



US-China Energy Center
中美能源中心



US – China Clean Coal Technology Initiatives

Richard A. Bajura

National Research Center for Coal and Energy
West Virginia University

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Outline

- Overview Comments about China Organizations and Coal Programs
- US – China Clean Energy Research Center (CERC)
- Annex II Programs – US-China Energy Center at West Virginia University



Photo from <http://mediamonarchy.blogspot.com>

Overview

Chinese Government Organizational Structure for Research (Simplified)

National Development and Reform Commission (NDRC)

- Formulate strategies for national economic and social development
- Develops short and long term plans

Industry Focus

Ministry of Science and Technology (MOST)

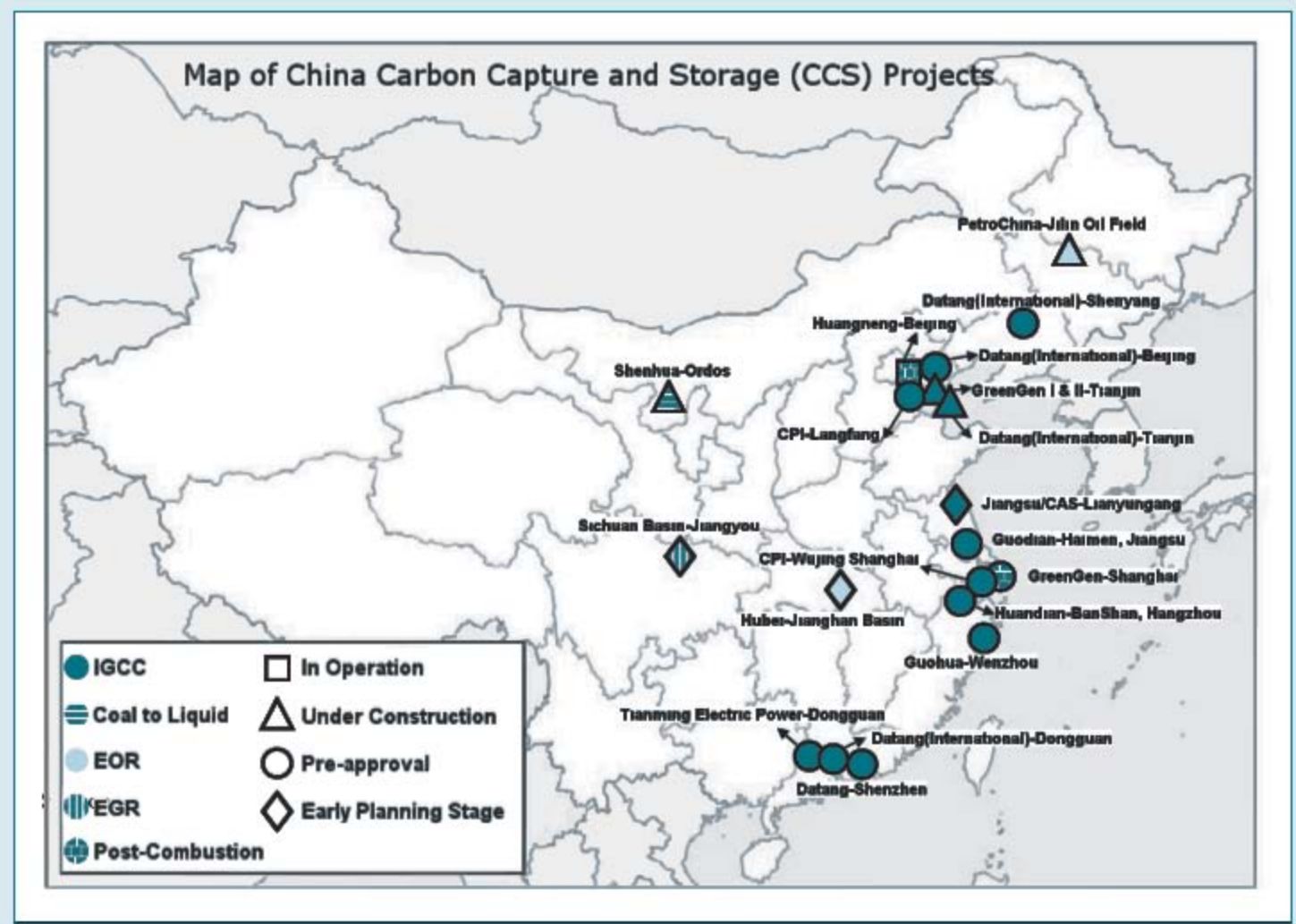
- Formulates S&T development plans
- Drafts related laws and regulations

