

Case Study: CBM production at Karaganda coal basin as a pre-drainage solution to enhance mine safety and optimize coalmining economics

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Background information

CBM resources of Kazakhstan coal deposits, prospective for gas extraction, estimated approximately at 2 trillion m³, only to the depth of 1800 m. A half of these resources contained in Karaganda Coal-methane basins and 47 billion m³ – in Ekibastuz basin. Prospective deposits are meeting the requirements of geotechnical criteria of coal deposits availability for industrial extraction of methane.

The main coal reserves concentrated in the Central, Northern and Eastern regions of Kazakhstan. The total coal reserves in the main coalmining regions of the country estimated at 30 billion ton and hypothetical reserves at about 140 billion ton.

CBM reserves and resources estimation for selected coal deposits of Kazakhstan was made by a group of Azimut Energy Services specialists in recent years. The works were conducted under a program of the Geology and Subsurface Protection Committee of the Ministry of Energy and Mineral Resources of Kazakhstan. The Temporary Manual for Coal Methane Reserves Estimation was developed in order to increase the estimation reliability.

Undiscovered coal methane reserves for studied coal basins of Kazakhstan amount to 1.2-1.7 trillion m³ and reserves of Karaganda coal basin up to the depth of 1500 m comprise 490.47 billion m³ (KazTransGas). At the same time methane content in the gas of Karaganda coal varies from 80 to 98% that makes it a viable potential alternative to natural gas.

Experience of CBM extraction in Karaganda basin for mine safety purpose traces back to 1960s. Specialists of “Karagandaugol” IE (main coal mining enterprise in the region for that time) jointly with scientists of Moscow Mining Institute (university) held scientific studies and pilot activities on steered hydraulic fracturing of coal seams at mines of Karaganda coal basin. The key purpose of these activities was reduction of natural (inherent) gas content and outburst probability of thick coal seams K12 and D6. Coal Division of Arcelor Mittal Temirtau maintains some of these activities until present time. The most significant input in elaboration and implementation of these studies was made by Professors N.A. Dizhd, S.K. Baimukhametov, N.H. Sharipov, Doctors I.A. Shvets, K.D. Li, F.A. Mullagaleyev and others.

Historically the pre-drainage activities were secured by drilling of vertical wells from the surface into virgin coal strata followed by hydraulic stimulation of the most outburst-dangerous seams to drain gas by formation pressure or with vacuum-pumping stations. Due to very low permeability of Karaganda coal seams application of this technology resulted in well yield of 0.2-0.7 m³/min at best. However, long-term draining through these wells over 5 to 7 years was able to provide reduction of inherent gas content of the coal for 6-9 m³ per ton of reserves or up to 25-35% at methane concentration in the drained gas reaching up to 85-95%. Since the subsurface gas drainage system of the coal mines is connected with vacuum-pumping stations as well leakages in the pipes reduce quality of the gas and complicate its utilization.

Overall current methane emission inventory reports on around 400 mln m³/a. Gas drainage system captures about 50 mln m³ and about 15 mln ms or 30% of the captured gas is utilised at the mines

of Arcelor Mittal Temirtau (the only entity utilizing this waste gas in the region). The rest of the gas is emitted to the atmosphere by ventilation and gas drainage facilities. In 2011 Coal Division of AMT installed a pilot 1.4 MW CHP unit at Lenina mine to generate power and heat on the drained gas.

Since 2008 ZhumysStroiService LLP based on the design elaborated by Azimut Geology LLP drilled 2 two wells up to the depth of 1040 m 1260 m and proceeded with core and gas sampling and test hydrofracturing of some seams. The laboratory results proved high quality of the released gas (99.6% CH₄).

Central Exploration and Development Committee of Kazakhstan Ministry of Energy has approved other CBM projects for Manzhinskiy and Sherubai-Nurinskiy sites of Karaganda coal basin elaborated by Azimut Geology LP.

CBM evaluation program of KazTransGas JSC

In this regard, JSC "KazTransGas", the national operator in the field of gas and gas supply, pursuant to the President's instructions, starts in 2015 to conduct exploration CBM in the framework of a cooperation agreement with a subsoil user of JSC "National Company" Socio- Entrepreneurial Corporation "Sary-Arka" in the Karaganda coal basin. After carrying out exploration work results will be obtained about the prospects of gas-bearing Karaganda coal basin and made recommendations for future phased transition to the implementation of industrial mining operations. Stage of development of the project JSC "KazTransGas" for the extraction of coal-bed methane involves three stages. Industrial extraction of methane is planned in 2017.



(Courtesy of KazTransGas JSC)

Once the first phase of the study of gas content and develop the most optimal production technologies of methane in the Karaganda coal basin reservoirs, and exploration drilling was produced first gas flow. Total plan is to drill 7 wells: 3 geological exploration (coring, well testing) and 4 –pilot production wells.

The first positive results, according to experts, talk about the great prospects in this field of gas. The use of methane will allow JSC "KazTransGas" significantly increase its resource base, and eventually obtained an alternative natural gas will be used for the gasification of the central and northern regions of Kazakhstan.

"KazTransGas conducts unique tests, which will allow the expansion of pilot projects run large state task - to get industrial gas, - a well-known in the industry expert, Professor of Karaganda State Technical University Nikolai Drizhd. - In the process of drilling obtained sufficiently high gas content of coal seams, which demonstrates once again the prospect of work done. This gas is essential for solving energy problems, not only of the Karaganda region, and Astana, and its production will have a fundamental impact on the further development of social and environmental concerns.

Further study of core will hold in the leading services in the field of international certified laboratories in the US, China and Poland. They already signed the relevant treaties. Completion of the 1st stage is planned in the next year, then the results will be developed on the feasibility study of the prospects of development of this area of gas production and reserve calculation is made of methane.



(Courtesy of KazTransGas JSC)

It should be noted that this project is implemented by JSC "KazTransGas" according to the "road map" and on the personal instructions of President Nursultan Nazarbayev on the exploration and production of methane in the Karaganda coal basin. Previously, specialists of JSC "KazTransGas" examined the international experience in this area visiting facilities methane production in Russia, China and India.

Contribution to mine safety precautions and emission reduction

Pros:

Note: In case of AMT gas ownership rights are secured.

- Gas removed in advance of mining.
- High purity gas of commercial value usually obtained.
- Removal of gas independent of underground mining activities.
- When hydro-fractured coal worked through, roof conditions not usually adversely affected.
- An opportunity to reduce emissions of methane to the atmosphere (reduction of greenhouse gas emissions) from coal mines. National GHG emission trading system (potential opportunity to substitute coal and heavy oil in power and heat generation)

Cons:

- No tax incentives
- Costly to complete.
- Surface collection pipelines needed to facilitate utilisation.
- Surface arrangements can be difficult in terms of ownership, access and visual intrusion.
- Disposal/treatment of produced/flow-back water.
- Very low permeability in most of the seams.
- High drilling costs for deep wells.
- Difficult to co-ordinate with mining plans.

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