

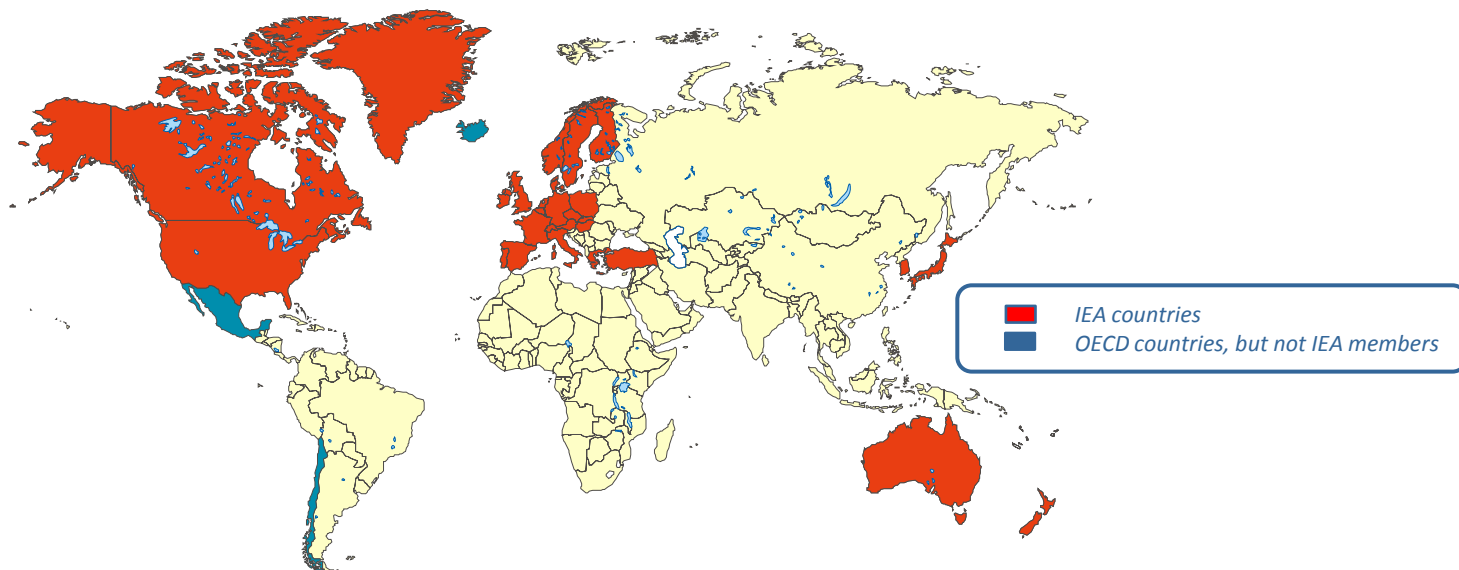
# Carbon Capture and Storage: Potential, Progress and Challenges

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Juho Lipponen

Head of Unit, Carbon Capture and Storage  
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

**CARBON CAPTURE  
AND STORAGE**

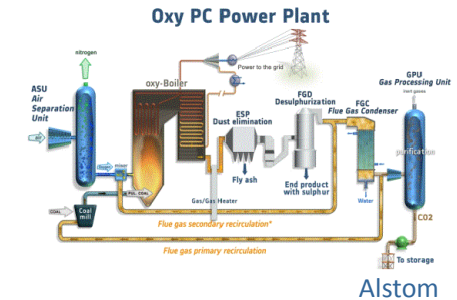


# CCS IS A *CHAIN*

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

## 1. Capture of CO<sub>2</sub> from large point sources

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



## 2. Its transport

Trucks, ships, pipelines



Maersk



Gassco

## 3. Storage of CO<sub>2</sub> in geological formations

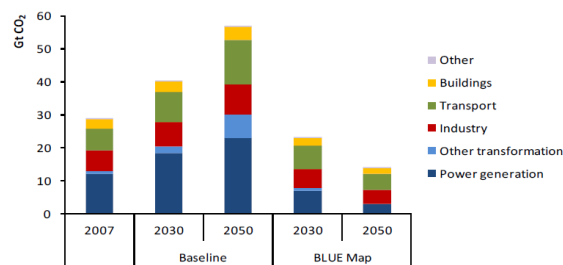
Depleted oil and gas fields, saline aquifers, EOR, ECBMR etc.



