Carbon Capture, Utilization and Storage (CCUS) Activities in China

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The Administrative Centre for China's Agenda 21

2011.8 Sanya

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China Australia Geological Storage of CO_2

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Outline

- Role & Status of CCUS Technology
- CCUS Technical Policies in China
- CCUS R&D Activities in China
- International Cooperation on CCUS in China
- Challenges & the Ways to Overcome

Role & Status of CCUS Technology

Role & Status of CCUS Technology

Why CCUS/CCS?

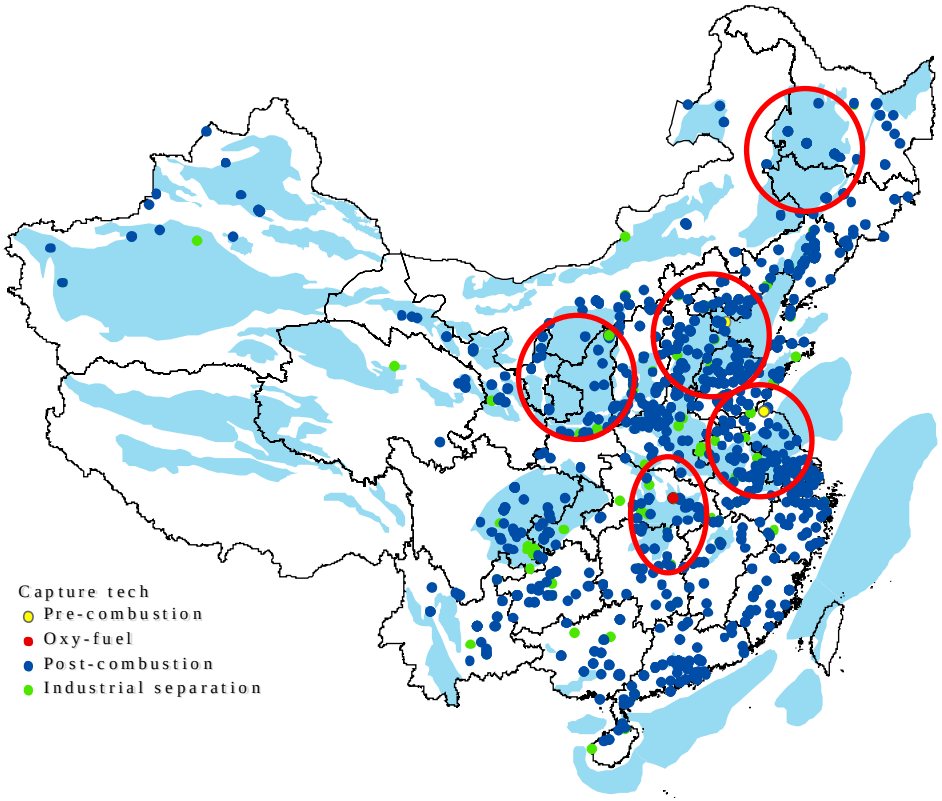
- Climate Change and its adverse impacts have been threatening the living of human kind, the international Community shall jointly address the Climate Change issue guided by the principle of common but differentiated responsibility.

- Fossil fuel will continue play very important role in the foreseeable future.

- CCUS is an emerging technology with potential for large-scale emission reducing, so it's considered one of the most important technologies to control green house gas emissions.

Role & Status of CCUS Technology

Integrated Demos: Possible Regions



All kind of CO_2 point emission source + onshore/offshore aquifer storage have many opportunities in Bohai Basin, Subei Basin, Jianghan Basin, Ordos Basin, Songliao Basin.

----Prof. Xiaochun LI, Institute of Rock and Soil Mechanics,CAS

Role & Status of CCUS Technology

- As CCS technology is still not mature, we should put our priority and emphasis on strengthening CCS technological development.
- We shall pay special attention to the research and development of new and innovative methods and technologies to use captured CO_2 as a resource.
- As the tech of CCUS is complicated, which calls for international cooperation.

CCUS S&T Policies in China

CCUS S&T Policies in China

- **National Medium- and Long-Term Program for Science and Technology Development (2006-2020), State Council, 2006**

  --**“**To develop efficient, clean and near-zero emission fossil energy utilization technologies”--highlighted as an important frontier technology

- **China’s National Climate Change Programme (2007-2010), State Council, 2007**

  --CCUS technology was included as one of the key GHG mitigation technologies that shall be developed.

