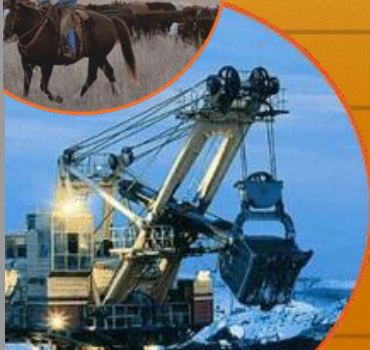
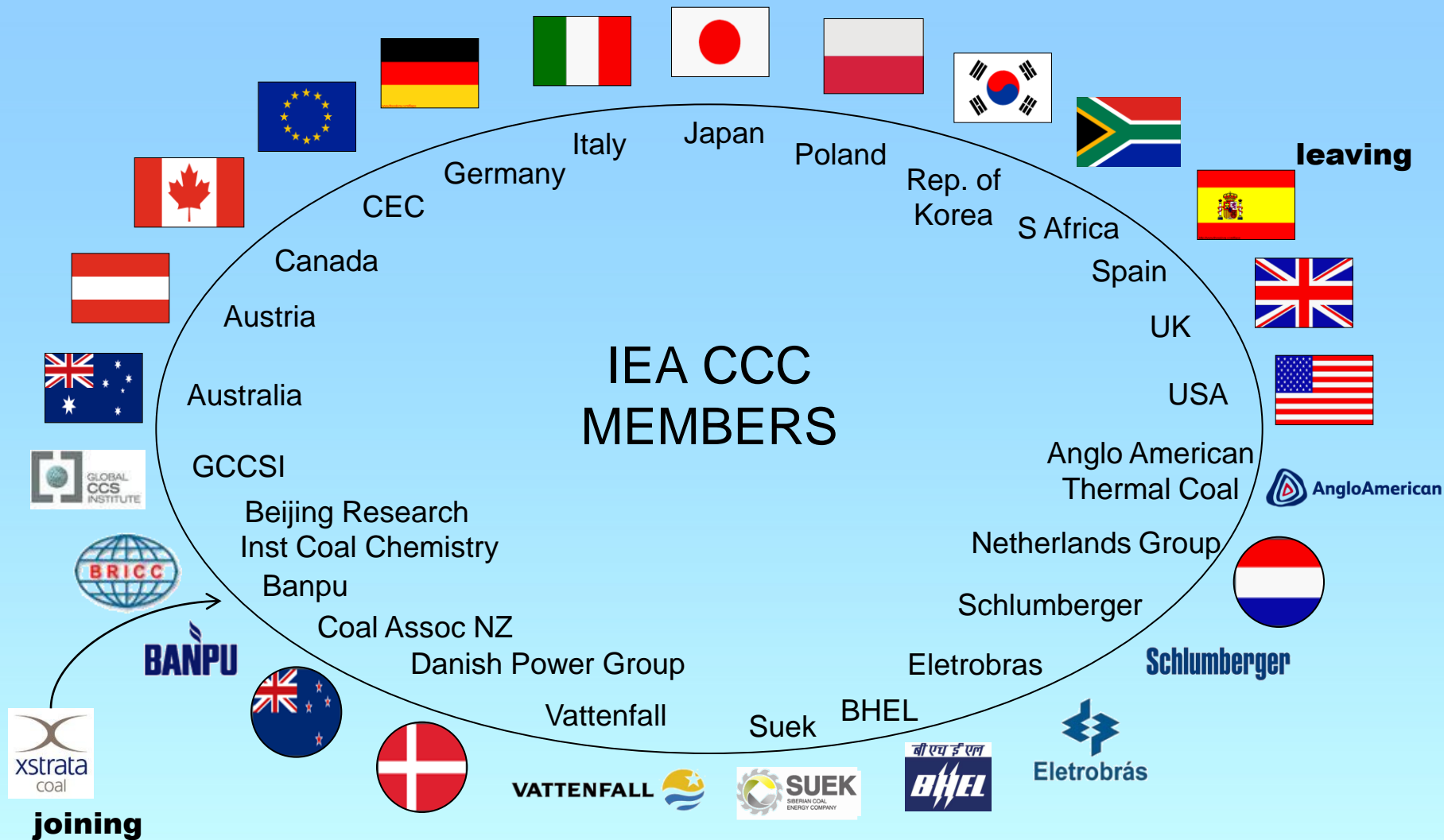


