PyNe
May 2002 ISSUE 13

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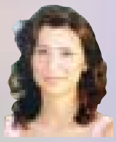

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Expert meeting on Pyrolysis and Gasification of Biomass and Waste

The future for biomass and waste pyrolysis and gasification: status, opportunities and policies for Europe.

Holiday Inn, Place de Bordeaux, Strasbourg, France.

30th September – 1st October 2002.

Scope and programme

The Expert Meeting has been organised to assist the European Commission to develop policies in the area of renewable energy sources. The meeting will review the achievements to date in the fields of biomass and waste pyrolysis and gasification and explore the ways in which the European Commission can encourage the implementation and penetration of these technologies.

Draft Programme

The meeting will include formal presentations by invited speakers as well as experts in the field, workshops and discussions. Workshops will be arranged to address topical problems under the chairmanship of an expert in that area, with a particular focus on definition of policies for encouragement, implementation and penetration of these important technologies.

Presentations

Presentations will be made by leading experts in the field.

Posters

Posters will be available for viewing and discussion throughout the meeting.

Workshops

A series of workshops will be held to discuss how to improve both the rate and extent of implementation of the technologies.

Proceedings

Contributions must be delivered to the organisers at the conference: late submissions cannot be accepted. The proceedings including recommendations for policies will be published as a book. Each delegate will receive a copy of the proceedings and the book will be available for purchase to disseminate information and results as widely as possible.

Who should attend

All those active in implementation and exploitation of biomass and waste pyrolysis and gasification as well as RD&D, will be encouraged to participate in order to contribute to the evolution and definition of recommended policies for the European Commission.

Organised by:

ThermoNet

PyNe GasNet

Sponsored by

Altener

CIRAD

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Joseph Spitzer, Past chairman of IEA Bioenergy Executive Committee, Dr Roslyn Prinsley, Chairperson, Bioenergy Australia, and Stephen Schuck, Bioenergy Australia Manager.

Bioenergy Australia 2001 – Realising the potential of bioenergy

This annual conference was held on 3rd to 5th December 2001 in Broadbeach, Queensland, Australia and attended by over 140 delegates. 33 papers were presented on all facets of the production and conversion of biomass driven by the recent Renewable Energy (Electricity) Act that requires the purchase of an additional 9,500 GWh/a of renewable electricity by liable parties by 2010. This mandatory target operates via trading of Renewable Energy Certificates. This legislation is intended to help Australia meet its commitments to mitigating greenhouse effects.

The vast majority of delegates and presentations were from industry – both from companies that are seeking to produce Renewable Energy Certificates for utilisation themselves or for trading, as well as those involved in the production of biomass.
In order to address concerns over use of native forest residues, most of the industrial attention is being paid to process and commercial wastes such as sugar cane bagasse. Some major power generation systems based on combustion and steam turbines are being installed up to 60 MWe.

In the medium term the focus seems likely to move to forestry wastes and plantations, particularly in areas of high salinity where replacement of forest areas is seen as a potential major contributor to resolving the rapid depletion of agricultural land.
(This problem will be described in an article in the next issue of PyNe News)

There is some interest in gasification, slow pyrolysis for charcoal, ethanol and biodiesel, but the research and development base is limited.

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Progress on PyNe Topic: Slow Pyrolysis for Charcoal

By Yves Schenkel, CRA, Belgium, and Morten Grønli, SINTEF Energy Research, Norway

The first workshop of the PyNe Topic on "Slow Pyrolysis for Charcoal" was included in the second ThermoNet meeting in Graz, Austria, in January 2002. The objective of the workshop was to present an overview of charcoal production and to agree on the activities that will be conducted in the framework of this Topic (see PyNe Newsletter issue 12).

Morten Grønli presented a survey of industrial carbonisation technologies, including a special focus on charcoal production for the ferrosilicon industry. Philippe Girard, of CIRAD-Forêt, France, reviewed the carbonisation techniques in developing countries and the needs for further development. André Fontana, of ULB, Belgium, introduced the pyrolysis treatment of waste wood and analysed the related various techniques. Finally, Michael J. Antal, Jr. of Hawaii Natural Energy Institute, USA, presented his recent developments on flash carbonisation.

The discussion, which followed the oral presentations, considered several subjects and drew a number of conclusions:

- It is necessary to break with the general opinion that charcoal production is equal to slow pyrolysis. It is necessary to first look to the product we are looking for (char, oil, gas), and then identify the technology that fits the best the constraints of the project: feedstock, socio-economics, environment, finance.

- Just as there are major efforts to show how an energy economy based on hydrogen is interesting for industrialised countries, PyNe should show that a biocarbon-based economy has at least as much potential as a hydrogen-based economy.

- Concerning waste wood, the question is how to transform char into a valuable product rather than a by-product or a waste. What are the processes to upgrade char and what are the markets for the upgraded char? However, the problem is very large due to the high number of contaminants that have to be considered. A workshop should be dedicated to the subject of waste wood thermal treatment.

- An important use for charcoal is low-grade activated carbon for filtration (gas or water cleaning) or other applications. A market survey should be conducted on this subject including consideration of commercial interest for lower specific surface charcoal, standards, analytical methods and applications.

- Co-firing charcoal in coal-fired power stations is another interesting application. What has been done and what could be done?

- The impact of feedstock on the process and product quality and new applications should be considered.

- The environmental impact of charcoal producing technologies is an important topic for further study and development.

The work programme agreed in 2001 (PyNe Newsletter issue 12, October 2001) includes the following subjects on which dedicated workshops will be held and proceedings published:

- country reports on slow pyrolysis.
- fundamentals of slow pyrolysis for charcoal.
- a review of industrial production of charcoal.
- a review of products from carbonisation.
- a review of charcoal applications.
- a review of thermal treatment of waste wood.
- state-of-the-art reviews including emerging technologies for production and utilisation of charcoal.

