Bioenergy NoE

European BioenergyNews

May 2007 Special Edition
15th European Biomass Conference & Exhibition, Berlin. V2,#3

Meet a researcher
see page 5

All the latest bioenergy news
see pages 2-4

Partner news
see pages 7-11

Residue management
see page 6

Bioenergy NoE contacts
see page 12

PUTTING EDUCATION ON THE AGENDA

Bioenergy NoE Coordinator Kai Sipilä

Bioenergy NoE Coordinator Kai Sipilä urges the bioenergy community to support education and training in the field

Dear colleagues and students,

Welcome to this special edition of the Bioenergy Network of Excellence newsletter for the 15th European Biomass Conference and Exhibition in Berlin.

Bioenergy covers five per cent of primary energy sources in Europe and is the dominant renewable energy source today.

The target for RES has recently been set at 20 per cent by 2020 boosted by the 20 per cent reduction in greenhouse gas emissions in Europe. Biomass based transportation fuels will be increased to 10 per cent by 2020 and a vision of 25 per cent by 2030 is outlined in the EU Biofuels for Transport Platform.

Bioenergy markets are growing at an unprecedented rate, and so are complementary opportunities in advanced education and training in the sector. High quality education and training programmes are crucial to build both a thriving research community and a skilled workforce for industry.

Bioenergy NoE is proud to sponsor a Bioenergy Education and Training Pavilion at the Berlin conference to promote opportunities in the sector. Please visit the pavilion to find out more about PhD and MSc course provisions in Europe in 2007-2008.

Bioenergy NoE is an EC sponsored Network of Excellence of eight research organisations from across Europe. The Consortium is integrating its expertise to strengthen bioenergy RTDD in Europe and support the development of a successful bioenergy industry.

A total of 25 oral presentations and 30 poster presentations are being contributed to the Berlin conference by researchers from the eight NoE partner institutes. A list of Bioenergy NoE presentations can be picked up from the Education and Training Pavilion.

Inside this newsletter you will find information on Bioenergy NoE's current activities, researchers and R&D news from the partners. If you would like to find out more about Bioenergy NoE, please visit our website.

I hope you enjoy the newsletter and the conference!

With best regards, Kai

›› Kai.Sipila@vtt.fi

›› www.bioenergynoe.com

NEWS FROM THE BIOENERGY NOE BOARD

Board Members finalised the new structure for Bioenergy NoE's activities in 2007/08 at a meeting in Brussels this April.

Carl Wilén, Benôit Gabrielle, Hannes Schwaiger and Yrjö Solantausta at the recent Board Meeting

Activities will focus on two key areas: Second generation biofuels for transport and High efficiency biopower. These will be supported by cross cutting actions.

Coordinator Kai Sipilä said: "The idea was that after the first three years of working across the entire bioenergy chain, it was time to nominate priority areas for remaining two years, and that's how the new structure evolved. We have set clear priorities in biofuels for transport and RES-E."

Work will be carried out via "integrating actions" (IA) and "jointly executed research projects (JERs).

"Integrating actions are common activities to promote integration among Bioenergy NoE partners, set strategies and facilitate information exchange," explained Prof. Sipilä.

"But most of our resources over the remaining project period will be allocated to JERs. This is where the core research will be carried out and the activities will include external funding" he added.

The Biofuels for Transport strategy area will be coordinated by Herman den Uil from the Energy Research Centre of the Netherlands.

"I've always viewed the objective of this NoE as aiming for real integration between the institutes," said Dr. den Uil.

"My main aim for this integrating action is to strengthen relations between partner institutes that are developing processes for synthetic biofuels," he said.

The Biofuels for transport IA includes three JERs. The Sugar Ethanol JER looks at development of valuable co-products of ethanol production. The Wood Ethanol JER will explore plans to cooperate in development on the design of wood to bioethanol R&D plant in Austria. While the Sustainability JER will assess the sustainability of second generation biofuels.

The RES-E area is being coordinated by Tuula Mäkinen from VTT, Finland.

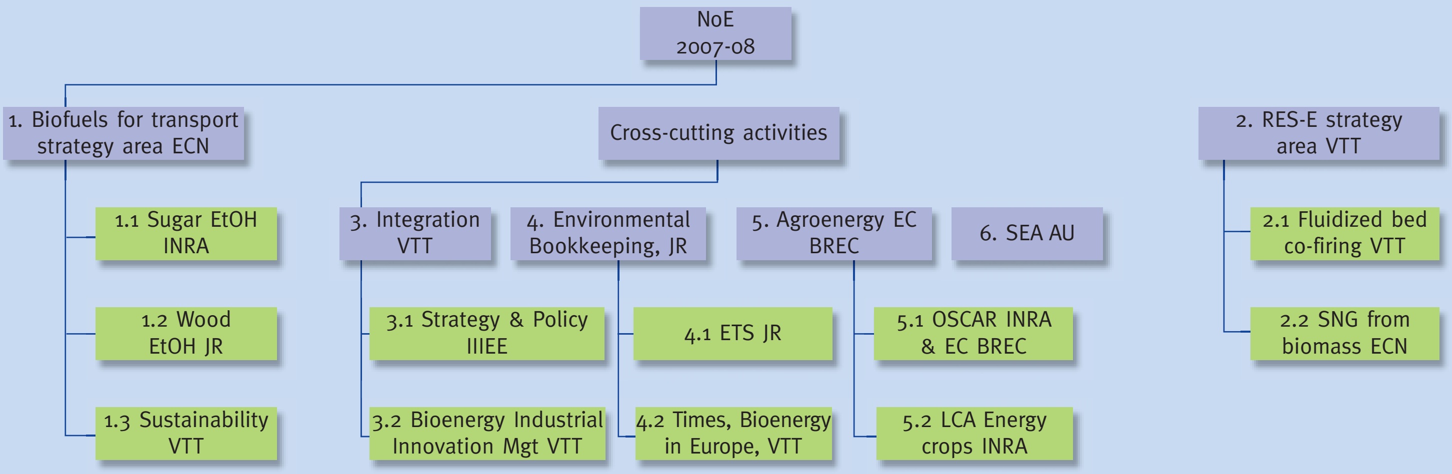
"I see this integrating action as being a collaborative platform for research carried out within the JERs," said Mrs. Mäkinen.

