Developments on the Implementation of CCS in Europe

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Introduction

- Recent developments under the International marine environment conventions
  - London Protocol & OSPAR
- European Commission initiatives to support CCS implementation
  - National initiatives and plans
  - National legal and regulatory frameworks
- Broader Issues

International Marine Conventions

- International marine environmental convention established in 1972
  - London Convention (LC) prevents dumping of wastes at sea
    - London Convention and extended London Protocol
- Below LC there are regional agreements covering specific regions of the ocean
  - Convention for Protection of the Marine Environment of the North East Atlantic (OSPAR)

London Convention

- London Convention introduced in 1975
  - Prevents aims to control all sources of pollution to the marine environment
  - Contracting parties agree to prevent dumping of of industrial wastes at sea
    - Those that are liable to cause damage to human health, marine life etc.,
  - Include precautionary approach to ensure preventative measures are taken in the event that anything introduced can cause harm
- London Protocol
- More extensive approach to dumping than LC
- Prevents dumping of all materials not included in a “reverse list”
  - CO_2 not in “reverse list”
- Includes sea, sea bed and sub soil
  - But does not include sub sea bed repositories accessed by land

OSPAR

- Entered into force in 1998
- Ratified by 15 signatory nations and EC
- Most comprehensive and strict legal convention
- Does not distinguish between water column and sub sea bed like the London Protocol
- Activities covered by a framework that considers sources and nature of placement
  - Discharges from land based sources into the sea are NOT PROHIBITED but must be authorised & regulated
  - Placement from a vessel is PROHIBITED
  - Placement of CO2 from the operation of an offshore platform is NOT PROHIBITED but must be authorised & regulated
  - CO2 from on shore to an offshore platform can be placed along as it is for enhanced oil recovery

Recent Amendments to Marine Conventions

- London Protocol
  - Meetings of Scientific Group and Legal Working Group held in April 2006
  - Technical Working Group meeting recommended that:
    - CCS is a waste management option to be considered by Contracting Parties' in their approaches to mitigating greenhouse gas emissions
  - Legal Working Group agreed to amend Annex 1 of Protocol to the Convention to allow CO_2 to be included under wastes that can be disposed of (Paragraph 1.8)
    - Only in sub sea geological structures,
    - The waste is overwhelmingly of carbon dioxide,
    - No wastes or other matter are added.
  - Proposals from Working groups submitted to first Statutory Meeting of the Protocol Parties
    - 30 October – November 3, 2006
  - Amendment to London Protocol accepted
    - CCS in sub sea geological storage structures (CCS_SSGS) now legal under London Protocol

Recent Amendments to Marine Conventions

- London Protocol
  - Guidelines adopted in April 2007 for use by national authorities regulating disposal at sea
  - Guidelines indicate that acceptance of CCS does not remove obligation to reduce need for disposal under the Protocol
- Guidelines require:
  - Waste prevention audit/Waste management option review
  - Characterisation of waste stream
  - Site characterisation
  - Impact assessment
  - Permit Issue
  - Compliance monitoring
  - Performance monitoring
  - Mitigation plan

Recent Amendments to Marine Conventions

- In Spring 2007 OSPAR adopted amendments to the Annexes to the Convention to allow storage of CO_2 in geological formations under the seabed.
  - Follows publication of reports on ocean acidification, which indicated early action was needed to prevent damage to the marine environment from natural uptake of CO_2.
  - CCS seen as one of a portfolio of measures to reduce emissions
- OSPAR adopted a Decision to ensure environmentally safe storage of carbon dioxide streams in geological formations
- OSPAR adopted guidelines for Risk Assessment and Management of that activity.
- A Decision was also adopted to legally rule out placement of CO_2 into the water-column of the sea and on the seabed.
- Actions considered complimentary to those of London Protocol

Guidelines on Risk Assessment and Management

- Objective of guidelines

  "authorities shall ensure that carbon dioxide streams, which are stored in geological formations, are intended to be retained in these formations permanently and will not lead to significant adverse consequences for the marine environment, human health and other legitimate uses of the maritime area".

Guidelines on Risk Assessment and Management

- Storage of CO_2 in geological formations shall not be permitted by Contracting Parties without authorization or regulation by their competent authorities.
- Any authorization or regulation shall be in accordance with the OSPAR Guidelines for Risk Assessment and Management,
  - as updated from time to time.
- A decision to grant a permit or approval shall only be made if a full risk assessment and management process has been completed to the satisfaction of the competent authority

  " and that the storage will not lead to significant adverse consequences for the marine environment, human health and other legitimate uses of the maritime area".
- The provisions of the permit or approval shall ensure the avoidance of significant adverse effects on the marine environment,
  - Bearing in mind that the ultimate objective is permanent containment of CO_2 streams in geological formations.

