



## **“Capture Ready” Moving forward from the concept to implementation**

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Geological Storage  
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## Introduction

- Background to the development of “capture ready concept”
  - Why do we need a “capture ready” power plants?
- Adoption of “capture ready concept” in CCS regulations worldwide – focus on Europe
  - Industry reactions
    - UK Consultation process
  - Generalise on NGO reactions
- Summarise current situation on “ capture ready concept”



## What I will not cover

- Not a technical paper so I do not intend to cover:
  - Relative costs of retrofitting IGCC or SCPCP
  - Pre-investment needs
  - Major pre-investment is unlikely to be worthwhile unless capture is going to be retrofitted soon after start-up of the power plant
  - More technical detail in IEA GHG Report No. 2007/4 - copies available on request



## Gleneagles G8 Summit July 2005



- G8 leaders addressed the challenges of climate change and securing clean energy and sustainable development
- The Gleneagles Plan of action on climate change, clean energy and sustainable development was agreed which included tasks to:
  - Transform the way we use energy,
  - Powering a cleaner future,
  - Promoting research and development,
  - Financing the transition to cleaner energy,
  - Managing the impact of climate change,
- Details can be found at: [http://www.iea.org/G8/docs/G8\\_Leaflet.pdf](http://www.iea.org/G8/docs/G8_Leaflet.pdf)



## Gleneagles G8 Summit July 2005



- **Cleaner Fossil Fuels**

- Support efforts to make electricity generation from coal and other fossil fuels cleaner and more efficient
- Work to accelerate the development and commercialization of CCS by:
  - (b) inviting the IEA to work with the CSLF to hold a workshop on short-term opportunities for CCS in the fossil fuel sector
  - (c) inviting the IEA to work with the CSLF to study definitions, costs, and scope for 'capture ready' plant and consider economic incentives;
- More details on cleaner fossil fuels programme can be found at:  
<http://www.iea.org/g8/index.asp>



## The Need for Capture Ready Plants

- CCS can help to achieve large emission reductions
- CCS is not yet economic in most cases
  - Carbon prices are too low and uncertain
  - No agreement to reduce emissions in many countries
- CO<sub>2</sub> capture is not yet demonstrated at large power plants
  - Several demonstration plants due to start up 2011-2016
  - Capture could become 'industry standard' around 2020
- Many power plants will be built in the next few years
  - 5087 GW of new and replacement plant between 2005 and 2030, mostly fossil fuel fired (IEA World Energy Outlook 2006, Reference Scenario)
- These plants should be 'Capture Ready'
- The aim of building plants that are capture-ready is to reduce the risk of 'carbon lock-in' or 'stranded assets'.



## Capture Ready Study

- Report published in July 2007 which defined capture ready as:
  - *A CO<sub>2</sub> capture ready power plant is a plant which can include CO<sub>2</sub> capture when the necessary regulatory or economic drivers are in place.*
  - *The aim of building plants that are capture ready is to reduce the risk of stranded assets or “carbon lock-in.”*
  - *Developers of capture ready plants should take responsibility for ensuring that all known factors in their control that would prevent the installation and operation of CO<sub>2</sub> capture have been eliminated.*
  - *This might include:*
    - *A study of options for CO<sub>2</sub> capture retrofit and potential pre-investments.*
    - *Inclusion of sufficient space and access for the additional facilities that would be required.*
    - *Identification of reasonable routes to storage of CO<sub>2</sub>.*
    - *Competent authorities involved in permitting power plants should be provided with sufficient information to be able to judge whether the developer has met these criteria.*





## Capture Ready Study Follow On Steps

- IEA engaged key industry stake holders on policy issues related to capture ready definition
- Concept was debated at near term opportunities workshop in Canada in October 2007
- Recommendations developed by IEA for G8 Summit in Hokkaido in Spring 2008

G8-IEA-CSLF



RESULTS FROM THE CALGARY WORKSHOP  
NOVEMBER 27 & 28 2007

3RD WORKSHOP

**NEAR-TERM OPPORTUNITIES  
FOR CARBON CAPTURE  
& STORAGE**





## Recommendations Going Forward to G8

- On capture ready the recommendation was:

*Further work is required to understand and define the concept of “capture and storage ready” plants and its value as a viable mitigation strategy*

