

ZEP – Skyggegruppemøte

Oslo 12. Desember 2007

**Paal Frisvold
Bellona Europa**

**Aage Stangeland, Christine Karlsen
Miljøstiftelsen Bellona**

Agenda

Velkommen

EUs planer for å bygge 10-12 demonstrasjonsanlegg for CO₂-håndtering.
- Hvordan skal dette finansieres?

Nytt EU-regulativ for CO₂-håndtering
- Hva vil dette bety for norske aktører?

Statsstøtte for Mongstad – kan ESA bli en flaskehals
- Orientering om EUs statsstøtteregler vs. CCS.

Forskning på CO₂-håndteringsteknologi
- Orientering om hva som vil bli prioritert

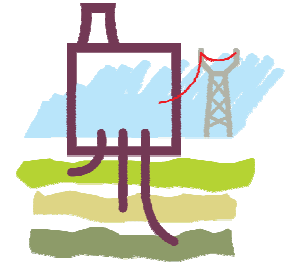
ZEPs planer for 2008

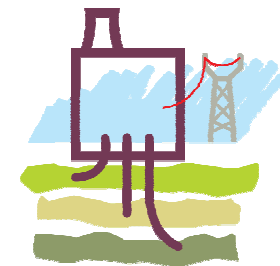
Bali – Hva ble egentlig resultatet?

Eventuelt

Ordet er fritt

Bellona vil ha innspill på hva ZEP bør fokusere på i 2008

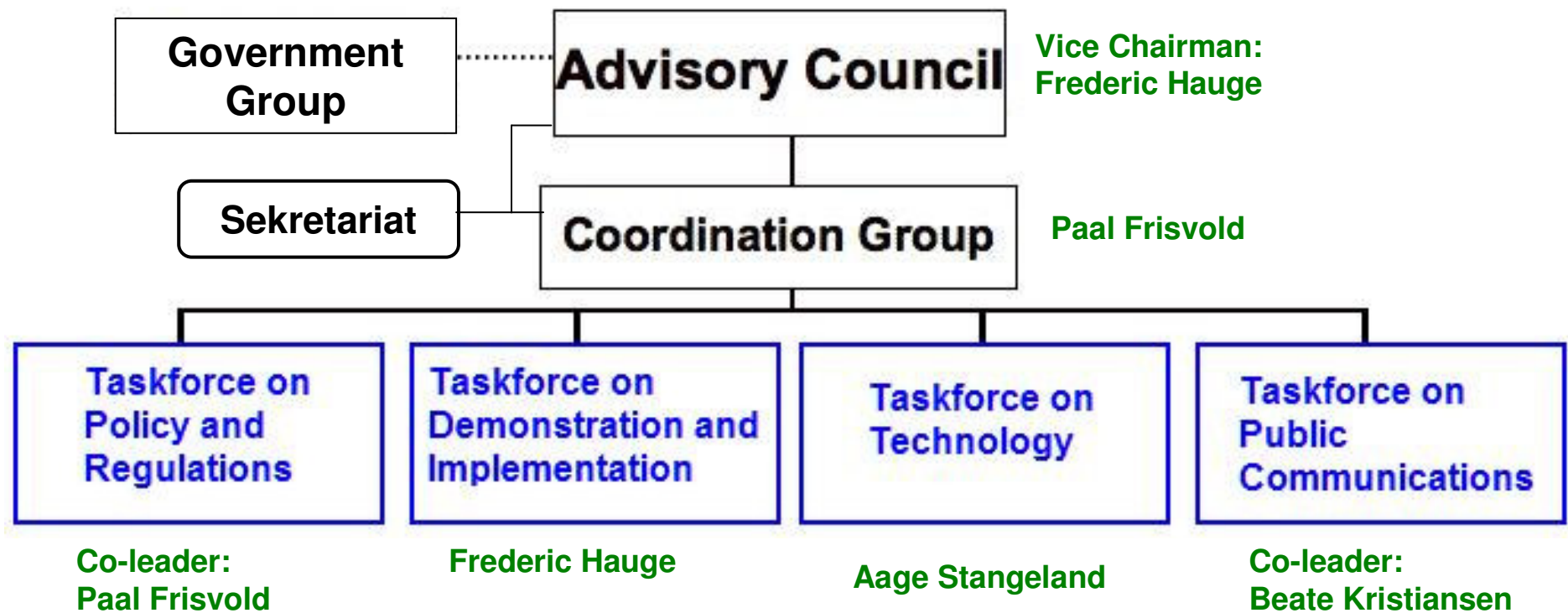
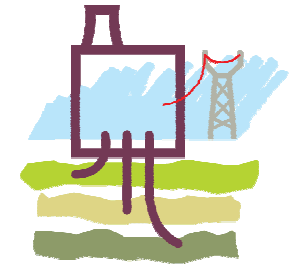




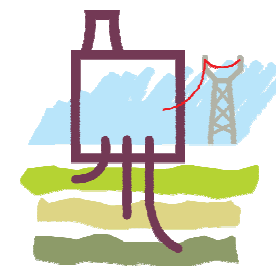
Status of CCS in ZEP, EU and globally

Paal Frisvold

ZEP - struktur



The Way Forward



**Min. 10-12 integrated
CCS Demonstration
Projects**

*Finalised construction of at
least 10-12 CCS
demonstration projects in
Europe (and China)*

2015

**EU Council and
Parliament**

*Adoption of Directive
on CO₂ Storage and
Comm. on
demonstration
projects.*

2008/2010

**Spring Summit
European Council
(Energy Council)**

*Strategic Energy
Technology Plan for
Europe*

(28 February 2008)

8 March 2008

**Communications
from Commission:**

*I. Legal Facilitation
Framework
II. Financial incentives
and the establishment
of a Flagship
Programme*

