

IEA Bioenergy Agreement: 2007-2009
Task 33: Thermal Gasification of Biomass
(Northern Hemisphere) Fall Meeting – 2008 Minutes

15-17 October 2008: TASK MEETING

Location: Novotel Montreal Centre, 1180, rue de la Montagne, Montreal, Quebec, H3G
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Prepared by
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16 November, 2008

The fourth Task Meeting for the 2007 to 2009 triennium was held from 15-17 October 2008 in Montreal, Canada.

Wednesday, October 15, 2008 – Fernando Preto has organized site visits to Plasco biomass gasification plant and NRC, Canada R&D facilities.

Thursday, October 16, 2008 – The list of attendees, for the Task Meeting on October 16 and 17, include: Lars Waldheim, TPS, SE, Thomas Kolb, FZK, Germany, Reinhard Rauch, TUV, Vienna, AT, Bram van der Drift, ECN, NL, and Bill Farthing and Suresh Babu, GTI, USA.

Others: Nesho Plavsic, Tom Browne, Blaine Kennedy, and Two Enerkem representatives.

Regrets for inability to attend were received from: Henrik Christiansen, Erik Winther, Philip Schild, Ilkka Hannula, Shu-sheng Pang, Ruedi Buhler, Serge Biollaz, Mehri Sanati, Vann Bush, and Richard Bain.

The Agenda was reviewed and amended to take into consideration the no-show-Task Members who had a role at the Task Meeting. The revised Agenda is shown in Attachment 1.

The minutes from the first semi-annual Task Meeting of 2008 held from April 21-23, 2008 in Vienna, Austria were revised with input from Task Members. The revised and approved minutes are posted on the Task 33 website.

1. Review of Task Deliverables for 2007-2009:

WS 2: Report on Procedures/Guidelines for Synthesis Gas Characterization is available on the Task 33 website. Further work on development of a Guideline will be explored in discussions between NREL, TUV, PSI, ECN, VTT, and GTI

WS 3 - HSE progress report: A German workshop on HSE in Biomass Gasification was organized from 8-9 August 2008, by Mr. Eberhard Öettel of FEE, Germany at Rosenheim, DE,. About 40 participants from DE, AT and CH attended the workshop,

about 80% gasifier manufacturers, 20% participants from authorities and HSE experts. The draft guideline was presented (main chapters with German translation) and discussed. The Guideline was discussed. Many different views were presented, sometimes controversial. Many participants made individual statements, but these could not be discussed in detail. In general there was agreement to the objectives of the guideline, and the need for the guideline. Several manufacturers showed interest in participating in selected case studies.

Many useful comments on the draft HSE guidelines were collected by H. Knoef, the task coordinator for this study. These were discussed at a progress review meeting, held at Buxton (UK) on 9 September 2008. In this meeting, it was decided to collect further comments and suggestions and upon review and evaluation, the HSE Guidelines will be revised as appropriate so that the next revised version could be made available by the end of 2008.

2. Feedback from EXCo 62: The Task Leader attended the EXCo 62 meeting only on October 14, 2008. On that day EXCo asked the Operating Agent for Task 33 (Mr. Paul Grabowski, US DOE EERE-OBP) to nominate the Task Leader for the next triennium (2010-2012). Mr. Grabowski submitted Dr. R.L. Bain's (NREL) name. Later in response to an inquiry, Dr. Josef Spitzer, Chairman EXCo summarized by e-mail the "The route to the next triennium" (as decided at ExCo62 on October 15 and 16) as shown in the following table:

ExCo62 October 2008	ExCo63 May 2009	ExCo64 October 2009	ExCo 65 May 2010
Agreement on structure/Task priorities/ Expression of interest for OA (intention to submit Task proposal)	Competing Task proposals available/go-ahead from EXCo/expression of interest by Contracting Parties to participate and to contribute to final Task planning	Tasks descriptions finalised and participation agreed/EXCo approval of Tasks (Work plan, budget) and firm decisions on participation	Revised Annex Documents Approved

The Chairman, EXCo has reported that all contracting parties would be invited to submit proposals for the new Task period (2010-2012). At EXCo 63 the decisions on these proposals will be taken, thus selecting Operating Agent (country) and Task Leader for the new Task period.

