Feature

ThermalNet – the new European Network for biomass pyrolysis, gasification and combustion

By Tony Bridgwater, Aston University Bio-Energy Research Group

After the successful conclusion of ThermoNet last year that led to reviews, assessments and advances in biomass pyrolysis and gasification, a new network is about to start up to continue this work with combustion as an additional technology. The project is funded through Altener in the Intelligent Energy for Europe Programme operated by DG TREN.

The new network will review the three main technologies of pyrolysis, gasification and combustion within a framework of seven technical tasks and four non-technical tasks, as shown in Figure 1 below.

Each technology has a co-ordinator – Tony Bridgwater for pyrolysis (which is also supported by IEA Bioenergy), Hermann Hofbauer for gasification and Sjaak van Loo for combustion. Each of the tasks has a Task Leader who will review and develop their tasks in co-operation with the other tasks and the underlying technologies.
The whole activity is supported by a network of experts with interests and expertise in one or several of the areas covered. Outputs from ThermalNet will include continuation of the newsletters and websites; technical and strategic reports and a programme of meetings, workshops, seminars, and visits.

There are 13 partners to cover the conversion technologies and the technical and non-technical tasks. (see table on page 11).

The first meeting will take place in May 2005 in Heidelberg, Germany.

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Figure 1 **Structure and content of ThermalNet**

ThermalNet	CombNet Combustion	GasNet Gasification	PyNe Pyrolysis	
WP1 TECHNOLOGY				
Technology & applications Policy and strategy				CO-ORDINATORS
WP2 TECHNICAL TASKS				
Biorefinery Characterisation & analysis Co-processing & co-firing Feedstocks, standards Fouling, corrosion, erosion Gas treatment Science & modelling Transport Fuels	EXPERTS	EXPERTS	EXPERTS	TASK LEADERS
WP3 NON-TECHNICAL TASKS				
Barriers Economics Education, training Environment, health, safety	EXPERTS	EXPERTS	EXPERTS	TASK LEADERS
WP4 DISSEMINATION				
WP5 MANAGEMENT				

IEA Bioenergy

The PyNe newsletter is published by the Bio-Energy Research Group, Aston University, UK and is sponsored by TREN of the European Commission and IEA Bioenergy.

For further details or offers to contribute, please contact Emily Wakefield (see inside front cover for details). Any opinions published are those of the contributors and do not reflect any policies of the EC or any other organisation. EoE

Designed and produced by: WAA +44 (0)121 321 1411

PyNe

April 2005 ISSUE 18

DynaMotive Energy Systems Corporation:

An Update on the West Lorne Bio-oil Project

DynaMotive Energy Systems Corporation has completed construction of the West Lorne pyrolysis plant and has initiated plant start up procedures as part of its West Lorne Bio-oil Cogeneration Project.

Once in operation, the West Lorne plant will be the largest biomass to Bio-oil cogeneration facility in the world and the first pyrolysis oil fuelled cogeneration facility. The plant is a showcase for DynaMotive's pyrolysis and Magellan Aerospace, Orenda division's industrial power generation technologies. The plant is expected to process 100 tonnes per day of biomass and to produce approximately 70 tonnes of bio-oil, 20 tonnes of char and 10 tonnes of non-condensable gases.

Continued on page 2


Figure 1: Wood feed hopper on left, char product hopper on right.

ThermalNet will continue PyNe for another 3 years


The Technology Co-ordinators, Hermann Hofbauer (gasification), Tony Bridgwater (pyrolysis) and Sjaak van Loo (combustion).
Further details on page 12.

ASTON UNIVERSITY

Comments and contributions are most welcome on any aspect of the contents.
Please contact your country representative for further details or send material to Emily Wakefield.

Contents

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ISSN 1470-3521

DynaMotive Energy Systems Corporation:

An Update on the West Lorne Bio-oil Project

Continued from front cover

Figure 2: The fast pyrolysis plant.

Up to 48 tonnes of bio-oil per day will be utilized to fuel a gas turbine developed by Magellan Aerospace, Orenda division, to produce up to 2.5 MWe of electricity (enough to serve 2,500 households), to meet the power requirements of Erie Flooring and Wood Products and to export electricity to Ontario's electrical energy grid. Surplus heat generated by the turbine will produce up to 12,000 pounds of steam per hour for Erie Flooring's industrial operations. The plant was designed to facilitate scale-up to larger plant capacities.

