

“Europe Towards a Low Carbon Future”

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"Overwhelming evidence shows that climate change is a serious and urgent issue"

Intergovernmental Panel on Climate Change 2007



G8 2007

Global greenhouse gas emissions must stop rising, followed by *substantial global emission reductions*

G8 2008

The G8 countries have *committed to the development of 20 large-scale CCS projects, to be in operation by 2020.*

This will provide the confidence to take CCS forward to commercial deployment, and achieve the scale needed for CCS to make a significant contribution to emissions reductions.

The Global CCS Institute will play a vital role in developing the partnerships needed to make these projects a reality.

G8 2009

Struggle against climate change is one of the Italian Presidency's priorities.

It is up to the entire international community to **limit the impact of global warming**, such as the rise in temperature, the melting of the glaciers and the soil degradation. The **industrialised countries must take the lead in this process** and make a decisive contribution to the **reduction of CO₂ emissions**; at the same time, however, it is essential for the **emerging economies** and the developing countries to **do their share** by reducing greenhouse gas emissions themselves, in line with a balanced sharing of responsibility.

United Nations Climate Change Conference in Copenhagen

7-18 December 2009

Following the Green Paper “A European Strategy for Sustainable, Competitive and Secure Energy” 2006

Strategic Energy Review (SER)

1st SER January 2007

Integrated climate and energy policy with emphasis on *Efficiency, Renewables, and Internal Energy Market*

2nd SER November 2008

Political agenda for energy for the short/medium term. It focuses on *Sustainability, Competitiveness, Energy Security*

- **20-20-20 Strategy**
20% reduction GHG, 20% increase renewables, 20% increase efficiency
- **EU Energy Security and Solidarity Action Plan**
 1. Promoting infrastructure essential to the EU's energy needs
 2. A greater focus on energy in the EU's international relations
 3. Improved oil and gas stocks and crisis response mechanisms
 4. A new impetus on energy efficiency
 5. Making better use of the EU's indigenous energy reserves

Making the best use of the EU's indigenous energy resources

- **Coal is an essential component of actual EU's domestic energy supply: it accounts for around one-third of the EU's electricity production**
- **Due to its availability, proximity of sources and flexibility it is an important alternative to oil and gas**
- **Coal will remain an essential component in the EU energy production portfolio**
- **To promote environmentally-compatible development the EU is currently aiming to drastically reduce carbon emissions from coal-fired power stations**
- **Long-term use of coal requires both highly-efficient plants and wide availability of Carbon Capture and Storage (CCS) technologies**

- January 2007: **Commission adopts a Communication on "Sustainable Power Generation from Fossil Fuels: aiming for near-zero emissions from coal after 2020"**
- November 2007: **Commission Strategic Energy Technology Plan (SET-Plan) highlights CCS as one of the key future energy technologies**
- January 2008: **Commission issues a set of proposals on CCS including the CCS Directive**
- April 2008: **Revised environmental state aid guidelines enter into force, allowing EU countries to subsidise CCS**
- December 2008: **EU summit agrees to provide 300M allowances from the Emissions Trading Scheme (ETS) to subsidise the construction of CCS demonstration plants (Commission to adopt rules for their allocation by end 2009)**
- December 2008: **Adoption of CCS directive in Parliament**
- April 2009: **CCS Directive approved by the Council**
- May 2009: **Adoption of the European Economic Recovery Plan by European Parliament (Allocation of the 1.05B€ to the demos plants by end 2009)**
- 2013: **Revised Emissions Trading Scheme comes into force. Stored CO₂ will be considered as "not emitted" as from that date**

Carbon Capture, Transport and Storage

OPTIONS:

- **Post-combustion**
Capture of CO₂ from flue gases
- **Oxy-combustion**
Burning fuel in oxygen instead of air
- **Pre-combustion capture**
Conversion of fuel to H₂ (and CO₂) before combustion

STATUS:

- **Much work still to be done: need to ramp up process improvements and demonstration**
- **CO₂ capture reduces power plant efficiency by 6-11 percentage points**
- **CO₂ capture has the largest share in the CCS cost chain**
- **Cost reduction likely from ‘learning by doing’**
- **Cement, iron, & steel, other industrial sectors need to step up efforts**

OPTIONS:

- **Pipelines**
- **Ship**

STATUS:

- **CO₂ pipeline transmission well established**
- **About 4000km in use today, mainly in USA**
- **Existing pipelines have a good safety record (enhanced oil recovery since '70)**
- **In Europe need to build pipeline infrastructure**
- **Ships can be attractive for long distance transport (>2000km)**

OPTIONS:

Geological

- **Deep saline aquifers**
- **Depleted oil and gas fields**
- **Unminable coal seams**

Ocean: unlikely to be environmentally acceptable in the near future

Mineralisation: unlikely to be economically practicable in the near future

STATUS:

- **Still need to prove security and retention in long term**
- **Enough CO₂ storage capacity in the world for 100s of years**
- **Need to improve CO₂ storage potential estimates**
- **Innovative combined CO₂ EOR & storage potential**
- **Saline aquifers the most likely long term solution**

- **Today: only 4 full-scale CCS demo plants operating worldwide; none with a coal fired power plant**
- **By end 2009 selection of the projects to be financed by the EC in the frame of European Economic Recovery Plan**
up to 7 CCS demonstration plants in 7 EU Member States (6 coal-fired power plants and 1 steel plant)
- **The number of major CCS efforts worldwide is expanding....**
EU ZEP, US FutureGen, Alberta Canada 2B\$ funding, Australia AUD\$400M, UK CCS competition, Norway's Gassnova...

LEGAL FRAMEWORK BEGINS TO BE PUT IN PLACE

- CCS Directive (2009/31/EC) approved by the Council (23rd April 09)
- Relevant environmental directives on waste and water amended to reflect CCS needs
- The ELD (Environmental Liability Directive) directive is in process of being adjusted for CCS needs
- As the revised ETS comes into force in 2013, stored CO₂ will be considered as “not emitted“

FINANCIAL INCENTIVES FOR CCS IMPLEMENTATION INCLUDE

- Adjusting state aid rules – member states may subsidise CCS projects
- 300M of CO₂ allowances for CCS and innovative technologies (translates into 6-7B€ based on Dec. 2008 allowance price levels)
- EERP 1,05B€ for CCS projects
- Autumn 2009 expected EC Communication on Financing Low-Carbon Technologies

IMPLEMENTATION ISSUES

- Launch of CCS Demo Project Network

LEGISLATIVE ISSUES – Directive to be transposed into national laws

LIABILITY ISSUES – Who should be responsible for potential leaks, and for how long?

OWNERSHIP ISSUES – Who should be responsible for maintaining the storage site and for how long?

PUBLIC ACCEPTANCE – CCS not well known by the public, some NGOs oppose CCS in principle

Should companies be requested to comply with zero emission levels by a certain deadline (as proposed in the UK “no coal without CCS)?

More **R&D EFFORTS** are needed

Despite EU’s efforts on the FINANCIAL side, substantial funding gaps still remains

European Commission is organised in Directorate Generals (DGs)

DG - JRC: Joint Research Centre

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies

JRC is composed by 7 Institutes, one of them is the Institute for Energy (IE)

The mission of the IE is to provide support to Community policies related to both nuclear and non nuclear energy in order to ensure sustainable, safe, secure and efficient energy production, distribution and use

“JRC-IE Activities on Clean Coal”