COUNTRY UPDATES: The following is a summary of Country updates on matters related to bioenergy in general and thermal gasification of biomass in particular.

Austria:

The principal BMG research organizations include Vienna, University of Technology, Institute of Chemical Engineering (TUV), Graz University of Technology – Institute of Thermal Engineering (GUT), Graz University of Technology - Institute for Apparatus

Design, Particle Technology and Combustion Technology (GUT), Joanneum Research Graz - Department of Energy Research, Austrian Bioenergy Centre, and FJ-BLT Wieselburg (HBLFA).

TUV is conducting R&D on dual fluidised bed steam gasification, production of Fischer Tropsch fuels, production of BioSNG, and use of product gas in fuel cells. TUV is a scientific partner in RENET Austria (Network of Competence for Energy from Biomass), Austrian Bioenergy Centre, and in Bioenergy 2020+.

GUT is working on evaluation and optimisation of a fixed bed gasifier, gas cleaning system and its integration with gas engine, R&D of a two staged gasification system, HSE issues of small-scale gasification systems, and on a heat pipe reformer/ gasifier (work initiated at the Technical University of Munich). GUT is a scientific partner of the Austrian Bioenergy Centre.

Graz University of Technology - Institute for Apparatus Design, Particle Technology and Combustion Technology is researching gasification and combustion in a fixed bed of solid fuel, and fundamental research on biomass particles under gasification conditions.

Joanneum Research Graz - Department of Energy Research is investigating 'Life Cycle Assessment' of bioenergy systems.

Austrian Bioenergy Centre is conducting R&D on pressurised gasification (in cooperation with TUV) and the use of product gas from biomass CHP Güssing plant in a SOFC.

FJ-BLT Wieselburg (HBLFA) is conducting research on 1st and 2nd generation biofuels and it is the current Austrian representative in IEA Bioenergy Task 39.

The BMG implementation projects include biomass based CHP and BioSNG at Güssing employing the TUV FICFB BMG process, Pyrotherm biomass based CHP at Güssing employing the Pyrofrce BMG process, and the commissioning of the next biomass based CHP at Oberwart, employing the TUV FICFB BMG process which is now in commissioning. A brief summary of the AT BMG projects is given below:

Owner	Type, Capacity	Biomass feed	Status
Biomassekraftwerk Güssing GmbH & Co., KG	FICFB, 2 MW _{el}	wood chips	in operation
BioSNG Demonstration	Methanation, 1MW _{SNG}	Product gas from biomass	in commissioning

		CHP Güssing	
Pyrotherm Kraftwerk Güssing GmbH	Pyroforce, 350kW _{el}	waste wood	in operation
Energie Oberwart	FICFB, 2.7 MW _{el}	wood chips	in commissioning

The particulars of the Oberwart TUV-FICFB plant are given below:

Owner	Energie Oberwart GmbH
Constructed by	Ortner Anlagenbau
Power production	2750 kW
Heat production	1500-6000 kW
Biomass type used	Wood chips
Status:	In commissioning

In addition to the continuing operation of the Güssing CHP plant, the construction of the pilot plant to demonstrate Synthetic Natural Gas (SNG) from biosyngas is progressing well at this plant, with financial support from the consortium of EU DG TREN research group. SNG production will be demonstrated on a significant quantity of slip-stream (~1/8) from this plant. The construction of the BioSNG plant was completed in July 2008, safety tests and electrical loop tests have been finished and cold commissioning is now in progress. The start of SNG production is planned around the end of the year. Support research for this effort at Güssing includes R&D on gas cleaning and methanation.

The status of the Pyrotherm CHP plant at Güssing is summarized in the following table:

Owner:	Pyrotherm Kraftwerk Güssing GmbH
Constructed by	Pyroforce / CTU
Power production	350 kW
Heat production (1) 70°C/90°C	437 kW
Heat production(2) 115°C	140 kW
Biomass type used	Clean waste wood from parquet floor industry
Hours of gas engine operation (as of 6 March 2008)	540 h, IBS Jan./Feb. 2008

Germany: The drivers for energy production from RES are CO₂ / Climate Change, security of energy resources, national economic well being, opportunities for new employment, and the political support.