Academic Focus

National Energy Administration (NEA)

China Has Aggressive Coal Programs

- Willing to take technology risk with 1st generation
 - Use computer simulation to guide large scale-ups
- Many technologies being demonstrated
 - Coal to Liquids
 - IGCC
 - Oxyfuel
 - Advanced combustion
 - CCS
- China sees commercial opportunities with later generations
- Programs include emphasis on advanced technology, increased efficiency, carbon management,



Other Perspectives on China

- R&D Spending for 2011
 - US \$405 B, + 2.4%
 - China \$154 B, +8.7%
- Energy Consumed – 2010 Estimate
 - China 2.25 BTOE (#1)
 - US 2.17 BTOE (#2)
- Chinese Climate Plans – Reduce energy intensity by 40% to 45% of 2005 level by 2020; not emissions
- Highest GHG emitter starting in 2007
- Oil Consumption
 - US 19 M Bbl/d
 - China 9.2 M Bbl/d (and rising)

Other Perspectives on China

- Energy security drives policy → continual coal use, most electricity from coal, #3 in coal reserves (behind US and Russia)
- Coal use – estimate for 2009
 - China 3.4 billion tons produced / consumed
 - US 1.1 b billion tons produced / consumed
 - US and China account for over 60% of global coal consumption
- Requires \$4 T in investments over 20 years to avoid blackouts and fuel shortages; needs to add 1,000 Gw in Electricity over next 15 years

US-China Clean Energy Research Center (CERC)



President Barack Obama and
President Hu Jintao
Announce Agreement in November 2009