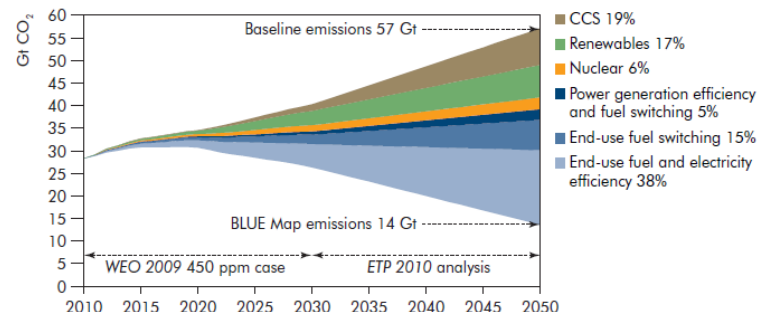
Vattenfall

# TOWARDS 450ppm: CCS PART-SOLUTION

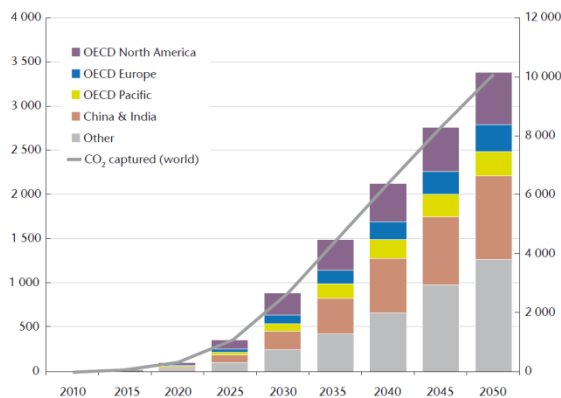
## 1. CO<sub>2</sub> emissions from energy must be halved



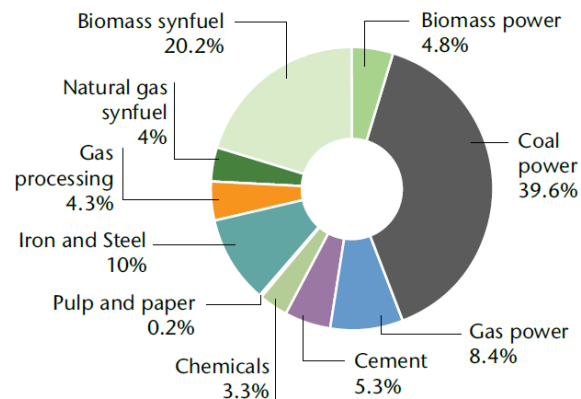
## 2. CCS plays a significant role in the low-carbon mix