David Baxter

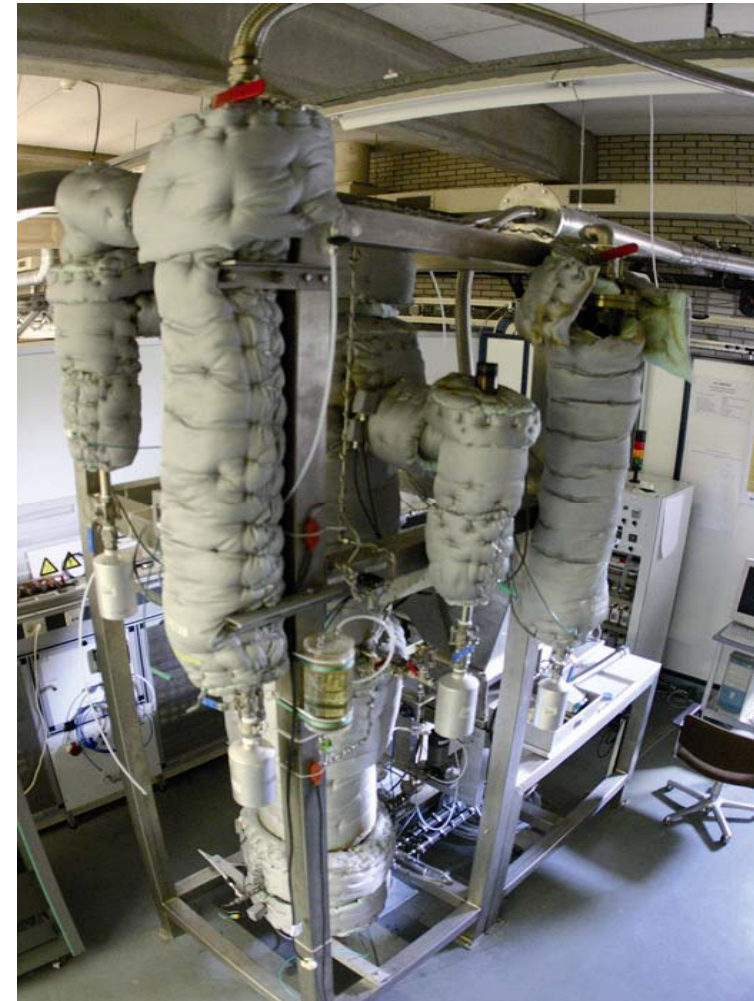
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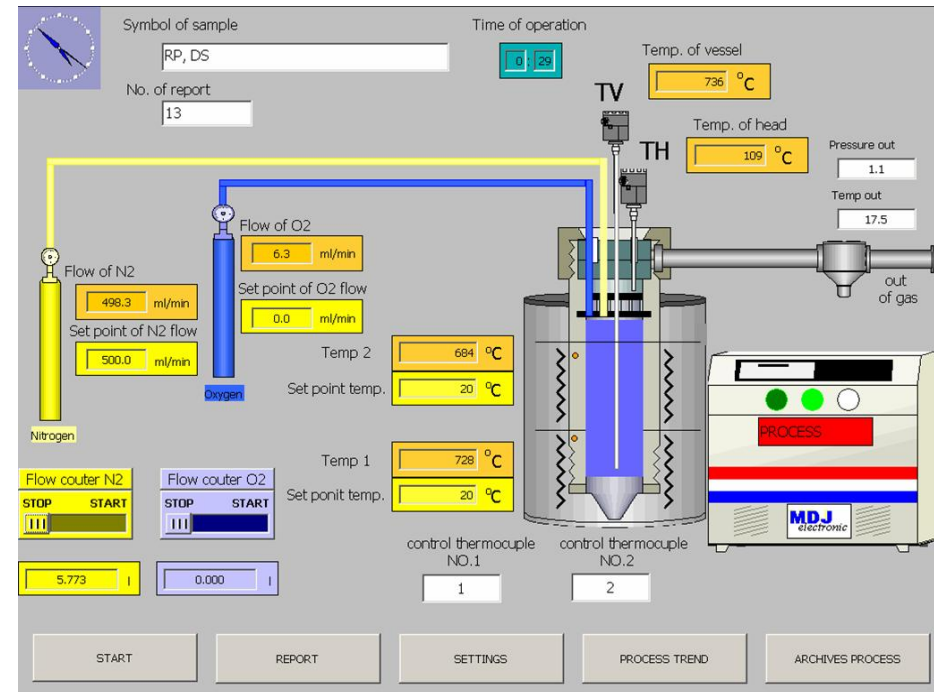
Research Activities

