FROM THE TASK BY RICHARD BAIN AND REINHARD RAUCH

This newsletter is the inaugural edition of IEA Bioenergy Task 33 "Thermal Gasification of Biomass.' The intent of the newsletter is to provide updates of Task activities and links to additional information on biomass gasification status and developments in Member Countries.

In this issue we are presenting information on 2011 Workshops held in Christchurch, New Zealand (April 2011) and Piteå, Sweden (October 2011), the recent activation of a new Task website, and an overview of the biomass gasification database now available on the Task 33 website.

The Christchurch workshop **"Gasification and Alternative Fuels Development"** organized by Dr. Shusheng Pang, University of Canterbury brought together 40 people from universities, research institutes, energy industry, wood processing industry and engineering consultancy companies to learn about the latest progress in biomass gasification R&D and commercialization, as well as recent developments in other alternative energy sources in New Zealand, Australia, Austria, and the USA.

The Piteå workshop **"Biomass Gasification Opportunities in the Forest Industry"** organized by Lars Waldheim addressed development status and issues associated with development of gasification-based advanced fuels processes in the forest industry. An overview presentation on the biomass portion of the recent IPCC SRREN study was given as an introduction to the workshop. The workshop included presentations from major gasifier developers, including Chemrec, Metso Power, Andritz Carbona, and NSE. Presentations were given by Esa Kurkela, summarizing gasification activities at VTT, and Reinhard Rauch summarizing gasification-based cogeneration. There were 30 participants in the workshop.

The new version of the **Task 33 webpage** was activated in July 2011. The aim was to create a new, clear and informative webpage on thermal gasification of biomass, not just for task members, but also for all specialists in the gasification area and involved public. The webpage consists of eight sections: 1) Thermal Gasification of Biomass, 2) Task Description, 3) Participants, 4) Publications, 5) Country Reports, 6) Meeting Minutes & Presentations, 7) Future Task Meetings, and 8) Thermal Gasification Facilities - Database.

A new **database with worldwide biomass gasification facilities**, based on Google maps, was created as a part of the IEA Bioenergy Task 33 webpage. At the present, 87 gasification facilities are active in the database. Fifty-four of them can be found in Task 33 member countries and 33 in other countries. There are four technologies of gasifiers in the database: 1) co-firing (4 gasification facilities), 2) CHP (37 gasification facilities), 3) synthesis (34 gasification facilities), and 4) other innovative (12 gasification facilities). There are three types of gasifiers displayed in the database (pilot, demo and commercial). Nearly a half of all gasification facilities (47%) are commercial, 27 % pilot plants and 26% demo plants.

Task 33 Members—Executive Committee (ExCo*) and Member Country Representatives

Austria
Joseph Spitzer*
Reinhard Rauch

Denmark
Jan Bunger*
Erik Winther

Finland
Kai Sipila*
Ilkka Hannula

Germany
Birger Kerckow *
Thomas Kolb

Italy
Gerardo Montanino*
NTL—TBD

Japan
Fumiaki Ishida*
Myumi Morita

The Netherlands
Kees Kwant*
Bram van der Drift

New Zealand
Elspeth MacRae*
Shusheng Peng

Norway
Petter Nilsen*
Judit Sandquist

Sweden
Asa Karlsson*
Lars Waldheim

Switzerland
Sandra Hermle*
Martin Rüegsegger

Turkey
Ufuk Kayahan*
Serhat Gül

United States
Paul Grabowski *
Richard Bain

Task Management
Paul Grabowski (Operating Agent—USDOE)
Richard Bain (Task Leader—NREL)
Reinhard Rauch (Assistant Task Leader, TUV)
Jitka Hrbek (Task Secretary—TUV)

Gasification and Alternative Fuels Development April 14, 2011, Christchurch, New Zealand By Jingge Li

In conjunction with the First Semi-Annual Meeting 2011of IEA Bioenergy Task 33 (Thermal Gasification of Biomass), a workshop of Gasification and Alternative Fuels Development was held on 14 April in the Copthorne Hotel Commodore, Christchurch. It was organised jointly by Professor Shusheng Pang, University of Canterbury, and Dr Richard Bain, Leader of the IEA Bioenergy Task 33. Biomass gasification experts from USA, Austria, Australia and New Zealand presented the latest progresses in biomass gasification R&D as well as commercialisation. 40 people from universities, research institutes, energy industry, wood processing industry and engineering consultancy companies attended the workshop.

