China's Policies and Actions on Carbon Capture and Storage (CCS)

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Workshop on CO2 Geological Storage

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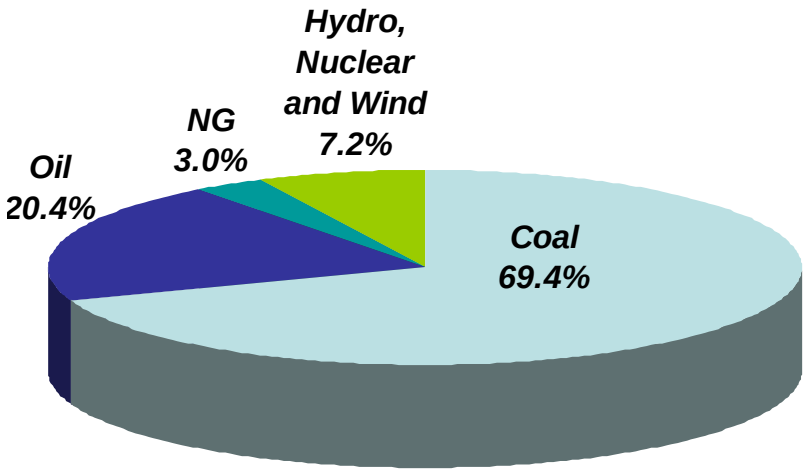
Outline

- Background
- CCS related Policies in China
- CCS Activities in China
- China’s Perspectives on CCS

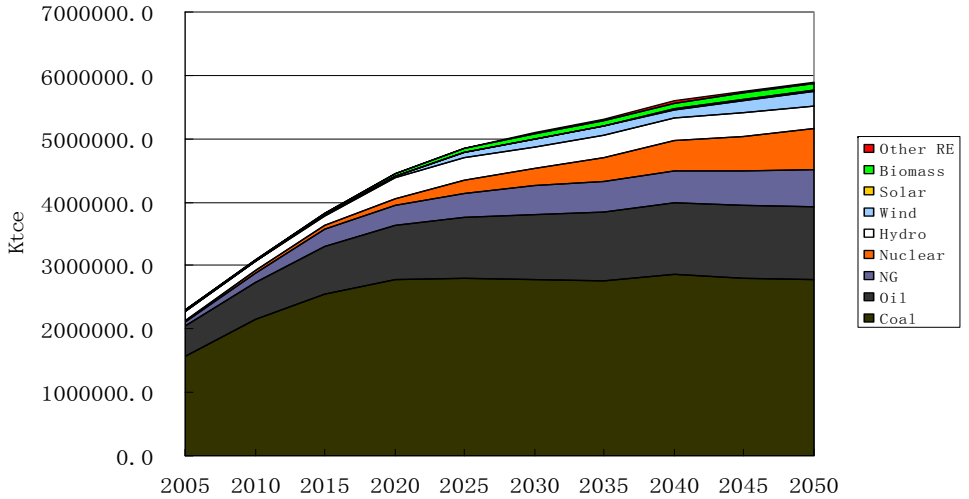
1. Background

Energy Resources and Energy Structure of China

- Relatively abundant coal reservation: 13% of world total
- Energy Structure:



Energy Structure in 2006

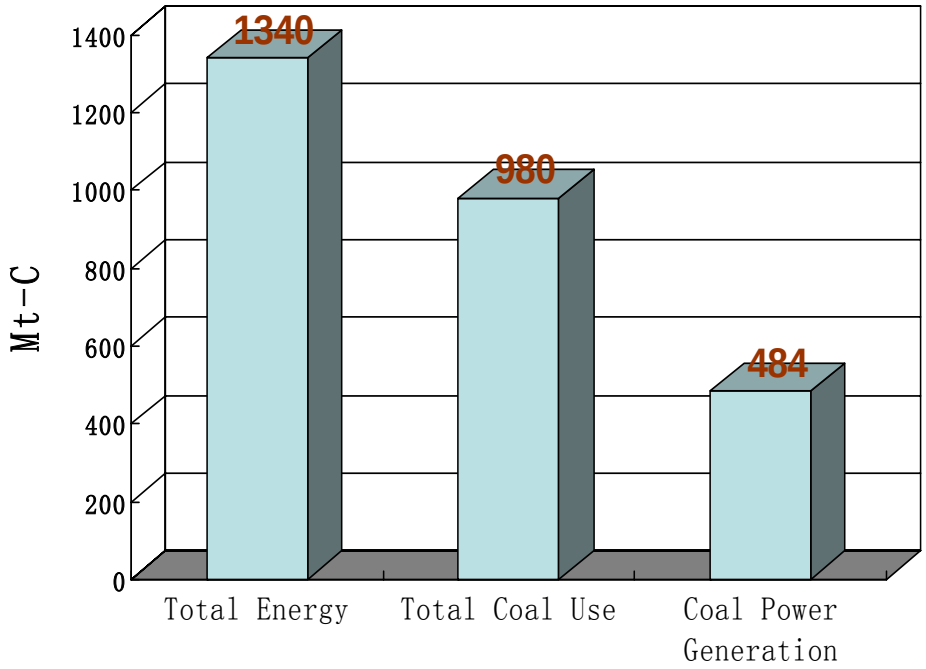


Referring to the simulation results based on an energy system model, if follows today's tendency of energy technology development and energy policy, the fraction of coal in primary energy consumption will decrease after 2015,but still be high: 54.5% in 2030, and 47.2% in 2050. Coal will still be the major primary energy.

（Source: Prof. Li Zheng, Tsinghua University）

CO2 Emissions and Storage Potential in China

- **CO2 Emissions in 2004**



Source: Prof. Chen Wenying, Tsinghua University

- Storage potential
  (Very preliminary estimation)

  - **46 oil & gas reservoirs, 7.2 billion t-CO2**
  - **68 unmineable coal beds with methane recovery, 12 billion t-CO2**
  - **24 saline aquifers, 143.5 billion t-CO2**

Source: Li Xiaochun, CAS

Government Policies & Actions to Climate Change

- Chinese Government attaches significant importance to the issue of climate change and have enacted policies and actions to address it
  - **The outline of the 11th Five-Year Plan for National Economic and Social Development: *Striving to make achievements in controlling GHG emissions*.**
  - **In 2007, the State Council established the *National Leading Group to Address Climate Change and Energy Conservation & Pollutant Discharge Reduction***
    - Chair: Premier Wen Jiabao
    - Vice Chair: Li Keqiang Dai Bingguo
    - Members: chief leaders from 19 relevant ministries/bureaus of the State Council
  - ***The General Work Plan for Energy Conservation and Pollutant Discharge Reduction***
    - **20% reduction of energy intensity per GDP and 10% reduction of major pollutant discharge during the 11th 5-year period**
  - ***Middle and Long Term Program of Renewable Energy Development***

Continued

- 2007, China’s National Climate Change Programme
- 2007, China’s Scientific and Technological Actions On Climate Change
- China's National Assessment Report on Climate Change
- National Public Action on Energy Saving and Emission Reduction
- ……

The report to the 17th CPC National Congress:

“We will enhance our capacity to respond to climate change and make new contributions to protecting the global climate. ”

2020 Goals fighting Climate Change

- reduce the intensity of carbon dioxide emissions per unit of GDP in 2020 by 40 to 45 % compared with the level of 2005
- Increase the share of non-fossil-fuel power (renewable energy, nuclear, etc.) to15% of the country's total primary energy consumption by 2020
- Increase 40 million hectares of forest areas and forest volume by 1.3 billion cubic meters from the levels of 2005
- Promote the Green development, circular economy and low-carbon economy, strengthen R&D&D of climate-friendly technologies

2. CCS related Policies in China

Outline for National Medium and Long-term Science and Technology Development Plan towards 2020

- CCS was identified in *The Outline for National Medium and Long-term S&T Development Plan towards 2020* as one of the leading-edge technologies;

"*To Develop high efficiency, clean and near zero emissions fossil energy development and use technologies.*"

China's National Climate Change Program (CNCCP)

- Issued by the State Council on 4 June 2007
- Sets target, principles, key areas and policies of addressing climate change
- China's first policy document to address climate change, and the first national climate change program among developing countries

CNCCP includes developing CCS in the key area of GHG reduction.