The prevailing BMG Policy is Erneuerbare Energien Gesetz (EEG), RES act 2000 / 2004 / 01.01.2009 , which includes the following incentives for electricity from renewables. The bonus base is: 8.03 – 10.99 ct/kWh. The new technology bonus is: +2 ct/kWh / degr. 1%/a = BMG / FC / CHP / elec. eff > 45%. The NawaRo bonus: +2.5 to 6 ct/kWh = fct??? (fuel, power). The CHP bonus is: +3ct/kWh. This bonus is guaranteed for 20 years.

The goal set in 2004 is to produce 12.5% electricity from renewables by 2010 and the present goal is to produce 27% of total electricity from renewables by 2020.

The EU goal on biofuel blending (by 2010) is 5.75 %. In support of achieving this goal, both BtL fuel and EtOH from cellulose will be tax-free until 2015. A new EEG guidelines are scheduled for release by January 1, 2009.

Germany has several small-scale, residential level and industrial scale biomass combustors; the latter for CHP and co-firing applications. Germany's principal BMG activities are summarized below:

> 100MW → fuel, chemicals, (HP by-product):

1. **Choren/SHELL** (fuel: wood / 65.000 t ds/a, thermal load: 45 MWth, FT-fuel: 18,000 m³/a, pressure: 6 bar, and investment of ~ 100 Mio. €)

2. **Bioliq, LURGI/Air Liquide & FZK** (distributed pyrolysis processing 2 GJ/m³ straw from a radius of ~25 km, and transporting 25 GJ/nm³ pyrolysis liquids to a central synthesis gas and synthetic fuels plant located 250 km away which produces a liquid fuel of 36 GJ/nm³ heating value)

3. **UHDE** (details not available)

4. **LINDE** (details not available)

10 – 100 MW → heat, power, SNG

1. **ARTFUEL Cutec** (CFBG / steam - oxygen blown, fuel: dry bm 60 - 100 kg/h, thermal load: 400 kWth, temperature 900°C, pressure: atmospheric, and FT-synthesis)

2. **AER ZSW / DVGW** (Integrated Steam gasification with in-situ CO₂ removal with Cao and airblown combustor to burn char and calcine CaCO₃ system to produce SNG/LNG)

< 1 MW → heat, power : many small companies, communities, and local utilities

In general the hurdles to advancing BMG include: rising prices of wood, plant oil (RME), steel, and other materials, and cost of polygeneration, expensive credits and growing insecurity of banks, health, security and environmental aspects, lasting insecurity of plant construction and operations permitting procedures almost all over Europe, objective and reliable criteria for the evaluation of BMG by all interested parties, recent set-backs during long-term operations attributed to materials of construction, high carbon content in the ash (> 5 %), utility for large quantities of ash, the lack of low-cost, robust, slow-running engines, slip of CO and benzene in engine exhaust, growing pressure of internal and external markets to supply plants which are not sufficiently proven with long-term operation, public knowledge and perception, growing competition for feedstock, process efficiency, readily available combustion technologies, and competition from liquefaction and pyrolysis.

The key factors to foster the advancement and commercialization of BMG include: proof of reliability of operations of BMG technologies, continuing support R&D for biomass process optimization, reliable process cost evaluation, reliable fuel supply evaluation, stable economic situation (of overall and manufacturers of systems and system components), and a conducive economic climate for investment.

Sweden: The formulated national policy is to ensure secure energy supply in an economic way, and reduce GHG emissions by 4% by 2012, by using revenues from environmental taxation. Sweden follows the following EU policy guidelines:

- ETS: Base case 26 Mtonne CO₂, ~ 50% of total emission
- 2004-2007 23 Mtonne
- 2008-12 20 Mtonne in proposed allocation plan
- No free emission rights for existing plants

The utility sector gets zero emission rights and the renewable energy industry gets a high percentage of its emissions rights. In general, all bioenergy indicators are supportive of growth and promotion of RE in Sweden.

Under the prevailing biofuels directive, 2.2% blending was achieved in 2005 and 3.1 % was achieved in 2006. Energy tax reductions upto 9 billion SEK is available on biofuels up to 2011. The import duty on ethanol (EU duty 290 €/m³) was removed in 2008.