Dr. John Sanderson presenting on Biomass Gasification in Australia

North America and Europe have been very active in R&D and commercialisation of biomass energy and bio-liquid fuel technologies. Numerous biomass gasification demonstration and commercialisation plants have been constructed and in operation. Efforts now are on Fischer-Tropsch (FT) liquid fuels synthesis from biomass producer gas. Dr Richard Bain, Principal Engineer of the National Renewable Energy Laboratory in US, presented an overview about the R&D status in North America. In US, the capacity of biodiesel is 11 billion litres, corn ethanol 55 billion litres, and biopower 10 GW. The Department of Energy has set up goals to increase the quantity and reduce the cost by 2030. Biomass gasification is one of the approaches to generate biopower and biofuels. There are about 50 biomass gasifier developers in the US which have been developing various types of gasifiers for diverse feedstocks and energy products. Technical details were also presented by Dr Bain for some successful biomass gasification projects and integrated biorefinery projects in US and Canada.

Dr Reinhard Rauch, the Head of the R&D Group of Synthesis Biofuels in the Vienna University of Technology and Co-Leader of the IEA Task 33, presented his first hand information on the well-known Güssing gasification plant in Austria. The Güssing biomass gasification plant uses a fast internal circulating fluidised bed (FICFB) gasifier with steam as the gasification agent developed by the Vienna University of Technology, which can generate a producer gas with high content of H_2 and high calorific value. The project started as a CHP plant with 2MW electricity output, it now becomes a test facility for development of BioSNG, Fischer Tropsch fuels, mixed alcohols, and hydrogen. Based on the successful operation of Güssing plant, the FICFB gasifier has been commercialized in six plants in Europe in stages of planning, construction or operation.

Dr John Sanderson from the Earth System in Melbourne gave a presentation on biomass gasification activities in Australia. Although no commercial biomass gasification plant is currently in operation in Australia due to limited funding in this area, it is recognized that a combination of avoided waste costs with income from energy production will be the key driver for bioenergy processes such as gasification in the near to medium term. Dr Sanderson hoped that a number of demonstration and test facilities associated with commercial entities will likely result in commercial biomass gasification plant installations in the near future. Five recently proposed gasification plants were detailed in the presentation as well as projects in biomass pyrolysis and BIGchar.

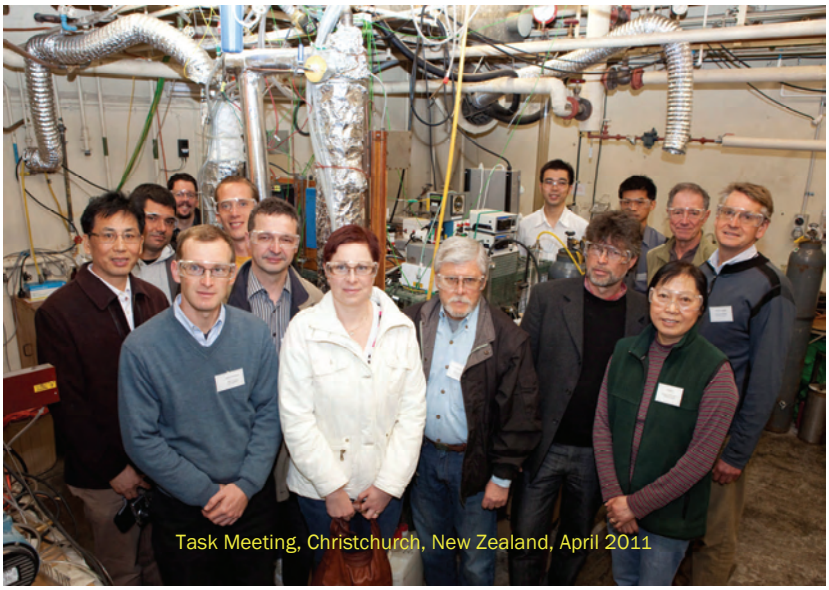
The IEA Workshop was also a showcase for New Zealand's work on biomass gasification. Doug Williams, a long

time pioneer for development of downdraft gasifier and Director of Fluidyne Co., started his presentation with nice photos of Napier's 1930s gasifier plant with a gas engine. Then he showed the Fluidyne's recent project in California for commercialization of a 100kWe gasifier for generation of process heat and electricity. The emphasis of the technology has been to produce a clean gas free of condensable components and toxic particulates. The Fluidyne gasifiers are also used to produce biochar for carbon sequestration and syngas for FT fuels. The Fluidyne gasifier is currently licensed for sale in Australia through Flow Force Technologies as shown in Dr Sanderson's presentation.