- **China’s Scientific and Technological Actions on Climate Change (2007-2020), and MOST issued it with other 14 Ministries together, 2007**

  --CCUS technology was identified as one of the key tasks in the development of GHG control technologies in China.

CCUS S&T Activities and Pilot Projects in China

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CCUS S&T activities and pilot Projects in China

- **MOST Supported S&T activities**
  - National High-tech R&D Programme (863)
  - National Key Technology R&D Programme
  - National Basic Research Programme (973)
  - National Major Special Projects
- **Enterprise S&T activities**
  - CO2 Capture
  - CO2 Utilization
  - CO2 Storage
  - Full Chain
- **International Collaboration**
  - European Union, Australia, Italy, Japan, the United States, etc.
- **Total Investment: 632.77 Million RMB**

CCUS S&T activities and pilot Projects in China

MOST Supported S&T activities (11th Five Year Plan)

Project Title	Funding by	Duration	Type of projects
The Project of CCS–EOR, Utilization and Storage	973	2006-2010	Basic Research
Program of CO2 Capture and Storage technology	863	2008-2010	Technology R&D
The Key Tech Research Program on CCS-EOR and Storage	863	2009-2011	
The Key Tech Research Program on CO2-Algae-Biodiesel	863	2009-2011	
CO2- Safety Mining of with CO2 Gas Reservoirs and CO2 Utilization tech	National Major Special Project	2008-2010	R& D
Demonstration Project of Mining and Utilization Tech of Volcanic gas containing CO2 in Songliao Basin	National Major Special Project	2008-2010	

Main Gaps & the Ways to overcome

MOST Supported S&T activities (12th Five Year Plan)

Name of Projects	Funding by	Duration	Type of projects
The Key Tech Research and Demonstration Program of Carbon Capture and Equipment on 35 MWt Oxy-Fuel Combustion	National Key Technology R&D Programme	2011-2014	Technology R&D
The Key Tech Research Project of CO2 Emission Reducing on Iron-Steel Sector	National Key Technology R&D Programme	2011-2014	Technology R&D
Research and Demostration Program of IGCC +CO2 Caputure, Utilization and Storage	National Key Technology R&D Programme	2011-2013	
CO2 Storage Capacity Assessment and Demonstration in China	China Geological Survey	2011-2014	
The Program of CCS –EOR, Utilization and Storage	973	2011-2015	Basic Research

CCUS S&T activities and pilot Projects in China

Enterprise activities

Project Title	Scale	Capture Tech	Storage/ Utilization	Status
The pilot project of CO2 Capture, Huaneng Beijing Gaobeidian Thermal Power Plant	Capture Capacity:3,000 T/Y	Post-Combustion	Food Use	Operated in 2008
Demonstration Project of CO2 capture and storage in Coal Liquification Plant, China Shenhua Group	Capture Capacity:100,000 T/Y Storage Capacity: 100,000 T/Y	Coal liquefaction	Saline Aquifer	operated in 2011
Demonstration Project of CO2 capture, Storage and Utilization in IGCC Plant Greengen of Huaneng	Capture Capacity:60,000--100,000 T/Year	Pre-Combustion	EOR	Launched in 2011
Small Scale Demonstration Project on CO2 Capture and EOR in Shengli Oil Field, Sinopec	Capture/Utilization:40,000T/Y	Post-Combustion	EOR	Operated in 2010
Demonstration Project of CO2 capture, Shanghai Shidongkou Power Plant, Huaneng	Capture Capacity:120,000 T/Y	Post-Combustion	Food/ Industrial	Operated since 2010
Demonstration project of Carbon Capture, Shuanghuai Power Plant, China Power Investment	Capture Capacity:10,000 T/Y	Post-Combustion	Food/ Manufacture	Operated in 2010
Pilot Plant of CO2 capture in Lianyungang City, CAS	Capture Capacity:30,000 T/Y	Pre-Combustio	N/A	Operated in 2011

CHINA HUANENG GROUP'S 3,000 T/A PILOT

Huaneng Beijing Gaobeidian Thermal Power Plant, start operation in 2008, CO2 used in food industry