Guidelines on Risk Assessment and Management

- Any permit or approval issued shall contain :
  - a description of the operation, including injection rates;
  - the planned types, amounts and sources of the CO_2 streams, including incidental associated substances, to be stored in the geological formation;
  - the location of the injection facility;
  - the characteristics of the geological formations
  - the methods of transport of the CO_2 stream;
- A risk management plan that includes:
  - monitoring and reporting requirements ;
  - mitigation and remediation options including the pre-closure phases;
  - a requirement for a site closure plan, including a description of post-closure monitoring and mitigation and remediation options;
    - Monitoring shall continue until there is confirmation that the probability of any future adverse environmental effects has been reduced to an insignificant level.
- Permits or approvals shall be reviewed at regular intervals, taking into account the results of monitoring programmes and their objectives.

Reporting Requirements

- All plans publicly available
- Reporting plans set out

General basis	Year concerned
Cumulative number of permits issued	
Are **guidelines** implemented	yes/no[2]
Amount CO_2 stored (tonnes)	
Net amount of CO_2 stored (tonnes)	

Site by Site basis	Year concerned
Chemical composition of the CO_2 stream	
Type of storage formation	
Any observed leakage rates and exposure pathways	
- any expected impacts from this leakage	
Any observed impacts on the marine environment and other legitimate uses of the maritime area	
Any (mitigative) measures taken	

