

Carbon Capture and Storage: Outlook and Challenges

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1. Why CCS?
2. Is CCS happening?
3. What are the challenges for wider deployment?

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WHAT IS CCS?

Carbon Capture and Storage is a group of technologies and applications that enable:

1. Capture of CO₂ from large point sources

Power plants, steel, cement, chemical industries, gas processing etc.



Alstom

2. Its transport

Trucks, ships, pipelines



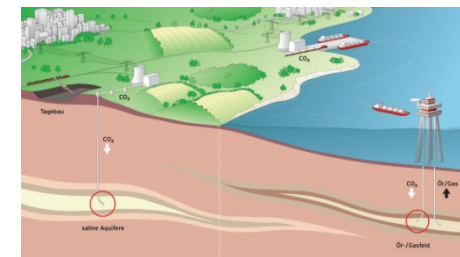
Maersk



Gassco

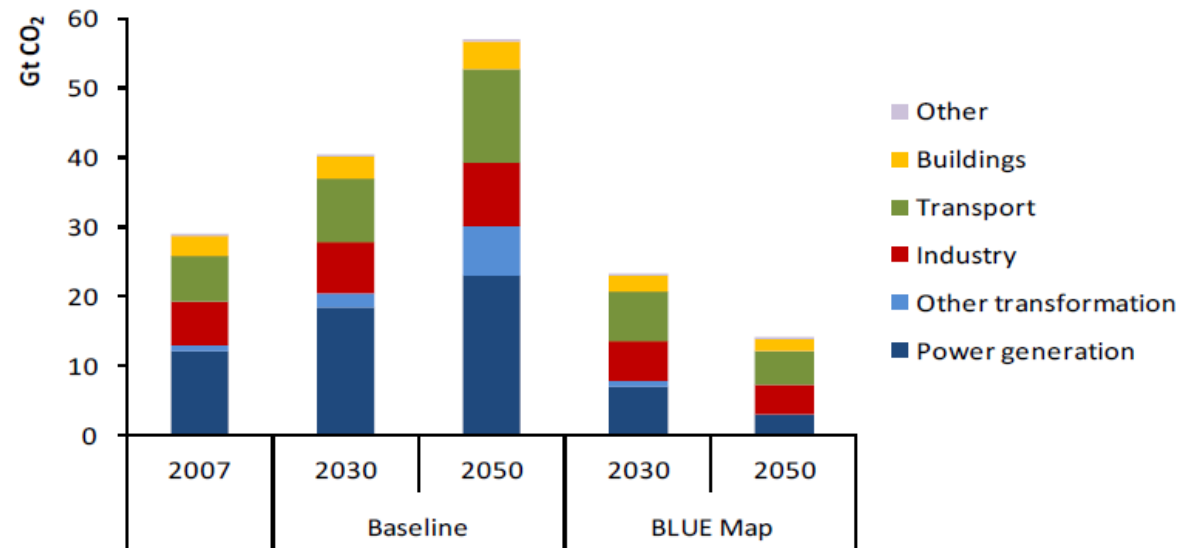
3. Storage of CO₂ in geological formations

Depleted oil and gas fields, saline aquifers, EOR, ECBMR etc.