China Power Investment Co.
10,000t/a capture pilot

10,000 t/a carbon capture device

Location: Hechuan Power station, Chongqing
Technology: Post-combustion capture
CO_2 Capture Rate: >95%
CO_2 Purity: >99.5%

Start operation since January, 2010

Huaneng 100kt/a CO_2 capture demonstration in Shanghai Shidongkou Power Plant

Project Entity: Huaneng Shanghai Shidongkou No.2 Power Plant
Location: Baoshan district, Shanghai
Technology: Post-combustion capture + reuse in the beverage industry
CO_2 purity: >99.5%

Start operation since early 2010

Huazhong University of S&T (HUST)
35MWt Oxy-fuel pilot, Hubei

Features of the 35MWt oxy-fuel pilot

Project Entity: HUST and others

Goal: To set up a full demonstration plant combining carbon capture, storage and utilization

Scale: 35 MWt oxy-fuel combustion boiler with 100,000 t/a CO_2 storage

Location: Yingcheng, Hubei Province

Technology: Oxy-fuel combustion + storage in salt mines

Status: under preparation

CO_2 capture rate: > 90%

Existing 400kWt Oxy-fuel recycle combustion facility

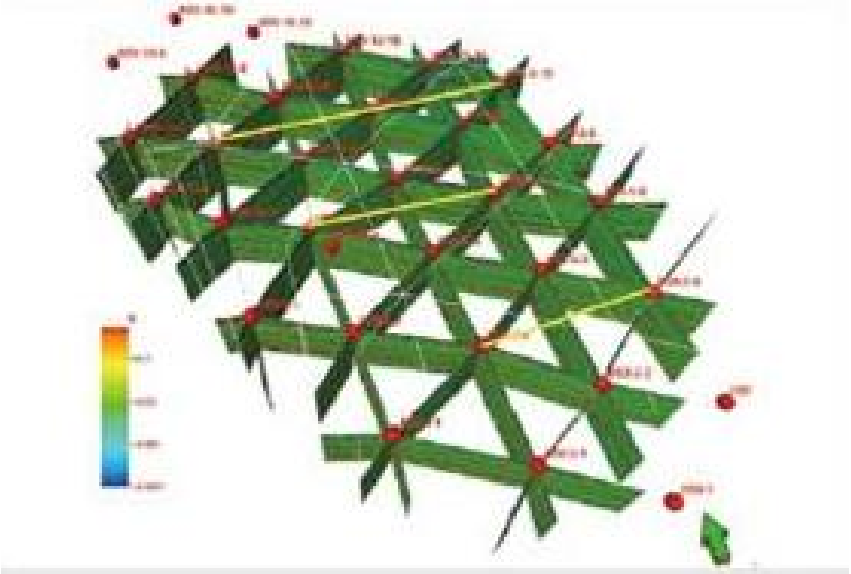
CCUS S&T activities and pilot Projects in China

CO2 Utilization Pilot/Demonstration

Name of Projects	Scale	Storage/ Utilization	Status
Project of CO2 Chemical Industry Utilization	Utilization Capacity: About 10,000 T/Year	Chemical Industry Utilization	Operated in 2007
Project of biodegradable Plastics made from CO2, CNOOC	Utilization Capacity: About 2,100 T/Year	Chemical Industry Utilization	Operated in 2009
Research and Demonstration Project of CO2-EOR in Jilin Oil Field, PetroChina	Storage Capacity: 100,000 T/Year	EOR	Operated in 2010
Pilot Project of Enhanced Coal-Bed Methane (ECBM) Development Tech, China United Coalbed Methane Company	Storage Capacity, Phase I: 230 T/Year: Phase II: 20,000T/Y	ECBM	Phase I: done; Phase II:on going
Pilot Project of Micro Algae Bio-fuel, ENN Group	Planning for Utilization Capacity: About 20,000 T/Year	Bio-fuel	The first phase operated since 2011

PetroChina's CO_2 EOR Research and pilot Injection, Jilin Oilfield

PetroChina EOR Project



Jilin Oil Field CCS-EOR pilot test block well network design

Goal: 0.8-1.0 million tons storage of CO_2 annually (Phase II)
Site: Jilin Oil Field
Technologies: Separation of CO_2 from natural gas + EOR
Status: Phase I has been completed and phase II is in progress

China United Coalbed Methane Co.
ECBM Pilot Project

CUCBM CO_2-ECBM Well Site

CUCBM CO_2-ECBM Well Site

Project Entity: China United Coalbed Methane Company (CUCBM)

Goal: Studying and developing ECBM and CO_2 storage technology, testing safety and permanence of CO_2 sequestration.

