



# ● Demonstration and Deployment of CCS in the European Union

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# Key Issues

- Energy Policy and Climate Change
  - » The need for CCS
  - » The barriers to CCS
- Policy and financial support for CCS in the EU
  - » Increasing legal certainty
  - » Emission trading
  - » Other support options

## The EU Council in March 2007

- Endorsed the main targets proposed by the European Commission in its Energy and Climate Change package (20, 20, 20 etc...)
- In addition, specifically concerning fossil fuels:
  - » Actions should be taken to enable low-CO<sub>2</sub> power generation from fossil fuels by 2020
  - » Up to 12 CCS demonstration plants should be in operation by 2015

## More specifically

### *The views of the March 2007 European Council*

- The European Union agrees that the burning of coal to produce electricity has no future unless it can very significantly reduce – to "near zero" (or less!) – the amount of CO<sub>2</sub> emitted per unit of energy produced.
- The aim is for all new fossil fuel plants built after 2020 to be equipped with carbon capture and storage (CCS) technology and for plants built before that date to be retrofit with the technology as quickly as possible – probably by 2030.

# The importance of CCS

- While energy efficiency and renewable energy are shorter-term solutions, other options are needed in longer term if we are to reach 50% GHG reduction globally in 2050
- It is crucial from a global perspective
  - » All countries that burn significant quantities of fossil fuels to supply their electricity will need to deploy it – sooner rather than later!
- The individual technologies used in CCS have been demonstrated as functioning, but not yet as an integrated process on a commercial scale nor at reasonable costs

# Technology Development

- Research is still ongoing to improve the different technologies or, in the case of storage, to better understand and model the processes involved.
- In addition, because CCS reduces the efficiency of fossil-fuelled power plants, major efforts must still be undertaken to improve the efficiency of existing systems.
- The European Commission has been supporting research on both clean coal technologies and CCS.

## Research

- The Commission funds research on Clean Coal Technologies (CCT) and on CCS under the Communities' Research Framework Programmes (FP)
- There have been important activities for the last decade and these are ongoing.
- There are also activities funded under the Research Fund for Coal and Steel (RFCS) actions that are complementary to the FP



## **In Framework Programmes 5 and 6 (FP5/FP6) 1998-2006**

- Projects on Clean Coal (FP5) and Carbon Capture and Storage (FP5/FP6) worth more than 35 € (CC) and 170 M€ (CCS)
- European Technology Platform on Zero Emission Fossil Fuel Power Plants (ZEP) launched on 1 December 2006
- Coordination of member states research activities, ERA-NET (FENCO)
- International Cooperation: member of the Carbon Sequestration Leadership Forum, IEA-GHG, EU-China MoU (NZEC/COACH), bilateral S&T cooperation



## Some of the EU projects supporting CCS

Project Acronym	Title	EU funds (M€)
CO2SINK (IP)	In-situ laboratory for capture and sequestration of CO <sub>2</sub>	8.7
ENCAP (IP)	Enhanced capture of CO <sub>2</sub>	10.7
CASTOR (IP)	CO <sub>2</sub> from capture to storage	8.5
CO2GEONET (NoE)	Network of excellence on geological sequestration of CO <sub>2</sub>	6.0
CACHET (IP)	CO <sub>2</sub> capture and hydrogen production from gaseous fuels	7.5
DYNAMIS (IP)	Preparing for large scale H <sub>2</sub> production from decarbonised fossil fuels with CO <sub>2</sub> geological storage	4.0
CO2REMOVE (IP)	The monitoring and verification of CO <sub>2</sub> geological storage	8.0

## ● Support under FP-7

*More than 54 M€ spent or earmarked for CCS/CCT so far, including on:*

- ***Outcome of the 1<sup>st</sup> Call (2007)***
  - *Advanced separation techniques: CESAR (4 M€)*
  - *Separation techniques in gaseous fuel power generation: CAESAR (2.3 M€)*
  - *Support to regulatory activities for CCS: STRACO2 (0.9 M€)*
  - *Advanced pre-combustion capture techniques: DECARBIT (10.2 M€)*

