

MINUTES
IEA Bioenergy Agreement
Task 33: Thermal Gasification of Biomass
Fall 2003, Task Meeting, October 27-30, 2003
Tokyo, Japan
Prepared by
Suresh P. Babu, Gas Technology Institute
Des Plaines, IL 60018, USA

The sixth Task Meeting for the 2001-2003 triennium was held with assistance from NEDO and Takuma Co., from October 27 to October 30, 2003, as a joint meeting of Tasks 32, 33 and 36. The list of Task Meeting attendees, and the complete list consisting of Task 32, 33 and 36 Members and invited speaker and observers for the one day seminar on October 28 on Operating Experience and Techno-economic Benefits and Environmental Benefits of Energy Recovery from Renewable Waste Materials are shown in Attachment 1. The Agenda for the entire Task Meeting is shown in Attachment 2.

The one-day seminar on Operating Experience and Techno-economic Benefits and Environmental Benefits of Energy Recovery from Renewable Waste Materials, was organized with 12 speakers and over 50 participants.

Monday, October 27, 2003: Task Meeting

Attendees: Matti Nieminen, Emanuele Scoditti, Martin Fock, Henrik Christiansen, Serge Biollaz, Reinhard Rauch, Bram van der Drift, Suresh Babu, Jorgen Overgard (invited speaker and observer from Denmark), and Akihiro Saiga (observer from Takuma Co., Japan)

Members Unable to Attend: Rich Bain, Erik Winther, Nick Barker, Esa Kurkela, Lars Waldheim, Kees Kwant, Kyriakos Maniatis, and Harry Knoef

The Agenda was reviewed and approved as proposed.

The minutes from the Spring 2003 Task Meeting were distributed to the participants for review and comments. Since, several of the attendees were substitutes for the regular attending members, they were requested to consult with the latter and return all comments and corrections to the task Leader by November 30, 2003.

Country Updates:

Switzerland: During the last 6 months the two pilot demonstrations, 130 KWth/60 KWe Xylowatt (the modified Indian Institute of Science gasifier with a demonstrated thermal efficiency of 72% and electrical efficiency of 23%) CHP plant in Bulle, Near Lusanne and the 400 KWth/200 KWe (target performance) Pyroforce in Spiez, continued to operate with focus on process optimization and automation.

There are now about 15 staff members at the Paul Scherer Institute (PSI), working on many aspects of thermochemical conversion of biomass to co-produce electricity by gas engines, gas turbines, and fuel cells and methane, hydrogen, methanol and liquid fuels from synthesis gas. PSI has built an updraft biomass gasifier for conducting lab tests with biomass derived synthesis gas. PSI has developed a tar sampling system using the Tar Protocol initiated by the IEA Thermal Gasification Task. PSI is also heavily involved in a variety of product gas characterization and slip-stream catalytic gas processing at the TUV FICFB demonstration plant in Guissing, Austria. PSI is interested in using the TUV process to produce substitute natural gas (SNG) from the biomass derived synthesis gas as a supplementary source of natural gas.

PSI is also evaluating the hydrothermal gasification of biomass to produce a raw gas rich in methane to produce and distribute SNG Process. Tests conducted at about 300 bar and 400° C, by heating a mixture of 18% wood, 9% proprietary catalyst, and the remainder 73% as water produced 34% CH₄, 21% H₂, and 45% CO₂.

Netherlands : The latest developments are summarized below:

Since reconstruction in 2002 and after 1500 hours of operation, the 85 MWth, AMER/ESSENT co-firing CFBG is now shutdown as planned for inspection and maintenance. The longest continuous run was for 5 days. The only persisting problem is solids handling.

HGP Systems Integration BV employs a 5 MWth Omega downdraft slagging gasifier from the company Oxytec (100% daughter of Umwelt Kontor Renewable Energy GmbH) in Leipzig, Germany. This gasification technology will play a role in a future demonstration project in the Netherlands where biomass will be converted to methanol as transportation fuel. The consortium for this initiative has been established.

BTG is continuing work on catalytic cracking of tar. In Bladel a 300 kWth reverse flow catalytic cracker has been operated for 1150 hours downstream a chicken manure gasifier at temperatures of 900-950°C. A reverse flow thermal cracker, a variation of the reverse flow catalytic cracker, has been tested at 30 kWth and temperatures of 1200-1400°C. It showed reduction in tar concentrations to 50 mg/mn³.

