International Energy Agency
Bioenergy Agreement
Task 32, Triennium 2004 - 2006
Biomass Combustion and Cofiring

Working Group Meeting

Arranged by:

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Content:

Minutes of the 1st Task Meeting, triennium 2004 - 2006
Working Group Meeting-Biomass Combustion and Cofiring

May 14, 2004
Hotel Art Deco
Rome, Italy

IEA Working Group Meeting Task 32
Biomass Combustion and Cofiring
May 14, 2004, Rome, Italy

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Programme

Friday June 14 Morning: Task 32 cofiring workshop

Chairpersons: Sjaak van Loo and Bill Livingston

From	Topic
9:00	Sjaak van Loo, IEA Bioenergy Task 32 Welcome and introduction
9:05	Jaap Koppejan, TNO, NL Introduction and overview of technologies applied worldwide
9:20	Larry Baxter, Brigham Young University, USA Biomass Cofiring Overview
9:40	Tom Miles, T. R. Miles, Technical Consultants Inc., USA Recent experiences of cofiring switch grass at the Ottumwa generating station
10:20	Bo Sander, ELSAM Engineering, DK Full-scale investigations of straw co-firing
10:40	*Refreshment break*
11:00	Ronald Meijer, KEMA Status of cofiring in the Netherlands
11:20	Stephen Schuck, Bioenergy Australia Country experiences in Australia
11:40	Bill Livingston, Mitsui Babcock Results of recent cofiring trials in UK
12:00	Pasi Vainikka, VTT Results from cofiring experiments from the world's largest biofuel fired CFB of Alholmens Kraft in Finland
12:20	Discussion and closing

Friday June 14 afternoon: Task 32 meeting

From	Topic
13:30	Opening, news from IEA Bioenergy ExCo (Sjaak van Loo)
13:45	Minutes of last meeting
14:00	Review of Cofiring workshop and formulation of policy statement
14:30	ThermalNet proposal
14:40	Results from Task projects
	- CHP overview (Ingwald Obernberger)
	- Cumulative Energy Demand (Thomas Nussbaumer)
	- Efficiency of biomass combustion (Thomas Nussbaumer)
	- Striated Flows (Larry Baxter)
	- SCR deactivation (Larry Baxter)
	- Cofiring overview (Jaap Koppejan)
16:00	*Coffee/tea break*
16:15	Planning for current triennium
	- Proposed deliverables
	- Workshops
18:00	Handbook of biomass combustion and cofiring
	- Results of external review
	- Approach for second edition and division of tasks
19:00	Closing
20:00	*Task dinner*

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Summary of the meeting

Cofiring workshop

Task 32 has organised a workshop on Biomass Cofiring on Friday morning 14 May 2004 in Rome, Italy. The workshop with the full title 'Biomass cofiring: current trends and future challenges' was an official part of the 2nd World Conference and Exhibition on Biomass for Energy, Industry and Climate Protection, held 10-14 May 2004 in Rome, Italy.

Cofiring biomass with coal is becoming increasingly popular around the globe for various reasons. It is often found to be a relatively low-cost measure for large-scale renewable energy generation. Depending on the specifications of biofuels to be cofired, various configurations exist, varying from directly mixing biofuel with coal and joint firing, pregasification and parallel firing. However, there are several barriers that hinder actual implementation, such as uncertainty about the legal and political environment, liberalization of the energy sector, as well as uncertainties about long term fuel supplies at low costs. Another issue is the utilization of fly-ashes, which is often not allowed if the ash is partly from biomass origin.

Sjaak van Loo (Task leader of IEA Bioenergy Task 32) and Bill Livingston (Mitsui Babcock) chaired the workshop and gave an overview of the aims of the workshop and presented all speakers. The overheads of his brief introduction are enclosed in Annex 1.