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Entrained Flow Gasification of Bio-oil

By Robbie H Venderbosch, Bert van de Beld and Wolter Prins, BTG biomass technology group b.v., The Netherlands.

Syngas from biomass
To produce synthesis gas from biomass, several options are possible, such as direct oxygen-blown pressurised biomass gasification. Entrained flow gasification of bio-oil may be an interesting option, because bio-oil offers the advantages that:

- it is a uniform clean liquid and easy to handle, especially pumping, atomisation and pressurisation.
- bio-oil production can be adapted to local conditions of biomass price and availability. Its utilization for large scale gasification can be centralized at an appropriate location, and
- it reduces transportation costs and
- most existing entrained flow gasifiers can probably be used.

Some of these advantages are summarised in Table 1. Research on both routes including the bio-oil gasification is justified which is why BTG is gasifying bio-oil.

Bio-oil gasification
The BTG entrained-flow gasifier used is shown in Figure 1. It consists of a feeding section for liquids and air, a gasifier, and a cooling section. Air, and mixtures of oxygen and air, are introduced through a dedicated inlet. The bio-oil flow rate can be varied from 0.1 to 2 kg/hr. The gases produced are cooled, and condensed water is weighed. Gas samples are analysed by GC.

Results of analysis of the 'tar' (by SPA) will be published in a separate paper, together with results derived for enriched air (50% oxygen) and pure oxygen. Only the air gasification results are discussed here. Figure 2 shows results for two temperatures, 1000°C (filled symbols) and 1100°C (open symbols) as a function of the Equivalence Ratio (ER). The solid lines represent the equilibrium composition of H_2, CO, CH_4, and CO_2.

Both CO and H_2 concentrations are significantly lower than the equilibrium values. However, H_2: CO ratios of 0.8 to 0.9 are obtained (Figure 3), and these are very close to the theoretical values. CH_4 concentrations decrease from 10 vol.% down to zero, while CO_2 concentrations increase from zero to 5 vol.%. A relatively high CH_4 concentration in the product gas is beneficial in energy production, but is not desired in syngas. Literature data suggests that thermal decomposition of CH_4 occurs at temperatures only above 1250°C: higher gasification temperatures are required to eliminate the CH_4.

Advantages of direct biomass gasification	Advantages of bio-oil gasification
• Cheap feedstocks are sometimes available • Biomass is a known feedstock • Energy efficiency of syngas production up to 80% • Close coupling of biomass conversion and green fuel synthesis allows intensive system integration • Gasification has been 'demonstrated' up to a scale of 30 MWth (Värnamo, Battelle)	• Bio-oil production is a cheap pre-treatment step • Liquid products are easy to handle • Energy efficiency of bio-oil gasification is over 85 % • De-coupling biomass conversion from bio-oil processing offers cost reduction opportunities • Oil gasification with pure oxygen is proven technology • Bio-oil contains no ash • Pressurisation of bio-oil is easy • Bio-oil syngas cleaning is cheap (less tar and methane) • Problems related to feedstock variations are avoided

Table 1. Comparison of biomass and bio-oil gasification for FT synthesis.

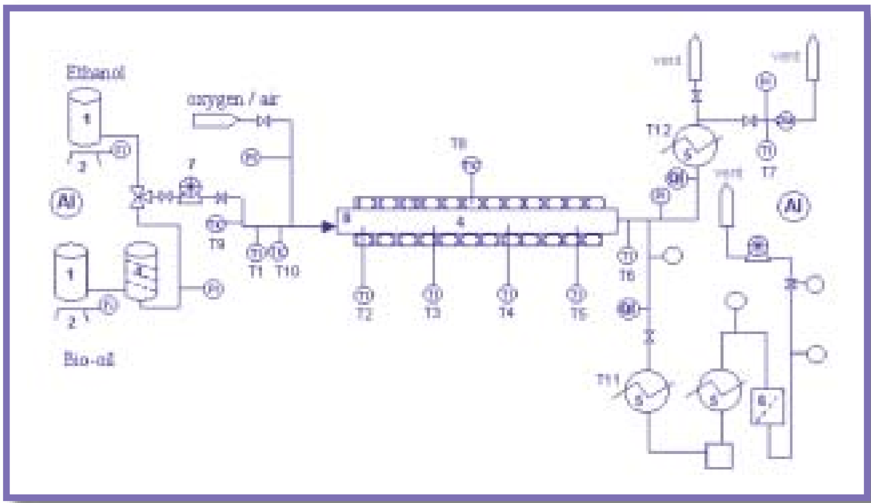

Figure 1: Entrained flow gasifier set-up.

Depending on the ER, the LHV of the gas varies from 8 MJ/kg at ER = 0.1 down to 4 MJ/kg at ER = 0.45 (Figure 4). The predictions, shown by the solid line, are in good agreement with theory.

Trends derived for enriched air and for pure O_2 are similar to the results reported for air gasification, but apparently yielding higher H_2 and CO concentrations. Work is continuing at BTG.

Acknowledgement
Some data were derived in a European programme (ENK5-CT2000-00111). The financial support of the European Commission is gratefully acknowledged. We are grateful to D. Assink (BTG), T. Minowa (NIRE, Japan), S. Mariappan (Tamil Nadu Agricultural. University, India), A. Akkerman and B. Al Faghri for their assistance.

