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Unconventional Gas Activities in the World

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COALBED METHANE & COAL SEAM GAS

EXPLORATION DISCOVERIES

AFRICA : Evaluating Coalbed Methane Plays in Frontier Areas — From Example from Southern Africa*. — UG₃₈₋₁

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*Adapted from oral presentation at AAPG Annual Convention, Denver, Colorado, June 7-10, 2009

Increasing global energy demands make the exploration for coalbed methane (CBM) plays in frontier areas attractive. CBM can be used as a feedstock to generate power and manufacture alternative products such as diesel (gas-to-liquids), liquid natural gas, and fertilizer. Challenges to economic development of CBM resources in remote areas of the world include undeveloped markets, distance to markets, and lack of infrastructure.

The four stages in the evaluation of a CBM project follow:

1. Formulate a strategic plan to define the objectives and duration of the project.
2. Conduct a feasibility study to analyze the economic and market potential of the

project and determine appropriate production methods.

3. Initiate an exploratory drilling program to identify contingent resources and “sweet spots” for pilot wells.

4. Prepare a reserve estimate report based on production from the pilot wells to obtain financing for project development.

The relatively unexplored Kalahari Basin in southern Africa has all of the prerequisites for a giant CBM play. Permo-Triassic (Gondwana) coal-bearing strata of the Karoo Supergroup underlie 60 percent of Botswana. Coal and organic-rich shale intervals are as much as 100 meters thick at depths between 300 and 1000 meters. Impermeable massive calcareous mudstone seals overlie the coalbearing rocks throughout the basin. Estimated gas-in-place in the central part of the basin is as much as 196 Tcf. These conditions suggest that the area has enormous economic potential.

The document can be downloaded at:

http://www.searchanddiscovery.com/documents/2009/80057hildebrand/ndx_hildebrand.pdf

CHINA : Pacific Asia Petroleum starts drilling operations in Zijinshan CBM asset. — UG₃₈₋₂

Pacific Asia Petroleum, Inc. commenced recently drilling operations on its 100% owned Zijinshan gas asset located in the Shanxi Province of China. This is the first well in a multi-well program planned on the Zijinshan Asset. The 100% owned and operated Zijinshan Asset was awarded to Pacific Asia in 2008 pursuant to a Production Sharing Contract that was approved by the Chinese Ministry of Commerce. The Zijinshan Asset is estimated by the China United Coal

Bed Methane Company to have potential gross gas resources in excess of 3.8 Tcf. It is also in close proximity to the major West-East gas pipeline and the Ordos-Beijing Pipeline, which link the gas reserves in China's western provinces to the markets of the Yangtze River Delta, including Shanghai and Beijing. (Oilonline, October 8, 2009)

PRODUCTION

UNITED STATES : Environmental authorities reject proposed rules on CBM

discharge water in Wyoming. — UG38-3

The Wyoming Department of Environmental Quality has scrapped proposed rules to regulate groundwater discharges from coalbed methane producers in the Powder River Basin. However, the Wyoming Environmental Quality Council, the DEQ's governing body, may still consider the rules proposal at a next meeting. The DEQ has already issued at least a dozen water discharge permits under the "agricultural use protection" rules, which were created in an attempt to determine pollution limits for coalbed methane water discharges. The pollution limits in the permits issued under the rules, however, can be adjusted at any time. DEQ's methodology for setting discharge water regulations has evolved over the past 10 years. However, growing evidence and testimony showed that the DEQ's salinity pollution limits were based on miscalculations. The "Tier II" soil sampling method of determining background water quality was also proven to be scientifically flawed. Independent consultants brought in

by the DEQ from New Mexico to study the proposed rules largely confirmed those findings in a report. Instead, the report recommended that the state should focus on monitoring and regulating the quantity - rather than the quality - of discharged water, since uncontrolled water discharges have raised the water table and have likely raised soil salinity. The DEQ agreed with the report's findings that the current methodology is "insufficient," said John Wagner, administrator of the DEQ's water quality division. But Wagner said it's difficult for the DEQ to find a better system, since the consultants offered no alternative rule proposals other than to recommend regulating water flow. Wagner said the DEQ will "go back to the drawing board" by convening a panel to study the issue. The DEQ will continue to issue water discharge permits until the panel makes its recommendations, which likely will take about a year, Wagner said. (Casper Star-Tribune, September 24, 2009)

SHALE GAS

EXPLORATION - DISCOVERIES

NETHERLANDS : Inventory of non-conventional gas in Netherlands (September 2009). — UG38-4

This report published by EBM describes the results of the inventory for each non-conventional gas resource expected to be present in the Netherlands, which are: tight gas, shallow gas, coal bed methane, shale gas, basin centered gas, aquifer gas and stratigraphic traps.

The document can be downloaded at: <http://www.ebn.nl/files/EBNreportfinal090909.pdf>

PERU : Maple Energy reports potential shale gas opportunity in Block 31-E. — UG38-5

Maple Energy provided recently an update on its ongoing drilling operations on its first well in the Santa Rosa prospect in Block 31-E in Peru (the "Santa Rosa 1X Well"). Maple has completed

the drilling and testing of the Santa Rosa 1X Well and has found unconventional gas in the Devonian Shale in Block 31-E. The Devonian Shale formation in Block 31-E is significant in terms of both potential thickness and geographic size, but significant additional work is required to determine if this shale gas opportunity can be developed to produce gas in commercial quantities. Further evaluation of this shale gas opportunity will be undertaken before committing to spend additional expenditures for the appraisal of this potential shale gas field. (Scandinavian Oil Gas Magazine, September 29, 2009)

PRODUCTION

CANADA : Nexen's success in Horn River shale gas play.— UG38-6

Following the conclusion of a recent three-well drilling and completion program, Nexen continues to make significant progress on its substantial Horn River shale gas position in north-east British Columbia. With five shale gas wells now on-stream, Nexen is producing between 15-20 mmcf/d with the majority of production coming from the three new wells.

