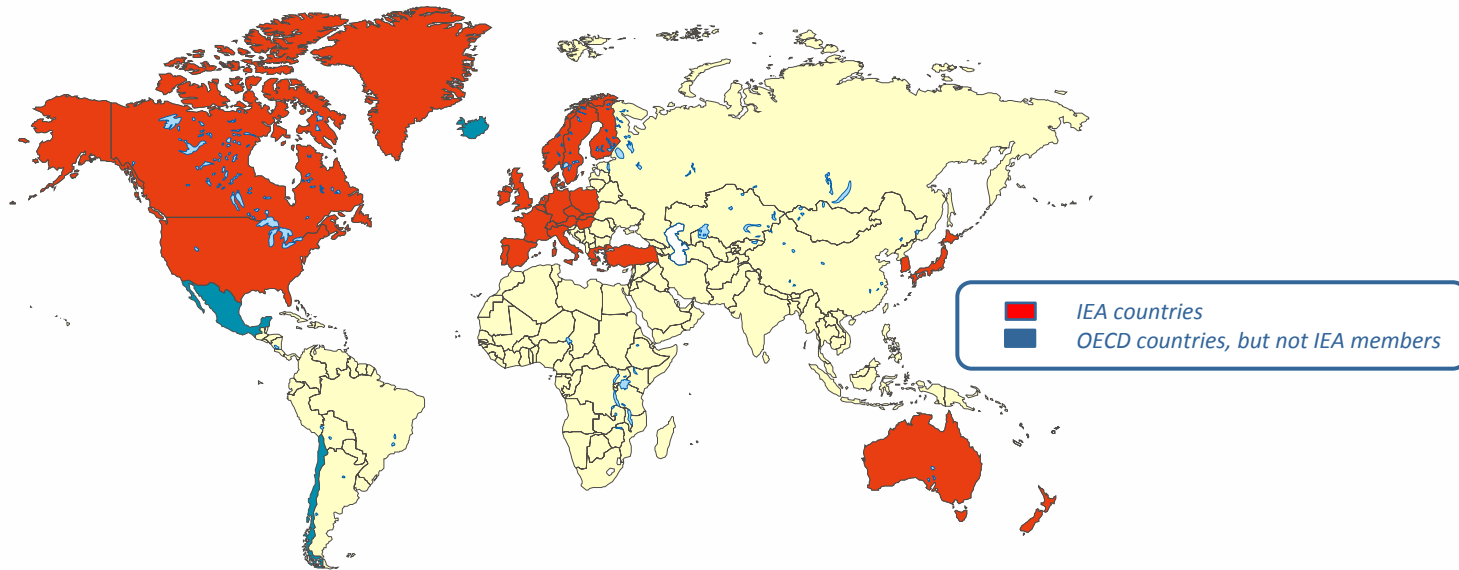


Why capture and store CO₂: Potential, Progress and Challenges

13 April 2011

Tsukasa yoshimura
Carbon Capture and Storage unit
International Energy Agency

International Energy Agency



- Inter-governmental body founded in 1973, currently 28 Member Countries
- Policy advice and energy security coordination
- Whole energy policy spectrum and all energy technologies: Key goals are: energy security, environmental protection and economic growth
- Flagship publications include WEO and ETP
- Host to more than 40 technology-specific networks (“Implementing Agreements” or “IAs”)
 - Operated independently with their own membership and financing
 - Includes GHG IA
- Active in CCS since 2000; dedicated CCS unit created in 2010
 - Provides policy advice
 - Supports broader IEA cross-technology analysis

CONTENTS

1. Role of CCS
2. Current status of development
3. Challenges for deployment



CCS IS A *CHAIN*

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

1. Capture of CO₂ from large point sources

Power plants, steel, cement, refineries, gas processing etc.



2. Its transport

Trucks, ships, pipelines



Maersk



Gassco



3. Storage of CO₂ in geological formations

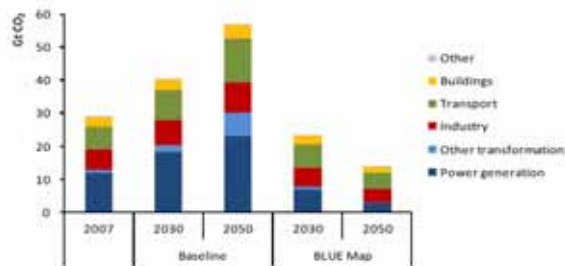
Depleted oil and gas fields, saline aquifers, EOR, ECBMR etc.



