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PyNE Pyrolysis

ISSUE 1 MARCH 1996

Co-ordinator

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Comments and contributions are most
welcome on any aspect of the contents.

Please contact your country
representative for further details or send
material to Karen Dowden.

Welcome



PyNE group meeting in La Coruña, Spain

Welcome to PyNE's first newsletter, wherein we aim to heighten the awareness and opportunities for biomass pyrolysis and related technologies for liquid fuels, electricity and other high added value products. The main focus will be opportunities and advances in the EC, although world-wide developments will be included.

The purpose of this newsletter is to provide a forum for the sharing of information in new developments, meetings, proposals, publications, reports which will be circulated among research scientists, technologists, industrialists, policy makers or anyone with an interest in this area.

What is PyNE?

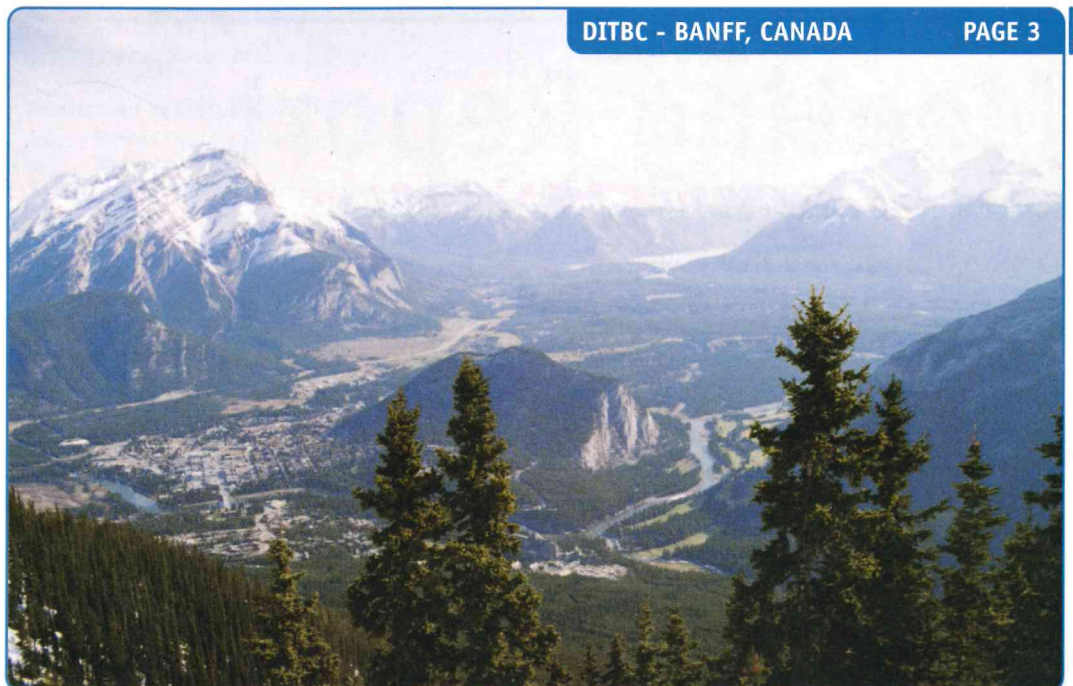
Funded by the EC, PyNE consists of a network of experts and enthusiasts from all the EU countries in biomass pyrolysis and related activities across Europe. Its basic objectives include:-

- to provide a forum for discussion and exchange of information on pyrolysis and all related technologies through regular meetings, specialist subject groups and publications,

- to identify research and development needs and establish priorities,
- to encourage the active involvement of industry in developing and implementing fast pyrolysis for liquids,
- to establish a database to aid information dissemination and improve co-operation.

DITBC - BANFF, CANADA

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The International Energy Agency Bioenergy Agreement & PYRA

The International Energy Agency has around 35 different implementing agreements covering a diverse range of topics such as global warming, transport fuels and bioenergy. The Bioenergy Agreement is one of these Agreements and covers biomass production and harvesting; biomass conversion; and MSW management.

There are six activities in the biomass conversion task that are reviewing pyrolysis, gasification, combustion, biotechnology, integrated bioenergy systems and system studies. The pyrolysis activity, known as PyRA, had its first meeting in Waterloo, Canada from 10 to 12 May 1995. The focus of the meeting was to begin to establish standards for pyrolysis liquids and their properties for different

applications. The second meeting was held in La Coruna, Spain in November 1995 in conjunction with the second PyNE meeting in order to share knowledge and experience and establish a sound basis for collaboration.

Progress in this activity will be reported through this newsletter, and opportunities will be provided for PyNE members to interact with the IEA group at workshops and seminars.



▲ IEA PyRA Group

Fast pyrolysis of biomass at moderate temperatures gives a dark brown mobile liquid. This liquid is known by various names including bio-oil, bio-crude oil, bio-crude, bio-fuel oil, pyrolytic oil, pyrolysis oil, pyrolysis liquid or liquid wood.

While bio-oil has become a popular name in Europe, there are moves to provide a more accurate or definitive name that satisfactorily defines and describes this unusual material and avoids misunderstanding of its properties. Suggestions will be published.



Meeting Report

The Second EC-Canada Workshop on Biomass Pyrolysis

Toronto, Canada, 8-9 May 1995

This workshop, the second in a series of collaborative meetings, was attended by 35 delegates from Canada and the EU. Twenty seven papers were presented on almost every aspect of biomass pyrolysis and all the related technologies needed for successful development and exploitation of this field of thermal biomass conversion. The meeting was sponsored by the EC DGI and Natural Resources Canada.

The purpose of these meetings is to further develop and enhance collaboration between universities,

research organisations and industry in order to enhance scientific and technological development and exploit market opportunities for implementation.

Proceedings from the meeting are edited by Ed Hogan of Natural Resources Canada and Tony Bridgwater of Aston University, UK and will be available after February 1996 from Karen Dowden.



**Biomass Energy Technologies and Renewable Energy Opportunities in New Zealand.**

Date: **11 - 14 March 1996**
Contact: Graham Diedrichs, Conference
Organiser:
Tel: +64 9 377 5328
Fax: +64 9 366 0531
Email: grahamd@eeca.ak.planet.co.nz

First European Seminar on Sorghum for Energy & Industry - Toulouse, France

Date: **1-3 April 1996**
This seminar aims to present the state-of-the-art of sweet and fibre sorghum; emphasise the agronomic and industrial advantages; identify the bottlenecks of the system; and define further scientific research. It will focus on agronomic techniques, industrial valorisation, environment management and economic studies.
Organiser: EC, INRA and ADEME
Contact: Claire Charonnat,
Tel: +33 1 30815555
Fax: +33 1 30815563
Email: charo@bcgn.grignon.inra.fr

11th International Symposium on Alcohol Fuels

Venue: Sun City, South Africa Date: **14-17 April 1996**
Contact: Traci Hanson, Francine Vaughan or Linda Angelos,
ISAF Symposium Co-ordinator
Rennies Travel Incentive & Conference
Management Division
PO Box 9395, Johannesburg 2000, South Africa
Tel: +27 11 403 7900
Fax: +27 11 407 3220

Energetic and Material Utilisation of Wastes & Renewable Feedstocks

Venue: Velen/Westfalen, Germany Date: **22-24 April 1996**
Combustion, Gasification, Pyrolysis, Hydrocracking of Wastes and renewable feedstocks. Topics: Feedstock preparation, reactivity, product, qualities, emissions, practical experiences, process studies
Contact: DGMK office, Mrs. C. Jenke,
P.B. 60 05 49, D-22205 Hamburg, Germany,
Tel: +49 40 63 90 04 11,
Fax: +49 40 63 0 07 36

Industrial Crops and Products

Venue: Reims, France Date: **22-24 April 1996**
Existing and new potential industrial crops such as oil and fibre crops and crops for production of carbohydrates. Industrial applications will be discussed.
Abstracts by: June 1995
Contact: Sharron Emsley
Tel: +44 1865 84 3721
Fax: +44 1865 84 3958
Email: s.emsley@elsevier.co.uk

Biomass Usage for Utility and Industrial Power

Venue: Snowbird Resort & Conference Centre, Snowbird, Utah, USA
Date: **28 April-3 May 1996**
Fuel characterisation, resource availability, fuel preparation & handling, conversion systems
Contact: Dr. S. Harding, Reaction Engineering International, USA
Tel: +1 801 364 6925
Fax: +1 801 364 6977
Abstracts by: 15 October 1995
Abstracts to: Engineering Foundation, 345 East St, Suite 303,
New York, NY 10017, USA
Tel: +1 212 705 7836
Fax: +1 212 705 7441

Developments in Thermochemical Biomass Conversion (DITBC)

This major international conference is for anybody interested in any aspect of thermal biomass conversion. (SEE PHOTOGRAPH ON FRONT COVER)
Venue: Banff, Alberta, Canada. Date: **20-24 May 1996**
Contact: Tony Bridgwater, Aston University,
Energy Research Group, Birmingham, B4 7ET, UK
Tel: +44 121 359 3611
Fax: +44 121 359 6814
Email: a.v.bridgwater@aston.ac.uk

Cereals: Novel uses and Processes

Place: Manchester, UK Date: **5-6 June 1996**
Speakers from the US, Europe, Asia & elsewhere will present papers on Novel Uses of Cereals (5 June) & Novel Processes (6 June). The Conference will feature poster presentations and an exhibition of cereal processing technology, new technology initiatives and cereal information dissemination networks including NF-AIRID.
Contact: Dr Grant Campbell, Dept. of Chemical Engineering, UMIST
PO Box 88, Manchester, M60 1QD, UK
Tel: +44 161 200 4472
Email: g.cambell@umist.ac.uk