University of Canterbury has been very active in biomass gasification R&D. Professor Shusheng Pang has been leading a research programme of biomass gasification and bioliquid fuels. In collaboration with Vienna University of Technology, the research team has designed, constructed and commissioned a 100 kW FICFB steam gasifier and various biomass originated from NZ have been tested. The technology has been proved to be capable for generation of syngas suitable for synthesis of FT fuels. Professor Pang gave an overview on the current biomass to hydrogen-rich syngas and liquid flue (BTSL) research progress. The BTSL programme, funded by the Ministry of Science and Innovation (previously FRST) aims to reduce production costs and increase conversion efficiency. Technologies in development include biomass gasification, co-gasification of biomass and coal, co-gasification of biomass and sewage solid, gasification of biomass pyrolysis slurry, biomass pyrolysis, gas cleaning, and small scale FT reactor. Fundamental studies are also being carried out for operation optimisation and scale-up design. Dr Woei-Lean Saw, a Research Fellow, presented latest trials on co-gasification of biomass and sewage solid. Chris Penniall, a PhD student, showed his research on development of micro-channel FT reactor and catalysts. Dr Tana Levi, Technical Manager in CRL Energy Ltd., talked about recent achievements in co-gasification of biomass and coal.

Dr Steven Pearce, General Manager of Gas Developments in Solid Energy NZ Ltd, was invited to give a presentation on the Solid Energy's on-going project of underground coal gasification (UCG). The UCG operation works like a fixed bed gasifier and has a number of advantages such as extraction and conversion of coal to syngas in one step; elimination of mining and coal handling. The UCG technology provides access to deep and otherwise unmineable coal resources and also eliminates H&S risks associated with underground mining.

If anyone is interested in having more details of the workshop, please contact Mrs Jingge Li (jingge.li@canterbury.ac.nz), the Research Engineer and project Manager of the BTSL program, University of Canterbury.



Task Meeting, Christchurch, New Zealand, April 2011

Biomass Gasification Activities in the Forest Industry October 19,2011, Pitea, Sweden By Lars Waldheim and Jitka Hrbek

The IEA Task 33 sponsored workshop addressed development status and issues associated with development of gasification-based advanced fuels processes in the forest industry. There were 31 participants in the workshop. All presentations are available on the task web site.

As an introduction to the workshop, an overview presentation on the biomass portion of the recent IPCC SRREN study was given. The main conclusion is that by 2050, the biomass potential realistically available for use could amount to 1/3 of the projected world energy demand.

The workshop included presentations from major gasifier developers, including Chemrec, Metso Power, Andritz Carbona, and NSE, but also presentations on R&D work.

On the R&D side Esa Kurkela, summarized the gasification activities at VTT, including current biomass-to-syngas projects for fuels, H2 and SNG production (Vetaani project) as well as on advanced analysis technique for gasification. He also commented on the Finish black liquor gasification (BLG) activities in the 80's and 90's, and why these were stopped. Reinhard Rauch of TUW summarized gasification-based cogeneration including the economic conditions in Austria, but also discussed R&D and projects concerning elements behavior during the biomass gasification and the synthesis of mixed alcohols. Rich Bain of NREL reported on climate change and the pulp and paper industry and on biomass gasification (BMG) in North America. Furthermore, the current status of biopower and biofuels in the USA was presented. The progress on large–scale gasification technologies and projects in the USA and Canada (Nexterra, Enerkem, etc.) was also described. Rikard Gebart of ETC reported on the black liquor gasification (BLG) R&D and on the project 'Transportation Fuels from Forest Residues via PEBG" as well as describing the newly started Swedish Gasification Centre. In Sweden, there are approx. 20 large pulp mills generating black liquor. If gasified, this represents a potential supply of about 25% of Sweden's use of transport fuels.

