



Harvesting forest residues in Finland. Courtesy John Deere.

## Bioenergy - the strongest renewable energy source in Finland

Guest Editorial by Kai Sipilä and Tuula Mäkinen, VTT and Marjatta Aarniala, Tekes.

Bioenergy is the most important renewable energy source in Finland. It currently comprises more than 20% of the nations total energy supply. In 2010, total energy consumption was 1445 PJ (402 TWh), with renewable energy sources supplying 26%. Bioenergy is typically used for industrial and municipal heat and power production. Biomass resources mostly originate from forest operations (residues from thinning or clear felling) or from wood processing industries (spent cooking liquors from pulp mills, sawdust, and bark).

As a member of the European Union, Finland follows regulations and targets for energy and emissions set by the EU. For Finland, the EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources sets a national target of 38% energy (gross final consumption) from renewable sources by 2020. The government's long term climate and energy strategy was issued to Parliament in November 2008 and Finland's national action plan for promoting renewable energy was published in the summer of 2010. In addition to setting targets for renewable energy production, the goal of renewable energy use in transportation was targeted at 20% by 2020, double the EU Directive target of 10%.

The 38% national target is ambitious and reaching it requires new measures (e.g. feed-in tariffs) to promote the use of renewable energy. These measures are currently being implemented. With respect to the role of bioenergy, increasing the use of wood-based fuels is considered to be one of the key strategies to increase the share of renewable energy. In particular, a considerable increase in the use of forest chips is expected. In 2009 the use of forest chips was 10 TWh (5 million solid cubic metres), and the target is to increase the use of forest chips to 25 TWh, about 13.5 million solid cubic metres.

RD&D has been one of the key activities to enable the increase in bioenergy use in Finland. Tekes, the Finnish Funding Agency for Technology and Innovation, is the main government financing organisation for research and technological development. Tekes has carried out several programmes contributing significantly to the development and commercialisation of new bioenergy technologies. The bioenergy R&D funding of Tekes was around 27 million Euros in 2010. For further information visit [www.tekes.fi](http://www.tekes.fi)

The VTT Technical Research Centre of Finland is one of the leading European research institutes engaged in developing new bioenergy technologies. For further information visit [www.vtt.fi](http://www.vtt.fi)

International co-operation is important for Finnish industry and research organisations. Finland has joined 22 Implementing Agreements of the International Energy Agency, of which Bioenergy is one. Finland is currently participating in nine IEA Bioenergy Tasks. Each Task has a national mirror project in order to get the Finnish research groups and industry committed to the co-operation. IEA Bioenergy networking provides an excellent platform for global perspectives.

For more information contact Tuula Mäkinen at [Tuula.Makinen@vtt.fi](mailto:Tuula.Makinen@vtt.fi)



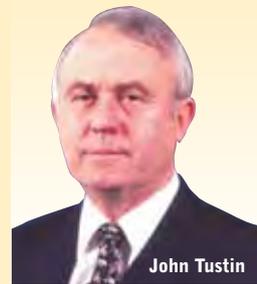
Helsingin Bussiliikenne Oy.

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# From the Secretariat



John Tustin

## ExCo67, Helsinki, Finland

The 67<sup>th</sup> meeting of the Executive Committee was held in Helsinki, Finland on 10-12 May with Birger Kerckow as Chairman and John Tustin as Secretary. The meeting was hosted by VTT and Tekes. The Chairman expressed the appreciation of the ExCo to Kai Sipilä and his team for the excellent meeting and study tour arrangements. Some of the outcomes of the meeting are detailed below.

### Changes in the Executive Committee

A new Member is Mr Fumiaki Ishida, Japan and a new Alternate Member is Mr Yasuhiro Oki, Japan.

### ExCo67 Workshop

A very successful workshop on 'Future Biomass-based Transport Fuels' was well attended by ExCo Members, Task Leaders, and Observers from Finland. The workshop presentations are listed below:

- Fuel strategies for short and long distance transport – Dr Thomas Garbe, Volkswagen, Germany
- Technology roadmap – Biofuels for transport – Dr Adam Brown, IEA Headquarters, Paris
- Ethanol market overview – Mr Mark Thomas Lyra, Raizen, Brazil
- The sustainable expansion of sugarcane ethanol in Brazil and the trends for other countries: the experience of ETH Bioenergia – Dr Carla Pires, ETH Bioenergia, Brazil
- What is the future of corn-based ethanol and when will cellulosic ethanol become the dominant paradigm? – Dr Jim McMillan, NREL, USA
- Does sustainable biodiesel have a future? – Mr Elmar Baumann, German Biofuel Producers Association VDB.
- From wastes to wheels: biogas creating the future – Mr Jacky Joas, Greenfield, Switzerland
- UOP/Honeywell development of green jet fuel technology – Mr Stan Frey, UOP Honeywell, USA
- Developments and visions of environmental friendly ships – Mr Patrik Rautaheimo, STX Europe, Finland
- Market introduction of next generation biofuels: industrial view – Dr Ari Juva, Transeco, Finland
- Biofuels end-use aspects: maximising impact and performance – Dr Nils-Olof Nylund, VTT, Finland
- Highlights of the next generation biofuels RTD&D in Finland – Prof. Kai Sipilä, VTT, Finland

For more detail please visit [www.ieabioenergy.com/DocSet.aspx?id=6863](http://www.ieabioenergy.com/DocSet.aspx?id=6863)

Immediately following the workshop there was a demonstration of Flexible Fuel Vehicles including features such as FFV vehicles with E85 in cold climate; plug-in hybrids with biofuels and FFV; trucks with ethanol and biomethane; and models from Think EV.

