CARBON CAPTURE AND STORAGE

International Energy Agency

Carbon Capture and Storage: Potential, Progress and Challenges

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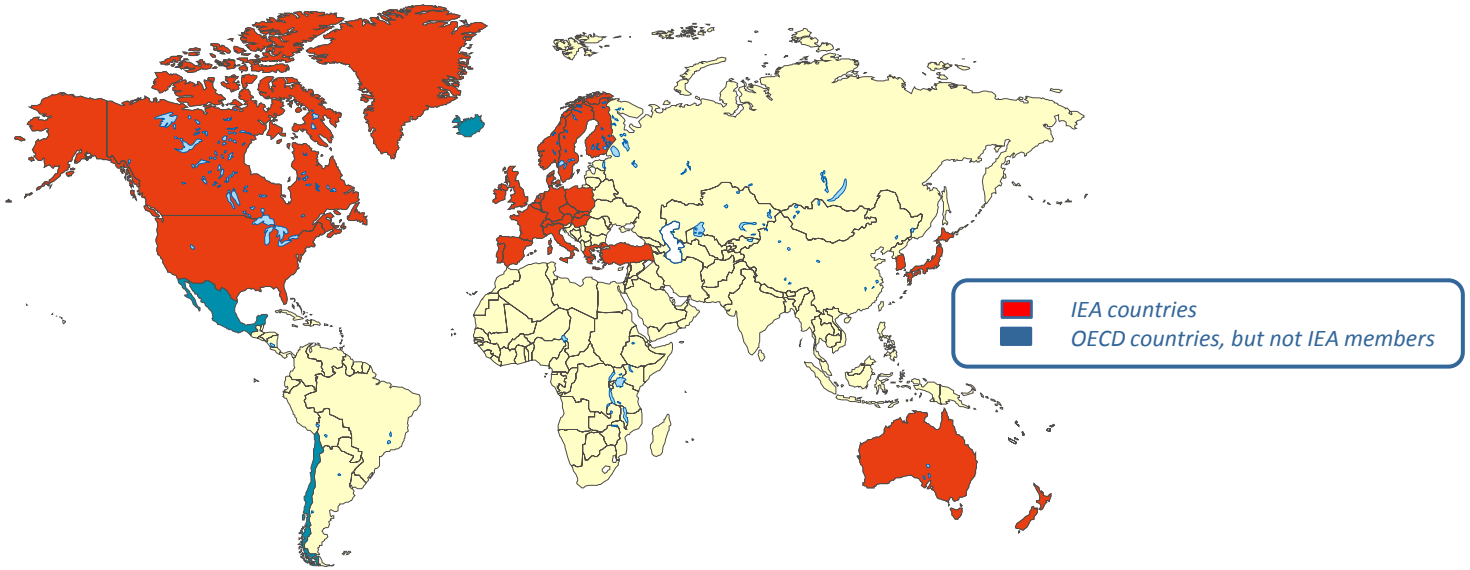

- **Inter-governmental body founded in 1973, currently 28 Member Countries**
- **Policy advice and energy security coordination**
- **Whole energy policy spectrum and all energy technologies: Key goals are:** energy security, environmental protection and economic growth
- **Flagship publications include 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**

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CONTENTS

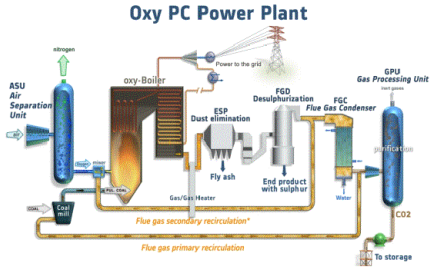
1. Role of CCS
2. Current status of development
3. Challenges for deployment

CCS IS A *CHAIN*

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

1. **Capture of CO_2 from large point sources**

   Power plants, steel, cement, refineries, 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

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TOWARDS 450ppm: CCS PART-SOLUTION