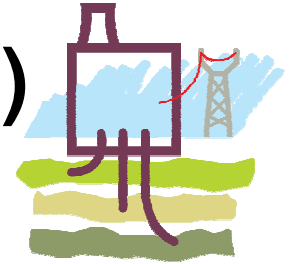
III. Revision of ETS

*IV. Revision of State
Aid Guidelines*

January 2008

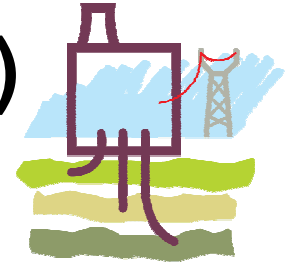


Strategic Energy Technology (SET) Plan for Europe



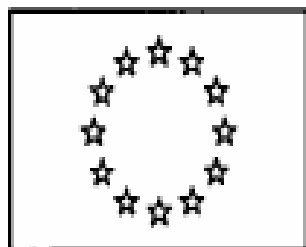
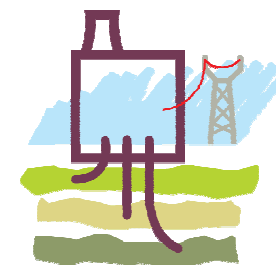
- Published on 22 November 2007, support from EU Energy Council on 3 December 2007
- **Aim:** better use and increase of resources to accelerate the development and deployment of low-carbon technologies by aligning European, national and industrial activities
- CCS: **key technology challenge** to reach EU's 2020 target
- Initiate transition to **low carbon energy network** and systems to help develop tools and models for EU level foresight in, among others, CO₂ transport and storage

Strategic Energy Technology (SET) Plan - DG RTD and DG TREN



- **European Industrial Initiative** on CCS to start in 2008:
 - Bring together actors and resources from industry, EU and MS to reach cost reductions and improved performance
 - For industries where scale of risks and investments can best be tackled collectively
 - To be implemented through public-private-partnership (e.g. JTI) or joint programming by a coalition of interested MS

- Communication on **financing low carbon technologies** by end of 2008:
 - Address resource needs and sources
 - Examine the possibility of new European mechanism/ fund for large-scale demonstration and market replication of advanced low carbon technologies
 - Examine the possibility of tax reduction mechanism on low carbon energy innovation



COMMISSION OF THE EUROPEAN COMMUNITIES

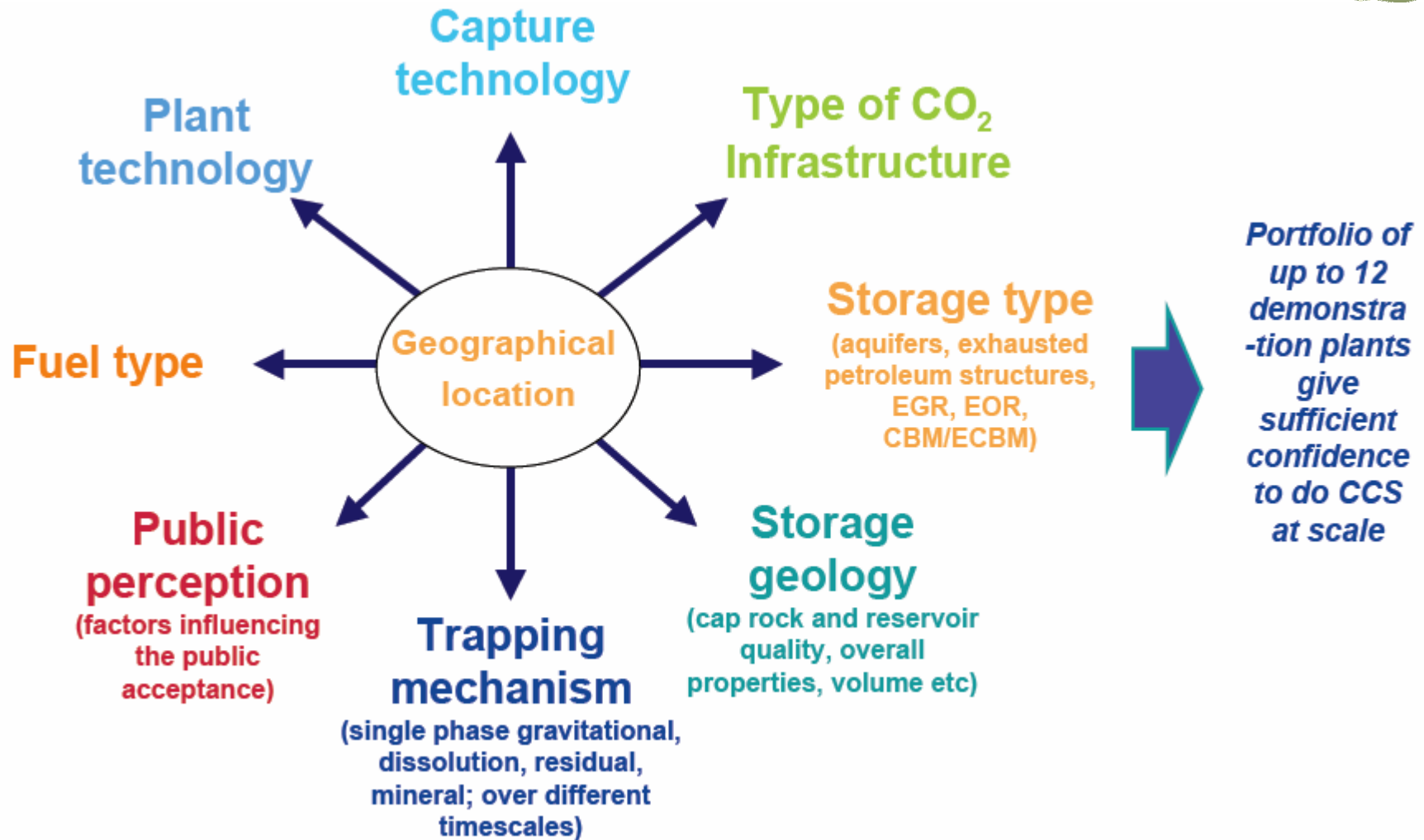
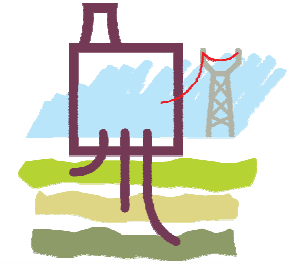
Brussels, 23.10.2007
COM(2007)