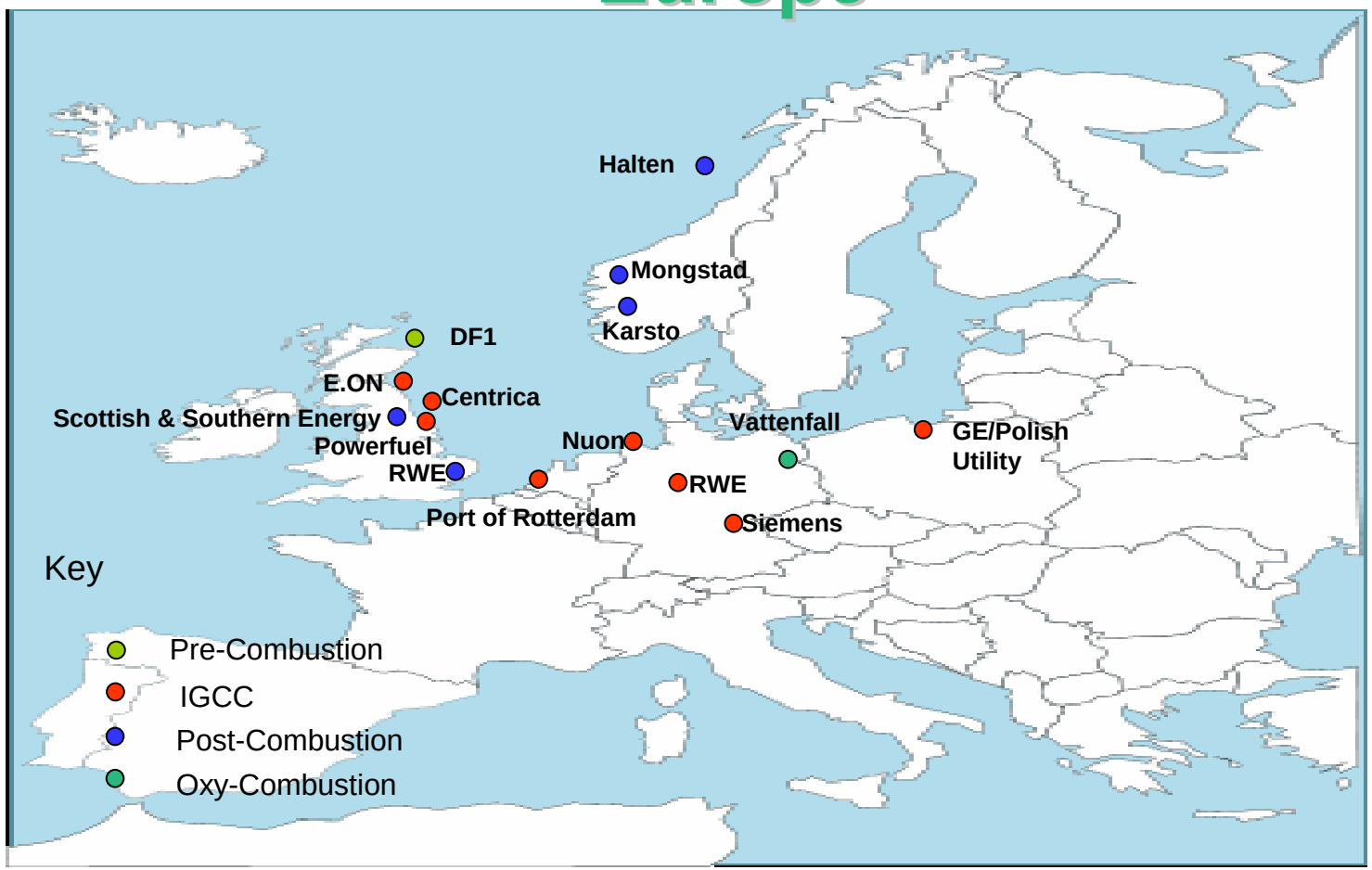
CO_2 Purity Issue

- Not dealt with Specifically by Marine Conventions
  - “Overwhelmingly” or “Predominately” CO_2
  - Acceptance that there will be some low level impurities from the capture process
  - Issue of setting" acceptable” CO_2 purity levels will be dealt with by National authorities

European Commission Plans

- COM(2006)843, 10.01.07, Sustainable power generation from fossil fuels: aiming for near-zero emissions from coal by 2020
  - 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 new fossil fuels plants will need to be ‘capture ready’ by 2020

Proposed Integrated CCS Projects in Europe



What is 'Capture Ready'

- IEA GHG has produced a headline summary of Capture Ready considerations
  - Carry out a study of capture retrofit options
  - Leave space and access for capture plant
  - Identify a reasonable route to storage of CO_2
- Major pre-investment is unlikely to be worthwhile unless capture is going to be retrofitted soon after plant start-up

CO_2 Capture Ready Plant

'Capture Ready' area

(Site of existing power plant)

Proposed 'capture ready' power plant at Tilbury

Courtesy RWE Npower

European Commission Plans

- The European Commission has considered how to implement CCS under its existing environmental directives
  - A new CCS Directive will be developed
  - Specifically cover storage
    - Capture covered under existing IPPC
      - Some updating of BAT documents required
    - Transport covered by existing NG pipeline standards
      - Considered CO_2 risk to be no different to NG therefore no need to change approach
  - Draft out for preliminary consultation in November 2007
  - Member states will have an initial 3 month consultation period
    - Initial feedback positive
  - Aim to be adopted by European Parliament by mid 2008

EC Draft CCS Directive

- Basic Provisions
  - Exploration
    - Subject to permit
    - Non discriminatory access to permits
    - Permits last for 2 years, if not converted to storage permit
  - CO_2 criteria
    - Consistent with OSPAR/London Protocol
    - Operators to demonstrate criteria are met before injection and records of origin, characterisation etc., kept
    - CO_2 streams from different sources from will be accepted on a non –discriminatory basis

EC Draft CCS Directive

- Site selection
  - Detailed requirements set out (static model, dynamic model, and risk assessment required)
  - Permit allowed if no significant risk of leakage or if no ecosystem damage in extreme cases
- Monitoring needed for:
    - Checking behaviour of CO_2 in reservoir
    - Detection of migration
    - Detection of leakage
    - Detection of adverse effects on environment
    - Assurance of permanent storage
  - Monitoring plan to be based on best monitoring practise and regularly updated.

EC Draft CCS Directive

- Measures in event of leakage
  - Competent authority notified and corrective measures taken
    - Operator or competent body to take measures
- Transfer of responsibility
  - Competent authority takes charge of site when CO_2 demonstrated to be secure
    - Ensures future liabilities for states are low
    - Polluter pays principle applies
      - If there is a risk the operator pays

EEC Draft CCS Directive

- Closure
  - Closure plan required for initial permit
  - Resubmitted to competent authority when closure planned
  - Site only considered closed when CA confirms plan fully implemented
  - Site remains responsibility of operator until transferred to state
- Financial security
  - Operators to demonstrate financial competence for operation and closure
    - Analogous to oil and gas industry decommissioning rules
  - Corrective measures covered by insurance
    - Typical provision for petroleum industry

