

IN THIS ISSUE:

IEA Bioenergy Task 39 2007-09	2
Biofuels and Bioenergy Workshop Summary	3
MaxiFuels	5
Visiting Scholar Opportunities	6
Future Workshops & Symposia	7
Contact Info	8

EDITOR'S NOTES

Welcome to the December 2006 issue of the Task 39 newsletter. It has been a busy year for our members, who continue to rise to the challenges of biofuel development. In this issue, we focus on the opening of the MaxiFuels Pilot Plant in Denmark in our continuing series of *Institutional Overviews*. Many thanks to Professor Birgitte K. Ahning for contributing this article. We also provide a general summary of the **Biofuels and Bioenergy: Challenges and Opportunities** conference, which was held in August at the University of British Columbia. This was a great opportunity for the larger bioenergy community to discuss common issues, particularly around biomass supply and the mechanisms behind choosing optimal technologies for bioenergy or biofuel production. Our thanks go to our co-hosts in Tasks 29 and 31 for making this meeting a success!

As most of you will be aware, Task 39 is about to enter its 3rd triennium under a new name, *Commercializing 1st- and 2nd-Generation Liquid Biofuels from Biomass*. In the New Year, our website will be updated to reflect this change. On January 14-16, we will be holding our inaugural planning meeting in Peterborough, UK. Thanks to Tony Sidwell and his colleagues at British Sugar for organizing this session. On April 28, we will be hosting a Country Representatives meeting in Denver, CO, as part of the 29th Symposium on Biotechnology for Fuels and Chemicals; this will be followed by a Special Session within the Symposium on May 1. Please check your calendars and save these dates, and be sure to check the website (www.task39.org) for more details.

As always, we encourage all IEA Bioenergy Task members to make use of this newsletter, to contribute content, and to suggest improvements. - [Warren Mabee](#)

FROM THE TASK LEADER

Welcome to the last issue of the Task 39 Newsletter for the current triennium! In this issue, we continue our series examining the research developments in our member countries, focusing on the new MaxiFuels Pilot Plant in Denmark. Thanks to Birgitte Ahning for preparing this document!

As many of you will be aware, we have been successful in extending our Task for another triennium. The new iteration of our Task will continue to blend both policy development and technological innovation around liquid biofuels; our mandate has expanded to include new foci on *Implementation Issues*, a subtask to be led by Manfred Wörgetter, and on *Synthetic Biofuels*, which will see us engaging our colleagues in Tasks 33 and 34 more regularly over the next three years. The structure for our new Task is described in the pages that follow. Many thanks to our colleagues who helped prepare the proposal for this task.

We also welcome new Task members for the next triennium. Norway, Australia, and Japan join our long-standing members from Sweden, Finland, Denmark, the Netherlands, Austria, Germany, the United Kingdom, the United States, the European Commission, South Africa, the United States, and Canada. Our Task is now a truly global group of experts and I look forward to working with you all!

Upcoming meetings and opportunities for Task members to participate include the Task 39 Planning Meeting (January 15-16 in Peterborough, UK), a Business Meeting and Special Session at the 29th Symposium in Denver, CO (April 28 and May 1). I would appreciate it if you would save these dates in your calendar and register for each event as soon as possible. You may find more information on our website (www.task39.org).

As always, the success of Task 39 rests upon the dedication and contributions of our members. I look forward to seeing you all soon, and to receiving your input into our next triennium's activities! - [Jack Saddler](#)

IEA BIOENERGY TASK 39 2007-09: COMMERCIALIZING 1ST- AND 2ND-GENERATION LIQUID BIOFUELS FROM BIOMASS

The work in the period 2007-2009 will be focused on the policies and implementation strategies for 1st- and 2nd-generation biofuels, and on the continued technical development of 2nd-generation biofuels derived from lignocellulosic biomass through biochemical or thermochemical platforms. This work is proposed based on the continued rapid development of biofuel infrastructure in many countries and regions, and the presence of mandates and targets for biofuel use in certain European and North American countries. Member countries of Task 39 will be able to access a large body of knowledge on strategies for implementing existing (1st-generation) biofuels such as sugar- and starch-based bioethanol and vegetable oil and waste oil-based biodiesel. These strategies will be also useful in the emerging (2nd-generation) biofuels sector, based on non-food lignocellulosic biomass. The Task will continue exploring new science, tools and technology for the bio-based production of 2nd-generation biofuels, and will link to existing pyrolysis and gasification Tasks within the Bioenergy IA to explore thermochemical platforms. The work of the proposed Task will help member countries achieve the biofuel policy targets and mandates that have emerged in many countries and regions.

