Directional survey is a method used for well position determination. There are some parameters need to be researched: hole inclination, the azimuth of the deviation, whipstock orientation angle. To provide the parameters study the following tools are used: gyroscopic instruments, free gyroscope, inertial navigation system, magnetic device and etc.

Additional researches such as petrophysical rock properties are determined by the method of neutron density logging, which measures a density and a porosity of the rock. The method applies to the shallow depth methods.

When the rock parameters measurements are done, the data collected in storage place should be transmitted to receiving equipment in real time. There are several types of telemetry used for it, such as hydraulic, with the pipes, through the rock [3].

Therefore logging while drilling uses lots of geophysical methods in the analysis of it, basic of which are gamma-ray logging, resistivity survey, directional survey, acoustic log. In selecting of gamma-ray logging instrument it is recommended to choose the 'Scenturion' tool because it has the best update rate in real time and minimal rate of sampling, which give us the best accuracy and timeliness of the data. In selecting of resistivity meter it is recommended to use the 'SlimTRIM' device because it has the best research diameter. And also to get better data the additional researches are used.

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REVIEW OF GAZPROM BASIC STRATEGIC PROJECTS FOR SOLVING TASKS FOR GAS SUPPLYING OF RUSSIAN AND FOREIGN PARTNERS

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According to the strategy program for the development of gas transmission network under the auspices of PJSC Gazprom (the Company), the goal of long term growth, in accordance with [3], is sustainable global leadership because of creation of a united gas supply system, covering not only the entire territory of the Russian Federation (RF), including areas with poorly developed infrastructure, but also foreign projects. Specification of the Company is the combination of some different technological functions aimed at extraction, transport, storage and processing, which allows solving diverse tasks of the industry complex on the basis of a powerful resource base and having a widely gas transportation system.Delivering products to other producers and rendering services for the transit of hydrocarbons, the current direction of the Company's development is the formation of an "energy bridge" between the markets of Europe and Asia and the consolidation of Russia among the world's energy leaders.

The purpose of the work is to review the main strategic projects of PJSC Gazprom under construction in the Eastern Gas Program (EGP), in the West of the country and on the regasification of liquefied natural gas (LNG).

Eastern Gas Program

In 2007, the Government of the RF approved a development strategy of EGP in order to create a unified production, transport system for natural gas in the territories of Western and Eastern Siberia, Far East for gas supply to these regions, including taking into account the likely export of products to the markets of China and other countries of the Asia-Pacific region. The Eastern Pacific Region. EGP will allow to form a modern gas transportation system (GTS), gas processing and gas chemical industries and organize new gas export routes according to the requirements of the world standards of quality and ecology, which defines this project as the largest in the history of modern Russia. In addition, a specific feature of EGP is the development along two routes, due to two sections of the borders with China along the eastern and western directions.

Eastern route

The first strategic project of the EGP in the Eastern route is the GTS "Power of Siberia", which will run through the territory of the Irkutsk Region, the Republic of Sakha (Yakutia), the Amur Region, the Jewish Autonomous Region and the Khabarovsk Territory. In these entities, natural gas production capacities are being created almost from scratch and 1,000-kilometer gas mains are being built. The first joint of the main gas pipeline "Power of Siberia" was welded on September 1, 2014. At the moment, the work is under way to lay the first section of the 2200 km gas pipeline from the Chayandinskoye field to Blagoveshchensk, where a gas pipeline will be built then for export to China, which will allow the construction of a 3000 km stretch. In the future, the GTS "Power of Siberia" will be connected in Khabarovsk with the Sakhalin-Khabarovsk-Vladivostok GTS put into operation. The second main strategic project of the EGP is the Amur Gas Processing Plant, which together with the GTS "Power of Siberia" will allow to extract various kinds of gas chemical raw materials from gas and export purified methane to China. This plant will become the leader in the Russian Federation for the production and processing of natural gas, including the production of inert gases (helium).

So, for 2014 the volume of gas from all gas processing plants in Russia is 40 billion m3. The Amur Gas Processing Plant will provide an annual turnover of 49 billion cubic meters of gas. The plant will consist of 7 threads, capacity of each up to 7 billion m3 of gas per year. At the first stage, 2 threads will be built, then annually the production capacity will be increased by 1 thread [4].

