CCS: Global Status and Challenges

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MUSTANG Annual Conference, 2011

June 2011, Edinburgh, Scotland

IEA Greenhouse Gas R&D Programme

- A collaborative research programme founded in 1991 as an IEA Implementing Agreement fully financed by its members

- Aim: Provide members with definitive information on the role that technology can play in reducing greenhouse gas emissions.

  Scope: All greenhouse gases, all fossil fuels and comparative assessments of technology options

  Focus: On CCS in recent years

- Producing information that is:
  - Objective, trustworthy, independent
  - Policy relevant but NOT policy prescriptive
  - Reviewed by external Expert Reviewers
  - Subject to review of policy implications by Members

Membership


BG GROUP
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ExxonMobil
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The energy to lead
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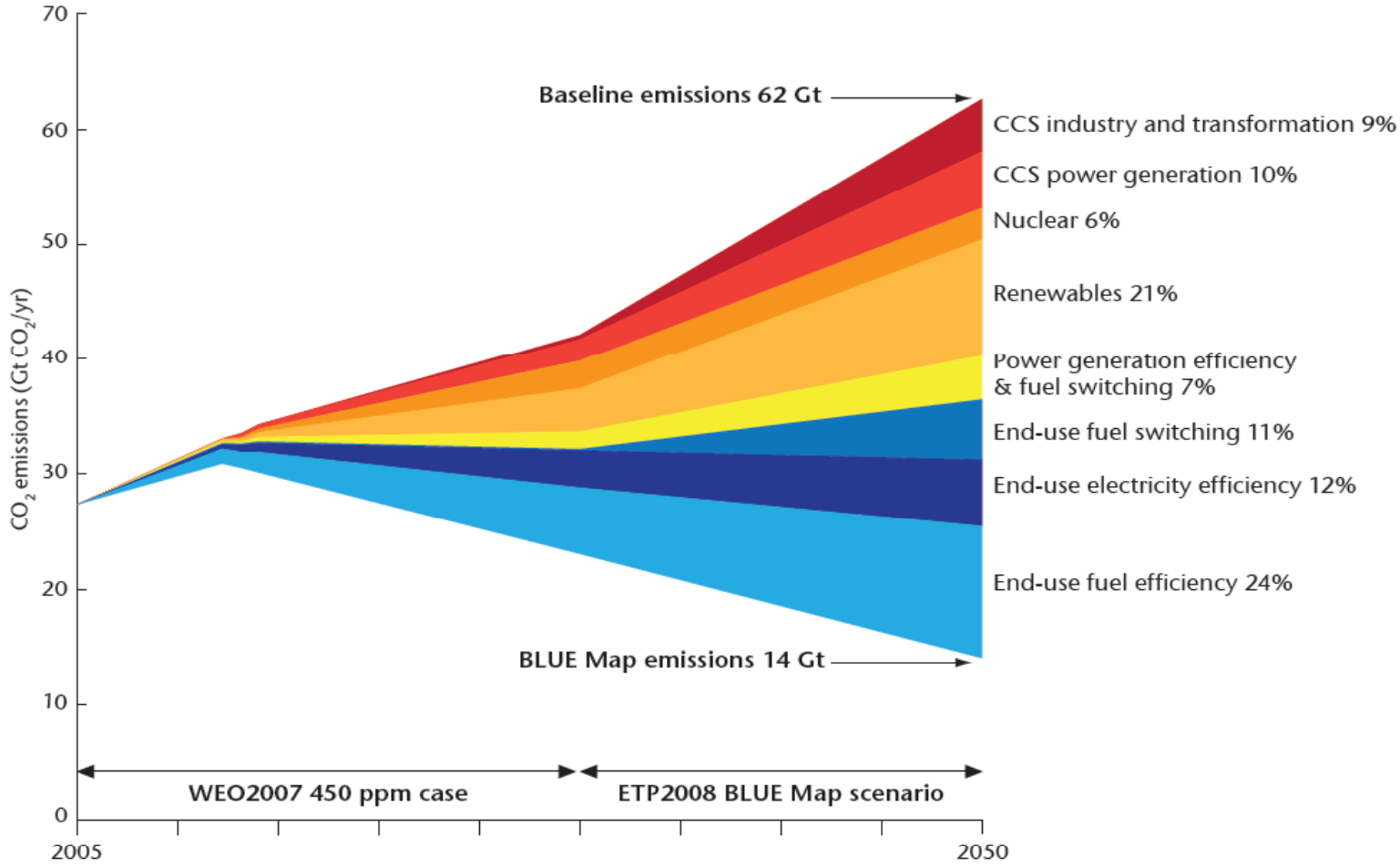
IEAGHG Activities