### Progress with Current Initiatives

- *Strategic Paper 'Life Cycle Assessment (LCA) of the Greenhouse Gas Balances of Bioenergy Compared to Other Energy Systems'*: The ExCo unanimously approved the final draft of the LCA paper. It will now be subject to a final technical review prior to editing and publication. The paper explains the need for a standard methodology for life cycle GHG quantification and demonstrates this through summaries of case studies on heat, electricity, CHP, and transport fuels. It will be available around August 2011.
- *AMF – Task 41, Project 3 'Fuel and Technology Alternatives for Buses'*: The project, initiated by VTT in Finland, is a joint initiative with Advanced Motor Fuels, Bioenergy, and Hybrid and Electric Vehicles. It aims to assess the overall efficiency, emissions, and costs (direct and indirect) for several fuel and drivetrain technology options for buses. It is divided into two main parts, fuel pathway analysis (well-to-tank) and vehicle (tank-to-wheel) performance. The project has gone very well and will result in a comprehensive test matrix. A draft report will be available in October 2011.
- *New Strategic Project 'Health and Safety Aspects of Solid Biomass Storage, Transportation and Feeding'*: A new strategic project proposed by Jaap Koppejan, Leader of Task 32, has been approved. It will incorporate the expertise available within the various IEA Bioenergy Tasks for a study on health and safety aspects of handling solid biomass fuels. The objective is to summarise the existing know-how and available research results on the issue of safe storage and transportation of different types of solid biomass and waste. The project will examine the issues and highlight current guidelines and requirements. It will be completed by the end of September 2012.



Sandra Hermle (Switzerland), Thembakazi Mali (South Africa) and Kees Kwant (the Netherlands) at the Flexi-fuel vehicle display.

### IEA Bioenergy Conference in Vienna

An end of triennium IEA Bioenergy Conference will be held in Vienna during the week 12-16 November 2012, back-to-back with ExCo70 and hosted by the Austrian Federal Ministry of Transport, Innovation and Technology. The venue will be the University of Technology Vienna, which will also be the co-organiser with Joanneum Research. This follows the very successful multi-Task Conference in Vancouver in August 2009 which significantly raised the profile of the Agreement by targeting senior people and showcasing the expertise and activities within the various Tasks.



Mr Esa Härmälä, Energy Department, the Ministry of Employment and the Economy, welcomed the visitors and opened the workshop.

## ExCo68 Workshop

The workshop for ExCo68 will be fully integrated into Day 1 of the Bioenergy Australia 2011 Conference and will have the theme 'Environmental Sustainability of Biomass'. Topics within this theme include GHG, water, soil, and governance.

## ExCo67 Study Tour

In conjunction with ExCo67 a total of 26 attendees participated in the study tour to the Helsingin Bussiliikenne Oy bus company and a St1 biofuel ethanol plant.

The first stop was at the Helsingin Bussiliikenne Oy bus company Ruha depot (approximately 330 buses). Mr Michael Andersson, technical manager made an interesting presentation to introduce the company. Nils-Olaf Nylund accompanied the group and provided extra information. The visit included a tour of the workshop facilities and the gas filling station.

Helsingin Bussiliikenne Oy has been a pioneer in reducing environmental emissions from its fleet. They described the OptiBio project which is being undertaken with VTT. The objective is to demonstrate the use of high quality renewable diesel fuel in buses in metropolitan Helsinki to reduce toxic emissions and increase the share of renewable fuels. It is the first project in the world involving the use of high quality renewable diesel at high concentrations. 70 buses were trialled on a 30% blend of renewable paraffinic diesel (HVO) made through hydrotreatment of vegetable oils and animal fats and four buses were trialled on 100% HVO. There were two reference buses on conventional diesel. No problems were identified despite the extremely cold winters in Finland during the trial period.

The second stop was at a St1 biofuel plant based on bakery waste and 'out of date' food products such as bread. St1 Biofuels Oy was established in 2006 with the goal to create a sustainable bioethanol production concept that could be utilised widely. The company has developed and patented a waste processing plant and process called Etanolix® and has been awarded for its innovativeness both in Finland and abroad. The process was designed specifically to convert food industry wastes and side streams into ethanol. The types of waste and side streams that can be processed include potato processing waste, bakery waste and side streams, dairy industry waste and side streams and brewery waste.

The first Etanolix® plant was opened in 2007 and in April 2009 St1 launched Refuel, a new ethanol biofuel – RE85. The waste-to-ethanol production concept is an easy to install, dispersed production process that makes small scale ethanol production economically profitable and at the same time keeps the associated CO<sub>2</sub> footprint at a minimum. To date, St1 has six bioethanol plants in Finland, a refinery in Gothenburg, and a total of around 1,200 St1 and Shell-branded distribution stations in Finland, Sweden, Norway, and Poland.