Draft

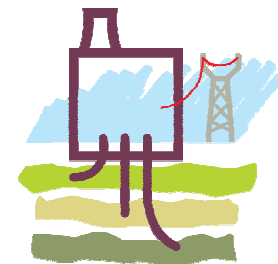
**COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE
EUROPEAN PARLIAMENT**

Supporting Early Demonstration of Sustainable Power Generation from Fossil Fuels

The Flagship Programme Will Cover a Wide Range of Parameters



Communication on supporting early CCS demonstrations - DG TREN



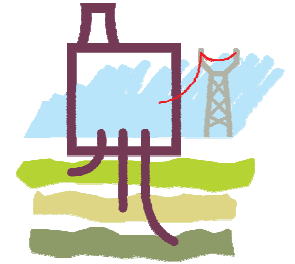
Member States

- Encouraged to **support demonstrations** through implementation of incentive measures or providing grants
- **EC will favourably view of state aid** covering the additional costs related to CCS demonstrations

Community level

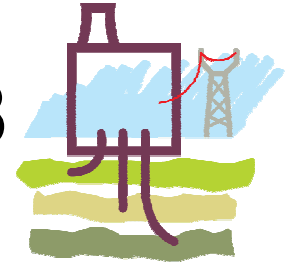
- Establishment of an "**EU Sustainable Fossil Fuels Network**"
→ selection of projects, information and experience exchange
- Revision of **Trans-European Energy (TEN-E) guidelines to include CO₂ pipelines and storage sites**
- **EU financing:**
 - Existing instruments: Structural/Regional funds, FP7, EIB
 - New instruments possible at later stage: ETS+

Communication on supporting early CCS demonstrations - DG TREN



- Final version to be published in January 2008
- Main messages:
 - *"Without bold funding decisions by the companies at the earliest opportunity, complementary public funding may not be triggered"*
 - *"Public funding would have to come primarily from Member States"*

G8 Communiqué: Tokyo June 2008



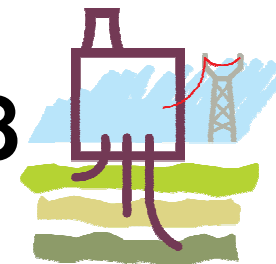
Demonstrating CO₂ Capture and Storage The G8 must act now to commit by 2010, to a diverse portfolio of at least 20 fully integrated industrial- scale demonstration projects

Taking Concerted International Action An early priority should be to include CCS in the CDM in December 2008.

Addressing the Financial Gap Establishing Legal and Regulatory Frameworks By 2010

Raising Public Education & Awareness

G8 Communiqué: Tokyo June 2008

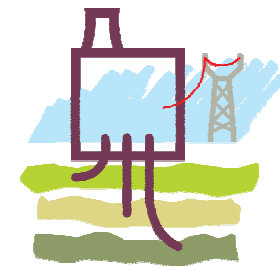


Urgent Requirements for the Near-Term Opportunities for Carbon Capture & Storage

G8 heads of government are urged to recognize the critical role of CCS in tackling global climate change and demonstrate the political leadership necessary to act now to initiate widespread deployment of this technology.

CCS can achieve substantial reductions in CO₂ in a world faced with increased demand for fossil fuels. With CCS, fossil fuels will become part of the solution, not part of the problem.

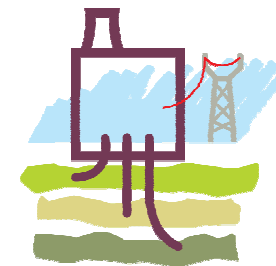
The IEA has estimated that, in addition to other mitigation options needed to combat climate change, CCS must be installed on the equivalent of 630 coal-fired power plants by 2030. Expedious deployment of CCS requires the following immediate actions:



Financial Models – Impact Assessment

Aage Stangeland

Financial Models for Flagship



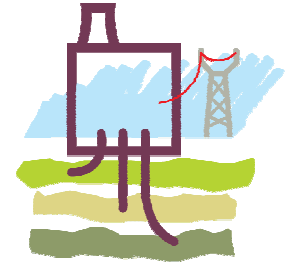
COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, (draft of 22 October 2007)

COMMISSION STAFF WORKING DOCUMENT

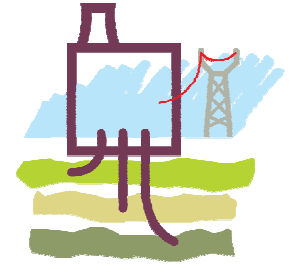
**Commission Communication to the Council and the European Parliament on
Supporting Early Demonstration of Sustainable Power Generation from Fossil Fuels
Impact Assessment**

Financial Models for Flagship Impact Assessment



- **Cost of Flagship: ~5 bn euro**
- **Problem: No budget in the Commissions for the Flagship**
- **Impact Assessment – 3 possibilities**
 - Option 0 – No policy Change
 - Option 1 – EU coordination mechanism
 - Establish coordination mechanism for demonstration projects
 - but no centralized programme
 - Option 2 – JU (Joint Undertaking)
 - The JU will coordinate the projects and bring in public funding
 - Legislative proposal for the JU
- **Option 1 is recommended**

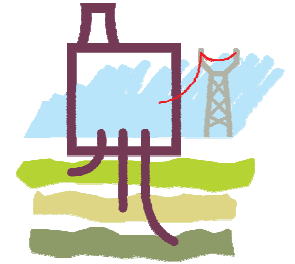
Financial Models for Flagship Impact Assessment