Figure 3: Gas turbine housing and bio-oil storage tanks.

DYNAMOTIVE

DynaMotive also disclosed that it has agreed terms with a third party in Ontario for the sale of excess bio-oil, char and electricity produced at the West Lorne Bio-oil plant. The terms will establish a fixed price for the product for 3 years.

- All of the pyrolysis process plant is now in place and hot commissioned.
- 27.6 kV and 11 kV high voltage power stations are erected and the 600-volt feeders are connected.

The Company received its Certificate of Approval to operate from the Ontario Ministry of the Environment on January 27th and certificates of completion by key contractors thereafter leading to the commencement of plant start up. Generation and retail energy licenses have been received from the Ontario Energy Board.

The West Lorne Bio-oil Cogeneration Project (the first of its kind for pyrolysis technology), is partially funded with a Cdn $5 million contribution from Sustainable Development Technology Canada (SDTC) for its development and demonstration phases.

For more information on DynaMotive, please call:
Corporate Communications:
Tel: (604) 267-6000 Toll Free (in North America): 1-877-863-2268
Fax: (604) 267-6005
Email: investor@DynaMotive.com
Website: www.DynaMotive.com

The need for European Standards for liquid and gaseous alternative fuels

By Anja Oasmaa

Based on the report by CEN/BT/WG 149 prepared by Björn Rehnlund (ATRAX/SIS/Sweden) and Ana Olaru (SIS/Sweden).

CEN's Technical Board created the working group CEN/BT/WG 149 "Liquid and Gaseous Alternative fuels" in December 2002. The Swedish Standards Institute SIS assumed the responsibility for the secretariat of this WG. The aim was to collect information in the areas of:

- Existing standards, for instance on specifications, classification systems and test methods for liquid and gaseous alternative fuels.
- Ongoing and planned work on standards for specifications, classification systems, test methods, etc. for liquid and gaseous alternative fuels.
- Setting priorities for future work and standards, for instance on specifications, classification systems and test methods for liquid and gaseous alternative fuels.

CEN standards exist on Fatty Acid Methyl Esters (FAME) for automotive use, use in stationary applications, and on automotive LPG. CEN/TC 19 is now working on an ethanol standard for blending up to 5% in gasoline. Besides this initiative, there are currently also two workshop agreements running under CEN guidance, one concerning ethanol fuel (E85) for use in flexible fuel vehicles (FFV) and the other for diesel emulsions. With a mandate from the EC, CEN is also preparing to undertake a feasibility study concerning hydrogen as a fuel.

The main result of the work in BT/WG 149 is an overview of priorities in standardization of liquid and gaseous alternative fuels for the coming 5 years. These priorities are listed below by category. The four categories are:

- Liquid alternative automotive fuels.
- Gaseous alternative automotive fuels.
- Liquid alternative fuels for stationary applications.
- Gaseous alternative fuels for stationary applications.

The liquid alternative automotive fuels with the highest priority for standardization are:

- Fatty Acid Ethyl Esters (FAEE), both pure (100%) and for blends in diesel fuel up to 5%.
- Alcohol and alcohol derivatives in diesel fuel.
- Gasoline with 10% ethanol (revised EN 228).
- Ethanol for diesel engines (E95).

Continued on page 4

The need for European Standards for liquid and gaseous alternative fuels

Continued from page 3

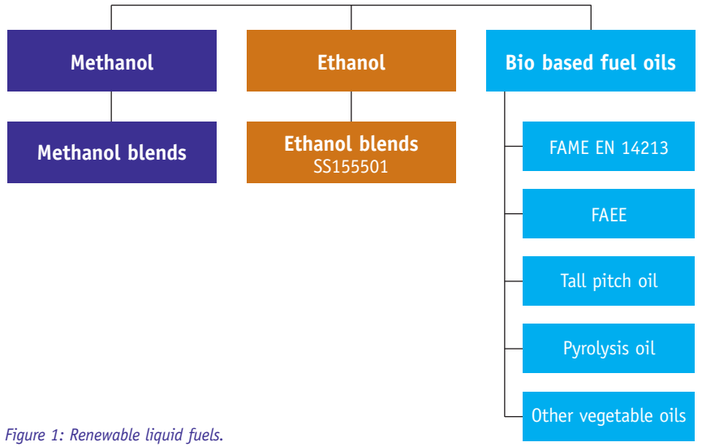

Figure 1: Renewable liquid fuels.

