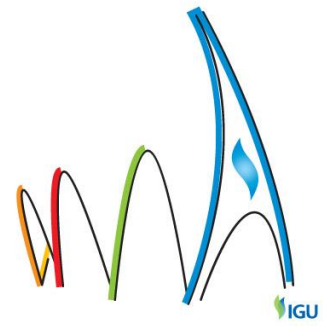


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"GROWING TOGETHER TOWARDS A FRIENDLY PLANET"



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Practices of constructing and developing wells with horizontal tailing in coal-beds in Kuzbass region – the first wells in Russia.

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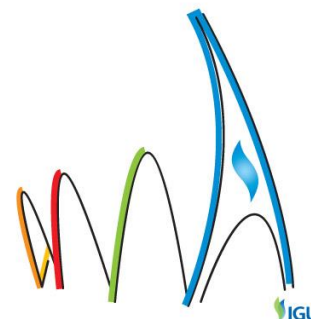


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Background

One of the key areas of gas industry resource base development is opening up of non-conventional hydrocarbons resources: coal-bed methane, shale gas. Inferred gas resources in coal basins of Russia are estimated at the level of 84 trillion cubic meters (tcm). Kuznetsky and Pechorsky basins are recognized as the highest-potential ones for producing gas.

Starting from 2001 JSC Gazprom has been carrying out research to study the possibility of producing methane from coal beds in Kuzbass region. Research and testing facility was set-up in Taldinskaya area 70 km from Novokuznetsk, and 4 vertical pilot wells were drilled. Wells construction and development technologies were tested at this facility, acceptance trials of pilot equipment samples were carried out. This resulted in creating the basis of engineering and regulatory framework for implementing the next stages of the project. All the developed technologies and engineering solutions are protected with patents. Methodology guidelines and regulatory documents in the sphere of exploration and development of coal-methane deposits were issued. Also, exploration was carried out at the second high-potential area – Naryksko-Ostashkinskaya. 26 vertical and directional wells were drilled, the reserves were assessed and the Initial Coal-Methane Field Development Plan was designed.

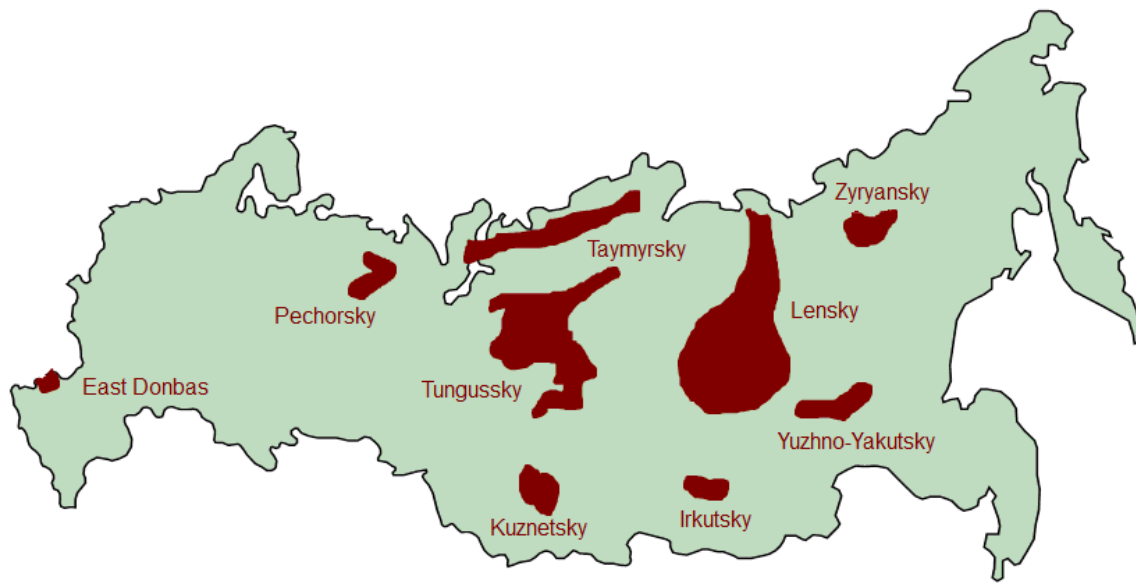


Fig. 1. Methane resource potential in coal basins of Russia

Aim

Development of coal-bed methane reserves in Kuzbass region assessed at the level of 13.1 tcm may provide Gazprom not only with significant reserve increment in the habitable and populated area with the developed infrastructure. The technologies developed for recovering methane from coal-beds may also be of demand for producing stranded gas from tight low-permeability reservoirs, as well as for producing residual gas reserves at the traditional fields in the conditions of low reservoir pressure and water-cut of the producing well stock.