■ Option 0 – no policy change

- Only a few very big operators have financial resources to take the early risks
- Only a few demos will be built
- CCS have no impact on EU target of 20 % GHG emission reduction by 2020
- CCS commercial in 2030, not 2020
- Negative impact on energy cost and security of supply
- Only a few technologies exploited
- Break even CO₂-price will for many technical options remain high for a long time

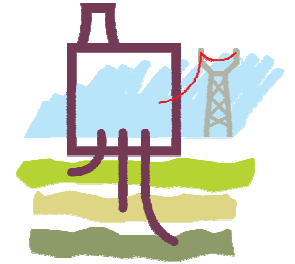
Financial Models for Flagship Impact Assessment



■ Option 1 – EU coordination mechanism

- Effective coordination structure in place 2008
 - Intermediary between industry and granting authorities
 - Exchange of info → better learning curves
- Will facilitate decision making of operators
- 12 demos expected by 2015
- CCS commercial available in 2020
- All technological options exploited
- Creating a common logo for CCS projects could give them additional commercial value

Financial Models for Flagship Impact Assessment

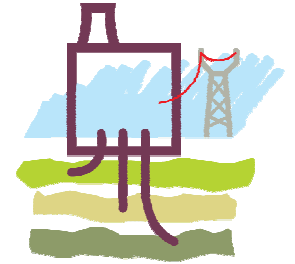


■ Option 1 – EU coordination mechanism

■ Financial model

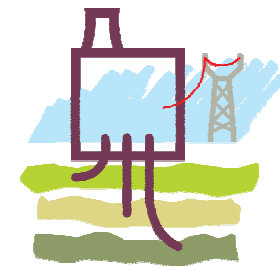
- Industry investment – because they will remain in the power generation business
- Member States (State Aid)
- Consumers if feed-in tariffs or low carbon certificates are implemented
- Auctioning of EU ETS allowances
- In long-term: electricity production cost in CCS plants will be competitive with traditional electricity cost
- Commercialization of CCS would increase electricity cost by 8 % in 2030

Financial Models for Flagship Impact Assessment



■ Option 2 – Joint Undertaking

- In long-term: Option 2 = Option 1
- Option 2 delayed 5 years compared to Option 1
- Positive effects
 - Allocated financial budget could channel investments proactive
- Negative effects
 - No budgets available
 - Demos will be delayed due to time consuming process to establish budget.

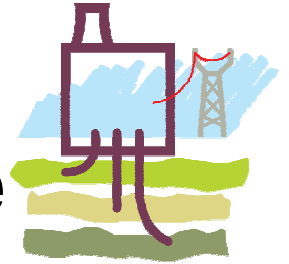


New EU directive on CO₂ storage

Aage Stangeland

New EU Directive from DG ENV

Regulatory Framework for CO₂ storage



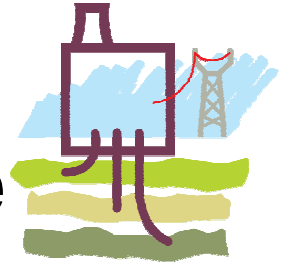
■ CO₂ Capture

- Regulation under Integrated Pollution Prevention and Control Directive (**IPPC**)
- **BAT** Reference Document for capture technologies?

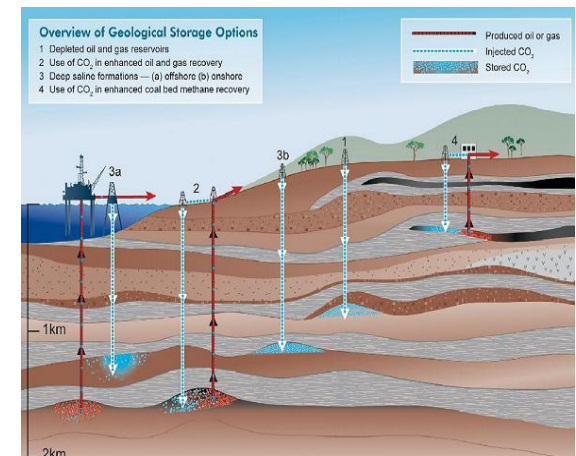
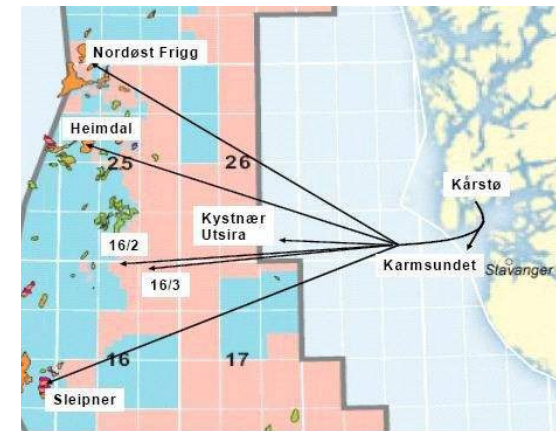
■ CO₂ Transport

- Transport by pipeline: Regulation at Member State level **as for gas transport**
- Transport by ship: similar approach

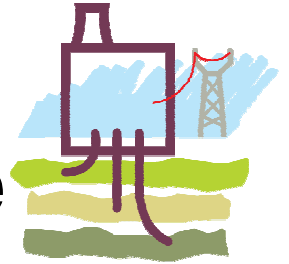
New EU Directive Regulatory Framework for CO₂ storage