"We are planning workshops on specific topics including cofiring of biomass fuels in fossil-fuel fired power plants and small scale biomass-based CHP or electricity production," she said.

The fluidised bed co-firing JER will focus on high efficiency CHP generation of cofiring large shares of biomass and waste derived fuels. While the SNG from biomass JER will quantify prospects for biomass SNG in Europe, looking at ways to reduce GHG emissions and costs, and increase renewable energy use.

Cross cutting actions include Environmental Bookeeping led by Hannes Schwaiger of Joanneum Research in Austria, Agroenergy led by Magdalena Rogulska of EC BREC in Poland and an Integration action led by VTT.

BIOENERGY NOE STRUCTURE 2007-08



Bioenergy NoE's new structure for 2007-08 has set key priorities in Biofuels for Transport and RES-E. Work is divided into Integrating Actions in the purple boxes and Jointly Executed Research projects in the green boxes.

PHYDADES SET TO CREATE WORLD'S LARGEST BIOFUELS DATABASE

The Phydades project kicked off on 15–16 February 2007 in Amsterdam. Phydades, short for Dissemination, Education and Standardisation of Phyllis Database for Biofuels and Bioashes, is part of the Intelligent Energy – Europe programme for heat from renewable energy sources.

Together the Phydades team will build the most comprehensive online database of solid biofuels and bioash properties in the world

The initiative and idea for this joint action originally resulted from the work of the Bioenergy Network of Excellence.

Phydades central task will be to further develop and improve the existing Phyllis database for properties of solid biofuels and bioashes. In addition to screening the existing data in Phyllis, a significant amount of new data will be added.

Partners will contribute data from their own laboratories and by liaising with their industrial contacts.

The existing database will not only have a new design and name, but it will also be developed to comply with the CEN specifications for biofuels, for instance CEN/TS 14961 (Fuel specification and classes) and CEN/TS 14588 (Terminology).

The second task is to disseminate the use of those biofuels standards in the EU countries. This will be done by means of public workshops and training of laboratory staff from the new member states.

The Phydades website, with links to the database and other valuable resources, will serve as a solid dissemination tool, where buyers and sellers of biomass fuels can find reliable information on compositions of fuels, ashes and on the use of standards.

The three essential elements of the action are:

- Collecting information and building the database
- Education, including preparation of training material, organising workshops and on-the-job training, and
- Dissemination through a public website with access to the new database, and distribution of materials.

Jan Pels, Co-ordinator, ECN, The Netherlands

›› pels@ecn.nl

Eija Alakangas, VTT Finland

›› eija.alakangas@vtt.fi

›› www.phydades.info

MAKING BIOENERGY INVESTMENTS FLOW: ALIGNING POLICY AND INDUSTRIAL BIOENERGY STRATEGIES

In the coming year, the bulk of Bioenergy NoE's research will take place in the 11 new Jointly Executed Research (JER) projects.

Here, Philip Peck and Kes McCormick from IIIEE, Lund University and Tomas Kåberger, Vice President corporate development at TallOil in Sweden, explain how their new JER project aims to strengthen the relationship between bioenergy industry and policy.

Several factors pose barriers to the uptake of bioenergy in industry:

- Unattractive economic conditions and perceptions of economic risk;
- Lack of technical and intellectual capacity;
- Weakness of stimulating and supporting actor networks;
- Insufficient policy support;
- Inadequate supply chain coordination and material-logistics rationalisation, and
- Customer (industrial and retail) understanding of technical system offerings.

Of these factors, the economic picture is often perceived as being paramount and sustained higher oil prices and significant policy support are often seen as a sufficient stimulus to resolve difficulties. In recent years, high oil prices and the policy measures in Europe do appear to have created economic conditions that should be sufficient for a significant increase in bioenergy use.

However, industrialists and investors – those very actors expected to be at the centre of growth in the sector – are describing the situation somewhat less optimistically. This is the key problem to be addressed.

Policies that support bioenergy (and thus help underwrite industry investment in bioenergy) are often perceived as uncertain and negative feedback mechanisms in the market have been experienced. Moreover, the implementations of systems like ETS have shown industries in competition with the bioenergy sector are able to capture the process, slowing the introduction of bioenergy.

One result is that in many countries investments are not made until the expected profits are very large. In many instances this can be seen as a function of insurance against significant perceived political risks. Put simply, a situation is being described where industrialists do not trust policymakers. Such a situation in turn leads to new challenges – or negative feedback loops.

The objectives of this JER are to investigate key areas of misalignment between policy interventions and industrial bioenergy strategies and to delineate pathways for resolution and to catalyse closer relationships and understanding between industrial actors and bioenergy policy makers in order to find ways to increase bioenergy investments.

