



## Results of the ENCAP — CASTOR Common Training Seminar / Workshop

The ENCAP - CASTOR common Training Seminar / Workshop was successfully implemented on 16<sup>th</sup> March 2006 at Hotel LEGOLAND in Billund, Denmark.

Issues related to CO<sub>2</sub> pre- and post-combustion capture and CO<sub>2</sub> storage were covered.

The status on CO<sub>2</sub> pre- and post-capture technologies outside the EU (e.g. in USA and Japan), was also presented.

More than 100 experts from Research Centres, Industry, Manufacturers, Universities participated in the event. Furthermore, Governmental and EC officers related to Environment and Climate Change were present.



The event was kicked-off by the ENCAP Project coordinator, Vattenfall

AB, with an opening speech given by Mr. Lars Stromberg, addressing the need to develop and evaluate cost effective and efficient CO<sub>2</sub> capture, transport and storage technologies. Mr. Lars Stromberg also mentioned the decision of Vattenfall to construct an oxyfuel 30MWh pilot plant in Cottbus, Germany adjacent to Schwarze Pumpe power plant.



Mr Tore A. Torp, from STATOIL, presented an overview of the demonstration projects either carried out or planned in the field of CO<sub>2</sub> transport and storage. These projects aim at better understanding of the various engineering, environmental and cost factors that are involved in. Finally, Mr Torp concluded that next steps in the way forward, should be focused on building trust and clarifying a legal &

regulatory framework concerning the long-term CO<sub>2</sub> storage.



A keynote speech was given by Mr. Philipp Troppmann representative of the European Commission, DG Research, Research Fund for Coal & Steel. Mr. P. Troppmann presented the objectives and the energy priorities of the 7<sup>th</sup> Framework Programme. He also provided an insight to the organizational structure and the action plan of the Technology Platform for Zero Emission Fossil Fuels Power Plants (ZEFFPP TP). Finally, he concluded with a brief introduction to the Research Fund for Coal and Steel (RFCS) Programme which constitutes a support mechanism to the sustainable development of EU Coal and Steel industry.



### Inside this issue:

Pre Combustion Session 2

Post Combustion Session 3

Other up-coming Events 4

### Special points of interest:

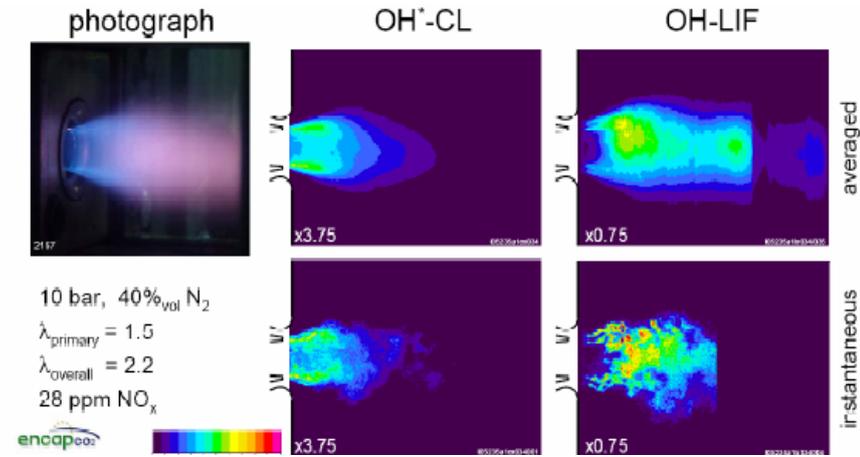
- Main results of pre - combustion session
- Main results of post - combustion and storage session

# Pre - combustion Session

The first technical session, which was dedicated to pre-combustion suitable chemical reaction mechanism a number of H<sub>2</sub>-rich fuel

and flue gas composition under oxy-fuel conditions. Based on these results, two conceptual designs of greenfield oxyfuel plants (PF concept and CFB concept) have been elaborated. As above-mentioned, an oxy-fuel pilot testing is planned for the second phase of the project (August 2006-February 2009) aimed at developing and commercialising this technology.

