DEAR COLLEAGUES,

The technology has always been the driving force behind the development of the oil and gas industry. And, nowadays, as we are increasingly addressing the challenge of extracting hard-to-recover reserves, its value has grown tremendously. From a technological progress perspective, Gazprom Neft has secured a foothold as one of the industry leaders. Gazprom Neft’s Technology Strategy has been formulated at the Science & Technology Centre in order to maintain the growing pace of oil and gas recovery. To date, it covers over 100 technology development projects most of which are run by our Centre’s staff.

Mars Magnusovich Khasanov,
Head of Gazprom Neft’s Technology Directorate,
General Director of Science & Technology Centre
The key mission of Gazpromneft Science & Technology Centre (Gazpromneft STC) is to increase and improve petroleum extraction by introducing innovative technologies and project management solutions at Gazprom Neft’s fields.

Gazpromneft Science & Technology Centre is tasked with finding new methods of enhanced field development.

STC provides analytical, methodological and scientific research and technical support to petroleum exploration and production operations, focusing on the new technology development, engineering, and scientific and technical review of hydrocarbon exploration and production projects, project management, analysis and monitoring of oilfield development and exploration activities, geological and hydrodynamic modeling, technological support, and operational oversight of drilling operations.

Gazpromneft Science & Technology Centre’s area of responsibility includes the following tasks:

— Set up and maintain a corporate database of geological and commercial data;
— Manage the oil recovery process using permanent geological and petroleum engineering models;
— Plan and organize pilot work to pioneer new oil recovery techniques.

The Science & Technology Centre’s headcount of Gazpromneft STC

1000+

— candidates of sciences
— doctors of sciences
— professors
Gazpromneft Science & Technology Centre develops the Technological Strategy of Gazprom Neft and also implements related projects.

Research activities

Gazpromneft Science & Technology Centre is deeply involved in research and development, for example, most of Gazprom Neft patented inventions have originated from STC. In addition, STC manages and safeguards oil exploration and production intellectual property rights across the Company.

Since 2013 Gazpromneft Science & Technology Centre has been translating and publishing professional oil and gas publications among which are unique books written by recognized world experts in the oil and gas industry and first translated into Russian with support from the Science & Technology Centre.

Since 2015, STC has been publishing its in-house journal ‘PROneft About Oil from Professional Perspective’, i.e. Gazprom Neft’s dedicated science and technology publication posting articles by the company’s professionals on current issues relating to oil exploration and production. Those methods, techniques and approaches featured in the journal are already widely used by Gazprom Neft to develop new fields and enhance oil recovery.

STC BUSINESS AREAS

1. GEOLOGICAL EXPLORATION PLANNING AND SUPPORT
   - Regional surveys
   - Seismic surveys
   - Prospecting and exploratory drilling support
   - Core and formation fluids analysis
   - Unconventional reserves
   - Economic evaluation of assets

2. GEOSCIENCE AND RESERVOIR ENGINEERING
   - Petrophysics
   - Lithology
   - Conceptual geological modeling
   - Hard-to-recover reserves
   - Well logging
   - Development planning

3. OIL AND GAS PRODUCTION METHODS AND TECHNOLOGIES
   - Oil production technologies
   - Osteel chemistry
   - Hydraulic fracturing
   - Gas business planning

4. FIELD FACILITIES AND INFRASTRUCTURE
   - Capital construction
   - Conceptual engineering
   - Cost engineering

5. SCIENTIFIC AND TECHNICAL SUPPORT OF DRILLING AND WELL INTERVENTION
   - «GeoNavigator» Drilling Management Center
   - Drilling engineering support

6. CREATION OF CONCEPTS FOR FIELD DEVELOPMENT AND FACILITIES CONSTRUCTION

7. PREPARATION OF ENGINEERING PRACTICES AND STANDARDS

8. INTELLECTUAL FIELD DEVELOPMENT & PRODUCTION

9. GATHERING, UPDATE, DISSEMINATION OF KNOWLEDGE AND BEST PRACTICES

10. MANAGING SCIENTIFIC WORK AND R&D* PROJECTS

* Research and Development
The pace of technological development shown by Gazprom Neft has made it one of the leaders in the industry. In particular, the share of high-tech wells out of the total number of wells drilled during the year accounts for more than 60%, which is the best result in Russia.

By late 2014, various projects undertaken by Gazprom Neft to enhance oil and gas recovery, develop new reserves and to meet the Company’s strategic targets were put together in one consolidated conceptual document entitled the Technology Strategy.

60+% OF HIGH-TECH WELLS

ALL TECHNOLOGICAL CHALLENGES FACING GAZPROM NEFT WERE BROKEN INTO 9 HIGH-PRIORITY AREAS THAT INCLUDE SPECIFIC PROJECTS WITH DESIGNATED TARGET COMPLETION DATES AND EXPECTED DELIVERABLES
The «GeoNavigator» Drilling Management Center, which is part of Gazpromneft Science & Technology Centre, is responsible for tracking the drilling progress across all fields operated by the company (for more details see page 20).