Shell and ECN are investigating the technical issues related to entrained flow gasification of wood. A joint project where different biomass-to-syngas technologies have been evaluated is finished.

ECN has recently installed new units connected to the existing 0.5 MWth pilot plant CFB-gasifier: gas cooler with probes to monitor deposition, high-temperature filter, oil based OLGA tar washer, new version of water based GASREIP gas cleaning, and low-NO_x afterburner. ECN is considering torrefaction of biomass to reduce the cost of size reduction and improve the reliability of feed handling for entrained flow gasification, which is considered a good option to produce syngas from biomass. SPS is a Dutch industry trying to bring torrefaction reactors into the market of co-combustion.

Finland: VTT and Condense OY have developed a new type of updraft fixed-bed gasifier (www.tekes.fi/opet/pdf/OPET_Report_4_2002.pdf). Condense OY will build a ~6 MWe

demonstration gasifier (Novel gasifier) which will use three 1.8 MWe Jenbacher gas engines. The 40 MWth, Corenso BFB gasifier in Varkaus, in central Finland has been operating successfully since 2001. The gasifier feedstock consists of plastics and aluminum containing waste materials, which require a lower gasification temperature compared to BMG. The product gas has a higher heating value of 12 MJ/nm³.

Engineering design is underway, to build two 50-80 MWth MSW gasifier in Helsinki. The fuel gas will be used to co-fire in existing boilers to reduce the amount of Coal currently used in the boilers.

The 60 MWth Lahti project is operating successfully with waste solids containing up to 60% moisture.

The VTT biomass gasification R&D projects include a variety of gas cleaning and gas processing experiments with a slip stream at the Lahti co-firing plant. VTT is also investigating advanced ash management methods to improve overall economics of fluidized bed gasification of biomass.

Italy: The 30-month program on 'clean energy from biomass,' utilizing molten carbon fuel cells is in progress. This program includes catalytic steam gasification of biomass, hot gas purification and integration with a 125 MWe MCFC. AMGA Spa, Genova has built two updraft fixed bed gasifiers with a capacity to produce 500 KWE. Rossano Energia is building a 4.5 MWe Prime Energy gasifier/combustor, using olives pits as the primary feed. The 1.1 MWe Thermosteel plant in Fondotoce di Verbania is in operation.

Denmark: Denmark consumes about 850 PJ/year of energy. A new 520 MWel installation outside Copenhagen - Avedøre 2 - is using straw, straw pellets, wood chips and natural-gas, operating at an electrical efficiency of 51 %.

The Danish Energy Research Program has increased from 30 MKR in 2003 to 75 MKR in 2004 and demonstration projects have been included in the scope of the Program.

Danish Plants in continuous operation include:

1. Viking gasifier - a two-stage, gasification unit involving the Biomass Gasification Group at DTU. The Viking gasifier is in continuous operation (<http://bqq.mek.dtu.dk/webcam/>).
2. Harboøre - the development of the updraft gasification unit has successfully reached continuous engine operation

The Danish R&D projects in focus in 2004 include:

1. AC Energy and Vølund will further develop the technical integration of the Vølund Gasifiers and Ansager Stirling engines.
2. The BioSynergi two stage gasifier in Græsted 100 kWel has been installed

3. Danish Fluid Bed Technology will verify and scaleup of the Low-Temperature Circulating Fluidized Bed gasifier. The small pilot plant has been scaledup to 500 kWth and is currently being constructed. The reactor operates at 700°C to pyrolyze biomass. The residual char containing most of the original alkali and chlorine, is then gasified to produce a product gas with very little tar.

4. The Thomas Koch Energy gasifier in Gadstrup has been scaledup from 100 kWth to 1.5 MWth for installation in Gjøl.

5. The Høgild project has been mothballed, due to the liberalization of the electricity and heat market in Denmark.

Projects under development include the 16-20 MWth, Skive CHP plant, using Carbona's Renugas Process, which is expected to supply 50% of the town's heat requirements. The feedstock for this plant is wood pellets.