- Reasoning was:

- Some parties support the notion of requiring “capture ready” facilities as a means of ensuring that retro-fits are possible under future regulation and to avoid “technology lock” in facilities built in advance of such regulation.
- Some argue that building a capture ready plant is more an issue of adequate design and planning, rather than one of additional investment.
- Others argue that such a requirement does not make economic or technical sense unless capture equipment is added soon after the facilities are built.
- This issue may be viewed in a different light for developing countries that are in the process of rapidly expanding their power sectors where a significant “carbon lock” could result



## Inclusion in Regulatory Developments

- Canadian Regulatory Framework *for Industrial Greenhouse Gas Emissions, May 2008* requires:
  - *All oil sand and coal fired electricity plants that come into operation during or after 2012 must meet new stringent targets based on the use of CCS*
  - Legislation based on recommendations from a Canada-Alberta Carbon Capture and Storage Task Force
  - No definitions of need to make plants *capture ready* if built before 2012.



## Inclusion in Regulatory Developments

- State of Victoria, Australia in its *Strategic Policy Framework for Near Zero Emissions from Latrobe Valley Brown Coal* recognizes need for future retrofit of CCS
  - *Without CCS, Latrobe Valley brown coal energy sources would be subject to significant cost increases if an emissions trading scheme was introduced.*
- Decision on National Emissions Trading Scheme deferred by Commonwealth Government until 2010/2011
- New Zealand Emissions Trading Bill
  - Future provision for CCS opt-in – date to be defined



## European Commission Activities

- COM(2006)843, 10.01.07, Sustainable power generation from fossil fuels: aiming for near-zero emissions from coal by 2020
  - Follow up to Commission Green Paper
    - A European strategy for secure, competitive, and sustainable energy – adopted in March 2006
  - Key actions included:
    - Make demonstration of sustainable fossil fuel technologies a priority research topic for 2007-2013
      - Substantial increase in EC R&D funding
      - Member states to make an equal commitment
    - Options to support up to 12 large scale demonstrations
    - All plants will need to be ‘capture ready’



## EC Draft CCS Directive

- **Enabling regulatory framework to ensure environmentally sound CCS**
- **Focuses on storage component**
  - Consistent with OSPAR and IPCC GHG Guidelines
  - Objective is permanent storage
  - Permits required for exploration and storage
  - Storage permit only if “no significant risk of leakage”
  - Emphasis on site selection, characterisation, risk assessment, monitoring
  - Corrective measures
  - Financial security required from operator
  - Liability transfer to regulatory authority “when evidence indicates contained for indefinite future”
  - Removes regulatory barriers in other Directives – IPPC, Waste, LCPD, Water, EIA, ELD
  - Capture-ready



## EC Draft Directive

- Embodies principle that once Directive is agreed all new power plants will need to be capture ready
- Definition of capture ready in EC Directive is based on IEA GHG concept, Article 9a in EC Draft states:

*“All member states shall ensure that all combustion plants with an a capacity of 300 MWe or more .... . after the entry into force of the Directive will have space on the installation site for the equipment necessary to capture and compress CO<sub>2</sub> and that the availability of suitable storage sites and suitable transport facilities, and the technical feasibility of retrofitting CO<sub>2</sub> capture has been assessed.”.*



## EC Consultation Process

- Response received from European Parliament with suggested (strengthening) amendments Article 9a, Paragraph 1 to the directive:
  1. .... that all *electricity generating* combustion plants..... is applied for after the entry into force of this Directive
    - (a) *are be sited and planned so as to facilitate capture of CO<sub>2</sub>...*
    - (b) *are authorised only after approval by a competent authority of a report by the operator that shall indicate a proposed storage site and propose the means by which CO<sub>2</sub> will be transported. The report will be made public prior to any authorisation being granted*



## EC Consultation Process

- In addition, three new paragraphs 1a was requested in article 9a which reads
- *1 a)..... where the construction license is applied for on or after 1<sup>st</sup> January 2015, are operated such that at least 90% of their emissions are captured, transported and stored in suitable geological formations.....*
- *1 b) ..... Plants referred to in paragraph 1 are from 1<sup>st</sup> January 2025 operated such that at least 90% of their emissions are captured, transported and stored in suitable geological formations.*
- *1 c) No later than 2015 ....the commission shall review the application of this Article only to electricity generating combustion plants ....*





## Article 3 Paragraph 3

### EC Proposed Text

- ‘Storage site’ means a *specific* geological formation used for geological storage of CO<sub>2</sub>.