## Future FP-7 activities

### ***Currently negotiated FP7 projects***

- ***Development of a value chain for CO2 incl. EOR***

### ***Response to the 2<sup>nd</sup> Call (2008)***

- ***Capacity building in emerging economies:*** 5 proposals
- ***Transport infrastructure:*** 3 proposals
- ***Public acceptance:*** 8 proposals
- ***Qualification of deep saline aquifers:*** 2 proposals

### ***Current thinking 3<sup>rd</sup> Call (2009)***

- ***Advanced capture technologies***
- ***Storage safety***
- ***Transport infrastructure***

# ● Barriers to CCS development and deployment

## ● Legislative Hurdles

## ● Non legislative Hurdles

- » Long term economic viability
- » Industrial Scale CCS Demonstration Projects  
(need to demonstrate all main technology routes: Pre-, Post-, Oxyfuel-Combustion)
- » Availability of infrastructure
- » General and Industry Awareness
- » Public Acceptance

# Steps towards overcoming the barriers to CCS

*The second energy and climate change package – January 2008*

- Included a number of proposals that could impact on CCS
  - » Communication “20 20 by 2020 – Europe’s climate change opportunity”
  - » Proposal for a Directive on “*The geological storage of carbon dioxide and amending Council Directives .....*”
  - » Proposal for a Decision on “*Efforts of Member States to reduce their greenhouse gas emissions to meet the Community’s greenhouse gas emission reduction commitments up to 2020*”
  - » Communication on “*Supporting early demonstration of sustainable power generation from fossil fuels*”.

# ● The geological storage of CO<sub>2</sub>

## *Addressing the legislative hurdles*

- Enables CCS by providing legal framework to
  - » Remove barriers to CO<sub>2</sub> storage in existing legislation
  - » Manage environmental risk
- Provisions for ensuring environmental integrity through the life-cycle of the plant (site selection up to post closure)
  - » Exploration of a site requires a permit
  - » A proposal for storage must include an EIA
  - » Operation of a site requires a licence
- CO<sub>2</sub> captured and stored will be considered not emitted under the ETS:

# Reduction of greenhouse gas emissions

*Addressing the long-term economic viability*

- The EU Emission Trading Scheme (ETS) is a “cap and trade” system
- It is designed to establish a “carbon price” that will bring about technology change that will result in lower CO<sub>2</sub> emission
- It covers close to 11 000 installations in the EU
- These installation together emit around 50% of the EU’s CO<sub>2</sub>
- The first phase ran from 2005 to 2007
- The second phase – with reduced emissions – runs from 2008 to 2012 inclusive
- The third phase will start in 2013

# ● Revision of the ETS

*To give a clear long-term carbon price*

- Designed to bring about a cost-effective contribution to - 20% GHG target for 2020, or to stricter target under international climate agreement
- With improvements based on experience
- Extended to cover all big industrial emitters: including chemical sectors and aluminium
- Extension to other GHG: nitrous oxide (fertilisers), perfluorocarbons (aluminium)
- New, single EU-wide cap instead of 27 caps set by Member States
- CO<sub>2</sub> allowances available in 2020: 1,720 Mt
  - » - 21% compared to 2005 emissions
- Linear decrease
  - » predictable trend-line to 2020 and beyond
  - » can be adjusted to stricter target



## Other important issues for the power sector in the ETS revision

- from 2013 onwards, full auctioning of CO<sub>2</sub> certificates for the power sector (Commission **proposal**)
- **CCS under the ETS:**
  - » CO<sub>2</sub> captured, transported and safely stored considered as not emitted
  - » ETS allowances must be surrendered for any leakage
- **ETS auctioning revenues**
  - » major potential source of funding for CCS demonstration projects
  - » EC suggestion: 20% earmarking to low-CO<sub>2</sub> technologies

# ● Economic viability of CCS under ETS

Additional Cost for  
CCS, per ton CO<sub>2</sub>

50

Certificate  
Price

Average  
Avoidance costs

2013

2015

2020

time

# ● Financing CCS demonstration projects

*Addressing the need to support industrial scale demonstration*

## ● Economics of early demonstration

## ● Sources of financing

### » Industrial commitments

- ETP-ZEP: a vital initiative with commitments to the issue
- still needed: clear, early and decisive commitments by individual players to concrete large-scale demonstration

### » Member States' involvement

- MS-level crucial given budgetary reality and size of challenge
- Commission guidelines facilitate state aid to CCS
- ETS revenues + structural policies hinted as suitable