Mr. Etienne Lebas - Institut Francais de Petrole -, provided an insight to the features of Chemical Looping Combustion (CLC) principle. A 10 kW<sub>th</sub> fluidized bed reactor system for solid fuels CLC fuel conversion has been put into operation at Chalmers as part of the ENCAP project. Furthermore, a design concept for solid fuels CFB boiler 445 MW<sub>e</sub> has been developed with low efficiency penalty (2%) and CO<sub>2</sub> avoidance cost lower than 10 €/ton CO<sub>2</sub>. Mr. Etienne Lebas reported an effi-



CO<sub>2</sub> capture technologies and the results achieved within the ENCAP Combustion Modelling high pressure. The preliminary burner tests aimed also at defining the capability of current com-

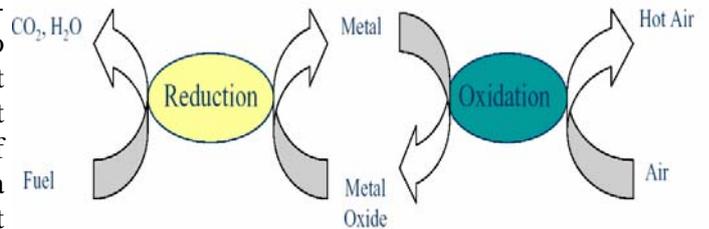
## ENCAP Project: "Recommendation, in 2008-2009, of a pre-combustion technology for a Demo Power Plant"

project, was opened by Mr Clas Ekstrom - Vattenfall AB. Mr C. Ekstrom presented the methodology developed for evaluating different CO<sub>2</sub> capture technologies and the databases established describing all major European power plants and CO<sub>2</sub> storage options together with a model able to calculate cost effective solutions for CO<sub>2</sub> free electricity production.

Mr Karl-Josef Wolf - RWE Power AG -, presented the progress achieved within the second subproject of the ENCAP project dealing with fuel decarbonisation technologies in IGCC power plants. The research efforts mainly focus on the development of H<sub>2</sub>-rich burners, which constitute the major technical barrier on pre-combustion CO<sub>2</sub> capture technologies. After the selection of the

mixtures were tested in a lab-scale burner at high pressure. The preliminary burner tests aimed also at defining the capability of current com-

combustors to deal with H<sub>2</sub>-rich fuels. An overview of the development of oxy-fuel combustion plants was presented by Ms. Marie Anheden - Vattenfall AB. Two different test rigs, a 20 kW at University of Stuttgart and a 100 kW at Chalmers University provided the first basic data related to ignition behaviour

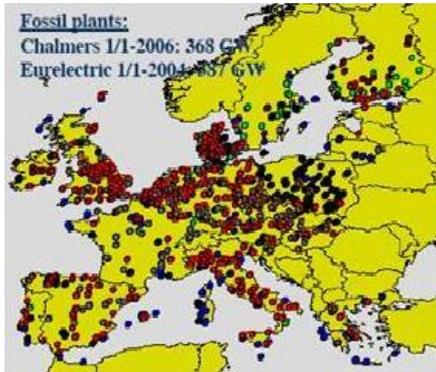


ciency of 52% for a CLC combined cycle with a double reheat gas turbine.

Ms Ilaria Ciattaglia from Linde company presented the research activities concerning the High-Temperature Oxygen Generation for Power Cycles. The integration of a CAR Unit in oxy-fuel PF-boiler power plant is selected as the most promising power plant scenario. Intensive experiments on ceramic materials performance



development are carried out. Ms Ilaria Ciattaglia also highlighted



the importance to scale-up a CAR test facility and to optimise the operating conditions.

The Workshop also provided the opportunity to look at the development of Novel Pre-Combustion and Oxy-fuel Concepts. Mr. Alain Feraud – ALSTOM presented the work carried out within the corresponding ENCAP subproject. The

most promising novel cycle options have been selected and classified into a common structure and modelling, as well as operational analysis has been developed. Mr. Alain Feraud completed the first session by presenting the most promising cycle and the general disadvantages of oxy-fuel cycles.

**CASTOR Project: "Define the overall strategies required to effect a 10% reduction of EU CO2 emissions"**

## Post Combustion & Storage Session

The "Liaison Between ENCAP and CASTOR Integrated Projects" was presented by Mr. Alexandre Rojey - Chairman of CASTOR Scientific Committee and Member of ENCAP Executive Board. Mr. A. Rojey pointed out the strong interactions between the two projects concerning their objectives, programmes and their joint further role in preparing the 7<sup>th</sup> Framework Programme through the creation of the ZEPP Technology Platform.

Mr. Pierre Le Thiez, IFP, coordinator of the CASTOR project, provided a general overview of the background of CASTOR Project.



