Innovational activities

The updated Innovation Development Program (hereinafter IDP) of Zarubezhneft JSC for 2016–2020 (with a perspective up to 2030) was developed in the framework of execution of Orders/instructions of the Government of the Russian Federation and approved by the Board of Directors on September 14, 2016 (Minutes No. 127).

According to the results of an independent expert assessment of the quality of development and implementation of IDP, the Company consistently received superior merits among oil and gas and energy companies with state participation — for IDP in 2016 and for the implementation of IDP in 2016 and 2017.

In 2018, as part of IDP implementation, 22 projects were implemented within the Zarubezhneft Group of Companies. Intended outcomes were achieved for all projects, the established milestones were successfully passed.

The main contractors involved in the implementation of innovative projects in 2018 were design and research organizations:

- including those falling under Zarubezhneft Group of Companies (VNIIneft JSC, Giprovostokneft JSC);
- Leading Higher Educational Institutions of the Russian Federation (Gubkin Oil and Gas Russian State University (RDU), Kazan (Volga Region)
- Federal University (KFU), Skolkovo Institute of Science and Technology (hereinafter – Skoltech), etc.);
- small and medium businesses and other scientific and industrial organizations.

**INNOVATIVE PROJECTS OF 2018 AND RESULTS REACHED AS PART OF THEIR IMPLEMENTATION**

**Development of a mobile preliminary water discharge unit (MPWDU) – NESTRO-KSI for small deposits.**

In 2018, pilot testing of the preliminary water removal unit (NESTRO-KSI) was carried out at LLC ZARUBEZHNEFT-Dobycha Samara. According to the test results, the plant demonstrated its efficiency, capital expenditures for creating the plant are on average 2 times lower than those of a similar capital object.

The NESTRO-KSI plant may be commissioned on average 4 times faster than a similar capital construction project (6 and 24 months, respectively).

**Creating oil-fired power plant using all types of russian-sourced oil**

An innovative project was initiated due to the significant expenditures for purchasing diesel fuel for electricity generation for the fields of LLC “JC “RUSVIETPETRO” and difficulties in its delivery. The project aims at using Russian-sourced equipment (Kolomna Plant internal combustion engines) for oil up to class 3 inclusively (high viscosity and sulfur) and increasing the operating life of energy-converting machines.

The existing energy-converting machines, both foreign made and produced by Kolomna plant, require a high degree of oil treatment and are designed to work on light and low-sulfur class 1 oil. Fuel injection equipment (injection nozzles, pipeline system) is the bottleneck of the operation of oil-fired energy machines.

As part of implementation of the innovation project in 2017-2018, research, development and testing & engineering work was carried out on refining units of equipment of the power plant operated by means of class 3 oil, elaboration of design documentation, adaptation of the power plant to the oil industry norms and rules and carrying out pilot testing at LLC “JC “RUSVIETPETRO”.

The diesel and oil power plant was manufactured and delivered to LLC “JC “RUSVIETPETRO” field. The power plant underwent pilot-scale testing (PST) operated by diesel fuel and was made oil-fired to carry out oil-fired PST and further testing of upgraded equipment and components as part of research and development.

In December 2018, the Zarubezhneft JSC project –- oil-fuelled power station using oil of all classes, was recognized as the “Project of the Year” by the Expert Council of “Time of Innovations” award in the category “Oil and Gas Industry”.

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Technology for increasing the oil recovery of high-viscosity oil fields by the catalytic aquathermolysis method

Since 2017, the Company, together with KFU, has been carrying out research and development works to develop a technology for enhancing oil recovery at high-viscosity oil fields using catalytic aquathermolysis. The technology allows intensifying the on-site treatment of heavy oil in the process of steam-heat treatments, which leads to an increase in the quality of oil and a decrease in its viscosity. Improving the properties of oil in reservoir conditions will increase the energy and economic efficiency of the development of Boca de Jaruco field (potentially - other similar fields in the heavy oil area in Cuba and in other countries).