The significant RD&D programs include 85 MSEK for black liquor gasification, 40 MSEK for new biomass gasification R&D program, and 150 MSEK for 2nd generation BTL pilot activities for the period 2008-2010. Efforts are in progress to facilitate policy supported financing for 2nd generation BTL projects during the 2008-2010 period. Furthermore, the FY 2009 budget allocates 875 million SEK for demonstration of second generation biofuels and other energy technologies for the 2009-2011 period. The related statistics and information are available at www.energimyndigheten.se.

One of the successful commercial BMG plants in Sweden is the CFB Gasifier (see the particulars given below) at Värö pulp mill.

- Supplier: Götaverken
- Fuel: Bark, wood wastes
- Fuel capacity: 30 MW
- Gas usage: lime kiln
- Commissioning: 1987
- Development: Enriched air tests in 2003 to try to debottleneck lime kiln

The Foster-Wheeler CFBG at the Norrsundet mill will be shut-down in 2008.

Opportunities are being explored to convert combustion plants to BMG based co-firing plants. Such retrofit modification was demonstrated by installing a 2 MW_{th} BMG unit at the Chalmers' 8 MW CFBC unit. This retrofit application is planned with two-100 MW_{th} capacity CFBG units which could be installed at the existing peat and coal fired, 600 MW PF boiler of MälarEnergi, Västerås facility. The gasifiers will use assorted and demolition wood, etc. The installation when complete will employ flue gas cleaning in compliance with WID requirements.

Göteborg Energi along with M+W Zander FE GmbH, CTU - Conzepte Technik Umwelt & Repotec is investigating the installation of a 100 MW output (Göbigas) SNG Plant based on the TUV-FICFB indirectly heated gasifier along with KTH's tar reforming technology. A decision to proceed is expected in 2008. If approved operations may begin in 2012.

Additional funds of 30 to 40 MSEK may be provided to continue with the CHRISGAS mission to establish the Varnamo high-pressure CFBG unit as a long term research platform. The activities at the end of 2007 at Varnamo are listed below:

Hot tests - Sep. 2007

- Gas turbine operation (with fuel oil), 82 hrs
- Combustion of biomass in gasifier at 950 °C, for 24 hrs
- Gasification at 950 °C and 17.5 bar, for 13 hrs
- Gasification at full load, for 7.5 hrs
- Wood chip/pellet feed rate: 4.5 ton/hr
- Produced power, 304 MWh

Nov.-Dec. 2007

- Gas turbine operation (with fuel oil), 84 hrs
- Combustion of biomass in gasifier overnight
- Gasification at 950 °C and 17.5 bar, for 46 hrs during daytime
- Gasification at full load, 26 hrs
- Wood chip/pellet feed rate: 4.5 ton/hr
- Produced power, 432 MWh

BLG technology development and demonstration is progressing well with the Chemrec led team (with support and participation from ETC, Total, Volvo, Topsoe, PREEM, Delphi, and DuPont) to demonstrate pilot production of 4-5 tons DME/day, to set-up and operate 4 DME dispensing stations, and to demonstrate 14 DME fueled vehicles. The total budget for this effort is a total of 28M€, ~17 M€ for operating the BLG pilot plant, and the balance for the remaining activities.

Another project of interest is the next Generation BMG process, developed by EoN Sverige, for the production of electricity, heat, and substitute natural gas. Based on the techno-economics of this co-production process, conducted by EON, a 50 MWth demonstration plant is scheduled for commissioning by 2012/2013.