World Renewable Energy Congress IV

Venue: Denver, Colorado, USA Date: **15-21 June 1996**
Contact: Professor A A M Sayigh, World Renewable Energy Network,
147 Hilmanton, Lower Earley, Reading, RG6 4HN, UK
Tel: +44 1734 611364
Fax: +44 1734 611365

Asia-Pacific Conference on Sustainable Energy & Environmental Technology

Venue: Singapore Date: **19-21 June 1996**
Contact: APCSEET Secretariat, Centre for Continuing Education,
Tel: +65 799 5243
Fax: +65 791 6178
Email: apcse96@ntuvax.ntu.ac.sg

9th European Conference on Bioenergy

This conference will focus on commercial applications of bioenergy and the challenges and successes of technology transfer from RD&D to industry and end-users. It will address new achievements of technologies under development and recent scientific advances.
Venue: Copenhagen, Denmark Date: **24-27 June 1996**
Contact: U-M Henius, Danish Energy Agency,
Tel: +45 4492 4492
Fax: +45 4492 5050

ECOS'96 Efficiency, Costs, Optimisation, Simulation and Environmental Aspects of Energy Systems

Venue: Stockholm, Sweden Date: **25-29 June 1996**
*Thermodynamic and Thermo economic analysis of Energy Systems and Processes
Improvement in the Use of Renewable Energy with Special Emphasis of the Use of Biomass - Environmental Aspects of Energy Systems - Energy systems for the Future.*
Contact: Dr Per Alvfors, Dept. of Chemical
Engineering and Technology,
Division of Energy Processes, Royal Institute of Stockholm
S-100 44 Stockholm, Sweden
Tel: +45 8 790 6526
Fax: +45 8 723 0858
Email: ECOS96@heat.kth.se

Power-Gen 96 Europe

Venue: Budapest, Hungary Date: **26-28 June 1996**
Contact: Ms Nel Jonk, Conference Co-ordinator,
PO Box 9402, 3506 GK Utrecht, The Netherlands
Tel: +31 302 650 963
Fax: +31 302 650 928

First European Congress on Renewable Energies for Regions and Cities

Venue: Ulm Kongresszentrum, Germany
Date: **27 - 29 June 1996**
Contact: Eurosolar e.V Plittersdorfer Strasse
103, D - 53173 Bonn, Germany
Fax: +49 228 361279

5th World Congress of Chemical Engineering

Venue: San Diego (CA), USA Date: **14-18 July 1996**
Several sessions of which the following two have special interest - Potential Impact of Renewable Biomass energy
Contact: Ralph Overend, National Renewable Energy Laboratory
1617 Cole Blvd., Golden, CO 80401-3393
Tel: +1 303 275 4450
Fax: +1 303 275 2905

Pyrolysis Furnace Technology

Contact: G Froment, University of Gent,
Krijkslaan, 281B-9000, Gent, Belgium
Tel: +011 32 92644516
Fax: +011 32 92644999

First Trabzon International Energy and Environmental Symposium

Venue: Trabzon, Turkey Date: **29-31 July 1996**
Contact: Prof Teoman Ayhan
Email: energy96@risc01.bim.ktu.edu.tr

CHEMRAWN IX - World Conference on Sustainable Production, Use, Disposal and Recycling of Materials & the Role of Advanced Materials in Sustainable Development

Venue: Seoul, Korea Date: **1-6 Sept 1996**
Contact: Organising Committee and Secretariat,
IUPAC CHEMRAWN IX, Tongwon B/D 6th Floor,
128-27 Tangju-dong, Chongno-ku, Seoul, 110-071 Korea
Tel: +82 2 739 4521
Fax: +82 2 739 6187
Email: 5502833@mcimail.com

International Workshop (European Conference) West-East in Biomass Research and Technology Utilisation

Venue: High Tatras, Slovak Republic
Date: **September 1996**
Contact: Dr. Rudolf Apalovic, Chairman SK-BIOM
Lamacska 1., 83330 Bratislava, Slovak Republic
Tel: +42 7 373301
Fax: +42 7 255819

Third Liquid Fuel and Industrial Products from Renewable Resources

Venue: Nashville, Tennessee Date: **15-17 Sept 1996**
Deadline: 1 March 1996
Contact: ASAE, Meetings & Conferences Department
2950 Niles Road, St Joseph, MI 49085-9659, USA
Tel: +1 616 429 0300
Fax: +1 616 429 3852
Email: buntjer@asae.org

Bioenergy '96 - 7th National Bioenergy Conference

Venue: The Opryland Hotel, 2800 Opryland Drive, Nashville,
Tennessee TN 37214-1297, US
Date: **15-19 September 1996**
Partnerships to develop and apply biomass technologies to be held jointly with the ASAE 3rd Liquid Fuels Conference - Liquid Fuels & Industrial Products from Renewable Resources
Abstracts by: 1 March 1996
Papers due: 15 June 1996
Contact: Bonnie Watkins
South Eastern Regional Biomass Energy Program,
Tennessee Valley Authority,
CEB 3APO Box 1010, Muscle Shoals, AL 35662-1010, USA
Tel: +1 205 386 2925
Fax: +1 205 386 2963

Second European Biomass Forum

Place: Graz, Austria Date: **22-25 Sept 1996**
This will review process made in R&D on liquid biofuels, as well as the growth of the industry & the penetration into various markets in Europe. The areas addressed include: new opportunities for liquid biofuels, the importance of a cheap raw material base and utilisation in combustion engines, as well as environmental, economic and political aspects.
Contact: Joanneum Research,
Elizabethstrasse 11, A-8010, Graz,
Austria, 2nd Biofuels European Forum
Fax: +43 316 876 320

11th International Conference on Solid Waste Technology Management

Venue: Philadelphia, USA Date: **12 - 15 Nov 1996**
Contact:
Tel: +1 610 499 4042
Fax: +1 610 499 4059

Third Meeting of the EU-Canada Collaboration on Thermal Biomass Conversion

Venue: To be decided
Date: **May 1997**
Review of biomass technology conversion developments in the EU & Canada.
Contact: A V Bridgwater, Aston University,
Aston Triangle, Birmingham B4 7ET, UK
Tel: +44 121 359 3611,
Fax: +44 121 359 6814,
Email: a.v.bridgwater@aston.ac.uk



new developments

UK Non-Fossil Fuel Obligation (NFFO)

The Non Fossil Fuel Obligation in the UK is intended to support the development of renewable energy technologies by providing fiscal incentives to purchase electricity generated from renewable resources at a premium level.

The level at which this renewable electricity is purchased depends on the technology and, for example is currently 8.75p/kWh (approximately 0.0105 ECU/kWh) compared to a pool or market price of around 2.5 p/kWh, a typical industrial price of 5.0/kWh and a domestic price of around 8p/kWh. UK government policy is aimed to providing 1500MW of new renewables based generation capacity in the UK by 2000.

In the fourth renewables tranche pyrolysis of energy crops or forestry waste is included for the first time along with gasification which clearly demonstrates the perceived status of fast pyrolysis technology for providing electricity in the future.

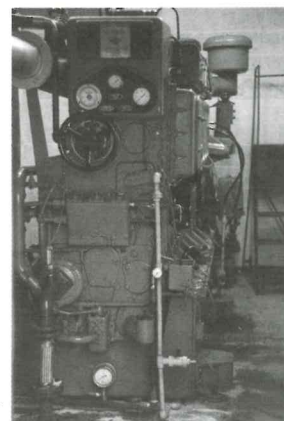
For further information on the NFFO scheme can be obtained from the Renewables Enquiries Bureau, ETSU, Harwell, OX11, 0RA, UK, Tel: +44 1235 432450; Fax +44 1235 433131 additional information can be obtained on the Internet at : <http://www.dti.gov.uk/nffo>.

ENEL Fast Pyrolysis Plant

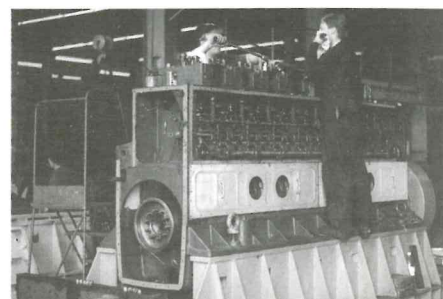
The 650 kg/h and Ensyn fast pyrolysis pilot plant that was ordered by ENEL recently has now been delivered to Italy and is being installed in the site of ENEL power station at Bastardo in Perugia. It is hoped that this will be fully operational by May 1996 and will become the largest operational fast pyrolysis unit in Europe.

Engine Development Project

A 250kWe diesel has been successfully modified to run on bio-oil by Union Fenosa in dual fuel mode by Ormrod Diesels, UK. The project is supported by the EC APAS R&D programme and the UK DTI.



Ormrod Diesels UK
The pictures show the engine undergoing modification in the workshop and operating in the testhouse.



REPORTS & PUBLICATIONS

This will be a regular section in the newsletter covering the following areas:

- 1 Useful Internet sites,
- 2 Useful publications in the "grey literature" that may be unknown or inaccessible to many working in the field and which would not normally enter the conventional abstracting services,
- 3 Useful addresses and contacts,
- 4 Occasional special surveys, examples of which are the EC Energy Centres in Non-EU countries in Europe.