Jaap Koppejan presented an overview of technologies applied worldwide the current status of cofiring worldwide, the presentation is enclosed in Annex 2. Around the globe, over 150 installations have experience with cofiring biomass, covering a wide variety of different types of biomass and boiler configurations and capacities. Several plants have been retrofitted for demonstration purposes, while another number of new plants are already being designed for involving biomass co-utilisation with fossil fuels. Typical power stations where co-firing is applied are in the range from approximately 50 MW_e (a few units are between 5 and 50 MW_e) to 700 MW_e. The majority are equipped with pulverised coal boilers (tangentially fired, front-wall fired, back-wall fired, dual-wall fired and cyclone). Furthermore, bubbling and circulating fluidised bed boilers, cyclone boilers, and stoker boilers are used. Tests have been performed with every commercially significant (lignite, subbituminous coal, bituminous coal, and opportunity fuels such as petroleum coke) fuel type, and with every major category of biomass (herbaceous and woody fuel types generated as residues and energy crops). As a relatively straightforward and low-cost option, direct cofiring is most commonly applied. Biomass fuel and coal are burned together n the same furnace, using the same or separate mills and burners depending on the biomass fuel characteristics. In the concept of indirect cofiring, a biomass gasifier can be used to convert solid biomass raw materials into a clean fuel gas form, which can be burned in the same furnace as coal. This offers the advantages that a wider range of biomass fuels can be used (e.g. difficult to grind) and that the fuel gas can eventually be cleaned and filtered to remove impurities before it is burned. Experiences with this option are rather limited. Examples are the Zeltweg plant in Austria and the AMERGAS project in the Netherlands. Finally it is also possible to install a completely separate biomass boiler and increase the steam parameters in the coal power plant steam system. An example is the Avedøre Unit 2 Project in Denmark.

Larry Baxter (BYU, USA) presented an extensive overview of issues related to cofiring biomass in pulverised coal (PC) fired boilers. Cofiring represents a combination of renewable and fossil energy utilisation that derives the greatest benefit from both fuel types. It capitalises on the large investment and infrastructure associated with the existing fossil-fuel-based power systems (e.g. fuel shipment and storage facilities as well as flue gas cleaning installations), while requiring only a relatively modest investment of typically $50-$300/kW of biomass capacity to include a fraction of biomass in the fuel. If there are no motivations to reduce CO_2 emissions, these additional costs are hard to justify. When compared to alternative renewable energy sources however, biomass cofiring generally turns out to be significantly cheaper. Major technical concerns when considering cofiring biomass in any coal power plant are related to pollutant formation, carbon conversion, ash management (deposition and corrosion), deactivation of SCR catalyst. An extensive amount of lab and field work done recently indicates that there are no irresolvable issues, but there are poor combinations of fuel, boiler, and operation. More details on the technical issues can be found in Annex 3.

Tom Miles ((T. R. Miles, Technical Consultants, Inc., USA) presented some recent experiences of cofiring switchgrass at the Ottumwa generating station. In December 2003, a test burn with 753 tons of switchgrass was done at this PC boiler (equivalent to 2.5% of heat input). The first aim was to optimise the performance of the switchgrass processing equipment. A separate facility was used for debaling, shredding and transporting the switchgrass. The equipment has shown to perform really well. The impact of cofiring swithgrass on air emissions was also determined. Emission measurements showed no effect on NO_x and CO, a positive effect was observed for SO_2, stack opacity, particulates and mercury. A large amount of fly ash samples was taken and analysed, the exact effects on the technical quality and marketability of the fly ash have yet to be evaluated. Finally, the experiments showed that the overall performance of the Ottumwa Generating Station was not affected. A 90 days test is foreseen for 2005 to evaluate boiler performance and collect data on corrosion, erosion, slagging and fouling. After this test, commercial cofiring of 100..200 kton/year of switchgrass is foreseen. Overheads presented are enclosed in Annex 4.