Canada: Sustainable Development Technology Canada (SDTC)'s mandate, as a policy instrument of the Government of Canada, is to deliver environmental and economic benefits to Canadians by fostering the development and demonstration of technological solutions that address: Clean Air, Climate Change, Clean Water, and Clean Soil. SDTC promotes innovative partnerships representing multiple players in the Innovation Chain and build a SD technology infrastructure. Furthermore, it ensures timely diffusion - increase number and rate of uptake of SD technologies into the market place across Canada, providing national benefits. SDTC funds technologies that are past the R&D stage but not yet commercial. In this process SDTC maintains confidentiality and protects innovators intellectual property (IP). SDTC funded Bio-based projects by type include:

1. Bioproducts/bioenergy technology road map
2. Types of bio-based feedstocks & sources
3. Bioproducts economy pathways
4. Emerging Biorefinery processes
5. Gasification
6. Pyrolysis
7. Fractionation, hydrolysis, fermentation
8. Oil seed crushing, separation, transesterification
9. Digestion, anaerobic
10. Combustion
11. Enabling technologies
12. Pretreatment, comminution, drying, cleaning
13. Biomass Gasification

SDTC recognizes, the need to produce clean BMG derived synthesis gas prior to gas conditioning, catalytic reforming and conversion to produce reactive intermediates and fuels such as alcohols (including ethanol) and chemicals in addition to heat and power.

So far, SDTC has provided financial support for technology development at Enerkem, Biothermica, Nexterra, Woodland, EnQuest, Terragon, and Aboriginal Cogeneration and it is now considering funding other projects.

Some recent announcements are Range Fuels and Poet Gasification projects.

Enerkem's thermochemical RD&D is focused on transforming multiple biomass feed stocks (sorted municipal solid waste, industrial and commercial waste, wheat straw, treated wood, wood chips, and wood residues) using low severity gasification and novel gas to liquids catalytic synthesis technology to produce biofuels and green chemicals. Enerkem claims to have developed a BMG based second-generation ethanol process and scaled-it up to industrial scale. In 2003 & in close collaboration with University of Sherbrooke, Quebec, Enerkem has set-up the Sherbrooke Pilot Plant and Research Center with a capacity to produce 125,000 gallons/yr of alcohols (methanol and ethanol). So far over 3,500+ hours of operations were logged-in with 20+ feed stocks.

Enerkem was founded in 2000 and it now has a total of 45 employees. It is privately owned and backed financially by US and Canadian investors (Rho Ventures, Braemar Energy Ventures & the Solidarity Fund QFL) and based in Montreal and Sherbrooke, Quebec. Three plants are in operation or under construction in Sherbrooke, Westbury, and Edmonton. Enerkem's R&D is also supported by government assistance at the Canadian federal (NRCan, SDTC) & provincial levels (Natural Resources Qc, AERI, Alberta). The Westbury Plant would be the World's First Second-Generation Ethanol Plant to produce 1.3 million gallons of ethanol per year (5 million litres) from treated wood (decommissioned power poles). The plant will use negative-cost materials that are usually land-filled. The conditioned syngas island is expected to be commissioned in November 2008 to be followed by ethanol production in 2009. With a tipping fee that is lower than the current cost of landfill (<\$70/tonne) and easier-access and cheaper feed stocks than corn and homogeneous cellulosic biomass, Enerkem expects to produce ethanol at a cost of approximately, <\$0.30/liter with <\$50 million capital cost.

The plant's second phase expansion will include residues from pulp and paper mills as well as municipal solid waste. When construction is completed at the end of 2010, the Edmonton plant is expected to be a model for urban centers. A 25-year contract between City of Edmonton and Enerkem/GreenField Ethanol, will employ 100,000 tons / yr (90% of Edmonton's landfill waste) of sorted municipal solid waste. Enerkem and GreenField Ethanol will build, own, and operate the plant to initially produce 10.4 million gallons of ethanol per year (36 million liters). The second phase will be followed by adding another 10.4 million gallons per year. Enerkem believes that the project will be less capital intensive and is profitable at lower operating scales than other technologies at about ~ 100,000 dry tons/y modules. The process is considered to be of low technology risk as it employs systems and catalysts that are industrially proven. The project will employ in-house team of process engineers; no dependence on third-party engineering or contractors. The commercial plants will be modular and 'skidable' at 10 M gal/yr (36 million litres) of ethanol production units, so that incremental capacity can

be added with additional modules. The water requirement & water disposal will be minimal.

Energkem has secured feedstock, sites and government assistance for ~85M gallons/yr of projects in Canada. It is also actively developing a number of other sites in various states in the United States.