In 2017-2018, a series of experiments was carried out based on the KFU to select the most efficient catalyst using a reactor. The selected nickel catalyst provides maximum oil conversion, a significant reduction in viscosity; an additional advantage of the nickel catalyst is its low cost compared to the cobalt catalyst.

In 2018, the second stage of research was completed. In this stage, the remaining R&D tasks were solved: evaluation of the catalytic activity and coking of the catalyst in the processes of aquathermolysis, the adsorption of the catalyst on the rock (displacement in the combustion tube), solubility study, thermal stability and filtration characteristics of the developed catalyst solution.

At present, an experimental catalyst batch has been manufactured for Pilot Development Planning. Catalytic injection in the course of Pilot Development Planning for testing the catalytic aqua-thermolysis technology at Boca de Jaruco field is planned to be performed in 2019.

Testing and implementation of new technologies system (nts)

In 2018, Zarubezhneft Group of Companies continued active work on developing a system for testing and implementing new technologies (NTS) existing on the market, but that were not previously used within the Group of Companies. Pilot-scale testing of new equipment and technologies was performed at LLC “JC “RUSVIETPETRO””, LLC ZARUBEZHNEFT-Dobycha Samara, ZARUBEZHNEFT-Production Kharyaga LLC and at the branch of Zarubezhneft JSC in the Republic of Cuba.

In 2018, more than 25 tests were conducted at LLC “JC “RUSVIETPETRO”” in the following main areas: optimization of ESP unit selection method, taking into account the theological properties of the liquid, testing the gas burner unit of gas valve type, testing the oil leakage detection system, which operates on cost imbalance principle.

At LLC ZARUBEZHNEFT-Dobycha Samara the work was carried out on studying, applicability assessment and testing of such technologies as energy-saving transformers, hydraulic drive, under-driven progressive cavity pump, submersible flow meters.

In 2018, ZARUBEZHNEFT-Production Kharyaga LLC continued active participation in the implementation of activities of NTS program of Zarubezhneft Group of Companies. The work was carried out on assessing the potential efficiency and testing the production string with coating that prevents the formation of asphaltene deposits, wellhead equipment for dual injection, sealing end on the pumping unit for coolant transferring, dynamic power compensators, bridge plugs in preparing wells for side-tracking, using plasma tubing cutter.

In 2018, the branch of Zarubezhneft JSC in the Republic of Cuba continued testing the heat-resistant rod screw-type pump units has been carried out, as per the plan.

In 2018, the Company carried out systematic work to improve innovation management processes. Pursuant to the requirements of the Government of the Russian Federation, an analysis of the management of rights to intellectual activity results (hereinafter – IARs)

Research and development expenditure trend vs. the revenue from 2014 to 2018, %

Research and development expenditure trend vs. the revenue from 2014 to 2018, %

was conducted in Zarubezhneft Group of Companies. According to the results of the work performed, the Policy of management of the rights to the IARs in the Zarubezhneft JSC Group of Companies was developed and approved by the Zarubezhneft JSC Board of Directors along with the Plan of Measures for Policy Implementation.policy implementation. Also in 2018, the business process "Management of the Rightright for IARs" was approved.

In 2018, Zarubezhneft Group of Companies received 4 patents for inventions, 1 useful model patent and 11 software certificates; 12 applications were filed to Rospatent for registration of intellectual activity results.

Zarubezhneft JSC continues to develop and expand the format of interaction with the innovative environment. In December 2018, between Zarubezhneft JSC and Kazan (Volga Region) Federal
University an Agreement was concluded on cooperation in the field of innovation and scientific and technological development. This Agreement confirms the mutual interest of Zarubezhneft JSC and KFU to continue and actively develop cooperation in the field of personnel training and re-skilling and in the field of science and innovation activities, mainly in areas related to the development and improvement of innovative methods for increasing the oil recovery and improving the efficiency of developing unconventional hydrocarbon reserves.