The biggest volumes of gas are produced from horizontally drilled wells, and then go wells with hydrofracturing jobs and with and wells with under-reaming/sidetracking to the pay zones. Also, horizontal drilling provides for developing the entire area with fewer wells, for saving time at the expense of reducing moving across the area and faster drilling in coal beds.

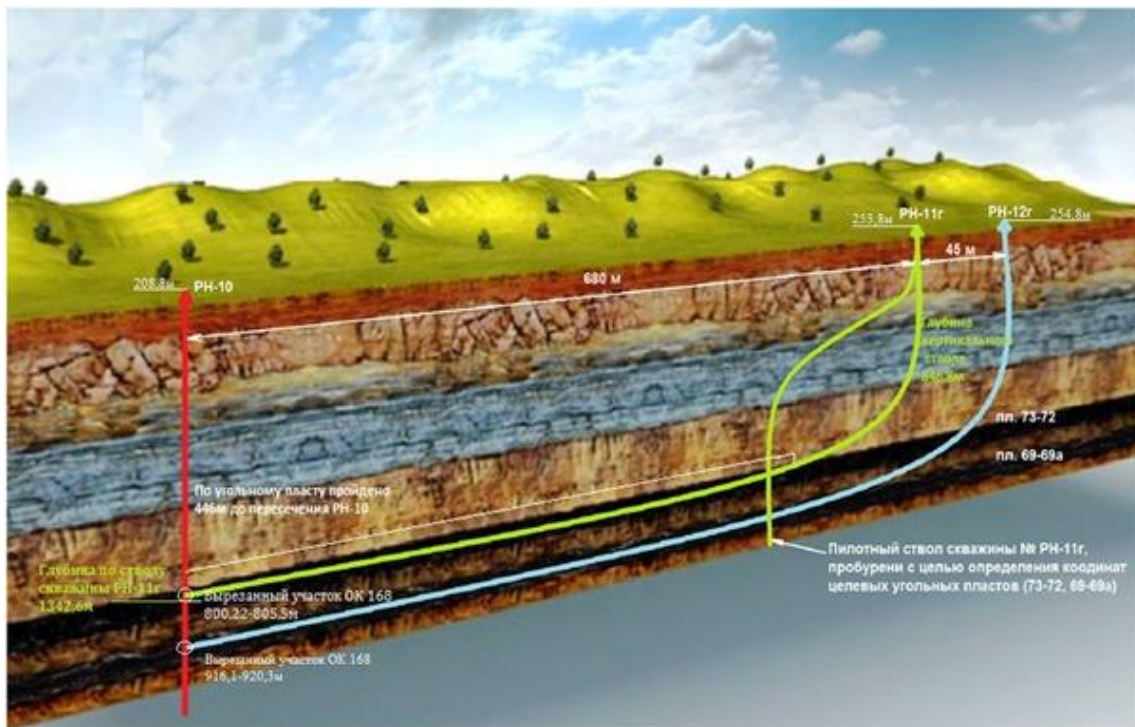


Fig. 2. Scheme of the system of wells with horizontal tailing RN-11g and PH-12g hitting the wellbore of vertical well RN-10

Methods

Today drilling wells with horizontal tailing is state-of-the-art technology and the most efficient way to produce methane from coal beds. Drilling such wells is feasible in the beds with thickness no less than 3.5 m with gas-bearing capacity > 15 cm/t, with a developed joint system and sufficient permeability. When drilling horizontal wells tectonic disturbances need to be avoided. Seismic exploration (in particular CDP-2D method) provides data to define orientation of the main joint system. Well location is selected to assure that the horizontal part of the wellbore is perpendicular to the main systems of joints.

A well with horizontal tailing is designed so that the horizontal wellbore hits the vertical wellbore for creating strong pressure communication between the wells. Horizontal well should be located at a maximum distance from the stressed area where coal may be split due to the pressure.

When constructing exploration wells with horizontal tailing, pilot well bore is designed with the purpose of geological studies of the well profile to update information about the actual top of target coal bed, about its thickness, azimuth of bed dip heading and further update of information about the designed profile of the main well bore.

Perforation is not performed in exploration wells with horizontal tailing, perforated casing string (tail) is landed into the pay zone, and no production stimulation activities are stipulated.

