CLUSTER APPROACH • MESHCHERIN INDEX •

HIMMASH APPARAT

BUSINESS MAGAZINE

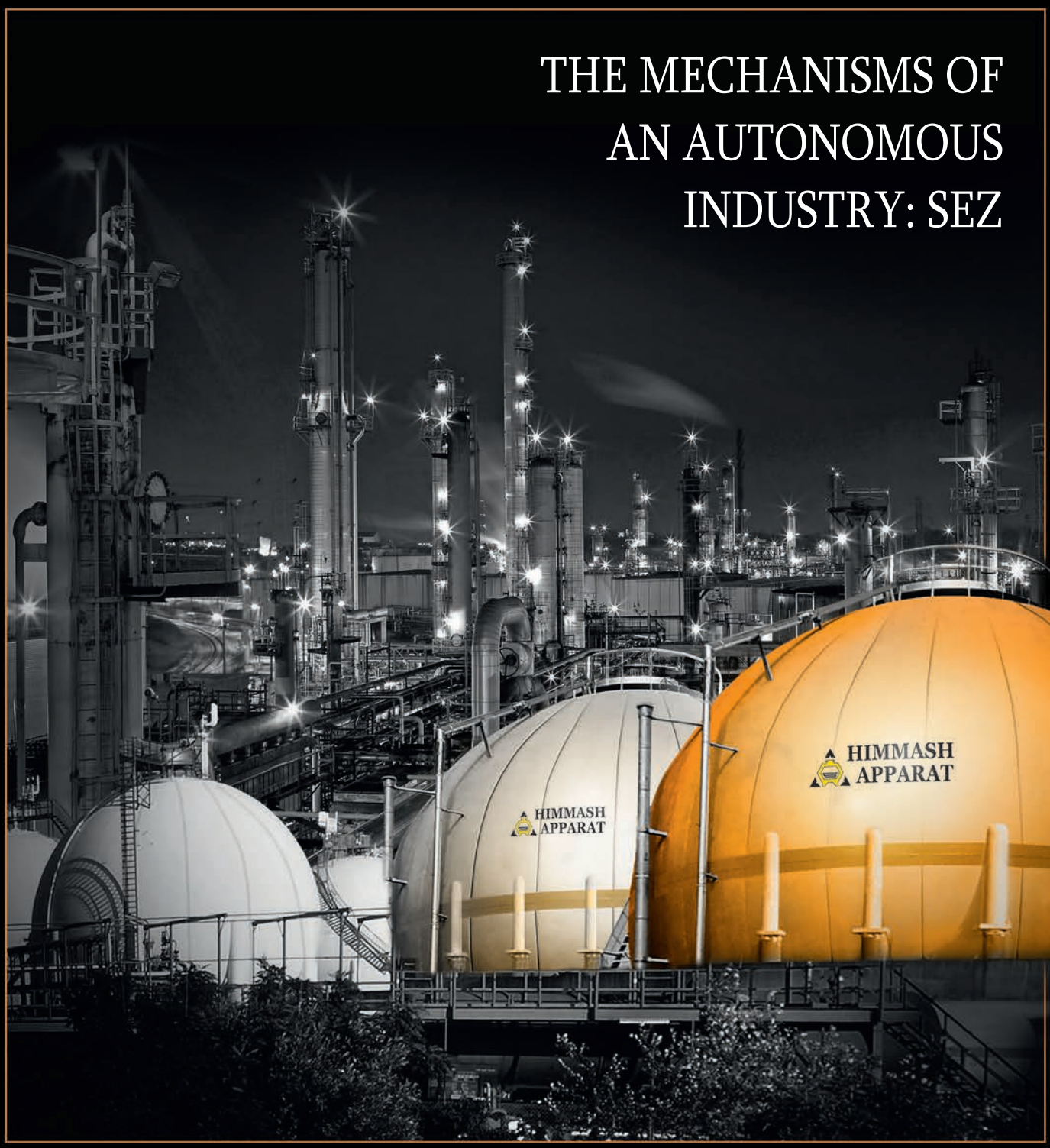
Neftegaz.RU

ISSN 2410-3837

SIMPLE ABOUT SERIOUS

4 [88] 2019

THE MECHANISMS OF AN AUTONOMOUS INDUSTRY: SEZ



Included in the list of VAC

Caméo

MOSCOW VILLAS

Hidden in the very center

+7 495 54 54 334

cameo-villas.ru

Deluxe villas at “Mayakovskaya” metro station in Moscow

17 villas
230-445 m²

Private
patios

Picturesque garden
and park

Closed area
0,55 hectar

Terraces at the
highest floor

Personal
elevator

Caméo is inspired by the high-class New York and London lifestyle and also by the architectural style of Tuscany residences. This unique combination turns into the completely new concept of Moscow Villas.

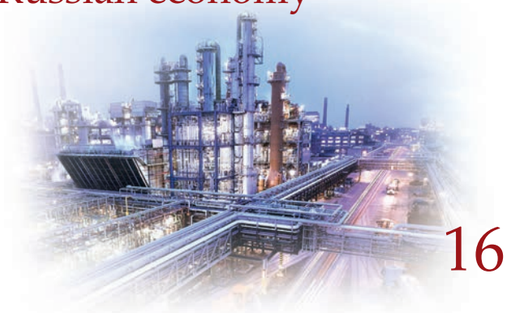
DEVELOPER STONE HEDGE

MARKET LAUNCH IS IN THE NEAR FUTURE
By the present time, the developer is the only one who supports the project by his own funds.
Investments from the other companies are not attracted.
The website of the developer: apartproekt.ru

Clustering a la russe

12

Growth points of the Russian economy



16

CONTENT

The mechanisms of an autonomous industry: SEZ

20

Cluster approach

30

The raw blood of economy

34

The potential of the Russian chemical industry

40

On the way to technological independence

42

Meshcherin Index

46

OIL AND GAS INDUSTRY EPOCHS

2219 years ago

In 200 BC China has drilled the first wells for gas production, which was used for lighting and heating.

323 years ago