*Kai Sipilä (left) with Tat Smith and Secretary, John Tustin.*



*The Study Tour Group at St1 Biofuel Ethanol Plant.*

# Task Focus

## Task 37: Energy from Biogas

Biogas has been produced and used as a fuel for centuries, but it is only in the last few decades that a commercial sector for biogas production has been established in the developed economies of the world. The process of anaerobic digestion (AD) occurs naturally in nature and can be harnessed to provide a very effective means to treat organic materials, including residues and wastes from many industrial and agricultural processes, and indeed from municipal waste streams and purpose grown energy crops. AD is most commonly operated as a continuous process and thus needs a steady supply of feedstock. The feedstock needs to be strictly checked and usually needs some form of pre-treatment to maximise methane production and minimise the possibility of killing the natural digestion process. Co-digestion of multiple feedstocks is most commonly practised to achieve the best balance of biogas yield and process stability. The two main products of AD are biogas and a residue digestate, which after appropriate treatment can be used as a biofertiliser. Biogas is primarily a mixture of methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) as well as minor constituents. Nitrogen (N<sub>2</sub>) is also present in landfill gas. Biogas is readily used as a fuel for combined heat and power (CHP) units and is increasingly used as substitute natural gas (SNG) after appropriate cleaning and up-grading. Biogas production also avoids emissions of greenhouse gases (GHG) and thus contributes to environmental protection.

Task 37 addresses various aspects of energy from biogas, from the biomass feedstocks through to the utilisation of all products and the avoidance of emissions.

**Biogas from energy crops.** The Task published a technical brochure in 2009 that addressed a range of energy crops and showed that methane yields ranging from 120 to 658 m<sup>3</sup> for each tonne of volatile solid (VS) (i.e. organic matter) is possible, although the ranges of reported yields vary widely. Numerous species of plants have been tested and many varieties of grass, clover, cereals, maize and even hemp, flax, nettle, *Miscanthus*, potatoes, beet, kale, rhubarb, and artichoke have proved viable biogas feedstocks. The most widely used energy crop for biogas production is whole crop maize (not just the residues of the plant after harvesting of the corn cobs) which can achieve a methane yield of 205 to 450 m<sup>3</sup>.t<sup>-1</sup> VS. Maize is very good feedstock owing to its high yield per hectare, typically 30 total solids (TS) (equal to insoluble matter) and ease of harvesting with modern equipment. While beets and potatoes can produce yields of up to 34 t.h<sup>-1</sup> and 50 t.h<sup>-1</sup> TS, respectively, they introduce operational drawbacks due to soil contamination which can lead to accumulation inside the digester. Grasses, at 14 to 20 t.ha<sup>-1</sup> have only moderate energy yield, but are commonly used on account of their wide availability and modest input for cultivation. All this equates to methane yields of up to 18500 m<sup>3</sup>.ha<sup>-1</sup> for whole crop maize compared to up to 6500 m<sup>3</sup>.ha<sup>-1</sup> for grass, 6000 m<sup>3</sup>.ha<sup>-1</sup> for sugar beet and up to 20000 m<sup>3</sup>.ha<sup>-1</sup> for potatoes. The energy input for crop cultivation, and indeed the associated emissions, must of course be set against the energy yield and saved emissions in the overall life cycle. Life cycle assessments consistently show that biogas production allows greater GHG savings than for example first generation liquid biofuels. Task 37 members have contributed to a comprehensive database on crop yields, appropriate climate, and growth conditions for biogas feedstocks<sup>1</sup>. The fact that many energy crops are harvested only once each year (e.g. maize and root crops), and in the best case up to five times (e.g. grass), means that some form of storage is needed so that a steady supply of biomass can be provided to the biogas plant. The basic form of biomass storage, ensiling, is similar to that used for storage of green feed for winter feeding of animals.

**Pre-treatment of biomass feedstocks for biogas production.** Achieving the best possible methane production in the shortest time is dependent on the quality of the feedstock, which is influenced by pre-treatment. For any feedstock particle size is a key factor and thus chopping and/or grinding are frequently necessary. Removal of soil/sand and other foreign matter is vital to avoid blockages and loss of active volume in the biogas digester. When waste matter is used from the municipal sector, care must be taken to avoid contamination. Heat treatment is often required for feedstocks containing animal products in order to deactivate species such as pathogens. To ensure high quality of the solid/liquid digestate, some countries have adopted so-called 'positive lists' of materials that may be safely used in anaerobic digestion. Additional forms of biomass are gradually being added to these positive lists. Anaerobic digestion is increasingly using lignocellulosic biomass and pre-treatment of this material is essential. Various pre-treatments have been devised, although a lot of potential improvement is possible. As a consequence, the Task is addressing pre-treatments in the 2010-2012 work programme.