Bo Sander of Elsam Engineering A/S presented some of the major results of two years experience with cofiring straw at 10% of heat input in the 824 MW_{th}/350 MW_e Studstrup PC boiler. When cofiring straw, Loss of Ignition (LoI) in fly-ash typically reduced. Water soluble alkaline and chlorine in the fly-ash also increased as a result of the higher concentrations in the fuel. The use of such fly-ash in concrete is expected to be allowed by the end of 2004, after an amendment of national rules on the basis of a revised EN450. For this purpose a compliance test programme has been initiated with the Danish concrete industry. The tests experience at Studstrup indicates no noticeable negative effects on ash deposition or corrosion. Tests with deactivation of high-dust SCR catalyst show a decrease in performance, however this deactivation rate is not larger when cofiring straw as compared to firing coal alone. Ongoing work focuses on long term corrosion, the alkali-chlorine-sulphur chemistry and the production of a CFD model for optimisation of the co-firing plant configuration. Further, long term high dust SCR catalyst deactivation tests are foreseen. Overhead sheets of his presentation are enclosed in Annex 5.

Ronald Meijer of KEMA, Netherlands, presented the current status of cofiring biomass in pulverised coal fired power plants in the Netherlands. The overhead sheets are enclosed in Annex 6. Cofiring in the Netherlands is stimulated by the coal covenant with the Dutch government, that enforces coal power plants to cofire up to 12% heat input of biomass from 2008 onwards, requiring approx. 2.2 Mtons of biomass/waste. This is enabled by financial instruments, such as a subsidy per kWh. Experience exists with a wide variety of biomass in the different power plants in a large number of tests performed since 1995. Cofiring up to 10 mass% is already common practise for most power plants. The major technical challenges that determine the success of a cofiring scheme are related to

- Biomass grindability,
- Capacity of the unit operations,
- Slagging, fouling, corrosion, erosion
- Possible effects on fuel gas equipment (FGD + SCR)
- Occupational health and safety aspects
- Emissions
- Quality of the ashes
- Load following behavior, (un)availability
- Heat balance, efficiency
- Integration

Some major non-technical challenges that coal power plants are confronted with are related to obtaining environmental permits and environmental constraints, dealing with fluctuations in availability and quality of the biomass in relation to flexibility of the biomass processing equipment and maintaining the quality and applicability of the by-products. Most power plants only cofire biomass directly, using the same or separate mills and burners for the biomass as for the coal. In order to increase the share of biomass in the primary fuel mix, several plant owners are now considering indirect cofiring using a CFB gasifier.

Stephen Schuck (Bioenergy Australia) presented the current status of cofiring biomass in Australia. Four power plants owned by Delta and Macquarie up to 2000 MW_e currently cofire wood waste commercially up to 5% by weight, this is done by directly metering the biomass on the coal conveyor. This concerns various types of wood waste with up to 60% moisture content. Several other plants have gained experience on the same concept in various trials.

Bill Livingston (Mitsui Babcock) is involved in several test trials for cofiring biomass in UK. Cofiring is of interest here because of the significant financial incentives provided to generators under the Renewables Obligation Order. Under certain restrictions, cofiring biomass in existing coal power plants is eligible. Some main commercial restraints are the availability of suitable biomass and the absence of a proper logistical infrastructure to get it to the plant. Because of the limited availability, plant owners generally decide to import fuels that can be contracted in large quantities, such as solid residues from the olive oil and palm oil industries. Power plant owners are generally unwilling to invest in transportation and handling of biomass, therefore preblending by the coal purchasing company is the preferred route in many cases. 14 out of 15 coal fired power plants already have experience with cofiring and four have gone into commercial operation after successful test trials and obtaining agreement on the Variation to the Authorisation under Section 11 of the EPA.

A major technical challenge is related to the milling behaviour of biomass, as most types of biomass usually do not mill by a brittle fracture mechanism and the heat balance can be disturbed (particularly for wet biomass). This may result in accumulation of biomass in the mill, and affected size distribution of the coal particles. Further, when cofiring larger amounts of biomass, the increased release of volatiles in the mill may cause safety risks. In practise, acceptable performance and controllable risk of the mills is first validated during a test trial on a single mill, after which cofiring can be rolled out to the other mills.