Philip Peck, IIIEE, Lund University

›› philip.peck@iiiee.lu.se

JER leader Philip Peck from IIIEE, Sweden

European BioenergyNews

BIOREFINERY BUILDING BLOCKS

Biosynergy partner Abengoa's bioethanol production facility Ecocarburantes Españoles in Cartagena, Spain.

Two new biorefinery projects involving Bioenergy NoE partners were recently launched. Some of the initial concepts for the projects were developed through NoE activities.

BIOSYNERGY

ECN, Aston University, Joanneum Research and VTT are four of the 17 partners involved in Biosynergy — a €13 million EC biorefinery project launched last month.

The BIOSYNERGY Integrated Project aims to make biomass derived products cost competitive with fossil fuels by developing and designing innovative biorefinery concepts.

Despite rising petrol prices, using biomass to produce transportation fuels, and to a lesser extent energy, is still more expensive than using traditional petrochemical resources.

However, a biorefinery can scale-up production and efficiency while cutting costs by making multiple products and maximising the value of the feedstock. For example, a biorefinery could produce a number of high value chemicals, large volumes of liquid transport fuels and use the excess energy to heat and power the plant.

The chemicals boost profitability, transport fuels replace some of the fossil fuels currently on the market, and reusing excess heat and power cuts carbon emissions further.

Led by the Energy research Centre of the Netherlands (ECN), BIOSYNERGY comprises academic and industrial partners from across Europe.

Researchers will use advanced fractionation and conversion processes for biomass and combine biochemical and thermochemical pathways to develop the most economical and environmentally sound solutions for large-scale bioenergy production.

Hans Reith, BIOSYNERGY Coordinator based at ECN said: “BIOSYNERGY aims to achieve sound techno-economic process development of integrated production of chemicals, transportation fuels and energy, from lab-scale to pilot plant.

“This project will be instrumental in the future establishment of biorefineries that can produce bulk quantities of chemicals, fuels and energy from a wide range of biomass feedstocks,” he said.

BIOSYNERGY will set-up pilot plants of the most promising technologies for a “bioethanol side-streams” biorefinery, in close collaboration with the lignocellulose-to-bioethanol pilot-plant of project partner Greencell, currently under construction in Salamanca, Spain.

Aston University will lead work to identify the optimum biorefinery based biomass-to-product chains for a future European bio-based economy, test and characterise biomass and lignin in its fast pyrolysis reactors, and produce a BIOSYNERGY Road Show to communicate results.

VTT’s role will be to help develop advanced biochemical conversion processes for the conversion of sugars and lignin into higher alcohols, sugar acids and functional lignin derivates.

While Joanneum Research will devise environmental profiles for various biorefinery concepts and quantify environmental impacts and benefits.

Hans Reith, BIOSYNERGY Co-ordinator

›› reith@ecn.nl

www.biosynergy.nl

BIOPOL

IIIEE joins ECN and ECBREC in a new EU project entitled “Assessment of BIOrefinery concepts and the implications for agricultural and forestry POLicy” (BIOPOL).

Kes McCormick from IIIEE, Lund University said: “BIOPOL aims to assess the biorefinery concept and explore the potential implications for agricultural and forestry policy in the EU. The first step for the partners is to narrow down the definition of what constitutes a biorefinery.”

The IIIEE will lead the work on political aspects. The first task is to explore the political legitimacy of the biorefinery concept among the policy community and political circles in the EU. This work will involve a general questionnaire and in-depth interviews in six member states: Sweden, UK, Netherlands, Greece, Poland and Germany.

The second task is to investigate the implications of renewable policy, forestry policy and agricultural policy for the viability of the biorefinery concept. This will be based on in-depth interviews and a literature review of relevant documents.

Kes McCormick, IIIEE

›› kes.mccormick@iiiee.lu.se

Philip Peck, IIIEE

›› philip.peck@iiiee.lu.se

CHIPPING HER WAY TO THE TOP!

MARZENA HUNDER, EC BREC, POLAND

A young woman who's passion for photography is only matched by her enthusiasm for woodchips, Marzena Hunder is a promising young bioenergy researcher at EC BREC in Poland. She talks to Crystal Luxmore about her PhD thesis and the perks of working in bioenergy RTD in Europe.

EC BREC colleagues Ewa Ganko, Lucyna Formela and Marzena Hunder at the Bioenergy NoE Researchers' Meeting in Helsinki last October.

You just finished your PhD thesis—congratulations! What was the topic?

Thank you, it's nice to be done! My thesis investigated some of the problems with using woodchips for energy. Today the popularity of woodchips as a bioenergy resource is growing throughout Europe, but for wood heating to really take off, some fundamental issues need to be solved.

The most important issues surround the storage and drying of woodchips. Storage can cause the wood chips to lose mass and calorific value, to increase in temperature and cause excessive growth of microorganisms—all of which devalue the chips as an energy source.

My research focused on three areas: first I formulated mathematical models of drying for thin and thick layers of wood chips; second, I researched the changes that occur during wood chips storage in three different conditions: in a storage chamber, in a storage chamber ambient-air ventilated and in storage chamber heated-air ventilated; and finally I undertook microbiological analysis during storage and unloading, including determination of water activity.

How did you approach the research?

I selected wood chips with an initial moisture ranging from about 45 to 56 per cent. The majority of the wood chips used—around 95 per cent—were pine wood, but I also used fir. I did the kinetic drying research in the Institute of Agricultural Engineering at the Agricultural University in Wroclaw. Then I went to the Institute for Building, Mechanisation and Electrification of Agricultural in Warsaw to do comparative testing of wood chips storage in different conditions.

What did you find out?