China's Scientific and Technological Actions on Climate Change

- Issued by MOST with other 13 departments on 14 June 2007
- to guide and coordinate climate change-related scientific research and technological development
- and to enhance the comprehensive science and technology capacity in response to climate change

It includes CCS as a key task of GHG control technology development.

Guide for CCS technology development – drafting

- **MOST has been leading on drafting the *Guide for CCS science and technology development*.**
- **The Guide plans**
  - **To determine the goal of CCS R&D in 2020 and 2030.**
  - **To Identify major tasks for capture, storage, transportation, and utilization technology development**
  - **Figures out some important (near-term) projects under National S&T Programs e.g. 863 (hi-tech), 973 (basic science), supporting S&T etc.**

3. CCS Activities in China

National S&T Programs (1)

- **National Key Technology Program**
  - **During the 10th five-year period, the national key technologies R&D program has supported strategic studies on CCS by Chinese research institutions**
  - **Emphasis is placed on the applicability of CCS in China, and its impact on energy system and GHGs emission reductions**

National S&T Programs (2)

- **National Basic Research Program (973 Program)**
  - **4 key projects are developed**
    - **Research on enhancing oil recovery, use as resource and storage of GHG**
    - **Basic Research of Polygeneration System with syngas co-produced from coal gas and coke oven gas**
    - **Basic research of high efficient catalytic conversion in reforming reaction of natural gas and syngas**
    - **Research of thermal-to-power conversion processes in gas turbine**
  - **In the following years during 11th 5-Year Plan period (2006-2010)**
    - **The 973 Program will emphasize on the basic theory of CO2 long term storage, high efficiency and cost effective separation, new theory and method of transportation, etc.**

National S&T Programs (3)

- **The National High Tech Program (863 Program)**
  - **863 Program will also support the development of CCS technology.**
  - **A few project has been implemented and plans to further support CCS R&D in the 12th 5-Year Plan period (2011-2015).**

Enterprises' Activities (1)

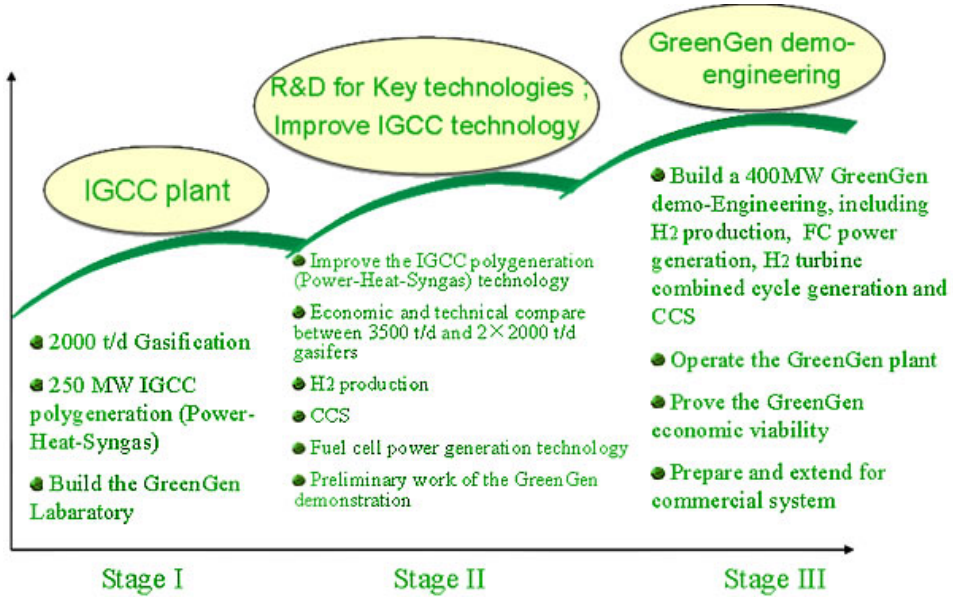
Some Chinese enterprises have already started CCS related research and project activities on their own initiatives.

