DRAFT MINUTES
IEA Bioenergy Agreement
Task 33: Thermal Gasification of Biomass
Spring 2005, Task Meeting, May 17, 2005
Stockholm, Sweden
Prepared by
Suresh P. Babu, Task Leader
Des Plaines, IL 60018, USA
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The third Task Meeting for the 2004-2006 triennium was held in conjunction with the SYNBIOS Conference in Stockholm, Sweden. TPS helped organize the meeting and host lunch and other Task Meeting related arrangements.

The Task Meeting participants include: Nick Barker, UK, Maria Fernandes-Guitierrez, CEC, Emanuele Scoditti, IT, Shu Sheng Pang, NZ, Hermann Hofbauer, AT, Serge Biollaz, CH, Reinhard Rauch, AT, Martin Wittrup Hansen, DK, Lars Waldheim, SE, Esa Kurkela, FI, and Richard Bain and Suresh Babu, USA.

Guests: Stephen Schuck, AU, Ed Hogan, CA, IEA EXCo Members, and Vann Bush, GTI, USA

Apologies were received from: Ruedi Buehler, CH and Henrik Christiansen,DK

The Agenda for the Task Meeting is shown in Attachment 1.

Day 1: Monday, May 17, 2005: Task Meeting

Following the approval of Agenda and the Minutes from the Fall 2004, Task Meeting held from October 25-27, 2004 in Copenhagen, Denmark the current status of biomass gasification research, demonstration, and commercial projects in the participating countries were presented:

Sweden:
Present emission taxes in Sweden applicable for energy conversion units >5 MWth: $100/tonne CO2, $4000/tonne SOx, and $5000/tonne NOx. It is noted that in recent years, there has been a significant reduction in oil use and increase in biomass use. Industry is concerned about recovering its recent investments from measures to replace fossil fuels with renewables, before the environmental incentives begin to expire starting from 2010.

The Swedish BMG activities include the CFB BMG plant at the Väro pulp mill, TPS gasification projects in Italy and UK, and the current efforts to set-up the Vaxjo

Varnamo Biomass Gasification Center (VVBGC, AB) in Malmo, Sweden. VVBGC AB will become the center piece for investigating several aspects of BMG employing the Sydkraft-Ahlstrom/FWE pressurized CFB gasifier. The recently approved €15.6 MM Clean Hydrogen Rich Synthesis (CHRIS) Gas project will help launch VVBGC, AB. The support for this venture is provided by European Commission (€9.5 MM), STEM (€1.5 MM), and other investors. Initial gasification tests at the CHRIS Gas project will be conducted with both woody biomass and crop residues.

Several Swedish universities are actively pursuing a variety of BMG research projects.

Related to BMG is the 30 MWth (300 dry TPD) black liquor gasification demonstration project at the Chemrec pilot plant, located in Pitea.

In order to improve the reliability of power supply, the Swedish electrical grid is now closely integrated with those of Finland, Denmark, Norway, and Poland.

Finland:
After about 4 months delay, commissioning of the 7 MWth capacity, Novel biomass gasification project in Kokemaki, has begun. The gasifier employs a combination of updraft and co-current gas-solid contacting scheme. The product gas will be used to produce about 1.8 MWe and 3.3 MWth heat.

The Entimos Oy gasification CHP plant in Tevola, Lapland has been shutdown. This gasifier design incorporates the beneficial features of both updraft and down draft gasifiers. One product gas stream is used for direct combustion for district heating and the clean second gaseous stream is utilized in a gas engine.

After 20 years, the Ahlstrom CFB gasifier at Pietersaari has been shutdown. During this period the gasifier was operated successfully with significant economic benefits.

The 60 MWth Lahti Ahlstrom/FWE CFB gasifier has been in continuous operation since 1998; plans are now underway to scale-up this process to a 160 MWth plant.

Since 2001, the 40 MWth, bubbling fluidized bed Corenso gasifier has been in commercial operation.

Carbona has started constructing the 7 MWth, low-pressure (2 to 3 bar) bubbling fluidized bed RENUGAS process plant for CHP in Skive, Denmark.

Other BMG R&D activities in Finland include PDU gasification tests with automobile shredder wastes, CFB gasification of plastic wastes to fire calcining kilns, catalyst development for gas clean-up in support of the Novel gasification process, and construction of a new 500 kWth PDU at VTT. In the tar decomposition development research, zirconia has been shown to be more robust compared to nickel but lower in reactivity.