In 1696, “amusing fireworks” were displayed in Moscow behind the Sretensky Gate. This required about one third of the pud (16 kg) of oil, which was purchased at a price of 10 kopecks per pound.

196 years ago

In 1823, an oil refining plant was built near Mozdok. The Dubinins brothers oil refining installation was made in the form of an iron cube with a copper lid.

165 years ago

In 1854, the first oil refinery was built in France.

160 years ago

In 1859, a steam engine was used to drill wells near Podolsk, thus drilling was mechanized for the first time.

154 years ago

In 1865, in Astrakhan a merchant F. Smolyaninov launched production of lubricants made from oil residues.

128 years ago

In 1891, a Russian engineer V.G. Shukhov patented the method of thermal cracking – a high-temperature processing of hydrocarbons.

87 years ago

In 1932, in the USSR rubber was synthesized on a large industrial scale.

86 years ago

In 1933, ethylene was first processed into polyethylene.

52 years ago

In 1967, the Medvezhye gas field was discovered, which became the first field where oil is produced in permafrost conditions.

Neftegaz.RU

Publishing house Neftegaz.RU

EDITORIAL OFFICE

Editor-in-Chief
Olga Bakhtina

Managing editor
Anna Pavlikhina

Editor
Anastasia Nikitina

Executive editor
Alla Yudina

Analysts
Arthur Gaiger
Maria Gulyaeva

Journalists
Anna Ignatieva
Elena Alifirova
Denis Savosin
Nikolay Zhabin
Sergey Shcherbakov

Design and layout
Elena Valetova

Proof-reader
Victor Blokhin

Editorial board
Ampilov Yu.P.
Alunov A.N.
Galiulin R.V.
Gritsenko A.I.
Gusev Yu.P.
Danilov A.M.
Danilov-Danilyan V.I.
Zagrivny E.A.
Makarov A.A.
Mastepanov A.M.
Salygin V.I.
Tretyak A.Ya.