**Biogas up-grading to biomethane.** Raw biogas from an anaerobic digester contains typically 35 – 70% methane and this concentration of methane is too low for substitution of natural gas. Hence, up-grading is necessary to reach accepted standards and to meet regulatory requirements so that safe gas appliance operation can be guaranteed. A number of different biogas up-grading technologies have been used extensively, particularly in Sweden, over the past

decade and commercial operation has been proved. Nevertheless, there is still considerable development needed to improve performance, for example in terms of methane losses during the up-grading process and the costs of investment and operation.

The first step of up-grading involves mainly removal of water, by cooling, compression, absorption or adsorption, and hydrogen sulphide, by precipitation, adsorption on active carbon or chemical absorption using for example sodium hydroxide or iron oxide. Additional components, depending on the biomass feedstock, may need to be removed such as ammonia, silane, and particulates. There are four commonly used up-grading technologies. Pressure swing adsorption (PSA) uses elevated pressure in combination with adsorbing materials such as activated carbon or zeolites in a cyclic process; water scrubbing takes advantage of the higher solubility of CO<sub>2</sub> in water than methane; organic physical scrubbing is very similar to water scrubbing except the solvent used is organic, in which CO<sub>2</sub> is more soluble than water; and chemical scrubbing in which CO<sub>2</sub> is absorbed by amines. Whereas methane losses for PSA can range from <3 – 10%, water scrubbing can achieve <2% and organic physical scrubbing can achieve 2-4%, chemical scrubbing can achieve <0.1% methane loss.

All processes can produce a clean gas with at least 96% methane. Emerging technologies involve membranes and cryogenic treatments. Membranes are being widely tested and Task 37 has been monitoring the progress of one installation in particular in Austria where the resulting biomethane is injected into the local low pressure natural gas grid. Cryogenic up-grading is just emerging at pilot scale and so no long-term experience is yet available. The process involves cooling in steps, first to remove water, hydrogen sulphide, sulphur dioxide, halogens and silanes, second to remove CO<sub>2</sub> as a liquid, and finally in a third stage to remove CO<sub>2</sub> as a solid. For landfill gas where nitrogen is a major component a fourth step is necessary to extract methane as a liquid. Depending on the technology used for up-grading, different measures need to be taken to prepare the resulting biomethane for use, for example pressurisation. Further conditioning is needed before injection into natural gas grids, for example adjustment of the calorific value (Wobbe Index) and odourisation. Task 37 published a biogas up-grading technical brochure in 2009 and is working with standards organisations on biomethane quality for natural gas grid injection.

**Quality management and utilisation of digestate.** Digestate is a good source of valuable biofertiliser, provided appropriate biomass feedstock selection, pre-treatment, biogas production conditions and post-treatments are applied. Nutrients used in crop cultivation and found in all forms of biomass, whether processed or in the raw form of energy crops, should be recycled back to the soil. Anaerobic digestion causes chemical changes to the nutrients in the raw biomass feedstocks enhancing their availability to crops when present in a biofertiliser. For example, some of the organic nitrogen in the biomass feedstock is converted to ammonia. This is perhaps not surprising since the process of anaerobic digestion is an integral part of nature's recycling process. The concentrations of key nutrients in the digestate are of course dependent upon the input to the digester. Animal slurries (and manure) are a rich source of phosphorus and potassium, particularly from poultry, and for this reason care must be taken to avoid nutrient overload in intensively farmed regions. Biomass feedstocks can contain beneficial micro-nutrients and heavy metals, as well as persistent organic compounds that are not bio-degradable. Most of the micro-nutrients are fully utilised when recycled back to the soil. However, heavy metals and persistent organic compounds can cause problems. As a consequence, legal limits are applied to the use of raw manure and organic fertilisers.

In 2010 Task 37 published a technical brochure on utilisation of digestate and in 2011 will complete a technical brochure on digestate quality management. The technical brochure will assess the various regulations and approaches to quality management taken in a number of countries and how different treatments affect the quality of the resulting digestate. The aim is to accelerate the acceptance of proven good practices so that digestate can be widely used as a safe biofertiliser, thereby replacing mineral fertiliser.

### Future Challenges

One of the biggest challenges for the biogas sector, is to achieve satisfactory financial returns on investment. Almost without exception, biogas plants need some sort of financial support to operate in a sound economic manner. This is most commonly achieved by investment grants, feed-in tariffs and green certificates/carbon taxes. While in many cases the various technologies applied to biogas production and utilisation are considered mature, there is nevertheless a large potential for process improvements. Each improvement should have a positive impact on reducing costs. Interest in biogas up-grading to biomethane has increased rapidly in recent years, and low-cost, low emission technologies are needed. There is also a widespread need to increase the utilisation of waste heat from CHP installations.

For more information please visit <http://www.iea-biogas.net/>

<sup>1</sup> CROGEN project – <http://www.crogen.soton.ac.uk>

## Obituary for Henrik Flyver Christiansen



It is with deep sadness we have to report that the Task 31 National Team Leader for Denmark, Henrik Flyver Christiansen, 53 years old, passed away Monday 24 January 2011, following a short battle against cancer.