### European Parliament proposed amendment

- ‘Storage site’ means a *defined area within* a geological formation used for geological storage of CO<sub>2</sub>; *a single storage site may include defined areas within separate geological formations at different levels.*



## Implementation of EC CCS Directive

- All member states will adopt Directive
- UK Government committed to introducing CCS legislation
- CCS demonstration project underway
  - 300 MW post combustion capture demonstration plant by 2014
- In June UK Government announced publication of a consultation on the legislative framework for CCS, including carbon capture readiness.
  - Fulfills UK Governments commitment in the 2006 Energy White Paper
  - Action designed to are designed to create a more consistent understanding of what this means across the EU.



## UK Consultation process

- Engaging industry and seeking views on:
  - Whether the UK should require new combustion stations (mostly fossil fuel ones) to be constructed capture ready?
  - What this might mean in practice in terms of preparing combustion stations for any subsequent retro-fit of CCS?
  - What types of power stations should be affected and also on how the UK might implement any capture condition
- Full details at:  
<http://www.berr.gov.uk/files/file46810.pdf>.



## UK Coal Forum Response to BERR CCS Consultation: Capture Ready (1)

### Several principles suggested

- Flexibility to adjust regulation as knowledge improves
- Emphasis on how to overcome barriers to later CCS deployment
- Gas and coal to receive equal treatment to avoid encouraging over dependence on imported gas supplies
- Avoid demanding early plant build (in anticipation of later adding CCS) such that performance in the interim years is adversely affected



## UK Coal Forum Response to BERR CCS Consultation: Capture Ready (2)

- Agree with elements of IEA GHG definition (Space, feasibility of adding capture, route to storage, and credible storage available)
- Feasibility to cover activities like flow sheeting and layouts but not detailed engineering design
- No need to earmark a specific storage site as want to retain open access and prevent commercial concerns buying up facilities in advance
- Routes to storage need to be credible but not secured in advance



## Implementation is awaiting the outcome

- Decisions on investment by companies and Government strategies for new coal fired power plant are waiting on the outcome of the EC Directive and the UK Consultation process



Schematic of E ON's proposed 1600MWe coal fired power plant at Kingsnorth, UK which is already consented by the local authority but is awaiting Government approval, which has been deferred awaiting the outcome of the CCS consultation and resulting draft law.



## NGO Position

- In general terms most NGO's in Europe and North America are amenable to CCS
  - There is a lets throw the whole portfolio at it approach by many to tackle climate change
  - With regard to capture ready their big concerns is that:
    - New coal plants will be permitted that will not ultimately include CCS because no time scales had been set
      - Strengthened EC Directive would overcome this in Europe
- Some are of course opposed to CCS
  - Those that are opposed are against continued use of coal
    - Propose an alternative energy efficiency/renewables portfolio
    - Leading opposition to plants like Kingsnorth in the UK.



## Summary

- Aim of capture ready concept is justified
  - To reduce a global carbon “lock in”
- Principle is that the concept we are talking about is CCS ready not just ‘capture’ alone
  - Provision for capture, transport and storage in the concept
- Any regulation needs to be flexible to avoid a technical “lock in”
  - Must allow new technical improvements to be included as and when appropriate





## Summary (2)

- Concept introduces the need to assess different transportation routes and storage opportunities but not “define” them
- Need to allow open access to storage sites and transportation routes
  - Otherwise a buying frenzy might occur and capture ready plants get “locked out”
- Need to be aware of concerns and set time bounds
  - To ensure that CCS is introduced



## Closing Thoughts

- A definition of “capture ready” has been developed
- This definition has been refined through a stakeholder consultation process in Europe
- A definition of “capture ready” will become part of the EC Directive on CCS
  - Member states will implement it.
- Significant work since G8 meeting on Capture ready
- IEA GHG to do follow on study
  - introduction of 2<sup>nd</sup> generation capture technology into capture plant.



Thank You!

Any Questions?

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