- Task 1: Evaluation of technology options
  - Based on a standard methodology to allow direct comparisons and are peer reviewed
- Task 2: Facilitating implementation
  - Provision of "evidence based information"
- Task 3: Facilitating international co-operation
  - Knowledge transfer from existing, laboratory, pilot and commercial scale CCS projects globally
- Task 4:To disseminate the results as widely as possible.

Introduction

- A lot of scepticism that CCS is losing its way
- Are we on track and more importantly what track are we on?
- Are any of the other low carbon options faring any better?
- What are the challenges we face?
- What must happen next?

The Low Carbon Options



Source: IEA

Where are the other options today?

- Energy efficiency
  - Big strides in industry over the decade
  - China has improved its coal fleet efficiency
    - Average coal consumption per kwh dropped 15%
  - Domestic sector lagging behind
- Nuclear
  - Limited number of suppliers
  - Big Cost over runs on current project in Finland
  - Uncertainty over safety/waste storage
  - Before Fukushima

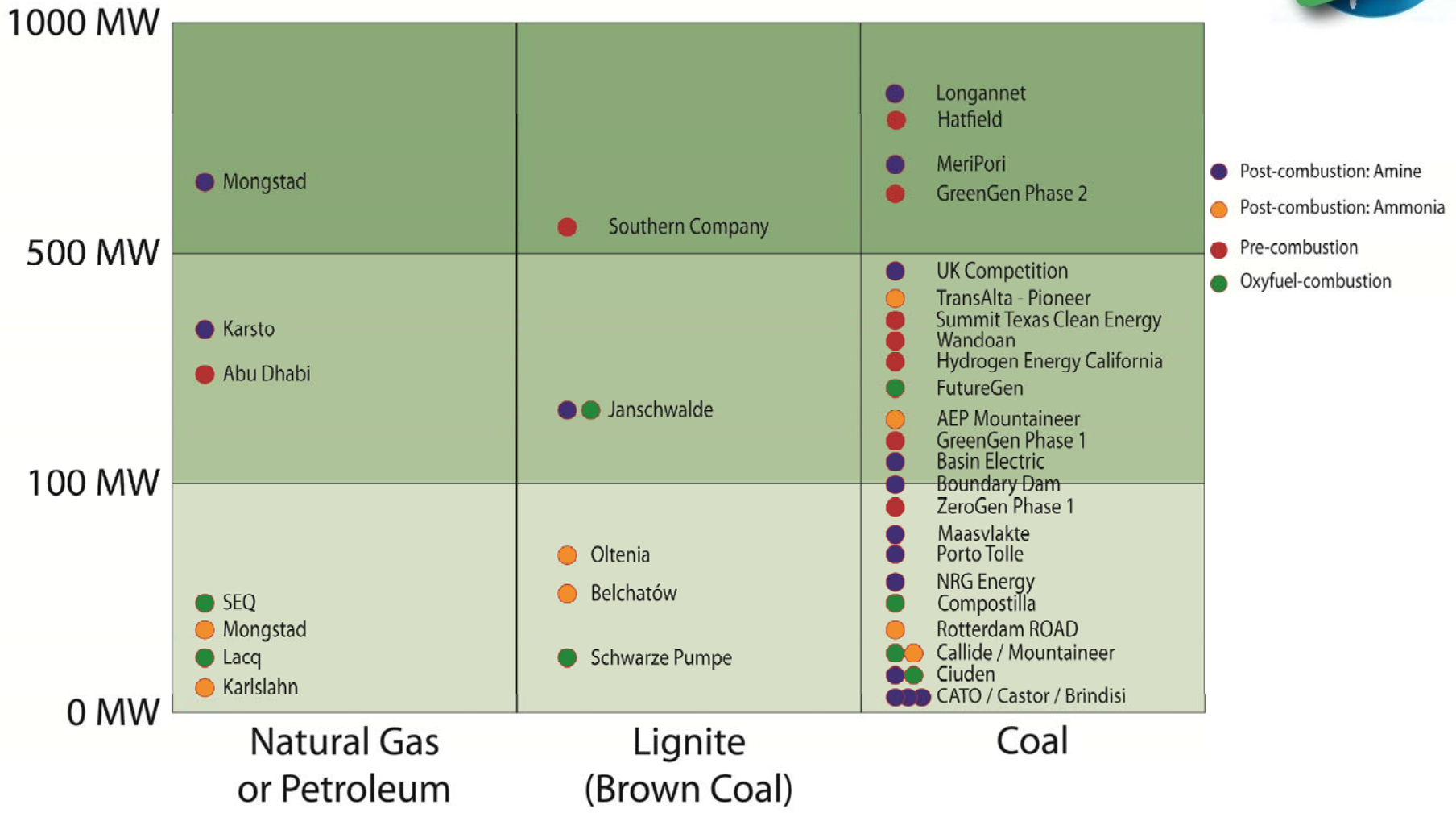
Where are the other options today?

