Huayi - Praxair Partnership in Integrated Coal to Chemical Site

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Gasification Technology Conference,
Washington, D.C.
Huayi Group’s Overview

- Large state-owned co., one of the earliest and most successful CTC producers in China, located at Shanghai
- Subsidiary listed in Shanghai stock exchange.
- Assets 5.6 bil$, employee 45,000, professional technician over 35%.
- Year 2007 Top 2 Chemical Co., No. 145 of Industrial 500 in China.
- Current CTC capacity: Glacial acetic acid 500kt, Methanol 800kt.
- 2007 group sales revenue: 4.68bil$, profit 76mil$
Huayi Group’s Coal based Poly-generation

- **ZnO**
- **Carbon black**
- **Tail gas**
- **Feedstock**
- **Fuel cell**
- **Hydrogen peroxide**
- **Poly Formaldehyde**
- **Carbon Products**
- **Steam, Salt Water**
- **Benzene anhydride, H2, steam**
- **Plasticizers**
- **PVC**
- **Sulfur Recovery / H2SO4**
- **CO2 vent gas**
- **Acetic Acid**
- **Botanical Garden**
- **Food grade CO2**

**Shanghai Coking Co.: Clean Coal Gasification and Methanol Synthesis Units**

**PRAXAIR**
Industrial Competitiveness:

- Leading position in acetic acid and methanol
- Single-plant Acetic Acid output ranked No. 4 in China.
- Substantial achievements in gasification operation and innovation

![Chart showing China Main Acetic Acid Producer Capacity 2007 and China Main Methanol Producer Output and Sales 2007]
Successful Experience in Gasification by Huayi

- In 1995, first startups of 4X500tpd gasifiers by Texaco at Shanghai Coking, Huayi Group

- The 2nd earliest Coal gasification tech. importer in China

- 200ktpy methanol started up in 1995

- Supply of pipeline CO outside the fence in 1996

- Additional 4X500tpd gasifiers by GE started up in July, 2008

- 3X1500tpd gasifiers by ECUST to be started up at Wuwei, in 2011
Opposed Multi-Burner Gasification Technology:

Verbal discussion of reasons why it is chosen and comparison.

华东理工大学 ECUST
兖矿集团有限公司 Yanquang

Huayi PRAXAIR
Huayi’s Strategic View and Objective:

- Develop safe, environmental friendly and recycling “Green” Production Base located along Yantse River, with Shanghai as the headquarter

- Develop core business: coal chemicals and clean energy, polymers and rubbers, fine chemicals, logistics, and biological medicine/chemicals

- Improve CO conversion and reduce CO2 emission

- Strengthen and expand business based on low cost feedstock from coal gasification

- Integrate production chain from raw material down to processed products
2008 and Beyond Strategic Planning

- Using CTC as core business, and expanding main product capacity
- Planned Huayi Coal Chemistry Park of 1.66 km², final over 5 km² in Wuwei, Anhui
- Develop down stream products to balance Acetic acid production, coal to olefins, DME etc.
- Integrate production chain from raw material down to processed products
- Lower cost with Coal as raw material to compete globally.
Coal to Chemical Project in Anhui Wuwei

- At Phase 1, invest 760MM$, produce methanol 600 ktpy, CO 250 ktpy, acetic acid 500 ktpy, and acetate 300 ktpy.
- Adopt coal slurry gasifiers to produce methanol synthetic gas.
- Adopt dual tower methanol wash process.
- Strategic partnership, air separation plant supplied by Praxair.
- Adopt 3 patented technologies.
- Phase 2 and 3 will increase methanol to 2.4MM tpy and equivalent downstream processes.
What Praxair will do at Wuwei project

- Invest, design, construct, and operate a T-3000 ASU plant to supply 84,000Nm³/h oxygen, and 30,000 Nm³/h N2 and 8,000Nm³/h Air to Huayi Wuwei Project for a term of 15 years at Phase 1 to be on stream by Jan. 2011.
- This is the 2nd T-3000 ASU for sale of gas by Praxair in China after Sopo Jiangsu which will be onstream in July of 2009.
- By the completion of Huayi’s phase 3 project, there will be 4 to 5 T-3000 size plants to supply over 320,000~400,000Nm³/h oxygen
Praxair Overview:

- 2007 Sales: $9.4 billion, among top three gases companies in the world
- Chemicals and Energy is a Strategic Segment (23% of total sales)
- 100 years of air separation experience
- Voted one of the most admired chemical companies in the world
- 3,000 active patents
- China is a Strategic Focus
Gasification Project & Operations Experience

- Houston, Texas – Shell, Pipeline supply
- Wilmington, California - Texaco, 800 TPD
- Texas City, Texas - Dow, 600 TPD
- Texas City, Texas - Praxair/Sterling, Pipeline supply
- API Refinery, Falconara, Italy, 2000 TPD
- Texaco, El Dorado, Kansas (Gas Turbine Integration), 200 TPD
- Star Refinery - Delaware, USA, 2900 TPD
- SOPO, Zhenjiang, China 3300 TPD (in construction)
- Huayi Group, Anhui, China 3300 TPD (in construction)
- North West Upgrading, Alberta, Canada, 1700 TPD
Praxair In China

- $600MM investment by 2007
- 25 entities, 20+ locations
- Over $300MM sales in 2007
- >1200 employees
- China and Asia HQ’s in Shanghai
- Regional Engineering and R&D Centers in Shanghai
- Fabrication in China
- Pipeline Complex
  - Beijing (1st in China)
  - Shanghai (SCIP)
    - BASF, BP, Sinopec, Bayer, Huntsman
  - Daya Bay, Cnooc-Shell
Air Separation Plant Technologies

- Key technology
  - Integrated supply systems
  - Model Predictive Control (MPC) Systems
  - Turndown efficiency
  - Unattended operation for many of our facilities
  - Hi Flux Tubes for Oxygen boilers.

- Key customer benefits
  - Lower power consumption
  - Lower product costs
  - Lower site preparation
  - Enhanced Reliability
  - Increased Safety

High Capacity Packing
Strategic partnership between Huayi and Praxair

- Alliance of Leaders, leverage respective advantages
- Praxair Advantages
  - Reliable technology,
  - Extensive operation experience
  - Quick response
  - Customer focus
- Invest capital on respective core processes
- Win-Win situation
Current Project Execution Status

- ASU Orders placed for equipment with long lead time in May 2008
- MEI for gasifiers and utility to be completed by Oct. 2010
- Mechanical completion for methanol facility by Dec., 2010 and Test-run by Jan. 2011
- Cold box, CO compressor to be completed by Dec. of 2010
- Mechanical completion for ASU by the end of 2010, and test run in Jan. of 2011,
- On stream in Feb. of 2011 expected.
**Summary**

- Coal Gasification Technology is reality in China with wide applications
- State of the art Integrated acetic acid and methanol production based on feedstock from coal gasification competes cost effectively globally
- Methanol from coal gasification is an important product for
  - As a transportation fuel or fuel addition, pending issuance of national standards
  - As the building block for downstream chemicals including olefin
- Chinese Fabrication with world class technology and QA provides best of the both worlds
- Partnership of Huayi and Praxair will be long and prosperous on the world stage
Thank You.