# Challenges and Opportunities for CCS in China

**John Topper**  
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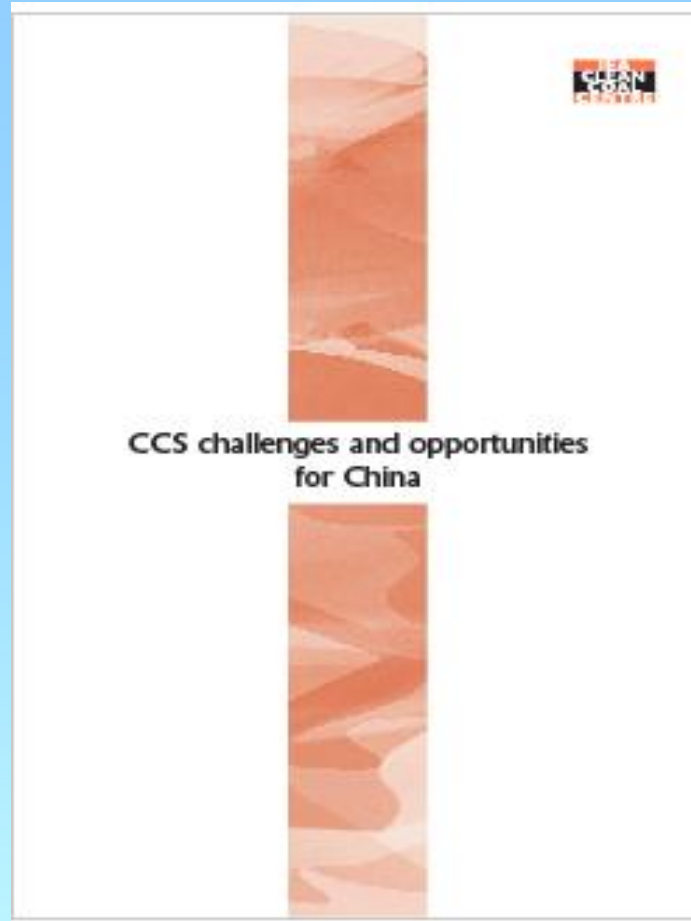




# IEA GHG Membership



# **IEA CCC Report Number 190, by Dr Andrew Minchener to be published October 2011**



# China's national CCS R&D programme

- **MOST supports both fundamental research (973) and technology development (863) while the National Science Foundation focuses on fundamental and generic research.**
- **In terms of GHG emission controls and climate change mitigation, R&D includes work on a wide range of CO<sub>2</sub> capture, utilisation and storage technologies. China has stressed that it will pay special attention to the research and development of new and innovative methods and technologies to use captured CO<sub>2</sub> as a resource.**



## Scope of work

**China wants its own intellectual property rights.**

- **The National Basic Research (973) Programme fundamental research on CO<sub>2</sub> use for EOR applications and long term storage, on syngas production from coal gasification and pyrolysis, and the high efficiency conversion of natural gas and syngas either for chemical products or for carbon free use in gas turbines**
- **The National High-Tech Research and Development (863) Programme includes projects on advanced CO<sub>2</sub> capture technologies using adsorption and absorption processes, and on CO<sub>2</sub> storage technologies**
- **Oxyfuel combustion and chemical looping combustion processes are included**
- **A preliminary assessment of CO<sub>2</sub> potential storage capacity in China is underway**

# **CO<sub>2</sub> utilisation activities by non-power sector Chinese industries**

**Emphasis on developing the use of CO<sub>2</sub> for EOR applications. A series of large scale trials are underway. For instance:-**

- PetroChina CO<sub>2</sub> EOR project at the Jilin Oil Field, Liaoning Province using CO<sub>2</sub> removed from a natural gas deposit**
- Sinopec EOR project at the Shengli oilfield of Shandong Province Sinopec with CO<sub>2</sub> captured from a coal power plant**
- ENN Resource CO<sub>2</sub> recycling project using algae to absorb CO<sub>2</sub> for subsequent processing to produce biodiesel**
- Jinlong-CAS CO<sub>2</sub> utilisation pilot project to produce polypropylene(ethylene) carbonate poly-oil from CO<sub>2</sub> that will be provided as gas captured from ethanol production plants**

# CO<sub>2</sub> capture and utilisation trials in the coal fired power sector



➤ In 2008, Huaneng Group established a side stream post-combustion capture unit on the 800MWe Gaobadian PC CHP plant in Beijing, with an annual CO<sub>2</sub> capture capacity of 3000 tonnes.