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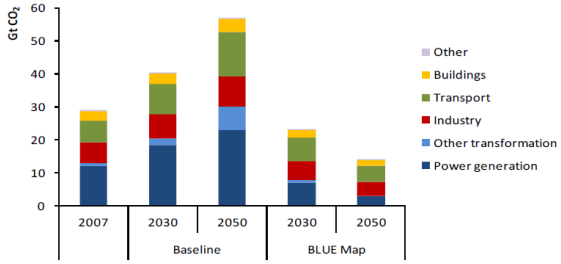
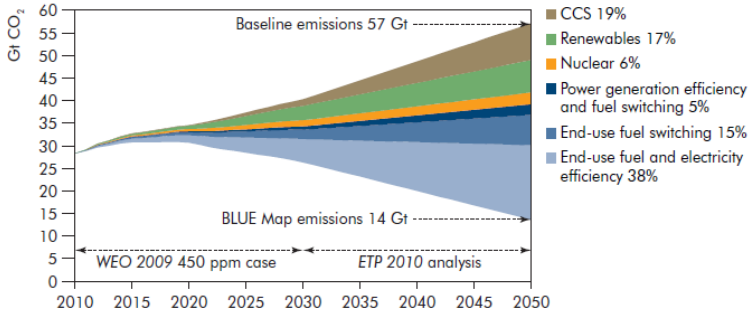
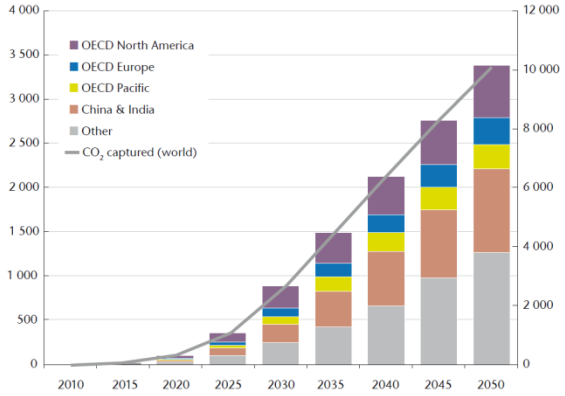
1. CO2 emissions from energy must be halved



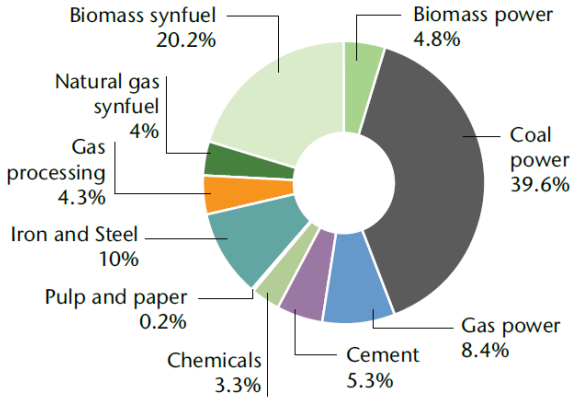
2. CCS plays a significant role in the low-carbon mix