The experience with cofiring biomass in Brittain up to 10% heat input indicates no significant impacts on boiler performance. Environmental impacts have also been negligible. There have been some minor problems with dust generation in the coal handling plant when using preblended fuels. Sheets are enclosed in Annex 8.

Finally, **Pasi Vainikka** (VTT) presented some results from cofiring experiments with the world's largest biofuel fired CFB of Alholmens Kraft, Finland, see Annex 9. This plant with a boiler of 550 MW_{th} is now already for 2.5 years in commercial operation and burns annually 50% peat, 25% wood and 25% coal, however any combination of these fuels is possible. Experiments have been carried out with various shares of peat, coal, bark, logging residues and wood chips, leading to a wide variety in contents of sulphur, chlorine as well as many minerals (Ca, K, Zn, P, Na, Al, and Si).

SO_2 emission was shown to be largely reduced when cofiring biomass with peat and/or coal due to the high Ca content of wood fuels, forming calcium sulphates and thereby avoiding the formation of corrosive alkaline chlorides. Chlorine bearing deposit formation can be avoided by appropriate fuel blending. The 'protective elements' required for such reactions can be supplied in the boiler in peat and/or coal ash. However, as a result of fuel blending, change in the composition of fuel ash can dramatically change ash melting behaviour.

The research also indicated that the S/Cl atomic ratio in the gas phase is a much better parameter than the S/Cl ratio in the fuel when describing the corrosion propensity of fuel blends in biomass cofiring. With higher shares of peat and especially coal, the effect of aluminium silicates should also be assessed. Finally, the amount of nitrous oxide (N_2O) increases steeply when coal is blended to the biomass blend. This could be an issue if there will be emission limits for this compound in the future.

Task 32 meeting

Opening, news from IEA Bioenergy ExCo (Sjaak van Loo)

This first task meeting of the new triennium took place in the afternoon of Friday 14 May 2004 in hotel Art Deco in Rome, Italy, immediately after the 2nd World Conference and Exhibition on Biomass for Energy, Industry and Climate Protection, held 10-14 May 2004. Sjaak van Loo welcomed all participants to the task meeting and a brief introduction was made by all participants. Ten out of eleven member countries were represented at the task meeting. Stephen Schuck from SINTEF represented Brett Corderoy as country representative for Australia. In addition, Thomas Brunner (Bios, Austria) attended the meeting. The overhead sheets used by Sjaak van Loo to present several issues at this task meeting are included as Annex 10.

At ExCo52 (Campinas, Brazil, Oct 2003) it was decided which countries would participate in the next triennium. In addition to New Zealand that already indicated withdrawal before, USA and Finland regretfully also announced that participation will not be extended. A reason for the withdrawal of Finland is the overlap in activities that appeared to exist with the Implementing Agreement on Fluid Bed Conversion. Biomass combustion here takes place for a large part in fluid bed combustion installations. At ExCo53 (Lucerne, Switzerland, May 2004) it was suggested that Task 32 should further explore options for collaboration with both the IEA Implementing Agremeements on Clean Combustion Sciences and Fluid Bed Conversion. Further the ExCo also appreciates continuation of earlier work by Task 32 on aerosols.

South Africa is expected to join the ExCo, while Germany is also considering becoming a member. Both countries can benefit significantly from participation in Task 32 considering the presence of several biomass combustion plants in Germany and large coal power plants in both countries. Further, the high level or research in the area of biomass combustion in Germany could also be very valuable to other members of Task 32. After formal agreement on the ExCo membership of these countries, Sjaak van Loo will start to communicate with the relevant focal point to check the interest.