DOE/FE Has Long History of Cooperative Research with China

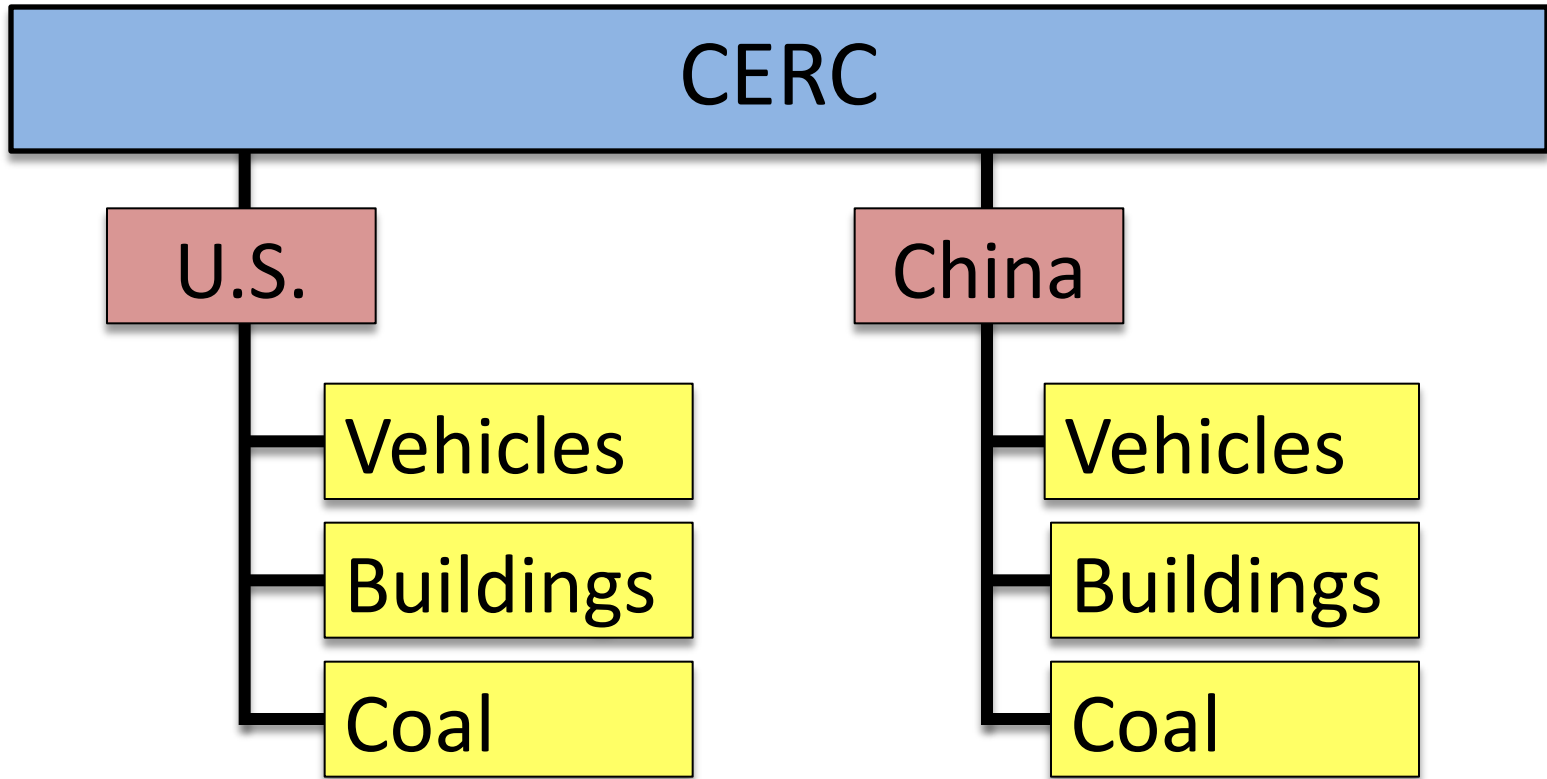
- US Objectives
 - Promote scientific and technological cooperation between US and China on FE RDD&D *
 - Create opportunities for US industry and power developers in China
- First Protocol between DOE and China signed in 1985
- Most recent Protocol Review Meeting held in 2010

Protocol ** has Six Annexes:

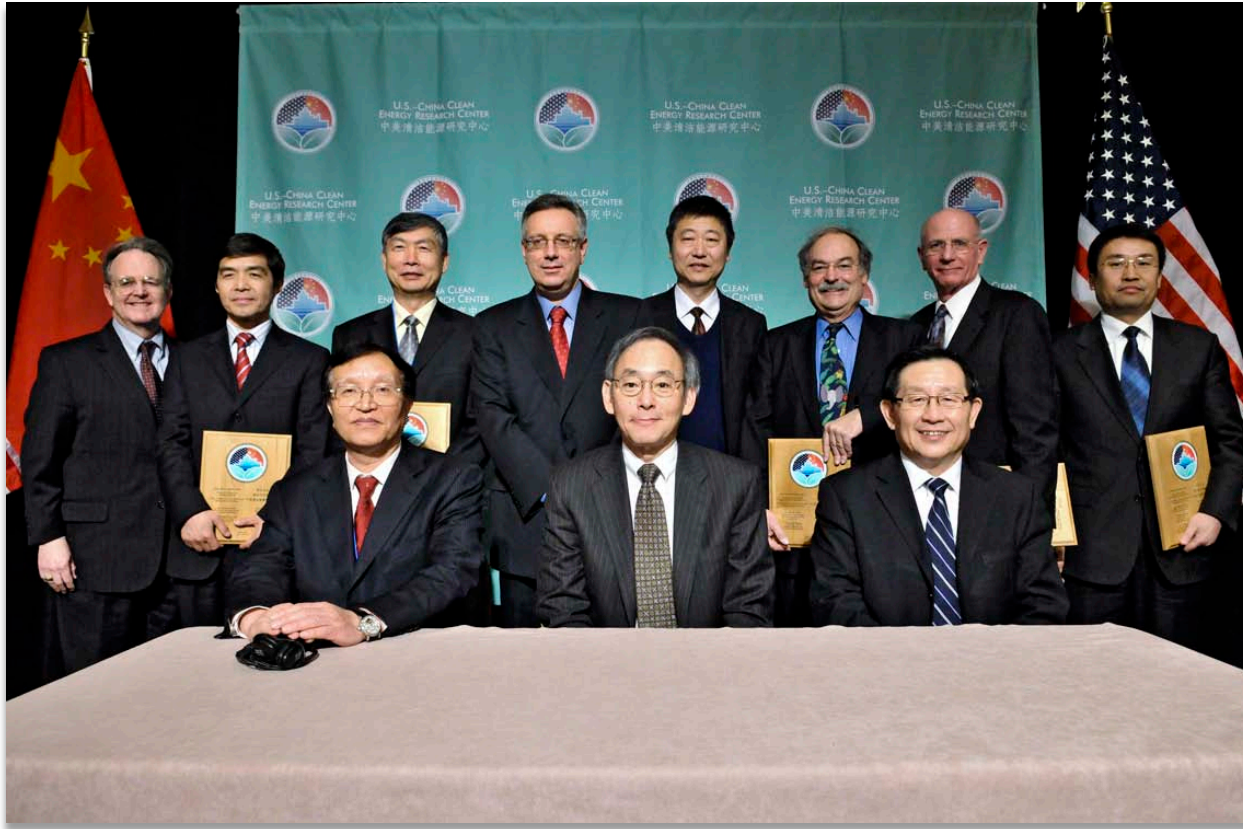
- I. Power Systems
- II. Clean Fuels
- III. Oil and Gas
- IV. Energy and Environmental Control Technologies
- V. Climate Science (Office of Science)
- VI. Advanced Coal-Based Energy Systems Research, Development and Simulation

* Research, Development, Demonstration and Deployment

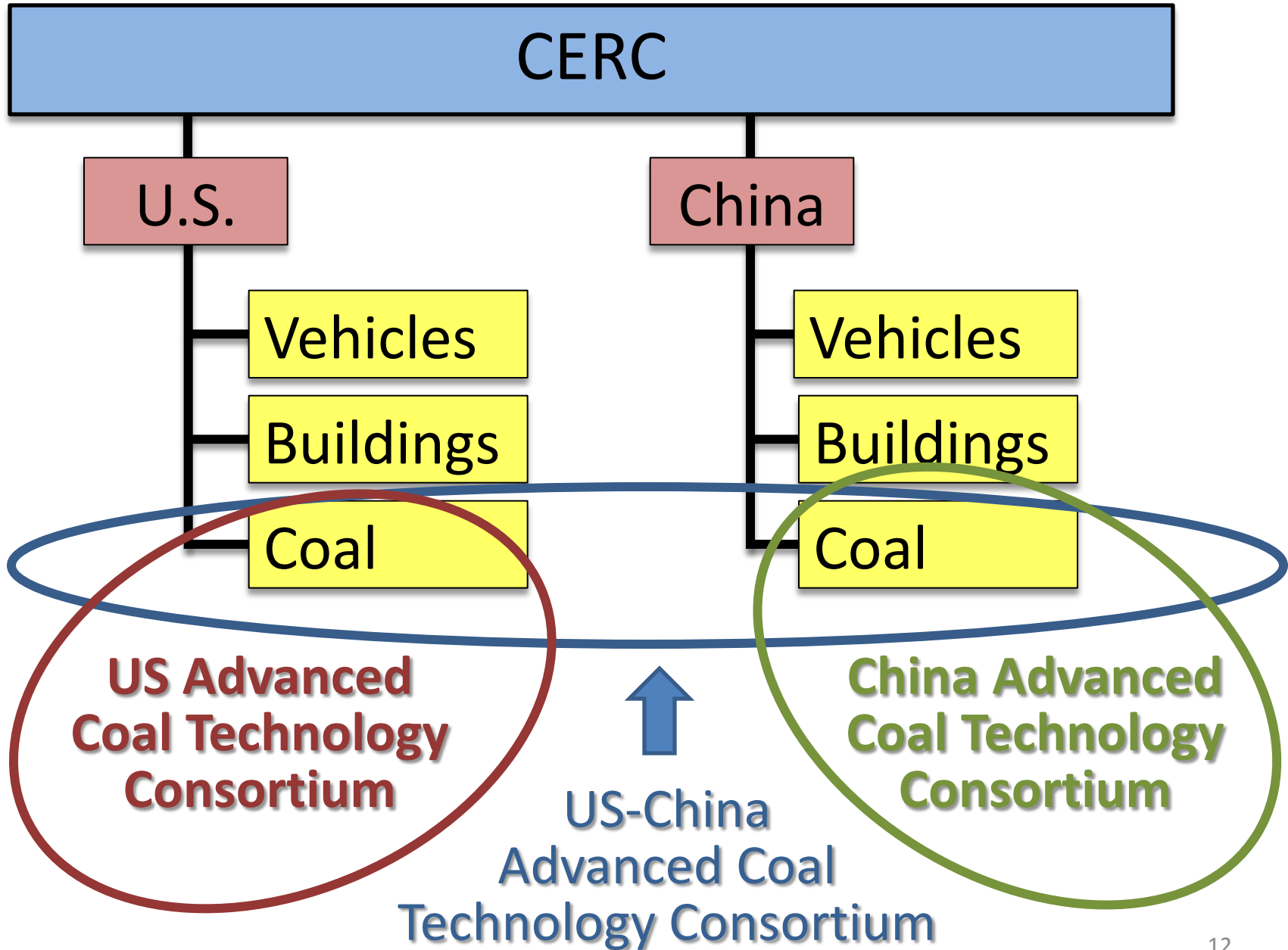
** Cooperation in the Field of Fossil Energy Technology Development and Utilization (US DOE and PRC MOST)