Each section will be updated each issue.



internet & email addresses

The European Community Research and Development Information Service, provides information about Research and Development sponsored and supported by the European Union.	http://www.cordis.lu/
EC Specific programmes managed by DG XII	http://www.cec.lu/en/comm/dg12/specpr.html
EC DG XII home page	http://www.cec.lu/en/comm/dg12/dg12tst2.html
IEA Greenhouse Gas R&D Programme	andrea@ieagreen.demon.co.uk (email)
Australian Environmental Resources Network (ERIN)	http://kaos.erin.gov.au/erin.html
Eastern Europe Eco-Directory	gopher://gopher.poniecki.berkeley.edu
Energy Efficiency and Renewable Energy Network	http://www.eren.doe.gov
Energy Efficiency and Renewable Energy Clearing House	http://www.eren.doe.gov/ee-cgi-bin/ee_renen-fuel.pl
European patent office	http://www.epo.co.at/epo/
US Patent Office	http://www.uspto.gov/other.html
UK patents	http://www.netwales.co.uk/ptoffice/index.htm
PyNE Newsletter	http://www.ceac.aston.ac.uk/erg/PyNE.html
Solstice: Sustainable Energy and Development Online	http://solstice.crest.org/
Biofuels Information Network	http://www.esd.ornl.gov/BFDP/BFDPMOSAIC/binmenu.html
Patent documents dealing with PTO, PCT and other bodies	http://sunsite.unc.edu/patents/ptodoc.html
STN International database	http://www.fiz-karlsruhe.de/stn.html

grey literature

There is a wide and varied array of information which is often referred to as grey literature i.e. documentation which would not typically appear on a conventional database search using the standard sources, e.g. Chemical Abstracts, STN etc. Further classification of this literature in different areas is therefore difficult. In some cases, rather than providing numerous lists of references, organisations and agencies who can supply the information are listed. A limited number of reports are known. Contact sources are given where known.

Bridgwater, A. V. and Evans, G. D., 'An Assessment of Thermochemical Conversion Systems for Processing Biomass and Refuse', report to ETSU, no. ETSU B/T1/00207/REP, ETSU Report-Crown Copyright, 1993. (ETSU, Harwell, Oxon. OX11 0RA, UK. Tel: +44 1235 432450, Fax: +44 1235 432050)

Bridgwater, AV and Hogan, EN (Eds.) "Bio-oil production and utilisation" Proceedings of the 2nd EU-Canada Contractors meeting, Toronto, May 1995 pp 270 (CPL Scientific 1996, Tel +44 1635 524064, Fax: +44 1635 529322)

ECOTEC Research and Consulting Ltd., 'Review of pollution control technology for waste combustion', report to ETSU, no ETSU B 1244, ETSU-Crown Copyright, 1990. (ETSU, Harwell, Oxon. OX11 0RA, UK. Tel: +44 1235 432450, Fax: +44 1235 432050)

Elliott, D. C., Hart, T. R., Neuenschwander, G. G., McKinney, M. D., Norton, M. V. and Abrams, C. W., 'Environmental Impacts of Thermochemical Biomass Conversion', in Report No. NREL/TP-433-7867, NREL, Golden, Colorado, 1995. (NTIS, US Dept of Commerce, 5285 Port Royal Road, Springfield, VA, 22161, Tel: +1 703 487 4650)

Fagnäs, L., Chemical and Physical Characterisation of Biomass-based Pyrolysis Oils, Literature Review. VTT Technical Research Centre of Finland, Espoo 1995

Lemieux, R., Roy, C., de Caumia, B. and Blanchette, B., 'Study of the performance of a process development unit for vacuum pyrolysis of biomass', report to Energy, Mines, Resources, Canada-Division of Renewable Energies, SSC contract no. 232830-7-6334/01-SZ, copies available from EMR, Canada, 1988. (Division of Renewable Energies, EMR-Canada, 580 Booth Street, Ottawa, Canada, K1A 0E4)

Proceedings of Seminar on Energy from Biomass and Waste, Valladolid, Spain 17-19 May 1995 (IDAE, Paseo de la Castellana, 95, 28046 Madrid, Spain, Tel: +34 1 556 8415, Fax: +34 1 555 1389)

Stevens, Don J., 'Review and analysis of the 1980-1989 Biomass Thermochemical Program', report to US DoE-NREL prepared under subcontract no. AAE-3-13209-01, NREL, Golden Colorado, USA, 1994 (NTIS, US Dept of Commerce, 5285 Port Royal Road, Springfield, VA, 22161, Tel: +1 703 487 4650)

NREL, 'Biomass pyrolysis oil - properties and combustion meeting' Proceedings of an international workshop, September 1994, Estes Park, CO, USA (available from NTIS, Publication No. NREL-CP-430-7215, US Dept of Commerce, 5285 Port Royal Road, Springfield, VA, 22161, USA, Tel +1 703 487 4650)

Additional contributions are welcomed and should be sent to the editor

newsletters & bulletins

UK

Review

(the magazine of new and renewable energy),

Renewable Energy Enquiries Bureau,
ETSU, Harwell, Oxfordshire OX11 0RA

Tel: +44 1235 432450

Fax: +44 1235 432050

Wood Fuel Now!

(twice yearly newsletter)

Renewable Energy Enquiries Bureau,
ETSU, Harwell, Oxfordshire OX11 0RA

Tel: +44 1235 432450

Fax: +44 1235 432050

Biomass Focus

(newsletter for users and suppliers of biomass fuels)

Dr. B. Hague

Biomass Focus-ETSU, Harwell, Oxfordshire OX11 0RA

Tel: +44 1235 432450

Fax: +44 1235 432050

Energy From Biomass - Principles and Applications

OPET-ETSU, Harwell, Oxfordshire OX11 0RA

Tel: +44 1235 432450

Fax: +44 1235 432050

CADDET Centre For Renewable Energy

ETSU, Harwell, Oxfordshire OX11 0RA

Tel: +44 1235 432450

Fax: +44 1235 432050

IEA Greenhouse Gas R&D Programme

CRE Group Ltd.,
Stoke Orchard, Cheltenham, Gloucester, GL52 4RZ.

Tel: +44 1242 680753

Fax: +44 1242 680758

Warmer Bulletin

Journal of the World Resource Foundation
Bridge House, High Street

Tonbridge, Kent TN9 1DP UK

Tel: +44 1732 368333

Fax: +44 1732 368337

India

TIDE-TERI Information Digest on Energy

Documentation and information Centre

Tata Energy Research Institute,
Darbari Seth Block, Habitat Place,
lodhi Road, New Delhi-110003, India.

Tel: +91 11 460 1550, 4622246

Fax: +91 11 461 1770

email: mailbox@teri.ernet.in

Thailand

Rural Energy journal in the Asia-Pacific region

P.A. Hick,

Regional Agricultural Engineering and Agro-Industries officer

FAO Regional office for Asia and the Pacific (RAPA)

Maliwan Mansion,

39 Phra Atit Road, Bangkok, Thailand

USA

Western Regional Biomass Energy Program

Western Area Power Administration, A7100,
PO Box 3402, Golden, Colorado 80401-0098, USA
Tel: +1 3030 275 1704

Biomass power-program overview fiscal years 1993-1994

DOE/Go-10095-089

available from NTIS, US Dept of Commerce,
5285 Port Royal Road, Springfield, VA, 22161, USA
Tel: +1 703 487 4650

DoE Regional Biomass Energy Program

(Publications list)

DOE/Go-10095-089

available from NTIS, US Dept of Commerce,
5285 Port Royal Road, Springfield, VA, 22161, USA
Tel: +1 703 487 4650

The Solar Letter

(international newsletter on all aspects of solar energy)

Allan L. Frank Associates, 9124 Bradford Road,
Silver Springs, MD., 20901-4918, USA

Tel: +1 301 565 2532

Fax: +1 301 565 3298 (US\$ 384/year)

Synergy

(directory of Renewable Energy, variety of information
sources from all over the world)

PO Box 1854, Cathedral Station,
New York, NY 10025, USA

Tel: +1 212 865 9595

EC Energy Centres in Non EU countries in Europe

EC Energy Centre Moscow

c/o ENIN Room 210, Leninsky Prospekt 19,
117927 Moscow, Russia

Tel.: +7 905 9525527

Fax.: +7 905 9525527

Telex: 411700 for Box Number 013010 ENCONS

EC Energy Centre St. Petersburg

c/o DNTP, 58, Nevsky Prospekt, 191011 St. Petersburg, Russia

Tel.: 7.812.2104932

Fax.: 7.812.3126238

Cellnet Tel.: 7.812.3126238

EC Energy Centre Minsk

c/o Belvec P.O. Box 154, 220002 Minsk, Byelorussia

Tel.: +7.0172.204114

Fax.: +7.0172.204114

Telex: 252 101 Neman SU

EC Energy Centre Kiev

Apartment 19, 39, Pushkinskaya Street, Kiev 4, Ukraine.

Tel.: +7.044.2212066

Fax.: +7.044.2297522

EC Energy Centre Tallinn

B428 Bolig Ministeries, 11, Harju Street, EE0001 Tallinn, Estonia.

Tel.: +7.0142.449511 (local)

Tel.: +372.2.449511/691218 (international)

Fax.: +7.0142.691218 (local)

Fax.: +372.5.247857 (international)

EC Energy Centre Warsaw

Jasna 22, PL - 00 - 950 Warsaw, Poland.