I found that the parameters of the drying air, for example the air temperature and speed of flow throw the wood chips' layer, are crucial to the drying process. Generally, increasing the thickness of the wood chips pile by 6 cm requires an increase in drying time of about 10 per cent.

During storage, the air temperature in the chambers was ambient. As well as the initial moisture of wood chips, weather conditions also impact on the development of microorganisms within the heap. Aerobic mesophile bacteria and fungi were most likely to develop at temperatures above 16°C and a high relative moisture of air of above 70 per cent.

As for the economics, the cost of wood chips storage for two variants: ambient-air and heated-air ventilation, varied from a few up to over 100 Polish zlotys per bulk metre of wood chips. The more moist the material, the higher the drying costs.

During your PhD thesis with EC BREC, you were also a member of Bioenergy NoE. Did being involved in this EU network help you?

Definitely. Bioenergy NoE offers excellent opportunities for researchers in the network to take part in a researcher exchange.

In September 2005, I arranged an exchange to Finland to talk to VTT researchers about issues related to my thesis.

The two week exchange gave me a real insight into the work being done in Finland on biomass drying and storage. I visited the VTT locations in Jyväskylä and in Espoo to discuss wood, pellets and peat production, handling and storage with a number of leading experts in the field. That visit helped me to narrow my thesis topic.

What was the highlight of the visit?

I really enjoyed the technical study tours organised as part of the International Bioenergy in Wood Industry Conference and Exhibition in Jyväskylä.

We trekked through the forests of Central Finland to see the latest wood fuel procurement systems, harvesting and chipping technologies machinery and technologies.

Laboratories and books are a huge part of PhD research, and sometimes it gets a bit isolating. So there's nothing like getting out into the field and actually looking at bioenergy being put into practice to inspire you to keep pursuing research.

What are your plans now that you're finished the thesis?

I'm working as a researcher at EC BREC. We're really busy these days and there are a lot of interesting projects relating to my work, so I don't have a chance to get bored!

I love photography and travel so it's a bonus that our institute is involved in a number of EU projects because I get a chance to see different parts of Europe.

›› mhunder@ecbrec.pl

RESIDUE MANAGEMENT – AN OFTEN OVERLOOKED PROBLEM IN BIOENERGY UTILISATION

Bioenergy NoE's Biogenic Waste to Energy work package (WP) wrapped up in December. In this article, WP Leader Juergen Vehlow shares its recommendations on future directions for research into residue management.

Above: *Reuse of pretreated bottom ashes, seen here in a freshwater incinerator, offer cost savings and environmental benefits to the bioenergy production process.*

Right: *Bottom ashes, leftover from biogenic waste incineration, are commonly treated and reused in construction projects like road paving in Europe.*

There is no such thing as a free lunch! All of our actions have unwanted side-effects, just think about the weight an opulent meal puts on you. And our technical processes are no different in this respect.

An unwanted side-effect of bioenergy processes is the appearance of by-products and residues because nearly all of these products come with disposal costs. This is a big issue when considering energy recovery from waste. Bottom ashes, filter ashes and gas cleaning products from waste incineration contain toxic elements like heavy metals, salts, and organic micro-pollutants.

Thanks to intense R&D efforts to improve the combustion process and the quality of the various materials used, technologies and strategies are now available to guarantee sustainable management of all residues from waste incineration.

Bottom ashes have good potential for reuse. After pre-treatment they are used as secondary building material in road construction in many EU countries. However, treated bottom ashes do not have a commercial value because they have to be pre-treated and are typically offered without charge. The main benefit is savings of disposal costs, which in many countries are higher than the gate fee at a landfill site, and will only increase in the future. From an environmental viewpoint, an additional benefit is the replacement of natural building materials like gravel.

Residues with higher quantities of pollutants, like filter ashes and gas cleaning residues can only be disposed of on special and expensive sites, preferentially underground. Reuse is mainly prohibited by the treatment cost of available processes. However, a macroeconomic evaluation might conclude that treatment, such as metal recovery from filter ashes, pays off in the long term.

Residues from other bioenergy processes like biomass combustion or gasification, by-products of pyrolysis and even the solids from anaerobic digestion are far less contaminated by heavy metals. Although for these materials, too, contamination cannot be ruled out, especially if waste materials are co-treated. In any case the concentration of halogens and alkali metals should be monitored.

In its review 'Management of Solid Residues in Waste-to-Energy and Biomass Systems' Bioenergy NoE's Biogenic Waste to Energy work package, pointed to a lack of knowledge on the quality of residues from the above mentioned processes, at least compared to that on waste combustion residues.

As a final conclusion, the review stated a need for further research on long-term reliable management strategies, especially for all types of residues from gas cleaning in all processes.

Additionally the residues from co-combustion of waste and coal, from combustion of SRF, from gasification and pyrolysis, as well as from fermentation of biogenic matter need more detailed investigation.

The challenge in all residue management scenarios - especially if these residues derive from waste or contaminated fuels - is the definition of sinks for pollutants. This task not only has a scientific and technical aspect, an environmentally sound after-care solution must be found if biogenic waste to energy is to meet socio-economic expectations and secure public acceptance.

Juergen Vehlow, FZK

» juergen.vehlow@itc-tab.fzk.de

MISCANTHUS PAVES THE WAY FOR A RENEWABLE FUTURE

Relatively unknown in Europe, Miscanthus giganteus is now in the European spotlight as a biofuel crop

INRA is carrying out miscanthus crop trials all over France, like this one on the INRA Estrées-Mons farm

Miscanthus is high yielding, rich in lignocellulose and requires little agricultural inputs. Growing this crop on a large-scale in France will involve developing cropping systems that seek to optimise energy balances and minimise environmental impacts. Several teams at the Institut National de la Recherche Agronomique (INRA) in France, have joined forces to combine the adaptation of crop management sequences with genetic improvement of the plant.