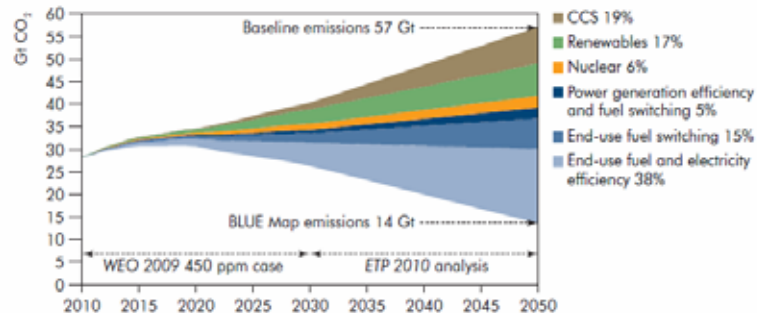
Vattenfall

TOWARDS 450ppm: CCS PART-SOLUTION

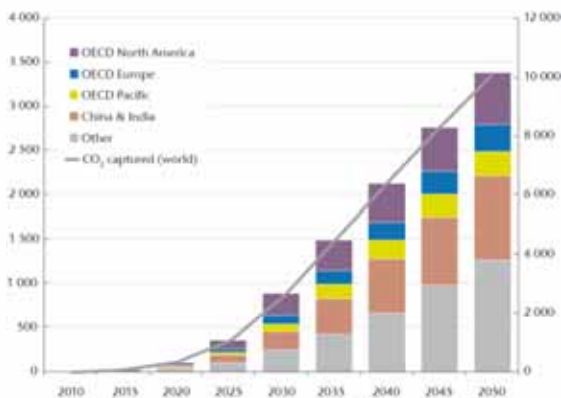
1. CO2 emissions from energy must be halved



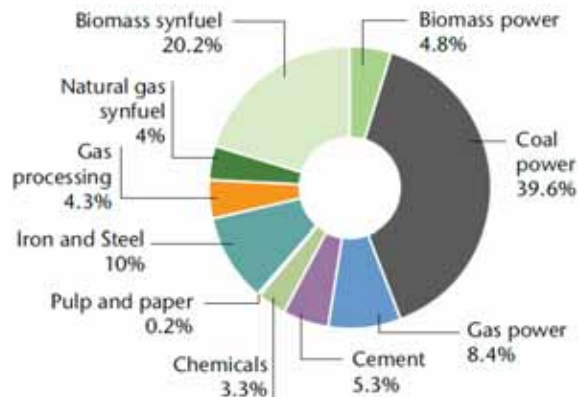
2. CCS plays a significant role in the low-carbon mix