### » EU-level financing

- limited availability for the time being
  - FP7 + EU structural funds
  - EU financial institutions for specialized cases
  - Communication on financing low-carbon technologies

# Demonstration of CCS on a large scale

*Technologies exist, but need demonstrating on a commercial scale*

- All the technologies required to capture, transport and store CO<sub>2</sub> in geological formations have been demonstrated
- However, these have not been done in a single power plant at a commercial scale (at least 440 MW plant)
- Demonstrating all the various options will require a number of such plants
- We estimate that it could require up to 12 demonstration plants

# A European Industrial Initiative (EII) for CCS

*To address most of the remaining barriers to demonstration and deployment*

**The objectives of the EII are to:**

- **Stimulate the commercial scale demonstration of CCS**
- **Integrate R&D with CCS demonstration and industrial deployment**
- **Increase public awareness and acceptance**
- **Foster international cooperation on CCS demonstration and policy**
  - » Synergies with USA, Japan, Canada and Australia
  - » Collaboration with China (ongoing)
  - » Collaboration with other coal users: India, South Africa
- **Early action: establishing a network of CCS demo projects**

## ● The European Summit of 11/12 November

- The European Summit agreed an energy and climate change package with a very strong focus on carbon dioxide emissions
- This was a very difficult negotiation, mainly because of the problems that full auctioning in the power sector would have given to the new Member States – especially those with a high reliance on coal.
- A compromise was reached that should still result in the 20% reduction of CO<sub>2</sub> by 2020.

## ● Novel financing options for demonstration projects

- It was proposed by the European Parliament that CCS could be funded using part (a very significant part) of the “new entrant reserve” (i.e. allowances for facilities not yet built)
- The Member States debated this – long and hard – and now agreed that 300 million allowances would be available for “innovative carbon capture and storage technologies and renewable energy sources”
- At a carbon price of €30/tonne, this would amount to €9 billion.

## Additional financing in the future

- Member States have expressed their “willingness” to use at least 50% of the money collected from auctioning allowances to support “actions to reduce GHG emissions, mitigate and adapt to climate change” that would contribute to a “safe and sustainable low-carbon economy”.
- Part of this money could be used to mitigate or adapt to climate change in developing countries that ratify a post-Kyoto agreement.



## ● And also .....

- Between 2013 and 2016 Member States may use auctioning revenues to support the construction of “highly efficient power plants, including new energy power plants that are CCS-ready”.
- In certain circumstances, this support for CCS-ready plant can cover up to 15% of the cost.

Note: Member States may obtain carbon credits covering up to 3%\* of the emissions from CDM or JI projects. (\* More in some instances)

## ● A note of caution..... !!!

- While Member States have reached a compromise on the Emission Trading Scheme Directive, it is not an easy one.
- Only certain countries will now be subject to full auctioning for power sector allowances
- In those countries NOT subject to full auctioning:
  - » the “driver” to reduce emissions will likely be weaker
  - » less money will be collected that could be used to support demonstration and deployment of CCS
- Allowing auctioning revenues to be used for the construction of “highly-efficient power plants” will not specifically encourage CCS deployment.
- Also “energy intensive” industries that are exposed to competition will be given free allowances and 100% auctioning in other industrial sectors will not reach 100% until 2027.
- The impact of this compromise – which has yet to be agreed with the European Parliament – still needs to be fully assessed.



# Conclusions

- **In the EU, coal is an important and necessary part of our energy supply.**
  - » Its uses helps our security of supply and supports our competitiveness
  - » However, it raises important sustainability issues – in particular climate change
- **The same is also true – though to a slightly lesser extent – for gas**
- **Both fuels can only have a future in our energy supply if the CO<sub>2</sub> they emit can be captured and safely stored. Therefore:**
  - » CCS is a strategically important process
  - » CCS needs to be commercially viable by 2020
  - » CCS presents both opportunities and challenges
- **The barriers to demonstration and deployment of CCS are being actively addressed in the EU**
  - » New proposed legislation provides a regulatory framework for CCS
  - » The ETS provides a driver for CCS that will help assure its longer-term economic viability
  - » The ETS also provides a potential support mechanism for demonstration and eventual deployment



***Thank you for listening***

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