800
Task 22: Techno-economic assessments ... etc.	4	10,000ø	40,000
Task 23: Energy from thermal conv. of MSW ... etc.	9	15,320	137,880
Task 24: Energy from biological conversion ... etc.	5	14,840	74,200
Task 25: Greenhouse gas balances ... etc.	9	13,883	124,947
Task 26: Biotechnology for the conversion ... etc.	5	9,600	48,000
Task 27: Liquid biofuels	5	9,000	45,000
Task 28: Solid biomass fuels standardisation ... etc.	5*	#	57,735
Task 29: Socio-economic aspects ... etc.	6	12,000	72,000
Total	**104**		**1,059,621**

* Actual participation was higher than indicated, because these are joint programmes with the CEC. The 'Total Task funds' column only shows funds handled by the IEA Bioenergy Secretary. In Tasks 21 and 28, the CEC paid directly.

There is a differential IEA Bioenergy contribution for CEC and non-CEC participants in this programme. In 2000, CEC countries paid $10,000 and non-CEC countries $27,735.

ø The programme was prolonged from 1 October 1999 to 31 December 2000. Participants in the prolongation paid $10,000 in 2000.

LIST OF REPORTS

Except where noted, the reports are available through the Task Leader of the relevant Task. For the addresses, please see Appendix 5.

Reports Issued by the Executive Committee

IEA Bioenergy Annual Report 1999. ExCo:2000:01

IEA Bioenergy News Volume 12, No. 1. July 2000.

IEA Bioenergy News Volume 12, No. 2. December 2000.

The newsletters are available through the Newsletter Editor - address in Appendix 5.

Reports From Task 16

Reports from this Task are planned for June 2001.

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A final report on the work of Task 17 for the period of 1998-2000 will be published in the Spring of 2001.

Reports From Task 18

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Minutes of the sixth meeting of Task 19 at Broadbeach, Australia. 7-8 December 2000.

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Topical Report 'Tar Measurement Protocols for Large Scale and Medium/Small-scale Biomass Gasification Systems'. Coordinator: John Neeft, ECN, The Netherlands (in prep).

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Topical Report 'Commercial Gas Utilization and Energy Conversion Technologies'. Coordinator: Nick Barker, AEAT/ETSU, United Kingdom (in prep).

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Granatstein, D.L. and Hesseling, W.F.M. Case Study of Robbins Resource Recovery Facility, Robbins, Illinois.

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These reports are available from Grace Gordon, AEA Technology Environment, E6/G30, Culham, Abingdon, Oxon, OX14 3ED, United Kingdom: email: grace.gordon@aeat.co.uk

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Kimmel, T. Dewatering solid residue after SSF using centrifugation.

Alkasrawi, M., Galbe, M. and Zacchi, G. Recycling of process streams in fuel-ethanol productions from soft wood based on simultaneous saccharification and fermentation.

Torry-Smith, M. New concept for increased validation of lignocellulosic materials.

Jantsch, T.G. Production of ethanol and methane from a sulphite pulp mill process stream.

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Session II: Raw materials and pre-treatment

Söderström, J., Pilcher, L., Galbe, M. and Zacchi G. Two-step steam pretreatment of softwood with dilute H_2SO_4 and SO_2 impregnation for ethanol production.

Palonen, H., Viikari, L., Tenkanen, M., Schmidt, A.S. and Thomsen, A.B. Comparison of wet-oxidation and steam explosion as pretreatment for soft wood hydrolysis.

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Domac, J. First results of an international project IEA Bioenergy Task 29: Socio-economic aspects of bioenergy systems. Forestry Magazine 7-8: 413-420, Zagreb.

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TASK 21 - Pyrolysis of Biomass

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* Formal participation is through IEA Bioenergy.

TASK 22 - Techno-Economic Assessments for Bioenergy Applications

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TASK 24 - Energy from Biological Conversion of Organic Waste

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Task Leader: Patrick Wheeler, AEA Technology plc, United Kingdom
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Continued from Task 24

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TASK 25 - Greenhouse Gas Balances of Bioenergy Systems

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TASK 26 - Biotechnology for the Conversion of Lignocellulosics to Ethanol

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TASK 27 - Liquid Biofuels

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