Neftegaz.RU

Publisher:
Neftegaz.RU Information Agency LLC

Director
Olga Bakhtina

Advertising department
Dmitry Averyanov
Denis Davydov
Ekaterina Romanova
Olga Shcherbakova
Yulia Kosygina
Yulia Nerush
Valentina Gorbunova
Nikita Danchenko
pr@neftegaz.ru
Tel.: +7 (495) 650-14-82

Representative in the European Union
Victoria Gaiger

Customer service
Yulia Smirnova
Aleksandra Milyutina

Exhibitions, conferences, distribution
Tatyana Petrova

Technical support
Andrey Vereykin
Sergey Pribytkin

Neftegaz.RU business magazine registered by the Federal Service for Supervision in the Sphere of Mass Communications, Communications and Protection of Cultural Heritage in 2007, certificate of registration ПИ No.ФС77-46285

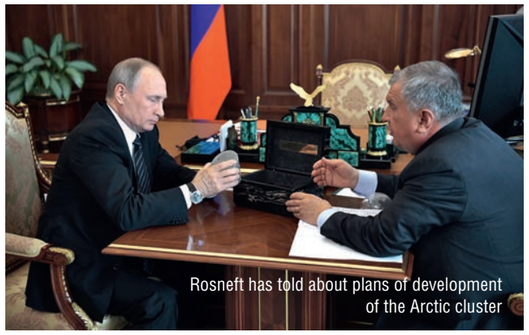
Editorial office address:
127006, Moscow, Tverskaya str., 18, building 1, office 812
Tel. (495) 650-14-82, 694-39-24
www.neftegaz.ru
e-mail: info@neftegaz.ru

Subscription index
МАП11407

Printed in the printing house "MEDIACOLOR"

Claimed circulation 8,000 copies

9 772410 383004


Rosneft has told about plans of development of the Arctic cluster


Defense industry enterprises will produce equipment for the oil industry

WHY DOES A COUNTRY NEED OIL?

Anna Pavlikhina

The question is rhetorical due to the obvious answer to it, but to synchronize understanding, let's answer: oil, like other minerals, is needed to process, sell, pay taxes and thus improve the welfare of citizens. In our further reasoning, just like before, we will rely on this postulate.

In early April, the head of Rosneft met with the Russian President and told that the company was considering the possibility of creating an Arctic cluster. According to the idea it should include Vankorskoye, Suzunskoye, Tagulskoye, Lodochnoye fields, Southern Taimyr and West Erginsky area. This grandiose project by 2030 should provide oil production up to 100 million tons per year. Of course, this concentration of resources will not leave investors indifferent. According to I. Sechin they are already coming from the west and east. The topic of the cluster was touched upon in a conversation with the president for a reason: describing all the attractive moments, the head of Rosneft asked to create favorable conditions for investors, which are likely to include tax incentives.

Thus, deposits already producing incomes are protected by the cluster from full taxation. An 11-year period is not such a long time, but during this time the budget will not receive adequate revenue. And in case of shortage in the budget, we know what happens.

For example, the government is considering the use of NWF funds as an option to compensate for the loss of revenues from paying oil companies for the supply of fuel to the domestic market. However, there is a small probability that they will take one of alternative ways which involve raising excise duties on fuel oil and medium distillates, or increasing MET. Concerning the last A. Novak reported that he considers it inexpedient to increase that in order to compensate the damper.

The search for new taxes is fascinating, and given the series of expensive projects - necessary. In early April, the Ministry of Finance published a draft of amendments to the tax code, according to which it is proposed to introduce new chapters: environmental tax, recycling tax, road user levy, telecom operator tax and hotel fee. So if you think that such projects as the Arctic cluster do not personally concern you, we recommend to reconsider your point of view, as almost all of us use roads and communication services, and the operators will easily find how to compensate for the additional tax burden.

The Ministry of Finance has published a draft amendments to the tax code


Irkutsk region gasified by 8.1%

Awareness of this sharply discords with information recently received by the Ministry of Natural Resources who estimated mineral resources in value terms. It turned out that the cost of oil reserves amounted to 39.6 trillion rubles, gas – 11.3 trillion rubles, coking coal – almost 2 trillion rubles, iron ore – 808 billion rubles, diamonds – 505 billion rubles, gold – 480 billion rubles. Experts argue that the formula of calculation was not quite correct, but the sense of joy does not become less from the realization of the territories where we live due to the efforts of gods and ancestors.