➤ In 2010, Huaneng installed a larger unit on the 2x660 MWe Shidongkou No. 2 Power Plant in Shanghai, which can capture 120,000 tonnes of CO<sub>2</sub> each year.

**In both cases, captured CO<sub>2</sub> is sold to the food and beverage industries.**



# Greengan IGCC CCS project



➤ **High-efficiency, coal-based IGCC polygeneration system and efficient treatment of pollutants with near-zero emissions of CO<sub>2</sub>.**

➤ **Phase 1 is to prove the scale-up of the Chinese gasifier**

➤ **Phase 2 aims to improve the IGCC polygeneration technology, and to determine how best to take forward the fuel cell power generation technology, and to produce up to 30-60,000 tonnes/year of CO<sub>2</sub> for EOR trials.**

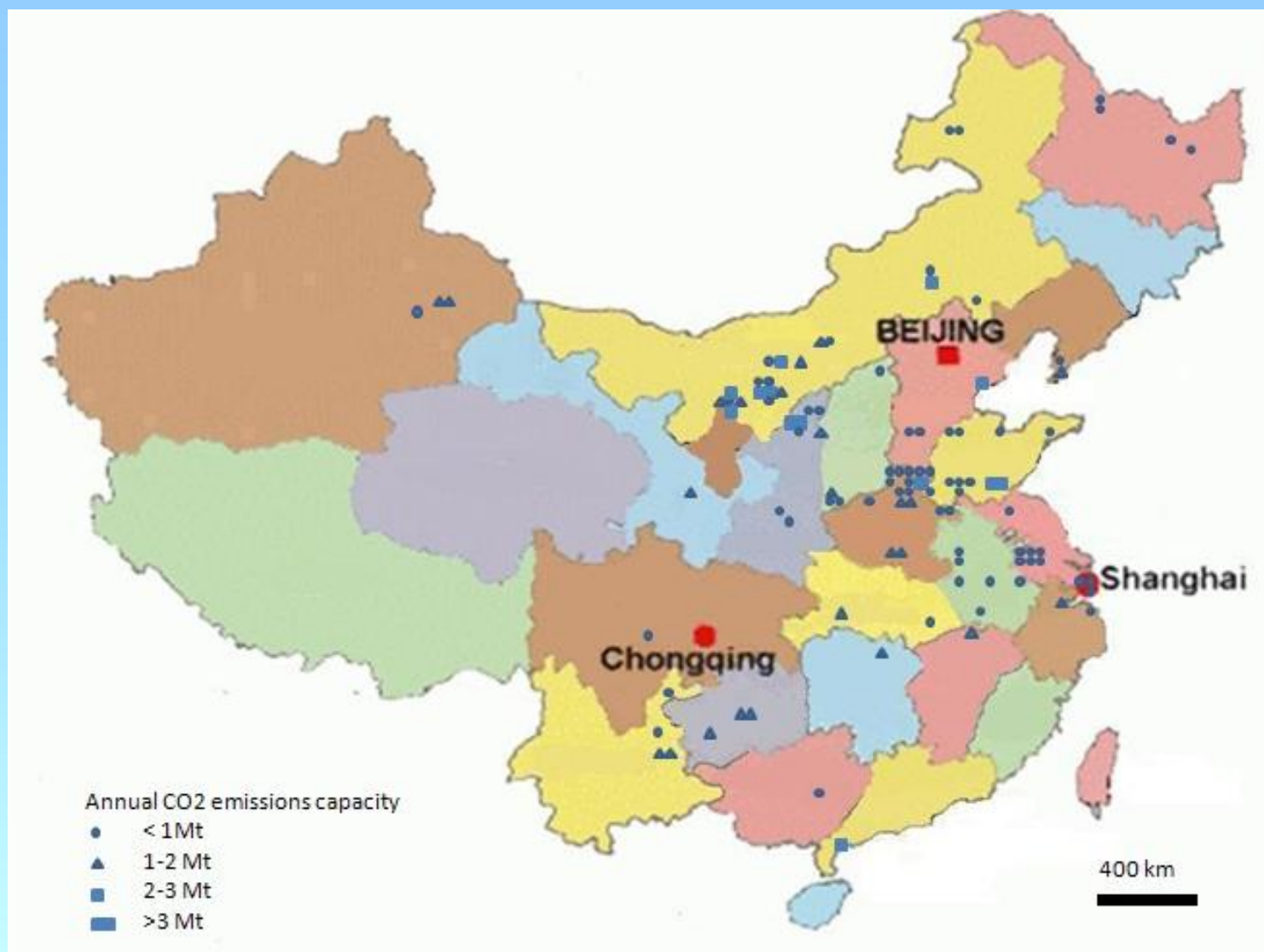
➤ **Phase 3 will comprise a 400 MWe demonstration of the overall concept.**