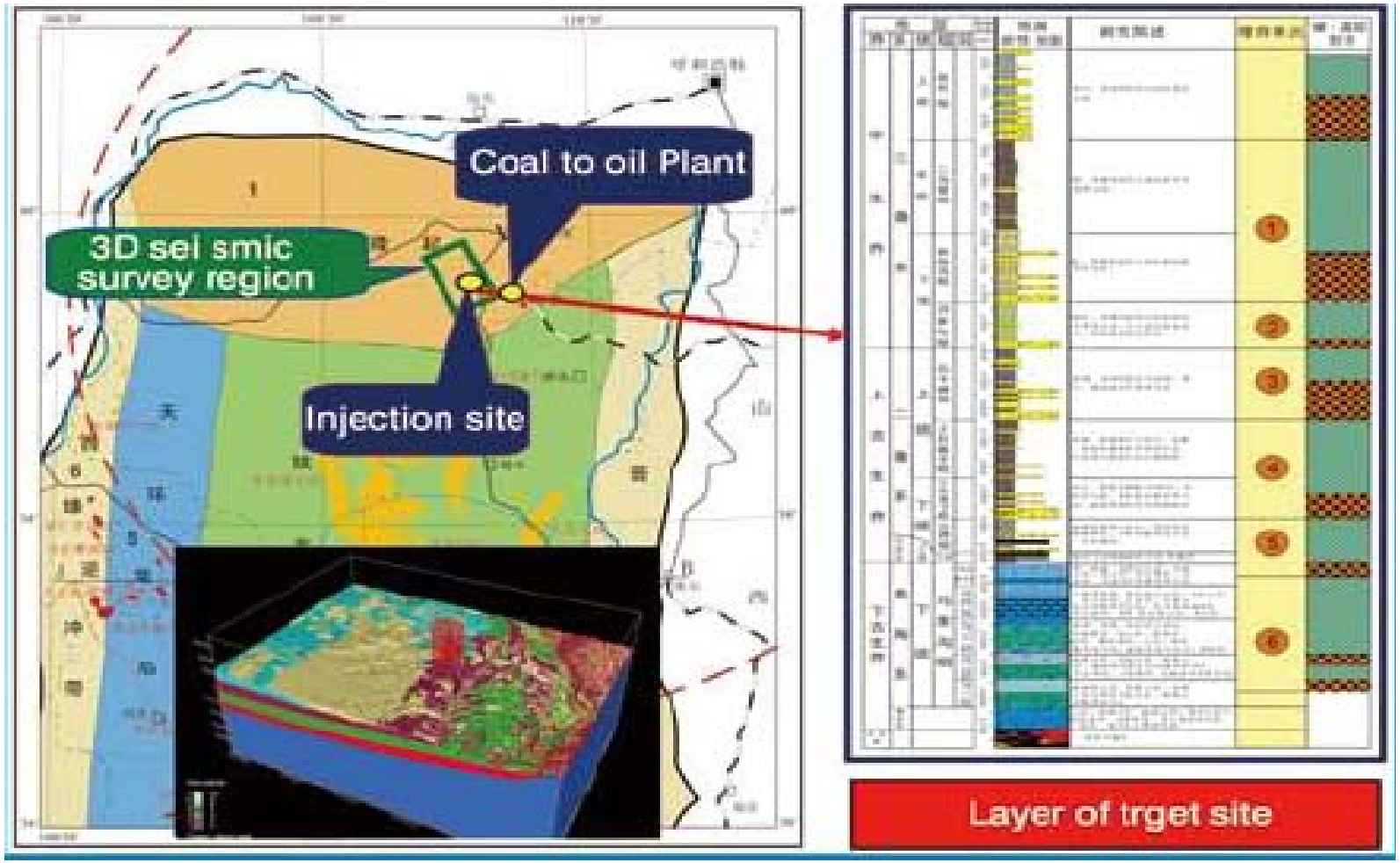
Location: Shizhuang, Qinshui County, Shanxi Province

Technique: CO_2 Storage for ECBM

Current Status: Ongoing, injection test started since April 2010

ENN Group's Micro algae Bio-fuel Pilot

Shenhua 100,000 t/a CCS demonstration site and site analysis



Sinopec's 30,000 t/a CO_2 flue gas capture and EOR Pilot

recycling power plant flue gas

absorbing and purifying

inject CO_2 into oil fields

Capture associated gas

Capture of CO_2 from associated gas

Started operation since mid 2010.