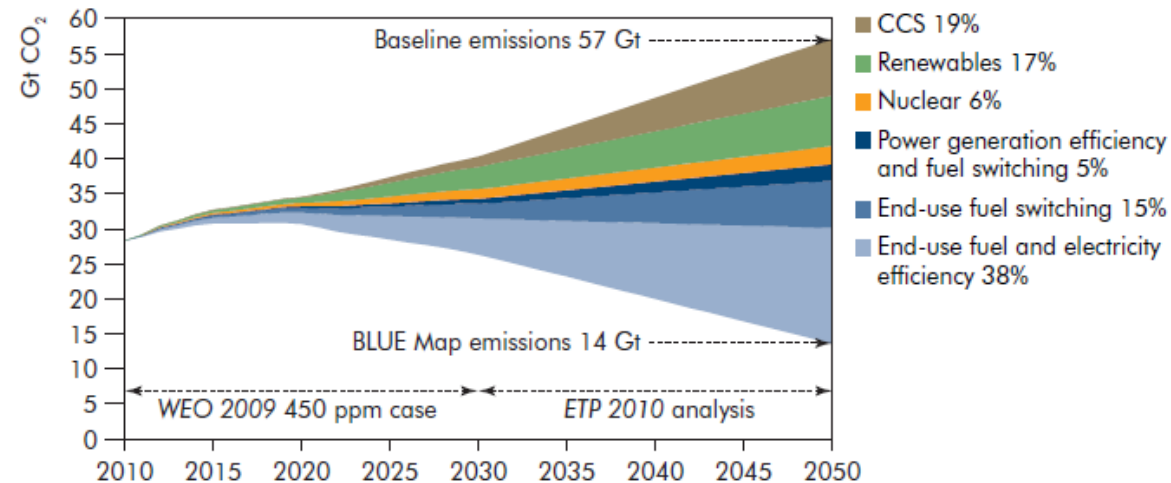
Vattenfall

CO₂ EMISSIONS FROM ENERGY TO 2050



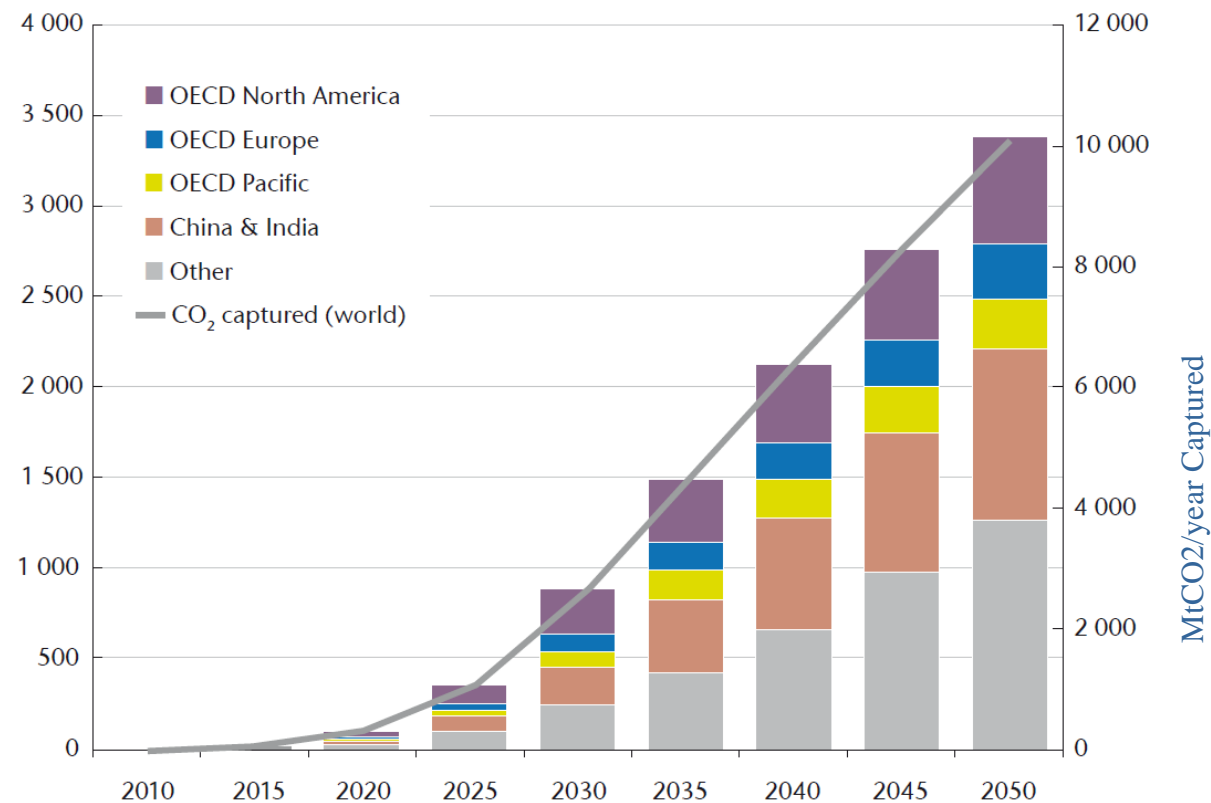
- 29 GtCO₂ in 2007
 - Baseline: double to 57 GtCO₂ in 2050
 - BLUE Map: halved to 14 GtCO₂ in 2050
- A wide range of low-carbon technologies contribute to the BLUE Map scenario CO₂ emission reductions

