



## Offering Summary:

# *Coal-Seq II Consortium*

## *Advancing the Science of CO<sub>2</sub> Sequestration in Deep, Unmineable Coalseams*

### Background

Enhanced Coalbed Methane Recovery (ECBM) technology represents a significant gas resource as well as an effective method for value-added carbon sequestration. In a study performed by Advanced Resources International (ARI), it was estimated that 90 Gt of CO<sub>2</sub> could potentially be sequestered via ECBM in the U.S. alone, while at the same time yielding 150 Tcf of new natural gas resources.



However there is limited experience with ECBM technology. The U.S. DOE-sponsored Coal-Seq project, performed from 2000 to 2004, and with industry partners Burlington Resources and BP America, carefully studied the two largest ECBM pilots in the world - the Allison and Tiffany Units in the San Juan basin - and integrated the findings

from those studies with theoretical and laboratory studies. Some important findings from the project included:

- CO<sub>2</sub>-ECBM/sequestration can be profitable at natural gas prices above ~\$2.60/Mcf for the conditions studied.
- Deep, low-permeability, high-rank coals in previously undeveloped areas (for primary CBM recovery) may represent the best opportunities for profitable ECBM/sequestration.
- Coal-swelling and injectivity reduction with CO<sub>2</sub> injection represents a serious impediment to economic performance.

While there were many additional important findings from that project (see [www.coal-seq.com](http://www.coal-seq.com)), a critical technology shortcoming was also identified: the absence of adequate predictive models that can simultaneously account for the various complex reservoir mechanisms at play, specifically multi-component gas sorption, bi-directional diffusion, and CH<sub>4</sub>-CO<sub>2</sub>-N<sub>2</sub> PVT behavior. A lack of understanding of these fundamental reservoir mechanisms, which in turn govern dynamic coal swelling and injectivity reduction, prevent accurate forecasts of process performance upon which to make project investment decisions. This critical shortcoming, until addressed, will remain a significant obstacle to technology implementation.





## Need

Developing better models to predict CO<sub>2</sub>-ECBM process performance is an important pre-requisite for technology adoption and project investment. With this capability, companies will be able to make sound business decisions on the economic merits of ECBM/sequestration projects, identify those geologic/reservoir environments best suited to the technology, and which development strategies are best for each environment.

## Objectives

The strategic objective of the Coal-Seq II consortium is to develop a reliable predictive model for ECBM/sequestration, and to validate, demonstrate and apply it to selected coal reservoir conditions. Additional objectives are to identify the best geologic/reservoir environments and operating strategies for ECBM/sequestration projects, and to provide a single resource on global R&D and demonstration activities for the consortium members.

## Work Program

To achieve these objectives, a three-year work program is proposed, based largely upon the time requirements for the various laboratory studies. The proposed work elements include:

- Develop advanced models for multi-component sorption/diffusion, bi-directional diffusion, and CH<sub>4</sub>-CO<sub>2</sub>-N<sub>2</sub> PVT behavior.
- Integrate those models with ARI's permeability model within the framework of the COMET3 reservoir simulator platform.
- Validate the model against laboratory flow experiments.
- Demonstrate the model on field data from the Allison and Tiffany ECBM pilots in

the San Juan basin, as well as the RECOPOL project in Poland.

- Perform a sensitivity analysis to identify which geologic/reservoir environments are the most favorable for ECBM/sequestration, and the best development strategies for each.
- Maintain existing relationships with other R&D and demonstration projects to provide a single information resource on global ECBM/sequestration activities.



## Deliverables

The deliverables from the consortium will include:

- A predictive model for ECBM recovery and sequestration; the theoretical relationships developed would be made available to all consortium participants.
- Assessment of coal reservoir properties and basins most favorable for ECBM recovery and sequestration.





- Assessment of strategies and reservoir conditions to mitigate the effects of coal swelling.
- An internet-accessible knowledge base with up-to-date information on worldwide ECBM/sequestration R&D, as well as a proprietary members-only area with status and results of consortium-sponsored R&D.
- Annual Coal-Seq Forums where international R&D is presented, plus private R&D briefings for the consortium participants.

Annual R&D briefings and planning sessions will be held (in conjunction with the annual Coal-Seq Forums), and quarterly progress reports will be provided to all participants.

### Participant Profile

Potential participants in the consortium would include:

- US government agencies and other international R&D sponsoring organizations seeking to leverage their R&D funds by partnering with industry.
- Companies interested in value-added CO<sub>2</sub> sequestration.
- Current and future coalbed methane producers that may enhance the value of their assets via the application of ECBM/sequestration technology.
- Forward-looking companies seeking a competitive advantage by staying on the cutting edge of this promising technology.

### Terms

The estimated cost for the program is \$1.5 million. The target funding makeup is 50% industry, 50% U.S DOE. ARI will be responsible for soliciting

all funding. A total of 10 industry participants are sought to provide \$25,000 per year to the consortium. As of April, 2005, the project is 70% subscribed. Six additional industry sponsors are being sought to bring the project to full subscription.



### Confidentiality and Ownership

All R&D results from the project will remain confidential to the participants for a period of two-years following the conclusion of the work

### Project Team

The project team consists of:

*Advanced Resources International* will provide overall management for the consortium, including technical oversight, coordination and management, solicitation of participants, preparation of contracts, organization of meetings, and distribution of communications and reports. ARI will also be responsible for all simulation activities associated with the project.





**Oklahoma State University** will perform the multi-component isotherm experiments and develop advanced equations-of-state for modeling their performance.

**Electrochemical Systems** will perform the necessary laboratory experiments and develop the resulting theories for bi-directional diffusion and CH<sub>4</sub>-CO<sub>2</sub>-N<sub>2</sub> PVT behavior.

**Southern Illinois University** will perform the laboratory flow experiments in coal upon which the models will be tested and validated.

### For More Information

Scott R. Reeves  
Executive Vice President  
Advanced Resources International, Inc.  
9801 Westheimer, Ste 805  
Houston, TX 77042  
713-780-0815  
[sreeves@adv-res-hou.com](mailto:sreeves@adv-res-hou.com)  
or go to  
[www.coal-seq.com](http://www.coal-seq.com)

### Consortium Organization