Advantages of Miscanthus

Miscanthus giganteus is a perennial grass originally from Asia. It has two outstanding qualities for biofuel production: it produces a large amount of biomass and requires few inputs. The exceptionally high yield of miscanthus is due to its "C4" carbon metabolism, which is similar to other plants of tropical origin. This type of metabolism means it can more efficiently capture carbon gas and transform it into organic material.

Moreover, miscanthus is a perennial crop. After being planted, it will produce crops for over 15 years. The first year is crucial because this is when the plant establishes its root system. Plant growth is slow and competition with weeds is steep. The use of herbicides allows the plant to establish itself satisfactorily. At the end of the first year, the crop is ground and returned to the soil, creating a surface bed that limits weed growth. In the following years, the crop grows quickly and does not require herbicides, nor does miscanthus require fungicides or insecticides.

Adaptation of crop management sequences

Optimal crop conditions are required for miscanthus to reach its full potential. In 2006, INRA researchers set up experimental miscanthus plantations as part of the national REGIX project.

The trials began simultaneously with seven potentially attractive species for energy production. These included three "C4" species (miscanthus, switchgrass and sorghum), three annual "C3" species (triticale, alfalfa and fescue) and plantations of poplars as short-rotation coppice (SRC).

The quantity and quality of the biomass for each species and for varying crop conditions will be measured. INRA researchers will evaluate the biomass quality biomass for its transformation into fuel. Depending on whether the conversion of lignocellulose into ethanol or wood is based on a biological or thermochemical method, the crucial parameters are (i) the content of minerals, such as silica or chlorine, that are undesirable in the thermochemical method, and (ii) the water content and lignin/cellulose ratio, which influence the fermentation yield in the biological method.

Genetic improvement

In addition to these studies, a project was initiated in 2007 to study the genetic variability of miscanthus for agriculturally valuable traits, including production of above-ground biomass, traits associated with flowering biology and physiology of nitrogen metabolism.

This research is the first step in studying the genetic determinism of miscanthus biomass production under abiotic stress (nitrogen availability, temperature conditions of the air and soil, water availability, etc.) in view of creating varietal innovations for Northern Europe and for use in bioenergy.

Jean Tayeb, INRA

›› jean.tayeb@reims.inra.fr

European BioenergyNews

SECOND GENERATION BIOFUELS OFFER SIGNIFICANT IMPROVEMENTS TO TAILPIPE EMISSIONS

The share of biofuels for transport is increasing fast. At the moment rape seed methyl ester (RME) and ethanol are the most common bio components, but both come with some disadvantages.

According to current regulations only five per cent RME can be mixed with diesel or five per cent ethanol with gasoline. Refinery made second generation biofuels are needed for better handling and blending characteristics.

New fuels must be carefully checked to ensure they meet emission levels, good driveability and other crucial standards. Analysing only the regulated gaseous and mass PM emissions is no longer enough to assess new fuels or emission control concepts. A more comprehensive understanding of exhausts is becoming a must.

VTT has a modern engine and vehicle laboratory equipped with a heavy-duty chassis dynamometer, a full flow dilution tunnel and both transient and static engine dynamometers. In addition to regulated exhaust emissions a wide variety of unregulated emissions can be measured. Today, particulate characterisation, on-line particle number measurement and gaseous emission measurements are common tests. VTT has also developed systems to trap even the hard-to-catch semi-volatile portion of the exhausts.

VTT's heavy-duty chassis dynamometer is used to examine small changes in fuel consumption and exhaust emissions. If needed, duty cycles can be recorded, for example from certain bus lines and the real duty cycle can be run on chassis dyno with good repeatability. This offers the possibility to test new fuels in the latest technology vehicles under real driving conditions.

Demand for diesel fuel is quickly increasing in Europe. The EU Biofuels directive has led many EU countries to demand a certain percentage of biofuels in their transport fuels. This is one reason why the oil industry is interested in second generation biofuel production. This summer will see the start-up of Finland's first 170 000 t/a biofuel production line. Research facilities like VTT's engine and vehicle laboratory can help ensure that second generation biofuels are the cleanest burning fuel on the road.

The heavy-duty chassis dynamometer is used to measure fuel consumption and emissions in large vehicles

Matti Kytö, VTT

›› Matti.Kyto@vtt.fi

DOWNSIZING: SMALL SCALE & MICRO BIOMASS CHP

Joanneum research is developing Stirling engine prototypes that could help commercialise small scale CHP.

Small scale combined heat and power (CHP) is generally defined as having a power output below 1 MWe. The CHP directive also classifies Micro CHP with an output below 50 kWel. Different technologies for biomass CHP use like gasification, (organic) rankine cycle ((O)RC) and the Stirling technology are being developed but have yet to reach technical and commercial maturity.

Joanneum's biomass driven Alpha-type Stirling Engine, 3kWel

For economic reasons, small scale CHP plants have to be simplified and are usually pre-engineered modular units. Annual operating hours typically vary between 4000 – 5000 hours, mostly partial load. The small physical size of the plants, short delivery time frames (8 – 20 months) and the general uncertainty in the energy market work in favour of simple, cheap plants. Therefore advanced process alternatives, which would increase the efficiency but also the costs of the plant, are not usually applied in small scale CHP technologies.