The gaseous automotive fuel with the highest priority for standardization is:

- Compressed biogas.

CEN/BT also recommends that CEN/TC 19 should start working on the following standards for alternative automotive fuels in the longer term:

- Compressed natural gas
- DME (Di-methyl ether)
- E15 (ethanol blended with up to 15% gasoline)
- FAME in diesel fuel (30%)
- Liquefied biogas
- Methanol (M100)
- Methanol blends in gasoline (M85)
- Synthetic diesel produced from natural gas and gasified biomass
- Hydrogen.

The liquid alternative fuels for stationary applications with the highest priority for standardization are:

- Methanol
- Ethanol and ethanol blends
- FAEE (Fatty Acid Ethyl Ester)
- Tall pitch oil.

In the longer term, CEN is also recommended to start working on the following standards on alternative fuels for stationary applications:

- DME
- Hydrogen
- Methanol blends
- Pyrolysis oil
- Other bio based oils.

The gaseous alternative fuels for stationary applications with the highest priority for standardization is:

- Biogas.

Recommendations

WG 149 recommends to the CEN Technical Board and to CEN/TC 19 to:

- Extend the work of CEN/TC 19, as soon as possible, to establish standards for the liquid and gaseous alternative fuels for automotive use that are mentioned above.
- Either to revise the title and scope of TC 19 to explicitly include alternative fuels for stationary applications, or to establish a dedicated TC (or BT Task Force) for alternative fuels for stationary applications.
- Take further necessary measures to establish standards on liquid and gaseous alternative fuels for stationary applications. In future work on revision of existing standards, or on production of new standards for alternative fuels, further research and development is necessary. This work to a great extent has to be carried out in combination with engine studies. In order to enable alternative fuels to be introduced to the fuel market, they have to be generally accepted by engine and vehicle manufacturers and fuel distributors.

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Bio-oil from woody biomass – a sustainable fuel for Australia

By Dr Damon Honnery, Monash University

The staff from the Laboratory for Turbulence Research in Aerospace and Combustion[1], Monash University, the Department of Chemical Engineering[2], Monash University, the Department of Mechanical and Manufacturing Engineering[3], the University of Melbourne, and the Bio-Energy Research Group[4], Aston University, have recently been awarded a five year Australian Research Council Discovery grant to investigate fast pyrolysis bio-oil.

The focus of the research is to demonstrate the viability of bio-oil as a future energy source for Australia. This will be achieved by optimising the pyrolysis process for production of liquid fuels from biomass and understanding the combustion characteristics of the resulting fuels by a combination of numerical and experimental studies. In particular the research aims to:

- Develop an advanced pyrolysis process optimised for the conversion of indigenous woody biomass to bio-oil suitable for use as a fuel for transport and remote power generation.
- Develop a fundamental understanding of the combustion characteristics of bio-oil through use of an array of numerical and of state-of-the-art experimental methods such as laser-based diagnostics and synchrotron-based X-ray techniques for in-situ study of the bio-oil combustion process (e.g. in a high pressure spray research engine).
- Develop a fundamental understanding of the relationship between bio-oil chemistry and its combustion.
- Explore the suitability of ethanol as a possible bio-oil blending agent for practical applications

The most significant outcome of this work is expected to be a process for producing a clean, greenhouse neutral, sustainable fuel based on thermal conversion of an Australian species of woody biomass for use in engines. This has the added benefit of opening up a possible solution to Australia's dry land salinity problem. Furthermore, application of X-ray based experimental techniques to these complex systems is an innovation that will enable a level of understanding that has so far been unattainable from conventional experimental techniques.