- PetroChina
  - Carry out China's first project of CO2 storage and usage (EOR) at Jilin Oil Field from 2006
  - Investment: 200 million RMB
  - CO2 injection at 10 wells
  - Combined with the project under 973 Programme (basic research) supported by MOST

Enterprises' Activities (2)

- **Huaneng Group**
  - **GreenGen**
    - **Stage I: 2006-2011**
    - **Stage II: 2012-2014**
    - **Stage III: 2015-2020**

Phase I is under construction NOW!



  - **CO2 Capture Pilot and Demonstration**
    - **China Huaneng Group constructed the first demonstration project in Beijing Thermal Power plant with 3000 t co2/y, which was in operation before 2008 Olympic**
    - **A 100,000 ton/a demonstration has been completed in Shidongkou Power plant in Shanghai and 96 hours continuous test run successfully earlier this month.**

Enterprises Activities (3)

- **Shenhua Group**
  - **China's largest coal miner, is working on research and development in CCS at its coal-to-liquids plant. This CCS project will be applied to Shenhua's 1-million-ton direct coal-to-liquids plant in Ordos, Inner Mongolia autonomous region, which launched trial operation at the end of 2008.**
  - **Geological storage, are being considered for Shenhua's CCS project. Shenhua Group has collaborated with US DOE on the research of aquifer storage in Ordos basin. At current stage, Shenhua did not announce the detail of this project, but it may be in the stage of site selection now.**

- **Sinopec**
  - **Shenli Oilfield, capture of it's own power plant for EOR**

International Collaboration (1)

- China was one of the initial members of the Carbon Sequestration Leadership Forum (CSLF) and MOST actively represents China within this forum.

- **EU-China Summit (September 2005)**
  - **Joint Declaration on Climate Change**

    “ *We will aim to achieve the following co-operation goals by 2020: To develop and demonstrate in China and the EU advanced, near-zero emissions coal technology through carbon capture and storage* **”**

International Collaboration (2) : China-EU-UK Collaboration on CCS

- **Two complementary Memoranda of Understanding with common and shared objectives for both MoU:**

  China-UK MoU signed December 2005

  China-EC MoU signed February 2006

- **The two MoU foresee 3 phases collaboration:**
  - **Phase 1: Exploring the options for NZEC technology through CCS in China;**
  - **Phase 2: Defining and designing a demonstration project; and**
  - **Phase 3: Construction and Operation of a demonstration project.**

China-EC MOU signed Nov. 2009 at 12th China-EU summit on NZEC Phase II Cooperation

Shared Objectives of China-EC-UK Cooperation

- **Update on the status and development of CCS initiatives in China and internationally;**
- **Review the status and progress of current CCS activity in China;**
- **Facilitate and strengthen links between Chinese and the international CCS community;**
- **Generate a 'road map' for assessing the potential of CCS in China;**
- **Identify key actions and milestones for development and deployment of CCS technologies in China.**

International Collaboration (3) : Projects under EC/UK MoU on CCS

- **China-EC-UK MoU Result in several parallel but complementary projects:**
  - ***COACH project funded by the EC FP6***
    - **2006-2009**
    - **8 Chinese partners & 12 EU partners**
  - ***UK Near Zero Emissions Coal Initiative (NZEC)***
    - **Launched in November 2007**
    - **20 Chinese partners involved**
  - ***Some Chinese organizations with EU partners are strengthening collaboration on CCS under EU/FP7, eg STRACO2.***

4. China’s Perspectives on CCS

1) CCS is one of the potential important technological options to address climate change

CCS, with significant potential for GHG reduction, is a strategic high-technology in the long run. R&D should be continually strengthened to promote and improve CCS technology.

2) There still remains many difficulties in the development and deployment of CCS technology

Given the high cost and energy penalty of the large-scale deployment, the main effectiveness of CCS is mitigating GHG reduction. Therefore, CCS can NOT become the priority area in developing countries at current stage.

3) To promote the development of CCS calls for broad international collaboration.

Positive efforts have been made by international society concerning development of CCS technology. In the future, further enhancement of international collaboration on CCS should be strengthened, especially the establishment and improvement of the financial mechanism in promoting the development of CCS technology, so as to jointly promote the development of CCS technology, technology transfer and share of knowledge and experiences.

Thank You for Your Attention!

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