The EnQuestPower Corporation project involves installation of a 5.8 MW combined cycle cogeneration power plant to provide heat and electric power to the grid. The plant will convert 24,000 tonnes/year of shredded municipal solid waste (MSW) into a clean syngas by steam gasification. The technology development focus will be to optimize syngas production, gas cleaning, and power generation.

Biothermica Technologies Inc. plans to couple a BMG unit to a Gazmont biogas power station. Biothermica will further develop, build and operate a pilot scale, 4 t/h fluidized bed, high pressure gasifier. Ultimately, Biothermica intends to use 35,000 tons/yr of construction and demolition waste and other urban wood waste to produce clean fuel gas for co-firing with landfill biogas in the 25 MW Gazmont power plant in Montreal. It is anticipated that syngas at \$4/GJ can displace natural gas at \$10 – \$12 /GJ. This demonstration will show the viability of coupling a fluidized bed gasifier to an industrial steam boiler. The project team has several decades of experience in biomass gasification, pollution control and thermochemical environmental processes and has marketed VOC thermal treatment technologies (BIOTOX process).

The Aboriginal Cogeneration project will use the Ankur down draft gasifier from India coupled with the gas scrubbing unit from EERC.

STDC is co-funding several biomass pyrolysis technologies. Canada is leading technology development in this field with the 70 ODT/day and multiples of Ensyn, Dynamotive pyrolysis plants. Dynamotive bio-oil is conditioned and used in Orenda/Magellan 2.5MW turbine generator. Ensyn pyro-oil is converted to wood smoke food additive and a substitute for phenol formaldehyde resin in composite board products.

Advanced BioRefinery Inc has developed 5 to 50 t/day portable pyrolyzers where the gaseous fraction is used for process heat but it also has potential for other applications. The char is used as fuel and converted to activated carbon for scrubbing flue gases and for other purposes. Pyrolysis liquids are used as liquid fuels by all projects but can be a source of many chemical feed stocks. ABRI has identified 200+ compounds in the pyrolysis liquids and it provides a platform for producing many products. The new ABRI flay sizer/dryer feeds the pyrolysis reactor which uses steel shot as the heat transfer medium that enables lower reaction temperatures and higher efficiency. ABRI contemplates developing 'Hub & Spoke' distributed pyrolysis integrated with a central gasification/production model.

STDC is also supporting the development of several enabling technologies listed below:

- Versatile, small scale biofuel energy systems
 - Small scale turbines for power generation and heat recovery: Altek with Magellan/Orenda 2.5 MW biofuel turbine
 - 2 stage, high temperature, slagging combustors for straws
- Biomass drying, comminution
 - Mechanical drying: Alternative Green Energy Systems (AGES) explosive deceleration mechanical, DryRex vacuum drying, FertiVal sludge drying, Elcotech electro osmosis, ABRI flay dryer
- Dehydration and cleaning
 - Polymer membranes: Vaperma, Whitefox
 - Microwave drying: Nutriloc
- Extraction, separation and enhancement of high value minor components
 - MCN, BioExx, Radient
- Vaperma Gas Separation Solutions

Biofuel advanced dehydration system uses an advanced dehydration process technology using a vapor permeation polymeric membrane. This has applications in the chemical, petrochemical and gas processing industries and increases energy efficiency (up to 40% on costs), easy integration in any fuel-grade ethanol process, modularity, flexibility, simple operation and low maintenance. The membrane would be capable of separating a 40/60 ethanol water vapor mixture to produce 99+% v/v fuel-grade ethanol. The technology employs the pressure differential across a novel capillary asymmetric, integrally skinned, combined polyimides and PVP polymer, membrane fiber which permits a high water flux and water/ethanol selectivity. They can sustain high temperature of 145°C and a pressure of 4 bars.