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[3] Dr. Andrew Ooi
[4] Prof. Tony Bridgwater

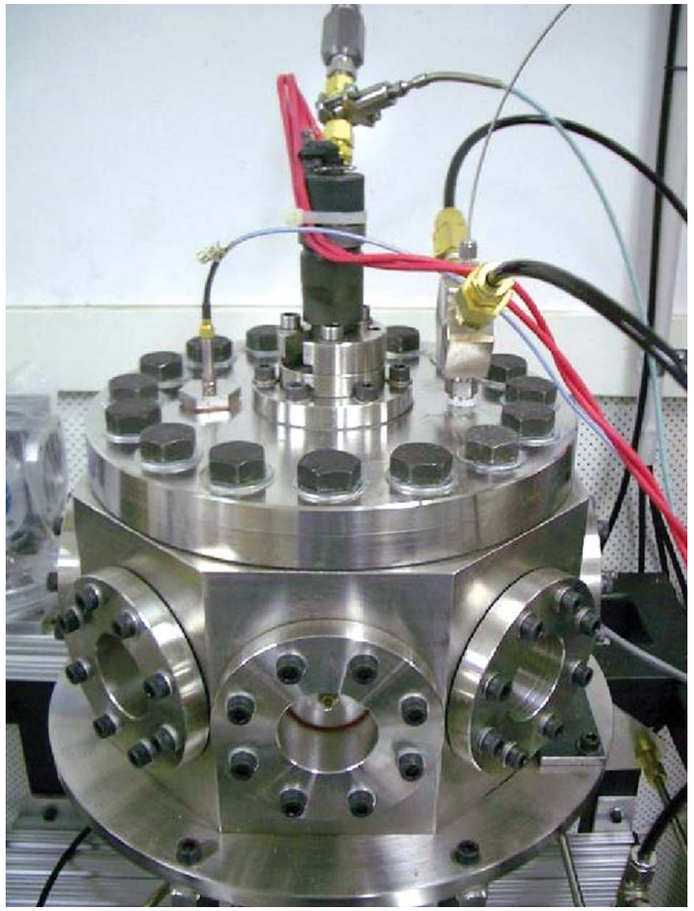


Figure 1: Constant volume high pressure spray combustion facility, in which bio-oil fuels will be examined.

Energy Prices & Taxes 2003

By John Brammer, Bio-Energy Research Group, Aston University, UK

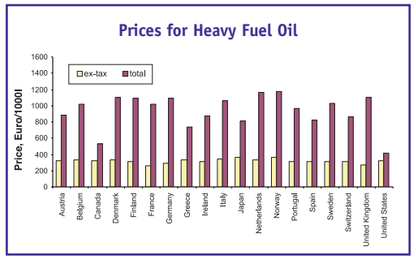
- Average prices over 2003, except *2002
- All liquid fuel prices in Euro per 1000 litres
- All gas and electricity prices in Euro per 100 kWh (or cents per kWh), gas on GCV basis
- All currency conversions based on exchange rates only
- 1 Euro = 1.13 US$.

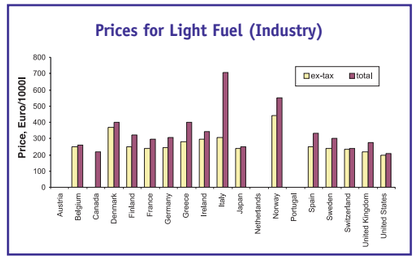
Principal source: IEA Energy Prices and Taxes, 3rd Quarter 2004 (ISSN 0256-2332)
Brazil omitted as no data available.