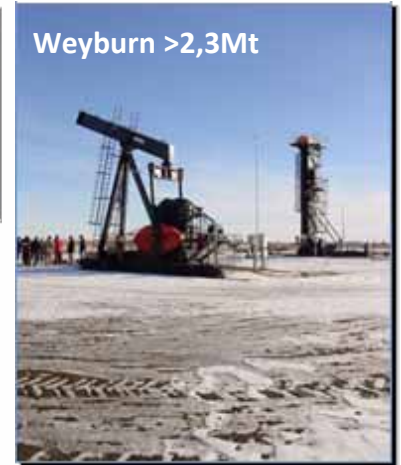
3. Deployment is very challenging



4. ... And CCS is not only about power



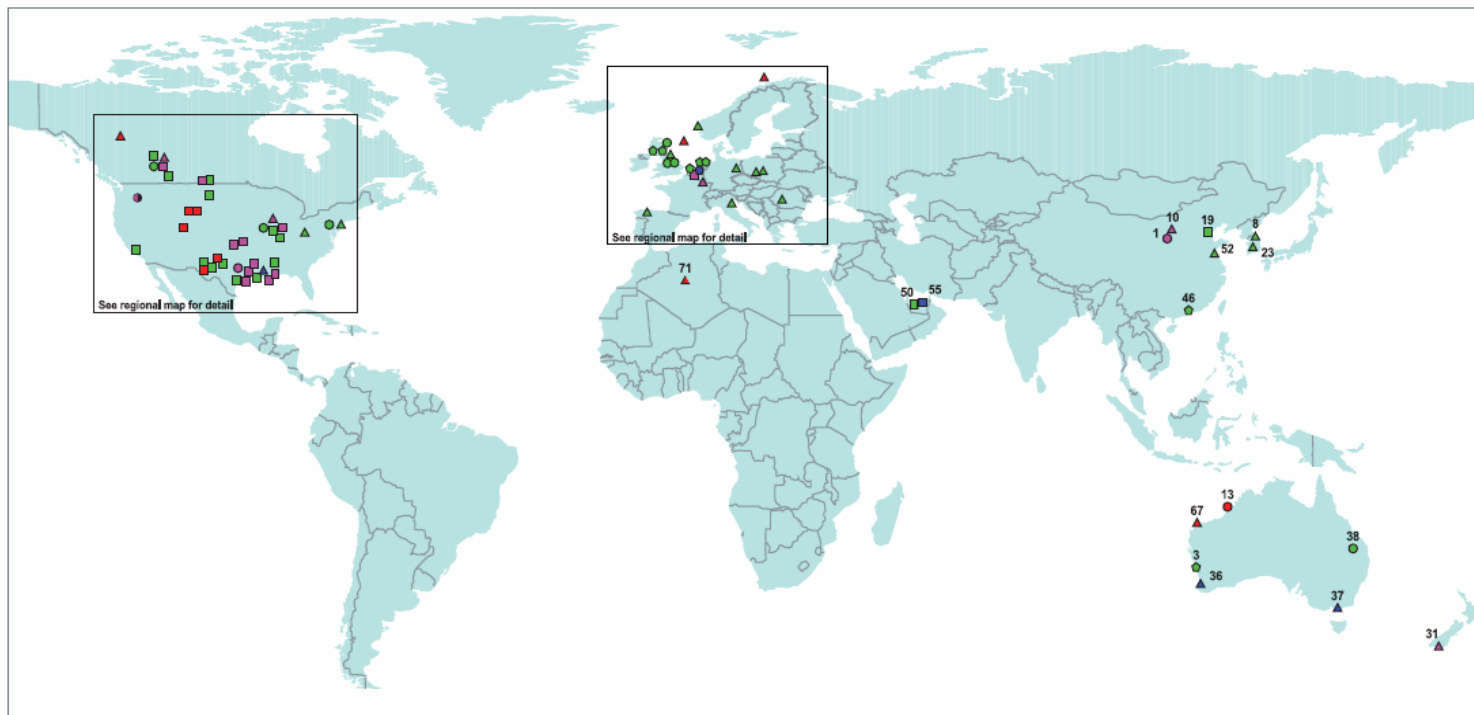
CO₂ IS CAPTURED AND STORED AS WE SPEAK...



*Five large-scale projects are currently
storing $\geq 5\text{Mt CO}_2$ per year*

... AND MORE IS PLANNED

*72 other integrated large-scale projects
in various stages of development*



LSIPs: Global

- Industry sector
- Power generation
 - Gas processing
 - Multiple capture facilities
 - Other industry

Storage type

- EOR (Enhanced oil recovery)
- △ Deep saline formations
- Depleted oil and gas reservoirs
- Deep basalt formations
- Various/not specified

Source:





So, we know CCS has enormous potential, technologies exist and projects are being advanced...

...but what are the challenges going forward?

**CARBON CAPTURE
AND STORAGE**

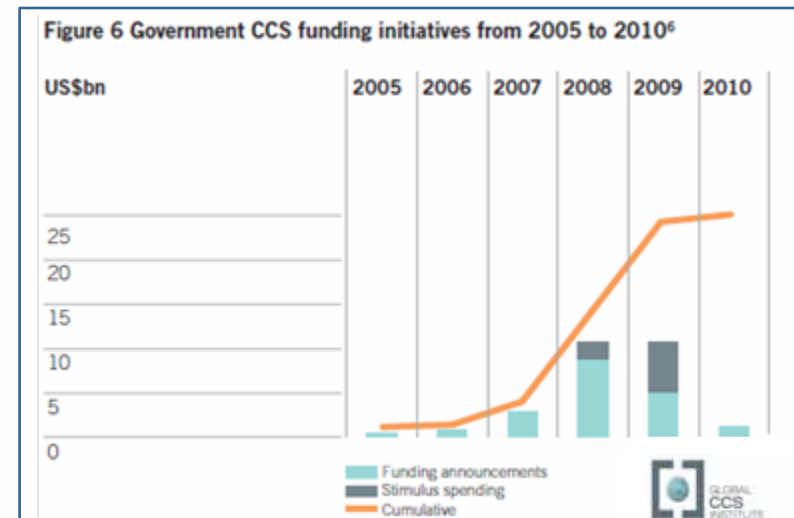
Challenges I: SETTING STRATEGIC POLICY DRIVERS & DIRECTION