Once again, Gazprom makes it possible to be clear about it; in 2018 they produced 497.6 billion m3 of gas, which is 5.7% more than in 2017. In the report to the president A. Miller proudly told that new gas transmission capacity has been created for the transportation of gas from Yamal, and the Power of Siberia works are ahead of schedule and on December 1, 2019 the deliveries to China will start. TurkStream will also be put into operation in 2019.

In terms of figures inside the country, the picture is different: as of January 1, 2019, the gasification indicator on the average of the country was 68.6%. But this is not a uniform distribution. For example, the level of gasification of the Irkutsk region is 8.1 percent. The issue was already raised at the federal level, but then postponed, at least until the end of 2019. In general it is typical of Russia to have slogans like "we'll be on short commons, but we will sell", therefore a great gas power which has places absolutely without gas is not a new phenomenon. To focus on the main idea a little more let us give another example. It turns out (for residents of the capital it is something new, and for the rest of the country it is a daily reality), 22.6% of the population of Russia has no access to a centralized sewerage. As for the inhabitants of rural areas, 66.5% of Russians live without access to centralized sewerage. In terms of urban population without access to safe and private toilets, Russia ranks fifth after India, China, Nigeria and Indonesia.

And now again, let's go back to incentives. Sanctions have restricted the access of Russian companies to European technologies. The way out was found in the enterprises of the military-industrial complex which will produce equipment for the oil industry. Competitiveness will be the main requirement for localized equipment. But the companies of fuel and energy complex are not very optimistic. Some are concerned by the lack of service units at the defense industry enterprises, because nobody will buy the equipment without any support service, others doubt the quality of work. So, they are asking to make the fracking fleet "normal, as abroad", instead of the form of a military tank. According to the Vice Prime Minister, the government is ready to support the defense enterprises with large-scale tax incentives.

Without governmental support, large-scale projects are extremely difficult to implement, and it is not fair, because in the end of the day the taxes go to the state budget. And, of course, it is worth supporting projects that will bring the greatest profit. But we should not forget the ultimate goal of these oil and financial flows, we are convinced that the well-being of the population of the country should be considered as such.

TAX MANEUVER TO BE ADJUSTED?

Nikolay Zhabin

The government is to consider the need to adjust the tax maneuver in the oil industry. They will be trying to avoid any manual control of oil products prices.

As D. Kozak declared, "In the coming days, we will once again check how the tax maneuver is working in the oil industry, and the mechanisms that were planned to keep the price level in small wholesale and retail. We will try to do everything in case there is an objective need to slightly adjust something". He noted that it was not related to any fundamental changes. "We will try to retreat from manual price control through agreements", said the deputy chairman of the government of the Russian Federation.

This includes the adjustment of the damping mechanism, as it does not cope with the functions assigned to it. The fact that the mechanism needed to be adjusted was reported in early March 2019 by the Minister of Energy A. Novak. On 12 March 2019, LUKOIL also proposed to the government to change the current damping mechanism, as it simply did not work in January 2019.

The tax maneuver in the oil industry should be completed by 2024. As part of this maneuver, oil export duty will be zeroed while the mineral extraction tax (MET) will be increasing. The completion of the tax maneuver began in January 1, 2019; excise duties for gas and diesel fuel increased by 1/3, VAT – by 2%.

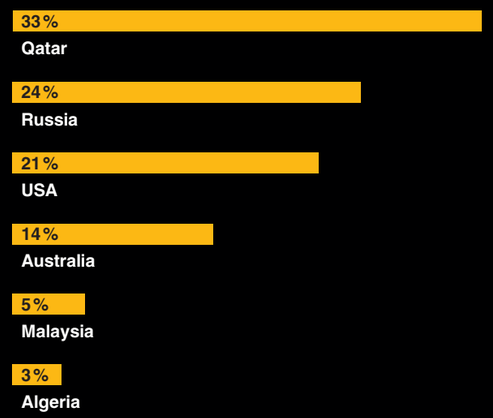
MET growth and oil export duties reduction may lead to an increase in domestic prices resulting in oil production costs growth.