In connection with ExCo53, a Task Leader workshop was organised to promote communication between the ExCo and Task Leaders. Here it was stated that Tasks were requested to provide more output in a form that could be used by the ExCo to provide advice to individual governments on designing enabling policies, such as statements, reports, etc. Sjaak van Loo has volunteered to design a format for progress and annual reports that reflects a more focused Task reporting procedure. The type of information wanted relates to R&D priorities, success stories etc. It was further agreed at this Task Leaders workshop that this shift in focus from pure R&D to implementation could be pursued from the year 2005 onwards, by reserving 10% of the task leader's budget to the production of such outputs.

The ExCo will change its structure as well, with more distinct focus on scientific progress on one hand and on policies on the other. The use of outputs of the individual tasks in the ExCo should be safeguarded by a Task Force, composed of a number of ExCo members and Task Leaders. In the future, at least one Task leaders/ExCo workshop will be organised per triennium.

Minutes of last meeting

The minutes of the previous task meeting, held 27 Oct 2003 in Tokyo, Japan, were accepted without further comments. Earlier an option was given to all task members to respond to a draft version sent electronically. The final version will be distributed in print shortly after the meeting.

Review of Cofiring workshop and formulation of policy statement

A brief reflection was made on the cofiring workshop, held earlier on the same day. This event was considered very successful, with over 50 participants and very relevant and interesting presentations. It was concluded that organising workshops or seminars on combustion/cofiring related issues in combination with an existing large conference or other event is a good approach that should be maintained in future.

In order to fulfil the request of the ExCo to produce statements, it was decided to produce a policy statement on the relevance of cofiring already during this task meeting. A draft for such a statement was already made during the task meeting with input from all task members. It was decided that Jaap Koppejan will add additional paragraphs containing an introduction, success stories and the need for R&D. This draft document is enclosed in Annex 11.

ThermalNet proposal

A relatively large proposal named ThermalNet has been submitted to the European Commission under the 6th Framework Programme for the formation of a closely integrated cluster of three networks on biomass combustion, gasification and pyrolysis. ThermalNet can be regarded as a follow-up of Gasnet and Pyne and also addresses commercialisation issues and providing support for more rapid and more effective implementation of all the technologies in the market place. The project is based on a matrix of three technologies and eleven tasks (divided into technical and non-technical areas) that provide interaction between common issues but retain the individual requirements and opportunities of the three technologies. Over 50 experts will provide the technical input through a programme of meetings and related activities.

With regard to combustion and cofiring, several members of Task 32 are involved with Sjaak van Loo as coordinator of this subnetwork named CombNet. As the aims of CombNet closely link to those of Task 32, interaction with Task 32 is foreseen on several occasions. Mutual meetings will also improve the interaction between combustion and gasification and pyrolysis.

Internet site

The Task 32 internet site attracts an increasing number of visitors, reaching up to approx. 3000 per month as of early 2004. Visitors of the internet site are mostly interested in downloading meeting reports and publications. Another topic of continuing interest is the FUELSIM model, developed by Øyvind Skreiberg.

Results from task projects

The status of all task supported projects was discussed; an overview per topic is given below.

CHP overview (Ingwald Obernberger)

This study has been finalised March 2004 and yielded two separate reports that are both available at the Task 32 internet site:

- Basic information regarding decentralised CHP plants based on biomass combustion in selected IEA partner countries
- Techno-economic evaluation of selected decentralised CHP applications based on biomass combustion in IEA partner countries

Ingwald Obernberger highlighted some of the main results. The first report provides an overview regarding the framework conditions and status of implementation for decentralised CHP plants (usually < 20 MW_e) based on biomass combustion in selected IEA partner countries, i.e. Austria, Belgium, Denmark, Finland, the Netherlands, Sweden and Switzerland. All participating countries have defined different targets concerning electricity production from renewable energy sources, three countries (Belgium, Denmark and Finland) have additionally defined targets concerning electricity production from solid biomass.