The Danish Energy Research Program and the Danish Public Service Obligation Program have decided to put high priority to staged gasification, and add on gasifier systems. Priority will be given to the existing ongoing gasification projects. Denmark would like to design, build and operate totally automated gasifiers that does not require any on-site operators.

Application has been submitted to scaleup the Viking gasifier to 200 kWel. An industrial partner WEISS has been included in the consortium.

Haldor Topsøe has decided on a three year development program for SOFC fuel cells.

Austria: No change in policy. However, demolition wood is subject to certain limitations. Forest wood gets the highest electricity rate at a 15 Eurocents/KWh.

The Austrian bioenergy, 'Energy from biomass program' includes the 8MWth TUV-FICFB Guissing demonstration project in Burgenland. This plant has operated successfully for 1200 hours with an Jenbacher gas engine. The plant is now being modified to develop a reliable method to feed, make-up inert solids. A smaller 2MWth, downdraft gasifier is currently being built in Wiener Neustadt, Niederösterreich. Gas Cleaning employs ESP. This plant will also produce electricity using the Jenbacher gas engine. Plans are underway to develop a pressurized TUV-FICFB gasifier.

USA: The USDOE has recently formed the National Bioenergy Center (NBC) at NREL. NBC now coordinates the national biomass R&D program. Complementing this effort, both NREL and PNNL, under the auspices of NBC has pooled their respective staff and research facilities to define and conduct a variety of support research projects to advance thermochemical conversion of biomass.

DOE has completed the modular biomass gasification program and it has completed its support for the FERCO Sylvagas project.

The present focus is on \$ 20 million/year biomass conversion to value-added chemicals and fuels projects, cost-shared with industry. These projects employ chemical and biological conversion schemes to process cellulosic biomass. However, in the near future DOE anticipates issuing solicitations to advance biomass gasification to produce synthesis gas for subsequent conversion to chemicals and liquid fuels. DOE has awarded a contract to the GTI research organization in Birmingham, Alabama to address issues related to integrating biomass gasification with forest product industries.

At present, the largest biomass gasification technology development effort in USA is the Georgia Pacific's low-temperature black liquor gasification (referred to as Steam Reforming) demonstration using the MTCI Process. The objective of this project is to develop and demonstrate a biomass gasification-based power generation system that will utilize existing wood waste fired boilers and flue gas cleanup systems. A 2-train demonstration plant with a total capacity to gasify about 200 TPD of black liquor solids is now being tested at Big Island, Virginia.

Discussion of Subtask Studies and Schedules for Completion

1. Gas Cleaning for Moving-bed BMG Coupled to Gas Engines (Coordinator: Harry Knoef, BTG, NL with input from CH, DK, IT, FI, UK, and USA) – Joint Subtask study with GasNet.

Harry Knoef has recently forwarded a revised Technology Brief which will be posted on the Task website. The Task members are requested to review and send their comments, if any, to Harry with a copy to the Task Leader.

2. Gas Cleaning and Effluent Characterization for CFB and FB BMG (Coordinator: Esa Kurkela/Pekka Simell, VTT, Finland)

VTT will shortly publish the slipstream hot-gas (tar) clean-up work that is being conducted at the Lahti co-firing plant. The final draft Technology Brief should be available for review and comments in October 2003. The Technology Brief will also include references for those who want to obtain complete information on published case studies etc.,

3. Toxicity of Waste Water Generated from Gasification of Woodchips (Coordinator: Henrik Christiansen, DEA and Martin Fock, dK Teknik, Denmark)

Martin Fock has forwarded the final report, prepared by Lund University under the sponsorship of the Danish Energy Agency, which is now posted on the Task website.

4. BMG to produce Synthesis Gas and Hydrogen or Hydrogen-rich Gas and Gas Utilization in High-temperature Fuel Cells and Gas Processing to Produce Liquid Fuels and Chemicals (Coordinator – Reinhard Rauch, TUV, Austria, Richard Bain, NREL, USA and Suresh Babu, GTI, USA) - Joint study with IEA Annex 16: Hydrogen

A draft report on BMG FOR HYDROGEN PRODUCTION – PROCESS DESCRIPTION AND

RESEARCH NEEDS, prepared by Suresh Babu was submitted to Annex 16. The report is posted on the Task website.