Tel.: +48.22.268391 or 268888

Fax.: +48.22.260585

EC Energy Centre Katowice

Espace Fracuska, UL. Fracuska 70, PT. - 40 - 028 Katowice - Poland

Tel.: +48.32.547622

Fax.: +48.32.574623

EC Energy Centre Riga

I Ganibu Dambis 12 - 4th floor, 226810 Riga, Latvia.

Tel.: +32.88.57 or 32.88.56 (local)

Tel.: +371.2.32.88.56 (international)

Fax.: +45.302.49903 (international)

EC Energy Centre Vilnius

c/o Lithuanian State Power System, 14 Zveju Street P.O. Box 2515,
2051 Vilnius, Lithuania.

Tel.: +370.2.75.07.74

Fax.: +370.2.29.02.24

EC Energy Centre Tyumen

38, Volodarskogo ul, P.O. Box 5211, Tyumen 625000 - Russia

Tel.: +7.345.2.25.11.41

Fax.: +7.345.2.24.74.00

EC Energy Centre Prague

c/o Vupek, Stetkova 18, Prumstav Building,
14068 Prague 4, Czech Republic.

Tel.: +42.2.430948

Fax.: +42.2.430948

EC Energy Centre Bratislava

Konventn 9, 81103 Bratislava, Slovakia

Tel.: +42.7.315.361

Fax.: +42.7.315.361

Email: ECEC@cvtstu.cvt.stuba.sk

Mr Ian Brown

EC Energy Centre Budapest, Knyves Kalman K'rt 76,
1087 Budapest VIII, Hungary.

Tel.: +361.269.90.67

Fax: +361.269.90.65

EC Energy Centre Sofia

51, James Boucher Blvd., 1407 Sofia, Bulgaria.

Tel.: +359.2.683.542

Fax.: +359.2.681.461

A survey of liquid fuel and electricity prices has been carried out to compare the effects of tax on consumer prices and the variation of costs in the different EU countries.

Further information on fuel prices without taxes is contained in the weekly Oil Bulletin published by the EC Directorate for Energy.

energy prices in europe

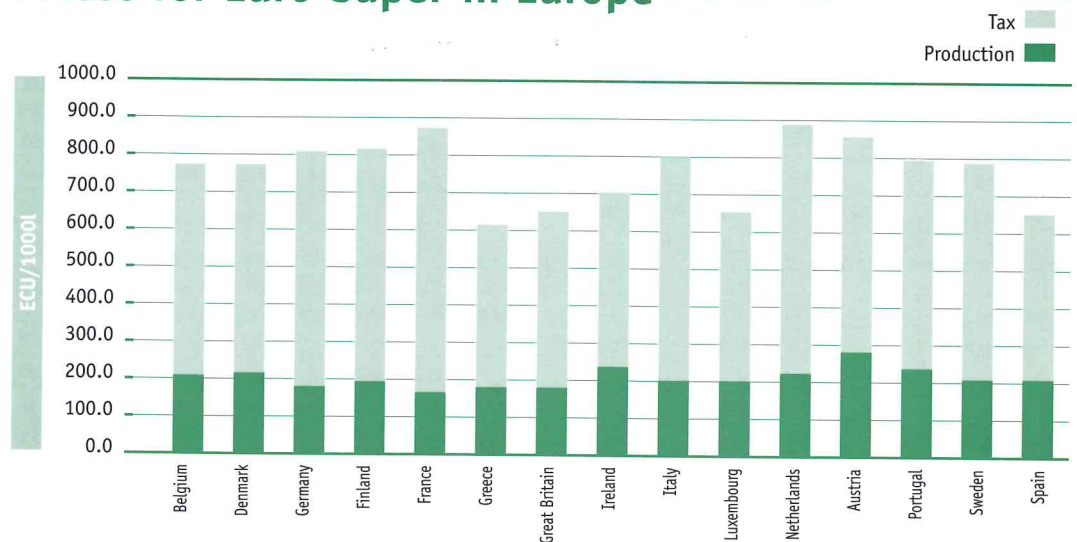
Wolfgang Baldauf - VEBA Oel, Germany

Liquid fuel prices

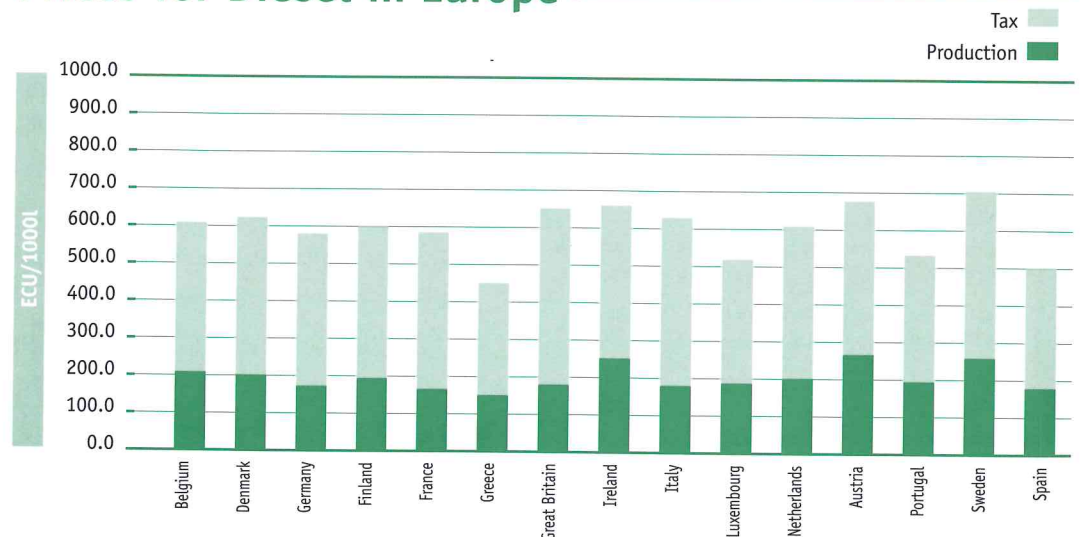
Date: July 1995 Source: Erdöl-Informationsdienst All prices in ECU/1000 litres

Country	Eurosuper			Diesel			Fuel Oil		
	Production price	Tax	Price incl Tax	Production price	Tax	Price incl Tax	Production price	Tax	Price incl Tax
Austria	284.0	579.9	863.9	262.5	415.3	677.8	198.0	140.9	338.9
Belgium	208.8	570.7	779.5	210.9	412.1	622.9	131.3	44.1	175.4
Denmark	210.9	566.4	777.3	208.7	427.7	636.4	187.2	350.7	537.9
Germany	181.3	633.1	814.4	171.6	409.4	581.0	146.3	71.5	217.9
Finland	195.3	632.6	827.9	199.0	402.9	601.9	171.6	81.8	253.4
France	172.7	697.2	869.8	160.3	427.7	588.0	177.5	124.3	301.8
Greece	181.8	443.3	625.1	148.5	310.9	459.4	128.0	307.2	435.2
Great Britain	180.2	469.1	649.3	180.7	469.6	650.4	117.8	36.6	154.4
Ireland	241.5	460.5	702.0	249.6	406.7	656.3	153.3	75.8	229.2
Italy	202.3	597.6	799.9	177.0	450.2	627.2	159.8	447.0	606.8
Luxembourg	208.2	435.7	643.9	188.3	335.1	523.4	172.1	26.9	199.0
Netherlands	222.2	670.8	893.0	204.4	419.6	624.0	176.4	111.9	288.3
Portugal	235.6	562.7	789.3	192.6	343.2	535.8			
Sweden	204.4	579.9	784.3	262.5	446.5	709.0	160.8	249.1	409.9
Spain	208.2	450.2	658.4	174.3	330.3	504.6	131.3	109.2	240.5