- Making firm decisions corresponding to the **scale and urgency of action** required to address climate change
 - Improving **understanding of CCS** and its role within the broader technology portfolio
 - More attention on **industrial CCS** applications
- *Key Related IEA Activities:*
CCS Roadmap 2009, Submission to UNFCCC 2011, UNIDO Industry CCS Roadmap 2011

Challenges II: CREATING INCENTIVES (1)

- Short-term: **accelerating financing** by industry and governments for large-scale **demonstration**
- Various “one-off” government schemes for 20-40 large-scale demo plant across the globe, worth ~USD 25 bn:
 - Direct subsidy
 - CO₂-price linked schemes
 - Fiscal measures etc.

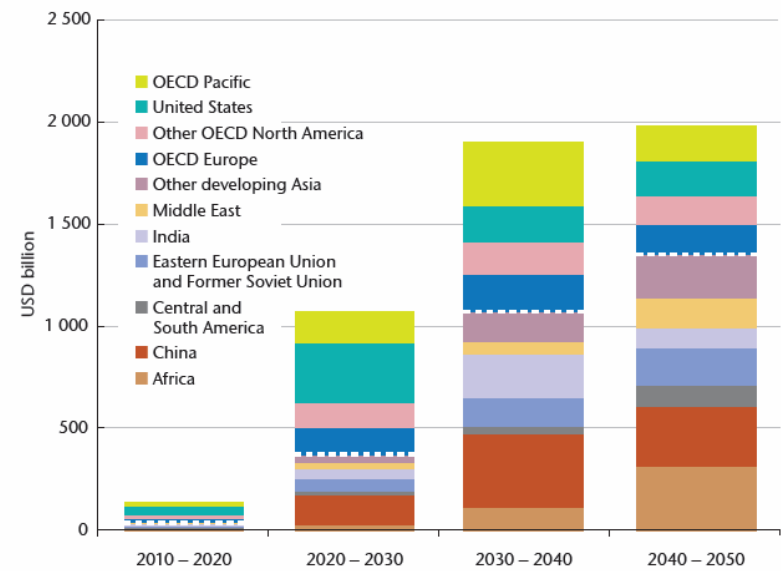
□ *Key Related IEA Activities:*
Forthcoming CCS Demo Projects
Financing Study



Challenges II: CREATING INCENTIVES (2)

- Long-term: mobilising **2500 bn USD** investment in capture plant, transport and storage between **2010-2050** for **deployment**
- Carbon pricing, feed-in tariffs, subsidies etc. etc.

□ *Key Related IEA Activities:
Forthcoming **CCS Incentives Study***



Challenges III: COMPLETING REGULATION

- Many OECD countries have implemented, or are implementing, **legal & regulatory frameworks**
 - Safety & environmental effectiveness
 - Long-term liability
 - Ensuring public engagement
 - Completing frameworks in many parts of the world, especially in key **non-OECD countries**
 - Dealing with outstanding **international legal issues** e.g. ratification of the London Protocol and OSPAR amendments
- *Key Related IEA Activities:*
Model CCS Regulatory Framework & Review, Workshops

IEA Model CCS Regulatory Framework & Review

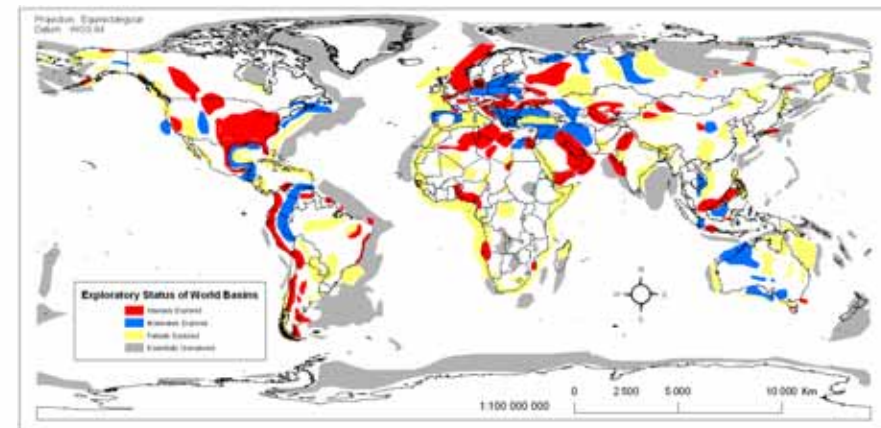


- Regulatory development process
- Capture, transport and **storage**
- 29 key issues
- 4 categories
 - A. Broad regulatory issues
 - B. Existing regulatory issues
 - C. CCS-specific regulatory issues
 - D. Emerging CCS regulatory issues