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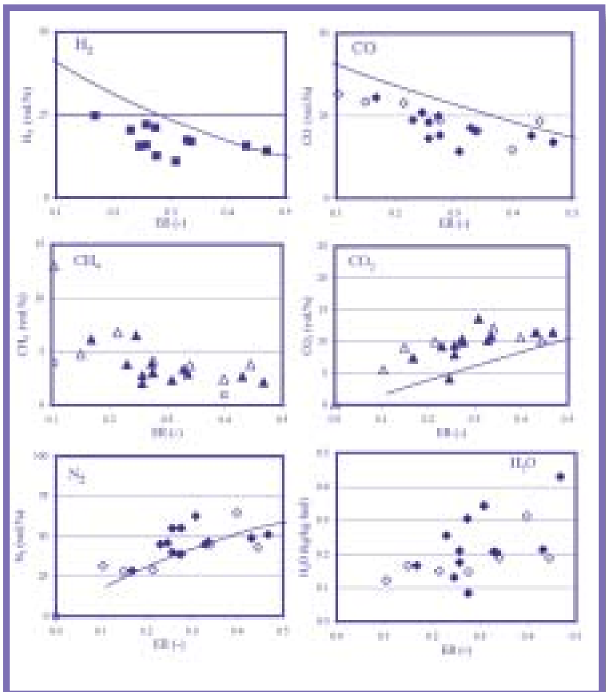

Figure 2: Dry gas composition upon bio-oil gasification using air at 1000°C (filled symbols) and 1100°C (open symbols). The solid lines represent theoretical values.

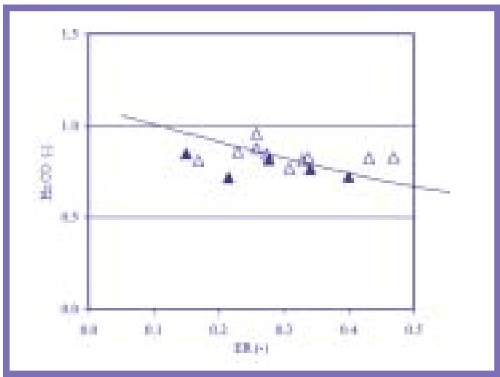

Figure 3: The H_2 : CO ratio versus the Equivalence Ratio (ER) for air gasification of bio-oil. The line represents the theoretical values at 1000°C, the symbols are the experimental results.

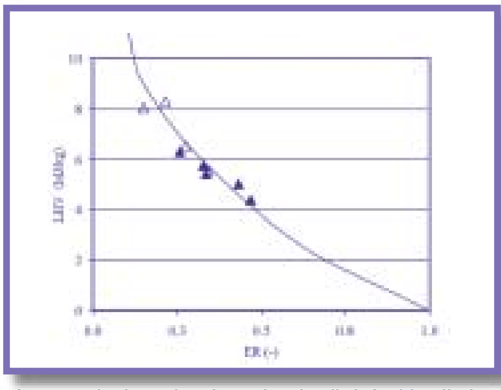

Figure 4: The lower heating value (MJ/kg) for bio-oil air gasification at 1000°C (filled symbols) and 1100°C (open symbols). The line represents the theoretical values.

The use of Charcoal in Norwegian Ferrosilicon Production

By Morten Grønli, SINTEF Energy Research, Bodil Monsen, SINTEF Materials Technology and Inger Johanne Eikeland, Elkem ASA.

Background

Based on the relatively cheap hydroelectric power, Norway has become the largest producer of silicon and ferrosilicon in Europe. Silicon is produced industrially by reduction of silicon dioxide by carbon in arc furnaces (see Figure 1) according to the idealised reaction:

SiO_2 (s) + 2C (s) → Si (s) + 2CO (g).

By adding iron oxide (Fe_2O_3) or iron scrap to the smelting process, ferrosilicon is produced. Very high purity silicon is used to manufacture semiconductors and photovoltaic cells. Ferrosilicon is also used as an alloy in the production of steel, cast iron, aluminium, and other metals. The major reductants currently being used, fixed carbon, are mineral coal and coke, while approximately 10% of the fixed carbon comes from bio-based reduction materials, such as charcoal and wood chips (see Table 1).

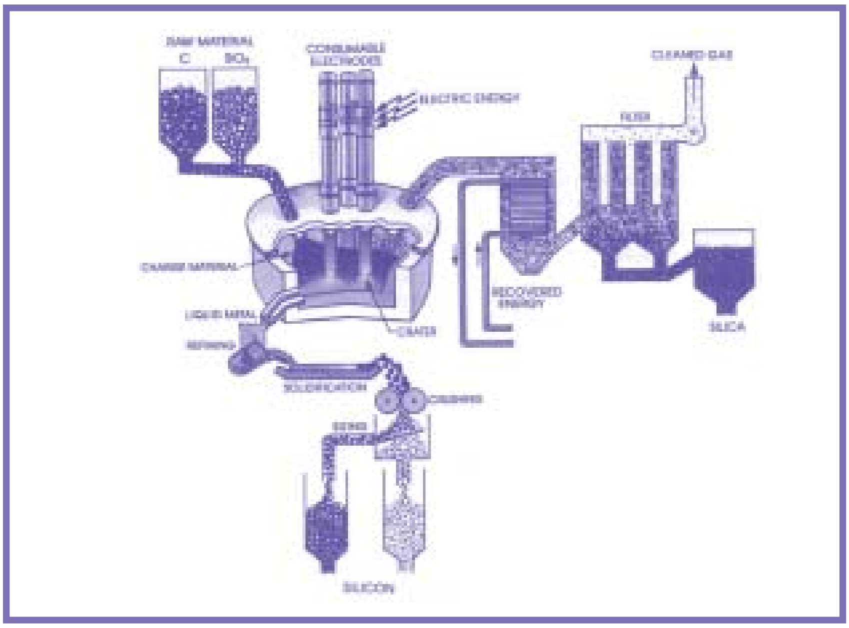

Figure 1. A typical plant for the production of silicon metal [1].