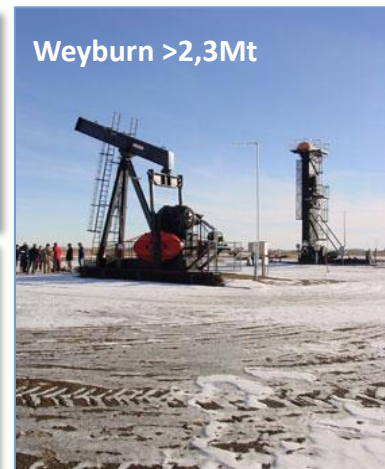
## 3. Deployment is very challenging



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



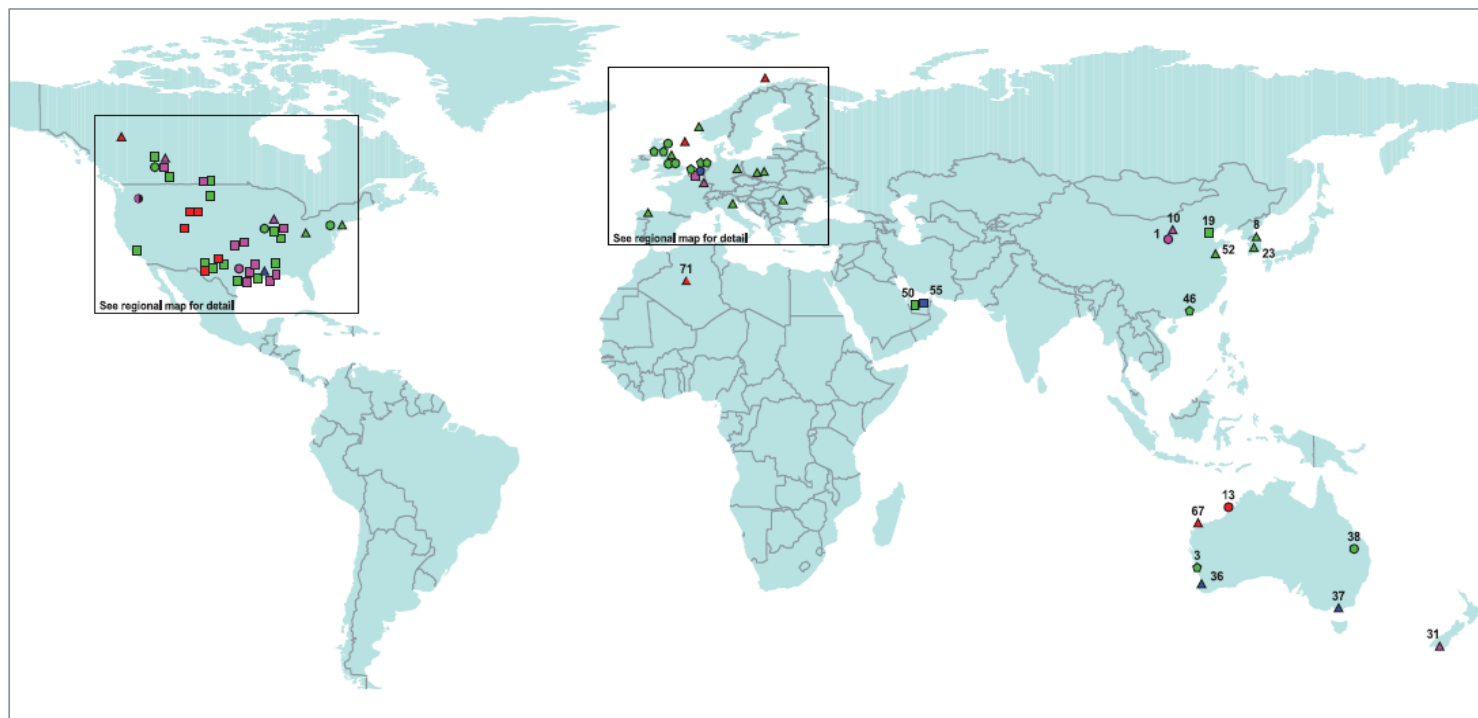
# CO<sub>2</sub> IS CAPTURED AND STORED AS WE SPEAK...



*Five large-scale projects are currently  
storing >5Mt CO<sub>2</sub> 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?**

# Challenges I: SETTING STRATEGIC POLICY DRIVERS & DIRECTION

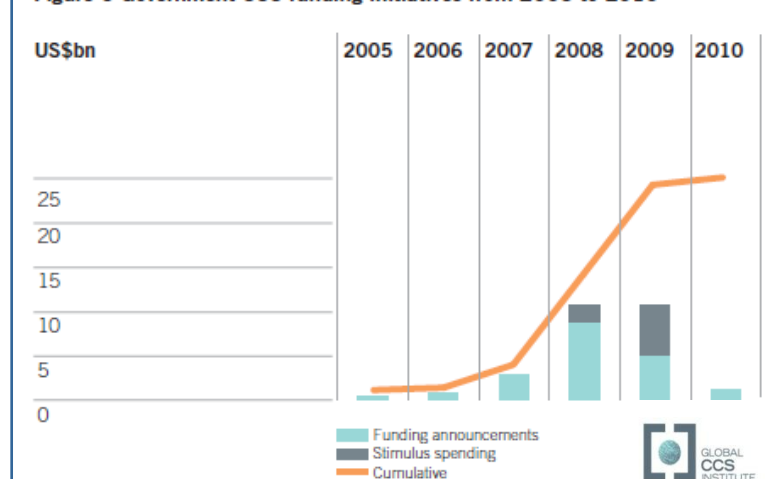
- Making firm decisions corresponding to the **scale and urgency of action** required to address climate change
  - Improving **understanding of CCS** and its role within the broader technology portfolio
  - More attention on **industrial CCS** applications
- 
- *Key Related IEA Activities:*  
*CCS Roadmap 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
  - CO<sub>2</sub>-price linked schemes
  - Fiscal measures etc.