Objectives

Specific objectives of the proposed Task are to:

- ▶ Provide information and analyses on policy, markets and implementation issues (including regulatory and infrastructure development) that will help participants encourage commercialization of 1st- and 2nd-generation liquid biofuels as a replacement for fossil-based biofuels, by continuing the deployment of 1st-generation biofuels and supporting development of 2nd-generation biofuels. Policy analysis of ongoing legislation concerning all liquid biofuels will remain a continued topic of the Task.
- ▶ Catalyze cooperative research and development projects that will help participants:
 - develop improved, cost-effective bio-based processes for the generation of 2nd-generation biofuels, including converting lignocellulosic biomass to ethanol;

- develop improved, cost-effective thermochemical-based processes, such as the Fischer-Tropsch process, for converting syngas to synthetic biodiesel and other 2nd-generation biofuels. For this objective, a strong liaison will be sought with the other IEA Bioenergy Tasks that are working in the field of gasification and pyrolysis of biomass (Tasks 33 and 34).
- Provide information dissemination, outreach to stakeholders, and coordination with other related groups.

Work Scope

To meet Task objectives, the Task will conduct a coordinated programme of work to deal with both the technical and infrastructural issues that influence biofuels use.

1. Policy, marketing, legislative/regulative and infrastructure issues to assist with the implementation and commercialization of 1st- and 2nd-generation liquid biofuels.
2. RD&D (Research, Development and Demonstration) issues used to catalyze and expand the use of:
 - a. Biological conversion technologies, matching pretreatment, hydrolysis and fermentation technologies to specialized substrates, including softwoods, hardwoods, and some agricultural wastes.
 - b. Thermochemical conversion technologies (in conjunction with other Tasks), focusing on the technical issues that surround production and cleanup of synthesis gas from biomass, accumulation of char and volatiles in gasification systems, and chemical catalysis to liquid fuels, primarily the Fischer-Tropsch platform and its derivatives.
3. The Task will provide information dissemination, outreach to stakeholders, and coordination with other related groups through a variety of means, including newsletters, workshops, conferences, and electronic communications.

BIOFUELS AND BIOENERGY: CHALLENGES AND OPPORTUNITIES

Vancouver, 27-30 August 2006

Warren Mabee

We are very pleased to provide this report on our successful IEA Bioenergy Conference, entitled Biomass and Bioenergy: Challenges and Opportunities, held August 27-30, 2006 in Vancouver, Canada. This meeting was jointly organized by IEA Bioenergy Tasks 29, 31, and 39, and we were honoured to host the event here at the Faculty of Forestry at the University of British Columbia. First we would like to thank our sponsors, who are highlighted on page 5; without their help we would not have been able to hold such an extensive event! We would also like to thank our colleagues at the University for their assistance in organizing the event. The conference brought together more than 130 experts from seventeen countries around the world, plus an additional group of more local colleagues. Participants from North America, Europe, Asia, and Africa each brought their own unique perspectives to the table and helped catalogue the technical and political challenges that the biofuels and bioenergy sector faces.



The Forest Sciences Centre at UBC

The three IEA Bioenergy Tasks involved in the meeting each brought their own expertise, ranging from socio-economic analysis, to short-rotation forestry and sustainability, to bioenergy and liquid biofuel production. Extended dialogue between the experts present at the meeting demonstrated the breadth of the opportunity that new biofuel and bioenergy technologies can provide, in terms of social, economic, and environmental returns. The convergence of biotechnology, chemistry, and forestry is

opening doors to innovations that could revolutionize nearly every aspect of our lives, from energy and fuel production, to industrial manufacturing, to the production of chemicals and consumer goods. It is apparent that there is great potential for combining environmental protection and services with sustainable bioenergy production!