Stirling engine prototypes at Joanneum Research

Several biomass driven Stirling engines are under development in Europe, but there is still no biomass driven Stirling engine commercially available. A key challenge is the heat transfer into the process. Ash and slag within the flue gas force developers to construct bigger engines with special heat exchanger designs. Joanneum Research has developed two prototypes that aim to meet this special demand. The engines have passed long term test runs in the laboratory and will be put into practical operation in spring 2007.

Joanneum's biomass driven Alpha-type Stirling Engine, 30kWel

Both engines are 520 rpm, use nitrogen as working fluid, have set temperatures of heat input/output at 1000/750 °C, electrical efficiency of 21-23 per cent and are fuelled by wood chips. The 30kWel engine operates on pressures up to 32 bar, and the 3kWel up to 30 bar. The set temperature of heat rejection/output on the 30kW is 50/60 °C and on the 3kW is 30/50 °C.

›› ief@joanneum.at

›› www.joanneum.at/ief

BIOENERGY POTENTIALS IN FINLAND

An expert group, nominated by the Finnish Ministry of Trade and Industry, has released findings from a study on the potential of bioenergy use in the long term in Finland.

Secretary of the expert group Satu Helynen and Kai Sipilä, member of the expert group.

Estimates were given in two scenarios: business as usual and improved competitiveness of bioenergy due to high prices of fossil fuels or obligations, subsidies or other measures.

Bioenergy use grew by 20–50 per cent in these scenarios compared to the present situation by 2015-2020.

In both scenarios, the role of wood fuels was significant. Energy crops and agricultural residues could also become more important bioenergy sources, but an increase requires additional subsidies. Peat – defined in this study as slowly renewable biomass – enables the stable quality and availability of fuel mix for large scale energy production.

The use of biomass increased significantly in large scale heat and power production, both in industry and in the district heating sector.

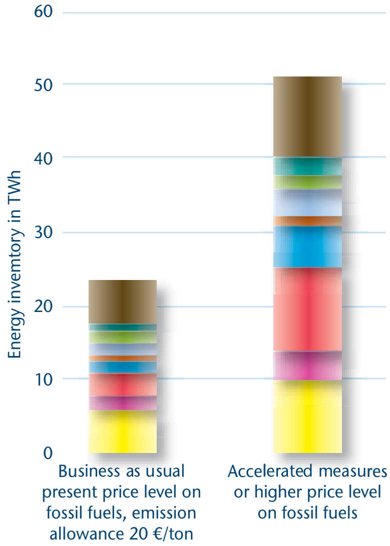
The heating sector in particular requires financial incentives to replace fossil oil and electricity in existing buildings with wood pellets, logs and chips. The role of liquid biofuels is estimated to grow, but its share is still expected to be modest by 2015-2020.

Satu Helynen, VTT

Chairman of the Bioenergy Association of Finland

›› Satu.Helynen@vtt.fi

The estimated increase of use of biomass for energy by 2015-2020 in two scenarios in finland



- Peat
- Drying or condensing flue gases of wood residues
- Traditional agrobiomass for liquid biomass (cereals)
- Energy crops from fields
- Traditional agrobiomass
- Recycled biomass based fuels
- Wood for heating
- Forest chips from thinning
- Forest chips from regeneration fellings

NEW BIO-SNG FACILITY PASSES THE TEST AT THE ENERGY RESEARCH CENTRE OF THE NETHERLANDS

Fixed bed SNG reactors at ECN with thermocouples to measure temperatures at eight positions in each reactor.

ECN's research on future heat supply from biomass focuses on the production of bio-SNG. In December 2006 the first successful 80 hours test was performed with a 5 kW SNG production test facility.

Natural gas provides half of the primary energy in the Netherlands. Although national reserves are still large, meeting the recent European guidelines on CO_2 reduction and renewables requires the introduction of bio-SNG (Synthetic Natural Gas from biomass).

In 2003 ECN produced its first bio-SNG in a micro-flow reactor using biomass producer gas from a 5 kW bubbling bed gasifier. Subsequent studies showed indirect gasification (e.g. the Silvagas concept and the FICFB concept applied in Güssing) to be the most promising path towards high efficiency bio-SNG production.

The main advantage of indirect gasification is the high content of methane in the producer gas, which limits losses inherent to the conversion of syngas into methane. However, the advantage comes at the cost of higher hydrocarbons and tar which must be dealt with before or in the methanation reactor. To solve this problem, ECN built a 5 kW bio-SNG production test facility.

Producer gas is provided by a 25 kW MILENA indirect gasifier, based on a concept developed by ECN. An 800 kW version is under construction and will be operational early 2008. Dust is removed by a cyclone and a conventional high temperature filter. The existing lab-scale OLGA tar removal system was adapted to process the higher tar load. Tar-free gas passes through the SACHA system, which consists of three reactors filled with absorption materials, mainly for removal of H_2S, COS and HCl. Clean producer gas is fed to a series of five fixed bed SNG reactors.

In December 2006, after initial tests to determine the operating conditions, a test was done to monitor performance during continuous operation over three days. Conversion of producer gas to CH_4 was nearly complete and stable. The product contains tiny amounts of CO and 15 times less H_2 than CH_4. Despite this excellent result, degradation of the catalyst was obvious. Organic sulphur compounds which pass through the SACHA system may play a role, but carbon deposition in the reactor exposed to the most demanding conditions was the most prominent problem.

Future research is aimed at finding remedies to these problems. Other activities involve industrial process design, upscaling, and upgrading of the product to specifications for natural gas. The latter means not only removal of residual CO and H_2, but also the removal of water and CO_2, which are present in amounts comparable to the amount of CH_4.