- Renewables – want a level playing field?
  - Financial subsidies to stimulate market uptake?
  - Cost competitive?
    - Do costs include:
      - Grid strengthening?
      - Balancing supply?
  - Don't have full public support
    - Local opposition in many cases
  - Internal market competition between renewable options
  - Good PR job

CCS status

- Major changes in international treaties in a relatively short period of time
  - At last movement on CCS in the CDM
- Regulations now in place or under development in many regions/countries
- CCS Industry is not divided but working closely together and speaking with one voice
- Economic downturn has not in all cases restricted demonstrations
  - Not all countries as committed
- Demonstration projects planned in USA, Canada, Europe (UK) and Australia

Projects Table (Dec 2010)



Why have some projects failed?

- Regulatory uncertainty – in early days
- Investor uncertainty
  - Overcome by Government support for demonstrations
  - Additional support; ETS and EOR price
  - Remains for post demonstration deployment
- Storage resource
  - Availability of suitable local geological resource
  - The “Achilles heel” for CCS
- Stakeholder resistance
  - Storage security is a big issue
  - Affecting Government thinking & creating uncertainity

Are we giving ourselves a chance?

- Are targets too tight to allow successful project delivery?
  - Feedback from ZeroGen project in Australia
    - To meet Government targets for funding had to following three planning tracks in parallel
    - Storage path failed due to lack of suitable storage resource
    - Whole project failed
  - Advice:
    - Stagger planning
      - » Start storage exploration early
        - – Upfront cost with high risk
        - – Longer project leads times (6-12 years)
        - – But overall decreased project risk
    - Keep a second option - added cost burden

So what track are we on?

• EU Track	• 12 Demos by 2015	• Possibly
• G8 Track	• 20 Demos by 2020	• Possibly
• IEA CCS Roadmap	• 100 projects by 2020	• NO

CCS not winning public hearts and minds

- Latest Euro barometer survey (364, May 2011) key results
  - Only one in ten (10%) said they had heard of CCS and knew what it was
  - In the 6 countries where there is a major EU co-financed CCS project, 88% had not heard of the project
  - 85% would be would be worried about CCS technology if an underground storage site for CO_2 were to be located within 5km of their home.
  - Respondents liked renewables but least popular were nuclear and coal as energy sources

Communication is Key

- More effort through the media to make people aware of CCS and its benefits
  - Clearly not doing enough
- Storage containment/safety is of concern to the public
  - Have data from R,D& D projects and we need to improve how we communicate what we know
- The CCS Community needs to get out more !!!