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

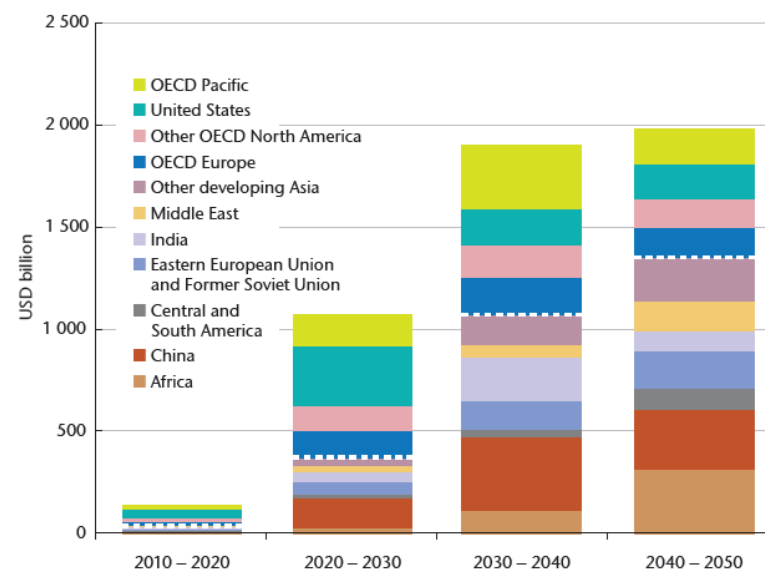
Figure 6 Government CCS funding initiatives from 2005 to 2010<sup>6</sup>



## 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

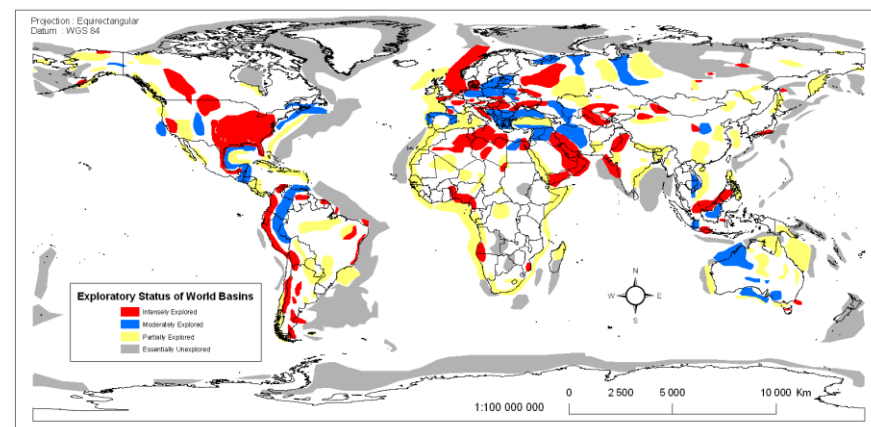
- Regulatory development process
- Capture, transport and **storage**
- 29 key issues
- 4 categories
  - A. Broad regulatory issues
  - B. Existing regulatory issues
  - C. CCS-specific regulatory issues
  - D. Emerging CCS regulatory issues



## Challenge IV: ENHANCE UNDERSTANDING of CO<sub>2</sub> 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*

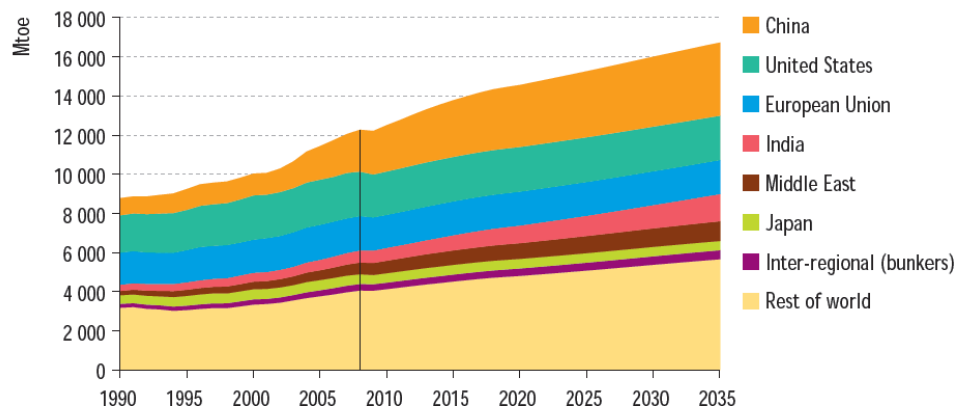


## Challenge V: TECHNOLOGY & INFRASTRUCTURE

- 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:*
  - CO<sub>2</sub> Capture Cost and Performance Analysis & Workshop 2011*