Western route

The main strategic project of the EGP along the western route is the "Power of Siberia-2" gas transmission system. "Gazprom" and "China National Petroleum Corporation" signed an agreement on the supply of natural gas on the "western" route on November 9, 2014, which will be implemented with the help of the "Power of Siberia-2" gas pipeline [2]. Proceeding from the project, the gas pipeline must pass through the territory of six constituent entities of the Russian Federation: the Yamal-Nenets Autonomous Area, the Khanty-Mansi Autonomous Area, the Tomsk Region, the Novosibirsk Region, the Altai Territory, and the Altai Republic. After the western border of China with Russia, the "Power of Siberia - 2" can be connected with the Chinese gas pipeline "East - West". After laying the gas pipeline, annual deliveries of 30 billion m3 are planned [1].

Strategic projects in the west of the country:

"Ukhta - Torzhok" and "Ukhta - Torzhok - 2"

The main gas pipelines "Ukhta-Torzhok" and "Ukhta-Torzhok-2" are of key importance for the development of the Unified Gas Supply System of Russia in the corridor from the Yamal to the Gulf of Finland. They are designed to deliver additional volumes of gas to the North-West of Russia for gas supply and gasification of domestic consumers and supplies for export. The construction of the Ukhta-Torzhok-2 gas pipeline began in October 2015. At present, construction and installation work is underway on the linear part of a total length of 500 km. The gas pipeline will be built and ready for operation by the end of 2019 [5].

"Turkish Stream"

"Turkish Stream" will significantly improve the reliability of gas supply to Turkey, as well as South and South-Eastern Europe. Turkey is one of the largest consumers of Russian gas. At present, its deliveries to the republic are carried out via the “Blue Stream” gas pipeline and the Transbalkan gas pipeline. "Turkish Stream" is a new gas pipeline for export to Turkey across the Black Sea, which will consist of two threads: one for export to Turkish consumers, the second for gas supplies to South and South-Eastern Europe. The capacity of the first and second threads of the "Turkish Stream" will be 15.75 billion m3 each. The offshore section of the "Turkish Stream" will pass from the "Russkaya" CS in the Anapa along the bottom of the Black Sea to the coast of Turkey. The length is more than 900 km. Next, a land transit line will be laid to the border of Turkey with neighboring countries. In September 2016, Gazprom received the first permits of the authorities of the Republic of Turkey for the implementation of the “Turkish Stream”. On October 10, 2016, the Agreement between the Government of the Russian Federation and the Government of the Republic of Turkey on the “Turkish Stream” project was signed.

“Nord Stream – 2”

"Nord Stream-2" is a new export gas pipeline from Russia to Europe via the Baltic Sea. In connection with the successful implementation of the “Nord Stream” project, it was decided to create the “Nord Stream-2” gas pipeline from Russia to Europe via the Baltic Sea, which would directly link Gazprom and European consumers and ensure high reliability of exports to Europe. The point of entry of the “Nord Stream-2” gas pipeline into the Baltic Sea will be the Ust-Luga region of the Leningrad Region, then the gas pipeline will pass across the Baltic Sea and exit on German territory in the Greifswald area, near the exit point of the “Northern Stream”. The length of the gas pipeline will be more than 1200 km. The aggregate capacity of the two “Nord Stream-2” threads is 55 billion m3 of gas per year. Thus, the total design capacity of “Nord Stream” and “Nord Stream -2” is 110 billion m3 of gas per year. The project is planned to be put into operation in 2019.

Strategic projects on regasification of liquefied natural gas (LNG)

LNG regasification terminal in the Kaliningrad Region

At present, the Kaliningrad region receives natural gas via the Minsk-Vilnius-Kaunas-Kaliningrad transit gas pipeline. Taking into account the peculiarities of the geographical location of the region, the possibility of obtaining natural gas by sea in a liquefied form will significantly increase its energy security. Therefore, on the coast of the Baltic Sea, Gazprom is working on the construction of a terminal for receiving, storing and regasifying liquefied natural gas. The terminal will be connected to the existing gas pipeline in the Kaliningrad underground gas storage area, which will allow gas to be channeled to the region's consumers and pumped into the storage. The process of regasification of liquefied natural gas will be carried out on a floating regasification unit. The terminal will provide an opportunity to supply gas to consumers in the Kaliningrad region in the amount up to 2.7 billion m3 of gas per year. As a result, the gas supply of the region, if necessary, can be completely autonomous for a long time. The project put into operation in the end of 2017.