Nature article

- “The media dictate what most people know about contemporary scientific debates. Given the need for informed policy, scientists need to learn to better read and engage with this media landscape. Closing the newspaper with a sigh is not enough”.
- *Simon L. Lewis is a Royal Society research fellow and reader in global change science at the University of Leeds, UK.*

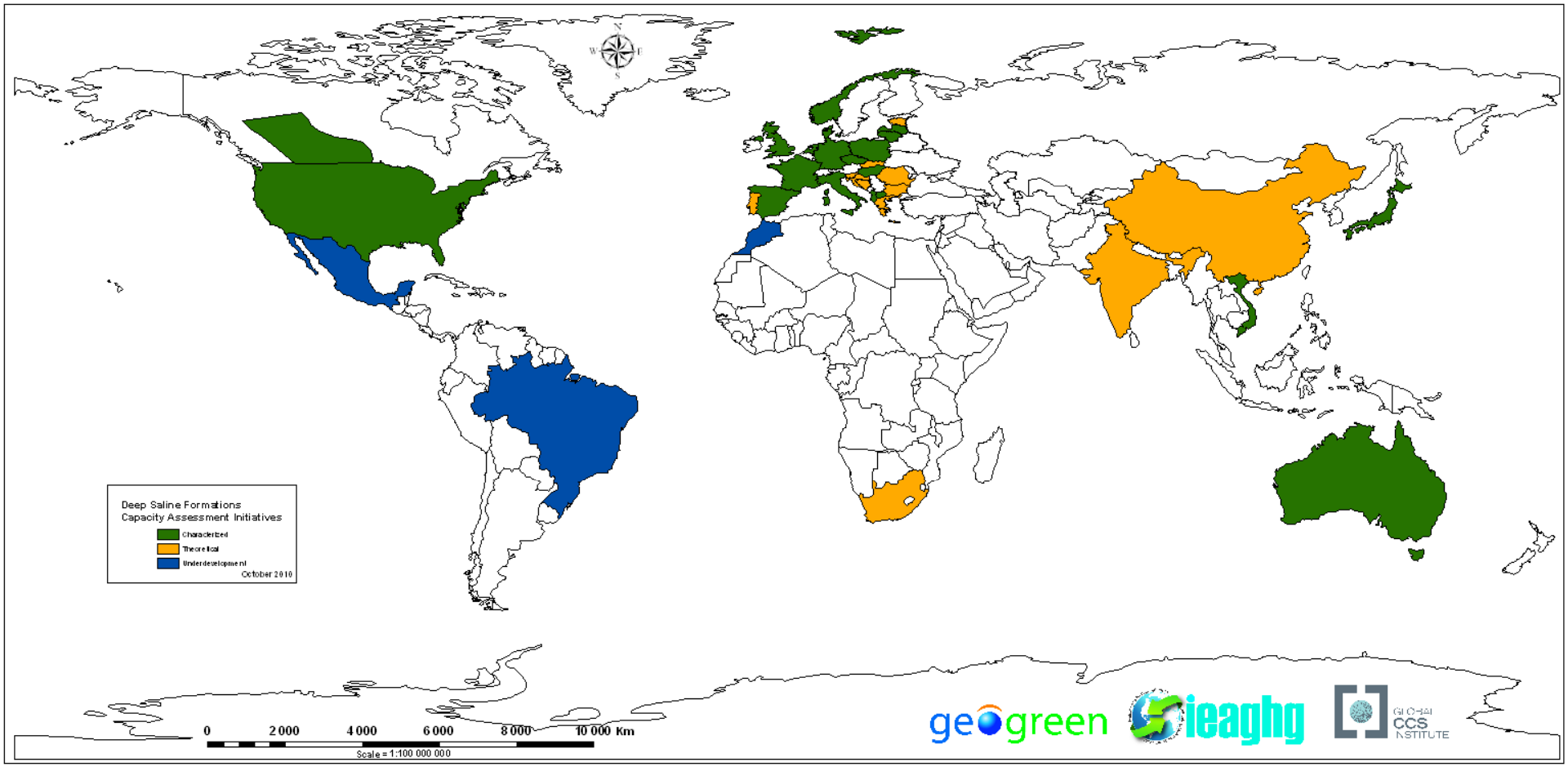
CCS is not just about coal!