Luc Rabou, ECN

› rabou@ecn.nl

› www.biosng.com

UK BIOENERGY NETWORK SECURES £6.4 MILLION CONTINUATION

SUPERGEN II will explore a wider range of bioenergy and biomass themes in the next four years as part of its continuation strategy

Aston University led a successful, multi-million pound bid to continue the UK's largest Bioenergy R&D consortium, SUPERGEN Bioenergy, for a further four years.

The EPSRC-funded £6.4 million continuation will build on the findings of the first four years of the project and extend the work into promising new areas of bioenergy including renewable transport fuels and biorefineries.

R&D focuses on nine themes that span the entire bioenergy chain: resources including marine biomass; characterisation and pretreatment; nitrogen; thermal conversion; power and heat; transport fuels and biorefinery; ammonia; and system analysis, complemented by a dissemination and collaboration theme.

"We decided to continue to concentrate on our core strengths in thermal processing of biomass, especially since this is the clear direction bioenergy is taking in Europe, rather than diluting resources to focus on new areas," said SUPERGEN Bioenergy manager Tony Bridgwater of Aston University.

SUPERGEN II will devote more attention to lower cost and more varied sources of biomass, like rape straw and bark, because growing competition for high quality biomass is expected to drive up the price in future.

Prof Bridgwater said he was looking forward to collaborating with Bioenergy NoE through researcher exchanges and other complementary activities.

SUPERGEN II welcomes three new academic partners – Forest Research, Imperial College and Policy Studies Institute – to total ten organisations. Jenny Jones of Leeds University is the financial manager.

Industrial partners will increase from six to eleven companies.

"It takes about one per cent of the agricultural land to supply one per cent of the electricity demand, so a real impact from bioenergy is achievable, and SUPERGEN Bioenergy's research will help to make it possible," said Jenny Jones.

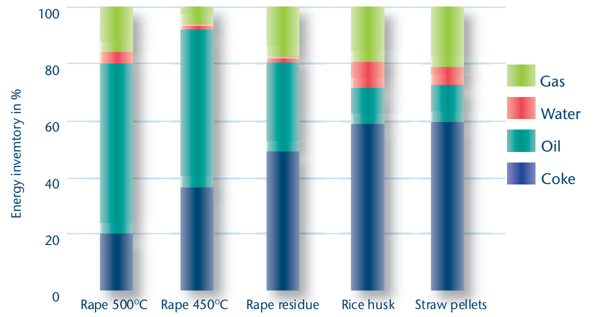
Tony Bridgwater

› a.v.bridgwater@aston.ac.uk

› www.supergen-bioenergy.net

USING PYROLYSIS TO TURN RAPESEED INTO ELECTRICITY

Haloclean®, a performance enhanced low temperature pyrolysis originally developed for the thermal degradation of electronic scrap, was successfully adapted at Forschungszentrum Karlsruhe (FZK) for biomass pyrolysis.



Percentage of the energy yield of pyrolysis products from different types of biomass at 500°C (rape) and for the others at 450°C

Researchers at FZK's Institute for Technical Chemistry, Thermal Waste Treatment Division, used Haloclean to create a new type of pyrolysis: the intermediate pyrolysis applicable for direct electrification of the generated pyrolysis fractions. This was accomplished using two other Forschungszentrum Karlsruhe approaches to energy recovery from biomass:

- fast pyrolysis leading to synthetic fuels (the bioliq® process) and
- the combustion of biomass and cokes leading to heat and power.

Different types of oil containing biomass have been tested and successfully applied to combined heat and power generation. The temperature for intermediate pyrolysis ranges between 350 to 550 °C combined with residence times of one to 15 minutes.

Investigations using a process line which consists of a Haloclean reactor, a hot gas filtration unit, double tube condensers and an aerosol precipitator were carried out to generate dust and tar free pyrolysis vapours, dry cokes and dust and aerosol free pyrolysis gases from oily biomass like rape seed, the residues from cold pressed rape.

The bar graph above shows that in the case of 500°C pyrolysis of rape the energetic content of pyrolysis liquids and gases account for about 80 per cent of the total energy recovered from the feed material.