The overall goal of this project is to develop and validate a portfolio of innovative technologies needed to capture CO<sub>2</sub> at the post-combustion stage and to store it underground. Mr. Pierre Le Thiez referred to the CASTOR post-combustion pilot plant operated since early 2006 by

Elsam in Denmark, whose inauguration took place the previous day.

Meanwhile, Mr. Erik Lindeberg -

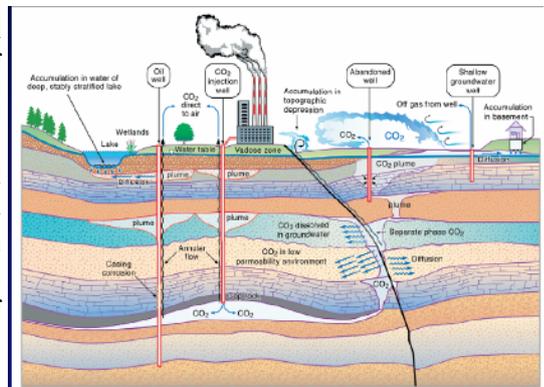


SINTEF Petroleum Research-, presented the work performed in the CASTOR SPI "Strategy for CO<sub>2</sub> reduction." The aim of this subproject is to define the overall strategies required to effect a 10% reduction on EU CO<sub>2</sub> emissions and to monitor the effectiveness of the strategies from a technoeconomic point of view.

Mr. Paul Feron, TNO, provided an extensive overview to the post-combustion capture with amine based solvent, a topic which constitutes the core of the CASTOR project. The overall objective of this subproject is to develop absorption liquids with an energy consumption of 2.0GJ/ton CO<sub>2</sub> at 90% capture rates while keeping a CO<sub>2</sub>

avoidance cost between 20-30 €/ton CO<sub>2</sub>. Key issues like energy consumption, reaction rates, chemical stability and desorption process improvements are investigated.

The last presentation of the event was given by Mr Alv-Arne Grimstad, SINTEF Petroleum Research. Mr A. A. Grimstad referred to the subproject "CO<sub>2</sub> storage performance and risk assessment studies" of the CASTOR project which aims at developing and applying a methodology for the selection and secure management of candidate CO<sub>2</sub> storage sites as well as to improve the SACS best practice manual by adding four more real CO<sub>2</sub> storage site cases.



Leakage through wells and rocks

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## More Information about the Training Seminar / Workshop ...

Further information regarding the ENCAP - CASTOR Training Seminar/Workshop, such as the Agenda, Presentations and Photos can be found at <http://www.encapco2.org/publications/proceeding.html>

[www.encapco2.org](http://www.encapco2.org)

## Up-coming Events related to power generation with CO<sub>2</sub> capture

- ♦ **19<sup>th</sup> FBC Conference** (with the IEA-FBC Conference to be held closely before it), Vienna University of Technology, *21 - 24 May, 2006*, Vienna, Austria
- ♦ **POWER-GEN Europe 2006 Exhibition & Conference**, *May 30 - June 1, 2006*, Koelnmesse, Cologne, Germany
- ♦ **Can Coal come in from the Cold? What is its future in a world of Cleaner Energy?**, Energy Institute, *June 25, 2006*, London, UK
- ♦ **Energex 2006**, SINTEF Research, Stavanger Forum, International Energy Foundation, *June 12-15, 2006*, Stavanger, Norway
- ♦ **9<sup>th</sup> International Network for CO<sub>2</sub> Capture**, Energie 2, *June 16, 2006*, Copenhagen, Denmark
- ♦ **8<sup>th</sup> International Conference on Greenhouse Gas Control Technologies, GHGT-8**, NTNU – SINTEF, *19 - 22 June 2006*, Trondheim, Norway
- ♦ **Russia and the Carbon Market**, *June 28-29, 2006*, Moscow, Russia
- ♦ **China Power Conference**, *June 28-30, 2006*, Shanghai, China
- ♦ **6<sup>th</sup> European Conference on Coal Research and its Applications**, Coal Research Forum, *September 5 - 7, 2006*, University of Kent, Canterbury, Kent, UK
- ♦ **POWER-GEN India & Central Asia 2006 Exhibition and Conference**, *October 24-26, 2006*, New Delhi, India
- ♦ **Global Environmental Change: Regional Challenges**, *November 9-12, 2006*, Beijing, China

More info about the events can be found in [www.encapco2.org/news/events.html](http://www.encapco2.org/news/events.html)

## Project Partners