Switzerland:
The current Swiss BMG demonstration plants include the 50 KWe down-draft Xylowatt gasifier connected to a turbo-charged gas engine and the 500 KWth Pyroforce gasifier connected to the smallest Jenbacher gas engine (200 KWe).

Fifteen persons are working at the Paul Scherrer Institute (PSI) on various aspects of synthesis gas conversion to substitute natural gas (SNG) and liquid fuels. Focus is on Ni catalysts for SNG and Fe and Co catalysts for converting synthesis gas to liquid fuels. PSI is also conducting research on hydrothermal gasification of biomass at 400 bar and 600^{o} C.

The Netherlands:
The following is a list of the extensive BM RD&D and commercial activities in The Netherlands:

1. The 80 MWth, Essent, Lurgi CFBG BMG co-firing plant is in operation. Raw gas is cooled to 400-450^{o} C, passed thru a cyclone to remove 65 to 70% of entrained particles before burning the gas into a boiler.
2. The 250 MWe, NUON, Shell coal gasification process located in Buggenum, has successfully co-gasified upto 34% by weight (equivalent to approx. 85 MWth) of variety of biomass and waste materials. This facility receives credits from 6.6 to 7.0 €cents/kWh.
3. BTG is now focused on developing flash pyrolysis of biomass in Malaysia
4. HOST is building a 5 MWth synthesis gas plant in Romania. The problem with autoignition of residual ash was solved by ash briquetting.
5. The Darwin, fluidized bed slagging gasification process to produce synthesis gas is under development.
6. The BIOXY down-draft gasifier is under development.
7. University of Eindhoven, University of Twente, and University of Delft are active in BMG research
8. ECN's focus is on Torrefaction for feed preparation and the Olga gas clean-up process. ECN is also developing the Millena BMG process which has many similarities to the TUV FICFB biomass gasification process that is currently demonstrated in Güssing.
9. TREC is developing a granular bed filter for gas clean-up.

United Kingdom:
The Government has set itself a target of securing 10% of electricity from eligible, renewable sources by 2010. There are four elements to the new strategy in support of renewable energy.

- The Renewables Obligations
- Climate Change Levy Exemption
- Capital Grants and Planting Grants for Energy Crops
- Research and Development Programme.

The Renewables Obligation means that licensed electricity suppliers will have to

provide a specified proportion of their sales from renewable energy in future years. This proportion is 10% in 2010 rising to 15% in 2015. Compliance is demonstrated by buying certificates from renewable generators. Certificates can be traded.

The Renewables Obligation favours gasification in that mixed waste gasification is allowed but incineration is not.

The climate change is a tax on some forms of energy. Renewables are exempt.

Capital grants have been provided for a number of Bio-energy plants, some of which are gasification plants. The most notable of these is the Peninsula Power project in Devon using FERCO technology. It is however currently held up in permitting with considerable local opposition. A grant has also been awarded to a project proposing to use rotating kiln technology.

The Environment Ministry has recently launched R & D and demonstration Programmes for waste management technologies. We expect to see a small number of gasification technologies developed through this scheme.

European Commission:

The White Paper for a Community Strategy and Action Plan has set the target to double the share of renewable energy sources from 6% to 12% of gross consumption by 2010. Bioenergy will have to make the main contribution of about 60% of this increase.

To implement EU energy policy, there is a legislative framework made up of specific measures. For biomass, the most important ones are:

Directive on the promotion of electricity from renewable sources, adopted in September 2001 setting a target of increasing the share of green electricity from 14% to 22% of gross electricity consumption by 2010.

Directive on the promotion of the use of biofuels for transport, adopted in May 2003, aiming to raise the share of biofuels to 5.75% in 2010.

Apart from regulation through Directives, EU is strongly committed in investment in research, development and demonstration of new technologies to bring renewable energy to the citizens. The main programmes are:

First, the 6^{th} Framework Program for Research and Technological Development (FP6) is spearheading initiatives focusing on renewable energy sources (including biomass) under the specific program “Sustainable Energy Systems”. This specific program also covers other areas such as new technologies for energy carriers/transport and storage, fuel cells and their applications, capture and sequestration of CO_2.