Chemrec is commercializing a BLG process using an oxygen-blown, pressurized entrained flow gasifier to produce synthesis gas. Ragnar Stahre reported on the DP-1 pilot plant. He also reported on the FP7 BioDME project where syngas from DP-1 is used to produce dimethyl ether (DME) by a technology developed by Haldor Topsøe, for use as a diesel fuel in Volvo trucks doing haulage for the Smurfit Kappa pulp mill. The industrial scale-up for the Domsjö project was also highlighted.

Jens Otterstedt, Sveaskog, presented a forest owner´s perspective on bioenergy. Sveaskog is the leading forest owner in Europe with its base in the Swedish boreal forests. Sweden has shown that a transition from fossil to renewable energy is possible, and where forestry plays a key role. Today, bioenergy in Sweden is the largest single energy source. Nevertheless, the supply of raw materials and energy from the forests has not yet been exhausted. Over time, an increase in the range between 30-100% is seen as possible.

Metso is a global supplier of sustainable technology and services. Metso´s customers operate in mining, construction, energy, oil and gas, recycling and pulp and paper industry. Metso employs about 28 500 people in over 50 countries. Timo Honkala presented details of their CFB gasifier and of the Lahti Energia project– solid waste gasifi-

cation.

Kari Salo of Andritz/Carbona reported on the company's capability for biomass handling and pretreatment, and on the different areas of gasification where it is active: CFB gasifiers (atmospheric, air blown, for boilers and kilns; 10-150 MWth) BFB gasifiers (low pressure, air blown; 10 – 50 MWth). Projects includes Skive and the cooperatioin with UPM, where tests are being made at the GTI Flexfuel unit in Chicago

NSE Biofuels Oy is a joint venture between Neste Oil Oy and Stora Enso Oy. The current activity includes developing technology for FT-diesel production via syngas from woody biomasses. Veikko Jokela presented the activities in the test plant in Stora Enso's Varkaus pulp mill that were concluded in August 2011. The next step is a scale up, the NOSE project,to be installed at either the Porvoo refinery or Imatra pulp mill, and for which support under the NER 300 program has been sought.

Lars Waldheim, the Swedish NTL, ended the day by concluding that there is a huge bioenergy potential for BMG to tap in to. He also observed that it appears as if the connection between the BMG unit and upstream fuel pretreatment and/or downstream synthesis processes are now realized already at the pilot scale whereas in the past this integration was only made at larger, more complete demonstration plants. Although, in some cases there may be good technical motives for the integration already at this scale, the difficulty to realize the demonstration scale project could be a likely explanation, as there is a tendency to go from an integration at pilot scale to the prototype industrial plant, without any intermediate demonstration unit.

TASK 33 WEBSITE
By Jitka Hrbek, TUV, Austria

The new version of the webpage for the Task 33 was activated in July 2011 (www.ieatask33.org). The aim was to create a new, clear and informative webpage on thermal gasification of biomass, not just for task members, but also for all specialists in the gasification area and involved public. During the last Task 33 meeting In Piteå, Sweden, the status of the webpage was presented.

A schematic figure of thermal biomass gasification, with input and output of the process can be found on the first site. Cellulosic biomass (mostly forest and agricultural residues) is converted by thermal gasification into heat and/or power and steam and/or synthesis gas, which can be used for production of liquid fuels (e.g. Fischer Tropsch liquids, mixed alcohols, or gasoline), hydrogen, methane, and other chemicals.

The webpage consists of eight sections:

- Thermal Gasification of Biomass
- Task Description
- Participants
- Publications
- Country Reports
- Meeting Minutes & Presentations
- Future Task Meetings
- Thermal Gasification Facilities - Database

The section “Thermal Gasification of Biomass” is new. The short, clear description of the gasification process, products and product gas usage can be found here. It is possible to download a table with primary gasification reactions, which provides important information on thermal biomass gasification process.

The section “Participants” was created from the former “Member countries” and “National representatives” sections. Here, the contact information about Task33 members can be found. In this Triennium 2010-2012, there are 21 Task 33 members from 13 countries.

National Task Leaders provide an update on their country reports regularly. The actual status of biomass gasification in all member countries can be found in the section “Country Reports”.

