ZARUBEZHNEFT IS A HIGH-TECH OIL AND GAS COMPANY:
• Possessing high competencies in onshore and offshore exploration, development and production of oil and gas
• Implementing challenging global projects in Russia, Vietnam, Cuba and Belarus
• Having two research, engineering and design centers with highly professional team of employees and modern laboratory equipment, specializing in:
  – geology and field development
  – drilling/ construction of surface facilities at oil and gas production/ transportation sites

TECHNOLOGY FOCUS OF ZARUBEZHNEFT:
• Improvement of exploration quality and information value
• Exploration and development of carbonate reservoirs
• Shallow offshore development
• Tertiary recovery (enhanced oil recovery)

ZARUBEZHNEFT JSC IS A RUSSIAN OIL AND GAS COMPANY OF STRATEGIC IMPORTANCE, POSSESSING A RICH HISTORY AND UNIQUE EXPERIENCE IN FOREIGN ECONOMIC ACTIVITY
JC RUSVIETPETRO LLC jointly with PetroVietnam

- 13 oil fields
- Upper Devonian Carbonate hydrophobic reservoirs

KHARYAGA PSA jointly with Total, Statoil, Nenets Oil Co.

- 1 oil field
- Upper Devonian and Permian carbonate hydrophobic reservoirs

VOLUME OF OIL PRODUCTION, thousand tons

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>5,325</td>
<td>5,431</td>
<td>5,685</td>
</tr>
</tbody>
</table>

VOLUME OF OIL PRODUCTION, thousand tons

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>4,352</td>
<td>4,684</td>
<td>4,739</td>
</tr>
</tbody>
</table>

ASSET INFORMATION

- 7 oil fields
- Fractured basement, terrigenous Oligocene and Miocene reservoirs
- More than 30 years of exploitation
- Independent NIPImorneftegaz Institute, Vung Tau, Vietnam (geology and development, offshore fields construction, drilling)
- Complete independent cycle of design and offshore fields construction
- 50% production from non-conventional basement reservoirs

PROSPECTS

- Maintaining production at 5 mln tons/year
- Increasing oil recovery factor of terrigenous collectors (infill drilling, horizontal drilling, sidetracking, hydraulic fracturing, optimization of pressure maintenance)
- Development of new blocks, including gas block O4-3 in 2016
- Re-engineering of field facilities

- Maintaining production at 4.5 mln tons/year
- Increasing oil recovery factor of carbonate reservoirs
- Commissioning “small” fields

SOCIALIST REPUBLIC OF VIETNAM
RUSSIAN FEDERATION. VOLGA REGION

ASSET INFORMATION
• 7 oil fields
• 1 plot for geological study
• Upper Devonian, Lower and Middle Carboniferous carbonate and terrigenous reservoirs
• More than 20 years of exploitation

PROSPECTS
• Restarting of drilling projects in the fields with imbalanced development system
• Horizontal drilling on single-formation fields
• Introduction of modern technologies for exploitation of multi-formation deposits (dual completion, dual injection)
• Optimization of pressure maintenance
• Exploration of existing plots
• Expanding field of activities
• Oil production increase in the region

JSC ORENBURGNEFTEOTDACHA
ULYANOVSKNEfteGaz LLC

VOLUME OF OIL PRODUCTION, thousand tons

2014 106
2015 119
2013 97

CONSTRUCTION OF GEOLOGICAL MODELS AND CALCULATING RESERVES
DESIGN AND ANALYSIS OF OIL FIELD DEVELOPMENT
CORE AND FLUIDS RESEARCH
• Standard
• Special
• Unique

DEVELOPMENT OF TECHNOLOGIES FOR ENHANCED OIL RECOVERY
• Thermal methods
• Polymer flooding
• Gas and water-and-gas methods
• Development of gel, viscoelastic, sediment-forming composition systems for injection redistribution
• Non-stationary flooding

JSC VNIINEFT
(Moscow)
The institute’s main aim is to increase the efficiency of field development and to develop competitive advantages by using technologies on the Group’s assets.