Challenge IV: ENHANCE UNDERSTANDING of CO₂ STORAGE

- Developing common **methodology** to estimate storage capacity
- Improving data on global/regional/national storage **capacities**
- Clarifying responsibilities for **long-term liability**
- Alleviating **public concerns**

□ *Key Related IEA Activities:*
Capacity Estimation
Methodology
Workshop April 2011



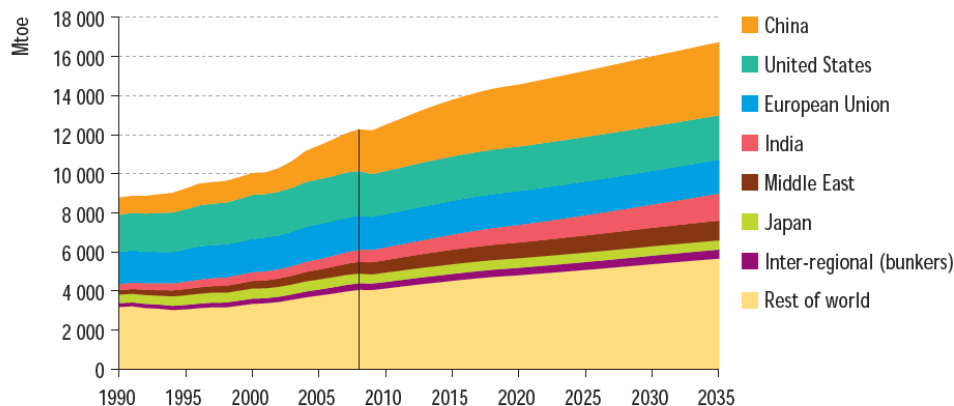
Challenge V: TECHNOLOGY & INFRASTRUCTURE

- Reducing capital and operating **cost**
 - Understand differences in costs across technologies & regions
 - Analyse potential for cost reduction by learning
- Understanding industrial and other **deployment bottlenecks**
- Accelerating progress in pipeline infrastructure **planning** and **coordination**

- *Key Related IEA Activities:*
CO₂ Capture Cost and Performance Analysis & Workshop 2011

NEW POLICIES: ENERGY & EMISSIONS GROWTH CONTINUES*

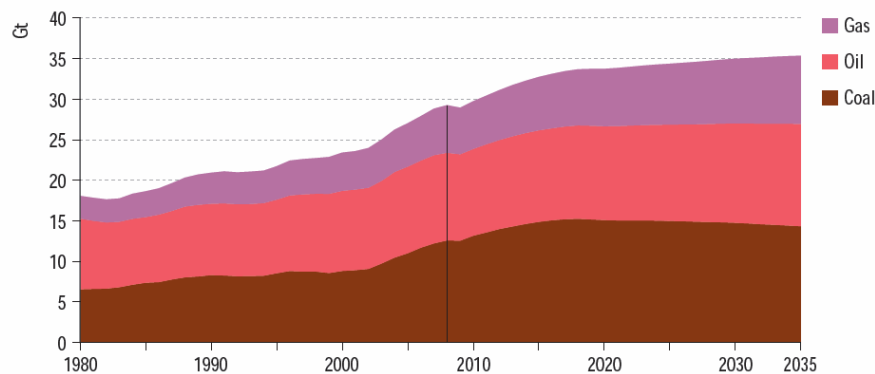
Figure 2.5 • World primary energy demand by region in the New Policies Scenario



2008-2035

- Energy demand +35%
- China: 35% of global incremental demand
- OECD demand stagnates

Figure 2.13 • World energy-related CO₂ emissions by fuel in the New Policies Scenario



- Energy-related CO₂ emissions 35 Gt by 2035
- Growth from non-OECD countries
- 650ppm pathway

CONCLUSION: ARE WE MOVING AHEAD?

- **Yes**, because we have **technology**, projects are advancing and **regulation** starting to emerge
- **No**, because we still **lack drivers and incentives** for large-scale deployment



Thank you!

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**CARBON CAPTURE
AND STORAGE**