The second report describes the techno-financial aspects of steam turbine processes (two plant configurations), ORC systems and Stirling engine based CHP systems. The following technical data is provided for all system types:

- Basic process description
- Interface between the CHP technology and the combustion plant
- Operating behaviour and efficiencies
- Control system and personnel demand
- Maintenance demand
- Special (technology related) operation costs
- Ecological aspects
- State of development
- Weak points
- Fuel characterisation and handling

Further, the second report provides detailed basic financial data (investment costs, O&M costs etc.) and evaluates financial performance of the different concepts under varying market conditions and frameworks. This may help potential investors to evaluate the financial performance of a certain CHP system under given market conditions or governments to design appropriate legislative and financial frameworks that stimulate market introduction of biomass combustion based CHP systems.

Cumulative Energy Demand (Thomas Nussbaumer)
This study was finalised by Thomas Nussbaumer January 2004 and resulted in a report titled 'Evaluation of Biomass Combustion based Energy Systems by Cumulative Energy Demand and Energy Yield Coefficient', which has been distributed and is also available at the Task 32 internet site (see http://www.ieabcc.nl/publications/Nussbaumer_IEA_CED_V11.pdf). In addition, the results of this study were also presented by Thomas Nussbaumer a few days earlier in an oral presentation at the 2nd World Conference and Exhibition on Biomass for Energy, Industry and Climate Protection. The paper for this presentation can be seen in Annex 12, the visual presentation is enclosed in Annex 13.

The study presents a method for a comparison of different energy systems with respect to the overall energy yield during the life cycle. For this purpose, the Cumulative Energy Demand (CED) based on primary energy and the Energy Yield Factor (EYC) are introduced and determined for different biomass fuels and combustion systems (both heat and CHP).

To enable a reasonable interpretation of the results, the energy demand related to the fuel consumption during plant operation is considered, which is often not the case for figures presented on non-renewable fuels in literature. The calculations are performed once with respect to all fuels used during operation (denoted as CED and EYC), and once with respect to non-renewable fuels only, hence without counting the energy content of the biomass (denoted as CED_{NR} and EYC_{NR}). The evaluation and comparison of both, EYC and $EYC_{N}R$, enables a ranking of energy systems without a subjective weighing of non-renewable and renewable fuels.

For a sustainable energy supply, it is proposed to implement renewable energy systems in the future which achieve an energy yield described as EYC_{NR} of at safely greater than 2 but favourably greater than 5. A parameter variation is performed for the plant efficiency, the transport distance, the fuel type for drying used for pellet production, and the heat distribution in case of district heat. A visualisation of the sensitivity of these parameters reveals a relevant influence on the ranking of the different scenarios and hence confirms the importance of these characteristics which are identified as key parameters.

For the reference scenarios and for an identical annual plant efficiency of 80%, an energy yield for non-renewable fuels of EYC_{NR} = 13.8 is achieved for log wood, of 13.0 for wood chips, of 9.0 for wood chips with district heating, of 8.3 for eco-pellets produced from saw dust with biomass used for drying, and of approximately 3.3 for wood pellets dried with fossil fuels. If the electricity from power production from biomass is used to drive local heat pumps for heating, similar or even higher energy yields are achievable than for direct heating with wood chips.

These results show, that all investigated scenarios based on biomass combustion are reasonable with respect to the overall energy yield. In comparison to heating with fossil fuels, biomass combustion enables CO_2 savings by approximately a factor of 10 for wood chips, eco-pellets and log wood, and by a factor of 4 to 5 for wood pellets, if fossil fuels are used for drying. It also shows that transportation of wood chips by truck still makes sense from an energy point of view up to transporting distances of at least 1500 km (depending on the type of woodfuel and combustion system).

The methodology developed and the scenarios described in this publication can be used as a basis for decisions to choose the most efficient energy systems based on biomass combustion in the future. The method can also be applied to other technologies for biomass utilisation and to other energy sources.

Efficiency of biomass combustion (Thomas Nussbaumer)
This study was initiated in 2003, and is continuing in the triennium 2004-2006. This study was started to evaluate different methods used in practise for the determination of efficiencies of automatic biomass combustion plants, using both theoretical and experimental investigations. It concerns both combustion efficiency, boiler efficiency and annual plant efficiency.