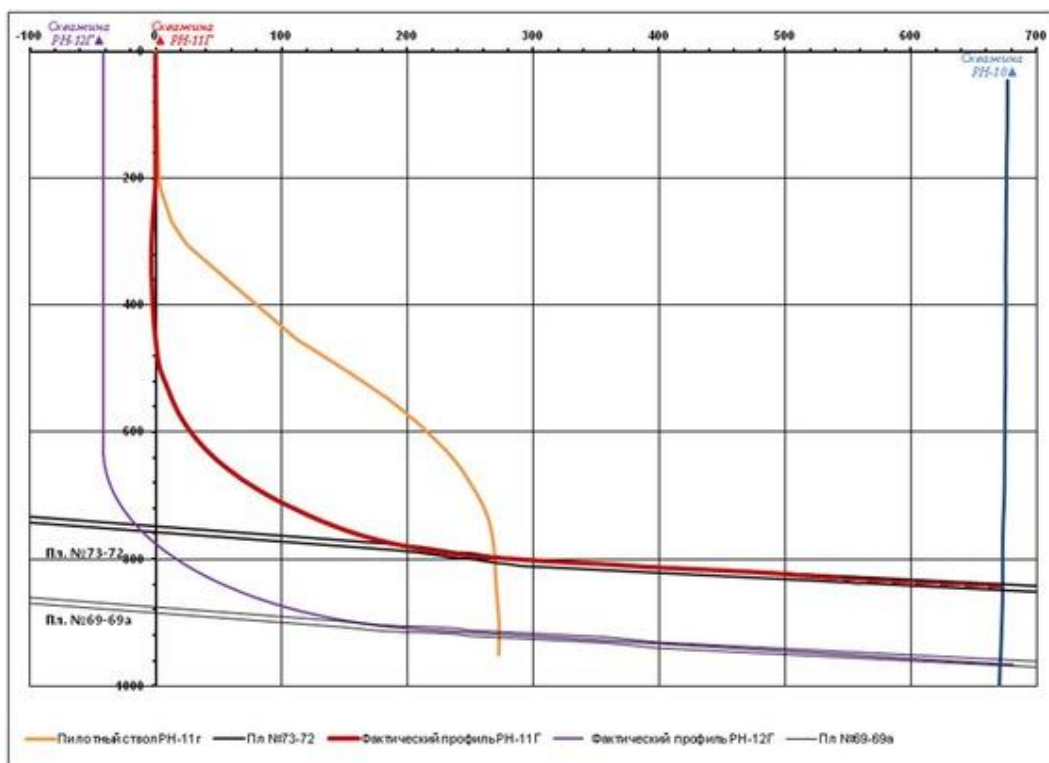


Fig. 3. Design of wells with horizontal tailing RN-11g and RN-12g hitting the wellbore of vertical well RN-10

To create a drawdown and start coal bed methane desorption the beds need to be dewatered, and downhole pumping equipment is run into the vertical well.

Based on the practices of horizontal wells drilling it was identified during degasification (methane drainage) of coal mining fields that horizontal wells across coal beds do not require additional production stimulation in the case of sufficient permeability.



Fig. 4. Wellhead of horizontal coal-bed-methane well RN-11g with gathering line attached – the first well of such type in Russia

Results

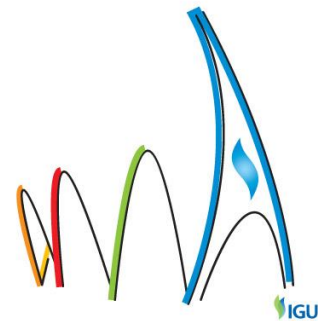
In 2013-14 two horizontal wells were drilled hitting the already existing vertical well. The length of each horizontal well across the coal bed was 1,000 m, and the drainage area constituted 1.5 km². Pumping equipment for produced water pump-out was installed in the vertical well. Significant methane accumulations were discovered in coal beds 77-78 and 80a of Naryksko-Ostashkinskaya area, which was confirmed by additional engineering studies. Besides good permeability, gas saturation and high quality of coal, these beds are characterized by significant thickness, which allow for high gas influx rate in the long-term perspective.

The horizontal well rate for 77-78 reservoir is forecasted to achieve its maximum (i.e., 15,000 cm per day) after 4 years and then by the 11th year of operation will decline (to 7,000 cm per day). The accumulated yield for 20 years makes 20 mcm. According to the forecast for 80a reservoir, the horizontal well rate will achieve its maximum (i.e., 7,000 cm per day)

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after 2 years and then by the 11th year of operation will decline (to 3,000 cm per day). The accumulated yield for 8 years makes 20 mcm.

Conclusions

Practice shows that the success of projects targeted at producing coal-bed methane depends on the quality of approach to developing ideas about drilling rate increase, gas flow rate increase and cost reduction.

Construction and development work already performed at horizontal wells in Naryksko-Ostashkinskoye field of Kuzbass region allows for decreasing the gas lifting costs and thus confirms the high potential of future development of coal-methane fields.

Measures proposed by JSC Gazprom will provide for a new impetus for producing gas from coal beds in Russia and will allow not only for significant increase of the reserves potential of Russian gas industry, but also for improvement of safety in coal mines due to reducing unauthorized methane blowouts.