Session 3:
US-China Cooperation on Clean Coal

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We have until 2020 to create energy technologies to reach our energy rich, low-carbon goals.

OECD: Organisation for Economic Co-operation and Development

IPCC, 2005
Demand growth is never met with emissions reductions alone

Tremendous growth in demand
  Current demand ~350-370 EJ per year
  By 2050, another 100-500 EJ needed
  Significant growth in developing countries

Limits to technologies that can meet demand
  Intermittency
  Power density
  Lack of development

We must rely heavily on fossil fuels for our energy needs

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Holdren, 2008
This is a shared obligation and a shared opportunity, in particular with the US and China

“...both countries will need not only bold leadership and a new set of national policies, but also a path-breaking cooperative agenda that can be sustained over the long run [over the next 5-10 years].”

Chu and Thornton, 2009

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Geological carbon sequestration is the deep injection of CO\textsubscript{2} to avoid atmospheric release.

CO\textsubscript{2} can be stored in deep geological formations as a pore-filling fluid:

- **Saline Formations:** largest capacity (>1600-3200 Gt, N. America; 2200 China)
- **Depleted Oil & Gas:** potential for enhanced oil and natural gas recovery

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The DOE and industry have embarked on a set of large-scale CCUS demonstrations: many sites and technologies.

Gasification, post-combustion capture, polygeneration, biomass co-firing, and oxyfiring demonstrations in many different geological settings.
Many CO$_2$ streams (130Mt total) exist that could serve as early development as CCS projects.

Estimated costs of GCS: $5-10/t CO$_2$

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New 100,000 t CO2/y PCC project in Shanghai is active: will scale up to 160,000 t this month; planned 2M t/y project
GreenGen project designed to demonstrate low-C gasification power plant w/ Chinese technology

Integrated IGCC + CCS outside Tianjin
- Project led by Huaneng and TPRI; also Petrochina
- TPRI gasifier
- CO2-EOR; future saline formation possible
- Research platform for technology testing
- Ultra-low sulfur & water

250 MW IGCC: 2011
500 MW IGCC+1Mt/y CCS: 2013
750 MW IGCC+2Mt/y CCS: 2015

Phase 1 IGCC project 40% built; partnership w/ Duke Energy

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West Virginia Univ., DOE/FE, and LLNL in US-China collaboration with Shenhua on large GCS project

- US-China Annex II collaboration
  - Signed in 2003
  - Resigned Sept. 2009
- Shenhua direct coal liquefaction plant (Ordos basin, Inner Mong.)
  - First of a kind plant
  - ~3 million tons CO2/year for sequestration
  - Pre-feasibility report completed
  - 100,000 t pilot in planning
- Real-world perspective on local needs, concerns for CCS commercialization in China

This could become a world-class flagship CCS project
Shenhua DCL plant is on target to be China’s first large CCS project
A strong and sustained US-China partnership will help both countries achieve their goals and needs.

**Businesses:** exchange knowledge, IP, and practices, joint ventures  
**Governments:** create incentives, opportunities; remove roadblocks  
**Both:** provide financing, people
A Roadmap for US-China Collaborations on CCS

Task Force: CAP, Asia Society, Monitor, and LLNL

There are tremendous available resources, applicable learnings, works in progress

- IPCC Special Report
  - 2004 snapshot
  - High level of technical detail
- CO₂ Monography (SPE)
- MIT Report: Future of Coal
- IOGCC draft guidelines (2007)
- NAS study (2009)
- WRI CCS draft guidelines
- Many 100’s DOE documents
  - N. America CO₂ Atlases
  - Technology Roadmaps
  - Regional Partnerships
  - FutureGen selection criteria
  - Task Force report

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