

INNOVATIVE ACTIVITIES

The updated Innovative Development Program (IDP) of Zarubezhneft JSC for 2016–2020 (for the period up to 2030) has been developed as part of the instruction of the Russian Federation Government and approved by the Board of Directors on September 14, 2016 (Minutes No. 127).

According to the independent expert evaluation of the IDP development and implementation quality, the Company consecutively received highest ratings among oil and gas and energy companies with public ownership – for the IDP development in 2016 and its implementation in 2016 and 2017.

In 2019, Zarubezhneft JSC worked on updating its IDP for 2020–2024 (for the period up to 2030) in response to the instruction of the Government Commission for Economy Modernization and Innovative Development of Russia. The Concept of Zarubezhneft JSC Innovative Development Program for 2020–2024 (hereinafter, the Concept) was developed and approved by Zarubezhneft JSC Board of Directors (Minutes No. 65 dated March 27, 2019). The updated Draft IDP, prepared based on the Concept, was approved by the Strategic Planning Committee of Zarubezhneft JSC Board of Directors (Minutes No. 63 dated October 30, 2019) and duly directed for consideration to the federal authorities. Approval of the updated IDP of Zarubezhneft JSC for 2020–2024 (for the period up to 2030) by Zarubezhneft JSC Board of Directors will take place in 2020.

Primary contractors engaged in the 2019 innovative projects were design and R&D organizations:

- within Zarubezhneft Group (VNIIneft JSC, Giprovostokneft JSC);

- leading universities of the Russian Federation (Kazan (Volga Region) Federal University (KFU), Skolkovo Institute of Science and Technology (Skoltech), etc.);
- SMEs and other scientific and production organizations.

INNOVATIVE PROJECTS OF 2019 AND PERFORMANCE ACHIEVED WITHIN THEIR SCOPE

Development of a plant powered by Russian oil of any class

An innovative project was initiated due to significant costs of procurement of diesel fuel for power generation of JC RUSVIETPETRO LLC fields and the delivery challenges. It is intended to use Russian equipment (engines by the Kolomna plant) for oil classes up to 3 (inclusively) (high viscosity and sour) and to increase the time between overhaul of power machinery.

The existing power machines manufactured abroad and by the Kolomna plant require a high degree of oil treatment and are designed for operation with class 1 oil (light and sweet). A bottleneck of oil power machines is fuel equipment (injection nozzles, the piping system).

Within the scope of the innovative project, in 2017–2019, R&D and designing activities were undertaken to improve the power plant equipment that operates with class 3 oil, to develop design documentation, to bring the power plant to a level of oil industry standards and to conduct pilot testing in JC RUSVIETPETRO LLC.

The diesel oil power plant was manufactured and delivered to JC RUSVIETPETRO LLC field. The power

plant passed pilot testing with diesel fuel and switched to oil for oil pilot testing and further testing of upgraded equipment and assemblies as a part of the R&D activity.

In 2019, the oil pilot testing was continued. According to the R&D, two applications were submitted to the Russian Agency for Patents and Trademarks for patenting unique technical solutions intended to upgrade the power plant assemblies for stable operation with oil up to class 3 inclusively. The Russian Agency for Patents and Trademarks has approved the issuance of patents for the inventions.

Technology of enhanced oil recovery at high-viscosity oil fields by catalytic aquathermolysis

Since 2017, the Company together with Kazan Federal University has carried out R&D on technology of enhanced oil recovery at high-viscosity oil fields by the method of catalytic aquathermolysis. The technology intensifies intra-formation treatment of heavy oil during steam treatment, which increases the oil quality and reduces its viscosity. Improvement of oil properties in formation conditions will improve the energy and economic performance of the Boca de Jaruco field development (and potentially other similar fields in the zone of heavy oils in Cuba and other countries).

In 2017–2018, at the premises of Kazan Federal University, a number of experiments were conducted to select the most efficient catalyst using a reactor. The selected nickel catalyst ensures the maximum conversion of oil and significant reduction of viscosity with an additional advantage of low price as compared with the cobalt catalyst.

In 2018, the second research stage was completed to address the remaining issues: evaluation of catalytic activity and coking of the catalyst during aquathermolysis processes, catalyst adsorption on the rock (displacement in the combustion pipe), study of solubility, thermal stability and filtration performance of the developed catalyst solution. A test batch of the catalyst has been manufactured for pilot testing.