CERC Signing Ceremony



January 18, 2011, Washington, DC



US Advanced Coal Technology Consortium

- Responsible for US coal research under CERC
- DOE award to WVU
- Five year project
- \$25 million total funding
 - Federal \$12.5 M matched with \$12.5 M industry cost share



China Advanced Coal Technology Consortium

- Chinese government and industry will also provide \$25 million

US Team Members

US Advanced Coal Technology Consortium

Academic

- Universities
 - West Virginia
 - Kentucky
 - Wyoming
- State Geological Surveys
 - Indiana
 - Wyoming
- National Labs
 - Lawrence Livermore
 - Los Alamos
 - NETL

Industry

- Alstom
- Babcock & Wilcox
- Duke Energy, Inc.
- GE
- Great Point Energy
- LP Amina
- Ramgen

NGO's

- US-China Clean Energy Forum
- World Resources Institute

China Team Members

China Advanced Coal Technology Consortium

Universities

- Huazhong University of Science and Technology (HUST)
- Tsinghua University
- Zhejiang University
- China University of Mining and Technology (CUMT)
- Shanghai Jiao Tong University
- Harbin Institute of Technology
- Northwest University

China Companies

- China Huaneng Group
- Shenhua Group
- ENN
- China Power Investment Corporation Group
- China Power Engineering Consulting Corporation
- Shaanxi Yanchang Petroleum (Group) Company, LTD.

Research Institutions

- Huaneng Clean Energy Research Institute
- Research Center for Clean Energy and Power, CAS
- Institute of Rock and Soil Mechanics, CAS

Status

US-China Advanced Coal Tech. Consortium

- Developing joint work plan
- Identified six research areas:
 1. IGCC with CCS
 2. Post-combustion CCS and use
 3. Sequestration capacity
 4. CO₂-algae biofixation and use
 5. Oxy-fuel combustion
 6. Coal co-generation with CO₂ capture

Issues

US-China Advanced Coal Tech. Consortium

- US and Chinese research interests not entirely congruent
- Data availability
- Intellectual property
- Defining value-added for industrial participation