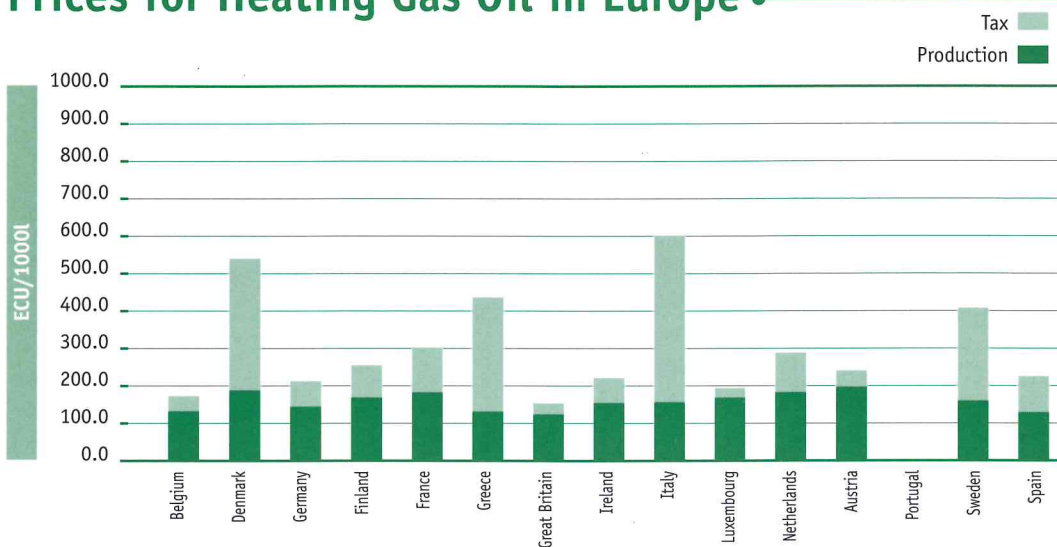
Prices for Euro-Super in Europe



Prices for Diesel in Europe



Prices for Heating Gas Oil in Europe



Electricity prices

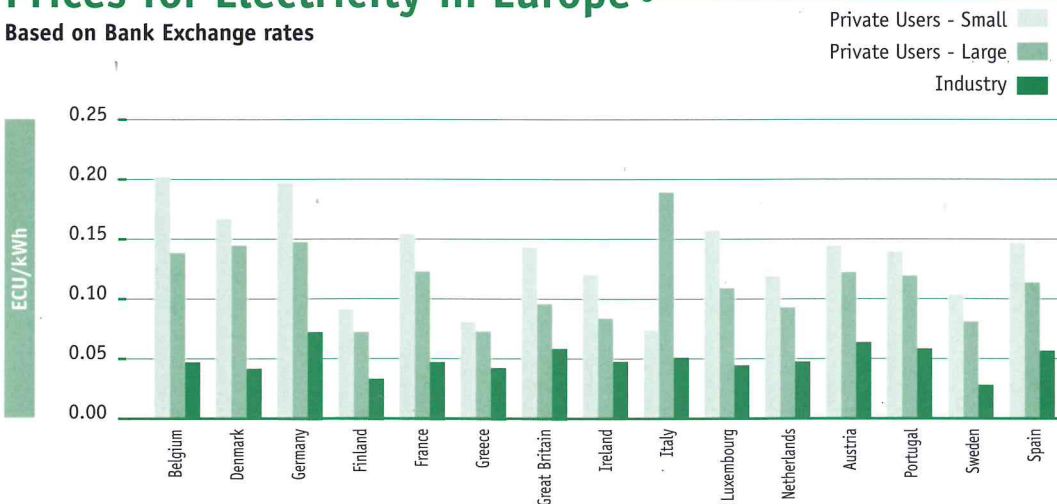
Date: January 1995 Source: VDEW e.V. Strompreisvergleich Stand 1 All prices in ECU/kWh

The international comparison of electricity prices is difficult. Electricity suppliers point out that comparison on the basis of bank exchange rates (BER) does not reflect the real situation due to different economic factors and purchasing powers in each country. Additionally, a comparison of prices related on specific purchasing power relations is provided (PPR). In the following table the purchasing power in Germany is set to 100% of the exchange rate. All other purchasing powers were related to the German DM and then converted to ECU.

	Private Users - Small		Private Users - Large		Industry	
	Consumption 1700kWh/a PPR	BER	Consumption 7500kWh/a PPR	BER	Consumpt. 10MW;7000h/a PPR	BER
Austria	0.15	0.15	0.13	0.13	0.07	0.06
Belgium	0.23	0.20	0.16	0.14	0.06	0.05
Denmark	0.15	0.17	0.13	0.14	0.06	0.04
Germany	0.20	0.20	0.15	0.15	0.07	0.07
Finland	0.09	0.09	0.07	0.07	0.04	0.03
France	0.17	0.15	0.14	0.13	0.06	0.05
Greece	0.14	0.08	0.13	0.07	0.07	0.04
Great Britain	0.19	0.14	0.13	0.10	0.09	0.06
Ireland	0.16	0.12	0.11	0.08	0.07	0.05
Italy	0.11	0.07	0.27	0.19	0.08	0.05
Luxembourg	0.18	0.16	0.13	0.11	0.06	0.05
Netherlands	0.13	0.12	0.11	0.09	0.06	0.05
Portugal	0.25	0.14	0.22	0.12	0.11	0.06
Sweden	0.10	0.10	0.08	0.08	0.03	0.03
Spain	0.22	0.15	0.18	0.12	0.10	0.06

Prices for Electricity in Europe

Based on Bank Exchange rates



energy prices in europe

This section will provide data on companies, institutions and individuals summarising activities, expertise and significant projects within the biomass pyrolysis community.

CONTRIBUTIONS If you wish to submit a profile of your organisation for publication, please contact Philippe Girard (address at end of newsletter) who is the co-ordinator of this task.



CIRAD-Forêt

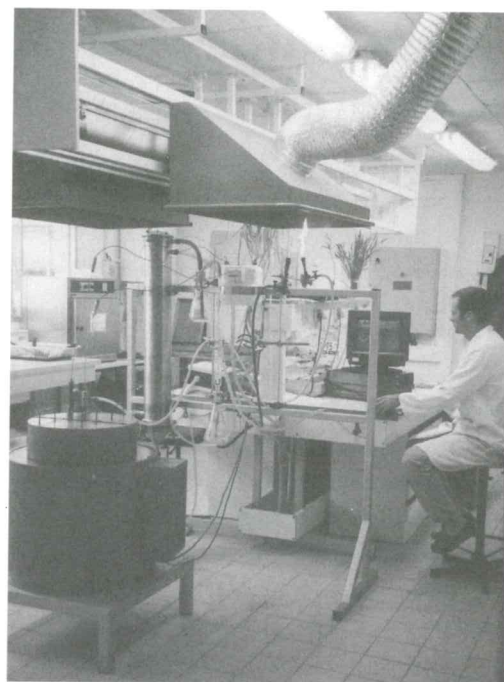
The mandate of CIRAD is to contribute to economic and social development in tropical countries through: research, experiments, training, scientific and technical information. Created in 1984 by merging of research institutes specialised in agriculture, veterinary medicine, forestry & food technology, its budget is approximately 1.3 billion FF for 1800 staff. The Wood Processing and Uses Research Unit (known as UR-TVVB) is one of the research unit of the Forestry Department of CIRAD (CIRAD-Forêt). One of UR-TVVB's research activities is the improvement of the quality of products produced through thermochemical treatment and energy generation from wood & biomass.

- 1 *Carbonisation for charcoal production and its environmental impact have been studied for several years. UR TVB's laboratory are equipped with:*
 - *Facilities for gas, liquid and solid feed stock and products analysis, as well as activated carbon properties measurements.*
 - *Slow pyrolysis reactors, one of each design to work under pressure of up to 10 bars.*
 - *Industrial scale charcoal working kilns.*
- 2 *Gasification for power and/or heat generation has been studied for more than ten years. Wood as well as charcoal gasification implementations have been tested on several industrial plants.*
- 3 *Torrefaction (partial carbonisation) of wood has been studied as firewood conversation process. Nowadays it is also studied to give natural durability to timber wood.*
- 4 *Combustion for industrial heat and/or power generation as well as domestic uses (firewood, charcoal) has been widely studied, including environmental aspects.*

Through its knowledge of the reaction processes the laboratory has conducted activity on the improvement of conventional equipment as well as the development of new technology in order to reduce pollutants emissions and to improve efficiency via strict regulation and control of the processes.

It has also developed technical and economic feasibility analysis of many projects in the field of transfer of technology to developing countries.

The CIRAD-Forêt operates in three fields: research, development and training in partnership with various national and international research centres as well as industries.



▲ Monitoring the carbonisation process



Dr. P. Girard ▶

Regions of operation and fields of application

Carbonisation, pyrolysis and torrefaction - Europe, Togo, Ivory Coast, Congo, Brazil, India

Gasification - Ivory Coast, France

Heat and power generation (steam process) - ASEAN (Malaysia, Indonesia, Brunei, Philippines, Singapore, Thailand), France, Brazil

References and publications

Shah N, Girard P, Capart R, 1989 : Carbonisation of wood : Production analysis and energy assessment. *Applied Energy* 34, pp 223-241.

Girard P, Vergnet L, 1994 : Biomass and residues from agro-industries and wood industries. A huge deposit in tropical countries for private power generation - 8th European conference on Biomass for energy, Environment, Agriculture and Industry - Vienna.

Girard P, Pinta F, Vergnet L F, 1994 : Profession charbonnier : beintot un metier propre. *le Bois National* 19/03/94, p. 23-29.

Shah N, Girard P, Mezerette C, Vergnet A M, 1992 : Wood-to-charcoal conversion in a partial-combustion kiln : an experimental study to understand and upgrade the process. *Fuel* vol. 71, p 955-962.

Girard P, 1993 : Analytical performance tests for charcoal-making techniques and equipment. *Holz als roh Und Werkstoff* 50, p. 479-484.

Mezerette C, Girard P, Vergnet A M, 1992 : Aspects environnementaux lies a la pyrolyse de la biomasse. *Bois et Forets des Tropiques*, n(232, p.67-80.

Vergnet L, 1994 : Guide Biomasse-Energie. Collection Etudes et filieres. Edition ACADEMIA.

Joanneum Research

With approximately 300 employees and 19 research units, Joanneum Research focuses on applied research and development in the key technologies of the 90s. Joanneum Research undertakes contractual research for business enterprises and political decision makers in the following areas: Geo-sciences and the Environment, Biotechnology and Technology.

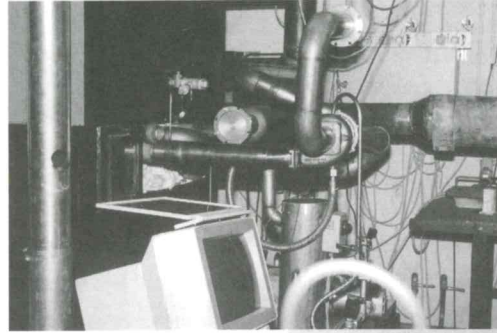
One research unit, the Institute for Energy Research, orients its research and development activities along an environmentally balanced long-term energy economy. From this emerges a field of activity which includes the use of renewable energy sources, the reduction of energy demand by saving and by a more efficient energy conversion, as well as the assurance of environmental standards in the utilisation of energy. With its approximate, 15 members of staff, the institute conducts research for public clients, for companies in the area of energy technology, for public utilities as well as for energy consumers in trade and industry.

