SIEG 350 MW Oxyfuel Thermal and Electrical Generation Demonstration Project

山西国际能源集团(格盟国际) 350 MW 富氧燃烧热电一体化示范工程

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SIEG Oxyfuel Power Plant with CO₂ Capture Technology

APCI

Oxygen Supply

Oxygen ~7,000 tpd

Coal

B&W

Steam Boiler and Turbines

350 MW_e

CO₂ Purification and Compression

WVU

CO₂ Transport and Utilization (e.g., EOR)

APCI

Flue Gas Recycle
Aug 26, 2010

• Joint US-China Fossil Energy Protocol signed
• SIEG and West Virginia University conducted a pre-feasibility & related carbon management study on a 300 MW Oxy combustion power plant as a project listed in Annex II of the protocol.

Sept 29, 2010

• Shanxi Province and West Virginia signed the Energy Cooperation Memorandum.
• SIEG and APD signed a MOU on oxyfuel CO$_2$ purification
• SIEG and WVU signed a MOU on CO$_2$ utilization & storage
March 3, 2011
• WVU made CO$_2$ sequestration & utilization recommendations based on initial results from China University of Geosciences and US practices.

April 11-13, 2011
• Shanxi Province Development and Reform Commission organized the Project Pre-feasibility Study Review
• CO$_2$ Utilization and Sequestration Team Leader - Prof Suping Pang, Director of Coal Resources and Safe Mining National Key Laboratory
• Oxyfuel Combustion Team Leader - Prof Chuguang Zheng, Director of Coal Combustion National Key Laboratory
(1) Shanxi SIEG establishes a 350MW Oxyfuel combustion power plant as a demonstration project which could capture 2 million tons CO$_2$ per year. This project is a world scale demonstration and meets the national strategy to deal with the climate changes.

(2.1) APCI, B&W, Doosan have undertaken world-class R&D work on large-scale, low cost oxygen production, oxyfuel combustion, compression and purification technologies. (B&W was selected as the boiler & environmental control equipment provider in June 2011).

(2.2) Based on SIEG’s project requirements, the technical proposals provided foundation and basis for the feasibility study. The technical proposal is reasonable, workable and with potential for large-scale application.
(3) Oxyfuel combustion technology is a key technology for large-scale CO$_2$ reduction. This project is going to take a risk sharing approach for the investment. The Expert Team suggests the relevant departments in the government to provide support on the project planning, approvals and other aspects.

(4) This is a relatively low cost CO$_2$ capture methodology. It will utilize the potential geological reservoirs nearby to establish a large scale CCS project. This will meet the national low carbon energy development strategic plan.
May 30, 2011
• Shanxi Development and Reform Commission organized a meeting between the Shanxi Province and West Virginia to establish the energy cooperation project.

• The Provincial government’s assessment to the project is “The collaboration is currently proceeding smoothly, both Governments should support the project and help the two parties to develop a better way to collaborate and speed up the project.”

August 1, 2011
• Shanxi Province Development and Reform Commission has granted ¥ 4 millions funding to SIEG’s 350MW Oxyfuel combustion power plant and CO$_2$ utilization project.
CPU from Lab to Demonstration

- **15 MWth**
  - 圆柱型小型实验装置

- **160 kWth**
  - 富氧燃烧装置

- **30 MWth 富氧燃烧中试厂**

- **1 MWth**
  - 旁路烟气

- **0.3 MWth**
  - 旁路烟气

- **6 kWth**
  - 小试装置

- **0.3 MWth**
  - 旁路烟气

- **Imperial College London**
  - London

- **Doosan Babcock Energy**
  - Renfrew, Scotland

- **DOE Project**
  - Host: Alstom, Windsor, CT

- **VATTENFALL**
  - Schwarze Pumpe, Germany

Photo courtesy of Imperial College

- **CPU from Lab to Demonstration**
Air Products’ Oxyfuel CPU Demonstration at Vattenfall
• First demonstration of Sour Compression in representative equipment
  首个利用代表性装置的压缩酸性气体示范

• First demonstration of auto-refrigerated inerts removal
  首个采用自冷却技术脱除惰性气体的示范

• Learned many lesson relevant to full scale plant design and operation
  积累了很多有关工业规模的设计与操作经验

• An on-going comprehensive test plan will continue for next year
  一个持续而全面的测试计划将在明年继续

• Air Products is bidding multiple global demo project in 250-350MW scale
  Air Products 正在投标多个全球示范项目，其规模为 250-350MW
Oxy-combustion Development Path

2001
Small pilot 1.8 MWth

2008
Large pilot 30 MWth

2015
200 MWe gross

Oxy-coal Combustion Development

• Multiple Oxy Eng Studies, including ASU / CPU Optimization & Process Heat Integration completed
• Small & Large Scale Oxy Pilot testing, completed
• Reference plant design complete at 680/450 MWe net SCPC
• Next step - Commercial scales lead plants (eg: FutureGen 2.0 )
350 MWe Proposed Process Configuration

"建议的工艺流程"
OxyCombustion Carbon Capture Technology

- Near zero emissions and greater than 90% CO₂ capture
- Combustion system with pure oxygen and recycled CO₂
- Reference plant designs completed
- Ready now to validate at commercial scale – new build, repowering or retrofit
- Oxygen supply system provides added operation flexibility