To keep domestic fuel prices down, the tax maneuver provides damping mechanisms including a reverse excise duty for the oil coming to refineries for processing. The government will reimburse companies for the difference between the fixed benchmark price and the higher export price for the fuel. ●

Neftegaz.RU ratings

The global market for liquefied natural gas (LNG) grew by 8.3% in 2018. Who will be the top LNG exporter in the coming years?

Which country will be the top LNG supplier in the next 5 years?



The government is looking for a way to compensate for 190 billion rubles shortfall in budget revenues coming from increasing compensation to oil companies for fuel supply to the domestic market. Where will they get the money?

Where should the government get the money to cover oil companies incentives?

Oil prices
Presidential elections
Duty abolition
Increase in production capacity
Gas wars
Nord Stream
The new head of "Gazprom"
Stock market crash
Launch of new production

Nizhnekamskneftekhim produced 18 M tons of ethylene

A 18-millionth ton of ethylene has been obtained at Nizhnekamskneftekhim since the start of this production in 1976.

Today, the plant capacity is 616 ths. t/year of ethylene.

This was achieved with the introduction of two new SRT-VI type pyrolysis furnaces in 2018. They replaced the outdated and mouldy SRT-II type furnaces, from which the history of the plant began. Among the advantages of new equipment are performance and environmental safety. The implementation of this project allowed to increase the reliability of furnace block, as well as reduce the amount of flue-gas emissions into the atmosphere. In December 2018, the plant completed the start-up operations at the benzene extraction and recovery unit, and by March 2019 it reached its design capacity.

Ethylene is the most important component of many factories not only at Nizhnekamskneftekhim, it is also transported via a pipeline to Kazan city and Bashkortostan.

D. Medvedev announced the investment in Amur GPP

Russian Prime Minister D. Medvedev announced plans to finance the Amur GPP construction project, which is to become the world's largest helium production plant and the second largest in gas processing.

The new business model of the State Development Corporation VEB.RF was approved at the end of 2018.

D. Medvedev said that the project budget is very large – about 19 B euros. One third of these funds are invested by Gazprom, the rest should be provided by a pool of Russian, Chinese and European lenders, the share of VEB is 1.5 B euros. Amur GPP will be built on the territory of the Amur region – Svobodny Advanced Development Zone. The plant will provide the required quality of methane, which is supplied from the fields in Eastern Siberia via the main gas pipeline Power of Siberia, and the processing of natural gas into high value-added products.

6 process lines with a total capacity of 42 B m^3/year of gas will be build within the framework of the project. The launch of the first stage is scheduled for 2021.

Kazanorgsintez will create import-substituting PE

From April 2019, Kazanorgsintez will begin industrial production of metallocene linear low density polyethylene (LLDPE). Until now, polyethylene processors had to use only foreign brands of this product.

The introduction of domestic brands to the market will reduce the shortage of metallocene products and make them available to a wide range of polymer processors.

This PE is currently one of the most in-demand. Its use in the plastic products production gives a huge economic effect: polymer consumption in the manufacture of the same volumes of final product decreases, the weight of products decreases and its strength increases.

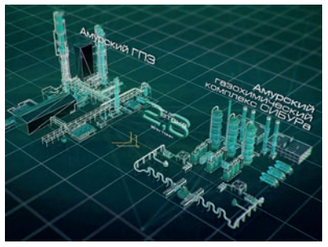
Metallocene linear polyethylene is used for stretch films production, stretch hood films, high-strength general purpose films, lamination films, agricultural films, also used alone or as an additive to other types of polyethylene.

Currently, Kazanorgsintez has already started a dialogue with the largest processors on trial supplies.

NGL: to be or not to be
Nord Stream built
Reached his hands up in the Arctic
Stock market crash
The second wave of crisis
Gas prices
Boguchany HPP launched
Russia has joined the WTO

Will Amur Gas Chemical Complex (GCC) be more 50 % powerful?