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Huaneng Greengen Tianjin 400WM IGCC Power Plant

three stages of the GreenGen Project

Project Entity: China Huaneng Group

Goal: To construct a demonstration project of 400 MW IGCC and to capture CO_2 for EOR in the Dagang Oil Field

Scale: 250 MW IGCC (1st stage), 400 MW IGCC + Capture + EOR (3rd stage)

Location: Binhai New Area, Tianjin

Expertise: IGCC + EOR

Construction period: The 250 MW IGCC demonstration power station (Phase I) is to be operational in 2011; the 400 MW (with CO2 capture) demonstration (Phase III) to be finished in 2016.

Current status: Phase I Under construction

GreenGen at completion

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International S&T Collaboration on CCS

International S&T Collaboration on CCS

Title	Funding by	Duration
China-EU NZEC Cooperation Phase I	UK,EU FP6	2007-2009
China-EU Carbon Capture and Storage Cooperation（COACH）	EU FP6	2007-2009
China-Australia Geological Storage of CO2 (CAGS)	RET	2010-2011
Sino-Italy CCS Technology Cooperation Project(SICCS)	ENEL	2010-2012
China-US Clean energy Research Center	MOST, NEA，DOE	2010-2015

International S&T Collaboration on CCS

- Bilateral scientific exchanges and cooperation conducted with European Union, Australia, Italy, Japan, the United States, etc.
  - China-EU NZEC Cooperation Phase I
  - China-Australia CO_2 Geological Storage Project (CAGS)
  - Sino-Italy CCS Technology Cooperation Project (SICCS)
- Exchange and cooperation under CSLF, MEF and other international framework
  - Host CSLF Ministral Conference in Beijing, Sep. 19-23, 2011
- Promote the development of CCUS technology in some extend
  - Info of Newest technology advancement and trends
  - Building capacity
  - Support preliminary researches, incl. techno-economic evaluation, preliminary assessment of storage potentials, etc.

International S&T Collaboration on CCS

China-Australia Geological Storage of CO2 (CAGS)

- **The goal:**
  To develop and explore means of mutual benefit, particularly in R&D of carbon dioxide geological storage, knowledge transfer and sharing, and training on relevant subjects and methodologies.

- **Program Activities**：
  - 3 Research projects
  - Workshops and exchange of experience
  - Capacity building and knowledge sharing
  - Exchange of researchers and students

International S&T Collaboration on CCS

- **Achievements and highlights**

  - 《Guideline for Carbon Dioxide Geological Storage Site Selection Criteria in China》
  - 《English-Chinese CCUS Terminology Dictionary》
  - 3 Workshops on CCS technology were held, and 150 experts attended and shared the knowledge.
  - 60 Postgraduates get training on CCS technology in summer schools we organized.
  - 9 Chinese researchers are sent to Australia to study CCS technology.

Challenges & the Ways to overcome

Main Gaps & the Ways to overcome

- Lack of comprehensive policies to guide CCUS technology development in China
- Lack of inter-sector/industry platform for stakeholders to cooperate and share, especially big companies.
- Lack of finacial support.
- Lack of study on CCS related regulatory/environmental impact/safety/risk management/standards.

Main Gaps & the Ways to overcome

- Chinese CCUS Technology Roadmap.
- China Strategic Alliance for CCUS Technology Development .
- To build up CCUS platform and implement the demonstration program.
- To build steady and high level R&D talents.
- To enhance public education on CCUS, and to improve public awareness.
- To further internation cooperation on CCUS, speed up tech transfer and knowledge sharing
- Financial support: Encourage private and company investment.

Main Gaps & the Ways to overcome

- To involve in international multilateral cooperation program, and gain the experience.
- To study on CO2 geological storage monitoring and safety assessment.
- To Study on offshore geological storage capacity assessment.

Thank You !