STC provided support to Gazprom Neft’s first multi-stage re-fracturing in a horizontal well. It was for the first time that such an operation was performed in a conventional reservoir in a well with non-steerable assembly anywhere in the world.

The innovative multi-stage re-fracturing was supported by 4D geomechanical field modeling in the area of operation. It provided a better understanding as to how the current development situation might affect the fracture response geometry and the updated model allowed us to come up with an optimal fracture design — which was also a first-time experience in the Russian oil and gas industry.

One of the key priorities in Gazprom Neft’s Technology Strategy is the development of new exploration technologies.

Among the technological challenges confronting the company are the unconventional oil and gas pools modeling, achieving higher accuracy and efficiency of predicting the oil and gas presence based on seismic data and improved survey data obtained from exploration wells.

In this area Gazprom Neft is integrating a ray-path modeling technique for its seismic work. It includes customized software packages, which utilize the historical geological data from the area and previously gathered seismic data to plot out the optimal patterns for putting elastic wave generation sources and recorders.

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It took Gazprom Neft a few years to significantly increase the number of high-tech wells (hydraulically fractured horizontal and multilateral wells). It was made possible mainly because the Company has applied the new drilling technologies.

Gazprom Neft is also testing innovative drilling muds. Their application resulted in significantly improved drilling performance for difficult wells with extended clay sections as a unique drilling fluid formula reduces clay swelling by limiting its ingress into the drilling fluid by triple inhibition.

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3. OIL RECOVERY ENHANCEMENT

This objective revolves around locating the residual hydrocarbon reserves and looking at ways of enhancing their extraction techniques.

The residual oil reserves mapping methods developed by Gazpromneft Science & Technology Centre more accurately define the structure and current state of a reservoir. Quite often it involves the development of hard-to-recover, or tight oil, as residual reserves are normally characterized by a complex geological reservoir structure or specific oil properties. The area also encompasses novel secondary and tertiary enhanced oil recovery methods: advanced fracturing and flooding solutions.

4. UNCONVENTIONAL RESERVES DEVELOPMENT

In Russia reservoirs occurring in the Bazhenov formation are classified as unconventional. It is the horizon of rocks identified in the central part of Western Siberia at depths of 2,000–3,000 meters covering an expanse of about 1,000,000 sq. m measuring on average roughly 40 m in depth.

According to geological estimates, oil reserves confined to the Bazhenov in Western Siberia alone may reach 100–170 bn tons.

The Bazhenov formation is composed of compact clay rocks that are defined as source rock. The peculiar feature of the Bazhenov proving its commercial potential is high-quality oil saturation — it is light and sweet, which makes treatment easy. The Science & Technology Centre oversees Bazhenov research activities and pilot work planning, applying modern well and reservoir engineering methods.

The unique nature of the Bazhenov formation calls for fundamental changes in field development and also for a totally new technology portfolio. In this area, STC formulates a potential prediction solution for the Bazhenov formation, which will allow identifying the most commercially viable subsurface areas from a perspective of unconventional reserves in the open acreage. STC professionals also develop new fracturing technologies since conventional fracturing solutions fall short of expectations in the Bazhenov formation. Another major project is the ‘Bazhenov Hydrocarbon Generation Technology’ where STC is exploring ways of expediting hydrocarbon generation in unconventional reservoirs.
5. GAS CAP DRIVE RESERVOIR DEVELOPMENT

More efficient development of gas cap drive reservoirs enhances production from the Company’s major fields that are currently in the early development stage: Novoportovskoye and Messoyakha fields.

Gas cap drive experience and competences are also required to develop new reserves that are already in production. When gas cap drive reservoirs come under development many approaches that have been found by the Gazprom Neft’s Science & Technology Centre to be successful for more conventional oil reservoirs have to be altered. Massive gas quantities present the risk of gas penetration into oil wells thus compromising the efficiency of such oil displacement methods as flooding. So, seeking alternative methods for gas cap drive reservoir development to address arising challenges adds one more job for the Company’s Science & Technology Centre.

GAZPROM NEFT ALREADY MAKES PARTIAL USE OF GAS CAP DRIVE RESERVOIR DEVELOPMENT METHODS AT THE ORENBURG FIELD

6. CARBONATE/FRACTURED RESERVOIR DEVELOPMENT

Carbonate/fractured reservoirs account for a major share of reserves in Gazprom Neft’s project portfolio.

Carbonate and fractured reservoir development has a number of essential features: a complex pore space structure, high heterogeneity of reservoir properties, a diversity of reservoir rocks and to name but a few. Such specific characteristics lead to many difficulties in locating reserves, field engineering and production management. Carbonated reservoirs are flooded unevenly while conventional field development methods fail to impact a large portion of a reservoir making it difficult to predict well performance, etc.

Efficient development of such fields requires unconventional approaches in many areas, including petrophysical modeling and core testing, dedicated geophysical test suites and non-standard approaches to geological and hydrodynamic modeling, etc.

On the technological side, the company is focused on bringing in and adapting to the company’s project portfolio globally acquired experience and discipline expertise in various fields: geophysical surveys and data integration, geomechanics and target modeling, flow tests, well operating conditions and enhanced oil recovery.
7. ELECTRONIC ASSET DEVELOPMENT

The Electronic Asset Development (EAD) is the Gazprom Neft’s IT project development strategy in the upstream that applies to all core activities: exploration, geology, drilling, field development, production and field facilities.