In 2019, the catalyst was delivered to Cuba by sea. Preparations for pilot testing of the technology were completed, as well as basic cyclic steam treatment was provided for the candidate well (without catalyst). In November–December 2019, Zarubezhneft JSC experts successfully injected the catalyst into the formation with further cyclic steam treatment. Currently, the pilot testing continues during oil production.

In August 2019, a joint application (with KFU) was submitted to the Russian Agency for Patents and Trademarks for patent registration for the method of developing bituminous carbonate reservoirs using cyclic steam soaking and aquathermolysis catalyst. The Russian Agency for Patents and Trademarks has approved the patent issuance.

Pilot testing of surfactants in a single well by swctt method in JC RUSVIETPETRO LLC

In 2019, at the Zapadno-Khodesayuskoye field, JC RUSVIETPETRO LLC successfully completed pilot testing for surfactants by BASF in a single well to improve oil recovery of hydrophobic carbonate reservoirs. It should be noted that this pilot testing of Zarubezhneft JSC by the SWCTT (Single Well Chemical Tracer Test) method for carbonate reservoirs was the first pilot testing of this type ever carried

out in Russia. The primary idea behind SWCTT is the application of chemical tracers to determine the residual oil saturation when oil is displaced by water and surfactants. SWCTT is intended to comparably quickly find the rise of displacement efficiency for surfactant and water.

The testing results proved an efficient performance of the selected composition. In accordance with the analytical interpretation, the displacement efficiency growth was 0.07 (when exposed to surfactant) as compared to that of water.

Pilot testing of diverter technologies in ZARUBEZHNEFT-Dobycha Kharyaga LLC

ZARUBEZHNEFT-Dobycha Kharyaga LLC successfully continues pilot testing of the diverter technologies (injection of cross-linked polymeric compositions based on polyacrylamide). The project has been under way since 2017. Its primary objective is to test the technology of re-distributing filtration flows of injected water using polymeric compositions injected into active wells.

The project covers wells of D3-III formation of the Kharyaga field's Devon sediments. 13 wells were treated in 2017–2019, with 18,215 m³ of cross-linked compositions injected.

Additional oil production is evaluated upon pilot testing results using common methods – displacement characteristics. The cumulative additional production of oil for the given period is estimated to exceed 140 thous. tons, with more than 75 thous. tons of oil produced in 2019.

The system of testing and implementation of new technologies (NTS)

In 2019, Zarubezhneft Group continued to actively developing the system

of testing and implementation of new technologies (NTS) offered by the market but not yet embodied by the Group. Pilot testing of new equipment and technologies was performed by JC RUSVIETPETRO LLC, Zarubezhneft-Dobycha Samara LLC, ZARUBEZHNEFT-Dobycha Kharyaga LLC, and Zarubezhneft JSC Branch in Cuba. A positive economic effect has been achieved according to the results.

In 2019, JC RUSVIETPETRO LLC conducted 16 tests in the following key areas: improvement of the technology of secondary drilling by a slot perforator, testing of the well clean-up highly efficient system, as well as other modern drilling equipment and devices.

Zarubezhneft-Dobycha Samara LLC also assessed the performance of the adaptive input gravity module used to operate equipment in horizontal wells and testing of pump-jack linear drive.

In 2019, ZARUBEZHNEFT-Dobycha Kharyaga LLC completed pilot testing of the technology for prevention of bottomhole zone clogging during well servicing and evaluated performance of ball valves used in the X-mas tree and dynamic power compensators at a substation 35/6/0.4 kV. In total, 8 tests were made by the subsidiary in 2019.

In 2019, Zarubezhneft JSC Branch in Cuba continued testing of the heat-resistant fiber-optic borehole system for monitoring of distributed temperature and pressure along with testing of heat-resistant progressive cavity pumps and cyclic steam soaking using such pumps.

In 2019, Zarubezhneft Group obtained 1 patent for invention, 2 patents for useful models, and 9 software certificates.



15 applications were sent to the Russian Agency for Patents and Trademarks for the registration of intellectual property. 36 scientific articles and papers were published.

Zarubezhneft JSC continues developing development and expanding formats of interaction with the innovative environment. In June 2019, a Cooperation Agreement was concluded between Zarubezhneft JSC and the Moscow State University n. a. M. V. Lomonosov. This agreement

proves mutual interest of Zarubezhneft JSC and the MSU in active training and re-training of personnel in the field of scientific and innovative activity.

As part of the Innovative Development Program, Zarubezhneft JSC actively develops mutually beneficial cooperation with universities in order to form plans of joint implementation of innovative projects and carry out joint work in the field of predicting scientific development, training and re-training of personnel.

Dynamics of R&D costs to revenue in 2014–2019, %

