

The Importance of New Approaches Development and their Implementation in the Oil and Gas Industry in Russian Federation-- the Current Situation Analysis

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Keywords: oil and gas industry, light crude, heavy oil, sectoral sanctions, the substitution of import, decision support systems, digital oilfield.

Abstract. In this paper I tried to dwell on the most crucial points, concerning the nowadays state of the Russian oil and industry in the conditions of sectoral sanctions, and the vital necessity of new approaches development and their instant application the industrial process of oil and gas production.

Introduction

Search for elaboration and implementation of new software industrial approaches for safe and efficient oil and gas production in Russia, have nowadays emerged full blown which is due to a variety of reasons both geological and geopolitical. Let us set forward some of the most significant ones.

Oil and gas industry of Russia

According to the adopted strategy of Russia's economic development until 2020, oil and gas industry plays a key role in the economic development of the country. Being one of the world's largest oil and gas producing countries, Russia receives significant revenues from the use of its resources (government budget surplus is directly dependent on the quality and quantity of the oil and gas produced, and later, exported) [1]. As part of a grand-scale tax reform that was implemented in Russia in the 2000s, the taxation system of the raw materials sector has been fundamentally changed: export duties mechanism has been readjusted, and the mineral extraction tax has been introduced, thus increasing the share of oil and gas rents received by the government budget, with less than 40% in 2000 raising up to 84% in 2005. At the same time today, more than 98% of all taxes for the natural resources use and 100% of all revenues from foreign trade (including export duties on oil and oil products, etc.) go to the federal budget. And since 2013 the so-called fiscal rule has been officially applied, determining the maximum level of budget expenditure, based on the oil price [2].

However, the global financial crisis has lead to destabilization of raw materials prices, therefore, the strategic importance of the oil and gas industry as a whole, *namely the problem of industrial processes cost reducing at all oilfield functioning stages has significantly increased in urgency.*

Generally, the reasons for the need to refer to this subject can be divided into two groups:

- global reasons;
- the relevance of the moment for Russia.

Global reasons

The era of easy oil is coming to its logical end

One of the most important tendencies, observed in today's global oil sector, is the reduction of light crude and medium crude oil production. Petroleum reserves, suitable for production, are depleting rapidly. Taking this into consideration, and furthermore taking into account the low prices for hydrocarbons, the global economy faces higher importance of expediency of heavy oil and gas hydrates production. To save and to increase the current production extents a thorough study of the deep drilling issue is necessary; great opportunities arise here, among which the primary is the

development of cutting – edge approaches to oil production, as it requires a severe reconsideration of all established geological conceptions. Future projects for deep drilling will create mainly a unique industrial and technological base. According to various sources, as well as to the results of various years, the top three in oil production may swap, but the subject structure always remains the same: Saudi Arabia, Russia, and The United States. Issues of heavy oil production are also urgent for the acknowledged leaders in the highest quality oil production and export - the Middle East (particularly Saudi Arabia). Large deposits of high-quality light crude oil (it is believed that this country accounts for 25% of world petroleum reserves) are the main advantage of Saudi Arabia. Specialists recognize that, light crude easy in production is out, the deposits of high gravity oil are gradually depleting, and Saudi Arabia (SA) also has to learn to produce heavy oil. According to Alex Manton, Middle East analyst from the consultancy group Wood Mackenzie, more than half of the oil deposits have been produced in the main fields in the Persian Gulf countries; which is traditionally followed by a fall in extent of production. But there is plenty of heavy oil (low API gravity oil) in the region - recoverable reserves in the Middle East amount to about 78 billion barrels, which is 3.5 times more than all the oil reserves in the United States.

According to the US Geological Survey, the recoverable reserves of heavy oil in the world are 434 billion barrels, and 2.962 trillion barrels are impossible to be produced yet. Heavy oil is also of particular importance in Russia, where more than half of light oil deposits has been mined out. Geological reserves of highly viscous and heavy oil in Russia is up to 6.7 billion tonnes (40-50 billion barrels), but their application and recovery require the use of special expensive technologies.