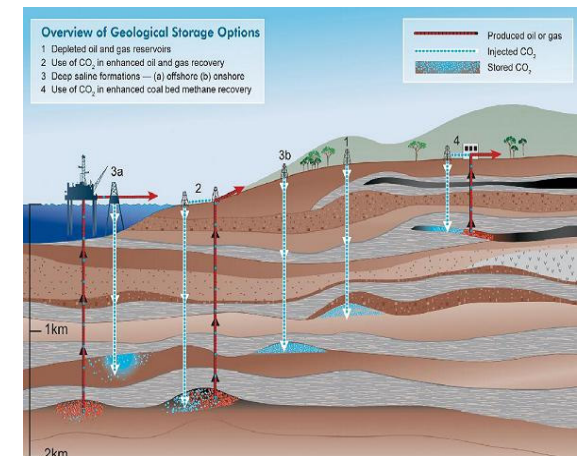
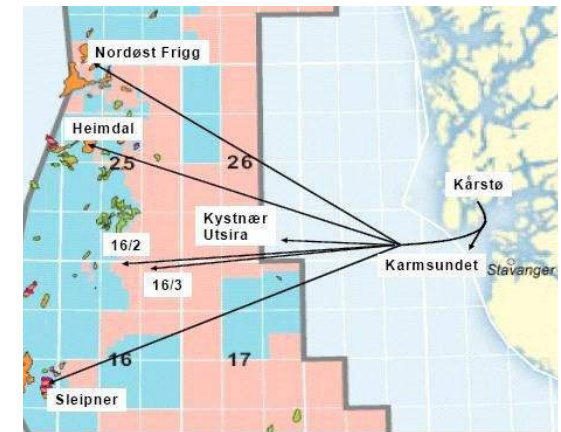
- The directive is designed to ensure that CCS is an available mitigation option, and that it is done safely and responsibly
- Action by Member States alone is not sufficient to ensure high level of environmental integrity for CO₂ storage
- The directive shall apply to the geological storage of CO₂, including enhanced hydrocarbon recovery
- Member States shall establish **competent authoritie(s)** responsible for fulfilling duties under the Directive



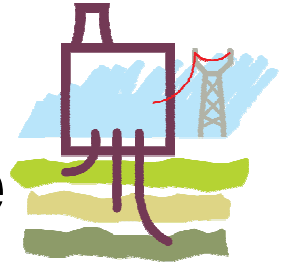
New EU Directive Regulatory Framework for CO₂ storage



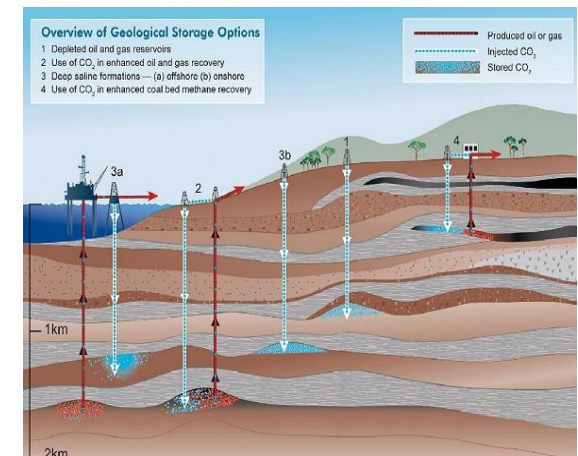
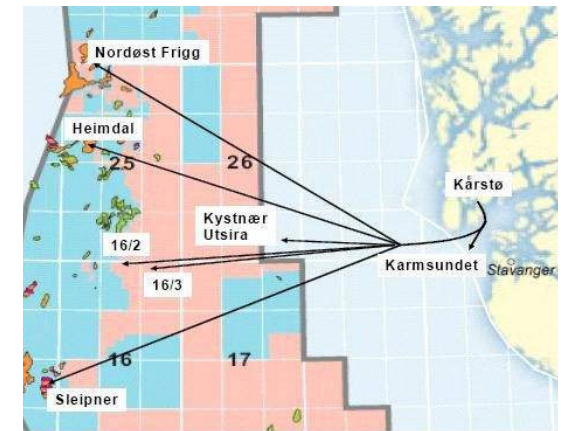
- Member States shall ensure that no exploration of potential CO₂ storage takes place without a ***exploration permit*** issued by a ***competent authority (CA)***
- ... and no geological storage without a ***storage permit***
- Application for storage permit shall include: site characterization, CO₂ source and quality, monitoring plan, closure plan, proof of financial security, proof of technical competence
- The CA must consider the Commission opinion before permits can be issued



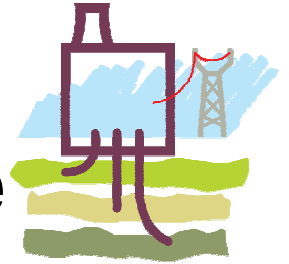
New EU Directive Regulatory Framework for CO₂ storage



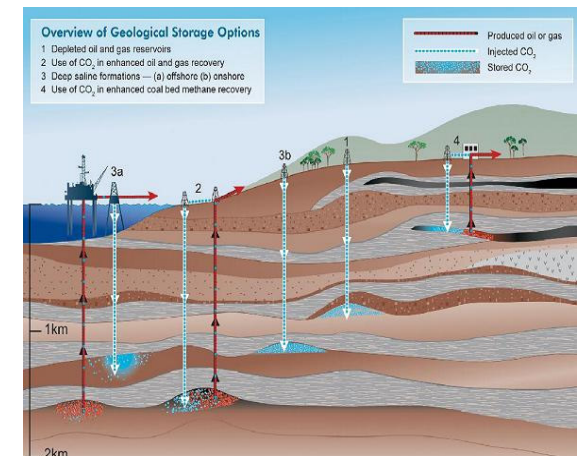
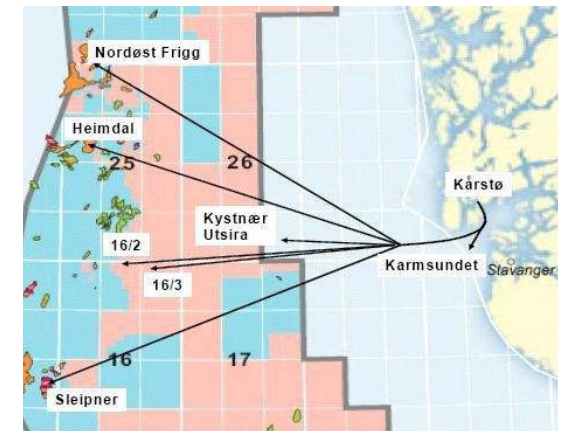
- The CO₂ stream shall consist overwhelmingly of carbon dioxide
- The operator must design a monitoring plan based on requirements laid out in the directive
- The monitoring plan must be approved by the CA
- The operator shall report all monitoring results to the CA