EC Draft Directive

- Access to transport/storage network
  - Non discriminatory access to network
  - Right to limit access retained
  - Non discriminatory access to storage prospects
- Review of draft permits
  - Review early on needed to ensure consistency of approach
  - Reviewed by EC or Scientific Panel
  - EC comments to be taken into account by Competent Authority
  - Final decision rests with Member States

Other EC Plans

- A revision to the existing directive on use of State aid will be announced in Late 2007.
  - Allow national governments to support demonstration projects directly
- The European Trading system will be modified to allow CCS projects to be included
  - Changes to rules to be announced in late 2007/early 2008
  - Help finance CCS projects in the future

United Kingdom

- UK currently has proposals for 8 demonstration projects
- UK Government has announced plans to support one demonstration project
  - Competition to be held in early 2007 with decision by end of 2007
    - Details not announced yet
- Guidelines
  - Project in UK and have a comprehensive engineering design
  - Will cover full CCS chain
  - At least 300MWe
  - Store at least 0.25mT/y CO_2
  - UK Government will support capture and storage component not full plant
  - Plant to be operational between 2011 and 2017
- UK will announce regulatory framework in Late 2007 for off-shore projects

Recent Developments in UK

- Government announced in October 2007 that it will support a single post combustion capture demonstration
  - Specific mention of coal
  - Post combustion technology considered to have most potential worldwide
  - Vital for the transition to a low carbon economy in China and India

Netherlands and Germany

- Dutch Government expressed their intent to host at least 1 CCS demonstration project
  - Mining Act adapted to allow for CCS
  - Initial informal tender to EC was rejected
    - Netherlands expected to build a 400 MW coal fired IGCC project
      - Magnum project supported by NUON
- Two project developers active in Germany
  - RWE planning a 450 MWe coal fired IGCC project with on-shore storage
    - May go it alone
  - Vattenfall have a built a 30 MW Oxy combustion pilot plant
    - Plans to build a 300MW demonstration project in Germany

Norway

- In July 2006 Statoil announces plan to build the Mongstad CHP plant
  - Gas fired power plant providing 350 MWh heat and 280 MWe
  - Due to be built in 2008 at a cost of $450M
  - Norwegian Government imposed need for CCS
  - Project pushed out to 2014
  - Norwegian Government will meet $594M for CCS plant
- It is also planned to create a European CO_2 Test Centre at Mongstad funded by Norwegian Government, DONG Energy, Statoil, Hydro and Vattenfall

Adaptation of Existing Laws

- Many countries in Europe looking at adaptation of existing laws
  - Norway – permitting operations under existing Petroleum and Pollution Control acts
  - Netherlands - Mining Law already adapted for K-12B
    - Covers both on and offshore operations
  - UK - Petroleum Act for North Sea operations
    - New White Paper to be issued in early 2008
    - UK Government will claim rights over all sea bed structures
    - Jurisdictional issues will prevent operations onshore for foreseeable future
  - Poland has advocated it will change its Mining Act
  - Germany can adapt oil and gas exploration laws for offshore operations and Mining Act for on-shore operations
- Most existing laws cover; permitting, construction, operational and abandonment phases but not post closure

Sleipner Case

- Sleipner is a production operation and is regulated under the Norwegian Petroleum Act
- Act requires:
  - A Plan for Development and Operation (PDO)
    - Approved by the Ministry of Petroleum and Energy
    - Approval requires a impact assessment
  - A Decommissioning plan
    - Monitoring conditions after decommissioning are yet to be set
- Pollution is subject to strict liability under PA

Sleipner Case

- Also regulated under the Pollution Control Act
  - Main provision is that pollution is prohibited unless permitted by law
  - Sources of pollution, or those that threaten pollution, must be identified
  - Sleipner also requires a permit under the PCA
  - Permit requires:
    - Injection is monitored and reported annually
    - Up to 1 Mt/y CO_2 can be injected
    - Actual volumes injected is reported annually

Summary

- It is likely than any regulatory regime will include the following:
  - Detailed site characterisation for permitting and operational requirements
  - Monitoring during all phases
    - Pre-operational, operational, post operational and post abandonment
  - Abandonment/closure plan
  - Remediation plan
  - Competent body to oversee permitting etc.,
  - Operators to demonstrate financial security
  - Insurance provision to cover leakage

THANK YOU
ANY QUESTIONS?