The ongoing Mountain pine beetle outbreak, projected to cumulatively impact almost 1 billion m³ of lodgepole pine in the province of British Columbia by 2013, served to provide a focus for the meeting. An outbreak of this size is unprecedented in recorded history, and has caused a crisis in the province's forest industry. The cumulative volume of wood impacted will be more than ten times BC's current annual allowable cut; this means that there is an accumulating surplus of standing deadwood in the forest, which increases the danger of catastrophic fires and reduces the merchantable volume of the working forest. Wood impacted by MPB loses its value as timber over time, and so wood that has been standing dead for extended periods cannot be processed into lumber or advanced wood products. Technology to transform wood (lignocellulosic biomass) into bioenergy and biofuels could be utilized to process a large portion of this material.

Over the past few years, we have witnessed significant advances in industrial biotechnology and particularly in the biorefining of lignocellulosic feedstocks such as wood and agricultural residues. These advances have come about because novel applications involving genomics, proteomics and bioinformatics are being applied to new problem sets. However, our conference highlighted the need for experts in biorefining technology to enter into dialogue with the providers of biomass, whether foresters or farmers, as well as with the stakeholders involved in stewardship of farms and forests. Cautionary notes on the potential for mismanagement and conflict over resource use were sounded by many of our participants. This conference set a strong direction for our future research, and has provided us all with an expanded network of expertise to draw upon. In coming months and years, this network will allow us to share knowledge and experiences that will speed the development and growth of a sector vital for value creation and sustainable industrial development.

Every presentation at this conference was selected to make a maximum impact on our participants. Our keynote speaker, Dr. Avrim Lazar of the Forest Products Association of Canada, made a special point of highlighting the role that the world's forest industry can play in developing biorefining as a new industrial model for the world's economy - one that works within the carbon cycle and respects the global ecosystem. Our Plenary speakers were carefully selected to describe the economic opportunities that biorefining might offer, the political challenges that these technologies might help

answer, and the ecological impact that a biorefining sector might have on the world. We were fortunate to have a number of industry leaders speak in these sessions, as well as North American government officials responsible for this area on national and provincial scales.

The Concurrent sessions held at the conference focused on a number of areas, including feedstock supply and logistics, environmental impacts, socio-economic issues, and biofuel production issues. The range of excellent speakers that we had in these sessions is a testament to the incredible research that is ongoing in all of these areas. Moreover, the participants in the meeting were able to take part in a number of sessions that perhaps lay outside of their core expertise, which led to rich dialogue in both formal and informal settings. We were also lucky to have a number of great posters presented by scholars from around the world.



Participants attend a dinner lecture

During the course of the conference, our participants were able to enjoy a range of facilities at the University of British Columbia's Point Grey campus. We were also able to spend an afternoon at the Malcolm Knapp Research Forest, a facility operated by the Faculty of Forestry for training and research purposes. The afternoon at the

forest was a great chance to talk with participants in an informal setting while taking part in a range of outdoor activities, including canoeing, hiking, orienteering and rock climbing. The visit to the Research Forest was capped by an after dinner speech by our colleague, Dr. John Innes, who placed bioenergy and biorefining opportunities into the context of global development.



In the woods at the Malcolm Knapp Research Forest

In conclusion, this conference marked the beginning of an important collaboration within IEA Bioenergy. There is a pressing need for us to link technical research into bioenergy and biofuel options with the environmental and socio-economic aspects of resource use, and this need was highlighted by our participants. The network of expertise that this conference engendered will be a useful tool in all of our research programs, and will hopefully serve to strengthen the core mission of IEA Bioenergy itself. Finally, we hope that this conference will serve as a template for future meetings of this type between the different Tasks of our Implementing Agreement. Thanks to the enthusiastic and dedicated participation of our members, our meeting was a great success and one that we were proud to be a part of.

MAXIFUELS PROPELS DENMARK INTO LEADING BIOETHANOL POSITION

Birgitte K. Ahring, Biocentrum-DTU, Denmark

MaxiFuels – the first fully integrated Danish bioethanol plant – was inaugurated at DTU, the Technical University of Denmark, on 13 September 2006. The pilot plant is the first of its kind in the world and has put Denmark in the lead in the international race for 2nd generation bioethanol, using agricultural waste products instead of grain and other potential foods.