Baltic LNG

In recent years, the liquefied natural gas market has been showing steady growth. The demand for liquefied natural gas dictates the need to build new capacity for its production. "Baltic LNG" is a plant for liquefying natural gas in the Leningrad Region. It is aimed, first of all, on the market of Europe and Latin America. The plant will be built near the seaport of Ust-Luga, its capacity will be 10 million tons per year.

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DETERMINATION OF WELLBORE STABILITY IN ROCK MASSIF

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Wellbore stability during drilling process should be estimated accurately and wellbore trajectory should be designed such that drilling process is mostly safe according to the collapse of borehole walls. For example, until the target drilling depth is reached a well penetrates rocks with different mechanic properties and stresses' spectra due to the difference in geological properties and chemical composition. It leads to the possible solution by which unstable rocks are penetrated with zero vertical angle so as not to allow excess tangential stresses to be formed near the wellbore. It diminishes the risk of collapsing (Figure 1).

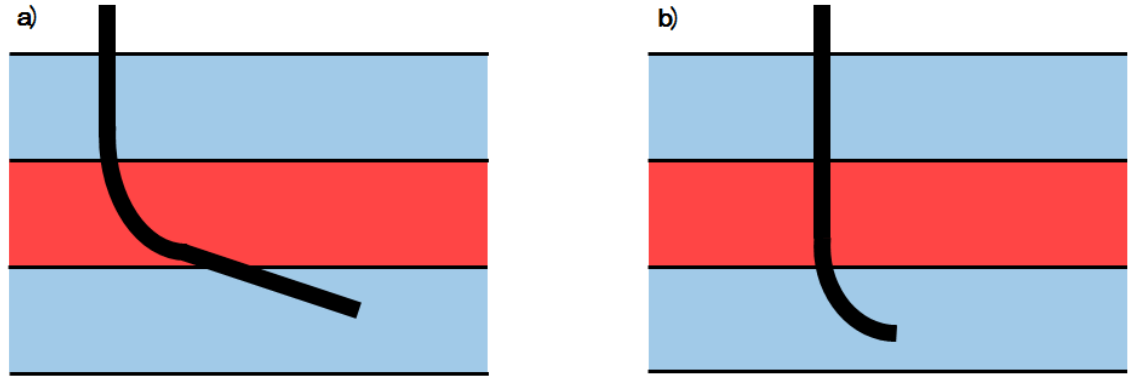

Fig. 1 Relationship between KOP and formation stability: a) build-up section is designed within the unstable formation (KOP is at the top); b) build-up section is located below the unstable formation (KOP is at the bottom)

Moreover, rocks may be characterized by critical build-up rate. That is why drilling well trajectory should be designed such that build-up section is not in the formation with undesired properties for this option, as shown in Fig. 1a, or build-up rate must be as low as possible.

If these requirements are not followed, it causes well's collapsing which may lead to following aftermaths:

Choosing of untrue and unsafe trajectory for well drilling can lead to inability of using less expensive water-based drilling mud and another more expensive drilling fluid has to be used instead, such as polymer drilling mud that allows hardening action on wells. Not only it is more expensive but more dangerous for the environment and it is harder to utilize it;

Collapsing causes reduction in rate of penetration due to the excess quantity of drilling cuttings in the wellbore, poor circulation of mud. It all makes drilling of particular well more expensive;

Unsafe drilling can cause the local increase in well diameter that will inevitably require higher volume of cement slurry for well cementing;

The critical case is that when further drilling operations' performing is not possible and it will be obligatory to install additional casing string so as to isolate the problematic interval. It will raise the price of well drilling and can even lead to inability to lower the tubing string of necessary diameter due to decreased casing internal diameter.

The basic aim is to investigate how geological conditions influence the wellbore stability so as to optimize the drilling process, reduce possible risks and choose the safest and most economically viable drilling method and most suitable well trajectory.

Since drilling starts from the pad for the field being developed it is recommended to use the existing pads for drilling new wells but not installation of new pads for new wells. It will severely reduce capital costs for operating company. So the particular problem now is how to choose the most appropriate pad for drilling depending on the safety drilling (Fig. 2).