The draft Technology Brief on BMG to Produce Synthesis Gas for Fuel Cells, Liquid Fuels and Chemicals is posted on the Task website. The final report should be completed by the end of this year.

5. Tar Protocol (on-going multinational study, coordinated by Mr. John Neeft, ECN/NOVEM, NL with support from FI, DK, UK, and USA)

The final report from this subtask study that should be valuable in implementing standard procedures for characterizing and measuring tars in raw BMG product gases. Suresh Babu will contact John Neeft to determine and report the status of this subtask.

6. Review and update on Energy Conversion Devices (Coordinator, Emanuele Scoditti ENEA, IT and N. Barker, AEAT, UK)

The final draft was completed and posted on the Task website. Task members are requested to review and send their comments, if any, to Emanuele with a copy to the Task Leader so that the final report can be completed by the end of this year.

7. Fuelgas Co-firing, (Coordinator - Dr. Ronald Meijer, Kema, NL) - Joint study with Task 32, Biomass Combustion and Co-firing

The final draft Technology Brief was completed and posted on the Task website. A copy of the draft Technology Brief was forwarded to the Task 32: Biomass Combustion and Cofiring, Task Leader for review and comments. Task members are also requested to review and send their comments, if any, to Ronald with a copy to the Task Leader so that the final report can be completed by the end of this year.

8. Municipal Solid Waste / RDF Gasification and Energy Recovery – (Coordinator – Nick Barker, AEAT, UK) - Joint study with Task 36, Energy from Integrated Solid Waste Management Systems and Techno-economic Assessment for Bioenergy Applications

On behalf of Task 36 David Granatstein has completed a Case Study on Waste-Fueled Gasification Project Greve in Chianti, Italy, which is posted on the Task 33 website. Mr. David Granatstein has also prepared a case study on the Zeltweg co-firing plant in Austria. Upon receiving the final report, it will also be posted on the Task website.

Following the three-task joint meeting, involving Task 32, 33, and 36 in Tokyo, Japan, from October 27-30, 2003 a joint report on energy recovery from wastes will be prepared and posted on the Task website.

9. Country Reports (Coordinator, Kees Kwant, NOVEM, NL) – Joint study with GasNet.

A report on BMG activities in all the participating countries of Task 33 and GasNet was recently

completed and distributed to members of both groups. The report is posted on the Task website.

Friday, May 30, 2003: Task Meeting - contd.

Legislation Regarding Technical Issues, Emission and Effluent Limits, Safety, Permitting, and Financial Considerations (Coordinator: R. Buehler, U+E, CH) – Joint study with GasNet. After considerable discussion this particular subtask was revised to: Health, Safety, and Environmental Aspects of Small Scale BMG Systems, and the Coordinator and team will be selected from: CH/AT/UK/FI/BE. It was also decided that this subtask should be deferred to the next triennium.

METHODOLOGY FOR PERFORMING WORK DURING 2004-2006

The group has also spent considerable amount of time discussing and developing the methodology for conducting subtask studies for the next triennium, 2004-2006. The Task as a whole selected the topics and agreed to initiate the subtask studies by organizing technical workshops, at the semi-annual Task meetings. Industrial and academic experts will be invited to participate in the workshop with Task members. Each subtask and the associated workshop will have a coordinator supported by a working team of 3 to 4 members. The presentations and discussion at the workshop will constitute the basic information and guidelines for the subtask studies. Reports resulting from these studies will be reviewed by the Task members, revised if necessary, and published to assist and aid private groups and government agencies interested in commercializing BMG. These reports should also be useful for national policy makers to identify the research needs for further development and advancement of BMG. Preliminary reports from the workshops will be published within 6 to 12 months from the workshop date and the final reports will be published in Fall 2006. The following table lists the the subtask studies, workshops, and schedules developed at the Spring 2003 Task meeting:

Meeting	Workshop/Subtask	Workshop Date & Location
Spring 2004	WS1: Short, medium and long term perspectives of biomass gasification technologies Coordinator and team to be selected from: SE/NL/UK/USA	May 5-7, 2004 (Proposed) * Austria *- May 10-14: 2 nd World BM Conference, Rome, Italy
Fall 2004	WS2: Co-firing Applications by Biomass and Waste gasification Coordinator and team to be selected from: FI/NL/UK/BE	Date: TBD Belgium or Finland
Spring 2005	WS3: Gas Cleaning & Gas Engines for Small-scale Applications Coordinator and team to be selected from: UK/Denmark/Belgium	Date: TBD Denmark or UK