Test facilities for the development of furnaces and emission measurement devices are available. In the area of Bioenergy and the Environment a number of international co-operative projects are carried out within the EU Research program and the Bioenergy Agreement of the International Energy Agency.

The following project examples show the range of activities.

Renewable Energy Sources:

- Development activities concerning biomass combustion and control systems for furnaces;
- Development of combined heat and power generation plants using biomass;
- Implementation strategies for renewable energy;



▲ Test facilities for small scale biomass CHP systems at Joanneum Research: Two cylinder Sterling engine and hot air turbine both driven by a standard wood chip furnace. ▼



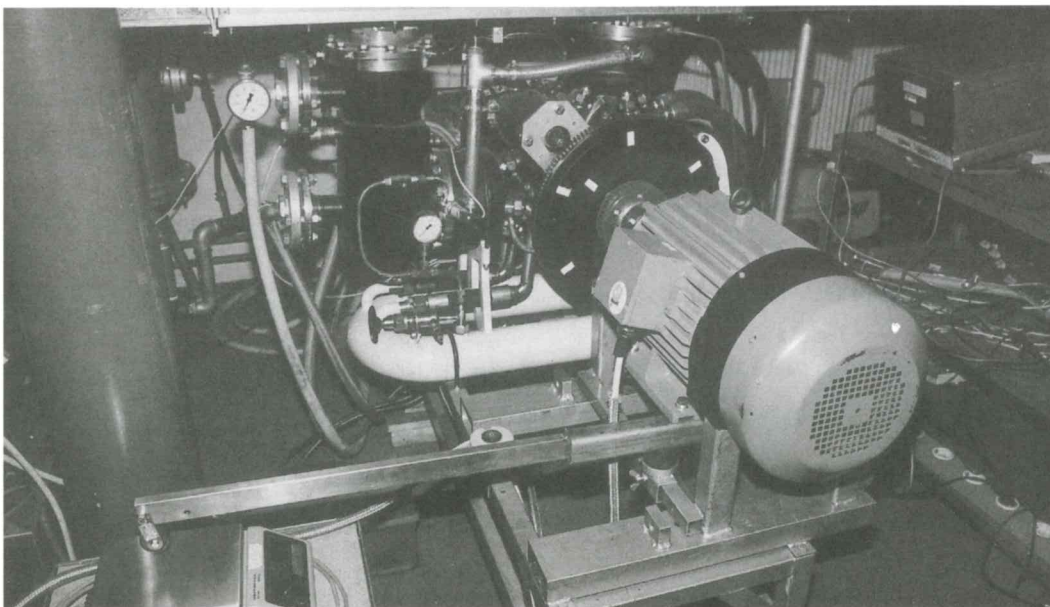
Dr. J. Spitzer ►

Energy Planning and Energy Economics:

- Regional, municipal and industrial energy concepts, concepts for district heating;
- Energy and emission balances;
- Consultancy for public administration and companies;
- Methods for energy consultancy in residential buildings;
- Projects for restructuring the energy systems in the neighbouring countries to the east;

Environmental Effects of Energy Conversion Plants:

- Emission measurements on furnaces with stationary and mobile testing equipment;
- Standardisation tests for furnaces using different types of fuel;
- Development of flue gas cleaning equipment;
- Humidity measurement and process control during drying processes;
- Greenhouse gas balances of bioenergy;





Federal Research Centre for Forestry and Forest Products (BFH)

Institute for Wood Chemistry and Chemical Technology of Wood (IWC) Leuschnerstr. 91, D-21031 Hamburg, Germany

The Federal Research Centre for Forestry and Forest Products (BFH) is a scientifically independent institution in the portfolio of the Federal Ministry of Food, Agriculture and Forestry. BFH is comprised of eight institutes:

- *Institute for Wood Forestry*
- *Institute for Forest Genetics*
- *Institute for Economics*
- *Institute for Wood Biology and Wood Protection*
- *Institute for Wood Chemistry and Chemical Technology of Wood*
- *Institute for Wood Physics and Mechanical Wood Technology*
- *Institute for Forest Ecology and Forest Inventory*
- *Institute for Forest Tree Breeding*

On the basis of an official agreement between BFH and Freie und Hansestadt Hamburg, BFH has extensive educational teaching responsibilities. In close personal union with the University of Hamburg (Chairs of World Forestry, Wood Biology, and Wood Technology), lectures are offered in the frame of the study of wood science and technology and wood economy. The staff of BFH (September 1994), 88 scientists, technicians and administration 217.

Institute for Wood Chemistry and Chemical Technology of Wood (IWC)

Research activities of the institute focus on the improvement of conventional as well as the development of new technologies in order to reduce the formation of pollutants and waste materials in the course of chemical processing of wood and to increase the efficiency of wood as a source of energy and chemical feedstocks. For process optimisation the raw materials and products are analysed by chemical and biochemical methods.

Department for Lignin Utilisation and Thermal Conversion

This department is responsible for the current pyrolysis activities. Expertise and facilities with respect to pyrolysis are:

- *Feedstock analysis,*
- *elemental analysis (C,H,O,S);*
- *calorific value;*
- *carbohydrate composition (ion exchange chromatography);*

- *lignin content and characterisation (wet chemical methods,*
- *FTIR,*
- *analytical pyrolysis - GC-FID/MS;*
- *molecular weight determination (HPGPC);*
- *characterisation of extractives.*

Thermal conversion technologies

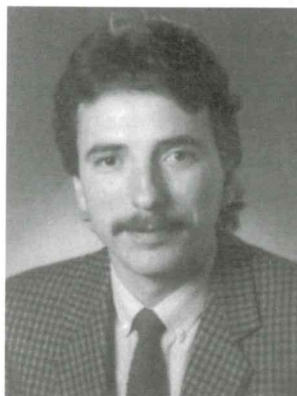
Batch flash pyrolysis in analytical scale for screening experiments; bench scale continuous flash pyrolysis unit (WFPP), capacity 100 g/h with pneumatic feeder, fluidized bed reactor, cooling and electrostatic precipitator; continuous pilot plant for flash pyrolysis with a fluidized bed reactor with overflow; scale 1-3 kg/h; screw feeder and pneumatic feeding system; closed gas circulation with a compressor; electrostatic precipitator for aerosols.

Product analysis

For liquids: (GC/FID, GCMS, HPLC, HPGPC, FTIR, 1H-NMR (80 Mhz); fractionation; distillation; extraction; water determination with Karl Fischer titration; for gases: complete determination of C1-C6 hydrocarbons, carbon monoxide, carbon dioxide, water, hydrogen with a bench top GC/TCD; on-line monitoring of product gases (CH₄, CO, CO₂, H₂, HO₂, C₂H₄, C₂H₆; for char: elemental analysis).

Upgrading facilities for pyrolysis liquids

250 ml semi-continuous autoclave system (Autoclave Engineers), 1 l Harshaw-autoclave (Autoclave Engineers) with stationary catalyst basket and falling basket to measure start times of catalyst reactions, bench top falling basket to measure start times of catalytic reactions, bench top reactor system (Autoclave Engineers) for testing catalysts. Its a continuous flow reactor with 5 ml bed volume and suited for screening of catalysts.



◀ Dr. D. Meier

Danish Technological Institute, Denmark

The history of the Danish Technological Institute (DTI) dates back to 1906. Today - with a staff of more than 1,200 - it is among the five largest companies of its kind in Europe.

The mission of the Institute is to enhance the competitiveness of the industry and the progress of society through technological development and technology transfer.

Danish Technological Institute is a self-governing, non-profit, private organisation in the legal form of a foundation. It means that the institute has no external owners. The Institute is authorised by the Danish Ministry of Industry as a technological service institute, and this status is a guarantee for our clients of our business ethics as neutral and independent.

DTI is a poly-technological institute with 22 departments (8 divisions) within a broad range of technological and managerial fields. The institute offers services in the form of contract research, consultancy, testing and certification, continuing education, information and documentation.

The major technological areas are:

- Energy technology
- Environmental technology
- Materials technology
- Biotechnology and chemistry
- Industrial development
- Metallurgy and tribology
- Production and distribution technologies
- Information technology
- Building and construction technology
- Management
- Human resource development

The annual turnover is approximately ECU 85 million, out of which two thirds are clients fees and one third is programme and project support from various public funds including a substantial amount from EU's R&D programmes (the institute undertakes at present more than 40 different contracts with the EU).