Henrik graduated from The Technical University of Denmark as Master of Science in Mechanical Engineering in 1987. In March 2009 he celebrated his 25<sup>th</sup> jubilee serving the state of Denmark, of which he served as an expert within bioenergy technology in the Danish Energy Agency for more than 22 years. The conversion of biomass for energy by thermal gasification technologies was a matter very close to Henrik's heart. He was deeply dedicated to the development and deployment of these technologies in the market and during the years he developed a deep insight in all technological aspects. Combined with his optimistic and unorthodox approach to solving problems and defeating barriers, this was a very fruitful combination. With his skills and passion Henrik was in great demand as an expert initiating and coaching the development of new projects in Denmark and as a member of a range of professional working groups. For almost two decades Henrik represented Denmark in the work of IEA Bioenergy Task 31 bringing his enthusiasm into the international knowledge sharing and networking to the benefit of all.

Henrik was of a rare authentic and gentle nature. In his passion for bioenergy Henrik did not distinguish between his private and professional life. Together with his family he lived at a small farm southwest of Copenhagen where he experimented with his own biomass boiler and machines and practices especially suited for ecological farming. Henrik is survived by his wife Ping He, his family, friends and colleagues at the Danish Energy Agency.

## Joint Workshop – Tasks 32 and 40

Tasks 32 and 40 held a joint workshop 'Development of torrefaction technologies and impacts on global bioenergy use and international bioenergy trade' on 28 January in Graz, Austria, as a side-event of the Central European Biomass Conference (CEBC). The workshop gave a comprehensive overview of the fundamentals of torrefaction, and the main advantages of and challenges in producing torrefied biomass. Ongoing R&D activities were shown, demonstration plants under construction or already in operation were presented and the latest state-of-science in torrefaction was discussed. A total of eight speakers highlighted these issues. In addition, four speakers spoke on the effects that the commercial availability of torrefaction technology may have on bioenergy trade.

Overall, the workshop was a huge success. While the room had 250 seats, at times attendees were standing in the corridors and in the back to follow the presentations. All presentations are available for downloading on the Task 32 and 40 websites.

## Task 33: Thermal Gasification of Biomass

A three day meeting of Task 33 was held in Christchurch, New Zealand from 12-14 April. The first day was a closed Task meeting where Member Country reports on renewable energy status, renewable energy incentives, and gasification status were given by meeting participants (USA, Austria, the Netherlands, Switzerland, Turkey, and New Zealand). A presentation by Reinhard Rauch, Austria, on the new Task website and development of a Member Country gasification project database was also given. The second day the Task visited the gasification research facilities at the University of Canterbury, as well as a local pellet mill (and rape seed press plant) and sawmill. On the third day an open workshop 'Gasification and Alternatives Fuels Development' was held and attended by approximately 40 people. Overview presentations were given on gasification developments in the USA, Austria, New Zealand (primarily Fluidyne), and Australia. A number of presentations on research projects related to gasification by researchers at the University of Canterbury; co-gasification of coal and biomass for hydrogen production at CRL Energy, New Zealand, and on underground coal gasification at Solid Energy, New Zealand were presented.

Copies of all the presentations are available on the Task website.

## Kai Sipilä awarded the Johannes Linneborn Prize

Professor Kai Sipilä, ExCo Member for Finland has been awarded the Johannes Linneborn Prize for Achievements in Biomass Development. The award recognises his leadership in development of biomass conversion technologies and for promoting biomass as a sustainable energy source within Finland, a leading country in bioenergy in the European Union and worldwide for more than 25 years. Trained as a chemical engineer at the Helsinki University of Technology, he acquired impressive abilities for process development showing creative and practical solutions like in the combined combustion/pyrolysis process of VTT which drew a lot of attention. His interests and successful activities however, cover an integrated bioenergy approach, including all kinds of thermo-chemical conversion technologies, waste to energy and material recycling systems, alternative motor fuel production, renewable energy systems, refining of biomass, energy and climate issues, to name a few.



Working for VTT, Kai has contributed to an extensive list of publications and reports and 10 patents. Apart from his technical papers, he has delivered authoritative reviews and overviews on biomass energy, biofuels and material resources at conferences and workshops which have had a lot of influence on the R&D and implementation agendas in the biomass field around the world.

All those within IEA Bioenergy congratulate Kai on his well-earned award.



## Don Stevens Recognised

Chairman, Birger Kerckow made a presentation to Don Stevens at ExCo67 in Helsinki to mark his outstanding contribution to IEA Bioenergy. Don has been associated with IEA Bioenergy for around 29 years. The first ExCo meeting he attended was ExCo12 in San Francisco in October 1983. At this stage Don was a collaborator in Programme Area D led by Simon Friedrich. Don's technical contribution to IEA Bioenergy has been mainly through his long standing involvement in the biomass conversion area. These collaborations have been variously called Programme Area D, Task IV, Task VII, Task X, Task XIII, Task 27, and Task 39. In most of them Don was either the Operating Agent or the Task Leader but he has also served in nearly every other role possible from Observer, Programme Leader, Assistant Operating Agent, National Team Leader, and Alternate ExCo Member. The presentation recognised Don's excellent leadership, planning, participation, and authorship all the way through. The Chairman noted that over the years Don has attended 30 ExCo meetings which is a tribute to his commitment, endurance, and patience! Don will retire from his role at the Pacific Northwest National Laboratory in Richland later this year.