Nexterra was founded in 2003, with headquarters in Vancouver and Product Development Centre in Kamloops, BC. It grew from 2 to ~45 employees between 2004 and 2008. The core competency is in designing and manufacturing fixed bed updraft gasifiers and wood processing residues as the main fuel source. Its R&D activities are partially funded by SDTC, NRCan, NRC resulting in developing a complex technology including optimized gasification, syngas conveying system, syngas combustion in boiler and lime kiln burners. Since 2004, about 2,000 hours per year of pilot plant operation was conducted to refine the technology. So far the following projects have been signed and executed: 38 MMBtu/hr at Tolko, Kamloops; 72 MMBtu/hr at University of South Carolina, USA; and 10 MMBtu/hr at Docside Green, Victoria (as heat input)

Latest updates from Nexterra projects:

- Completed scale-up testing for 20-foot gasifiers
- Completed over 1,000 hours of pilot plant operation with the objective to optimize process of syngas tar thermal cracking;
- Designed a "slip stream" that includes syngas cleaning and 0.3 MW gas engine operations to be installed at the product development pilot plant in Kamloops.

- Signed a contract to deliver 72MMBtu/hr gasification unit to US DOE's Oak Ridge National Labs, Tennessee
- Negotiating contract with Kruger's Tissue Plant in New Westminster, BC to install a gasification unit that will include direct firing of syngas within the existing boiler, displacing natural gas

Near future plans of Nexterra:

- Install a slip-stream syngas cleanup process and gas engine at the product development centre in Kamloops
- Initialize testing program of the slip-stream line
- Test the existing process at the pilot plant when fed with fuel other than wood processing residues
- Continue commercializing already tested technologies

The NETHERLANDS: In 2007, Netherlands scaled down the introduction target for biofuels into the transport infrastructure from 5.75% to 4 %. The national R&D budget is distributed as follows: 31% renewable energy, 29% energy efficiency, 21% fossil, mainly CCS. The current (as of April 2008) subsidies for RE is given below:

	total price incl. subsidy	max. subsidy in contract period	contract period
wind on-shore	11 €/kWh	796 M€	15 years
biomass (<50 MW)	12 €/kWh	289 M€	12 years
waste	11.5-13.7 €/kWh ^a	187 M€	15 years
PV	56 €/kWh	46 M€	15 years
green gas ^b	27.7 €/m _n ³	16 M€	12 years

a: efficiency 22% to 31%

b: from digestion of sewage sludge/water treatment or landfill gas

A summary of the commercial BMG implementations is given below-

ESSENT: The 85 MW_{th} CFB gasifier is operating on demolition wood. The raw gas is cooled and cleaned in a cyclone prior to co-firing in the 600 MW_e coal-fired boiler (Amer-9 power station, Geertruidenberg, NL). In addition, 22 % of total fuel energy is supplied by co-firing of clean wood pellets using dedicated milling and burners.

NUON POWER: The 250 MW_e plant in Buggenum which started operations in 2002 is using up to 30 wt% biomass in co-gasification with coal in the Shell gasifier. At present the plant is using ~15

wt% demolition wood, which may be increased further to 30 or even 40 wt% in combination with clean wood. Tests are also planned to capture 1% slip stream CO₂ during 2010/Q1. The co-gasification performance will be utilized in the development of the Magnum project. The Magnum plant will start as a 1200 MW_e NG-fired plant with dual-fuel turbines. Biomass gasifiers will be added in next phase, to provide up to 50% biomass for co-gasification

HOST: The particulars about the chicken manure gasification in Tzum is given below:

- 3 MW_{th} CFB gasifier, cooler, cyclones, boiler, steam turbine
- flue gas cleaning: bag house filter
- 3500 h in 2007 (limited supply of chicken manure did not permit longer operation), ash to fertilizer industry
- in 2008 mainly test runs on RDF and MBM, emissions measured (to verify WID standards)
- Problem: location does not need heat, options considered: move the plant or add OLGA and gas engine
- several initiatives for new plants is under consideration

BIO-MCN (formerly: METHANOR)

- past: 900 kton/y methanol produced from natural gas in two parallel trains
- new owner: bio-MCN (Methanol Chemistry Netherlands) for bio-methanol
- first feedstock option: glycerin from biodiesel production
- since 30 March 2008: 20 kton/y plant started successfully
- planning: 200 kton/y in 2009/Q1 and 800 kton/y in 2010

ECN- OLGA

- interest from all over the world
- supplier Dahlman: 3 fte on OLGA
- crucial role in biomass-to-SNG development at ECN
- adapted successfully to the MILENA indirect fired gasifier
- work started to adapt OLGA for low-temperature gasifiers