SCIENTIFIC TECHNICAL CENTERS

ZARUBEZHNEFT PROJECTS AND LOCATIONS

ACHIEVEMENTS IN GEOLOGY AND DEVELOPMENT
JSC GIPROVOSTOKNEFT (Samara)

JSC Giprovostokneft is a leading integrated institute for scientific research and project surveys in the Russian oil sector. The institute joined the Zarubezhneft JSC group of companies in 2004.

SCIENTIFIC TECHNICAL CENTERS

DESIGN OF FACILITIES AND SURVEYS
- Facilities for fields construction
- Facilities for oil treatment
- Gas treatment plants
- Main pipeline transport facilities
- Environmental safety

DRILLING ENGINEERING
- Drilling design
- Improvement of drilling technologies
- Monitoring of construction and recovery of wells

LABORATORY RESEARCH
- Core and formation oil research
- Control of quality indicators of oil industry and formation wastewater
- Survey of the chemical composition of sediments and scaling
- Soil and water analyses

EXPLORATION
MODERN SEISMIC EXPLORATION TECHNOLOGIES

WIDE AZIMUTH 4-COMPONENT 3D SEISMIC SURVEYS WITH GROUND REGISTERS
Block 09-1 (offshore, Vietnam, 2015)

BROAD BAND OFFSHORE 3D SEISMIC ACQUISITION
Block 12/11 (offshore, Vietnam, 2013)

SOLUTION OF KEY CHALLENGES
• Ascertaining geological construction of small-scale, low-amplitude structures, searching for non-structured traps
• Forecasting of zones with increased filtration capacities in sections of terrigenous rocks and zones with increased basement fracturing and fluid saturation
• Quality of acquired results (seismic and technological challenges)

MODERN TECHNOLOGY FOR INTERPRETATION OF RESULTS FROM SEISMIC TOMOGRAPHY ATTRIBUTIVE ANALYSIS

RESULTS OF ATTRIBUTIVE SEISMIC ANALYSIS AT NORTH KOHSEDAYU FIELD
(Nenets Autonomous Region, Russian Federation)

FORECASTING FRACTURING AND RESERVOIR PROPERTIES BASED ON SEISMIC EXPLORATION RESULTS

847 km² of offshore seismic acquisition in 2015
50 km² of onshore seismic acquisition in 2015

847 km² of offshore seismic acquisition in 2015
50 km² of onshore seismic acquisition in 2015

Narrow Azimuth
Wide Azimuth

Porosity forecast
Coherency cube analysis
Fracturing intensity forecast
AFE analysis

EXPLORATION ACHIEVEMENTS IN GEOLOGY AND DEVELOPMENT

12

13
INTEGRATION OF DATA DURING INCEPTION OF PROSPECTING AND EXPLORATION DRILLING

Example of identification of paleo-channels by 3D seismic survey at North Khosedayu field

Example of integration of seismic data with wells logging and inversion results at Beluga field

COMMERCIAL DISCOVERY – BELUGA FIELD
ST-3X WELL
(Beluga field)

- Four prospects tested, total oil free flow over 2,000 tons/day
- One prospect is under testing
- Oil saturated thickness - over 100 m
- 2017 – start of field development

7 exploration wells in 2015
100% success of prospecting and exploration drilling in 2015

PROSPECT IV Lower Miocene
2,670–2,675 m
\( \text{Ø pc.} = 6.35 \text{ mm} \)
Oil flow rate = 1.78 thousand m³/day
Gas flow rate = 1.78 thousand m³/day

Prospect III Lower Miocene
2,974–2,980 m
\( \text{Ø pc.} = 9.5 \text{ mm} \)
Oil flow rate = 58.3 m³/day
Gas flow rate = 1.78 thousand m³/day