- Coal will continue to dominate as the fuel for power generation
  - Generation back bone countries like China and India
- Non conventional gas discoveries are changing expectations for natural gas supply
  - WEO 2010 indicates 250yrs of recoverable gas reserves
- Increasing interest in natural gas fired plant with CCS
- Bio CCS
  - Potential for negative emissions - no ETS allowances
  - Global technical potential - 10 Gt CO_2 eq/yr
    - Needs stable sustainable supply of biomass

Capture plant

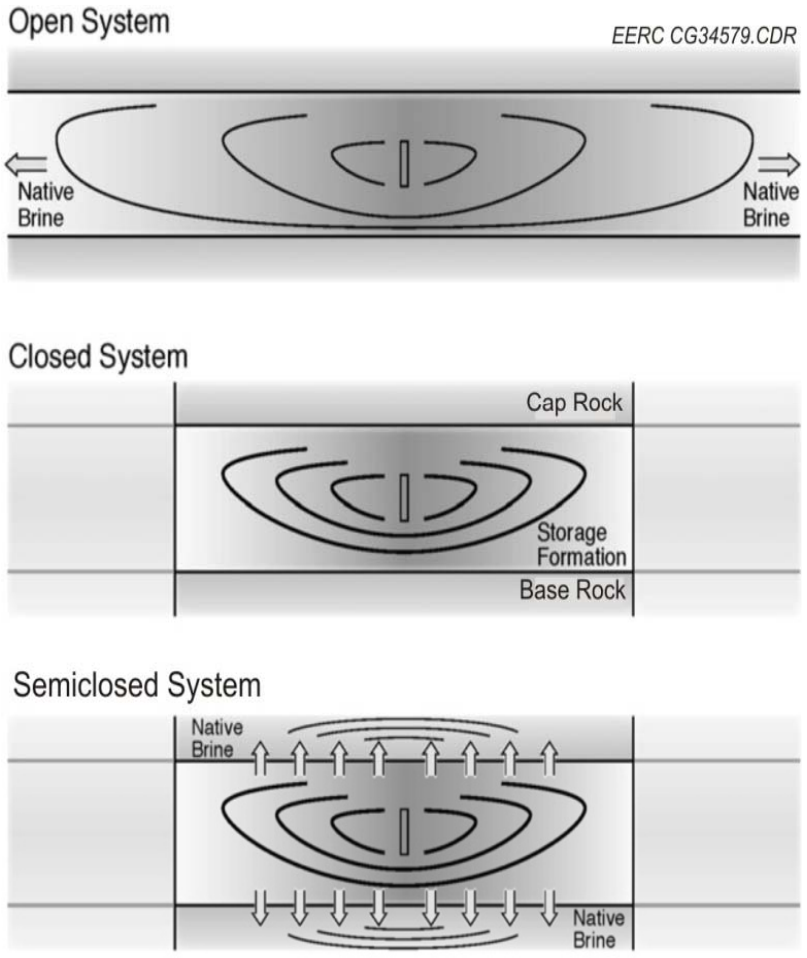
- Scale up is the biggest challenge faced
- Currently for power sector at:
  - Post combustion (~2 MWt)
    - Alstom Chilled Ammonia Pilot, Mountaineer, USA – 54MWth
  - Precombustion
    - 10-20 MWth equivalent industrial syngas
  - Oxyfuel
    - Schwarzepumpe ~30 MWth
- Manufacturers confident in making next step