	Electricity	Reduction materials				Emissions	
		Coal	Coke	Charcoal	Woodchips	CO_2	SO_2
	kWh/ton	kg/ton	kg/ton	kg/ton	kg/ton	ton/ton	kg/ton
FeSi75%	8.200	800	375	-	-	3.9	15
Silicon	11.600	1.250	-	100	400	4.2	13

Table 1. Consumption of electricity and reduction materials in the production of ferrosilicon (FeSi75%) and silicon, and typical emissions of CO_2 and SO_2 related to the production (per ton alloy produced).

Encouraged by the Kyoto agreement, the Norwegian Ferroalloy Producers Association in 1997 initiated a five-year research project aimed at clarifying the consequences (financial and environmental) of increased use of charcoal, and the possibility that the Norwegian ferroalloy industry will have to reduce their part (~3 million tons or 7%) of the Norwegian fossil CO_2 emissions. Most of the charcoal used today (around 60,000 tons/year) is imported from Asia and South America. The crude, traditional methods of charcoal making, which are still widely used in these countries, are inefficient and heavily pollute the environment. As part of this project, we wanted to study the feasibility of charcoal production in Norway by modern carbonisation techniques from our own forest resources.

Feasibility study

The feasibility study that was carried out in 2001 included collection (logging), chopping and transportation of 80,000 tons of wood on a dry basis to a carbonisation plant with an annual production capacity of 25,000 tons of charcoal (=20,000 tons fixed carbon). Two different carbonisation processes, the VMR and Lambiotte (see Figures 2 and 3) were compared. We also assumed that 25% of the surplus energy from the carbonisation could be recovered in a boiler and sold at a net profit of 0.011 USD/kWh [2].

Figure 2. VMR-oven.

Figure 4 shows the cost breakdown of charcoal produced in Norway by these two processes, with and without energy recovery. The main cost is the feedstock, which accounts for 70-85% of the total cost. Labour and maintenance is the second largest expense, with the Lambiotte process being the cheaper because it requires less labour and less maintenance. Capital costs have been calculated using a 15-year repayment period and 7% interest. These costs are of the same order of magnitude as the income from energy sales.

As can be seen from Figure 5, charcoal produced in Norway is far from being competitive to imported coke and coal, and only charcoal produced in a Lambiotte kiln with energy recovery is competitive with imported charcoal from Indonesia. Hence, charcoal production based on virgin wood is not viable in Norway. However, charcoal produced from cheaper feedstocks, e.g. waste wood, forest or agro residues, or by more efficient carbonisation processes could be a viable product.

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References:
[1] Schei, A., J.K. Tuset and H Tveit, "Production of High Silicon Alloys", Tapir, Trondheim, Norway, 1998.
[2] Eikeland, I. J., B. E. Monsen and I. S. Modahl, "Reducing CO2 emissions in Norwegian ferroalloy production". COM 2001 (Greenhouse gases in the metallurgical industries: policies, abatement and treatment), Toronto, Canada 26-29 aug. 2001.

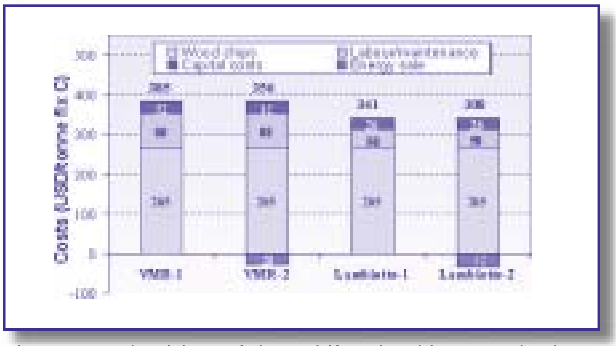

Figure 4. Cost breakdown of charcoal if produced in Norway by the VMR and Lambiotte carbonisation process, with and without and energy recovery [2]. (9 NOK/USD)

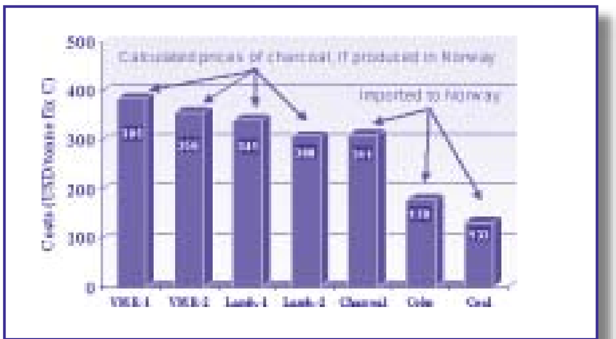

Figure 5. Competitiveness of charcoal if produced in Norway, compared to imported charcoal, coke and coal [2]. (9 NOK/USD)