Prospect II Lower Miocene
2,573–2,580 m
\( \text{Ø pc.} = 9.5 \text{ mm} \)
Oil flow rate = 30.3 m³/day
Gas flow rate = 109 thousand m³/day

Prospect I Upper Oligocene
3,573–3,720 m
\( \text{Ø pc.} = 25.4 \text{ mm} \)
Oil flow rate = 1.379 m³/day
Gas flow rate = 109 thousand m³/day

Prospect III* Lower Miocene
2,740.5–2,817 m
\( \text{Ø pc.} = 19.05 \text{ mm} \)
Oil flow rate = 30.3 m³/day
Gas flow rate = 31 thousand m³/day

GEOLOGY AND DEVELOPMENT
CENTER FOR ANALYTICAL AND SPECIAL CORE RESEARCH:
• Standard core research: porosity, permeability, oil and water saturation, pore-size distribution, characteristics of saturation distribution of oil-water contact
• Special core research: relative permeability during two and three-phase filtration; oil for water, gas and various chemical agents displacement factor
• Unique core research: core orientation relative to earth’s magnetic poles, evaluation of anisotropy of permeability and strained condition of rock collector on core orientation

FLUID FORMATION RESEARCH CENTER:
• Standard research of deep and surface testing of fluid formations
• Research (experimental and analytical) of fluid formations with abnormal properties and structures, and those occurring in abnormal conditions
• Research of oil deposits with high levels of paraffins, tars, asphaltenes, sulphur and rare metal compounds
• Studying the effect of heavy oil deposits on development and oil production processes

JSC VNIINEFT’S LABORATORY RESEARCH BASE

GEOLOGICAL STUDY AND CHARACTERISTICS OF CARBONATE RESERVOIRS

SHARE OF ZARUBEZHNEFT JSC RESERVES IN CARBONATE COLLECTORS*, %

- Carbonates: 47%
- Carbonates: 42%

SHARE OF PRODUCTION BY ZARUBEZHNEFT JSC FROM CARBONATE COLLECTORS*, %

- Carbonates: 42%

* Share of current extractable reserves of category 2P based on the results of an assessment by D&M for 2014 (of the company’s share)

* Share of average daily production for 2014 (of the company’s share)
Modern hydrodynamic simulators are used for the modeling of flow processes during development of oil and gas formations, including “complex” hydrodynamic modeling:

INTERSECT HIGH-RESOLUTION RESERVOIR SIMULATOR

• for modeling of large fields with minimization of upscaling

STARS – THERMAL & ADVANCED PROCESSES RESERVOIR SIMULATOR

• Intra-formation combustion and thermal gas treatment
• Water-and-gas treatment
• Steam treatment
• Polymer flooding
• Composition modeling
• Non-isomer modeling with chemical transformations

GEOLOGICAL SUPPORT OF HORIZONTAL WELL DRILLING

11% of wells had “complex” design in 2015

290 m effective drilling of formation

WELL DRILLING IN 2014-2015

2014 2015
66 72
72 86

• Selection of well structures based on geological and technological conditions
• Focus on complexity of structures of new wells to increase their productivity and oil extraction coefficient
• Geological support for installation of horizontal wells with correction ofshaft trajectory in real-time

2.2 times higher coefficient of well productivity compared to surroundings
ORGANIZATION OF PRESSURE MAINTENANCE SYSTEMS AT CENTRAL DRAGON (SRV) FIELD TERRIGENOUS RESERVOIRS

CHALLENGES
- Imbalanced system of development
- Inefficient pressure maintenance system
- Low displacement coverage and oil recovery factor
- Multiformation deposit with one terrigenous and several carbonate formations
- Arrangement of dual injections in the lower carbonate formations and the terrigenous formation
- Carrying out selective acid treatment of carbonate formations for leveling the injectivity profile

SOLUTION
- Detailed geological modeling
- Implementation of competencies for optimizing the development system, creating sections that apply independent technologies for flooding management