SIBUR may increase the capacity of Amur GCC for processing of LPG from the Amur GPP by 50 %, if the government introduces a reverse excise tax on liquefied petroleum gases, and Gazprom agrees to



supply raw materials from the Amur GPP. SIBUR is already negotiating with Gazprom, which is quite constructive mood. In 2018, the companies signed a contract for the supply of raw materials for 20 years.

The SIBUR project, which is scheduled to start in 2024, involves processing 1.5 M t/year of ethylene and can be expanded to 500 ths. t/year of ethylene and about the same amount of propylene, depending on how much volume will be agreed on with Gazprom.

A possible change in the configuration of GCC will not affect the timing of final investment decision, which is expected before the end of 2019. The company is simultaneously working out with the pyrolysis licensors two configurations of the complex – only on ethane or on ethane and LPG.

The current value of the Amur GCC is estimated at 7–8 B US dollars. Now SIBUR observes what position the government will take on the negative excise tax for LPG.

The first cryopump test bench in Russia

Rosatom has created the first in Russia cryogenic pump test bench for LNG projects. As expected, it will allow to test the entire line of cryogenic pumps for medium-tonnage LNG and ship systems of Russian and foreign projects. The bench was created in St. Petersburg, on the basis

of NIIEFA (D.V. Efremov Institute of Electrophysical Apparatus), a Rosatom enterprise, on the order of Afrikantov OKBM. The available capabilities of the bench allow for acceptance and certification testing of LNG pumps in liquid nitrogen medium.

During the tests, all necessary characteristics of the pumps are monitored: noise and vibration levels, flow rate and pump head, power consumption, positive suction head.

Launching the bench at NIIEFA allows to provide the necessary equipment tests for these projects.

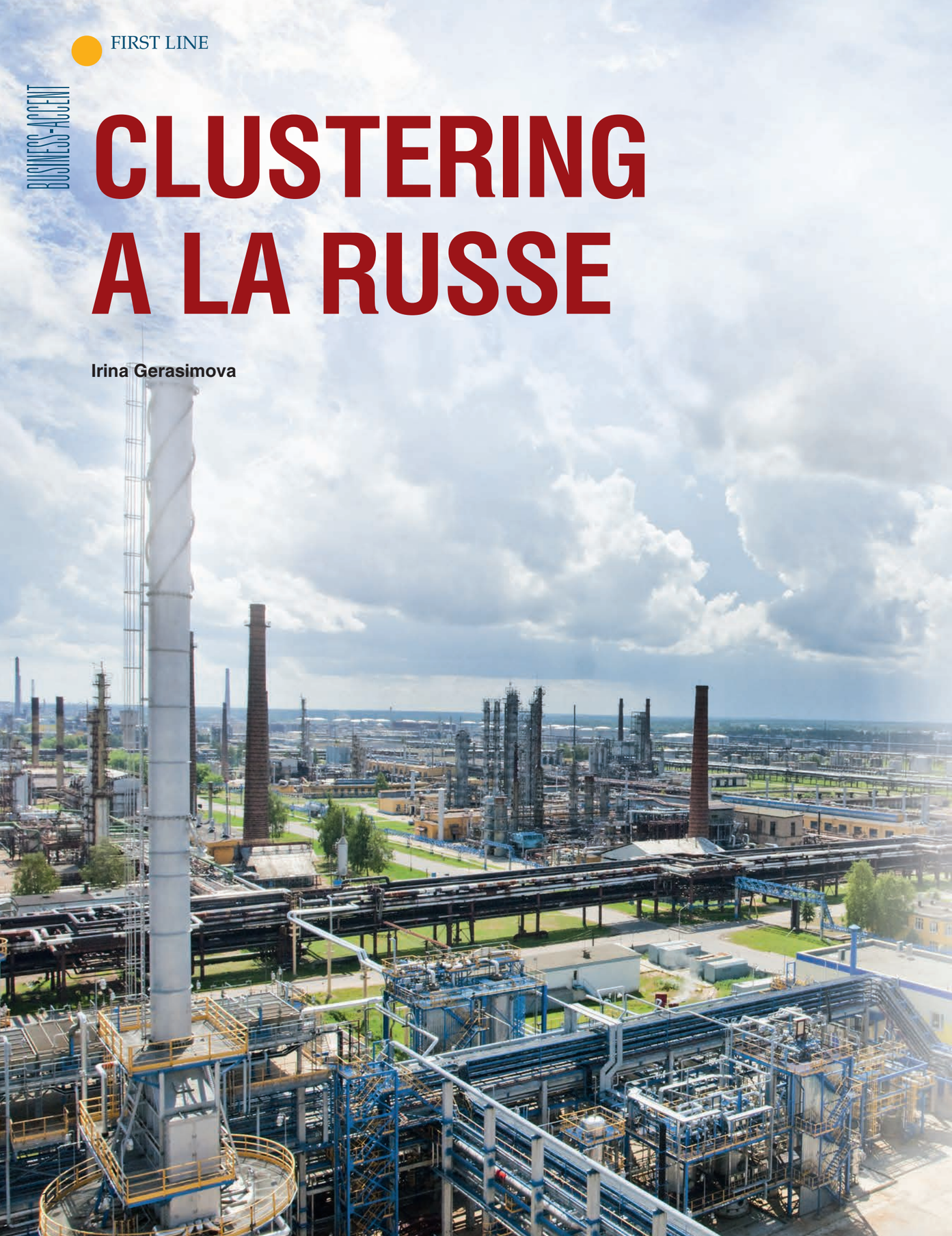
ZapSibNeftekhim obtained the first granules of PP