Fall 2005	WS4: Health, Safety, and Environmental Aspects of Small Scale Systems Coordinator and team to be selected from: CH/AT/UK/FI/BE	Date: TBD UK (No. Ir)
Spring 2006	WS5: Hydrogen and Synthesis gas for Fuels and Chemicals (co-op. with Fossil Energy conversion people) Coordinator and team to be selected from: SE/NL/AT/IT/USA	Date: TBD USA or Sweden
TBD	WS7: Economic, environmental and legislative issues (WID, landfill directives, subsidies, green certificates etc)-Tentative	Date: TBD Location: TBD

The semi-annual Task meetings as proposed will last for three days; one day for the workshop, one day for conducting Task related matters, and the third day will be used for plant visits.

The methodology described above, the subtask topics, the coordinator and the working group for each subtask will be reviewed and finalized at the beginning of CY 2004, prior to initiating the activities for the next triennium.

Few members have stated the desire to seek nominal financial support from the Task for conducting subtask studies. It is reported that the European GasNet activity pays for such studies and these members asked Task 33 to make similar arrangements. The proposal approved for the current triennium (2001-2003) does not include any provision for financial support for conducting subtask studies. After taking this request under consideration, the Task Leader has revised the Task-continuation proposal, for the next triennium (2004-06), submitted to EXCO. The revised proposal has set aside a sum of \$10 to 15K per year to partially finance such subtask studies. The EXCO will consider this proposal at its next meeting from 27-31 October, 2003 in Campinas Brazil and provide their feed back to the Task Leader.

Cooperation with Other Tasks: Task 33 is in active cooperation with some of the IEA Bioenergy Tasks, IEA Annex 16 on hydrogen, and European GasNet. The joint subtask studies are identified above.

In addition to the joint subtask studies, Task 33 has conducted a joint Task Meeting with GasNet on Wed. October 2 and Thursday, October 3, 2002 in Strasbourg, France.

Task 33 is in the process of coordinating the organization of a joint Task Meeting October 27-30, 2003 in Tokyo, Japan with Task 32, Biomass Combustion and Co-firing and Task 36, Energy from Integrated Solid Waste Management Systems and Techno-economic Assessment.

A meeting was held in August 2003 with Mr. Gerard Closset, Coordinator of Annex XV, Black Liquor Gasification, to discuss and identify technology areas of common interest. Mr. Closset presented the mutually agreed proposal to collaborate in the area of gas cleanup and conditioning and the production of liquid fuels and chemicals from biomass-derived synthesis gas, at a meeting of Annex XV held in August 2003 in Sweden. The proposal was well received and

approved by Annex XV. The proposed cooperation will be launched beginning CY 2004, subject to approval from the IEA Bioenergy Agreement, EXCO to continue Thermal Gasification of Biomass Task into the next triennium, 2004-06.



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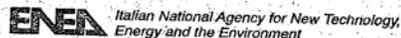
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IEA Bioenergy Agreement
Task 33: Thermal Gasification of Biomass
Fall 2003 Task Meeting
Tokyo, Japan

AGENDA

Confirmed Task 33 Attendees: Reinhard Rauch, TUV, Martin Fock, DK Teknik, Matti Nieminen, VTT, E. Scoditti, ENEA, Serge Biollaz, PSI, Bram van der Drift, ECN, Henrik Christiansen, Danish Energy Authority, Suresh Babu, GTI

Task Members Not Attending: Esa Kurkela, VTT (Matti Nieminen attending), Erik Winther, ENERGI E2, Kyriakos Maniatis, EC, Ruedi Buhler, U+E, (Serge Biollaz attending), Kees Kwant, NOVEM (Bram van der Drift, ECN attending), Nick Barker, AEAT, UK, and Richard Bain, NREL, USA

Invitees/Observers: Hiroaki Harada, Mitsui Engineering & Shipbuilding Co., Ltd, Daisuke Ayukawa, TAKUMA CO, LTD, Jorgen Overgaard, JO-CONSULT,

Day 1– Monday, October 27, 2003, Task Meeting.