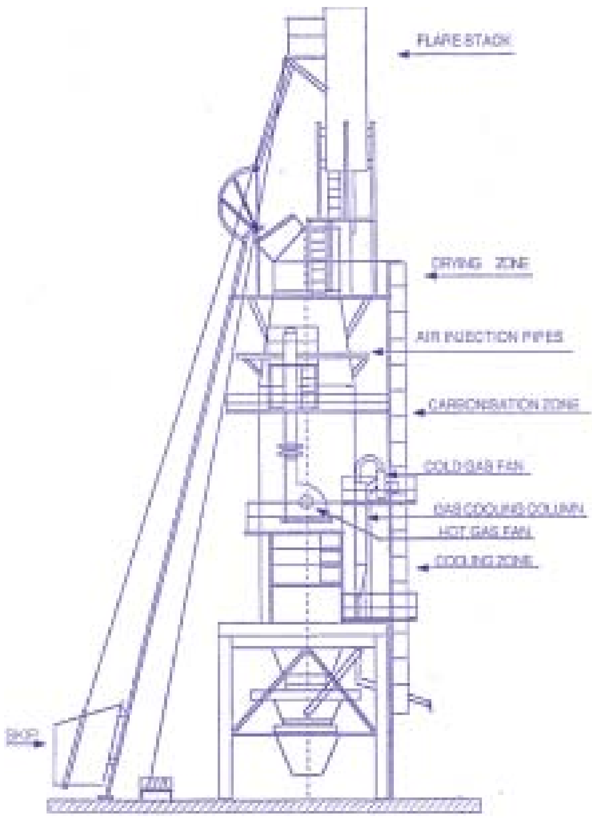

Figure 3. Lambiotte kiln.

Biocoal from Groundnut Shells – A Promising Approach for Senegal

By Benjamin Jargstorf, Factor 4 Energy Projects, Wismar, Germany.

Starting Point

Large areas of agricultural land in West Africa is used for a single cash crop: groundnut. In Senegal, the largest portion of groundnuts is exported in the form of groundnut oil, which is processed in large oil mills and transported by ship to Europe where it is refined and marketed. Groundnut oil is a much sought after product for food processing, such as margarine.

When these large oil mills were erected during French colonial times, no electricity grid existed. Thus the groundnut shells (about 25 % of total weight) were burned in boilers to make steam for turbo generators.
The energy intensive process of milling groundnuts consumes about 1 MWh per tonne of oil produced. The boilers deliberately had a low efficiency to assure that all the shells were burned thus matching the need of raw materials for producing oil.

New oil mill

NOVASEN is a private oil mill, constructed in 1999, which uses a highly efficient hot pressing process. On account of its size (about 15,000 tons of oil per year as opposed to 200,000 t for the large government-owned oil mills) it was not economical to install a steam boiler for electricity and process heat. NOVASEN produces its electricity in a large diesel generator (1.25 MVA) running on heavy fuel and has an additional boiler for generating process heat. The factory uses, at present, more than 1,200 tons of heavy fuel per year, while producing up to 15,000 t of groundnut shells as a waste (see Figure 1).

Figure 1: Detail of NOVASEN plant: Two conditioners (roasters) with screw presses where the oil is produced.

Household Energy Crisis in Senegal

Senegal consumes about 360,000 tons of charcoal each year for household energy purposes, the production of which requires more than 2 million tons of wood. It is estimated that annually 50,000 ha natural forest is converted into charcoal and lost to the sensitive eco-system of the Sahel country Senegal. Any attempts to stop this alarming rate of destruction have not been very effective during the past 20 years.

Against this background, the project intends to introduce energy efficiency to groundnut processing and use the groundnut shells as a raw material for charcoal briquettes which can be sold as a household fuel and directly substitute lump charcoal from Senegalese forests (1).

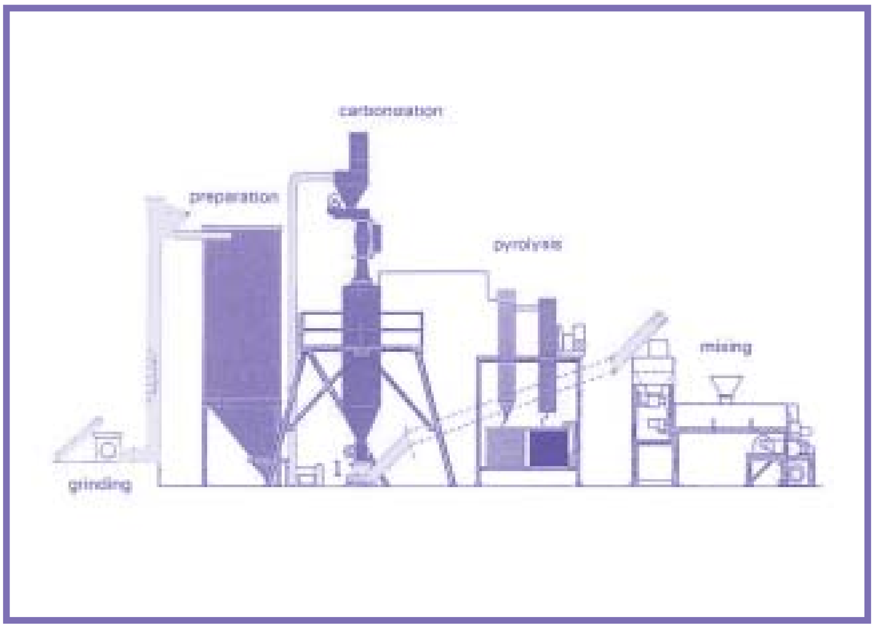

Figure 2: Process Schema for the Geneltec/BASA pyrolysis plant, as planned for NOVASEN.

Current Status of the Project

The technical planning for the integration of three down draft retorts for groundnut shells into the NOVASEN oil mill are underway (see Figure 2). The pre-feasibility study shows that the factory can achieve energy autonomy with 15000 t of groundnut shells per year, while producing 4200 t of biocoal briquettes. The flue gases from the retorts fuel two 850 kW electric generators providing enough electricity to supply the mill. In addition, the pyrolysis oil from the retorts will be burned in the existing process heat boiler. Thus, apart from producing more than 4000 t of charcoal substitute per year, the NOVASEN plant is expected to completely replace its current consumption of about 1200 t of fuel oil.