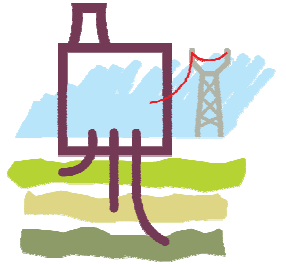
New EU Directive Regulatory Framework for CO₂ storage



- CA must arrange routine and non-routine environmental inspections
- If irregularities:
 - CA must take necessary corrective actions
 - Corrective actions by CA with cost incurred from the operator
- Closure plan must be based on best practice
- Post-closure responsibility transfer to CA can only take place if and when all available evidence suggest long-term security of the storage



New EU Directive Regulatory Framework for CO₂ storage



Making CCS mandatory:

- Impact Assessment Study → No proposal of making CCS mandatory

- But: Capture-ready requirement

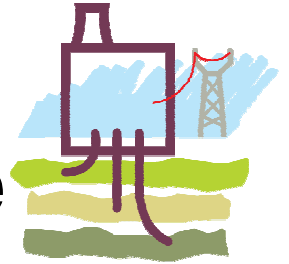
"...all combustion plants...have suitable space on the installation site for the equipment necessary to capture and compress CO₂ and that the availability of suitable storage sites and the technical feasibility of CCS retrofit have been assessed"

(amendment of Large Combustion Plants (LCP) Directive)

Reaching to stakeholder comments DG ENV will now consider the need for further specification of the categories of combustion installations that the requirement applies to

- Further legislative proposals possible by end 2015

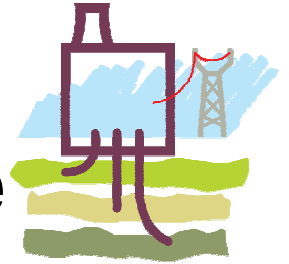
New EU Directive Regulatory Framework for CO₂ storage



Inclusion of CCS into the European Emissions Trading Scheme (EU ETS)

- Phase II (2008-2012):
 - **Opt-in** on voluntary basis for projects that include whole CO₂ value chain
- Phase III (2013-): **EU ETS Review**
 - Explicit and separate **inclusion of capture, transport and storage installations**
 - CO₂ captured credited as not emitted

New EU Directive Regulatory Framework for CO₂ storage



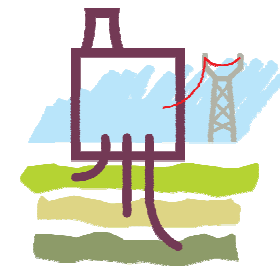
Change of water and waste legislation:

■ Water Framework Directive:

allow for "injection of carbon dioxide streams for storage purposes into geological formations which for natural reasons are **permanently unsuitable for other purposes...**"

■ Waste Framework Directive:

to be excluded from the scope of the Directive is "carbon dioxide captured and transported for the purposes of geological storage..."

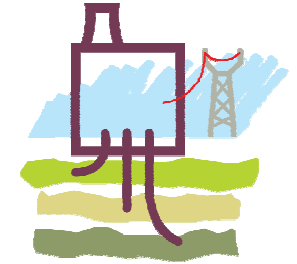


State Aid and the Mongstad Project

Christine Karlsen, Paal Frisvold

State Aid for Mongstad

- Will ESA be a problem?



EØS avtalen Art 61.

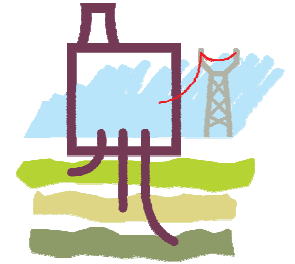
1. Med de unntak som er fastsatt i denne avtale, skal støtte gitt av EFs medlemsstater eller EFTA-statene eller støtte gitt av statsmidler i enhver form, som virer eller truer med å vri konkurransen ved å begunstige enkelte foretak eller produksjonen av enkelte varer, være uforenlig med denne avtales funksjon i den utstrekning støtten påvirkersamhandelen mellom avtalepartene. (art 87 EC Treaty)

The EFTA Surveillance Authority's State Aid Guidelines

Kommisjonen reviderer retningslinjene for miljøstøtte

State Aid for Mongstad

- Will ESA be a problem?



Kommisjonen sier i høringsnotatet;

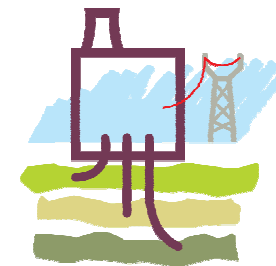
http://ec.europa.eu/comm/competition/state_aid/reform/reform.cfm

Støtte til oppsamling, transport og lagring av CO₂ kan utgjøre statsstøtte

P.g.a manglende erfaring er det for tidlig å fastsette retningslinjer for slik støtte

P.g.a EU's erklærte støtte til oppførelsen av demonstrasjonsanlegg m.m. kan prosjekter vurderes etter EF-traktaten art 87 (3) c eller være støtteberettigede som prosjekter av felleseuropeisk interesse, art 87 (3) b

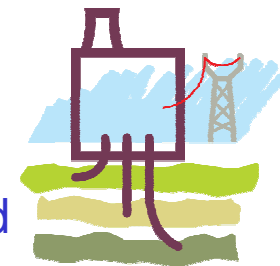
Krever at fordeler som følge av prosjektet gjøres gjeldende i hele EU