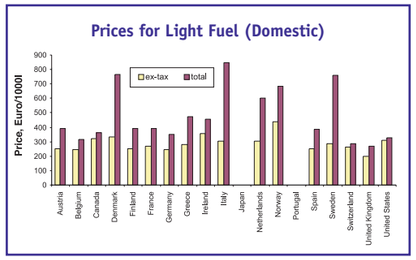
FUEL OILS

Country	Heavy Fuel Oil			Light Fuel Oil (Industry)			Light Fuel Oil (Domestic)		
	ex-tax	tax	total	ex-tax	tax	total	ex-tax	tax	total
Austria	158	35	193	–	–	–	251	143	394
Belgium	174	13	187	247	13	261	246	68	314
Canada	–	–	181	–	–	220	324	37	360
Denmark	214	51	265	368	33	401	334	432	765
Finland	176	58	234	250	71	321	250	141	391
France	178	18	196	238	57	294	269	120	389
Germany	156	24	181	243	61	305	243	110	353
Greece	210	18	229	280	121	401	280	193	473
Ireland	246	13	259	294	47	341	354	102	456
Italy	196	30	226	305	403	708	305	545	850
Japan	254	13	267	239	12	251	–	–	–
Netherlands	197	31	228	–	–	–	302	298	600
Norway	298*	144*	442*	440	112	552	440	245	685
Portugal	203*	27*	230*	–	–	–	–	–	–
Spain	218	14	232	249	85	334	249	138	387
Sweden	–	–	–	241	60	300	286	475	761
Switzerland	186	6	190	232	6	238	262	26	289
United Kingdom	152*	39*	191*	219	57	276	199	70	270
United States	–	–	168	195	10	206	309	18	327

Heavy fuel oil is low sulphur, except Canada, Ireland, Portugal, UK and US (high sulphur).
Heavy fuel oil density 0.97 kg/l.



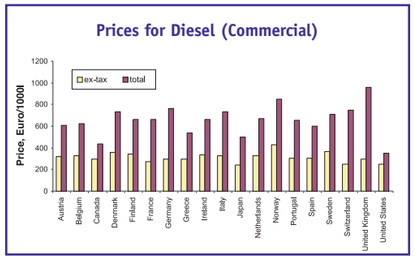


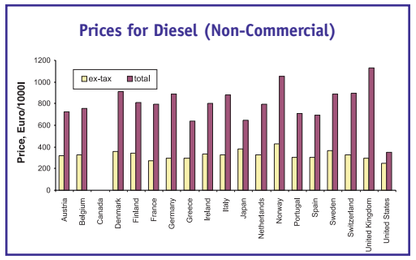


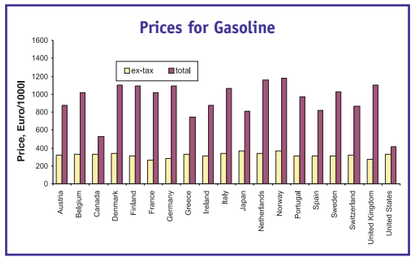
TRANSPORT FUELS

Country	Diesel (Commercial)			Diesel (Non-commercial)			Gasoline		
	ex-tax	tax	total	ex-tax	tax	total	ex-tax	tax	total
Austria	316	290	606	316	411	727	319	562	880
Belgium	331	294	625	331	425	756	334	683	1017
Canada	295	141	436	–	–	–	325	199	525
Denmark	359	370	729	360	552	912	336	768	1104
Finland	343	319	662	343	465	808	310	785	1095
France	271	392	663	271	522	793	261	756	1017
Germany	294	470	764	294	592	887	287	806	1093
Greece	295	245	540	295	342	637	331	409	740
Ireland	334	331	664	334	470	804	315	556	871
Italy	328	403	731	328	549	877	341	719	1059
Japan	241	257	498	381	264	645	363	450	812
Netherlands	324	344	668	324	471	795	336	823	1159
Norway	429	416	846	429	619	1049	365	807	1172
Portugal	306	347	653	306	404	710	308	657	965
Spain	304	294	598	304	390	694	308	509	817
Sweden	363	348	711	363	526	889	308	722	1030
Switzerland	248	503	751	327	566	892	317	545	862
United Kingdom	293	669	962	293	837	1130	270	834	1104
United States	247	105	352	248	104	352	325	90	415

Gasoline is premium unleaded 95 RON, except Canada (97 RON), Denmark (98 RON) and Japan (Regular).