Biomass and pyrolysis activities

Research and Development

R&D-activities take place through consultation with producers of boilers, furnaces, combustion plants and gasifiers as well as consumers, suppliers and public authorities. The working area is normally trouble shooting, product development or process development. Technological consultancy, assistance and dissemination of scientific results are important objectives. The activities are:

- Fuel characterisation and selection

- Fuel supply and basis for agreement
- Combustion and gasification techniques
- Catalytic conversion of product gas
- Engine tests
- Environment pollution control
- Shraw and wood chip technique
- System evaluations
- Export conditions
- Heat and power distribution

There are extensive laboratory facilities including:

- bench scale and pilot combustion and gasification units
- downstream fixed bed catalytic and absorption test units and facilities
- chemical analysis of solid, liquid and gaseous product

Measurement and testing

Measuring and testing is carried out according to several standards including:-

Danak accreditation:

- DS 887** (biofuel burning stoves)
- SP 1071** (biofuel burning stoves)
- RTE** (biofuel burning boilers)

DAP accreditation:

- DIN 4702** (biofuel burning boilers)
- DIN 18891** (biofuel burning stoves)

DTI has been selected by the Danish Energy Agency to be the national Testing Centre of biofuel boilers. The main objective of the Centre is to improve performance, reliability and efficiency of boilers through testing activities.

Standardisation work

The department participates in the below mentioned standardisation committees:

- CEN TC 285:** Residential Solid Fuel burning Appliances
- CEN TC 57:** Heating boilers for Solid Fuel
- CEN TC 295** Residential solid fuel burning appliances
- WG5** Standardisation of 'Test Methods' within the EU Countries.



◀ Mr. K. Pedersen





EC Gasification Network

Analysis and Co-ordination of the Activities Concerning a Gasification of Biomass (AIR-CT94-2284)

Objective

In the context of the latest discussion concerning climate change and other increasingly visible consequences from the high consumption of fossil fuels, the usage of biomass for energetic purposes becomes more and more important. In addition, the future ban on land filling of non-inert waste material as well as the need for new sources of income in rural areas are expected to lead to an increased usage of biomass within the European Union (EU). In particular, gasification of biomass is expected to offer considerable potential as a promising option to process organic waste and offering a favourable option for the generation of electricity.

In this context, the objective of the Network is to evaluate the present and future state of gasification technology, present and future markets, and technical prospects. This will include assessment of technical and economic opportunities, national policies, potential markets and development of an integrated R,D&D strategy as well as a strategy for a better flow of information among the active groups. State-of-the-art report and position papers will be produced for submission to the European Commission to support future decisions concerning energy policy, funding of projects, and R, D&D strategies.

Time Schedule, Participants

The Concerted Action started on the 1st December 1994. The total duration will be 30 months. The following institutions are participating:

IER, Germany (co-ordinator)	<i>ENEL, Italy</i>
TPS, Sweden	<i>Utrecht University, The Netherlands</i>
ADEME, France	<i>University of Groningen, The Netherlands</i>
IVD, Germany	<i>Joanneum Research, Austria</i>
CIEMAT, Spain	<i>ETSU, United Kingdom</i>
VTT, Finland	<i>Riso National Laboratory, Denmark</i>

- *general information on the energy system and the national energy policy,*
- *a market analysis,*
- *an evaluation of prospects for biomass gasification,*
- *R, D&D needs from a national point of view.*

Workshops.

The results of the collection of data in each area of responsibility have to be discussed among the participants and with researchers, manufacturers, and other relevant experts, in order to gather further information and experiences. Therefore, the Network includes two Workshops in addition to the Initial Meeting and the Final Open Seminar. The First Workshop has already taken place at CIEMAT, Madrid, on October 5-6, 1995. The Second Workshop will take place in Finland at VTT, Espoo, on September 26-27, 1996. In Spring 1997, an Open Seminar will take place in Germany which will probably be held as a

joint meeting with the Pyrolysis Network. The results of the Networks will be presented and discussed among researchers, manufacturers, and other invited experts.

Links of Corresponding Working Groups.

With one of the objectives of this Concerted Action being an improvement of the flow of information among those groups that are active in the field of biomass gasification, links to corresponding working groups are considered essential. Links have been created with the Pyrolysis Network, PyNE, as well as to the IEA Bioenergy Agreement working group on biomass gasification.

Documentation, Publication. The results of the Concerted Action will be published as a state-of-the-art report, as position papers to the European Commission, and in articles and papers at conferences.

Intermediate Results

The draft country reports show that activities on biomass gasification have been identified in nearly every country within the European Union. The contribution of biomass to the total primary energy consumption is between 1% (e.g. Germany, France) and 18% (Finland). In some countries (e.g., United Kingdom, The Netherlands, Belgium), many activities have started within the last three years. On the other hand, many gasifiers have been dismantled due to technical or economic problems. It is clear that the amount and quality of activities on biomass gasification strongly depend on public funding and on national and international energy policies. The technology used depends on local circumstances such as available biomass and required plant size. In order to be able to work out strategies for future R, D&D activities, these specific circumstances have to be analysed and evaluated in detail.

Further Information

Further information (e.g., a detailed description of the Concerted Action, the minutes of the Initial Meeting and the First Workshop, the Draft Country Reports) can be requested from:

Dr.-Ing Martin Kaltschmitt
Dipl.-Ing Ludger Dinkelbach
University of Stuttgart

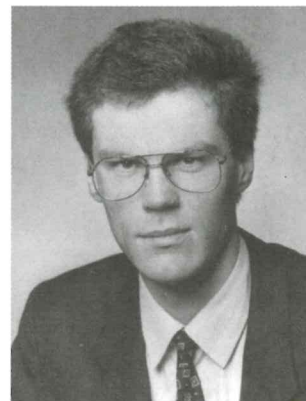
Institute for Energy Economics and the Rational Use of Energy (IER)

Hessbruehlstr 49a

D-70565 Stuttgart, Germany

Tel: +49 711 780 6116

Fax: +49 711 780 3953



Dr.-Ing Martin Kaltschmitt

BIOMASS FOR ENERGY ENVIRONMENT AGRICULTURE AND INDUSTRY

Edited by Ph. Chartier, A.A.C.M Beenackers, G. Grassi

Elsevier, 1995, 2426 pp. 3 Vols.

Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, UK.

The new EU agricultural policy is one of the strongest short-term drivers in the Union. Under the Common Agriculture Policy 15% of agricultural lands need to be removed from food production. If all this lands were utilised with reasonable biomass yields for energy production, over 4% of EU's electricity requirements could be met.

The work, published in three volumes, reports the proceedings of the 8th European Biomass Conference held in Vienna, 3-5 October 1994.

Arguments of particular importance are discussed mainly in the plenary session of the conference:

- the principal advantage of biomass product and conversion and the main barriers hindering their development,
- the policy regulatory, fiscal, pricing and other measures more suitable for the promotion of biomass and their entry in the market,
- the bioenergy R&D strategy.

Subsequent chapters are dedicated to the communications presented in the different sessions. Session A reports the tests of oral and poster presentations concerning experimental researches and results on productivity, physiology, cultivation & harvesting techniques of the different crops. Subsequent sessions are dedicated to the economic, political, technical problems met in the conversion of biomass in electricity and heat (session B), to the conversion of biomass in transportation fuels (session C), to the biotechnology, chemicals and products (session D1, D2), to economics, environmental aspects & development activities (session E).

In all, more than 80 oral presentations and plenary lectures, and 200 poster communications offer to the reader the latest overview on the state of the art in the field of the production and conversion of biomass and energy.

The work will be useful to researches and technicians of energetic and chemical sectors interested to acquire an exact updating on the utilisation of biomass.

BIOMASS, ENERGY AND ENVIRONMENT

A Developing Country Perspective from India

N H Ravindranath and D O Hall

New York 1995, 400 pp, 50 illus, Oxford University Press

Presently developing countries are searching for alternative energy solutions which promote sustainable development and equity. Modernised bioenergy is an option now being considered to meet this growing need. Using India as the example, the authors show how this energy source has the potential to meet the rural needs of a large populous country along with significant social, environmental, and economic benefits. From this case study, conclusion regarding the potential of using biomass energy in other developing countries can be drawn. Finally, issues concerning the global interest in bioenergy and green house gas emission reduction option are examined.

Contents:

1. Introduction
2. Energy and Biomass Consumption Patterns in India
3. Environmental Impacts of Biomass Energy
4. Assessment of Bioenergy Programs in India
5. Bioenergy projects
6. Bioenergy - A Modernised Fuel Option for India
7. Land and Biomass Availability for Sustainable Bioenergy
8. Environmental and Socio-Economic Benefits of Bioenergy
9. Economic Analysis of Bioenergy Options
10. Approaches to Implementing Bioenergy programs
11. Implications for Bioenergy in Developing Countries
12. Bioenergy: Barriers, Policy Options and Guidelines
13. Conclusions and Implications

ALTERNATIVE ENERGY HANDBOOK

Paul Rosemberg

ISBN 0881731404 1993, Fairmont Press, 700 Indian Trail,

Lilburn, Georgia, USA

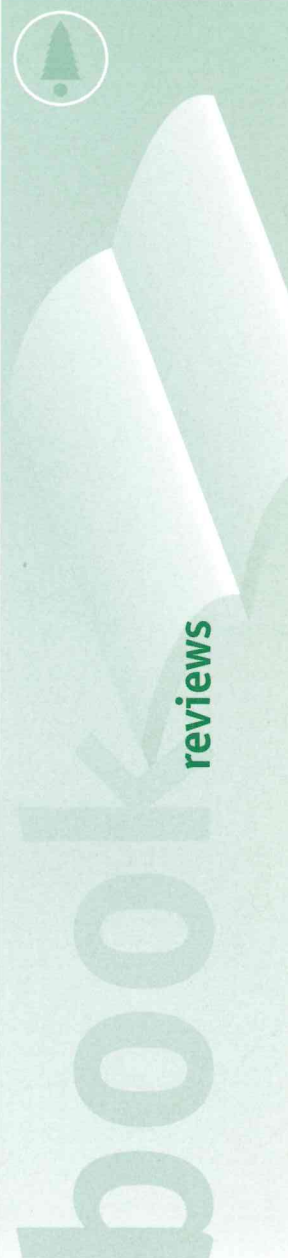
Fax: +1 404 381 9865

Technologies examined include innovative solar electric power systems, hydropower, wind power, co-generation, biomass and wood fuels. Independent electric power generators are also covered, together with an update on the latest development in storage batteries for electric vehicles.