# NEW POLICIES: ENERGY & EMISSIONS GROWTH CONTINUES\*

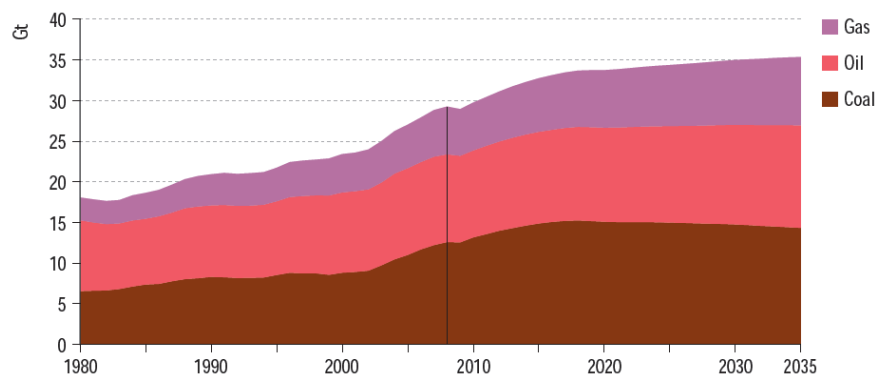
**Figure 2.5** • World primary energy demand by region in the New Policies Scenario



**2008-2035**

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

**Figure 2.13** • World energy-related CO<sub>2</sub> emissions by fuel in the New Policies Scenario



- Energy-related CO<sub>2</sub> emissions 35 Gt by 2035
- Growth from non-OECD countries
- 650ppm pathway

\* "New Policies Scenario", IEA World Energy Outlook 2010

## 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

**For today's debate:**

What role could CCS play in Russia's energy future?



**Thank you!**

**[juho.lipponen@iea.org](mailto:juho.lipponen@iea.org)**

**+33 1 40 57 66 80**

**[www.iea.org/ccs](http://www.iea.org/ccs)**

**CARBON CAPTURE  
AND STORAGE**

# Examples of general IEA activity on outreach

- IEA Partnership Meeting process
- Wider **country-specific work programmes** covering many aspects of energy policy (China, Russia, India, Indonesia etc.)
- General **energy-related training**
  - Regular training of energy statisticians etc.
  - April 4-8: “IEA Training Week”, targeted to non-IEA member country officials and industry

# Examples of IEA activity in CCS outreach

## ■ Publications

- CCS book, CCS roadmap etc. → **general analysis** on role & potential for CCS
- Information papers on **Regulation, Economics** → **current benchmark**
- Forthcoming: work on **incentive policies** (also incl. non-OECD countries)

## ■ Knowledge-sharing

- **CCS regulatory network** (incl. “emerging frameworks”, webinars, workshops)
- **CCS costs** and **CO<sub>2</sub> storage capacity** workshop
- Knowledge sharing between **US, EU and Chinese CCS Demo Projects**
- **Contributions to conferences** organised by non-member countries
  - ◆ Numerous conferences in China, Brazil, Indonesia, South-Africa, etc. during 2008-2011

# Examples of IEA activity in CCS outreach

## ■ Roundtable meetings

- Discuss technology, policy and regulatory issues of interest
- Held in 2009-2010 in **China, Indonesia, Poland, South Africa, Brazil**:
- In 2011 at least in **Mexico, Russia, Ukraine, Vietnam, Malaysia**

## ■ Focused workshops

- China: **CCS workshop Beijing October 2010** → discussing status and future of CCS in China, together with China Coal Information Institute and MOST
- **South Africa**: legal and regulatory issues workshop April 2011, together with South Africa CCS Centre and Department of Energy
- **Bi- and multilateral activities**: workshops with China-US cooperation, APEC, Asian Development Bank, World Bank etc. on topical CCS issues

## ■ Focused analysis

- Joint analysis with China Coal Information Institute on **future of CCS in China**

## CCS @ IEA: WORK PROGRAMME

CCS Strategy & Policy

Technical & Economic

Legal & Regulatory

Capacity-Building &  
Outreach

Stakeholder Relations & Global Policy Fora