As part of the development of cooperation of Carbonate Consortium created in 2017 on the initiative of Zarubezhneft JSC with Gazprom Neft PJSC and Tatneft JSC, in the reporting year, a number of joint scientific and technical events were held to exchange the experience and develop competencies in carbonate reservoirs exploitation area:
- Scientific and technical meeting in the framework of the Carbonate Consortium in Kazan, April 27, 2018;
- Seminar on modeling technologies in the framework of the Carbonate Consortium in St. Petersburg, July 31-August 1, 2018;

In addition, as part of the Carbonate Consortium, a joint research and development "Digital Core" was initiated and launched jointly with PJSC Gazprom Neft.

As part of the Innovation Development Program, Zarubezhneft JSC has actively developed mutually-beneficial cooperation with higher education institutions in planning plans for the joint implementation of innovative projects and performance of joint work in the field of scientific and technological development forecasting, training and reskilling. Currently, the most active interaction is occurring with the Gubkin Oil and Gas Russian State University, Skoltech and KFU.

**STW competition**

VI Competition of Scientific and Technological Works of Young Experts of the Group of Companies, which in 2018 was timed to the 75th anniversary of VNIIneft JSC, became a traditional event of a reporting year. The competition program was held in five sections with the participation of 60 projects of young employees of the Corporate Center, subsidiaries of the Russian segment, and young people from subsidiaries located in Vietnam and the Republic of Srpska.

The competition has become one of the tools the Company is using to improve the efficiency of technical and process decisions by unlocking the potential of young people in preparing their own projects. Every year, the number of works and participants also grows, and consequently – the results achieved through the implementation of young people’s proposals.
Between 2014 and 2018, more than 270 young employees took part in the competition. They presented more than 240 innovative projects aimed at solving the key production and organizational tasks of Zarubezhneft Group of Companies; more than 80% of these projects were successfully introduced into production activities with positive results.

The positive dynamics of the results and the high efficiency of the field of unlocking the potential of young people is stipulated, in particular, by systematic approach to the full cycle of work of young employees with own projects - from selecting the projects of practical importance for the Company to their implementation into production activities.

An increase in a share of successfully implemented works is annually observed; currently, 83% of the works presented at the Competition last year have been implemented, and more than 80% of them have already been replicated in Zarubezhneft Group of Companies.

Knowledge management system
In 2018, Zarubezhneft JSC decided to revise the existing processes of managing the unique competencies and optimizing the approaches to the accumulation, use and dissemination of knowledge for transformation of its own intellectual assets into a higher productivity, efficiency and new value.

In the reporting year, large-scale work was carried out to analyze current trends in the field of building and developing the knowledge management, optimizing the Company’s current model of working with knowledge in terms of changing the approach to their systematization and searching for technologies to distribute them more efficiently. This resulted in the development of a private Knowledge Management System, which takes into account the best practices and specific features of the Company. At the end of 2018, the System’s pilot operation began.

The revision of the model of working with knowledge is determined by both the growth of technological and organizational development level, specific features, and the strategic orientations of the Company; today, within the adopted Strategy, replication of the accumulated experience and using unique corporate knowledge grow in importance for quick implementation and effective adaptation of business processes and structures, and active involvement of new employees in production and innovation processes, carefully sharing the experience of Zarubezhneft JSC experts generation for complex problems solving. The key top-level tasks of the Knowledge Management System of Zarubezhneft JSC are the creation of “correct” solutions standard by eliminating the repeated and incorrect performance of production tasks, and the formation of a platform for creating new ideas and tools for their quickest possible and effective implementation into processes.

The main System capabilities as of today are the following:
- Creating a material library in the line of the technological focus
- Crowdsourcing Tool - identifying and collecting the employees' knowledge
- Smart search
- Collecting the technological ideas and suggestions for improving the production processes
- Expert support, communication platforms, discussions, considerations

Throughout the entire pilot operation period, the system has continuously been improved by continuing to study the best practices and users’ suggestions for development. The system is focused on the preservation and dissemination of unique process knowledge and the creation of new technologies. Today, the system comprises six knowledge areas – Geology and Development, Production, Well Operations, Industrial Safety, Innovations and Digitization, and is already available to the target audience of users within the corporate contour.