

CARBON CAPTURE & STORAGE [CCS] OPPORTUNITIES IN CHINA



■ In operation
■ Under construction
■ Pre-approval
■ Pre-approval IGCC Projects
 EOR = Enhanced oil recovery
 EGR = Enhanced gas recovery
 IGCC = Integrated gasification combined cycle

- 1 HUANENG GAOBEIDIAN CO-GENERATION CO., BEIJING**
Participants: China Huaneng Group and Australian CSIRO
 The 845 megawatt power plant is the first in China to fully test CO₂ capture, and features a full suite of environmental controls. During winter months, steam from the plant is used for district heating, and efficiency can be as high as 84 percent. Engineers estimate the plant uses about 400,000 tons less coal annually than a similarly-sized conventional plant. Eventually, engineers plan to capture 60,000 tons of CO₂ per year (equivalent to the annual CO₂ consumption (dry ice, food-grade CO₂) of Beijing).
- 2 SHENHUA DIRECT COAL LIQUEFACTION (DCL), ORDOS**
Participants: China Shenhua DCL Co., Ltd. (project lead), U.S. Lawrence Livermore National Laboratory, and West Virginia University
 This first-of-its-kind facility employs a Chinese-developed technology to convert 6,000 tons of coal a day into more than 1 million tons of liquid fuels per year (70% diesel oil and 20% naphtha). The plant sits above a geologic formation that experts say could store more than 4.4 billion tons of CO₂. Geologists are currently studying the site, and an experiment that will inject 100,000 tons of CO₂ per year is expected to begin in late 2009. The project is sponsored in part by the U.S. DOE.
- 3 GREENGEN I & II IGCC, TIANJIN**
Participants: GreenGen Co., Ltd.
 GreenGen is China's most prominent IGCC project, owned by a consortium of China's top power and coal producers. Eventually, engineers plan to use its gasifiers to capture 1 million tons of CO₂ per year, which will be injected into the ground to enhance oil recovery.
- 4 PETROCHINA CO₂ EOR AT JILIN OIL**
Participants: Field PetroChina
 Started in 2006, PetroChina has developed the Jilin Oil Field project as a pilot test site for enhanced oil recovery, as well as 10 injection wells for CO₂ storage.
- 5 GREENGEN POST-COMBUSTION PLANT, SHANGHAI**
Participants: GreenGen Co., Ltd.
 It is anticipated that this project will capture approximately 100,000 tons of CO₂ per year.
- 6 SICHUAN DEPLETED GAS FIELD**
 Although this area has a high concentration of large industrial CO₂ sources, including power plants, cement kilns, iron and steel foundries, and petrochemical facilities, a detailed feasibility study is needed to assess whether CCS (and associated enhanced gas recovery) would be cost-effective.
- 7 JIANGHAN BASIN DEPLETED OIL FIELD, HUBEI**
 Ammonia, fertilizer, alcohol, and petrochemical plants are all located near the Jianghan oil field. As such, it stands as one of the more promising near-term CCS opportunities in China.
- A-L PRE-APPROVAL IGCC PROJECTS**
Projects: A. Datang (International)-Shenyang; B. Datang (International)-Beijing; C. Datang (International)-Tianjin (under construction); D. CPI-Langfang; E. Jiangsu/CAS-Lianyungang; F. Guodian-Haimen, Jiangsu; G. CPI-Wujing, Shanghai; H. Huandian-BanShan, Hangzhou; I. Guohua-Wenzhou; J. Tianming Electric Power - Dongguan; K. Datang (International)-Dongguan; L. Datang-Shenzhen
 Proposed IGCC projects offer opportunities for capture-ready CO₂. Although there are no concrete plans for geologic storage associated with these projects, they represent an important potential.

NOTE: GreenGen Co., Ltd. is a company formed by China Huaneng Group, China Datang Group, China Huadian Corp., China Guodian Corp., China Power Investment Corp., Shenhua Group, State Development & Investment Co., China Coal Group, and Peabody Energy. Huaneng is the largest shareholder.