Coal Research and Development to Support National Energy Policy

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KENTUCKY ENERGY SUMMIT
UK Center for Applied Energy Research
30th Anniversary

Kentucky Geological Survey
UNIVERSITY OF KENTUCKY
Purpose of the report

- Focused on federal R & D on the “upstream” side of the coal industry.

- 8% of federal R & D goes for “upstream” activities in the coal cycle.

- Coal production will increase 70% by 2030.

- U.S. has more than adequate reserves to accommodate this increase, R & D is needed.
Federal Funding for Coal-Related R & D

- **Utilization & CCS**: 82%
- **Transport & Transmission**: 9%
- **Safety & Health**: 4.5%
- **Reserve Assessment**: 1.9%
- **Environment/Reclamation**: 1.8%
- **Mining & Processing**: 0.2%

“Downstream” vs “Upstream”

NRC 2007
- No new mega-agency like Bureau of Mines-BUT!
- Greatly improved coordination among federal agencies
- Increase research for federal agencies such as:
  - OSM
  - NIOSH
  - MSHA
  - USGS
CO₂ emissions pose the greatest constraint to future coal utilization.

Large-scale demonstrations of carbon sequestration are needed to prove the commercial readiness of this technology.
“Coal will continue to provide a substantial portion of U.S. energy for at least the next several decades, a major increase in federal support for coal R & D is needed to ensure that this natural resource is extracted efficiently, safely, and in an environmentally responsible manner.”

The report recommends an increase of about $144 million annually in new federal funding across a variety of areas.
The Past
U.S. Energy Imports
1950 to 2005

Arab Oil
Embargo

EIA, 2007
Trends for U.S. Coal Production, Mines, and Employment
Peak of World Petroleum Production?

Historical

Predicted

The Present
U.S. Coal Resources and Reserves
At January 1, 1997

Billion Short Tons

- Recoverable Reserves at Active Mines (19.4)
- Estimated Recoverable Reserves: 275.1
- Demonstrated Reserve Base (Measured and Indicated, Specified Depths and Thicknesses): 507.7
- Identified Resources (Measured, Indicated, and Inferred): 1,730.9
- Total Resources (Identified and Undiscovered): 3,968.3

EIA 1999
Sources of U.S. Electrical Energy

EIA 2006 and American Magazine, 2007
The Future
Carbon Capture and Storage (CCS)
OECD is the Organization for Economic Cooperation and Development. There are 30 member-countries: U.S.A., Canada, Australia, New Zealand, and nearly all of Europe.

ExxonMobil Energy Outlook, 2006
Least Expensive Methods to Cut CO₂ Emissions

SFA Pacific, JEC Study, American Magazine, 2007
Methods for storing CO2 in deep underground geological formations

Overview of Geological Storage Options
1. Depleted oil and gas reservoirs
2. Use of CO2 in enhanced oil and gas recovery
3. Deep saline formations — (a) offshore (b) onshore
4. Use of CO2 in enhanced coal bed methane recovery

SRCCS Figure TS-7
2007 KY Energy Bill- $5 million for KGS to investigate \( \text{CO}_2 \) sequestration, EOR and EGR

[Diagram showing \( \text{CO}_2 \) test wells in the Illinois Basin and Appalachian Basin]
Kentucky Energy Bill

- For the advancement of energy policy, science, technology, and innovation.

- Investigate enhanced oil and gas recovery including Devonian gas using CO$_2$.

- Investigate enhanced coal bed gas recovery using CO$_2$.

- Investigate CO$_2$ sequestration in deep boreholes in Illinois and Appalachian Basins.
Exploring Kentucky for sequestration potential

Mount Simon Sandstone Isopach Map
Mt Simon Sandstone Saline Reservoir

- Illinois Basin geology contains multiple seals for carbon dioxide ($CO_2$) above the Mt. Simon Sandstone
- Monitoring other sandstones above the Mt. Simon Sandstone can provide warning of any problems

Deep, saline Mt. Simon Sandstone reservoir for $CO_2$
Storing CO$_2$ in Sandstone a Reservoir

- Using technical information to answer basic questions

- Pore space
- Pin head
- Sand grain
Subsurface geology at East Bend

- Precambrian basement
- Mount Simon Sandstone
- Middle Run Formation
- Knox Group
- Black River Group
- Well

Diagram showing geological layers and formations at East Bend.
Oil and Gas Fields of Kentucky

- Oil: 5.8 billion barrels
- Nat. Gas: 125 Tcf
- Production
  - 780 MMbo produced
  - 5.6 Tcf produced
Conclusions

• Kentucky has potential for secure long-term storage of carbon

• Coal synfuels and CTL are clean coal technologies when coupled with sequestration

• KGS is committed to innovative subsurface research for sequestration and EOGR
Thank You!