Cost effective determination of efficiencies is particularly important for operators of relatively small automatic (woodfuel) combustion plants who have to pay fuel suppliers on the basis of the energy content of the fuel. In this case the costs of measuring efficiency can be significant in comparison to the price of the fuel.

In this project, theoretical investigations of the appropriateness of using the different efficiencies have already been performed by Verenum. For an assessment of the experimental determination of the three efficiencies, systematic measurements are to be carried out in three automatic biomass combustion plants:

- a test bench in Belgium, which allows an independent operation for the measurements.
- two plants in practical operation in Switzerland.

Some delay has occurred in the implementation of these experiments due to technical problems with the test bench in Belgium. It is expected that this project can be finalised in the course of 2004. The presentation of Thomas Nussbaumer on this study is enclosed as Annex 14.

SCR deactivation (Larry Baxter)
This project focuses on SCR deactivation when cofiring biomass. It is increasingly admitted that SCR catalyst deactivation can be a showstopper for cofiring certain types of biomass and therefore proper R&D on this topic is highly relevant.

Experiments at BYU have shown that a dust layer on an SCR does not necessarily imply degradation of the performance. However if the catalyst becomes wet, water soluble contaminants deteriorate the catalyst. At BYU an online SCR deactivation measurement setup is available that can be installed in an existing full scale PC power plant that cofires higher percentages of biomass. All task members are requested to consider if such a plant can be identified. Further, task members are asked to submit SCR samples that have been exposed to biomass/coal flue gas mixtures, as well as similar samples that have been exposed for the same time on a pure coal flue gas. Also, anecdotal evidence is welcome that could support developed theories and expectations of SCR deactivation. A final report with the results of this project will be delivered in 2004.

Striated Flows (Larry Baxter)
This task project aims at validating the computational predictions on increased corrosion/ash deposition rates that may occur in a typical PC boiler as a result of striated flows and inhomogeneous gas composition profiles. A final report will be delivered in 2004.

The project has already yielded some interesting results, e.g., the analyses have indicated that a slow velocity, high diameter oxygen lance may achieve better mixing conditions than a high velocity, small diameter oxygen lance. For the validation of the results, cooperation is sought with power plants that have experimental data.

Cofiring overview (Jaap Koppejan)
A brief presentation containing the status of this task supported project is included as part of Annex 10. As of December 2003, approximately 150 coal fired power plants have been identified with experience with cofiring biomass. A database containing the below information has been prepared:

- Country and location of the plant
- Plant name and owner
- Type of cofiring (direct/indirect/parallel)
- Boiler type (pulverised coal/CFB/BFB/grate /….)
- If PF: burner arrangements (tangential/stoker)
- Output (MWth and MWe)
- Primary coal type
- Cofired fuel(s)
- Max cofiring% on heat or mass basis
- Duration of test or commercial operation
- Fuel preparation
- Technology supplier
- Contact information

A draft report of this project will be circulated amongst the task members in June 2004. In August 2004 the results will be put on the task's website, for this purpose a web-based user interface of the database has been developed. The project will be continued in the coming years, as a rapidly increasing number of power plants are performing trials and continue to commercial operation.

Planning for current triennium

As a result of the reduced number of countries that participate in Task 32 during the new triennium, the relatively low exchange rate of the US$ against the Euro and the requirement of the ExCo to allocate 10% of the Task leaders budget to specific outputs required by the ExCo, there will be significantly less budget available to (co)funded projects that can be implemented in addition to normal information exchange (mainly the regular semi-annual task meetings and publication of various reports both in print and on the website). In the new triennium, the Task's focus will therefore be more on translation of results towards policy-related outputs, thereby following national priorities. At the meeting the members of Task 32 have agreed to deliver the following outputs in the new triennium:

Workshops
6 Workshops in connection with each Task meeting on topics to be agreed on, followed by a policy statement. A tentative planning of workshops is listed below:

Topic	Organizing country	Planning
Co-firing	Netherlands	May 2004 (already done)
Public perception	Canada	Aug- Sept. 2004
Aerosols	Austria	March 2005
Fuel flexibility	Sweden	Not yet decided (in connection to a FB Conference
Corrosion and deposit formation	UK	Not yet decided (if opportune in connection to a ThermalNet meeting)
Optimisation of small scale systems	Denmark	Not yet decided (if opportune in connection to a pellet conference)

Handbook of Biomass Combustion and Cofiring
A revision of the first edition of the Handbook on Biomass Combustion and Cofiring will be prepared, based on the suggestions made by external reviewers. Detailed and very useful comments per chapter have been received from Bo Leckner (Chalmers University) and Bo Sander (Elsam Engineering). Although the best approach suggested is a complete and thorough revision of the book, an easier alternative is the inclusion of more information on energy chain by rewriting Chapter 2, while other parts need relatively minor rearrangements and thorough editing.

It was decided that the editing of the revised handbook will be done by a single person. At the next task meeting the revised Table of Contents will be discussed.

Task shared projects
In addition to the above mentioned activities (workshops and a revised Handbook), other task-shared-projects can be initiated by members and facilitated by the Task Leader. In order to arrange such cross-border knowledge transfer effectively, a format was distributed by the Task Leader in which task members could indicate national programs or large projects in which specific research is currently performed that may be of interest to other Task members. Only three countries have yet responded, others are also requested to fill in these formats in order to enable a proper evaluation of possibilities for cooperation.

Planning of next meetings

The next (second) meeting of Task 32 in this triennium will be held 3 Sept 2004, immediately after the IEA Bioenergy Conference on Science in Thermal and Chemical Biomass Conversion in Victoria, Vancouver Island, Canada.

At this meeting Task 32 will also organise a workshop on the public perception of cofiring biomass. It was earlier recognized by Task 32 that attention should be paid to the public image and policy aspects of biomass combustion and cofiring. Experience has shown that many decision makers as well as the larger public consider the various options available for (co)combustion of biomass often unattractive for different reasons, which can often be a result of misunderstandings. Examples of topics in this workshop are:

- When cofiring biomass and coal, the biomass fraction can be regarded as renewable energy
- Being available already, residue based fuels can be considered more renewable than dedicated energy crops that still require external inputs
- What policies would work to increase the amount of bioenergy in the primary energy mix
- To what extent could biomass combustion have a real impact and what are the associated costs and greenhouse benefits?

The third Task meeting in the triennium 2004-2006 will be held March 2005 in Austria, in combination with a seminar on aerosols.

The time and location of other meetings have yet to be decided, this will depend on other conferences and meetings that are being organised and that link with the topics for workshops as agreed (see page 18).

Future actions of Task 32

- A first draft will be prepared for a revised Table of Contents for the second edition of the handbook.
- The next meeting of Task 32 will be held in Victoria, Sept 3 2004 immediately after the IEA Bioenergy Conference on Science in Thermal and Chemical Biomass Conversion, Mon 30th Aug to Thu 2nd Sep 2004.
- March 2005 a workshop on aerosols will be organised by Austria. Other workshops for which no dates have yet been decided are on fuel flexibility, corrosion and deposit formation and optimisation of small scale systems.
- All are invited to submit information on coal power plants that have performed test trials on cofiring or that have already gone over to commercial operation of cofiring biomass to Jaap Koppejan of TNO, Netherlands.
- The draft statement on biomass cofiring prepared during the Task meeting will be further elaborated by TNO and commented on by other Task members before agreement and further distribution.
- All are requested to forward data on national research programmes or major projects related to the interest of Task 32 to the Task Leader, in order to facilitate knowledge exchange in accordance with the priorities of Task 32.
- Practical data (e.g. exposed SCR samples) are requested on both SCR deactivation and striated flows in PC boilers. For the first topic, a location is desired where real-life tests can be performed. Please contact Larry Baxter of BYU, USA