2 times
Increase in daily oil production

2.2 times
Increase in assessment of end oil recovery factor

INJECTION WELL NO. 31

<table>
<thead>
<tr>
<th></th>
<th>Injectivity before treatment, %</th>
<th>Injectivity after treatment, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z11</td>
<td>70</td>
<td>22</td>
</tr>
<tr>
<td>Z12</td>
<td>30</td>
<td>43</td>
</tr>
<tr>
<td>Df</td>
<td>0</td>
<td>35</td>
</tr>
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GEOLOGY AND DEVELOPMENT

ACHIEVEMENTS IN GEOLOGY AND DEVELOPMENT

FLOODING MANAGEMENT. OPTIMIZATION OF EXISTING PRESSURE MAINTENANCE SYSTEMS

+30% daily oil production

25 thousand tons of additional oil production

2 times increase in daily oil production

2.2 times increase in assessment of end oil recovery factor
Laboratory research of geomechanical properties of rocks using field cores
Selection of core/borehole survey correlations (acoustic methods) for ascertaining geomechanical properties of potential well boreholes
Selecting composition of acid components of field cores based on properties of oil and water formations
Carrying out acid hydraulic fracturing

Selection of potential wells based on the geological and development history of the field, and the results of potential wells operation
Construction of designs for carrying out hydraulic fracturing and assessment of potential growth

For deeper formation penetration of acid, a reaction inhibition is used by adding weak, organic acids, which lowers the rate of the reaction by 2-6 times
A single-atom alcohol (isopropyl alcohol) is used for leveling the frontal advancement of the acid composition in the formation and for a more complete removal of waste solution from the formation
Testing the acid composition for compatibility with formation oil (emulsifiability) and formation water (loss of insoluble precipitates) by adding, as necessary, extra additives (especially Fe³⁺ stabilizers) - prevention of secondary clogging and achieving minimal possibility of secondary sedimentation
Ascertaining the corrosion activity of the acid component by adding inhibitors (as necessary)
Testing of the obtained acid composition on field cores and comparison with standard acids

ACID HYDRAULIC FRACTURING IN CARBONATE RESERVOIRS

Selection of potential wells based on the geological and development history of the field, and the results of potential wells operation
Construction of designs for carrying out hydraulic fracturing and assessment of potential growth

SELECTION OF ACID COMPOSITIONS FOR BOTTOMHOLE TREATMENT IN CARBONATE COLLECTORS

For deeper formation penetration of acid, a reaction inhibition is used by adding weak, organic acids, which lowers the rate of the reaction by 2-6 times
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Testing of the obtained acid composition on field cores and comparison with standard acids

10 acid hydraulic fracturing operations during winter season 2015 by JC Rusvietpetro LLC

INCREASING THE EFFICIENCY OF ACID TREATMENTS
REMEDIAL CEMENTING/ISOLATION AND REPAIR WORK AT FRACTURED CARBONATE COLLECTORS

SUCCESSFUL TECHNOLOGIES

ISOLATION BY MECHANICALLY USING WATER CUT INTERVALS
- Installation of explosive/drillable packer
- Dual-packer installation

ISOLATION BY INTEGRATED CHEMICAL COMPOSITIONS
- Gel-forming components on non-organic base (liquid glass, polyacrylamide)
- Adjustable organically based components (silicone polymers)

WORKFLOW FOR SELECTION AND CARRYING OUT INSULATING REPAIR WORK

SELECTION OF TEST PROSPECT
GEOLICAL ANALYSIS
ANALYSIS OF WELL OPERATIONS
SELECTION OF REMEDIAL CEMENTING TECHNOLOGIES
ANALYSIS OF RESULTS
REMEDIAL CEMENTING PERFORMANCE
LABORATORY RESEARCH