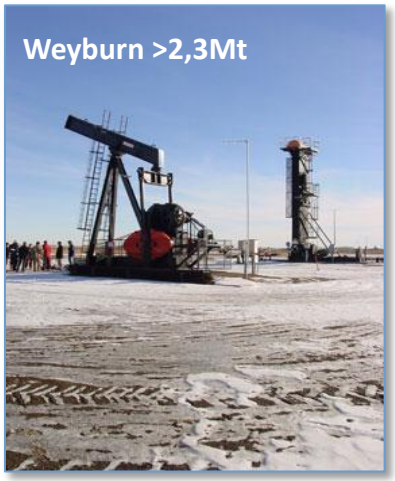
3. Deployment is very challenging



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



CO_2 IS CAPTURED AND STORED AS WE SPEAK…



Five large-scale projects are currently storing >5Mt CO_2 per year

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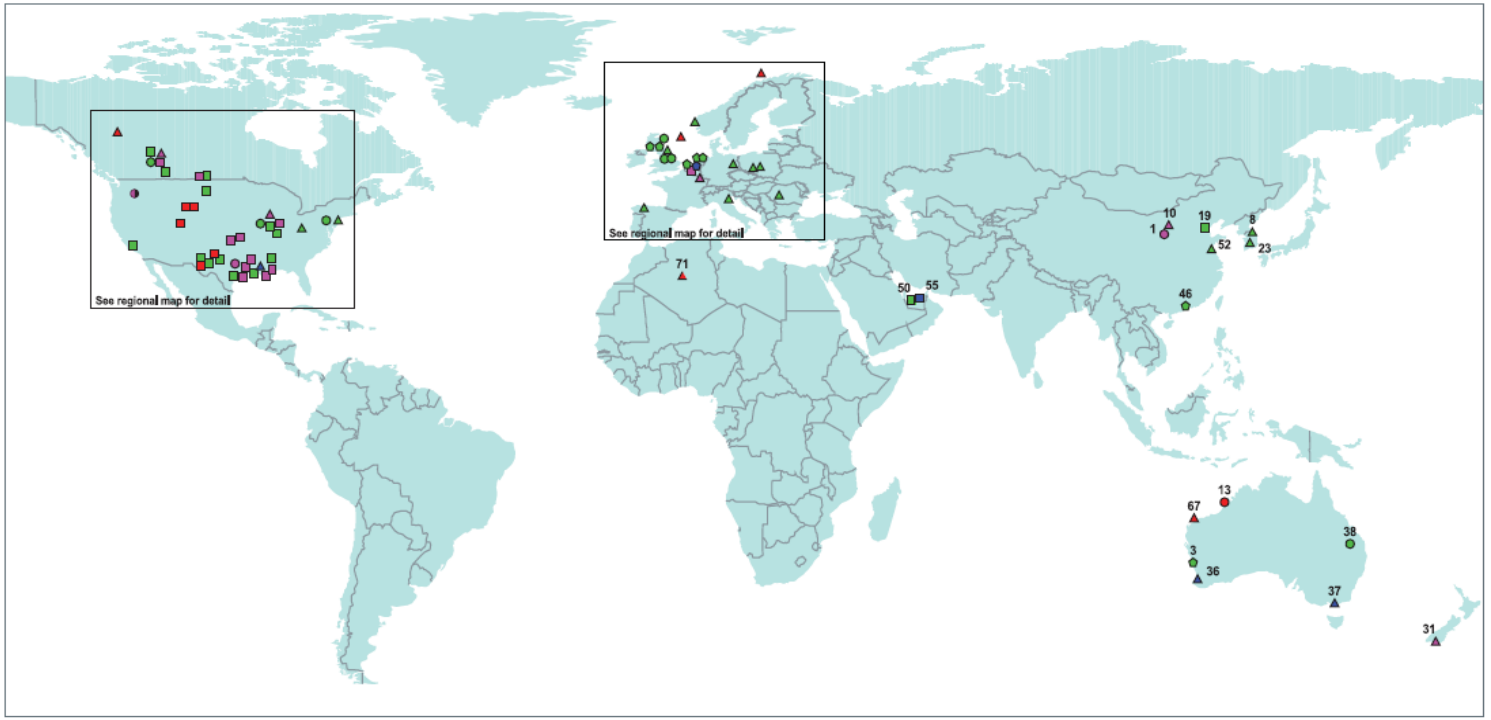
… AND MORE IS PLANNED

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: GLOBAL CCS INSTITUTE

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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

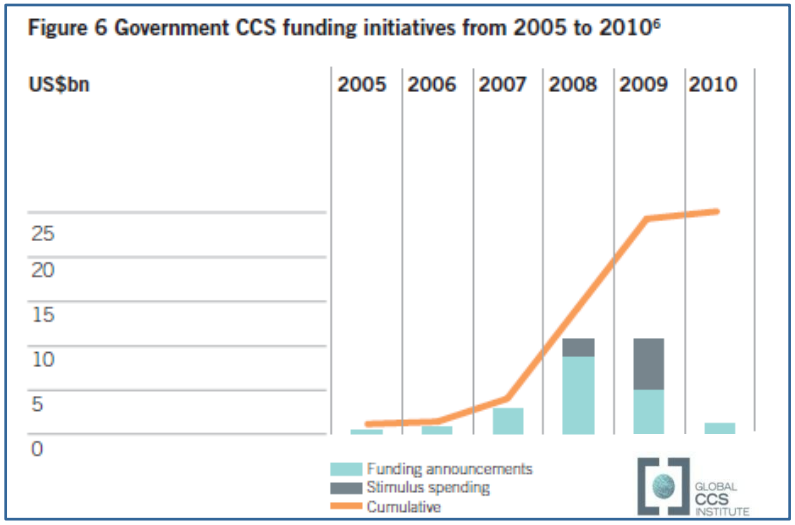
- Making firm decisions corresponding to the **scale and urgency of action** required to address climate change
- Improving **understanding of CCS** and its role within the broader technology portfolio
- More attention on **industrial CCS** applications

- *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_2-price linked schemes
  - Fiscal measures etc.

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



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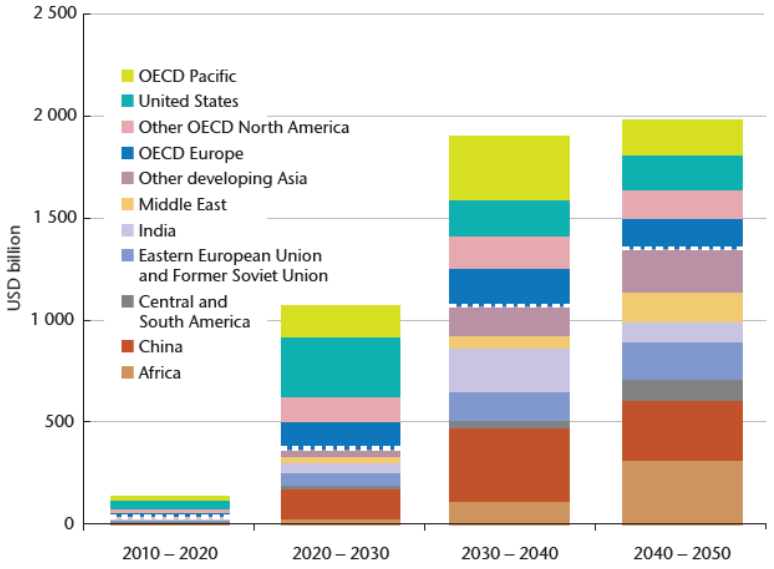
Challenges II: CREATING INCENTIVES (2)