- **Indirect co-firing of biomass (biomass gasification – Fluidised Bed)**
- **Co-gasification of coal and biomass**
- **Cost evaluation for advanced fossil power generation and CCS (Part of contribution to the SET-Plan – Strategic Energy Technologies Plan)**



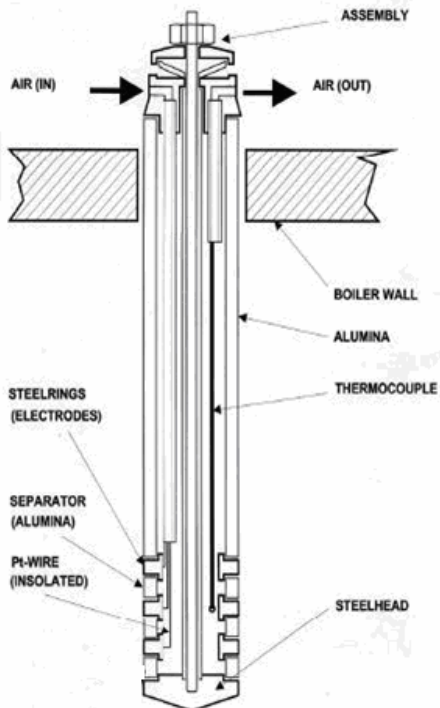
Research Activities

- Biomass characterisation for co-firing
- Coal and biomass classification systems



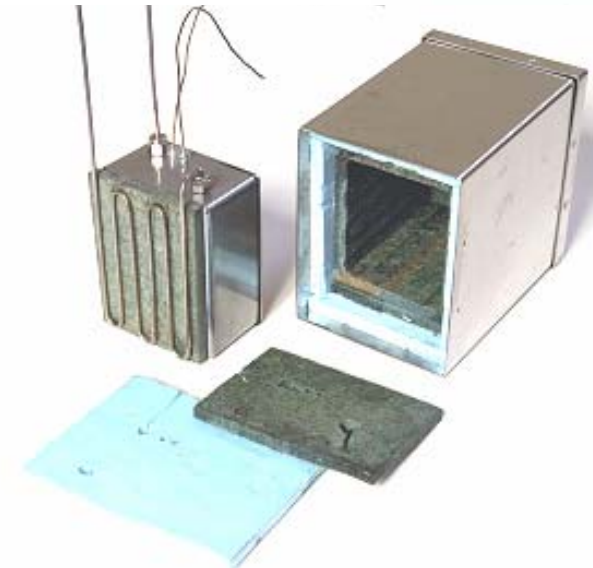
Research Activities

- Thermochemical process monitors and sensors: development and demonstration



Electrochemical noise sensor

Combustion bed flue gas monitor



Thank you for your attention

"Clean coal technology" describes a new generation of energy processes that sharply reduce air emissions and other pollutants from coal-burning power plants.



- **EERP (European Economic Recovery Plan)**
Decision on 1,05B€ support to CCS demonstration plants in 7 EU Member States (6 coal-fired power plants and 1 steel plant). Award of contracts expected before end-2009
- **300M€ Allowances from Emissions Trading Scheme new entrant reserve (ETS-NER)**
Currently discussion in comitology on implementation (decision by end 2009). First funding decisions winter 2010/spring 2011
- **FP7 (Framework Programme 7: 2007-2013)**
Projects on-going: next call - end of 2009
- **European Investment Bank (EIB)**
- **Autumn 2009 expected Communication on Financing Low-Carbon Technologies**
European Industrial Initiatives CCS
European Energy Research Alliance (EERA)

ENABLING FRAMEWORK

- Member States determine whether and where CCS will happen
- Companies decide whether to use CCS on the basis of conditions in the carbon market

- **CCS IS NOT MANDATORY, BUT MEMBER STATES NEED TO**
- Assure, that enough space is available on site to retrofit plant with capturing and compression facilities
- Verify, if storage capacity and transport facilities are available and retrofitting is technological feasible