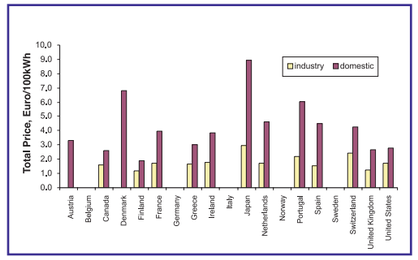




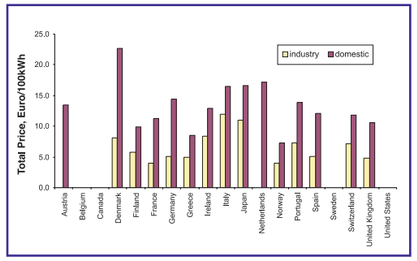
GAS

Country	Natural Gas (Industry)			Natural Gas (Domestic)		
	ex-tax	tax	total	ex-tax	tax	total
Austria	–	–	–	2.40	0.92	3.32
Belgium	–	–	–	–	–	–
Canada	–	–	1.60	–	–	2.59
Denmark	–	–	–	2.86	3.95	6.81
Finland	1.04	0.17	1.21	1.39	0.52	1.91
France	1.74	–	1.74	3.38	0.59	3.97
Germany	–	–	–	–	–	–
Greece	1.69	–	1.69	2.75	0.24	2.99
Ireland	1.77	–	1.77	3.38	0.46	3.83
Italy	–	–	–	–	–	–
Japan	2.80*	0.14*	2.94*	8.52*	0.43*	8.94*
Netherlands	1.60	0.10	1.69	2.92	1.67	4.59
Norway	–	–	–	–	–	–
Portugal	2.19	–	2.19	5.76	0.29	6.05
Spain	1.55	–	1.55	3.90	0.62	4.52
Sweden	–	–	–	–	–	–
Switzerland	2.41	0.02	2.44	3.95	0.33	4.28
United Kingdom	1.14	0.09	1.23	2.56	0.13	2.69
United States	–	–	1.70	–	–	2.78

GAS



ELECTRICITY



ELECTRICITY

Country	Electricity (Industry)			Electricity (Domestic)		
	ex-tax	tax	total	ex-tax	tax	total
Austria	–	–	–	9.23	4.25	13.48
Belgium	–	–	–	11.26*	–	–
Canada	–	–	–	–	–	–
Denmark	7.14	0.95	8.08	8.82	13.84	22.68
Finland	5.34	0.45	5.79	7.37	2.53	9.89
France	3.63	0.33	3.96	8.55	2.66	11.20
Germany	5.15*	–	5.15*	12.40*	1.98*	14.38*
Greece	4.93	–	4.93	7.86	0.63	8.49
Ireland	8.32	–	8.32	11.39	1.54	12.93
Italy	9.00*	3.00*	12.00*	11.00*	5.50*	16.50*
Japan	10.14*	0.85*	10.99*	15.55*	1.12*	16.67*
Netherlands	–	–	–	9.54	7.59	17.12
Norway	3.25	0.78	4.03	4.67	2.59	7.26
Portugal	7.34	–	7.34	13.16	0.66	13.82
Spain	4.89*	0.25*	5.14*	9.91*	2.18*	12.09*
Sweden	–	–	–	–	–	–
Switzerland	7.14	–	7.14	10.95	0.83	11.78
United Kingdom	4.50	0.33	4.83	10.04	0.51	10.55
United States	4.34	–	–	7.70	–	–

Science in Thermal and Chemical Biomass Conversion – STCBC

By Tony Bridgwater and Emma Wylde

Victoria BC, Canada
August / September 2004

This was the sixth international conference in the thermo-chemical biomass conversion series following on from Tyrol in 2000, Banff in 1996, Interlaken in 1992, Scottsdale in 1988 and Estes Park in 1982. The conference covered all scientific, technological, environmental, economic and commercial aspects of combustion, gasification, pyrolysis and related thermal conversion processes for biomass.

167 papers were submitted of which pyrolysis and hydrothermal processing attracted 61 papers, gasification attracted 47 papers, combustion attracted 26 papers and 33 papers were on systems, feedstocks and bio-diesel. All the papers have been peer reviewed and will be published by CPL Press later in 2005 (details below). Figure 1 shows most of the 192 delegates outside the Victoria Conference Centre and Figure 2 shows one of the poster discussion sessions.

Of particular significance was a special award to Prof. Donald Scott, who has contributed so much to the science and development of fast pyrolysis over the last 25 years. Figure 3 shows Don Scott being presented with a specially engraved commemoration of his contributions.

