

**PetroChina Company Limited**



# **CCS Activities and Developments in China**

**September 10-11, 2007**



# Outline

- Government support to CCS
- International cooperation
- Developments of CCS projects
- Recent CCS project of PetroChina
- Trends of CCS in China



# Government Support to CCS

- China is the 2nd largest country of CO<sub>2</sub> emission, the total emission is to 5.1 billion tons in 2004, accounting for 13% of the world, the average emission per people is still low, only 87% of the world average level
- Government has been paying much attention to global climate change and involved in carbon emission reduction action
  - Signed the United Nations Framework Convention on Climate Change (UNFCCC) in June, 1992, Kyoto Protocol in May, 1998
  - Adjust energy consumption structure, increase the energy efficiency
  - Setup polices to encourage energy saving, renewable energy application
  - Participate in the CDM project with global cooperation



# Government Support to CCS

- CCS technology study has been listed into several key national R&D plans
  - China's Scientific & Technological Actions on Climate Change
  - Medium & Long-Term Science and Technology Plan of China
  - State High-Tech Program (863) R&D Project
  - The China's National Climate Change Programme
- Activities in CCS
  - International cooperation
  - Enhanced oil recovery (EOR)



# International Cooperation

- Carbon Sequestration Leadership Forum (CSLF)
  - Regional Opportunities for CO<sub>2</sub> Capture and Storage in China
    - Primary Goal: evaluate the CO<sub>2</sub> storage potential and the feasibility of CCS technologies in China
    - Project Status: underway (2005 ~ 2007)
    - Participants: Chinese Ministry of Science and Technology, United States Department of Energy, Chinese Academy of Sciences, Tsinghua University, PetroChina, etc.



# International Cooperation

- Carbon Sequestration Leadership Forum(CSLF)
  - China Coalbed Methane Tech./CO<sub>2</sub> Sequestration Project
    - Primary Goal: inject CO<sub>2</sub> into the coalbed to enhance methane production, and design, operate a pilot
    - Project Status: completed (2002 ~ 2006),
    - Participants: China United Coalbed Methane Corporation Ltd., Canadian Alberta Research Council, etc.
    - Conclusions: the methane recovery is increased, and the storage of CO<sub>2</sub> in Shanxi is feasible. the recommendation is to manufacture a full-scale demonstration unit.



# International Cooperation

- CCS Cooperation Action within China-EU-UK (COACH)
  - Develop and demonstrate advanced, near-zero coal emissions technology through CCS in China and the EU
  - 3 phases (2006-2014)
    - Phase 1: explore the options for Zero Emissions Coal (CCS) in China during 2006~2008
    - Phase 2: design a demonstration plant during 2008~2010
    - Phase 3: construct and operate the demonstration plant during 2010~2014



# International Cooperation

- China-EU-UK Cooperation
  - Progress
    - Approve the UK & China nZEC Memoranda of Understanding (MOU) (Dec,2005)
    - Set up the China-UK Climate Change Working Group (WGCC) (Sept,2006)
    - International Workshop on nZEC Power Generation with CCS in China(July,2006)





# International Cooperation

- New Asia-Pacific Partnership on Clean Development and Climate (APADC)
  - Primary goal: create a new partnership to develop, deploy and transfer cleaner, more effective energy technologies, especially the CCS tech ( July, 2005)
  - Participants: China, USA, India, Australia, Korea and Japan



# Developments of CCS Project in China

- Stationary CO<sub>2</sub> sources and geological storage potential
  - Capacity: 1445.8 BT, about 400 years (3300 ~ 4000MT/year)
  - Northeast: one of the most prospective areas
  - South: further exploration expected
  - Central & southwest: mainly in Sichuan Basin



