Focus Group Meetings

- Initial consortium meeting on Dec. 7, 2007
- Over 100 in attendance
- Expressed desire to organize overall project by geographic area and project type
- 3 focus groups meeting this week:
  - Wednesday: Western Kentucky deep CO₂ storage
  - Thursday: Eastern Kentucky deep CO₂ storage
  - Friday: Enhanced oil and gas recovery
Outline

- HB 1 funding and directives
- Kentucky Consortium for Carbon Storage
- Vision and expected results
- Project organization and structure
- Preliminary budget development
- Discussion and questions
Why Are We Here?

- Kentucky HB 1 was passed in a 2007 special session and signed into law August 30.
- Provides financial incentives for coal gasification plants
- Provides $5 million for carbon sequestration research in Kentucky
- “The Kentucky Geological Survey is encouraged to use these funds to match available federal and private funds to the extent possible.”
2007 HB 1 Directives

- Drilling of deep wells in the eastern and western coal fields to estimate sequestration potential

- Quantify the potential for:
  - Enhanced oil and gas recovery
  - Enhanced coalbed methane recovery

- Test the Devonian shale for CO$_2$ enhanced gas recovery and CO$_2$ sequestration potential
Vision

- $5 million is not sufficient to accomplish everything in HB 1
- A joint industry-government consortium is the only way to achieve these objectives
- The Kentucky Consortium for Carbon Storage (KYCCS) has been formed by KGS
Consortium Model

- Industry involvement is necessary for the success of this project
  - Cost sharing
  - Guidance and direction of research
  - Provide expertise not available at KGS
  - Justification of the Commonwealth’s investment in carbon management research
Today’s Goals

**Morning**

- Identify likely members of Eastern Kentucky project
- Create a Project Advisory Committee and define its responsibilities
- Discuss and agree on funding structure, funding levels, deadline for participation, other concerns

**Afternoon**

- Present our initial technical approach
- Discuss preliminary budget
HB 1 Research Organization:

3 Subprojects

- **Western Kentucky Deep Sequestration**
  - Rick Bowersox and Dave Williams

- **Eastern Kentucky Deep Sequestration**
  - Steve Greb and Warren Anderson

- **CO₂ EGR/EOR**
  - Devonian shale CO₂ EGR, Brandon Nuttall
  - CO₂ EOR, Marty Parris
  - Enhanced coalbed methane production, Cortland Eble

- **Public Education and Outreach**
  - Mike Lynch
Subproject Integration

- Subprojects will run concurrently
- Communication between teams important
- Efforts will be made to coordinate work schedules and contracts to extent possible for cost savings
  - Seismic acquisition, drilling
Eastern Ky. Project Goal

Identification, characterization, and testing of CO$_2$ storage in saline reservoirs in Eastern Kentucky

Will be accomplished by drilling of a deep well to test multiple potential target zones
Impact of Results

- Kentucky geology is not homogeneous

- Research sites will be as representative as possible, however:
  - A successful project will not prove sequestration is possible everywhere, and an unsuccessful project will not condemn the entire state

- We cannot guarantee success – there is risk involved
Project Structure

- Industry cost-share to be administered separately by subproject
- University of Kentucky Research Foundation (UKRF) is a not-for-profit 501(c)(3) corporation
- This existing legal structure should suffice for tax benefits to contributors
- Maximum tax benefits may be realized through a gift mechanism, but this would preclude direct benefit or involvement in project decisions
Another Option

The western Kentucky group has decided to form a separate 501(c)(3) corporation to handle the industry cost share funds. Advantages include:

- Liability protection
- Avoid university overhead fees
- More control/governance on industry money
Project Advisory Committees (PACs)

- Separate advisory committees proposed for 3 subprojects
- Equal representation from major participating companies, the Commonwealth, and KGS
- Advisory committee responsibilities:
  - Major project decision points
  - Major expenditures
  - Main contact point for communications
  - Technical support, guidance, and oversight
PAC

- HB 1 mandates that KGS lead the technical effort with input and collaboration from partners

- KGS to evaluate sites and develop objectives based on technical merit

- KGS will present major project decisions to PAC for agreement on significant expenditures
Liability of Sponsors

- Sponsor liability for university research:
  - UK cannot indemnify sponsors, but we know of no case where a sponsor has been held liable for research activity
  - UK legal counsel is currently looking into this