"We are making excellent progress in reducing costs and increasing well productivity on our Horn River shale gas acreage with more upside still to come," commented Marvin Romanow, Nexen's President and Chief Executive Officer. Nexen estimates that the lands contain between 3 and 6 trillion cubic feet of contingent recoverable resource which could double our existing total proved reserves. (Marketwire, September 21, 2009)

UNITED STATES : Schlumberger wants know more about hydraulic fracturation chemicals.— UG38-7

Schlumberger Ltd. is pressing suppliers for permission to disclose the chemicals used in the hydraulic fracturing in shale formations that could be slowed by regulation after spurring an increase in U.S. natural-gas production. Bills were filed June 9, 2009 in the U.S. House and Senate to impose a federal permitting process after environmentalists alleged that chemicals used in hydraulic fracturing contaminate groundwater supplies. Gas producers say the liquids they inject are encased in steel and concrete until they get hundreds of feet underground, below the level of water

deposits. Gary Hogan, a member of the Texas Oil and Gas Accountability Project in Fort Worth, said disclosing chemicals is an important starting point in addressing the environmental concerns over hydraulic fracturing. At the same time, he said he questions the accuracy of what the oil and gas industry said, including claims that shale-gas developments are safe. Ten states require some level of disclosure of substances used in gas drilling, according to the U.S. Energy Department. (Bloomberg, September 29, 2009)

PROCESSING

UNITED STATES : Enterprise announces transportation and processing deal in Eagle Ford shale play.— UG38-8

Enterprise Products Partners L.P. (EPD) announced recently that it has entered into a long-term agreement to provide natural gas transportation and processing services on dedicated acreage owned by one of the largest and most active producers in the developing Eagle Ford Shale play. The completion of expansion projects at two of the partnership's seven South Texas processing plants during the first quarter of 2009 increased total processing capacity of the facilities to more than 1.5 billion cubic feet per day. (Downstream Today; September 15, 2009)

TIGHT GAS

EXPLORATION - DISCOVERIES

ARGENTINA : Apache to explore unconventional gas in the Neuquen basin.— UG38-9

Argentina's secretary of energy approved recently the first contract under an incentive program to encourage development of unconventional natural gas reservoirs. Under the contract, Apache Corp., Houston, will drill as many as 48 wells in two Neuquen basin fields in the next 4 years and supply 50 MMcfd of gas at a price of \$5/MMbtu.

The contracts take effect in January 2011, but the power plant customer has indicated it may begin taking gas in mid-2010. At Anticlinal Campamento field in Neuquen Province, Apache will drill as many as 12 wells. Apache describes the reservoirs as unconventional and said it will apply multiple hydraulic fracs in the highly deviated lower part of the wells. Meanwhile, Apache will drill as many as 36 wells in Estacion Fernandez Oro field in Rio Negro Province. (Oil and Gas Journal, October 7, 2009)

GAS HYDRATE

EXPLORATION - DISCOVERIES

CHINA : Gas hydrates discovered in Tibet.— UG38-10

The Chinese Ministry of Land and Resources (MLR) announced recently that natural gas hydrate samples had been discovered in northwestern China's Qinghai province, the first land-based find of this kind in China. According to initial estimates, China, the third largest frozen soil country, with a frozen soil area of 2.15 million square kilometers, has a prospective natural gas hydrate reserves of 35 billion tons of oil equivalent. Zhang Hongtao, the engineer general of the MLR said the discovery was made at a height above sea level of 4,062 kilometers in Qinghai

province's Tianjun County, where some areas have perpetually frozen soil. Wen Huaijun, a senior engineer of the Qinghai Provincial Bureau of the China National Administration of Coal Geology (CNACG), said that Qinghai's natural gas hydrate finding has an average depth of 130 to 300 meters, providing relatively favourable conditions for exploration and development. But he echoed Zhang Hongtao's caution on environment protection problems, stressing that there is still a long way to go before any breakthrough would take place. (Xinhua News Agency, September 26, 2009)

UNITED STATES : NIST develops database on gas hydrates properties.— UG38-11

The National Institute of Standards and Technology (NIST) have developed a free, online collection of data on the properties of gas hydrates. The U.S. Geological Survey estimates that the total amount of carbon captured in methane hydrate, worldwide, is at least twice the total amount held in fossil fuels. NIST researchers spent three years combing the literature on gas hydrates and comparing and evaluating data collected in experiments by numerous sources.

The database contains about 12,000 individual data points for about 150 compounds spanning 400 different chemical systems. The data include phase equilibria (proportions of solid, liquid and gas phases in a material at a given temperature and pressure) and thermophysical property information such as thermal conductivity.

The NIST web interface also provides the first electronic access to scientific results from the 2002 Mallik research well in Canada, an international geophysical experiment exploring the properties of naturally occurring hydrates and the feasibility of using them as energy

resources. NIST developed the database in association with CODATA (The International Committee on Data for Science and Technology). (NIST press release, October 6, 2009)

The database is available at: <http://gashydrates.nist.gov>

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