Source: APEC 2005

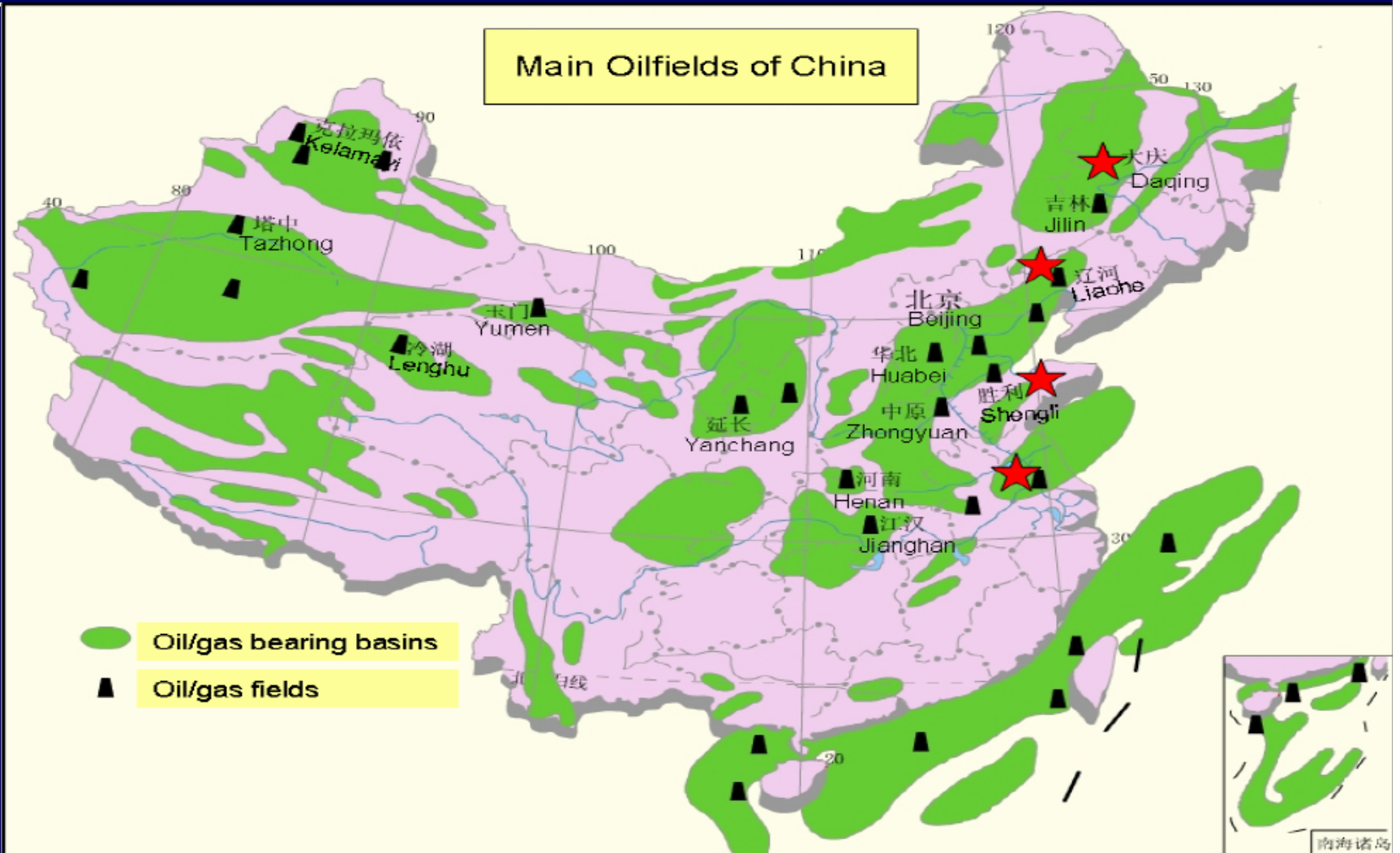


# Development of CCS Project in China

- Enhanced Oil Recovery (EOR)
  - It is estimated, EOR can be used in 1.23BT inland light oil reserves exploitation of total 10.14 BT, increasing 160MT oil production more than with conventional methods
  - Several research projects have been implemented by PetroChina and CNOOC from 1960s. By now experiments on EOR have been ongoing in Daqing, Shengli, Liaohe, Jiangsu oil fields