The significant and expanding collaboration between the EU and Canada in thermal biomass conversion and particularly fast pyrolysis is being enhanced through the new IEA Bioenergy Agreement pyrolysis activity (PYRA) - see Meeting Report. The members are currently Canada, EC, Finland, UK, USA and there is interest from several other countries. In addition, there is a well established EC-Canada collaboration in thermal biomass conversion. These international activities provide access to almost all the relevant ongoing research, development, demonstration and commercial activities in North America.

The key contacts for further information are currently Tom Milne at the National Renewal Energy Laboratory in Golden, Colorado, USA; and Ed Hogan at Natural Resources Canada, Ottawa, Canada. Their contributions will be included in the relevant sections of this newsletter as well as special features on relevant activities in the USA and Canada.

CONTRIBUTIONS If you wish to submit a review of a book, please contact Professor L. Conti (address at end of newsletter) who is the co-ordinator of this task.



News from North America



DATABASE

A database of expertise & technology will be established to provide a unique record of all relevant activities in the areas of biomass pyrolysis and related processes. The assistance of readers in ensuring accuracy and completeness is essential if the database is to be useful.

The country representatives will be contacting all organisations over the next few months to solicit information.

Specialist Subject Groups in PyNE

Four specialist working groups have been convened to study selected topics in more detail, to provide an authoritative overview of the subject and identify opportunities or critical areas requiring further research, development & demonstration. The special topics are:

- 1 *Pyrolysis technology*
- 2 *Upgrading*
- 3 *Characterisation and Analysis*
- 4 *Applications*

Interim summary reports for two of these groups are provided below to show their scope and direction.

Upgrading

Rosanna Maggi: Group Convenor

Upgrading covers any method of improving the quality of the crude bio-oil produced from fast pyrolysis so that it may be more readily utilised in the application. Although physical processing to improve viscosity and other physical properties is a potentially low cost path to follow, catalytic processing offers more exciting long term prospects.

While the utilisation of catalysts in the petroleum refining as well as in coal liquefaction is widely known, only few groups in Europe, USA and Canada use catalysts in biomass thermochemical conversion and related technologies. Many problems must still be solved and this PyNE workshop acts as a regular forum of experts contributing with their experience in discussing and solving relevant and pertinent problems.

Highly hydrogenating catalysts such as those containing high levels of Ni or Ru or even those doped with other noble metals (Pt, Pd or Rh) can contribute to the avoidance of coke deposition problems. Nevertheless, these catalysts are highly sensitive to poisoning by sulphur and must be used in the sulphide form to avoid poisoning. Noble metal doped catalysts are currently being developed at UCL.

It is important to consider how much upgrading and what type is required for each application. It is essential to identify the possible customer and set a realistic price for the upgraded liquid. In all cases precise specifications such as water content, viscosity characteristics, acidity & solid content must be known.

It is necessary to look for new processes either singularly or in combination, for example the removal of acids which are responsible for catalyst poisoning by coke deposition before mild chemical upgrading. These chemicals could also be recovered. Separation methods such as fractionation are also interesting but vacuum distillation can be very expensive and only gives low yields. Steam distillation has met with some success.

Characterisation and Analysis

Dietrich Meier: Group Convenor

Feedstocks

Knowledge about the properties of the feedstock for pyrolysis is important as they have an impact on the performance of the process and the product quality. Properties which should be determined or known include:

- *source and species of feedstock*
- *chemical composition (lignin, cellulose, hemicellulose, and extractives). For this type of analysis standard methods exist published by TAPPI (Technical Association of the Pulp & Paper Industry)*
- *ash content and composition*
- *moisture content*
- *particle size*
- *elemental composition*

Pyrolysis products

There are three main product categories from the pyrolysis of woody biomass:

- *liquid (incl. water)*
- *char*
- *gas*

The interest of the group is basically focused on the characterisation and analysis of the liquid fraction which is the most important product from fast pyrolysis both in terms of yield and potential applications.

The terms "pyrolysis oil" or "oil" which are often used for the liquid fraction should be avoided as they suggest a petroleum-like liquid with similar characteristics. But this is absolutely not the case as they are, to a certain extent, miscible with water and not miscible with petroleum products.

Pyrolysis liquids from woody biomass contain all the condensable thermal degradation products from the three main wood constituents: cellulose, hemicelluloses and lignin. Additionally, minor amounts of liquid are derived from extractives such as polyphenols and resins. Because of the unspecific thermal degradation of the macromolecules, hundreds of low molecular weight compounds and molecular aggregates of higher molecular weights are formed which constitute the pyrolysis liquid.

The group identified several physical and chemical methods which are important for both the characterisation of the pyrolysis liquids and potential applications:

viscosity at different temperatures

water content by Karl Fischer titration, solvent methanol

pH at different temperatures, density, elemental composition, Stiazny no.

lower heating value, ash content, microcarbon content

surface tension, solubility in different solvents, ageing, pour point, flash point

The detailed conditions for each method are currently being developed and will be cross-checked by inter-laboratory round robin tests and exchange of information.

For chemical analysis of the whole oil, various chromatographic and spectroscopic methods can be specified:

1 capillary gas chromatography for the identification and quantification of low molecular weight compounds. To improve the comparability between different laboratories the following reference GC-conditions were proposed and should be applied to all GC analyses:

1.1 *DB-1701 column, 60 m x 0.25 mm, film thickness 0.25 (µm)*

1.2 *temperature conditions*

1.2.1 *oven: 45 °C isotherm. 4 min, 3 °C/min to 280 °C*

1.2.2 *injector: 250 °C*

1.2.3 *detector (FID): 280 °C*

1.3 *carrier gas helium, 200 kPa*

1.4 *split injection*

2 *¹³C-NMR spectroscopy*

3 *FTIR for functional groups analysis*

Methods similar to "PONA" (Polars, Olefins, Naphtha) which is used in petroleum oil characterisation also need to be identified or developed.

Chemical analysis may be more effective if the pyrolysis liquid is fractionated before. Therefore three methods are proposed which are currently being used and optimised:

flash chromatography with sequential elution by different solvents with increasing polarity; leads to fractions which contain components with similar chemical characteristics, good for isolation of levoglucosan

steam stripping; leads also to fractions with similar chemical characteristics, good for isolation of levoglucosan

phase separation by addition of water to obtain water soluble compounds and water insoluble compounds

The same chemical analysis methods as described above can be applied to the individual fractions. Additionally, HPLC with an ion-exchange column can be applied to separate water soluble products, and GPC can be applied for the determination of the average molecular weight of the high molecular weight compounds.

Sample information

The group emphasised the importance of a correct liquid sample information which should comprise the following:

feedstock

pyrolysis conditions (reactor type, vapour residence time, temperature)

production date, storage conditions, yields

Tasks

Several tasks were agreed and established:

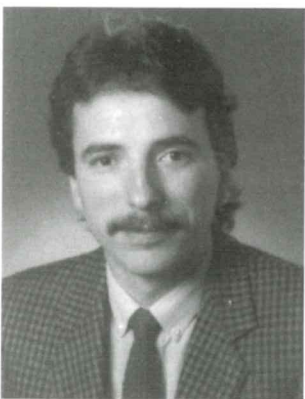
A resource package for analytical methods available at various laboratories in Europe, Harmonisation of methods,

Materials and safety data sheets,

A round robin will be performed in collaboration with the IEA pyrolysis group.



▲ Rosanna Maggi: Group Convenor



▲ Dietrich Meier: Group Convenor

CALLS FOR PROPOSALS

Information will be provided on new calls for proposals from national and international organisations. Information for inclusion should be sent to Rosanna Maggi (address at end of newsletter).

Call for "Experts" (DG XII)

Closing date: Open continuously
 Topics: Any aspect of renewable technologies
 Contact: Dr E Andretta or Mrs S Gruener
 Tel: +32 2 296 0687
 Fax: +32 2 296 6882

JOULE

Closing date: 14 May 1996
 Topics: Biomass gasification and other renewable energy topics
 Contact: Mr J Sachau
 Tel: +32 2 299 4706
 Fax: +32 2 296 0621

FAIR

Closing date: 15 March 1996
 Topics: 1 Integrated production and processing chains in particular the biomass and bioenergy chain in Area 1
 2 Concentration activities in any relevant area.
 Contact: Mr Daskaleros
 Tel: +32 2 295 3196 · Fax: +32 2 296 4322

Closing date: September 1996
 Topics: 1 Scaling and processing methodologies in areas 2.1, 2.2, 2.3.
 2 Demonstration of integrated production and processing chains in areas 1, 2, 3.
 Contact: Mr Daskaleros
 Tel: +32 2 295 3196 · Fax: +32 2 296 4322



PyNE Membership

Most EU countries have at least one representative who provides a centralised facility for collation and dissemination of information. Enquiries for further information or interest in participation should be directed to the national representative to ensure that this interest is properly co-ordinated. In case of difficulty please contact the Co-ordinator directly.

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Editorial

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