Within two weeks after the Task 33 meetings, all presentations from meeting and joined workshop are posted on the webpage in section “Meeting Minutes & Presentations”. And also the Meeting minutes, after the approval by all Task 33 members, can be found here.

In the section “Future Task Meetings” the Task 33 members informed about the next meeting and Workshop topics for the Triennium 2013-2015.

The important part of the webpage is the section “Thermal Gasification Facilities”, which consists of a worldwide gasifier database.

BIOMASS GASIFICATION DATABASE
BY JITKA HRBEK AND REINHARD RAUCH, TUV, AUSTRIA

A new database with the biomass gasification facilities worldwide, based on Google maps, was created as a part of the IEA Bioenergy Task 33 webpage.

At the present, 87 gasification facilities are active in the database. Fifty-four of them can be found in Task 33 member countries and 33 in other countries as shown in the following table.

Austria	9	NZ	1
Denmark	7	Norway	0
Italy	0	Sweden	4
Finland	4	Switzerland	4
Germany	7	Turkey	2
Japan	2	USA	8
Netherlands	6	Total	54

All gasification facilities can be divided by technology, type and status.

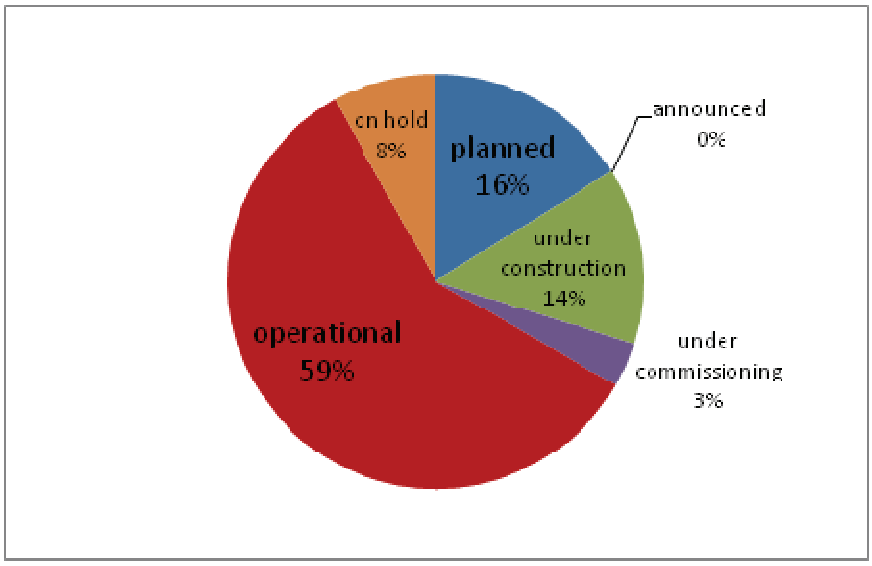
There are four technologies of gasifiers in the database:

Co-firing (4 gasification facilities)
CHP (37 gasification facilities)
Synthesis (34 gasification facilities)
Other innovative (12 gasification facilities)

There are three types of gasifiers displayed in the database (pilot, demo and commercial). Nearly a half of all gasification facilities (47%) are commercial, 27 % pilot plants and 26% demo plants.