# Publications



## 2010 IEA Bioenergy Annual Report

The 2010 Annual Report contains a special feature article 'Algal Biofuels Status and Prospects' prepared by Task 39. Also included is a report from the Executive Committee; a detailed progress report on each of the Tasks; and key information such as Task participation, Contracting Parties, budget tables and substantial contact information, plus lists of reports and papers produced by the Implementing Agreement. The Annual Report is available on the IEA Bioenergy website at: <http://www.ieabioenergy.com/LibItem.aspx?id=6780>

## Bioenergy, Land Use Change and Climate Change Mitigation

This report was prepared by Associate Professor Göran Berndes, of Chalmers University of Technology, Sweden; with input from contributing authors Dr Neil Bird, Joanneum Research, Austria and Professor Annette Cowie, The National Centre for Rural Greenhouse Gas Research, Australia. It was co-financed by IEA Bioenergy and the Swedish Energy Agency. The report addresses a much debated issue – bioenergy and associated land use change, and how the climate change mitigation from use of bioenergy can be influenced by greenhouse gas emissions arising from land use change. The purpose of the report was to produce an unbiased, authoritative statement on this topic aimed especially at policy advisors and policy makers. The publication can be downloaded at: <http://www.ieabioenergy.com/LibItem.aspx?id=6770>



## Developing Sustainable Trade in Bioenergy

The 'summary and conclusions' publication from the workshop held in conjunction with ExCo65 in Nara City, Japan in May 2010 has been published and is available to download at: <http://www.ieabioenergy.com/MediaItem.aspx?id=6880>

## Bioenergy - a Sustainable and Reliable Energy Source. A review of status and prospects

These publications are the Main Report and the Executive Summary jointly prepared by the Energy Research Centre of The Netherlands, E4tech, Chalmers University of Technology and the Copernicus Institute of the University of Utrecht. They provide an overview of the potential for bioenergy and the challenges associated with its increased deployment. Opportunities and risks in relation to resources, technologies, practices, markets and policy are all discussed. The aim is to provide insights into the opportunities and required actions for the development of a sustainable bioenergy industry. Both publications can be downloaded at: <http://www.ieabioenergy.com/Library.aspx>

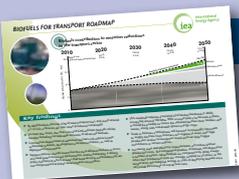


## Algae - the Future for Bioenergy?

The 'summary and conclusions' publication from the workshop held in conjunction with ExCo64 in Liege, Belgium in October 2009 has been published and is available to download at: <http://www.ieabioenergy.com/DocSet.aspx?id=6436>

## The Pellet Handbook: The Production and Thermal Utilization of Pellets

This handbook produced by Task 32, is the first comprehensive guide in English which covers all aspects of pellets. The book is extensively illustrated and contains comprehensive practical information. It addresses all of the major stakeholders in the pellet market, ranging from raw material producers and suppliers, pellet producers and traders, manufacturers of pellet furnaces and pelletisation systems, installers, engineering companies, energy consultants, and end users. The handbook was written by experts within Task 32, and with significant input from Tasks 29, 31 and 40; and external experts. Financial support was received from IEA Bioenergy and the Austrian organisations Landesenergieverein Steiermark and BIOS Bioenergysysteme GmbH. It was edited by Ingwald Obernberger and Gerold Thek of BIOS Bioenergysysteme GmbH and can be ordered from Earthscan, see <http://www.earthscan.co.uk/?tabid=102497>.



## IEA Technology Roadmap Biofuels for Transport

The International Energy Agency (IEA), at the request of the G8, has developed a roadmap 'Biofuels for Transport' with special focus on technology development and diffusion. Biofuels provide around 2% of total transport fuel today, but new technologies offer considerable potential for growth. The roadmap identifies technology goals and defines key actions that must be undertaken. Download this publication at: [www.iea.org/roadmaps](http://www.iea.org/roadmaps)

## Better Use of Biomass for Energy – Position Paper and Background Report

In December 2009 IEA RETD and IEA Bioenergy presented the key findings from a joint project on 'Better Use of Biomass for Energy' during the RETD side event at the COP15 in Copenhagen. The project identified opportunities for bioenergy to achieve better greenhouse gas reduction, and for climate policies to achieve better bioenergy development. Details on the findings, recommendations and brief case studies are given in a background report prepared by CE Delft, Oeko-Institut, AidEnvironment and CIEP. Download these publications at: [www.ieabioenergy.com/LibItem.aspx?id=6476](http://www.ieabioenergy.com/LibItem.aspx?id=6476)



## World Energy Outlook 2010

The World Energy Outlook 2010 (WEO-2010) provides updated projections of energy demand, production, trade and investment, fuel by fuel and region by region to 2035 and it includes for the first time, a new scenario that anticipates future actions by governments to meet the commitments they have made to tackle climate change and growing energy insecurity. WEO-2010 also puts the spotlight on several topical issues, including what more must be done and spent post-Copenhagen to limit the global temperature increases. To order a copy please email: [weo@iea.org](mailto:weo@iea.org)

## CO<sub>2</sub> Emissions from Fuel Combustion - 2010 Edition

In recognition of fundamental changes in the way governments approach energy-related environmental issues, the IEA has prepared this publication on CO<sub>2</sub> emissions from fuel combustion. This annual publication was first published in 1997 and has become an essential tool for analysts and policy makers in many international for a such as the Conference of the Parties. To order a copy visit the IEA Online Bookshop at: [www.iea.org/w/bookshop/add.aspx?id=570](http://www.iea.org/w/bookshop/add.aspx?id=570)



# IEA Bioenergy Events

## Executive Committee

**ExCo68** will be held in Maroochydore, Sunshine Coast, Australia from 22-24 November 2011. This meeting will be held in conjunction with the Bioenergy Australia Conference, 24-25 November 2011.