The meeting was sponsored by IEA Bioenergy, Natural Resources Canada and Biox.

Proceedings will be available from:
CPL Press
CPL Scientific Publishing Services Ltd
Suite 36 Liberty House
The Enterprise Centre
New Greenham Park
Newbury, RG19 6HW
UK
www.cplpress.com

Figure 1: STCBC delegates outside the Victoria Conference Centre.

Figure 2: Poster discussion session.

Figure 3: Don Scott is presented with an award for his contribution to fast pyrolosis.

Diary of Events

Information compiled by Emily Wakefield, Aston University, UK

The Clearwater Coal Conference
Venue: Clearwater, Florida, USA
Date: 17-21 April 2005
Contact: Barbara Sakkestad
601 Suffield Drive
Gaithersburg,
Maryland 20878
Tel: 301-294-6080
Email: BarbaraSak@aol.com
Website: www.coaltechnologies.com

5th Asia Pacific Conference on Sustainable Energy and Environmental Technologies
Venue: Wellington, New Zealand
Date: 9-11 May 2005
Contact: APCSEET ,
c/-PO Box 8031,
Palmerston North, NZ
Email: apcseet@massey.ac.nz
Website: www.apcseet.org

World Biofuels 2005
Venue: Seville, Spain
Date: 17-19 May 2005
Contact: Agra Informa Ltd
80 Calverley Road
Tunbridge Wells
TN1 2UN, UK
Tel: +44 (0)1892-511807
Email: conferences@agra-net.com
Website: www.agra-net.com

Synbios Syngas Route to Automotive Biofuels International Conference
Venue: Stockholm, Sweden
Date: 18-20 May 2005
Contact: Henrick Boding
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Floragatan 10B,
SE-114 31 Stockholm,
Sweden
Tel: +46-8-545-168-03
Email: synbios@ecotraffic.se
Website: www.ecotraffic.se/synbios

World Renewable Energy Congress
Venue: Aberdeen, Scotland
Date: 22-27 May 2005
Contact: Ms Victoria Withy
Conference Secretariat
Aberdeen Exhibition and Conference Centre
Bridge of Don,
Aberdeen AB23 8BL,
Scotland, UK
Tel: +44 (0) 1224-330-428
Fax: +44 (0) 1224-825-276
Email: WREC2005aberdeen@aecc.co.uk
Website: www.wrec2005aberdeen.co.uk

3rd Dubrovnik Conference on Sustainable Development of Energy, Water and Environment Systems
Venue: Dubrovnik, Croatia
Date: 5-10 June 2005
Contact: 2005 Dubrovnik Conference
FSB, Luciceva 5,
HR-10000 Zagreb,
Croatia
Fax: +385-1-6156940
Email: dubrovnik2005@fsb.hr
Website: www.dubrovnik2005.fsb.hr

7th World Congress of Chemical Engineering
Venue: Glasgow, UK
Date: 10-14 July 2005
Contact: Concorde Services Ltd
42 Canham Road
London
W3 7SR
Tel: +44 (0) 20-8743-3106
Fax: +44 (0) 20-8743-1010
Email: info@chemengcongress2005.com
Website: www.chemengcongress2005.com

1st International Biorefinery Workshop
Venue: Washington D.C., USA
Date: July 20-21, 2005

Biorefineries Renewable Fuel and Chemicals
Venue: Washington D.C., USA
Date: August 28th - September 1st, 2005
Contact: Doug Elliott
Pacific Northwest National Laboratory
Richland
WA 99352
Tel: 509-375-2248
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Bioenergy in the Wood Industry 2005
Venue: Jyvaskyla, Finland
Date: 12-15 September 2005
Contact: Tiina Lampinen
Tel: +358-14-334 0031
Email: tiina.lampinen@jklmessut.fi
Website: www.finbioenergy.fi/bioenergy2005

2nd Conference of COST Action E31
Venue: Bordeaux, France
Date: 29 September - 1st October 2005
Contact: Gerfried Jungmeier
Joanneum Research
Forschungsgesellschaft m.b.H
Fax: +43-316-876-1320
Email: gerfried.jungmeier@joanneum.at
Website: www.ctib-tchn.be/coste31.htm