ECN - MILENA indirect gasifier

- 160 kg/h pilot plant installed late 2007
- officially opened by minister on 4th September 2008
- Pilot plant tests have begun

ECN - SNG, technology choices (details at www.bioSNG.com and www.bioCNG.com)

- 10 MW CHP demonstration plant (MILENA with OLGA & gas engine) will be ready by 2012
- 50 MW SNG demonstration plant (MILENA, OLGA, etc.) will be ready by 2015
- HVC will team up with ECN in development
- HVC will be the owner of the demo plants

Proposed Scope of Work for the Next Triennium (2010-2012):

The discussion of prospective work for the next triennium is summarized below along with possible workshop topics:

Summary of tentative scope of work:

1. Conduct Semi-annual Task Meetings/ Technical Workshops (Joint WS where appropriate)
2. Survey & Exchange of Information/Maintain Task Website
3. Report/Update BMG Activities in Participating Countries & Other Selected Countries
4. Identify Gasifier Feeders that can handle Feed Stocks with Variable Properties
5. Discuss, Identify, and Address Sustainability (feed stock & water) and Social Responsibility Issues (job creation) – Joint Study
6. Monitor Advances in Gas Cleanup for BMG Applications
7. Second Generation Biofuels (Thermochemical & Biological Synthesis – Process and System Integration) + Identify Process Steps with Short Commercial Implementation Timeline/Warranties - Joint WS/Study with Task 39
8. Status of BMG Technologies, Related Bioenergy and Chemicals Production, and RD&D Needs
9. Encourage collaborative RD&D for Innovations and Market Development+ Examine opportunities for Embedded Generation with Forest Product Industries/Utilities as well as Integration with Chem. Process Industries & Refineries
- 10. Initiate Protocols for Characterization of Synthesis Gas for BTL** (Contact EC and national programs for financial support)**
11. Develop Safety and Environmental Guidelines for Small-scale Biomass Gasification Plants
- 12. Develop Position Papers for Policy and Decision Makers - Joint Study**
13. Survey (MS & RDF) Waste Gasification - Joint WS & Study w/Task 36
14. Publish Selected Results
15. Provide other EXCo Deliverables

**** - Bold & italics items 10 & 12 are new initiatives**

Summary of Prioritized Prospective WS Topics:

1. Second Generation Biofuels (Thermochemical & Biological Synthesis – Process and System Integration) + Identify Process Steps with Short Commercial Implementation Timeline/Warranties - Joint WS/Study with Task 39
2. Status of BMG Technologies, Related Bioenergy and Chemicals Production, and RD&D Needs
3. Monitor Advances in Gas Cleanup for BMG Applications
4. Identify Gasifier Feeders that can handle Feed Stocks with Variable Properties
5. Survey (MS & RDF) Waste Gasification - Joint WS & Study w/Task 36
6. Encourage collaborative RD&D for Innovations and Market Development+ Examine opportunities for Embedded Generation with Forest Product Industries/Utilities as well as Integration with Chem. Process Industries & Refineries
7. Discuss, Identify, and Address Sustainability (feed stock & water) and Social Responsibility Issues (job creation) – Joint Study

Future Task Meetings: A summary of the group discussion on future task meetings is given below -

1. First Semi-annual Task Meeting of 2009: Any 3 consecutive days during the Weeks 19 & 20 of 2009

WS Topic: Gas Clean-up for Synthesis Gas Conversion, Location: Karlsruhe, Germany – tentative structure & contributors: Task 39 Overview of 2nd Gen Biofuels R&D Survey (Keynote), Lurgi, Uhde, Linde, CHOREN, CUTEC, PORVAIR, Johnson Mathey, Sud Chemie, ITC-Hans Leibold, VTT, TUV+PSI, Haldor-Topsoe, BASF, ENERKEM, NREL

2. Second Semi-annual Task Meeting of 2009 – Date and Location: TBD

WS Topic: Operating Experience & R&D Needs; Tentative structure & contributors: Repotec, UPM/Andritz/Carbona, Babcock Völund, Foster Wheeler, CHEMREC, METSO (Gøtaverken), NEXTERRA, NUON, ESSENT, Biomass Engg, & PYROFORCE/CTU

END