According to preliminary estimates, investment costs of about 2.7 million are needed for the installation of the complete pyrolysis plant, including all auxiliary gear (electric generators etc.). At present, an offer from the Swiss company Geneltec/Bio-Alternative SA for delivering and installing the equipment is being evaluated, while NOVASEN has contacts to several national and international financing organisations.

Outlook

In Senegal as elsewhere in West Africa, the production of groundnut oil for export uses a huge amount of energy. At present, around 250,000 t of groundnut shells and several thousands tons of fossil fuels supply this energy. If the "biocoal from groundnut shell" strategy were introduced into all oil mills of Senegal, about 25% of the country's charcoal needs could be covered and approx. 12,000 ha of forest would not be felled – every year.

Reference

(1) A component of the German Technical Co-operation Project "Support of the Household Sector in Senegal", carried out by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) on behalf of the Bundesmimisterium für Wirtschaftliche Zusammenarbeit und Entwicklung (BMZ)

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New biomass refinery technology for production of charcoal

By John Flottvik, JF Ventures, Canada.

The process starts by drying the feed material that can in principle be any organic material. This is carried out in a 6 metre high suspension dryer using hot air at 30°C from a heat exchanger in the reactor.

The bone-dry biomass is then fed into the 18 anaerobic retorts for a residence time of anywhere from 15 minutes to an hour depending on the quality of char required. Char quality is controlled by the material feed rate and temperature. Each retort has several 100mm vents that allow the gas and volatiles to be expelled. This gas goes directly into a condenser cooled by refrigerated water to condense the oil. The non-condensable gas is returned to the reactor and is used as fuel together with 5% of the charcoal produced to provide energy self-sufficiency.

Carbonisation Plant.

Full size plants are conservatively projected to take 120 wet ton per day feed, dry them to 60 ton and produce 20 ton of charcoal. Approximately 3000 gallons per day of bio-oil will be collected. Excess hot air can be used for central heating or on site heating.

So far fuel grade charcoal has been successfully made from chicken manure, horse manure, creosote railway ties, municipal solid waste and wood residue. Charcoal pellets have been made to use in pellet stoves as a home heating product, although a pellet line has not yet been built.

Emissions monitoring to date on flue gases shows 0% opacity, particulates at 6.6 mg/dscm, SOx 19 mg/dscm, NOx 69 mg/dscm, VOC 1 mg/dscm.

Technical problems to date include tar accumulation that prevents operation for more than 5 days. However, they have designed the system for easy cleanup so that after 5 days of running, it only takes 1 hr to clean the system to be able to continue operating. A cracking tower is planned to replace the water cooled condenser and try to separate at least some of the high end oils.

Once the first production plant is built in summer 2002, the pilot plant will be modified and used for making activated charcoal.

Some Liquid Products.

The small footprint of these plants will make them ideal for local landfills or construction dumpsites where major co-generating facilities would not fit. Mobile units are planned for taking to sites in need of clean up where trucking is uneconomical.

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JF VENTURES LTD.

ALTENER II Project:
Determination of norms and standards for biomass fast pyrolysis liquids as an alternative renewable fuel for electricity and heat production
(Altener Contract 4.1030/C/00-015-2000)

By Cordner Peacocke, CARE Ltd, UK.

This ALTENER II funded project originated in 1999, with a proposal by members of PyNe to carry out more detailed work on norms and standards of bio-oil. Partners in the project are:

- VTT Energy (Finland)
- Institute of Wood Chemistry (Germany)
- Wellman Process Engineering Ltd (United Kingdom)
- Fortum Oy (Finland)
- Ormrod Diesels (United Kingdom)

The contract started in July 2001.

The principal aims of the work are:

- To assess the important technology developers, providers of power conversion technology and end-users, collate data on produced liquids, and assess the quality for energy applications.
- Develop norms and standards for pyrolysis liquids, equivalent to existing methods for hydrocarbon and other conventional fuels, e.g. bio-oil grades that are accepted across the EU to increase end user confidence.
- Carry out sector, market and long term cost/benefit analyses, comparing renewable energy sources to conventional fuel oils.

Bio-oil.

The following Tasks are included:

1. Review fast pyrolysis technologies and describe processes at pre-commercial and commercial scale, suitable for heat and power production in the near term [1-4 years] to medium term [5-10 years]. Review incentives to develop fast pyrolysis technologies at national and EU level.

2. Derive norms and standards for biomass fast pyrolysis liquids. The project will review end user requirements and specifications for biomass fast pyrolysis liquids to obtain specifications and standards in liquid fuel quality.

3. Review sector and market strategies for the production of heat and power from pyrolysis liquids.

4. Carry out long-term cost/benefit analyses comparing biomass fast pyrolysis to traditional forms of energy and other alternative renewable energy sources and comparing the overall conversion efficiencies to electricity.

5. Quantify benefits obtained in improving the producer-converter-user interface and improvement of the energy/environmental balance in pyrolysis liquids production.

Task 1 is nearing completion and Task 2 is in progress. This uses a criteria assessment method to allow pyrolysis liquids to be classed as suitable for boilers, engines or turbines and will be developed in conjunction with engine and turbine manufacturers. This will lead to the specification of norms and standards for pyrolysis liquids comparable to standard fuel oils will allow end users to rapidly assess the pyrolysis liquid quality necessary for their application. It is expected that the results will increase the rate of uptake of pyrolysis liquids for heat and power applications.

Refinery.

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Bio-energy chains from perennial crops in South Europe

EC Contract No. ENK6-CT-2001-00524

By Myrsini Christou CRES, Greece.

