



STRATEGY OF DEVELOPING ACHIMOV DEPOSITS OF URENGOY REGION

Justification of development strategy of
Achimov deposits, Urengoy region

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Background

Urengoy oil and gas system is the world's largest engineering structure for production, processing and treatment for transport of gas, condensate and oil located at the latitude of the Arctic Circle. Multi-deposit Urengoy oil and gas field is unique not only in the initial reserves in excess of 11 trillion tonnes of fuel oil equivalent but also on a variety of hydrocarbon deposits' composition and conditions of its development.

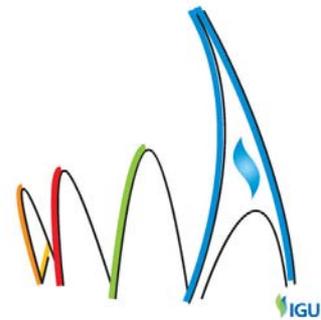
At present, the hydrocarbon products is extracted by two thousand wells from depths ranging from 1,000 to 4,000 meters and is transported to the commercial installation of gas, condensate and oil treatment via pipelines with a total length of over 1,700 km. Treatment of hydrocarbon raw materials is conducted on twenty-three comprehensive gas treatment plants and two oil treatment facilities. Over the 36 years more than 6.6 trillion cubic meters of gas is produced.

To date the depletion of Cenomanian gas deposit has reached more than 70%, and the depletion of Valanginian gas deposits is about 50%.

Aim

To maintain the current production volumes of the Company specialists of OAO Gazprom and the Government of YANAO proposed to start development of the Achimov deposits in the Urengoy field. To the Company Gazprom dobycha Urengoy belongs right to use subsoil of 5 Achimov Areas. Total reserves of these areas make up more than half trillion cubic meters of dry gas and almost five hundred million tonnes of condensate.

Productive sections of Achimov deposits are spread in more than 12 thousand km² and divided into 11 license areas. Subsoil use rights within the Achimov sequence spread belong to three main subsoil users. Total geological gas reserves reach 2.96 trillion cubic meters, condensate - 0.48 billion tonnes, oil - 0.54 billion tonnes. In this regard an important task is



to develop a unified strategy for the development of the Achimov deposits of the Urengoy region, in order to obtain the maximum level of hydrocarbon effective output and minimum values of intrastratal hydrocarbon overflows between neighbouring license areas.

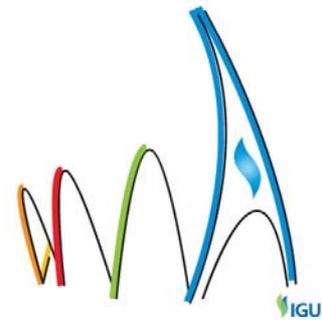
The slide shows the distribution of hydrocarbon reserves by Achimov deposits subsoil right owners. Gazprom dobycha Urengoy owns 56% of gas and condensate reserves and 25% of oil reserves. Total annual production of hydrocarbons from Achimov areas of Gazprom dobycha Urengoy LLC by 2025 will reach 35 billion cubic meters of gas and 10 million tonnes of condensate. By 2030 the proportion of minerals from the Achimov deposits in the energy balance of the Company will increase from 7 to 50%.

Methods

To solve the problem of joint development of the Achimov deposits TyumenNIIgiprogaz has created a unique in scale single three-dimensional model of the filtering of the main operational objects of the Achimov deposits. With its help a strategy was created for the development of the Achimov deposits in the Urengoy field, which takes into account interests of all subsoil users. The order of wells commissioning and the parameters of their work was determined to ensure the specified gas output from deposits. In the long term annual gas extraction from the Achimov formation of the Urengoy field for all subsoil users will reach about 65 billion cubic meters. This is more than 10% of Russian gas production. By 2030 Gazprom dobycha Urengoy will produce 434 billion cubic meters of separation gas and 129 million tonnes of condensate.

2008 was a starting point in the development of Achimov deposits of the Urengoy oil, gas and condensate field. Joint Russian-German company ZAO Achimgaz established by OAO Gazprom and Wintershall AG commissioned UKPG-31. In October 2009 gas condensate treatment facility UKPG-22 was put into operation. Development of the Achimov deposits is one of the main directions of development of the Company Gazprom dobycha Urengoy in hydrocarbon production. In the near future additional infrastructure development at II pilot area, Achimov formation will begin as well as equipping of areas IV and V. Their commissioning is scheduled for 2017. And from 2019 it is planned to start with the development of area III.

Structure of the Achimov deposits layers is heterogeneous and they have specific thermobaric conditions. Abnormally high initial reservoir pressure at a depth of 3700 meters makes up to 60 MPa and the temperature 106°C. The formation fluid comprises the condensate in an amount of up to 500 g / thousand cum of reservoir gas and up to 6 % wt. of refractory paraffin in the condensate.



At the stage of design and pilot operation of these circumstances demanded the research and implementation of innovative technologies in the field of production and treatment of hydrocarbon raw materials.

Based on the experience of wells drilling during the pilot operation of the Achimov deposits it was found that wells with a vertical opening of the reservoir are characterized by a small area of deposit drainage. During their operation it was necessary to ensure high drawdown, which leads to increased losses of condensate in the formation. Virtually all production companies adopted the vertical opening with the hydraulic fracturing as the main way of operation. The use of hydraulic fracturing allowed providing increase in well productivity by 2.5 times. However small in extent cracks did not allow to significantly expand the area of wells drainage.