Capacity assessment initiatives

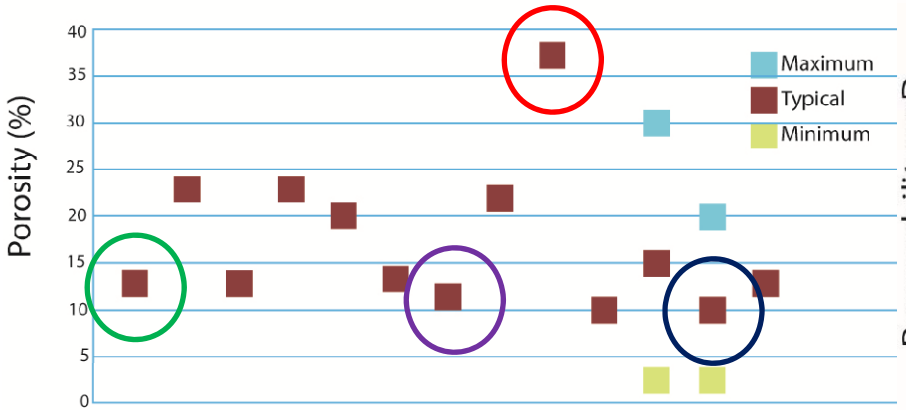


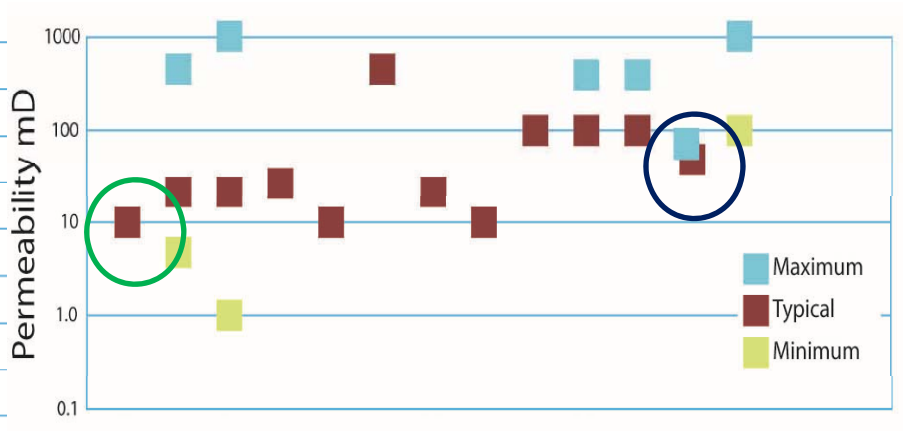
Closed versus Open DSF Systems

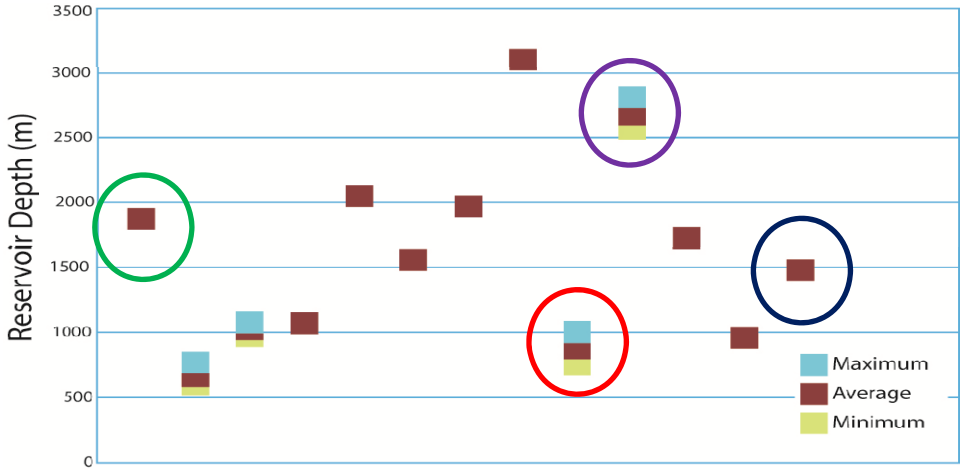
- **Open systems: regional lateral brine flux, transient pressurisation**
- **Closed systems: rapid loss of injectivity**
- **Semi-closed systems: more realistic?**



Storage Reservoir Characteristics







Sleipner – open system

Weyburn

In-Salah

Snohvit- closed system?

Geological storage

- Who is going to map the worlds storage capacity
  - Consistent basis across all continents?
  - Considerable cost?
  - Exploration capacity?
- Technical issues
  - Effect of reservoir pressurisation and impact on storage capacity needs to be assessed
    - Pressure relief?
  - Need to be able to quantify leakage
  - Impacts on ground water resources?
  - Impurities?

Capacity constraints

- Many developing countries suffering skill shortages
- Need to get their skill base and engineering capacity back to levels not seen since 1970's
- Where are the capacity constraints
  - High quality castings?
  - Large pipelines?
  - Surveying vessels?

Summary

- CCS has moved forward quickly
- As we near demonstration there will be a natural (frustrating!!) lull
- Take the opportunity in that time
  - To address the outstanding issues
    - Communication to the public
    - Safety/storage integrity
  - Make plans for wider implementation
- Then we will have a new “golden era” as results flow from the demo projects

Thank you

Enjoy the Conference!!

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