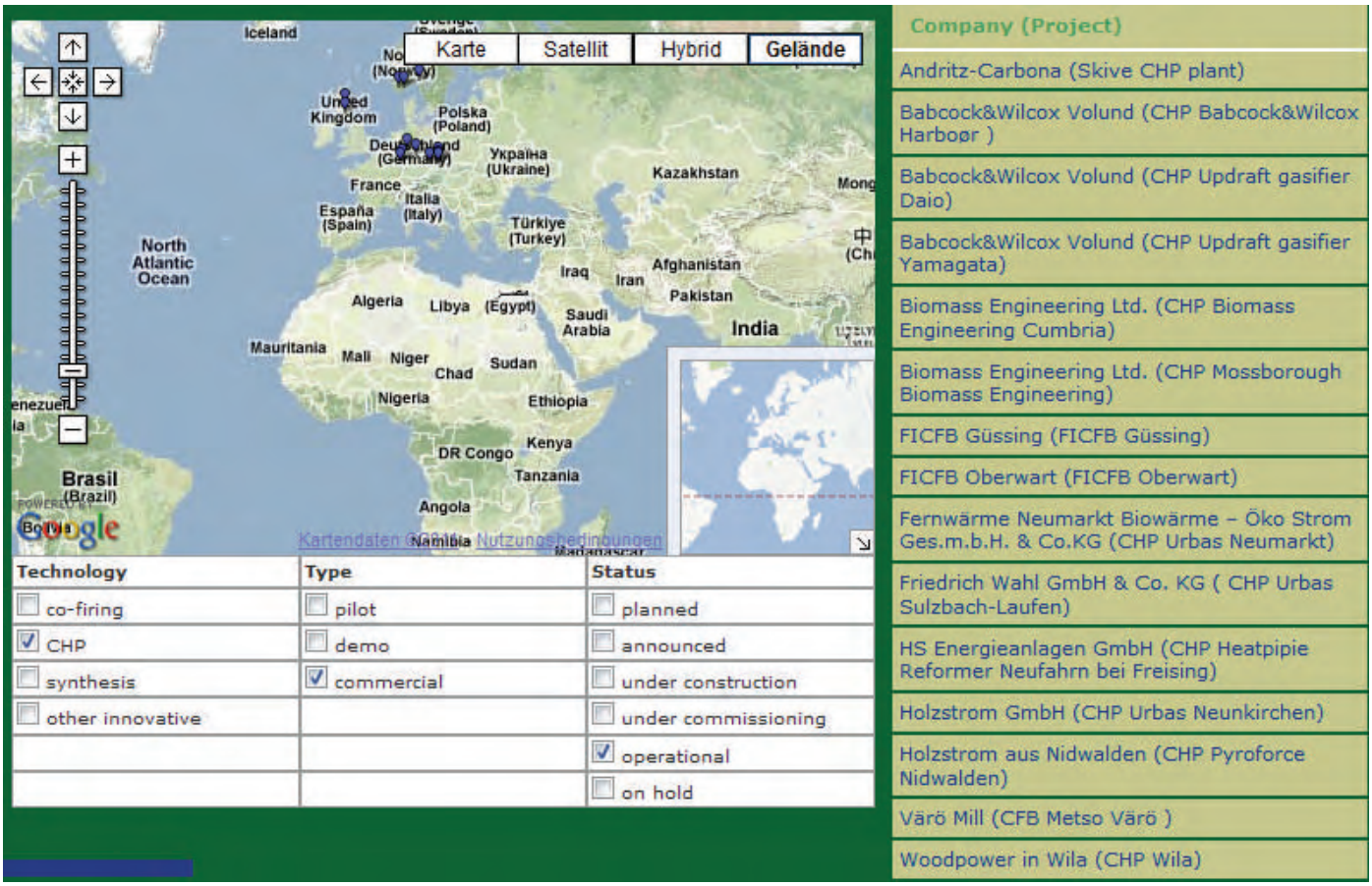
All gasification facilities can be divided also by status:

- Planned
- Announced
- Under construction
- Under commissioning
- Operational
- On hold



As can be seen in the figure above, the majority of all 87 gasification facilities are now in operation (59%), an additional 14% are in construction, 3% are in commissioning and 16% are planned. Only 8% of all gasification facilities are on hold.

Not only technology, type and status of the gasification facilities can be found in the database.
If technologies, types or status of the facilities are selected, the table on the right can be seen.



Technology	Type	Status
☐ co-firing	☐ pilot	☐ planned
☑ CHP	☐ demo	☐ announced
☐ synthesis	☑ commercial	☐ under construction
☐ other innovative		☐ under commissioning
		☑ operational
		☐ on hold

Company (Project)
Andritz-Carbona (Skive CHP plant)
Babcock&Wilcox Volund (CHP Babcock&Wilcox Harboør)
Babcock&Wilcox Volund (CHP Updraft gasifier Daio)
Babcock&Wilcox Volund (CHP Updraft gasifier Yamagata)
Biomass Engineering Ltd. (CHP Biomass Engineering Cumbria)
Biomass Engineering Ltd. (CHP Mossborough Biomass Engineering)
FICFB Güssing (FICFB Güssing)
FICFB Oberwart (FICFB Oberwart)
Fernwärme Neumarkt Biowärme – Öko Strom Ges.m.b.H. & Co.KG (CHP Urbas Neumarkt)
Friedrich Wahl GmbH & Co. KG (CHP Urbas Sulzbach-Laufen)
HS Energieanlagen GmbH (CHP Heatpipie Reformer Neufahrn bei Freising)
Holzstrom GmbH (CHP Urbas Neunkirchen)
Holzstrom aus Nidwalden (CHP Pyroforce Nidwalden)
Värö Mill (CFB Metso Värö)
Woodpower in Wila (CHP Wila)