ROLE OF CCS IN EMISSION CUTS



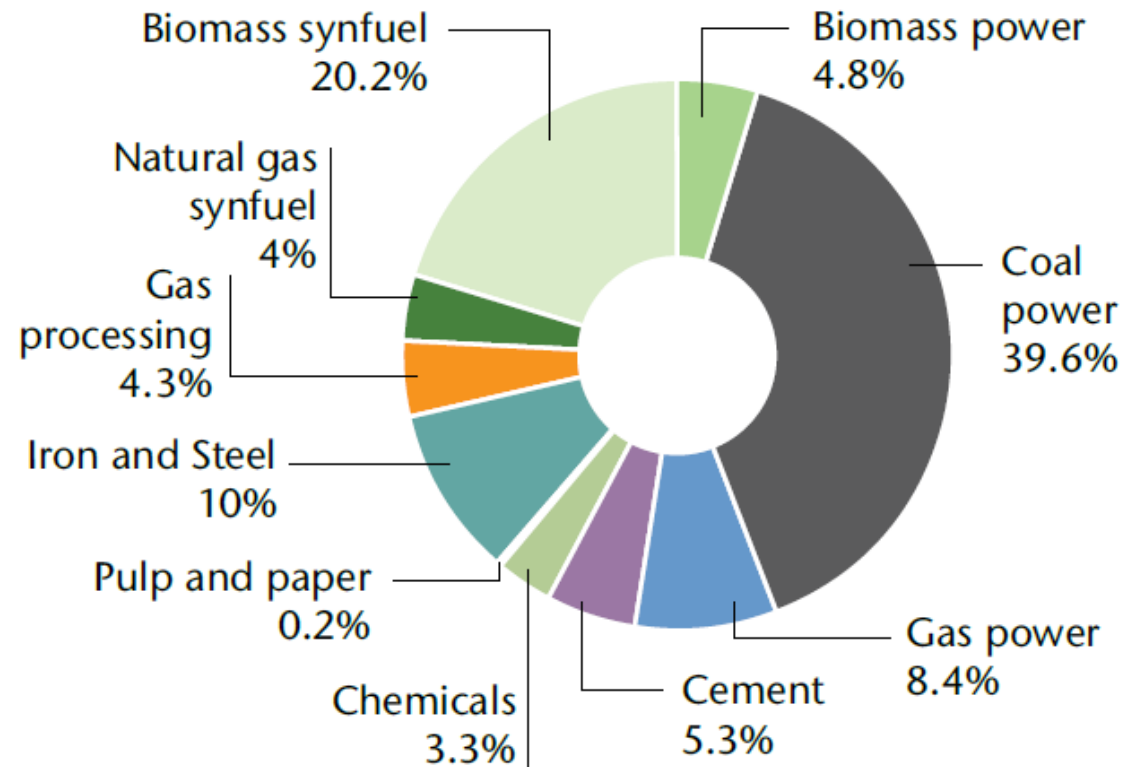
- 2nd largest share (19%) of CO₂ reductions in 2050
- 31% of CO₂ reductions in power sector in 2050
- In 2050, 90% of coal-electricity is from CCS plant
- Scenario without CCS-power: + USD 4,7 trillion additional investment cost 2010-2050
- In industry & fuel transformation, CCS contributes to 33% of direct emissions reductions

CCS: CHALLENGING DEPLOYMENT



Ambitious growth path 2010-2050:
 - 3400 projects operational in 2050
 - 145 Gt stored 2010-2050

CCS NOT ONLY ABOUT “CLEAN COAL”



Coal power only makes up around 40% of stored emissions in 2050

SO WHY CCS?