Opening of MaxiFuels Pilot Plant, 13 September 2006

Efficient and optimized use of the raw materials with an environmentally friendly technology is the key to future success for the 2nd generation bioethanol production. Therefore the overall process outline for MaxiFuels has been defined to yield the maximum amount of biofuels per unit of raw material and to increase the process benefit by utilization of the residues for further energy conversion and by-product refining. The result is an integrated 2nd generation bioethanol pilot plant with a cost efficient conversion of the raw material, maximizing the amount of biofuels and minimizing the disposal of process water. The technology is new and has the potential of setting the standard for cost efficient industry production of lignocellulosic based bio-ethanol.

The code word for MaxiFuels is maximum utilization. Every carbon atom present in the raw material is utilized, resulting not only in bioethanol but also in other valuable energy products like methane gas and hydrogen. The residual product at the end of the process can be used as a solid fuel or converted by gasification to more liquid biofuels. Maximum utilization is a major contributor to the exceptionally competitive production process. Calculations based on the pilot plant suggest that full-scale plants (500,000 tons wheat straw per year) will produce bioethanol at a price of € 0.31/US\$ 0.40 per liter. While already low, the price could decrease further by optimizing the process. Full and innovative utilization of the raw material adds a number of environmental and energy advantages, e.g. recycling of the process water after purifying it with the use of biogas generated in the production process.

MaxiFuels has great economic and environmental potential. The technology behind the plant can be utilized in future biorefineries for the production of bioethanol and other products currently manufactured by oil refineries. Biorefineries will help current oil reserves last longer. In cost terms, MaxiFuels bioethanol not only matches the world's cheapest bioethanol; its 2nd generation technology

will make bioethanol with much higher CO₂ reduction than 1st generation based on corn, grain and sugars.



Professor Ahring in the Pilot Plant

The pilot plant in Denmark is the first step towards commercialization of the technology. The patents behind the process are placed in the engineering and technology company, BioGasol. This company anticipates within the next two years to build the first bioethanol demonstration plant based on the MaxiFuels technology. The pilot plant at DTU will also be used for further basic research, contributing to new knowledge and optimization of 2nd generation bio-ethanol processes.

MaxiFuels consists of the following process steps:

Pre-treatment

This process is a combination of steam-explosion and wet oxidation, applying both the addition of oxygen and a pressure release at high temperature. No chemicals are used. The method is efficient and cost effective for opening of all major biomass materials such as straw, corn stover and woody materials

Hydrolysis and glucose fermentation

To enhance enzymatic hydrolysis of the pre-treated biomass material a combined hydrolysis and fermentation is used. The main product from the hydrolysis is glucose and xylose. The glucose is simultaneously fermented into ethanol by yeast.

Xylose Fermentation

The xylose fermentation transforms pentoses into bioethanol using a tailored thermophilic anaerobic bacterium. Hydrogen is a by-product.

Solid Fuel Production

A lignin product is produced with excellent abilities for processing into pellets or combustion fuels.

Anaerobic digestion of process water and recirculation

After the bioethanol production there still remains a part of the organics. They are transformed to methane by anaerobic digestion. The great benefits of this process are reuse of the process water and an overall positive energy balance of the waste treatment process. The income from the by-products lower the ethanol production price.

The combined process as well as technology behind the individual process steps and microbes are patented.

The Background of MaxiFuels

Maxifuels is the result of corporation between public research and the industry. MaxiFuels is financed by the Danish Energy Authority's energy research programme (EFP 2005), DTU, DONG Energy and Novozymes. Total cost of the plant is approx. 3.36 million euros.

VISITING SCHOLAR OPPORTUNITIES

As many of you know, one of the goals of Task 39 is to facilitate student and faculty exchanges. We hope to encourage the exchange of ideas and methods between our members and the larger biofuels community around the world, and in the process help to generate new ideas and concepts. Most recently, the Task has helped sponsor Karin Öhgren, a Ph.D. candidate at Lund University, in her six-month visit to the Forest Products Biotechnology lab at UBC. This exchange has proven highly beneficial to both parties. Karin brings tremendous expertise in fermentation technology to the UBC group, and benefits from working with a group dedicated to understanding the fundamental science associated with pretreatment and enzymatic hydrolysis of cellulosic substrates.