From the beginning of the research and design work on the development of the Achimov deposits a question was raised on the optimal design of bottom-hole. In 2007-2008 the company ZAO Achimgas drilled the first pilot wells with horizontal bottom-hole on Achimov deposits. Experience gained in the construction of these wells was very complex because of the presence of Sortym clays over Achimov deposits. Thanks to the experience of horizontal drilling a mud formulation is selected for drilling horizontal wells. This will optimize the stock of Achimov wells and increase the area of deposits drainage. Multi-stage hydraulic fracturing will improve the efficiency of horizontal wells. Along with this pitless method of wells construction was adopted to enhance the environmental safety of Achimov deposits development.

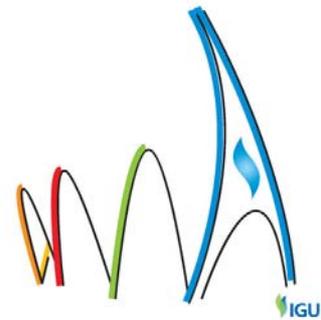
Abnormally high reservoir pressure requires the use of technologies aimed at ensuring safety in the blowout prevention during wellhead operation and reducing the specific metal consumption of wells equipment and gas transportation system.

So wellheads use Christmas trees, designed for a working pressure of 70 MPa with the hydraulic valves and underground shutoff valve. The Christmas tree control station allows for automatic control of the wellhead valves and control remotely and on site (from the station) of underground shutoff valve. In case of emergency the well shuts automatically.

Wells are placed on the pilot area according to a cluster scheme. Every cluster comprises 3 to 5 wells. Proceeding from the ease of installation, maintenance and monitoring of the wells, production equipment sets of each well are made in modular pattern of the individual blocks and placed at the top of the cluster pad.

As part of the wells equipment the following items are used:

1. valve blocks



2. connection unit for the pipeline and methanol-pipeline
3. block of the torch piping
4. connection unit for test separators

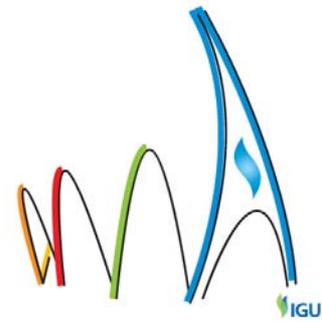
As already mentioned, each cluster well pad is equipped with a connection unit for test separators. The piping allows for wells surveys to be carried out with products discharged in the gas gathering system without discharging it into the atmosphere. This prevents loss of wells products and reduces the negative impact on the environment. In the period from 2011 to 2015 it prevented the release of 68 million cubic meters of gas into the atmosphere.

Process of low-temperature treatment of gas and condensate required the development of innovative technological schemes and design solutions aimed at reducing the consumption of methanol. On UKPG-31 and UKPG-22 a scheme is used patented by Gazprom dobycha Urengoy of methanol recirculation flow and desorption from the water-methanol solution, released in the low temperature separator. This reduces the total flow rate of methanol for a unit by 20-25% and also the methanol concentration is reduced in industrial wastes. To reduce the negative environmental impacts on field facilities of Achimov formation a technological scheme is implemented for industrial and domestic waste water joint treatment and injection into the reservoir.

At present Gazprom dobycha Urengoy and ZAO Achimgas implemented design solutions for the effective monitoring of the Achimov deposits development, comprising a set of underground and industrial equipment for continuous registration of temperature and pressure parameters, as well as comprehensive field and laboratory studies. Effective use of the rich information obtained in the course of deposits development monitoring allows to raise quality of work on the modelling of the field development, planning process, technical and economic indicators of development.

Conclusions

1. OAO Gazprom, the Government of YANAO, TyumenNIIgiprogaz LLC and Gazprom dobycha Urengoy LLC created a strategy of Achimov deposits development for Urengoy region. it is based on a single three-dimensional model of the filtering of the main operational objects. The order of wells commissioning and the parameters of their work was determined to ensure the specified gas output from deposits in view of interests of all subsoil users.
2. On the license areas of Gazprom dobycha Urengoy LLC it is planned to develop additional infrastructure on II pilot area, as well as to start development of areas IV and V; III area is planned for development in 2019. Total annual production of hydrocarbons from Achimov areas by 2025 will reach 35 billion cubic meters of gas and 10 million tonnes of



condensate. Until 2030 Gazprom dobycha Urengoy will produce 434 billion cubic meters of separation gas and 129 million tonnes of condensate.

3. Further development of Achimov deposits will require a pitless method of wells drilling with a horizontal formation penetration and multi-stage hydraulic fracturing.
4. Safety of wells operation is ensured due to automated Christmas tree control system. For the ease of installation, maintenance and monitoring of the wells, production equipment sets of each well are made in modular pattern of the individual blocks.
5. To ensure the ecological safety of the operation the following is used:
 - energy-saving technologies for wells surveys without gas discharges into the atmosphere
 - recirculation schemes of methanol supply in the process of low-temperature treatment of gas and condensate
 - a technological scheme for industrial and domestic waste water joint treatment and injection into the reservoir.

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