According to estimates, when operational, EAD will upgrade production due to optimization algorithms, save energy costs by 12%, extend the downhole equipment service life by 15%, and also cut drilling costs.

Currently STC is actively working on the Integrated Design project as part of EAD. It is a major technology development area revolutionizing the existing assessment and analysis concept of field development projects.

Several years ago, Gazprom Neft completed the testing of its proprietary development — the ‘Geomate’ information system analyzing and building up geological data covering all the company’s fields.

The program has integrated about 80% of geological and geophysical data interpretation: seismic data, maps, well test and core test results, etc. Access to a shared data environment enables all available indicators to be reviewed to build field models, and identify and detail promising zones and reservoirs.

Gazprom Neft is developing an in-house oil production control IT-system that includes the Checkerboard data system and Mechfond (Pump-driven Well Count) module.

It is required to computerize operating data collection and review processes as well as to plan work and to adopt enhanced oil recovery solutions.

8. NEW GENERATION INFRASTRUCTURE

This part of the Technology Strategy focuses on cost optimization for infield infrastructure and the use of the best solutions to develop remote fields.

To prepare adequate solutions, NTC conducts tests of modular system (compact infrastructure solutions which are cheaper to build). Such solutions allow oversize equipment to be delivered to the field and put into operation within a short span of time. So, in particular, a new associated petroleum gas disposal process i.e. soft steam reforming was tested. The tested facility does require any permanent supporting infrastructure can be moved to another field any time.
In May 2016, the Company commenced export of Yamal oil from the Novoportovskoye field via the ‘Arctic Gate’ oil loading terminal.

The application of the latest technologies to build production, transportation and, which is more important, export infrastructure in Novy Port made it possible to commercialize the field within just four years. The application of the latest technologies for better and safer oil production in a permafrost environment is one of the Company’s key priorities. On this front, work is also underway to make logistic facilities — transportation and pipework infrastructure — more technologically advanced.
Gazpromneft Science & Technology Centre houses the «GeoNavigator» Drilling Management Center (DMC) providing around-the-clock monitoring and oversight of and remote engineering support to the construction work on the most challenging or unique wells across the company’s fields.

More than 60% of wells drilled by Gazprom Neft during the year were put in the high-tech category and were built under the supervision of DMC experts.

DMC’s job is to ensure that the drilling operations meet the relevant as-built documentation. Where well data arriving in real-time signals the need to fine-tune the project to make it more efficient, DMC experts, including professionals from across various fields, take prompt action to make necessary changes. The Centre helps maintain a high rate of drilling operations and achieve their maximum performance.

The DMC team shares common tasks and common key performance indicators: well completion time and productivity factors. The Centre’s professionals provide support to high-tech well construction both in the field in the areas where Gazprom Neft has been operation a long time, and also at its new assets, including Yamal and Eastern Siberia. This includes the development of unconventional reserves of the Bazhenov and Abalak formations.
KNOWLEDGE SHARING SYSTEM

One of the Science & Technology Centre’s roles is to gain and share knowledge about the best technologies, best practices and experience acquired across the Company and all its subsidiaries.

The knowledge sharing system (KSS) is a tool facilitating the coordination of management and sharing knowledge on exploration and production problems within the Gazprom Neft Group to address technological and operational needs in decision-making.

It is intended to set up knowledge acquisition, processing and sharing procedures designed to maximize the benefit from practices and technologies put in place at the Company. KSS is organized as an information system comprising several modules assisting in getting required information on various field operation aspects.

The system enables the user to do a comparative analysis and opt for the best technological solutions meeting any user defined criteria. It also retains data on new equipment tested within the company thus allowing setting up and running new equipment and technologies at any field owned and operated by the company.
In 2015, a Career Development Centre (CDC) was launched at Gazpromneft Science & Technology Centre. Originally operating as part of the NTC in-house competence base, CDC has now become a valuable component of Gazprom Neft in personnel training and skills development.

CDC is on the fast track to building collaboration with key institutions of higher education, foreign universities (Heriot-Watt University Edinburgh, Texas A&M University, French Institute of Petroleum IFP), international professional communities (SPE, EAGE) and leading service providers (Schlumberger, Baker Hughes, Halliburton) and others.

The CDC strategic goal is to accumulate and pass on the required technical knowledge and expertise to employees of the Gazprom Neft Exploration and Production Division and allied professionals giving them continuous professional and career development opportunities.

At present CDC is essentially a technological competence development platform for the Upstream functions.

The portfolio of courses includes 198 unique training programs of varying levels of advancement and also training modules as part of running educational university-level programs.

THE CDC TRAINERS ARE THE STC STAFF WHO DO THEIR JOBS AND CONCURRENTLY ACT AS TRAINERS. THERE ARE NOW NEARLY 150 TRAINERS: THEY ARE EXPERTS FROM ACROSS VARIOUS FIELDS INCLUDING 4 DOCTORS AND 26 CANDIDATES OF SCIENCES