Annex II and WVU China Programs



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China Programs

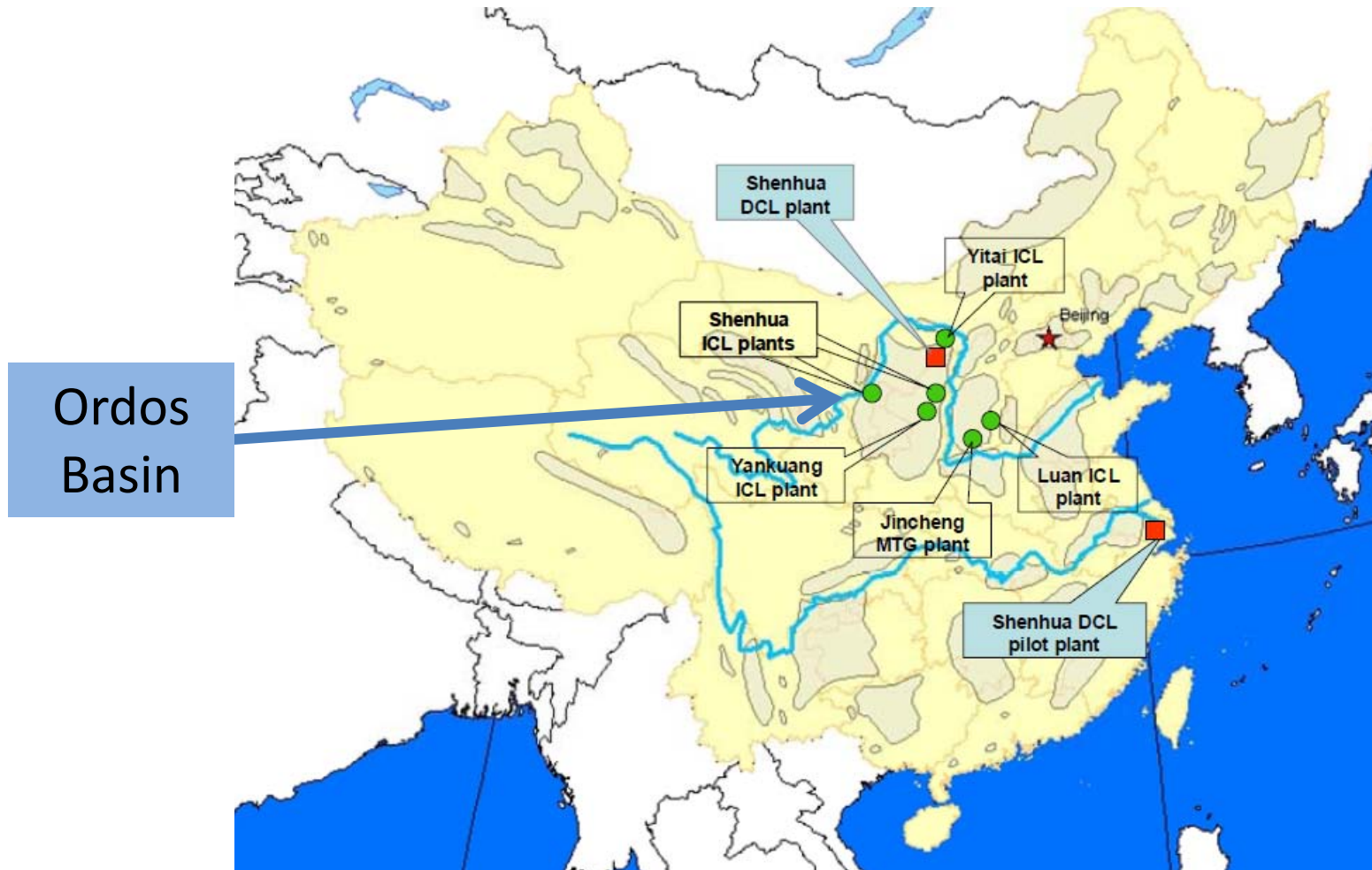
- Support for Annex II of the US-China Fossil Energy Protocol (signed by US DOE and China NEA)
- US-China Clean Energy Workshops
- Clean Energy Collaborative Projects
 - Energy efficiency and carbon management
 - Clean coal utilization and coal conversion
 - Mine safety and CBM utilization
 - Land reclamation and mine water treatment
 - Sustainable economic development
- Training and educational programs
- Business development – private sector support