- Liability related to injected CO₂ is a concern in all CO₂ projects (like FutureGen)
  - This project will involve small volumes of CO₂
  - Will follow lead established by DOE demonstration projects
  - Liability insurance could be explored
Confidentiality

- Data and results of project to be published
  - No confidentiality

- Confidential data provided by consortium members to aid in regional or site evaluation will be held confidential within the consortium
Fate of the Well

- Various options for the well after research is completed
  - Well plugged and site reclaimed
  - Possible sale to mineral rights owner if hydrocarbons are encountered
  - Possible use for future CO$_2$ injection
Probable Participants

Western Kentucky Deep Storage

- **Commonwealth of Kentucky**
  - Portion of $5,000,000 total funding (to be determined)

- **Crossrock Drilling**
  - Bids on drilling of eastern and western deep wells (no mention of in-kind contribution)

- **Interstate Natural Gas**
  - Engineering services, oil wells, Devonian Shale wells

- **Schlumberger Carbon Services**
  - Consulting services, discounted logging and well services, Petrel and ECLIPSE software donation
Pending Participants

Western Kentucky Deep Storage

- Chesapeake Energy
  - Drill site near Big Sandy power plant; financial and in-kind resources

- Pine Mountain Regional Industrial Development Authority
  - Drill site and partial well costs
Federal Cost Share

- Several options to obtain federal matching dollars
- No federal dollars identified yet for Eastern Kentucky project
- Appalachian Basin DOE partnership (Battelle) a possibility
Project Schedule

- Eastern Kentucky project to require approximately 2 years for completion
- Site and target selection: by Summer 2008
- Seismic acquisition/interpretation: Summer/Fall 2008
- Well design/permitting: Fall/Winter 2008
- Drilling: Spring 2009
- Testing/injection to follow
Discussion Points

- Project Advisory Committees
- Liability concerns
- Project schedule
  - Organization and participation deadline
  - Technical milestones
- Identification of additional participants
- Budget
  - Financial contributions: equal shares or variable?
Deep Saline Reservoir Projects

- Tests in eastern and western Kentucky
- Depths $\geq 2,500$ ft; likely 5,000 to 9,000 ft range
- Injection tests with either water or $CO_2$
- Locations to be chosen to provide most data on multiple target zones
- No sites have been considered yet
- Agreement with mineral owner to buy back the well if hydrocarbons are encountered possible
Technical Work: Deep Wells

- Obtain whole core and sidewall cores in reservoir and seal intervals
- Run and interpret extensive suite of well logs
- Collect brine samples from target zones for geochemistry
- Analyze core samples for porosity, permeability, mineralogy, mechanical strength, and other physical properties
- Conduct injection tests using fluid, air or CO$_2$
- Public education and outreach
- Reporting and technology transfer
Deep Wells

- Site characterization by KGS and consortium members
  - Subsurface mapping
  - Purchase existing seismic data; acquire new seismic
  - Evaluation of well logs, cores, and well samples
  - Characterize seals
  - Design monitoring plan (subsurface and surface)
  - Permit wells according to regulations for oil & gas wells or EPA-regulated injection wells.

- Well design and engineering
  - Outside consultants and consortium members
Well Design and Engineering

- KGS lacks in-house petroleum engineering expertise
- Outside consultants will be used for design of EOR projects, wells, injection tests, and operations oversight
- Will seek in-kind contributions from service companies
While CO$_2$ EOR potential is significant, deep saline or Devonian shale storage will be needed to handle expected volumes.
What’s Next?

- Participation decisions requested by Jan. 15
  - Consortium will remain open after that date
- We expect the level of industry funding will vary
- In-kind participation is welcomed
- A company’s participation and funding level cannot be held confidential
- Project results to released immediately
## Proposed Program Budget

### Eastern Kentucky Subproject

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<tr>
<th></th>
<th>State Funds</th>
<th>Industry Match</th>
<th>DOE &amp; other states</th>
<th>Total</th>
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<td>$1.35M</td>
<td>$0.5M</td>
<td>$3.2M</td>
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Budget for 7,500 foot injection well in Decatur, Illinois is $4.1M
Triana Energy Rome Wells
Clark County, Ky.

- Triana Energy recently drilled 3 wells to Precambrian basement in Clark County
- Two of the wells have been offered to the project for possible use in CO2 sequestration
- Cost would be salvage value of the casing ($15-20K)
- Excellent sandstone reservoir quality at depths of 3500-4200 ft.
  - 600 ft of gross interval, porosity of 10-15%