Location : Takuma's Office in Tokyo, Eitaro Bldg., 8th floor,2-5, 1-chome, Nihonbashi,Chuo-ku,Tokyo,Japan,Zip:103-0027,Tel: 03-3276-7211, Fax:03-3276-7207

9 AM : Leave Mielparque Hotel, Escorted by Takuma staff by Taxi to Takuma Office in Tokyo.

9:30 AM Introduction

Review and Approve Agenda

Review and Approve Minutes from Spring 2003 Task Meeting, held in UK.

BMG RD&D: Country Reports – ALL

UK – Nick Barker, AEAT

CH – Serge Biollaz, PSI

FI – Matti Nieminen, VTT

IT – Emanuele Scoditti, ENEA

DK – Henrik Christiansen, DEA or Martin Fock, DK Teknik

SE – Lars Waldheim (to be confirmed)

12:30 – 13:30 - Lunch

AT – Renhard Rauch, TUV

NL - Bram van der Drift, ECN

USA – Rich Bain

Future Work (2004-2006) – Developed during the Spring '03 Task Meeting, London, UK

First meeting for the next triennium – May, 2004 in Austria (to be confirmed)

Wrap-up/Actions

19:00 : Dinner Hosted by Takuma

Day 2 – Tuesday, October 28, 2003, Invited Industrial Presentations
Location: Mielparque Hotel, 2-5-20 Shibakoen Minato-ku Tokyo 105-8582, Phone#: 03-3433-7211, Fax#: 03-3433-3895

Operating Experience and Techno-economic Benefits and Environmental Benefits of Energy Recovery from Renewable Waste Materials

9.30 Opening remarks from Chairman

Session to be chaired by Niranjana Patel

9.45 Handling heavy metal contaminated wastes and evaluation of energy recovery technologies

Mr Jorgen Overgaard, JO-CONSULT, International Environmental Consultants, Haarby Fyn, Denmark.

10.10 Operating experience with pyrolysis/gasification of wastes and ash melting in energy recovery from waste materials

Mr Hiroaki Harada, Mitsui Engineering & Shipbuilding Co., Ltd, Tokyo, Japan.

10.35 Coffee

Session to be chaired by Suresh Babu

11.00 Operating experience with energy recovery from waste

Mr. Daisuke Ayukawa, TAKUMA CO, LTD , Japan.

11.25 Practical experiences of the calorific value sensor and practical issues in optimising the control concept of grate combustion.

Mr. Robert van Kessel, TNO, Netherlands

11.50 Experiences on waste wood combustion in Sweden

Mr. Magnus Berg, AAF-Energi & Miljö AB, Sweden

12.15 Practical issues of co-firing and gasification of biomass

Mr. Gary Walling, Alliant Power Generation, USA

12.40 Lunch

Session to be chaired by Jaap Koppejan

13.50 Waste gasification: Experience from Amer co-firing project (waste wood) and a special 2-stage gasifier (Gibros Pec)

Mr. Bram van der Drift, ECN, Netherlands

14.15 Three fluidised bed gasification case studies

Mr. David Granatstein, Canada

14.40 Combination – a novel concept to reduce costs without changing the environmental standards of waste combustion

Mr. Juergen Vehlow, Germany

15.05 Abstract of waste and biomass energy conversion technology development in Japan

Mizuhiko Tanaka, NEDO, Japan

Tea

Session to be chaired by Niranjana Patel

16.00 Development of gas engine using pilot oil for waste gas

Sumio Koroda, Sumitomo Metal Co. Ltd, Japan

16.25 Introduction of waste power generation with natural gas repowering system

Nishioka Tohru, Sakai municipal office, Japan

16.50 Closing

Time?? – Dinner hosted by NEDO (to be confirmed)

Day 3 - Wednesday, October 29, 2003 – Plant Visit

Site Visit Programme, Leave from Mielparque Hotel
09.00 – 12.30

Toshiba -NEDO project/ Development of high-efficiency waste gasification power generation technology - A 10 TPD pilot plant for the development of high-efficiency waste gasification power generation technology is located in Yokohama City, Kanagawa Prefecture. The plant includes a high-temperature air pre-heater made of austenitic stainless steel. The preheated air is used for the gasification step.