Objectives:

The overall objective of this project is to define and evaluate complete bioenergy chains from biomass production to thermochemical conversion for production of valuable energy products. A number of perennial energy crops will be produced in southern Europe (Greece, Italy, France and Spain), which have been carefully selected to provide year-round availability of raw material. These will be processed thermally by combustion, gasification and fast pyrolysis. The complete chains will be evaluated in technical, environmental and economic in order to identify the most promising combinations of biomass resources and technologies.

Figure 1: 'Giant reed (Arundo donax) field in Central Greece'.

Description of work:

There are three main phases in the project:

1. Four selected biomass crops (cardoon, giant reed, miscanthus and switchgrass) will be cultivated in large fields in representative agricultural regions in Greece, Spain, France and Italy and successively harvested. Field measurements will be used for the technical, economic and environmental analyses in the following work packages.
2. Each crop will be fully characterised and subjected to a comprehensive test programme of combustion, gasification and fast pyrolysis. A report on the technical evaluation of the overall integrated bio-energy chain performance from biomass in the field to a derived heat and/or power product will be produced.
3. An economic assessment will be carried out on the data collected from the first two phases. The overall performance from biomass in the field to a delivered energy product as heat and or power will be measured by reference to the component parts in the chain starting in the field and progressing through each stage of handling and processing to a final marketable product. An overall performance model will be derived to provide consistent comparison between different bio-energy chains. This will be complemented with an environmental assessment, also conducted on all stages of the bioenergy chains. These assessments will be used to identify and prioritise the best combinations of biomass and conversion technology for each country.

Figure 2: 'Capitulas of cardoon (Cynara cardunculus)'.

Figure 3: 'Cardoon (Cynara cardunculus) field in Central Greece'.

Figure 4:- 'Miscanthus (Miscanthus x giganteus) field in Central Greece'.

Figure 5:- 'Switchgrass (Panicum virgatum) field in Central Greece'.

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Technical University of Graz, (VT-TUG) Austria
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Opportunities for bio-oil in European heat and power markets – an assessment of competitivity

By Tony Bridgwater, Aston University, UK and Max Lauer, Joanneum Research, Austria.

Background

This two year project project was started in June 2001 to run in parallel with the current PyNe Network. There are two contractors – Aston University and Joanneum Research in Austria, and all members of PyNe are subcontractors to provide data for the competitivity assessment. The project is clustered with another Altener project to establish norms and standards for bio-oil (see page 11) and this latter project will form the basis of a continuing Topic within PyNe.

Figure 1: Wellman Fast Pyrolysis Pilot Plant.

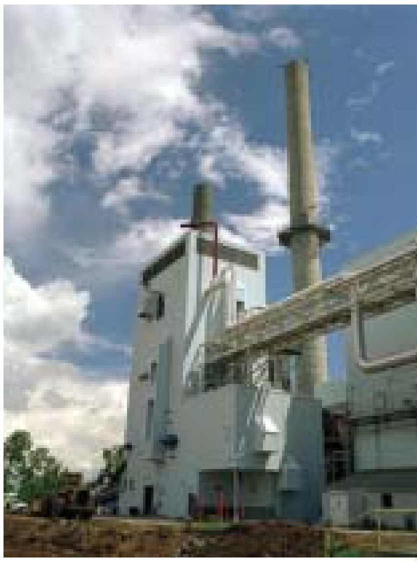

Figure 2: Burlington Gasifer, Vermont, USA (Picture courtesy of DOE/NREL.

Objectives

The main objectives are:

- To assess the economic competitiveness of a variety of biomass pyrolysis applications in the EU.
- To identify the possibilities for mitigation of greenhouse gas emission by implementing biomass pyrolysis systems.
- To identify niche applications for the development of market strategies to help implementation of biomass pyrolysis technologies.

Description of work

The project will consider the competitiveness of bio-oil for heat and/or power at appropriate scales of operation. In all cases, these will be compared with the standard fossil reference, i.e. power from the grid at the average price to the user in that location; and heat from a new gas or oil boiler, based on the average gas or oil price to the user in that location. The users considered will be domestic, industrial and utilities that supply electricity and/or heat. An electricity utility has the option of buying electricity for resale or generating its own, and therefore comparison with the standard fossil reference is legitimate.

Figure 3: Wood chip production (Picture courtesy of DOE/NREL).

Data on biomass resources, utility costs and conversion costs will be incorporated into a spreadsheet based model that was originally developed for evaluating a utility oriented biomass implementation strategy in Austria. However, this new competitivity model will be adapted to include the following:

- specification of final demand for heat and/or power (e.g. GJ/annum).
- incorporation of full cost-performance models for each thermal biomass conversion technologies, rather than simple linear correlations as at present.
- revision of methods for specifying feedstocks and applications.
- an ability to provide assessments across all countries in Europe.

Non-Technical Barriers to the wider implementation and adoption of fast pyrolysis technology and utilisation of the products will also be reviewed. A market assessment will be carried out by considering the economic competitiveness of bio-oil based applications in combination with the assessment of non-technical barriers and the questionnaire responses from PyNe members.

Expected results

The expected results from the competitivity study are data on specific applications of biomass fast pyrolysis technology in heat, power and CHP markets in Europe. This will allow a thorough assessment of the chances for realisation of the specific application investigated in terms of its competitivity with conventional applications for heat and power. A second result is the assessment of possibilities for greenhouse gas mitigation by implementing biomass fast pyrolysis technology.

Figure 4: The Woodland 25MWe Power Plant, California, USA.

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All members of PyNe.