As an example, the FICFB gasifier in Oberwart in Austria was chosen.

As can see in the table below, all the important information including location, technology, raw material used, input and output data, products, facility type, partners, total investment, status and start up is displayed. Also a short technology brief or a flow sheet is enclosed. If there is more information needed, the contact person displayed in the table can be contacted to answer questions concerning the gasification facility.

Data sheet:	
Coordinating Organisation/Company	FICFB Oberwart
Project Name	FICFB Oberwart
Location	Oberwart, 7400, Austria
Technology	CHP conversion
Raw Material	lignocellulosics; wood chips
Input	8,7 MWfuel
Product	heat; power;
Output	1-6 MWth; 2,7 MWel
Facility Type	commercial
Partners	Ortner Anlagenbau
Total Investment	16 M Euro
Status	operational
Start-Up	2008
Technology Brief	FICFB, steam as oxidizing agent in gasification zone, air in combustion zone In Oberwart the second Biomass CHP with the concept of the FICFB gasification system was realised. It consists similar to the biomass CHP Güssing of gas generation in a DFB system, gas cooling and gas clean-up in a bag filter followed by a tar scrubber. The cooled and cleaned producer gas is fed into two gas engines for power generation. In addition there is an biomass drying unit and an organic rankine cycle (ORC) integrated, to have a higher electric efficiency. For the ORC all heat at the biomass CHP is collected by thermo-oil and transferred in the ORC in electricity.
Contact Person	Ing. DI (FH) Dr. Klaus Bosch ; Tel.: +43 (0) 26829015-752
Picture	

The database is updated regularly. It is based on the member countries Country Reports and information from the National Task Leaders. It is very helpful for searching about information in the thermal biomass gasification area.

Task 33 Overview

Objectives: To promote commercialization of biomass gasification (BMG) to produce fuel and synthesis gases that can be subsequently converted to substitutes for fossil fuel based energy products and chemicals, and lay the foundation for secure and sustainable energy supply; to assist IEA Bioenergy Executive Committee activities in developing sustainable bioenergy strategies and policy recommendations by providing technical, economic, and sustainability information for BMG systems; to conduct subtask studies to review and evaluate information from the current worldwide RD&D programs and operating gasification systems to identify and resolve barriers for advancement of economical, efficient, and environmentally preferable BMG processes; and to enable National Team Leaders (NTLS) to develop forward looking strategies and policies to implement programs in their respective countries, and help 'leapfrog' resource consuming repetitive and redundant exercises

The Task builds on a number of years of activities that have concentrated primarily on technical barriers to development and commercialization of BMG for diverse markets, e.g., small scale combined heat and power systems (CHP), utility scale CHP systems, and emerging liquid fuels and chemicals markets. A major is devoted to dissemination of international status and BMG development through a series of workshops in member countries. Workshop presentations are posted on the Task website. The Task has developed a BMG projects database for member countries that is posted on the Task 33 website.

Our work programme involves

- *Organize semi-annual Task Meetings to exchange and review global RD&D programs and projects to identify barriers to commercialize BMG.*
- *NTLs will prepare and update Country Reports and RD&D needs and make them available for use by other NTLS and Executive Committee members to aid in the development of their respective national BMG and bioenergy plans.*
- *Conduct subtask studies, including technical workshops, with industrial and academic experts to address the key barriers to advancing BMG on a country and global basis.*
- *Conduct joint studies/workshops with related tasks, annexes, and other international activities to pursue mutually beneficial investigation.*

FUTURE MEETINGS

April 17-19, 2012—Task Meeting and Workshop, Istanbul, Turkey

November 12-16, 2012—IEA Bioenergy Conference and Task Meeting, Vienna, Austria