- 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

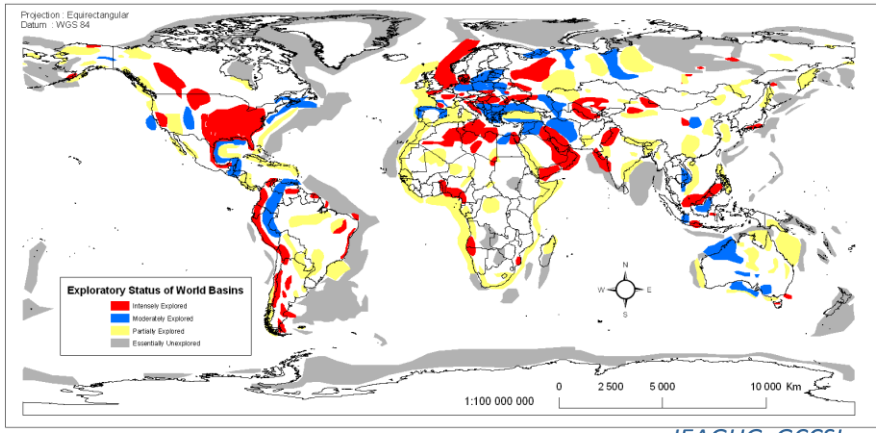
IEA Model CCS Regulatory Framework & Review

- 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_2 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



IEAGHG, GCCSI

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_2 Capture Cost and Performance Analysis & Workshop 2011

NEW POLICIES: ENERGY & EMISSIONS GROWTH CONTINUES*

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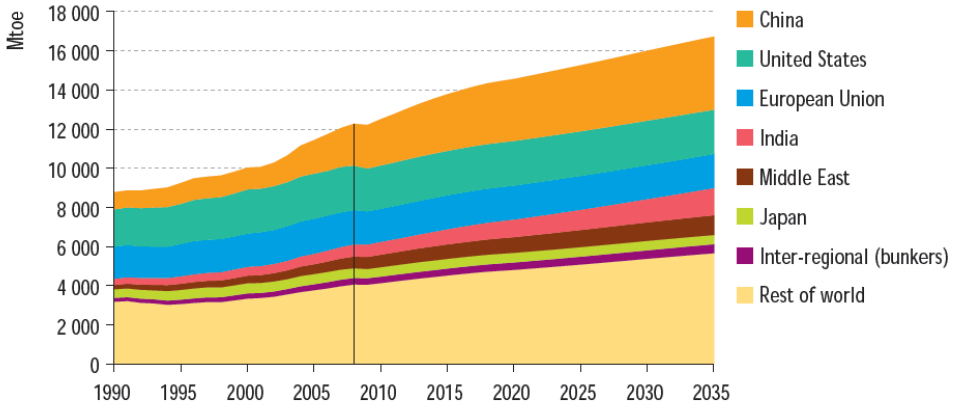
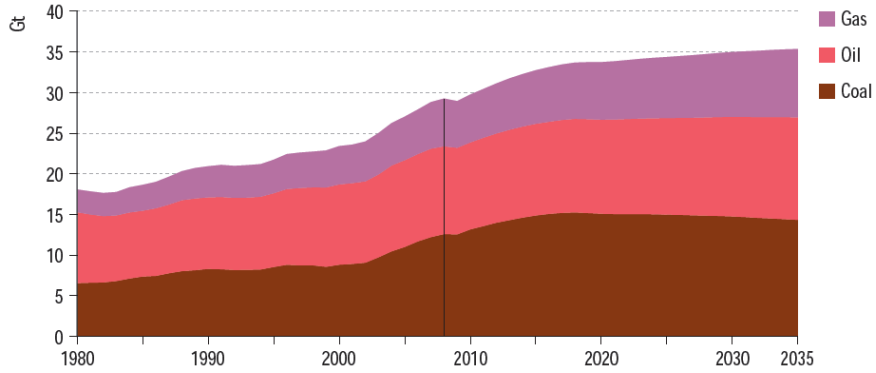
Figure 2.5 • World primary energy demand by region in the New Policies Scenario



2008-2035

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

Figure 2.13 • World energy-related CO_2 emissions by fuel in the New Policies Scenario



- Energy-related CO_2 emissions 35 Gt by 2035
- Growth from non-OECD countries
- 650ppm pathway

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

World Energy Outlook 2010

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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?

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Thank you!

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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_2 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