



Advanced Resources
International, Inc.

December 2012

Advanced Resources International QUARTERLY UPDATE

Unconventional Resources • Enhanced Recovery • Carbon Sequestration

Advanced Resources International (ARI) is a professional services firm that provides geological, reservoir engineering, business and policy analysis and advice on a global basis related to unconventional gas resources, enhanced oil recovery and geologic carbon sequestration. Our quarterly update highlights current industry trends, ongoing and completed projects, recent publications, upcoming workshops and events, and company news. We encourage you to visit our website at www.adv-res.com to learn more about our company history, research and technology activities, industry news and much more. You may also contact our offices listed at the bottom of this page for additional information.

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CO2 UTILIZATION WITH ENHANCED OIL RECOVERY: THE NEW PARADIGM FOR CO2 CAPTURE AND STORAGE

In early December 2012, Vello Kuuskraa, President of Advanced Resources International, traveled to Texas to participate in the annual 2012 CO2 Conference Week in Midland. Mr. Kuuskraa was the Opening Keynote Speaker for the second day at the 10th Annual Carbon Management Workshop. Mr. Kuuskraa's presentation was entitled, "CO2 Utilization with Enhanced Oil Recovery: The New Paradigm for CO2 Capture and Storage".

www.adv-res.com/pdf/0815-Kuuskraa-ARI-EOR-Size-of-the-Prize-ROZ-12-4-12.pdf

www.co2conference.net/category/2012-co2-conference/



11TH INTERNATIONAL CONFERENCE ON GREENHOUSE GAS CONTROL TECHNOLOGIES

During the 11th International Conference on Greenhouse Gas Control Technologies being held during the 18th - 22nd November 2012, at the Kyoto International Conference Center in Japan, Vello Kuuskraa, President of Advanced Resources International, presented a paper and presentation entitled, "CO2 Utilization from "Next Generation" CO2 Enhanced Oil Recovery Technology", this paper introduces the feasibility of applying "next generation" CO2-EOR technologies to new, challenging areas, such as to residual oil zones (ROZs) below and beyond the structural confinement of existing oil fields and to offshore oil fields. The paper provides a case study that tracks the performance and the economics of CO2-EOR in the Permian Basin of West Texas. While much of the information in the paper is drawn from the CO2-EOR experiences in North American oil fields, the paper also examines the CO2 utilization and storage potential from applying "next generation" CO2-EOR technology to the large oil fields of the world, drawing on extensions of work performed by Advanced Resources International for the IEA Greenhouse Gas R&D Programme. Mr. Kuuskraa also presented a paper and poster entitled, "The Synergistic Pursuit of Advances in MMV Technologies for CO2-Enhanced Recovery and CO2 Storage".

Michael Godec, Vice President of Advanced Resources International, made a presentation at the 11th Greenhouse Gas Control Technologies Conference (GHGT-11) held 18th-22nd November 2012, in Kyoto, Japan entitled "Assessment of Factors Influencing Effective CO2 Storage Capacity and Enhanced Gas Recovery in the Marcellus Shale", This paper will report on research to date, sponsored by the U.S. Department of Energy, to assess factors influencing effective CO2 storage capacity and injectivity in the Marcellus Shale in the Eastern United States. Geological characterization was conducted that estimated total gas in-place and theoretical maximum CO2 storage capacity within the Marcellus Shale. Theoretical maximum CO2 storage capacity assumes 100% of methane in-place, either as adsorbed or "free" gas, is replaced by injected CO2. Mr. Godec also presented a poster at the conference entitled, "Potential Global Implications of Gas Production from Shales and Coal for Geological CO2 Storage", this paper builds upon previous

work to assess the global potential for geological storage of CO₂ in shale and coal formations. This includes assessment and characterization of: (1) the global status of hydrocarbon production from shales and coal seams; (2) the potential theoretical capacities for CO₂ storage in shales and coals; and (3) containment issues arising from shale fracturing, both for shales as a storage medium, and in terms of cap rock integrity for underlying storage units, particularly deep saline formations.

George J. Koperna, Jr., Vice-President of Advanced Resources International also presented two posters entitled, "The SECARB Anthropogenic Test Status from the Field", which provided an update of field MVA and injection operation activities at the Citronelle, AL test site, and "Coal-Seq III Consortium: Advancing the Science of CO₂ Sequestration in Coal Seam and Gas Shale Reservoirs", which provided an update of the ongoing Coal-Seq III Consortium work.

For further information see the below link:

www.ghgt.info/index.php/Content-GHGT11/ghgt-11-overview.html



UNCONVENTIONAL GAS OPPORTUNITIES AND ACTIVITY IN THE ASIA-PACIFIC REGION

In November 2012, Vello Kuuskraa, President of Advanced Resources International, traveled to Beijing, China to participate in the Global Unconventional Gas 2012 meeting. Mr. Kuuskraa's presentation was entitled, "Unconventional Gas Opportunities and Activity in the Asia-Pacific Region". This meeting was held at the China World Summit Wing Hotel and was co-organized by the Gas Technology Institute (GTI) and CERS.

www.gug2012.com

www.flickr.com/photos/gug2012/sets/72157632047768119/show/



OPPORTUNITIES FOR UTILIZING ANTHROPOGENIC CO₂ FOR ENHANCED OIL RECOVERY AND CO₂ STORAGE

Michael Godec, Vice President of Advanced Resources, made a presentation at the 2012 Gasification Technologies Conference, on October 30, 2012, in Washington, DC, entitled "Opportunities for Utilizing Anthropogenic CO₂ for Enhanced Oil Recovery and CO₂ Storage."