Shenhua Commercial Direct Coal Liquefaction Plant In Inner Mongolia

- **World's 1st DCL commercial plant with combined technology from the US, Japan, Germany, and Chinese innovations**
 - 24,000 BPD (mainly diesel)
 - \$1.5 billion USD
 - Nearly zero emission



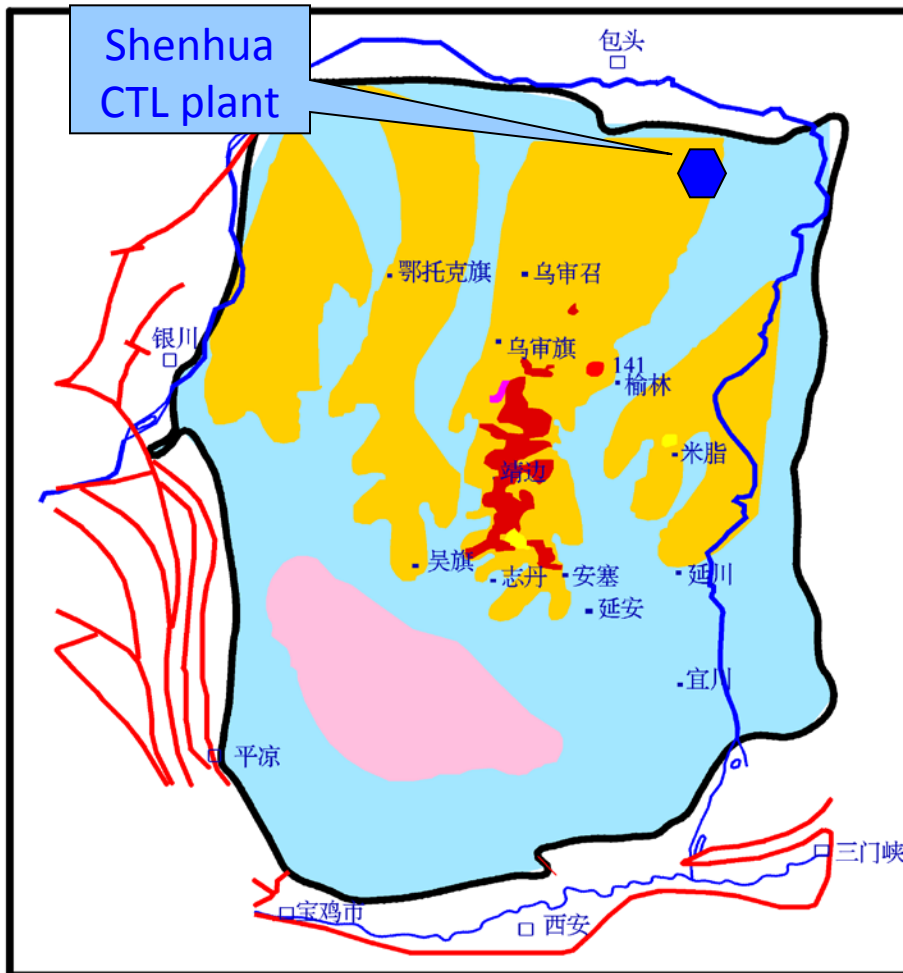
Coal to Liquids Development in China



At Least Seven CTL Demonstration Plants

Ordos Basin

Opportunity for CCS Demos



- Site of many CTL and coal power plants
- Option for enhanced oil and gas recovery

*Gas and Oil Reserves
in Ordos Basin*

Other Opportunities



Conclusions

- Mechanisms are in place for meaningful collaborative RDD&D on coal between US and China
 - Broad academic and industrial involvement
- China has an aggressive demonstration program in place
 - Potential opportunity for cooperation

Contact Information

- Richard Bajura
- 304 293 2867 Ext. 5401
- Richard.Bajura@mail.wvu.edu
- National Research Center for Coal and Energy
West Virginia University
Morgantown WV 26506-6064