ZEP R&D Recommendations

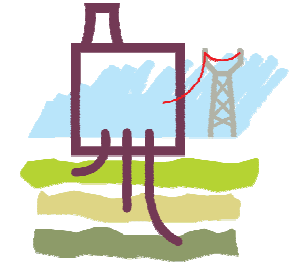
Aage Stangeland

ZEP R&D recommendations



- Updated report on recommended CCS R&D actions will be published February 2008
- **FP7 First Call:** ZEP recommendations only partly addressed
- **FP7 Second Call**
 - Opened in November 2007. Closing February 2008
 - Budget 26.3 mill euro (small call)
 - ZEP recommendations are addressed
 - CCS topics:
 - *CCS – Capacity building with large emerging economies*
 - *CO₂ transport and storage infrastructure development*
 - *CCS – Public acceptance*
 - *Development of a suitable methodology for the qualification of deep saline aquifers for CO₂ storage*
- **A large call is expected in spring 2008**
 - DG TREN call for Clean Coal
 - This call will show if EC is serious about CCS

ZEP R&D recommendations

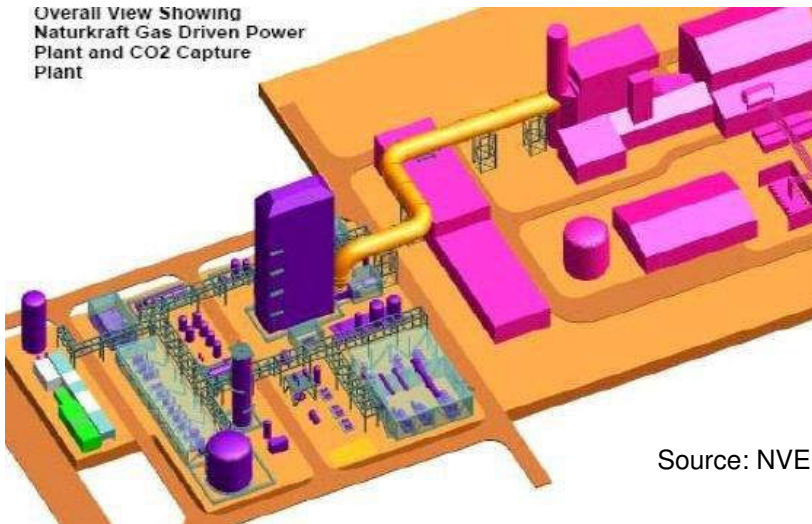


■ Prioritized R&D actions

■ Capture

- New solvents
- Full process optimization for pre-combustion
- H₂ gas turbines
- Oxyfuel boilers
- Material selection for oxyfuel
- Compression and conditioning of flue gas

Overall View Showing
Naturkraft Gas Driven Power
Plant and CO₂ Capture
Plant

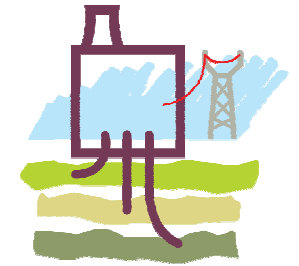


Source: NVE

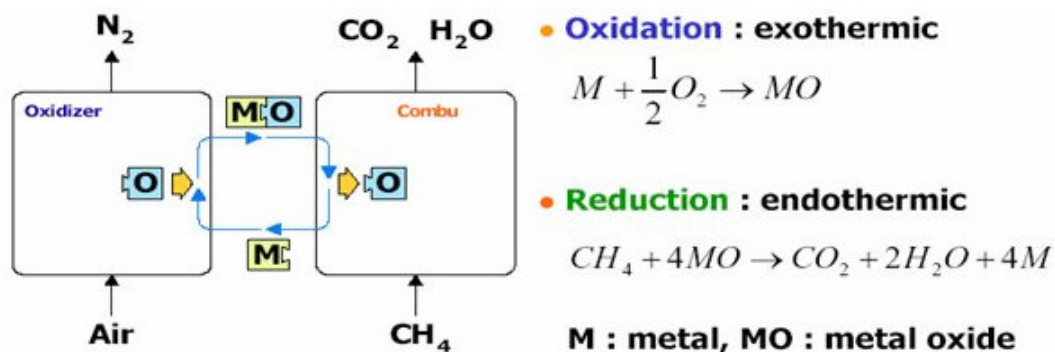


Source: StatoilHydro

ZEP R&D recommendations



- Prioritized R&D actions
 - Emerging an new capture technologies
 - Chemical looping
 - Carbonate looping cycles
 - CCS efficiency
 - Steam power plant efficiency improvements
 - GT development
 - Reduce turbo-machinery energy combustion