Toshiba Corporation entered into a technology collaboration agreement with PKA Umwelttechnik GmbH & Co. KG (PKA), to develop and demonstrate a pyrolysis and gasification system to treat diverse household and industrial waste, including shredded cars, tires, plastic waste, and contaminated soil. The waste is processed into usable products, among them clean combustible gases, such as hydrogen and carbon-monoxide, ferrous and non-ferrous metals, and carbon. Another advantage of the system is that emissions of dioxins, NO_x and SO_x into the atmosphere are substantially lower than with conventional waste treatment systems. The overall system provides an environmentally-friendly and efficient solution for treating a wide range of waste, and recovering resources for reuse.

Following separation and preparation, waste is fed into a rotary kiln that is externally heated to 500-600 °C . The organic gas generated in the kiln is then lead to a cracker, a high temperature thermal decomposer, where dioxins are almost entirely destroyed and the organic gases are cracked into their light components. The gas is next transferred to a gas cleaning system, which removes chloride and sulfur, leaving a clean reusable gas. The metal residue from the kiln can be reused. The carbon residue can be used as a reduction material in furnaces, and also can be supplied to a gasification device to produce combustible gas, which is mixed with the pyrolysis clean gas.

Mistubishi: - NEDO project/ Development of high-efficiency waste gasification power generation technology - To develop a fluidized bed pyrolysis reactor that uses "steam+oxygen" as the fluidizing agent.

Kanazawa MSW plant. Incineration plant for MSW with Stoker furnace(1,200t/d=400x3furnaces), steam power generation equipment(35,000kw), ash melting equipment(60t/d) and heat utilization facilities(a heated pool and a waste spring)

Lunch in Kamakura
Sightseeing in Kamakura

Day 4 - Thursday, October 30, 2003, Task 33 Meeting (Continued)

Presentations and Discussion of Subtask Studies and Schedule for completing and publication of Technology Briefs and Reports:

1. Small-scale systems – Harry Knoef (Suresh Babu to contact Harry Knoef)
2. Gas Cleaning and Effluent Characterization for CFB and FB Gasifiers - Esa Kurkela/Pekka Simell/Matti Nieminen, VTT, Finland, Coordinators.
3. Emissions and Effluents, Process Waste Water from All Sources, Emissions Regulations, Permitting, Toxicology and Environmental Issues - Henrik Christiansen, DEA and Martin Fock, DK Teknik, Denmark, Coordinators
4. Biomass Gasification to produce Synthesis Gas and Hydrogen or Hydrogen-rich Gas and Gas Utilization in High-temperature Fuel Cells and Gas Processing to Produce Liquid Fuels and Chemicals - Reinhard Rauch, TUV, Austria, Richard Bain, NREL, USA and Suresh Babu, GTI, USA, Coordinators, Joint study with IEA Annex 16:H2
5. Fuel Gas Co-firing, Ronald Meijer, Kema, NL, Coordinator - Joint study with Task 32, Biomass Combustion and Co-firing
6. Review and update on State-of-the-art Energy Conversion Devices, E. Scoditti ENEA, IT and N. Barker, AEAT, UK, Coordinators
7. Municipal Solid Waste / RDF Gasification and Energy Recovery – Nick Barker, AEAT, UK, Coordinator (Joint study with Task 36, Energy from Integrated Solid Waste Management Systems and Techno-economic Assessment for Bioenergy Applications)

Next Triennium : Format, Minutes, Reports, Industry Participation, Special Topics, Meeting Dates, and Locations

OPEN

Action Items/Wrap-up

Noon-13:00 – Lunch

13:30 Opening remarks from NEDO director

13:40 Opening remarks from METI(Ministry of economic ,trade and industry)

14:00 Opening remarks from IEA Bioenergy Mr.Niranjan

14:20 The situation of RPS law and Waste power generation Pf.Dr.Takao

Kashiwagi

15:00 rest

15:20 Key technology of Biomass firing and co-firing Dr.Sjaak Van Loo

15:50 Key technology of Biomass gasification Dr.Suresh Babu

16:20 Key issues in energy recovery from MSW Dr.Niranjan Patel

16:50 The trend of Waste power generation Dr. Kiichiro Ogawa

17:20 end

18:00 – END OF THE MEETING

* - Proposed Coordinators