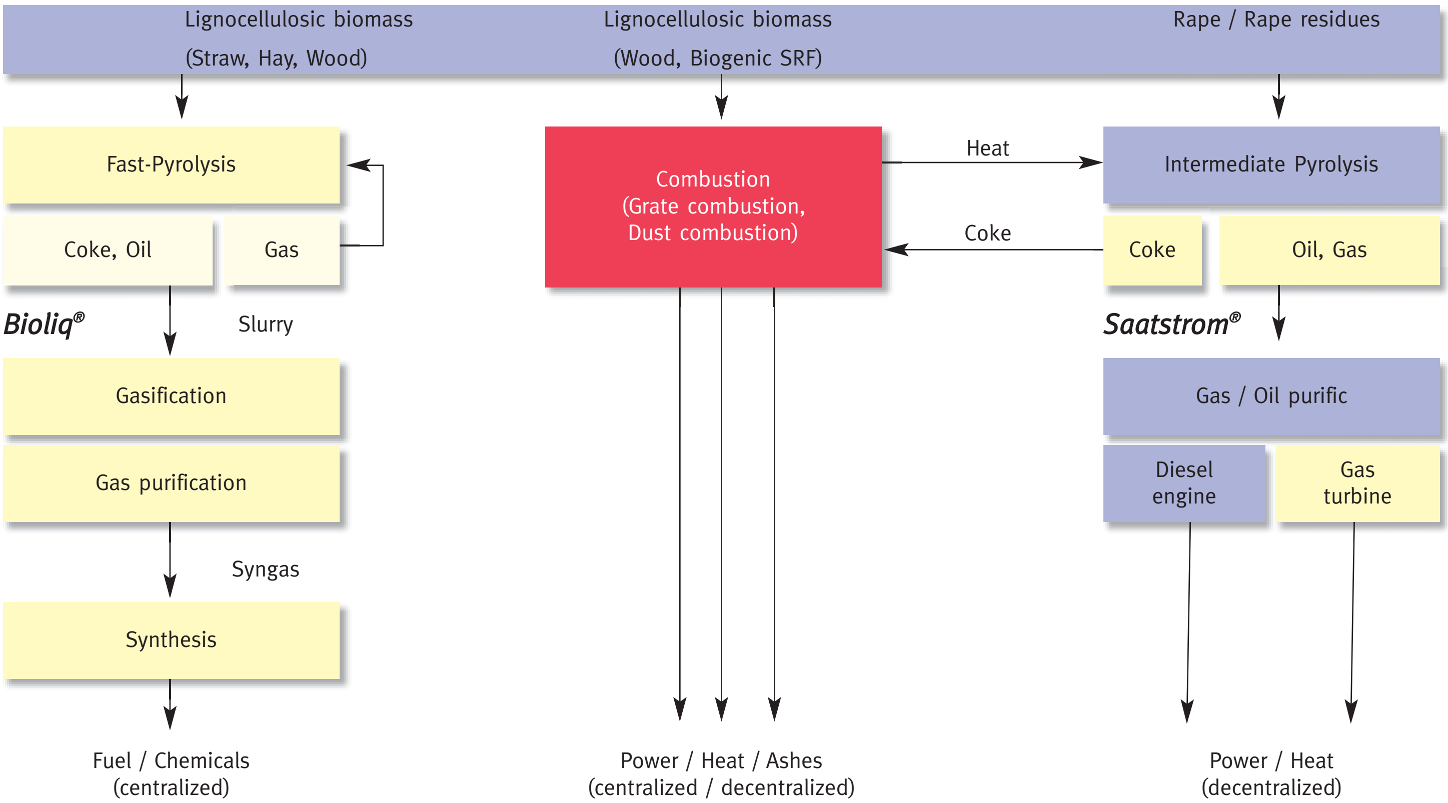
These products can be used for electricity production, preferably in combined heat and power systems. As the bar graph indicates, 500°C provided the highest yield of the tests. In all other tests the fraction of coke was significantly higher. The coke can be utilised as co-fuel in grate or dust combustion systems as is indicated in the chart below.

FZK is continuing its work to develop and optimise CHP systems with industrial partner Schnell, based in Amtzell, Germany.

Andreas Hornung, FZK

›› andreas.hornung@itc-tab.fzk.de

The new Haloclean pyrolysis method at FZK was created by incorporating existing biomass treatment lines already in use at Forschungszentrum Karlsruhe with the Haloclean process



BOARD MEMBERS

Coordinator
VTT

Kai Sipilä

P.O.Box 1000
02044 VTT, Finland

t: +358 20 722 5440
f: +358 20 722 7000
kai.sipila@vtt.fi

Joanneum Research
Josef Spitzer

Elisabethstrasse 5
A-8010 Graz, Austria

t: +43 316 876 1332
f:+43 316 876 1320
josef.spitzer@joanneum.at

Energy Research Centre of the Netherlands (ECN)
Hubert Veringa

P.O. Box 1
1755 ZG Petten
The Netherlands

t: +31 224 56 4628
f:+31 224 56 8487
veringa@ecn.nl

Forschungszentrum Karlsruhe GmbH (FZK)
Jüergen Vehlow

Institute for Technical Chemistry – Division of Thermal Waste Treatment
POB 3640
D-76021 Karlsruhe, Germany

t: +49 7247 82 4372
f. +49 7247 82 4373
Juergen.Vehlow@itc-tab.fzk.de

Lund University, International Institute for Industrial Environmental Economics (IIIEE)
Thomas B. Johansson

Tegnersplatsen 4
P.O.Box 196
221 00 Lund, Sweden

t: +46 46 222 02 22
f: +46 46 222 0230
thomas.b.johansson@iiiee.lu.se

Aston University
Tony Bridgwater

Aston University
Bioenergy Research Group,
Birmingham B4 7ET, UK

t: +44 121 204 3381
f: +44 121 204 3680
a.v.bridgwater@aston.ac.uk

EC Baltic Renewable Energy Centre (EC BREC)
Magdalena Rogulska

EC BREC/CLN
Jagiellonska 55, bud.6,
PL 03-301 Warszawa

t: +48 22 5100 231
f: +48 22 5100 220
mrogulska@ecbrec.pl

Institut National de la Recherche Agronomique (INRA)
Ghislain Gosse

Présidence du centre de Lille
INRA 80200
Estrées-Mons, France

t: +33 3 22 85 75 04
gosse@mons.inra.fr

Education and Training enquiries

SEA-2 Spreading of Excellence Activities
Aston University

Tony Bridgwater

Aston University
Bioenergy Research Group,
Birmingham B4 7ET, UK

t: +44 121 204 3381
f: +44 121 204 3680
a.v.bridgwater@aston.ac.uk

Bioenergy NoE
BioenergyNews

Editor
Crystal Luxmore

Public Relations and Promotions Officer

Bioenergy Research Group
Aston University
Birmingham, B4 7ET, UK

Tel: +44 121 204 3430
Fax: +44 121 204 3680
c.s.luxmore@aston.ac.uk

www.bioenergynoe.com