Chief Researcher of the Geological Institute of the Russian Academy of Sciences Yuri Volozh said that deep oil production is the way to the unknown, even from the theoretical science viewpoint. Our first steps in this direction have proven that these depths are promising, though it was recently believed that one should search for diamonds on the 5 km depth and more, at least gas; but not the oil. Today everyone understands that it is possible to extract oil in such conditions. Deterioration of the oil reserves structure for the last fifteen years has led to a decrease in flow rates, to the complication of the field conditions, which, in turn, caused the oil extent decrease, the turnaround interval (TAI) and working life of mining equipment reduction, the special service equipment cost increase. A switch to low-productivity equipment is accompanied with an increase in specific energy consumption for oil production. The consequence of these processes is a steady decline in oil production profitability, which is known to be determined by such factors as:

- oil production volume;
- the cost of the equipment and its service life;
- TAI of the oil production equipment;
- the value of variable operating costs (primarily, energy cost).

Operating costs for heavy oil and natural bitumen extraction are 3-4 times higher than of the light oil production ones, which is associated not only with higher density and viscosity of heavy oils, but with the lack of its production and processing technologies development in our country. Therefore, *new technologies development for the heavy and extra-viscous oil production is a priority for the entire oil industry development.*

Environment

This aspect has no borders, so it can be safely referred to the global. It is well known that the oil and gas industry, being a budget-forming one keeps a leading position in the Russian economy and is characterized by high intensity of anthropogenic impact on all components of the environment and brings great harm to the environment. Fire and explosion danger and toxicity level of hydrocarbons cause increased demands for oil production facilities safety. Contingency situations in the oilfields cause unwanted geo-ecological consequences, the enormous losses caused by oil pollution. The costs of oil-producing companies in the prevention and response of oil spills, oil contaminated soil remediation each year amount billions of rubles, but the stabilization of the situation with the leaks in the oilfields fails: the number of accidents and incidents on the pipelines and, consequently, the contaminated soil area is increasing. Since we are talking about the need for deep oilfields, it is

obvious that software and technical component of the oil and gas production should be specialized and become far more high-tech. Generally, labor-intensive technologies upon the occurrence of failures or accidents undeniably lead to far more serious environmental consequences. Safety is certainly important for any method of oil and gas extraction (in whole, the industry is not eco-friendly), but as processes become more complicated, as the accidents' consequences inevitably get worse. The task of the oil industry development is to ensure environmentally safe operation of all its components. Sanctions from the Federal Service for Supervision over Natural Resource Usage are not enough here. It is obvious that *a complex of actions to reduce the geo-environmental risk in the development and operation of oilfields should combine into a single system legislative, monitoring and technological measures, which definitely include the development of intelligent decision support systems in the oil and gas industry.*

The urgent character of the moment for Russia

Sectoral sanctions

A year ago, in July 2014 the European Union has expanded economic sanctions against the Russian Federation, imposing the so-called "sectoral sanctions", in particular by limiting the equipment export for the oil industry which is the key sector of the Russian economy.

Substitution of the import

In the context of "sectoral sanctions" Russian political and economic strategy in import substitution comes on top. While this material was being prepared, several key events occurred, which anyway identified (stated) problems and their possible solutions on this issue. From 18th to 20th of June 2015 at the 19th International Economic Forum in St. Petersburg the President of Russian Federation Vladimir Putin stated that Russia was going to revive the high-tech industries, sending more than 2.5 trillion rubles for import substitution program. On March 11, 2015 Moscow hosted the National Oil and Gas Forum on the prospects for import substitution in the sector and its innovative development under sanctions and fall in oil prices. According to experts it will take 3 years for import substitution in the industry as a whole. The director of the Energy Center "Skolkovo", Managing Director of VYGON Consulting Grigory Vygon, who has been working for more than 15 years in the oil and gas sector of the economy, dwelt on the possibility to accelerate the process and the amount of money necessary to be spent. He pointed out that import substitution is required not only in terms of equipment (where according to the research of the Ministry of Industry, the dependence on foreign supplies is 60%), but also in terms of software (where the dependence is 90%). First and foremost, it is necessary to focus on issues where the sanctions and the lack of domestic developments (home-grown technologies) can critically affect the production. And this, according to G.Vygon, is unquestionably software; our dependence in the drilling process of high-tech wells, refining process management - at failures (shutdowns) software will seriously affect the level of production, volumes and depth of processing.