A guide to physical property characterisation of biomass-derived fast pyrolysis liquids

This publication is a revised and updated version of VTT Publication 306: Physical characterisation of biomass-based pyrolysis liquids, issued in 1997. The main purpose of the on-going study is to test the applicability of standard fuel oil methods developed for petroleum-based fuels to pyrolysis liquids. New methods have also been tested and further developed. The methods were tested for pyrolysis liquids derived from hardwood, softwood, forest residue, and straw.

Recommendations on liquid handling and analyses are presented. In general, most of the standard methods can be used as such, but the accuracy of the analyses can be improved by minor modifications. Homogeneity of the liquids is the most critical factor in the accurate analyses, and hence procedures for its verification are presented.

By Anja Oasmaa & Cordner Peacocke

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Diary of Events

Information compiled by Claire Humphreys, Aston University, UK

Technibois Energie 2002

Venue: Québec, Canada
Date: 2-4 May 2002
Contact: Rolande Gauvin
GESTION TB Inc
C.P. 1010
CAN-G6P 8Y1
Victoria (Québec), Canada
Tel: +1 418 845 8247
Fax: +1 418 845 8576
Email: gesttb@videotron.ca
Website: www.technibois.com

6th Asia-Pasific International Symposium on Combustion and Energy Utilisation (UPISCEU)

Venue: Kuala Lumpur
Date: 20-22 May 2002
Contact: Professor Farid Nasir Ani
Local Chairman
Organising Committee
6th UPISCEU
Fax: +607 5566159
Email: farid@fkm.utm.my
Website: www.fkm.utm.my /apisceu/

Sustainable Development of Energy, Water and Environment Systems

Venue: Dubrovnik, Croatia
Date: 2-7 June 2002
Contact: 2002 Dubrovnik
Conference
Energetika Marketing
Sokolska 25
HR-10000 Zagreb, Croatia
Tel: +358 1 3771 256
Fax: +358 1 3772 429
Email: dubrovnik2002@ege.hr

12th European Conference and Technology Exhibition on Biomass for Energy, Industry and Climate Protection

Venue: Amsterdam, Netherlands
Date: 17-21 June 2002
Contact: ETA-Florence
Piazza Savonarola, 10,
I-50132 Florence
Tel: +39 055 500 2174
Fax: +39 055 57 3425
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Website: www.etaflorence.it

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D-81369 Munich
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Fax: +49 89 720 1291
Email: wip@wip-munich.de
Website: www.wip-munich.de

International Conference on New and Renewable Technologies for Sustainable Development

Venue: Azores, Portugal
Date: 24-26 June 2002
Contact: Prof. M Graca Carvalho
Instituto Superior Tecnico
(DEM/SME)
Av. Rovisco Pais
1049-001,
Lisboa – Portugal
Tel: +351 21 8417378
Fax: +351 21 8475545
Email: renewables@navier.ist.ist.utl.pt
Website: http://navier.ist.utl.pt/renewables2002

Australia and Europe Partnerships for Sustainable Energy R&D

Venue: Cologne, Germany
Date: 29 June 2002
Contact: Dr Tony Vassallo
Tel: +61 2 9490 8862
Fax: +61 2 9490 8909
Email: tony.vassallo@csiro.au
Website: http://www.det.csiro.au/

ISREE-8 Conference

Venue: Orlando, Florida
Date: 4-8 August 2002
Contact: Kate Ziemak
Tel: +1 352 392 1701 Ext 246
Fax: +1 352 392 5437
Website: http://www.doce-conferences.ufl.edu/isree8/

Waste Management 2002

Venue: Cadiz, Spain
Date: 4-6 September 2002
Contact: Gabriella Cossutta
Conference Secretariat
Waste Management 2002
Wessex Institute of Technology
Ashurst Lodge, Ashurst
Southampton, SO40 7AA, UK
Tel: +44 (0) 238 029 3223
Fax: +44 (0) 238 029 2853
Email: enquiries@wesex.ac.uk
Website: www.wessex.ac.uk/conference/2002/waste02/

The Tenth Biennial Bioenergy Conference – Bioenergy 2002 – Bioenergy for the Environment

Venue: Boise Idaho
Date: 22-26 September 2002
Contact: Bioenergy 2002
John Crockett
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1st International Ukrainian Conference on BIOMASS FOR ENERGY

Venue: Kyiv, Ukraine
Date: Monday, 23 September 2002
Contact: Dr Georgiy Geletukha
Institute of Engineering
Thermophysics of National
Academy of Sciences of Ukraine
2a, Zhelyabov str.,
03057, Kyiv,
Ukraine.
Tel: +(38 044) 441 7344, 446 9462
Fax: +(38 044) 446 6091
Email: conference@biomass.kiev.ua

Deadline for abstracts is 30th April 2002

China Hi-Tech Fair/Environment & New Energy 2002

Venue: Shenzhen, P.R. China
Date: 12-17 October 2002
Contact: Coastal International Exhibition Co, Ltd.
Tel: +852 2827 6766
Fax: +852 2827 6870
Email: general@coastal.com.hk

Reactor Engineering for Biomass Feedstocks – 2002 Annual AIChE Meeting

(Abstract Due: On-line submission by 1st May 2002)

Venue: Indianapolis, Indiana
Date: 3-8 November 2002
Contact: Chair - Michael J. Antal, Jr.
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Website: http://www.aiche.org/annual/

URFRO – All Division 5 Conference

Venue: Rotorua, New Zealand
Date: 11-15 March 2003
Contact: John Stulen
Innovatek
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Rotorua
New Zealand
Tel: +64 7 348 1039
Fax: +64 7 343 1420
Email: johnstulen@clear.net.nz
Website: http://www.forestresearch.co.nz/site.cfm/alldiv5iufronz

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PyNe Group in Graz, Austria, January 2002.

IEA Bioenergy

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