SELECTION OF TEST PROSPECT

GEOLOGICAL ANALYSIS

ANALYSIS OF WELL OPERATIONS

SELECTION OF REMEDIAL CEMENTING TECHNOLOGIES

ANALYSIS OF RESULTS

REMEDIAL CEMENTING PERFORMANCE

LABORATORY RESEARCH

OIL PRODUCTION RATE, thou-tonnes

WATER CUT, %

Before isolation repair work
After isolation repair work

409 tons/day
Total additional daily production in 2015

91% efficiency of remedial cementing works in 2015

GEOLOGY AND DEVELOPMENT

ACHIEVEMENTS IN GEOLOGY AND DEVELOPMENT
82% economic efficiency of technical geological operations in 2015 in decreased oil prices environment

>1.2 million tons additional production in 2015
INTEGRATED DESIGN (NESTROWAY)

INTEGRATED MODEL

FORMATION MODEL
- Results of hydro-dynamic model (Eclipse)
- Integrated proxy model
- Business plan for gas and oil production (Excel)

WELL MODEL
- Well design
- Proxy model for artificial-lift production (including gas lift)

MODEL OF SURFACE INFRASTRUCTURE
- Hydraulic model of pipeline transportation
- Material balance of area facilities
- Energy proxy models

ECONOMIC MODEL
- Economic model (results for any facility/any group of facilities)

WELL MODEL
- Well design
- Proxy model for artificial-lift production (including gas lift)

MODEL OF SURFACE INFRASTRUCTURE
- Hydraulic model of pipeline transportation
- Material balance of area facilities
- Energy proxy models

ECONOMIC MODEL
- Economic model (results for any facility/any group of facilities)

OCCUPRIN Model
- Designation of «BOTTLE-NECKS»
- Optimization of production
- Engineering solutions
- Automated algorithms for optimizing site facilities and pipelines
- Integrated understanding of system and concepts for asset development
- Re-engineering of "OLD" assets
- Minimization of operating and capital expenses (OPEX/CAPEX)
- Analysis of risks and uncertainties

OPPORTUNITIES

FUNCTIONAL, SMART AND EFFICIENT ASSET MANAGEMENT
- Minimum of operating and capital expenses (OPEX/CAPEX)
- Analysis of risks and uncertainties

INTEGRATED PROJECTS OF THE COMPANY’S MAIN PRODUCTION ASSETS
- Vietsovpetro J.V.
- JC RUSVIETPETRO LLC
- Integrated modeling

INTEGRATED MODELING FOR ASSESSMENT
- Conceptual modeling at the stage of assessment of acquired assets in early stages of development
- Multi-option calculations of production and construction of fields for selecting optimal solutions and rated plateau for production

INTEGRATED DESIGN FROM FORMATIONS TO ULTIMATE PRODUCTION FACILITY, INCLUDING ECONOMIC CONSIDERATIONS
OBJECTIVE

- Assessment of opportunities for commercial exploitation and developing steam injection technologies
- Pilot cyclic steam injection works in carbonate formations are being implemented
- Depth of formation stratification 600–1,200 m
- Development of formations is complicated by the presence of hydrophobic matrices and high-penetration fracturing, high-viscosity oil containing significant quantities of tar and asphaltenes, and by low formation pressure

PILOT EOR PROJECTS. STEAM TREATMENT. BOCA DE JARUCO (REPUBLIC OF CUBA)
PLANS
• Conducting additional laboratory experiments and ascertaining the models of chemical transformations occurring in the formation, taking into account the results of actual operation
• Registration of patents for thermal gas method of treatment based on results of experimental industrial development

EXPECTED RESULTS OF PROJECT
• Increased oil production of current project
• Development of competencies, development of reliable technologies for design and implementation of similar projects
• Application of thermal gas treatment in prospective projects in the case of appropriate geological and physical conditions

PROJECT STATUS
• July 11, 2014 – putting the formation air injection compressor station at Vishanskoe field into operation
• October-December 2014 – growth in gas factor and occurrence of CO₂ in products of exploitation wells (self-combusting oil in the formation)
• 2015 – growth in well production of experimental oil plot 1.5-2 times compared with the start of operations (July 19, 2014)