With regard to the equipment, we are also experiencing a serious dependence, which varies depending on the technologies used. For example: during the drilling of horizontal wells, during the formation hydraulic fracturing (FHF); we depend on drilling fluid, propane, chemicals, liquefied gas (currently the United States control the market - 95% of the licensed technologies to liquefy gas belongs to America). Taking in to account the fact that our strategic direction - an extension of the LNG (liquefied natural gas) - it is necessary to start with the development of the technology, and hence to invest in R & D.

The current economic situation, related to the sanctions introduced by a number of countries on oil and gas complex of Russia and the rouble devaluation as well, creates opportunities for suppliers of domestic technologies and equipment to increase their own market share, - said the Minister of Energy of the Russian Federation Alexander Novak. In addition, he noted that the Ministry of Energy of the Russian Federation intends to replace foreign technologies completely by 2020. It is planned that within the framework of the project three "planning horizons" will be created; such milestones will be 2016, 2018 and 2020:

- by 2016 the country should completely eliminate foreign influence in the technology of horizontal drilling and hydraulic fracturing;
- by 2018 self-reliance should be achieved in matters of software and hard recoverable energy reserves;
- by 2020 domestic equipment is to be developed and implemented on LNG shelf and projects. As part of the goal of reducing the critical dependence on foreign technologies in the oil and gas sector Ministry of Energy of the Russian Federation has developed a plan to reduce the share of imported equipment from 60% to 43% in the medium term. It is about the total share of imports related to 12 priority areas of the industry, which has been developed during the collaboration with the Ministry of Industry of the Russian Federation, and now the expert groups are being formed whose aims will be to have the order implemented in the Russian industry by 2035 - and in the first place this is the order for innovative technologies. From 23rd to 26th of June 2015 the 13th Moscow International "Oil and Gas» Exhibition / MIOGE 2015 took place in Moscow, in terms of which the 12th Russian Petroleum and Gas Congress / RPGC 2015 occurred. Exhibition "Oil and Gas» / MIOGE is one of the five major industry exhibitions in the world and is the leading oil and gas exhibition in Russia; this year it demonstrated to professionals of the industry the best innovations in the oil and gas production field, hydrocarbons transportation and processing. This year's exhibition and congress were held shortly before the important for the domestic oil and gas industry anniversary – the 150th anniversary of the commercial oil production start in Russia. In this regard, the organizers of the exhibition and the congress prepared a project "Oil and Gas in Russia: the history, the people, the future." This work incorporated unique materials on the history, the present and the prospects for oil and gas industry development in Russia. As Deputy Energy Minister K.V. Molodtsov pointed out in his greeting the organizers, participants and guests of the Congress, "the current economic situation, associated with the sanctions introduced by a number of countries on the Russian oil and gas complex and the ruble devaluation *creates opportunities for suppliers of domestic technologies and equipment to increase their own market share*".

Summary

In whole, the situation within Russian oil and gas industry is rather difficult. The amount of “easy” oil is quite low, the oil price is definitely underestimated (it’s considered that ‘fair’ price should be about 65-70 US dollars for the barrel (today it’s 49\$). These circumstances force to apply new approaches in order to discover new oilfields and to reduce the extraction cost on the known ones.

Funding

This paper is published due the financial support of the Russian Science Foundation (RSF) via the grant № 15-19-00196.

References

- [1] I.S. Korovin, M.V. Khisamutdinov. Neuronetwork decision support system for oilfield equipment condition online monitoring. *Advanced Materials Research* (Trans Tech Publications, Switzerland). Volume 902 (2014), Pages 409-415.
- [2] P. Danilov. Effect of the oil industry on the environment. Work. Summary on the topic: The impact of the oil industry on the environment // // Summary MSTU "STANKIN" Department of Environmental Engineering. Information on <http://referat-web.ru/content/referat/ecology/ecology35.php>.
- [3] I.S. Korovin, M.V. Khisamutdinov. Hybrid method of dynamograms wavelet analysis for oil-production equipment state identification. *Advanced Materials Research* (Trans Tech Publications, Switzerland. Volume 909 (2014).