# Development of CCS Project in China





# Development of CCS Project in China

- Enhanced Coal Bed Methane (ECBM)
  - CO<sub>2</sub> storage capacity of coalbeds in China

$$120.78 \times 10^8 t$$

## CO<sub>2</sub> Storage Capacity of Eight Coalbeds in China

Estimated Region	Recoverable Methane/(10 <sup>8</sup> m <sup>3</sup> )		CO <sub>2</sub> Storage Potential /(10 <sup>8</sup> t)
	Traditional Method	CO <sub>2</sub> -ECBM	
Ordos	2745.84	4820.44	44.52
Turfan-Hami	953.44	1868.21	21.95
San Tang Lake	417.62	838.19	9.91
East Junggar	287.98	551.28	6.54
Qinshui Basin	2170.07	3100.10	6.13
Yili	258.61	496.67	5.63
North Junggar	278.06	518.20	5.30
South Junggar	243.29	436.60	3.42

Source: Y. Liu et al. Preliminary estimation of CO<sub>2</sub> storage capacity of coalbeds in China. Chinese Journal of Rock Mechanics and Engineering, Aug. 2005



# Development of CCS Project in China

- Enhanced Coal Bed Methane (ECBM)
  - Qinshui Project
    - Objective: demonstrate and prove that CO<sub>2</sub> will enhance the production of coal bed methane from the deep unmineable coal seams
    - Time: July, 2007-
    - Participants: China United Coal Bed Methane Co. Ltd. (CUCBM); Petromin Resources Ltd., Canada
    - Location: Qinshui, Shanxi province



# Development of CCS Project in China

- Green Coal-based Power Generation (GreenGen)
  - increase the efficiency of power generation, realize the near-zero CO<sub>2</sub> emissions target
  - **Plan**
    - Phase 1 (2000-2005): build a pilot system of CO<sub>2</sub> separation and storage for the experiment
    - Phase 2 (2006-2010): build the industrial demonstration plant
    - Phase 3 (2011-2015): complete the engineering development , prepare for the commercialization
  - **progress**
    - Phase 1 has been launched in which the feasibility of coal gasification power generation will be explored based in 2 gas fired power plants in China



# Recent CCS Project of PetroChina

## Profile of PetroChina

- PetroChina (CNPC, Chinese National Petroleum Company) is a world-leading integrated energy corporation with businesses covering oil & gas exploration, development and production of; refining, petrochemical, transportation, and marketing of petroleum products and chemical products;
- PetroChina is the largest oil & gas producer in China, the most important owner abundant in oil & gas resources, and the largest oil & gas producer overseas (have oil & gas assets and interests in 26 countries ).
- Rated the 39th by the Fortune Global 500 and ranked the 7th among the world's top 50 petroleum companies in 2006; PetroChina continued to hold the title as the most profitable company of Asia in 2006 with the net profits up to 185 billion yuan(RMB).





# Recent CCS Project of PetroChina

- Exploitation of CO<sub>2</sub>-containing natural gas, CO<sub>2</sub> storage and utilization in Jilin oil field
  - Primary goal: develop the bottleneck tech. of the exploitation of CO<sub>2</sub>-containing natural gas, CO<sub>2</sub> storage and utilization in Jilin oil field; provide technical support for CO<sub>2</sub> storage and EGR
  - Time: April, 2007-2009



# Trends of CCS in China

- Further research and test will be progressed in major CO<sub>2</sub> emission sources in China
- Study of carbon capture technologies will be strengthened, especially in coal based power generation, hydrogen energy;
- International cooperation will be enhanced.
- Financial system will be improved as the mechanism of risk sharing and mutual development.



**Thanks !**