Typically, Task 39 can assist in facilitating exchanges by providing funds for travel or accommodation costs, with matching funds from the visitor's parent institution and from the host organization. In the past, we have found that the presence of some outside funding has made it easier for host universities to find matching funds.

If any of our members would like to participate in an exchange or host a visitor, the Task Leadership would be very happy to speak with you. Please don't hesitate to contact Jack Saddler or any of the Associate Task Leaders with your suggestions. We look forward to sponsoring more opportunities in 2007!

FUTURE WORKSHOPS/SYMPOSIA

Clean Energy Power 2007

January 24-25, 2007

Berlin, Germany

<http://www.energiemessen.de>

European Renewable Energy Policy Conference

January 29-31, 2007

Brussels, Belgium

<http://www.erec-renewables.org/events>

National Biodiesel Conference & Expo 2007

February 4-7, 2007

San Antonio, TX, USA

<http://www.biodieselconference.org/2007/>

World Renewable Energy Network (WREN)

Renewable Energy for Sustainable Development 2007

February 4-8, 2007

Fremantle, Australia

<http://www.etc.murdoch.edu.au>

European Pellets Conference 2007

February 28, 2007

Wels, Austria

<http://www.wsed.at/wsed/fileadmin/wsed/>

World Sustainable Energy Days

February 28 - March 2, 2007

Wels, Austria

<http://www.energiesparverband.com>

World Biofuels Markets Congress & Exhibition

March 6-9, 2007

Brussels, Belgium

<http://www.greenpowerconferences.com>

Biofuels Americas Conference & Expo III

March 12-14, 2007

Cartagena, Columbia

<http://www.biofuelsconferences.com>

8th Annual European Fuels Meeting

March 14-15, 2007

Paris, France

<http://www.wraconferences.com/wra114overview.html>

Success and Visions in Bioenergy

March 21-23, 2007

Salzburg, Austria

<http://www.aston-berg.co.uk/index.php?id=97>

4th Annual World Congress on Industrial Biotechnology & Bioprocessing

March 21-24, 2007

Orlando, FL, USA

<http://www.bio.org/worldcongress>

Growing the Margins Conference & Exhibition

April 11-13, 2007

London, ON, Canada

<http://www.gtmconf.ca>

8th Exhibition 'Bois Energie'

April 19-22, 2007

Orleans, France

<http://www.boisenergie.com>

3rd International Congress on Energy Efficiency and Renewable Energy Sources

April 25-28, 2007

Sofia, Bulgaria

<http://www.viaexpo.com/congress-ee-vei/eng/congress.php>

29th Symposium on Biotechnology for Fuels and Chemicals

April 29-May 2, 2006

Denver, CO, USA

<http://www.simhq.org/html/meetings.html>

15th European Biomass Conference & Exhibition

May 7-11, 2007

Berlin, Germany

<http://www.conference-biomass.com>

International Conference on Biotechnology Engineering 2007

May 8-10, 2007

Kuala Lumpur, Malaysia

<http://www.iiu.edu.my/icbioe>

5th European Biorefinery Symposium

May 30-June 1, 2007

Flensburg, Germany

<http://websrv5.sdu.dk/bio/workshop07.htm>

Nordic Bioenergy 2007

June 11-13, 2007

Stockholm, Sweden

<http://www.nordicbioenergy2007.se>

Renewable Energy Europe

June 26-28, 2007

Madrid, Spain

<http://www.renewableenergy-europe.com>

Bioenergy 2007

International Bioenergy Conference & Exhibition

September 3-6, 2007

Jyväskylä, Finland

<http://www.finbioenergy.fi/bioenergy2007>

IUFRO (International Union of Forest Research Organizations) - All Division 6 Conference

October 29-November 2, 2007

Taipei, Taiwan

<http://www.iufro.org>

Biomass Asia 2007

October 29-31, 2007

Beijing, China

20th World Energy Congress

November 11-15, 2007

Rome, Italy

<http://www.rome2007.it>

CONTACT INFORMATION

Please find information below for both the IEA Bioenergy contacts and IEA Bioenergy Task 39 contacts. Additional information is available at www.iea.org, at www.ieabioenergy.com, and at www.task39.org.

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