1. CCS is **part** of the solution to climate change
2. CCS has enormous **potential** to cut CO₂ emissions globally
3. Allows flexibility for governments and industry
4. CCS can help achieve climate goals **cost-effectively**
5. Provides a field for cooperation and partnerships between developing and developed countries

But, deployment pathway is very challenging and 2010-2020 is a critical period to kick-start development

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CO₂ IS CAPTURED AND STORED AS WE SPEAK...



*Five large-scale projects are
successfully storing CO₂*

... AND MORE IS PLANNED

85 integrated large-scale projects in various stages of development



Storage Type

- △ Geological
- Beneficial reuse
- Geological and/or beneficial reuse
- ☆ To be determined (TBD) or undisclosed

Capture Facility

- Power generation
- Natural gas processing
- Coal to liquids
- Coal gasification
- Oil refining
- Fertiliser production
- Aluminium, steel, cement or paper
- Various

Source:



SO IS CCS HAPPENING?

1. **Technologies** to capture, transport and store CO₂ **exist**
2. Large-scale projects are being **operated**
3. More demonstration activities are **planned**
4. New demonstration concentrated in **OECD countries** and in the **power sector**

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The next ten years: a critical period for CCS

■ Demonstration milestones

- Achieve commercialisation with 100 projects by 2020
- G8 goal of 20 project announcements by 2010
 - ◆ The G8 commitment to “beginning broad deployment of CCS by 2020” is achievable but it will be challenging

■ Financial milestones

- Provide USD 42 bn for near-term demonstrations; also need to fund longer-term R&D
- OECD governments increase funding for CCS to an annual average investment of USD 3.5 – 4 bn between 2010 and 2020
- Provide an annual average investment of USD 1.5 – 2.5 bn between 2010 and 2020 in Non-OECD regions
- Finance and plan CO₂ transport infrastructure

Challenges I:

UNCLEAR STRATEGIC DIRECTION

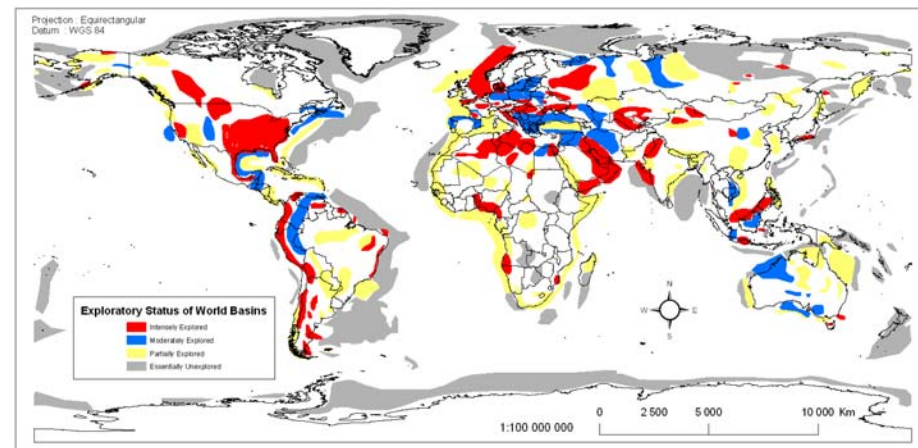
- Lack of broad understanding (and belief?) of the **scale and urgency of action** required to address climate change
 - Currently no global binding commitment to cut CO₂ emissions
- Limited public and government **understanding of CCS**, of its positive and negative features and of the role of CCS within the broader technology portfolio
- Limited attention on **industrial CCS** applications

Challenges II: INCOMPLETE REGULATION

- Lack of **legal and regulatory frameworks** for CCS demonstration and for broad deployment in many parts of the world, especially in key non-OECD countries
- **Outstanding issues** in domestic legal and regulatory frameworks e.g. long-term liability
- Outstanding **international legal issues** including lack of international incentives within the UNFCCC

Challenges III: UNDERSTANDING CO₂ STORAGE

- No common **methodology** to estimate storage capacity
- Uneven data on global/regional/national storage **capacities**
- Limited appreciation of the **time** required to select and characterise a CO₂ storage facility
- Significant uncertainty on who should be responsible for **long-term liability**
- Lack of **public awareness** and acceptance