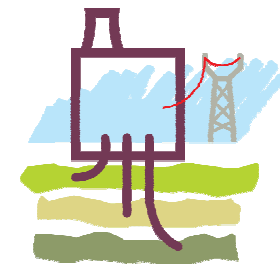


Source: Western Kentucky University

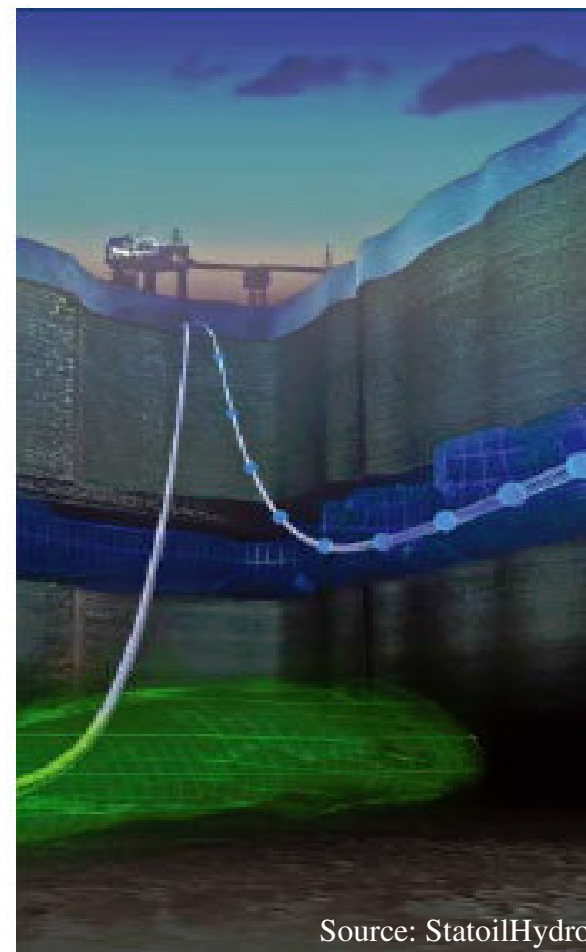


Source: Chalmers

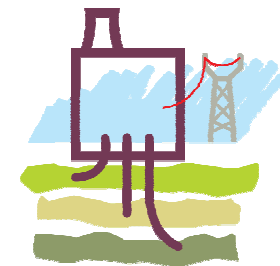
ZEP R&D recommendations



- Prioritized R&D actions
 - Storage in aquifers
 - Technical protocol for safe operation
 - Leakage through natural pathways
 - Capacity assessment
 - Long-term modelling
 - CO₂ use, transport and storage
 - Impact of CO₂ quality
 - Wellbore integrity
 - EOR/EGR/ECBM
 - Equipment modifications on existing installations
 - Support actions
 - Public communication
 - International coordination and collaboration
 - Preparing for post-Kyoto



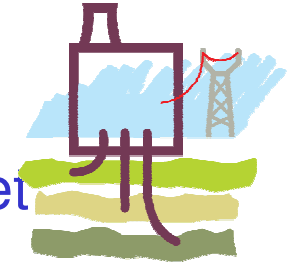
Source: StatoilHydro



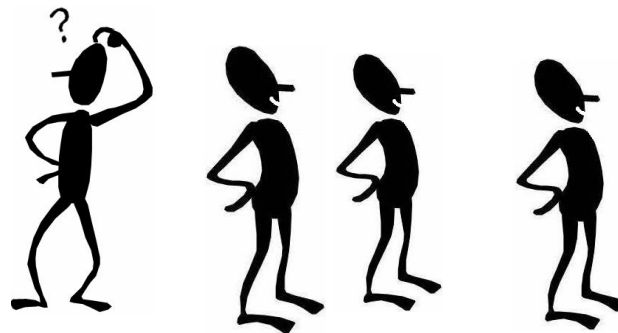
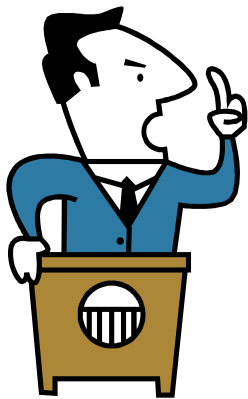
ZEP Public Communication

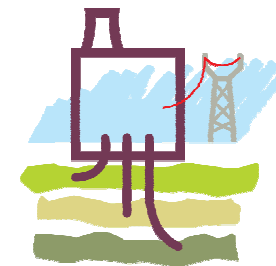
Paal Frisvold

Public Communication - Status



- Public Communication strategy established, but no budget available yet
- Employing full time person on communication
- Workshop with government group for application for FENCO funding
- Working with FP7 application
- Stand at EU Sustainable Energy Week, Brussels, January 2008
- EP Hearing on 4 March

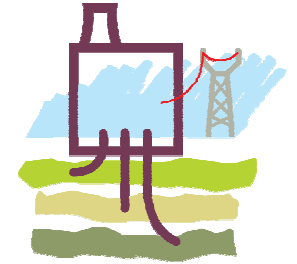




ZEP Plans 2008

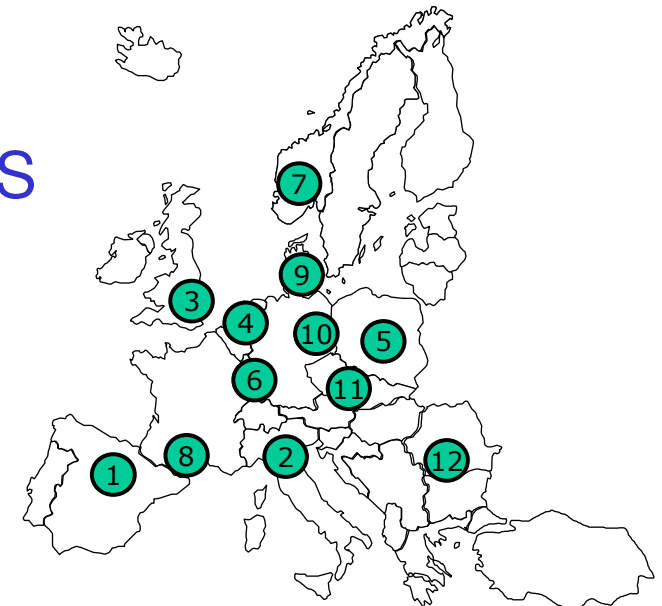
Paal Frisvold

ZEP plans for 2008



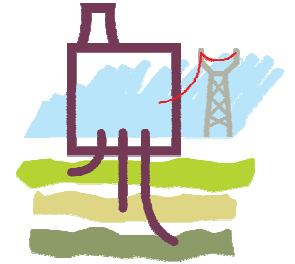
- Work closely with EC to ensure establishment of mechanism for supporting early demonstration of CCS
- Establish Financing of Flagship
- Update R&D recommendations
- Public communication

EU Flagship Programme

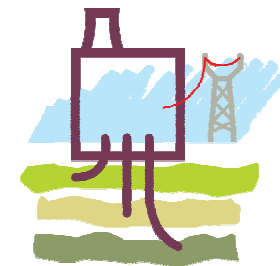


"a well known coherent set of demo projects spread over Europe"

Bellona ZEP plans for 2008



- **Actively participation in ZEP taskforces, AC and CG**
 - Ensure Flagship funding
- **Public communication – Establish Bellona CCS Web**
- **Skyggegrupper**
- **Conceptual studies**
 - Regulatory framework for CO₂-storage
 - Infrastructure – Define optimal infrastructure for transport of energy and CO₂
 - How to reach 50-85 % reduction in global CO₂ emissions



AOB

Summary of the Bali conference

Discussion