This work program, with a total budget of € 890 MM, is implemented in two complementary parts – R&TD activities having the potential for exploitation in the

short to medium term (managed at DG TREN) and those which are expected to have an impact in the medium to longer term (managed at DG R&TD).

The long term research in bio-energy is carried out in 5 main areas: (1) Combustion technologies, (2) clean biofuels and standardization, primarily but not exclusively, for transport (3) gasification systems for efficient production of electricity and clean hydrogen-rich gas (4) energy from crops and waste and (5) bio-refinery aiming at the integrated production of energy and other products.

Second, the "Intelligent Energy for Europe" Program (IEE) supports the European Union's policies in the field of energy by providing funds for actions to remove market barriers to the increased use of energy efficiency and renewable energy sources. In this respect, the IEE program is complementary to the 6th Framework Program.

The first R&TD call of the "Sustainable energy systems workprogramme programme", under the 6th Frame Work has set aside €20MM for CHRIS gas and RENEW projects. Two project were selected to test and evaluate the performance of fuel cells coupled with BMG with a total budget of €5.5MM. The total budget for biomass projects in this of this call was over €40MM.

New Zealand:
New Zealand produces about 30 MM cu.m/yr of biomass. University of Canterbury in Christ Church has received a total of NZD 4.5MM to develop a small-scale two-stage biomass gasifier, similar in concept to the TUV FICFB gasifier. An industrial initiative was launched to build a 1.0 MWth gasifier employing the Fluidyne co-current downdraft system. Wood wastes will be gasified to supply steam for industrial application.

Italy:
The production of olive cake from oil extraction is estimated to be 500,000 TPY. The TPS plant in Greve, Chianti and the 3 MWth Thermoselect plant have been shutdown. The current notable BMG projects include the 3 MWth Wellman gasification plant and ENEA's design for a 160 KWth gasifier for China.

Austria:
The TUV FICFB BMG demonstration project in Güssing has logged in more than 13,000 hours of integrated operation with Jenbacher engines. The Wr. Neustadt gasifier is now in operation. A new initiative is participation in the RENEW project which involves BMG and F-T synthesis to produce transportation fuels. Other activities include the development of a 50 kWth capacity 10 bar, pressurized fluidized bed gasifier. This unit would be operated with steam and oxygen, in addition to air blown gasification.

Denmark:
With change in government the current biomass programs are under review as it is the case with other renewable energy RD&D. Plans are under way to scale-up the 2-stage

Viking process to 200kWe and the TK Energie project to 650 kWe. The 5.4 MWe capacity Skive demonstration plant is making progress.

USA:
The current R&D focus is on gas clean-up at GTI (engineered catalysts), RTI (Sud-chemie catalyst), NREL (Ni based tar reforming catalysts), and at Southern Company (removal of particulates and volatile metallic compounds).

The 50 kWe, Community Power Corporation (CPC) open-top, stratified, (no grate) gasifier is now in operation at the US Forest Service, in Louisiana. The power generator is a modified diesel engine. The 25 TPD of rice straw capacity, Pearson/Brightstar gasifier is now in operation in Mississippi.

A recent initiative is the Antares, Eastman, and PNL hydrothermal industrial sludge gasification project, using Ni and Rh catalysts for SNG and alkali catalysts for H2 production.

US DOE has invested about $80 MM in the commercial demonstration at the Georgia Pacific Big Island (carbonate pulp mill) project. This project with two, 210 TPD MTCI gasifiers, has demonstrated the first long duration tests lasting up to 25 days. Other design changes are being implemented to avoid bed sintering and to improve operational reliability.

The 22 MWe, FERCO Sylvagas Project is under consideration for scale-up and demonstration in Devon, UK.

STRUCTURE AND GUIDELINES FOR FUTURE TASK MEETINGS

The Task Members discussed the structure and the general program for the FUTURE semi-annual Task Meetings. The consensus recommendations are given below.