# CCS potential in the coal to chemicals sector



- **There is a growth in scale and extent of application in the coal to chemicals sector, with the opportunity to capture CO<sub>2</sub> at relatively low cost,**
- **So, there is potential for some early CCS demonstrations and commercial prototypes, probably for EOR applications.**

# CCS opportunities for the modern coal to chemicals sector



# CCS capture and storage trial underway



➤ **The first major coal gasifier CCS trial in China is underway at the Shenhua Direct Coal to Liquids (CTL) Demonstration Plant, close to Erdos, Inner Mongolia Autonomous Region**

➤ **Aim is to remove up to 100,000 tonnes/year of CO<sub>2</sub> from the waste stream and transport it for storage in a nearby aquifer**



# Extensive international cooperation

## **China cooperates on CCS R&D and related issues through:**

- **membership of international organizations (GCCSI, CSLF, APP)**
  - **bilateral agreements with many nations**
  - **multilateral agreements**
  - **academic cooperation, with financial support from various funding bodies; and**
  - **industrial cooperation, either with or without government financial support**
- 
- **Active CCS cooperation agreements are with Australia, Canada, EU, Italy, Japan, Norway, UK and the USA.**
  - **CCS R& D projects run in parallel to the national programme (MOST)**
  - **Where such work might develop to the point where commercial prototype demonstration projects are being considered, then this falls within the remit of the NDRC.**



# What does the overall study tell us? (1)

- **China has ambitious plans to shift away from a coal dominated economy. But CO<sub>2</sub> emissions will continue to rise, at a decreasing rate, until about 2030. Then change in the energy system underway from now should see such emissions levelling off.**
- **Absolute reductions in annual CO<sub>2</sub> emissions will require CCS across all coal using sectors**
- **Various international cooperative activities have increased Chinese capacity and raised awareness of CCS among many stakeholders.**
- **Further such engagement is needed, not just to take forward the development work but also to establish demonstration and deployment in China.**
- **China is unlikely to introduce CCS technology without external financial support and so the need for a robust link to be established between CCS and CDM becomes important**

## What does the overall study tell us? (2)

- **China is now becoming well positioned to move to the forefront on many aspects of CCS, certainly on CO<sub>2</sub> capture and, for the moment, on CO<sub>2</sub> utilisation, with less expertise established on storage although there is considerable interest in CO<sub>2</sub> based EOR.**
- **Subject to finance being established, there are several demonstration options that should be pursued.**
- **There is also considerable scope for further international cooperation, especially on non-technical aspects of CCS**
- **China is becoming well placed to become a serious supplier of CO<sub>2</sub> capture technology alongside its initiatives to export advanced based power plant within the Asian region and elsewhere. As well as combustion based systems, this could include equipment for the various gasification subsectors, especially if their attempts to establish the Greengem IGCC polygeneration CCS demonstration are successful.**

**THE END – Thank you for your attention**

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