**ExCo69** will be held in Istanbul, Turkey from 8-10 May 2012.

**ExCo70** will be held in Vienna, Austria from 12-16, November 2012, along with the end of triennium IEA Bioenergy Conference.

## Task Events

**Task 29's** schedule of upcoming meetings is:

- 19-22 October, Cavtat, Croatia: Sustainable Energy Finance and Investment Summit. participating banks and finance institutions. The aim of this conference is to identify ways of financing energy efficiency and renewable energy projects using innovative financial instruments. The Conference will highlight the importance of investment and regional co-operation to promote renewable energy, with a view to reduce energy costs, have a cleaner environment and increase security of energy supply. A Task meeting will be held alongside this event.
- May 2012, Ontario, Canada: Task meeting, site visits and conference. Dates to be confirmed.
- October 2012, Germany, Task meeting, site visits and conference. Dates to be confirmed.

**Task 32's** schedule of upcoming meetings is:

- 18-21 October 2011, Dublin, Ireland: A workshop on 'Processing options for Solid Recovered Fuels' in conjunction with Task 36.

- May 2012. A joint workshop on biomass co-firing will be held with the IEA Clean Coal Centre and VGB Powertech. Dates and location to be confirmed.

**Task 33's** schedule of upcoming meetings is:

- 18-20 October 2011, Pitea, Sweden. A Task meeting and technical tours are being organised along with a workshop 'Forest Product Industry Gasification Opportunities'.
- There will also be two Task meetings held in 2012 in Turkey and probably Austria. Dates and locations are to be confirmed.

**Task 34's** schedule of upcoming meetings is:

- 3-7 October 2011, Richland, Washington, USA: Task meeting and a technical visit to the PNNL pyrolysis and bio-oil upgrading laboratories.

- 7-11 May 2012, Ottawa, Canada: Task meeting and a technical visit to CanMet (NRCan). Dates to be confirmed.

- 8-12 October 2012, Kapolei, Hawaii: Task meeting and final reports. Dates and location to be confirmed.

**Task 36's** schedule of upcoming meetings is:

- 18-21 October 2011, Dublin, Ireland. A workshop on 'Combustion of Solid Recovered Fuel (SRF)' will be held in conjunction with Task 32.

**Task 37's** schedule of upcoming meetings is:

- September 2011, Cork, Ireland: Task meeting and workshop. Date to be confirmed.

**Task 38's** schedule of upcoming meetings is:

- 19-21 September 2011, Campinas, Brazil: Task meeting followed by a joint Task 40 and 43 workshop 'Quantifying and managing land use effects of bioenergy'

**Task 39's** schedule of upcoming meetings is:

- 14-18 August 2011, Campos do Jordao, Brazil: Task Technical workshop in conjunction with the 1st Brazilian BioEnergy Science and Technology Conference (BBEST).

- February 2012, Copenhagen, Denmark: A Technical workshop. Dates to be confirmed.

- May 2012, Vancouver, Canada: Task planning and technical conference.

- November 2012, Vienna, Austria: IEA Bioenergy Multi-Task Conference.

**Task 40's** schedule of upcoming meetings is:

- 19-21 September 2011, Campinas, Brazil: Task meeting followed by a joint Task 38 and 43 workshop 'Quantifying and managing land use effects of bioenergy'.

**Task 42's** schedule of upcoming meetings is:

- 2nd half of 2011, Australia: Task meeting to be organised by APPI; including an Australian stakeholder meeting and site visits. Dates and location to be confirmed.

- 1st half of 2012, Denmark: Task meeting to be organised by the University of Copenhagen; including a Danish stakeholder meeting and site visits. The meeting may also include a joint event with Task 39. Dates and location to be confirmed.

- 2nd half of 2012, Canada or the Netherlands: Task meeting to be organised by Canmet/Alberta or WUR; including a stakeholder meeting and site visits. Dates and location to be confirmed.

**Task 43's** schedule of upcoming meetings is:

- 19-21 September 2011, Campinas, Brazil: Task meeting followed by a joint Task 38 and 40 workshop 'Quantifying and managing land use effects of bioenergy'.