1. All Task members are urged to devote three full days to the Task Meeting. Late arrivals and early departures by Task Members diminish the value of group discussions and they also tend to interrupt the on-going proceedings.
2. In order to engage Task Members in discussion on technical issues and country activities, schedule these discussions along with other Task related matters for the **first day** of a three-day Task Meeting.
3. Day 2 should be set-aside for Task Workshop and Day 3 either for a plant/site visit or continuation of technical discussions, Country Reports and if required to extend the Workshop to a more than 1 day event.
4. In case there is no plant/site visit, the Task Leader should seek the majority concurrence of Task Members to move the Workshop to the 3rd day, so that there is continuity in discussion on matters from Day 1 that could be extended to Day 2.
5. To present detailed **technical** Country reports, allot adequate time and split these reports into 5 for each of the two semi-annual Task Meetings.
6. Develop an agenda with time assignments for all technical presentations and use the balance of time for the remaining 5 Country reports.

7. Plant/site visit is not a necessity for each Task Meeting. Visits should be scheduled primarily to see **new** and **informative** operations.

TASK DELIVERABLES
The reports for Workshops 1 and 2 are now under preparation.

FUTURE TASK MEETINGS
The schedule for the remainder of three Task Workshops, for the current triennium, is revised as follows:

Fall 2005 – WS4: Health, Safety, and Environmental Impact of Small-scale Biomass Gasifiers, in coordination with GasNet/ThermalNet, at a time and location to be determined by the GasNet group

Spring 2006, and **Fall 2006:**
1. WS 5: State of the Art of Gas Clean-up – tentatively listed for Spring 2006 in Germany.
2. WS 6: Co-firing Applications involving Biomass and Waste Gasification or a topic to be selected by the Task Members at the next Task Meeting in Fall 2005 - details TBD

The semi-annual task meetings will be held in conjunction with these workshops.

Attachment 1
IEA Bioenergy Agreement: 2004-2006
Task 33: Thermal Gasification of Biomass
Spring 2005 Meeting
Stockholm, Sweden
May 17-19, 2005
Agenda

Monday, May 16, 2005, Arrive at Best Western Mornington Hotel, Nybrogatan 53, Box 5197, 102 44 Stockholm, Sweden, Tel. +46 (0)8 507 33 000, Fax. +46 (0)8 507 33 039), (**http://www.mornington.se/m909.asp**)

Day 1, Tuesday, May 17, 2005: Task Meeting. Location: Best Western Mornington Hotel
8:30 AM- Introduction, S.P. Babu
Review and Approve Agenda
Review and Approve Minutes from Fall 2004 Task Meeting, held in Copenhagen, Denmark
9:00 AM – Detailed Country Reports
Sweden – Lars Waldheim, TPS(30 min)
Finland – Esa Kurkela/Matti Nieminen, VTT(30 min)
Switzerland – Ruedi Buhler/Serge Biollaz (30 min)
The Netherlands - Bram van der Drift, ECN(30 min)

United Kingdom – Nick Barker, AEAT, (30 min)
Discussion (30 min)
Noon: LUNCH
1:00 PM; Summary Country Reports from EC, NZ, IT, AT, DK, & USA (30 min)
1:30 PM: Gas Net & Task 33: Hermann Hofbauer, Gas Net Leader, TUV, AT (30 min)
2:00 PM: Task Deliverables

- Status of WS 1 Report on: Short, medium and long term perspectives of biomass gasification technologies, Suresh Babu, USA (15 min)
- Status of WS 2 Report on: Gas Cleaning & Gas Engines for Small-scale Applications, Henrik Christiansen, DK (15 min)
- Review & Comments on Health & safety Report, (see mid-Nov. 2004 e-mail report) – Ruedi Buhler, CH/Hermann Hofbauer, AT (15 min)
- WS 3 : Synbios Conference – Bram van Der Drift, NL (15 min)

3:00 PM: Coffee Break
3:30 PM: Comments, Discussion and Action Items.
Future meetings: WS topic, date, and location to be determined.

Fall 2005, **Spring 2006**, **Fall 2006:**

1. State of the Art of Gas Clean-up – tentatively listed for Fall 2005
2. Health and Safety of Biomass Gasification Installations – details TBD
3. Co-firing Applications involving Biomass and Waste Gasification- details TBD
4. Joint Activity with GasNet - TBD

5 PM : Adjournment/ 5 min. walk to Quay Nybroplan
5:30 PM: Leave by boat to a harbor island/Dinner at Sea-food Restaurant.
9:30 PM: Return by boat to Quay Nybroplan

Day 2 & 3: May 18 & 19: WS 3/ SYNBIOS Conference

END

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