VISHANSKOE FIELD
(Republic of Belarus)

PILOT EOR PROJECTS
THERMOGAS TREATMENT

PILOT EOR PROJECTS
INJECTION OF SMART WATER

PLAN EOR PROJECTS
INJECTION OF SMART WATER

VISOVOE FIELD
(Nenets Autonomous Region, Russian Federation)

PLANS
• Analysis of results of industrial testing operations
• Corrections to technology and schematics of conducting operations based on the results of industrial testing operations

EXPECTED RESULTS OF PROJECT
• Lowering of water-cut, increased oil production index
• Development of competencies, development of reliable technologies for design and implementation of similar projects
• Replication of project at the Company’s carbonate fields

PROJECT STATUS
• 2014 – laboratory research conducted (together with the University of Stavanger), establishing the design of pilot operations
• February-August 2015 – conducting experimental injections of smart water into well 2206 of Visovoe field
• September-December 2015 – launch of well 2206 operations, tracking results

PLAN EOR PROJECTS
THERMOGAS TREATMENT

VISHANSKOE FIELD
(Republic of Belarus)
THERMAL METHODS
- In differentiated high pressure scanning calorimeter (DSC) HP DSC1, and in thermochemical reactor (activation energy, reaction order, pre-exponential multiplier, enthalpy, etc.)
- Modeling of processes for virtual direct combustion in the “combustion pipe”

POLYMER FLOODING, GAS AND STEAM METHODS
- Modeling of polymer flooding in porous environment, including significantly heterogeneous and fractured formations
- Modeling of multi-phase filtration with use of core holders, producing filtration processes on original rock samples from fields, and also conducting quality filtration research on bulk formation models
- Experimental research on steam treatment carried out on modernized filtration installation at temperatures of up to 300°C and pressure up to 35 MPa

GEOLOGICAL EXPLORATION
- Modeling oil and gas systems
- Increase in information content of seismic operations in the field
- Increase in quality and information content of interpretation of seismic tomography

INCREASE IN QUALITY OF NEW DATA AND LABORATORY RESEARCH
- Preparation of carbonate hydrophobic core for laboratory research (“ageing” of core, etc.)
- Interpretation of BHI data (micro-imager) for fractured carbonate reservoir
- Assessment of impact of heavy oil components on hydrophobic carbonates
- Ascertaining saturation in low-resistance terrigenous reservoirs with borehole surveys

GEOLOGICAL AND HYDRODYNAMIC MODELING
- Geological modeling of fractured reservoirs
- Ascertaining phase saturation of fractured reservoirs
- “Complex” hydrodynamic modeling

METHODS FOR STIMULATION OF OIL PRODUCTION AND RESERVOIR RECOVERY
- Selection of acid components for stimulation and conducting acid hydraulic fracturing
- Injection of ionically modified water
- ASP-flooding
- Steam treatment
- Thermal gas treatment

IT SOLUTIONS
- Collection and analysis of commercial geological information
- Analytical solutions in development
- Integrated design
SCHLUMBERGER
• Geologic and mechanical properties of carbonate formations
• Methodology for hydrodynamic modeling

BEICIPFRANLAB
• Description and research of carbonate formation cores
• Geological modeling of carbonate formations

UNIVERSITY OF STAVANGER
• Injection of ionic modified water (Smart Water) into carbonate formations

I.M. GUBKIN RUSSIAN STATE UNIVERSITY OF OIL AND GAS
• EOR methods
• Educational programs

M.V. LOMONOSOV MOSCOW STATE UNIVERSITY
• Modeling of petroleum systems

MOSCOW PHYSICS AND TECHNICAL INSTITUTE
• Methods for hydrodynamic modeling

KAZAN (VOLGA REGION) FEDERAL UNIVERSITY
• Interbedding combustion and thermal gas methods for enhanced oil recovery

COOPERATION WITH SCIENTIFIC ORGANIZATIONS AND UNIVERSITIES
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