The Progress of the CCS Demonstration Project in the Shenhua Group

China Shenhua Coal to Liquid & Chemical Engineering Company, July 9, 2012
2012 NETL CO2 Capture Technology Meeting, July 9-12, 2012 in Pittsburgh, PA.
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Overview of the Shenhua Group Corporation

Shenhua Business 2011

- The largest coal company in China and the largest coal supplier in the world
- One of the State-Owned Enterprises (SOEs), established in 1995

- An integrated mega-large energy company with the businesses covering mining, power, railway, port and coal to liquid and chemicals
- 47 subsidiaries, over 200,000 employees and USD 100 billion in assets
Overview of Shenhua Group Corporation

Shenhua Business 2011

- Coal Production: 400 million tons
- Coal Trading: 500 million tons
- Power Generation: 211 billion kWh
- Revenues: $48 billion
- Profit: $12 billion
China Shenhua Coal to Liquid and Chemical Co., Ltd, one of the main subsidiaries of the Shenhua Group

As a wholly owned subsidiary of Shenhua Group, China Shenhua Coal to Liquid and Chemical Co., Ltd. is:

- a sole-owned limited liability company established in Beijing on June 12, 2003 with approval of the State Administration for Industry and Commerce;
- responsible for managing the CTC (Coal to Chemical) and CTL (Coal to Liquid) - related business of Shenhua Group;
- involved in producing products such as polyethylene, polypropylene, methanol, diesel, naphtha and LPG, etc.
In 2011, the capacity of coal-to-liquid & chemical and coking production amounted to 9,900 kta

- Shenhua Direct Coal Liquefaction (DCL) Plant (1000 kta, fuel oil)
- Shenhua Indirect Coal Liquefaction (ICL) Plant (180 kta, fuel oil)
- Shenhua Coal to Olefin (CTO) Plant in Baotou (600 kta, PP and PE)
- Shenhua Coal-to-Methanol plants
- **Shenhua Shenning Coal to Chemical (CTC) Plant (500 kta, PP)** *
- **Shenhua Coking Plant in Wuhai (5,000 kta)** *
- Shenhua 100 kta CCS Project associated with Shenhua DCL plant in Erdos

*Note: The plant that does not belong to China Shenhua Coal to Liquid and Chemical Co., Ltd.*
China Shenhua Coal to Liquid and Chemical Co., Ltd,

Shenhua DCL Plant (1000 kta)
China Shenhua Coal to Liquid and Chemical Co., Ltd.

Shenhua ICL Plant (180 kta)
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3. Shenhua 100 kta CCS Demonstration Project
China Central Government Policy related to the CCS project:

- On Feb. 9, 2006, the State Council released the “National Outline for Medium and Long Term Science and Technology Development (2006-2020)”, in which developing high efficiency, clean and near-zero CO2 emissions fossil energy technology is listed as a key component in the advanced energy area.

- On June 4, 2007, the National Development & Reform Commission (NDRC) issued “China’s National Climate Change Program”, which proposes to vigorously develop CO2 capture, utilization and storage technologies.
China Central Government Policy related to the CCS project:

- On June 14, 2007, the Ministry of Science and Technology and NDRC jointly released “China’s Scientific and Technological Actions on Climate Change”, in which CO2 capture, utilization and storage is emphasized as one of the key tasks.

- On Oct. 29, 2008, the State Council Information Office published a white paper entitled “China’s Policies and Actions for Addressing Climate Change”, which points out that China is determined to emphasize the importance of CCS technologies.
It is inevitable to produce and emit CO2 from coal mining, transportation and conversion (such as CTL, CTC, etc.), as a coal mining based company.

As a state-owned company and the leader of the coal industry in China, Shenhua needs to actively take on its social obligation and responsibility to reduce the emission of CO2 during coal production and its consequent processing.
Prior to large-scale application of renewable and new energies, CO2 Capture and Sequestration may be one of the most efficient ways to reduce atmospheric hazards due to CO2 emission.
All of the main sectors of Shenhua Group emit CO2 during their running or operation;

Considering the convenience of gaining relatively higher CO2 concentration emitted from the syngas purification unit of CTL or CTC plants, the subsidiary of Coal to Liquid and Chemical Company, Ltd., was chosen to conduct the Shenhua CCS Demonstration Project;

The CTL Demonstration Plant of Shenhua Coal to Liquid and Chemical Company, Ltd., is located in Erdos Basin;

There are suitable underground structures and conditions for choosing Erdos Basin as the CO2 injection area.
Shenhua 100 kta CCS Demonstration Project

Key Links of CCS

CO₂ capture → Transport → Sequestrate → Monitor

Steps of CCS Project Conduction

Scope Defining → Feasibility Study → CO₂ Injection → Completion of the Project
International support and collaboration during Pre-feasibility Study of the Project

With the support of the US Department of Energy (DOE), National Development & Reform Commission (NDRC) and State Environmental Protection Administration (SEPA) of China, the Shenhua Group and the West Virginia University began the Pre-feasibility Study for the Shenhua Demonstration CCS Project in 2007.
Optional area for CO2 injection and sequestration:

- Optional area for enhancing rate of oil and gas recovery;
- Optional area for burying of deep coal seams;
- Optional area for burying of saline aquifer.

Conclusion: Saline aquifer is the appropriate option for CO2 injection and sequestration of the Shenhua CCS Demonstration Project.
Feasibility Study and the Implementation of the Project

Supported by the joint pre-feasibility study mentioned previously, the Shenhua Group conducted a feasibility study of the project and then decided to implement a 100 KTA CCS Demonstration Project—injecting the CO2 from Erdos Direct Coal Liquefaction (DCL) Plant into the saline aquifer of Erdos Basin.
Shenhua 100 kta CCS Demonstration Project

CO2 Concentration Process

> 80% CO2 from DCL

Compression → Purification → Liquification → Distillation

- 95% CO2
- 99% CO2
Shenhua 100 kta CCS Demonstration Project

The site construction started in Jun 2010 and was completed by Dec 2010:

Compression zone

- Pipeline construction completed on Nov. 22, 2010;
- Building construction for compressor completed on Nov. 24, 2010;
- Equipment insulation completed on Dec. 5, 2010;
- Commissioned on Dec. 25, 2010;
Injection zone

- Foundation construction for control room and equipment completed before Jan. 2011;
- Drilling for injection well completed with depth of around 2000 m;
- Drilling for two monitoring wells completed before Jan. 2011.
Shenhua 100 kta CCS Demonstration Project

Tests for CO2 Injection well started in Jan. 2011;

Trial injection of CO2 was done successfully on Jan 2nd, 2011;

Till Jun. 10th, 2012, the largest CO2 injection was 360 tones per day;
Till now, over 10,000 MT CO2 has been injected into the saline aquifer;

The parameters of CO2 production, transportation, injection and monitoring have met the requirements of process design;

There have not been any leakage or other undesirable results based on the data collected from the monitoring wells.
Thanks for your attention!
Questions ?