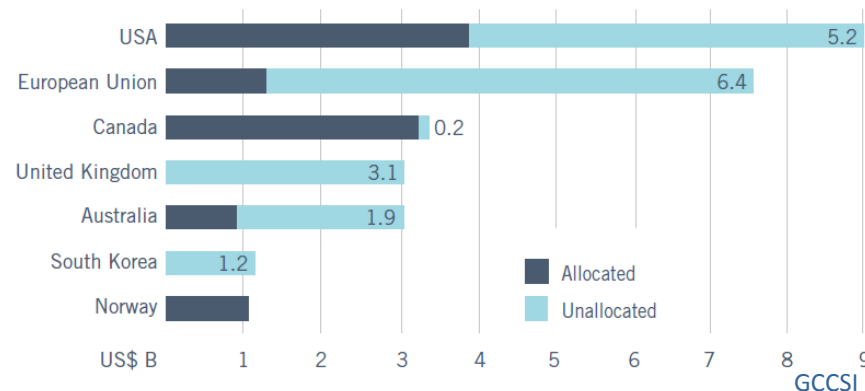
IEA GHG, GCCSI

Challenges IV:

MONEY & KNOWLEDGE SHARING

- **Insufficient or slowly emerging** financing by industry and governments for CCS demonstration
- High capital and operating **cost** with today's capture technology
- Limited incentives for commercial-scale **deployment**
- No broad mechanism for financing CCS in **non-OECD countries**
- Lack of global **knowledge-sharing** mechanism for demonstration projects

FIGURE 2: Funding announcements and allocations by country



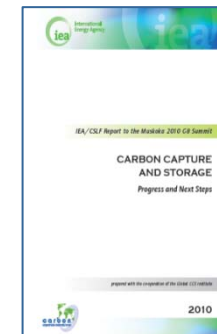
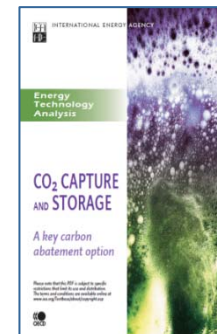
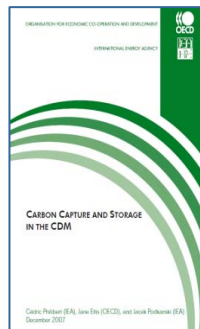
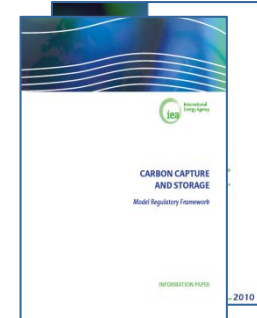
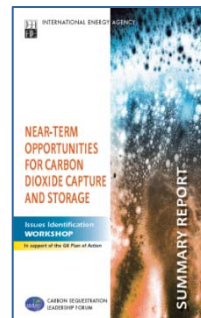
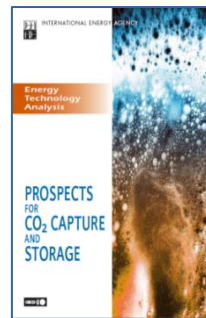
SO WHAT ARE THE CHALLENGES?

1. Understanding, communicating the role of CCS
2. Getting regulation right
3. Increasing knowledge on storage capacities
4. Developing financing/incentive mechanisms, also in non-OECD countries
5. Enhancing demonstration efforts

Next steps

- Enhance efforts to meet the goal of broader CCS deployment by 2020
 - Across sectors and in developed and developing countries
- Continue efforts to have CCS recognised fully in UNFCCC incentive mechanisms
- Promote knowledge sharing on CCS demonstration projects
- Commit private and public financial resources for CCS demonstration, particularly in developing countries.
- Develop and finalize legal and regulatory frameworks in key CCS regions
- Increase efforts to characterize suitable geology for CO₂ storage

CCS@IEA: PUBLICATIONS TO DATE



2004

2005

2006

2007

2008

2009

2010

Latest in Oct 2010:

IEA Model Regulatory Framework and Legal & Regulatory Review

Thank you!

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www.iea.org/ccs