www.adv-res.com/pdf/GTC-2012-11-4.pdf

www.gasification.org/page_1.asp?a=96&b=4



TURKEY: COAL BED METHANE RECOVERY AND UTILIZATION (FS)

Advanced Resources International was awarded a contract in 2012 on an open tender basis to develop a feasibility study on coalbed methane production and utilization in Turkey, with Jonathan Kelafant, Senior Vice President, as lead. The study is funded through a U.S. Trade and Development Agency (USTDA) grant signed with Hema Natural Energy Resources Company to evaluate the critical aspects of a combined coal bed methane (CBM) extraction and power generation project over Hema's approximately 5,000 sq. km CBM lease in the Zonguldak region of the country. The \$449,960 grant is expected to support over \$150 million in new business opportunities in Turkey, as well as create 800 to 1,000 local jobs. Using technology for CBM extraction that is brand new to Turkey, the project will provide an additional source of power to meet the country's increasing energy needs.

www.ustda.gov/news/pressreleases/2011/MENAEurope/Turkey/TurkeyCBMSmartGrid_120511.asp

www.turkey.usembassy.gov/new_projects_clean_energy.html

www.ustda.gov/businessopps/contractawards.asp



COAL-SEQ PHASE 3 FORUM VIII

On October 23-24, 2012, the Coal-Seq Phase 3 Forum VIII was held at the Sheraton Station Square in Pittsburgh, PA. The Coal-Seq consortium has objectives to develop and test three advanced geochemical and geomechanical modules that will increase the accuracy of simulating CO₂ behavior in coals and shales, and couple these with flow simulation. The project also will address coal storage factors such as coal failure and permeability enhancement, matrix swelling and shrinkage, and competition of water as an adsorbed phase on coals, as well as other aspects of CO₂ sequestration.

Over the 2 days, numerous presentations were given on the results from the different DOE sponsored field pilots as well as on currently on-going laboratory studies. George Koperna gave an update of the status of the Coal-Seq consortium; Michael Godec gave a presentation titled, "Assessment of Factors Influencing Effective CO₂ Storage Capacity and Enhanced Gas Recovery in the Marcellus Shale" and Steve Carpenter gave a presentation titled, "Outcomes from Forum VII – Houston Group Discussion".

www.coal-seq.com/forum_VIII.asp

www.coal-seq.com/Photos/Coal-Seq Forums/Forum VIII/Photos 102312.pdf

29TH ANNUAL PITTSBURGH COAL CONFERENCE



Michael Godec, Vice President of Advanced Resources International, presented two papers at the 29th Annual Pittsburgh Coal Conference, held October 15 - 18, 2012. The first presentation was entitled "Assessment of Factors Influencing Effective CO₂ Storage Capacity and Enhanced Gas Recovery in the Marcellus Shale." The second presentation was entitled "Opportunities for Utilizing Anthropogenic CO₂ for Enhanced Oil Recovery and CO₂ Storage."

Steve Carpenter, Vice President of Advanced Resources International, also presented two papers at the 29th Annual Pittsburgh Coal Conference. The first presentation was entitled "Determining the Applicability of Carbon Capture and Storage under Best Available Control Technologies (BACT) for Any New or Modified Prevention of Significant Deterioration (PSD)" and the second was titled "Development of the First Internationally Accepted Standard for Geologic Storage of Carbon Dioxide – update from the Public Comment Period".



George Koperna, Vice President of Advanced Resources International, also presented two papers at the 29th Annual Pittsburgh Coal Conference. The first presentation was entitled, "Initial Lessons Learned From the SECARB Anthropogenic Test: The First U.S. Integrated CO₂ Capture, Transportation and Storage Test", this presentation showed the results and lessons learned to date, including permitting efforts, injection startup operations, monitoring and detailed reservoir modeling of the storage site as well as project team integration efforts, and the second was titled "The Coal-Seq Consortium: Advancing the Science of CO₂ Sequestration in Coal Bed and Gas Shale Reservoirs", specifically, this project is developing robust mathematical models to accurately predict how coal permeability and injectivity change with CO₂ injection, and that correctly accounts for multi-component (CH₄-CO₂-N₂-H₂O) matrix shrinkage/swelling, coal-weakening, competitive adsorption, bi-direction diffusion, and system PVT behavior.

www.engineering.pitt.edu/Coal_Conference/2012_Conference.aspx



UPCOMING EVENTS

SPE Unconventional Resources Conference

The Woodlands Waterway Marriott Hotel & Convention Center

The Woodlands, Texas 77380

April 10–12, 2013

www.spe.org/events/urc/2013/index.php

13 AIChE Spring Meeting and 9th Global Congress on Process Safety

Grand Hyatt San Antonio & Henry B. Gonzalez Convention Center

San Antonio, TX

April 28 – May 2, 2013

www.aiche.org/conferences/aiche-spring-meeting-and-global-congress-on-process-safety/2013

OTC 2013

Offshore Technology Conference

Houston, TX

May 6 – 9, 2013

www.otcnet.org/2013/

AAPG 2013 Annual Convention & Exhibition

David L. Lawrence Convention Center

Pittsburgh, PA

May 19 – 22, 2013

<https://www.aapg.org/pittsburgh2013/>

Carbon Management Technology Conference

Hilton Alexandria Old Town

Alexandria, VA

October 21 – 23, 2013

<http://fscarbonmanagement.org/content/cmte-2013>

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