## OTHER EVENTS

### The 1st International Conference on Algal Biomass, Biofuels and Bioproducts

17-20 July 2011, St Louis, USA  
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Web: [www.algalbb.com](http://www.algalbb.com)

### 1st Brazilian BioEnergy Science and Technology Conference (BBEST)

14-18 August 2011, Campos do Jordao, Brazil  
Web: [www.bbest.org.br/](http://www.bbest.org.br/)

### International Symposium on Anaerobic Digestion of Solid waste and energy crops

28 August - 01 September 2011, Vienna, Austria  
Web: [www.adsvec2011.org](http://www.adsvec2011.org)

### 1st European training course on the Principles and Technologies for Biorefining

29 August - 01 September, Paris, France  
Web: <https://colloque.inra.fr/biorefiningschool>

### Nordic Bioenergy Conference 2011

5-9 September 2011, Jyväskylä, Finland  
Email: [bioenergy@finbio.fi](mailto:bioenergy@finbio.fi)  
Web: [www.nordicbioenergy.finbioenergy.fi/](http://www.nordicbioenergy.finbioenergy.fi/)

### 2nd Oxyfuel Combustion Conference

12-16 September 2011, Queensland, Australia  
Web: [www.ieaghg.org/index.php?/20100518210/](http://www.ieaghg.org/index.php?/20100518210/)

### International Conference on Biogas Microbiology

14-16 September 2011, Leipzig, Germany  
Web: [www.ufz.de/index.php?de=20779](http://www.ufz.de/index.php?de=20779)

### Waste-to-Fuels Conference & Trade Show

25-27 September 2011, San Diego, California  
Email: [gene@swix.ws](mailto:gene@swix.ws)  
Web: [www.waste-to-fuels.org](http://www.waste-to-fuels.org)

### LignoFuels 2011

28-29 September 2011, Copenhagen, Denmark  
Email: [mailto:amicrael@acieu.net](mailto:mailto:amicrael@acieu.net)  
Web: [www.wplgroup.com/acil/conferences/eu-ee2.asp](http://www.wplgroup.com/acil/conferences/eu-ee2.asp)

### tcbiomass2011 'The international Conference on Thermochemical Conversion Science'

28-30 September 2011, Chicago, USA  
Web: [www.gastechnology.org/tcbiomass2011](http://www.gastechnology.org/tcbiomass2011)

### Biofuels International Canada Expo and Conference

3-4 October 2011, Calgary, Canada  
Email: [rebecca@horseshoemedia.com](mailto:rebecca@horseshoemedia.com)  
Web: [www.biofuelsinternationalexpo.com/canada](http://www.biofuelsinternationalexpo.com/canada)

### 5th Biodiesel International Conference

6-7 October 2011, Berlin, Germany  
Web: [www.agam-biodiesel.de/index.php?msg=339](http://www.agam-biodiesel.de/index.php?msg=339)

### XIX ISAF - International Symposium on Alcohol Fuels

10-14 October 2011, Verona, Italy  
Web: [www.isaf2011.it/](http://www.isaf2011.it/)

### 2nd International Conference on Lignocellulosic Ethanol (2IGLE)

11-13 October, Verona, Italy  
Web: [http://ec.europa.eu/energy/renewables/events/2011\\_10\\_11\\_ethanol\\_en.htm](http://ec.europa.eu/energy/renewables/events/2011_10_11_ethanol_en.htm)

### Low Carbon Earth Summit-2011 (LCES-2011)

19-26 October 2011, Dalian, China  
Contact: [ashley@lcesummit.com](mailto:ashley@lcesummit.com)  
Web: [www.lcesummit.com](http://www.lcesummit.com)

### Tree-stumps for bioenergy – harvesting techniques and environmental consequences' International Symposium

24-26 Oct 2011, Uppsala, Sweden  
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Web: [www.slu.se/treestumpsymposium2011](http://www.slu.se/treestumpsymposium2011)

### Future Role of Bioenergy from Tree Biomass in Europe

6-11 November 2011, Vienna, Austria  
Web: [www.cost.esf.org/events/Bio-energy-from-Tree-Biomass](http://www.cost.esf.org/events/Bio-energy-from-Tree-Biomass)

### Bioenergy Australia

24-25 November 2011, Queensland, Australia  
Web: [www.bioenergyaustralia.org](http://www.bioenergyaustralia.org)

### 5th International Algae Congress

1-2 December 2011, Berlin, Germany  
Web: [www.algaecongress.com/page/3789](http://www.algaecongress.com/page/3789)

### World Future Energy Summit

16-19 January 2012, Abu Dhabi  
Web: [www.worldfutureenergysummit.com](http://www.worldfutureenergysummit.com)

### Renewable Energy World Conference and Expo North America

14-16 February 2012, California, USA  
Web: [www.renewableenergyworld-events.com/index.html](http://www.renewableenergyworld-events.com/index.html)

### World Biofuels Markets 2012

11-13 March 2012, Rotterdam, The Netherlands  
Web: <http://www.worldbiofuelsmarkets.com/>

## Objectives of IEA Bioenergy

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

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in implementing bioenergy projects  
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Task 38: Greenhouse Gas Balances  
of Biomass and Bioenergy Systems  
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Task 39: Commercialising Liquid Biofuels  
from Biomass  
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Bioenergy Trade – Securing Supply  
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Task 42: Biorefineries: Co-production  
of Fuels, Chemicals, Power and Materials  
from Biomass  
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