14th European Biomass Conference and Exhibition
Venue: Paris, France
Date: 17-21 October 2005
Contact: Eng. Silvia Vivarelli
ETA Florence
Piazza Savanarola, 10
50132 Florence,
Italy
Tel: +39-055-500-2174
Email: biomass.conf@etaflorence.it
Website: www.conference-biomass.com

International Symposium on Wood Science and Technologies 50th Anniversary of The Japan Wood Research Society
Venue: Yokoyama, Japan
Date: 27-30 November 2005
Contact: Prof. Masahiro Samejima
Conference Secretariat
Department of Biomaterial Sciences
Graduate School of Agricultural and Life Sciences,
The University of Tokyo
Tel: +81-3-5841-5255
Fax: +81-3-5841-5273
Email: iawps2005@jwrs.org
Website: www.jwrs.org

The 2005 International Chemical Congress of Pacific Basin Societies (Pacifichem 2005)
Venue: Hawaii, USA
Date: 15-20 December 2005
Contact: Pacifichem 2005 Congress Secretariat
c/o American Chemical Society
1155 16th St. N.W.,
Washington,
D.C. 20036,
USA
Fax: +1-202-872-6128
Email: pacifichem2005@acs.org
Website: www.pacifichem.org

Renewable Energy 2006
Venue: Makuhari Messe, Japan
Date: 9-13 October 2006
Email: RE2006.sec@gsjss39.a07.aist.go.jp
Website: www.re2006.org

14th European Biomass Conference and Exhibition

Biomass for Energy, Industry and Climate Protection

Palais des Congrès, Paris, France 17th to 21st October 2005
Call for papers deadline is 7th April 2005

The 14th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection is scheduled to take place from the 17th to 21st October 2005 in Paris. This event will be an excellent forum for the presentation of the latest innovative global strategies, technologies, projects and efficient practice rules for energy and the environment. It will also give the opportunity for information exchange and for discussions among scientists, policy makers, practitioners of the use of biomass for energy, industry and climate protection.

The exhibition integrated into the Conference will provide an excellent opportunity for making business in the emerging biomass sector.

PROGRAMME

The five-day programme for this Conference will comprise:

- Plenary lectures describing the state-of-the-art in biomass technology
- Oral and visual presentations of research, development, demonstration and commercial projects
- Workshops on specific Biomass issues
- Exhibition of biomass products, utilisation and conversion technologies
- Social programme
- French Day: Thursday 20 October 2005.

Contact:
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Web: www.conference-biomass.com

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WP	PARTNER	ORGANISATION	TOPIC
WP 1A	S VAN LOO	Procede, Netherlands	Combustion Co-ordination
WP 1B	H HOFBAUER and H Knoef (S/C)	Technical University of Vienna, Austria	Gasification Co-ordination
WP 1C	A BRIDGWATER	Aston University, UK	Pyrolysis Co-ordination
WP 2A	D ELLIOTT	PNNL, USA	Biorefinery
WP 2B	K HJULER and D Meier (S/C)	FORCE, Denmark	Characterisation and analysis
WP 2C	G BREM	TNO, Netherlands	Co-processing and co-firing
WP 2D	M DORAN	Rural Generation, Northern Ireland	Feedstocks and standards
WP 2E	W LIVINGSTON	Mitsui Babcock, UK	Fouling, corrosion, erosion
WP 2F	N PADBAN	TPS, Sweden	Gas treatment
WP 2G	C DI BLASI	University of Naples, Italy	Science and modelling
WP 2H	H BOERRIGTER	ECN, Netherlands	Transport fuel
WP 3A	P THORNLEY and W Prins (S/C)	University of Manchester, UK	Barriers – technical and non-technical
WP 3B	M LAUER	Joanneum Research, Austria	Economics
WP 3C	D CHIARAMONTI	University of Florence, Italy	Education and training
WP 3D	P GIRARD and R Buehler (S/C)	CIRAD, France	Environment, health and safety
WP 4	E WYLDE	Aston University, UK	Dissemination
WP 5	A BRIDGWATER	Aston University, UK	Co-ordination & Management