The first pellets of the product were obtained on the ZapSibNeftekhim's polypropylene (PP) unit. Progress in the construction of a polypropylene unit within the framework of construction of ZapSibNeftekhim raw hydrocarbons deep conversion complex has reached 99.8 %. Construction and installation works at the technological unit are completed, and commissioning works are in the active phase. As a part of the commissioning works, in test mode, the first PP granules from imported raw materials were obtained. The technology allows to produce all types of PP, presented in all market segments. The total production capacity is 500 ths. t/year of polypropylene. After Zapibneftekhim is launched,

the total volume of polypropylene produced at the Tobolsk enterprises of SIBUR, including the existing polymer production of SIBUR Tobolsk, will be 1 M t/year of polypropylene. This is the largest capacity in Russia and one of the largest in the world. ●

CLUSTERING A LA RUSSE

Irina Gerasimova



PRESIDENT VLADIMIR PUTIN AT A LANDMARK MEETING DEVOTED TO THE IMPROVEMENT OF PETROCHEMICAL INDUSTRY IN OCTOBER 2013 ENCOURAGED "NOT TO PUMP THE RAW MATERIALS OVER ABROAD, BUT TO RECYCLE THEM RIGHT IN PLACE IN RUSSIA". SO FAR IT WAS NOT A CONCERN ABOUT ONE PARTICULAR INDUSTRY, BUT RATHER THE TRANSFORMATION OF THE ENTIRE ECONOMY OF THE COUNTRY – THE SHIFT AWAY FROM THE RAW MATERIAL MODEL. PETROCHEMICAL INDUSTRY ORGANIZED BY THE CLUSTER PRINCIPLE CAN AND MUST BECOME A DRIVER OF THIS PROCESS

Driver has been found

Petrochemical industry is one of the backbone industries. Its products are widely demanded in the automotive industry, instrument making, chemical production, agriculture, medicine, the production of consumer goods and in many other areas. But Russia has to import significant volumes of petrochemical products of high processing, especially high-technology products.

In recent years, the share of the petrochemical industry in Russian GDP was only 1.5%, while the share of crude oil – 9%. At the same time, similar indicators of countries leading in terms of production volumes in the industry are 6% for the United States and 9% for China.

This looks surprising, since the resource base in Russia is superabundant for development of petrochemical industry. Moreover, the number of leading market players includes the mining companies themselves: Gazprom, Rosneft, LUKOIL – all of them are interested in improving the monetization of the reserves (including "wet" gas and APG).

Naphtha and liquefied petroleum gas (LPG) are preliminary the primary raw materials for domestic petrochemical enterprises. Nevertheless, according to the data of the Analytical Center under the Government of the Russian Federation, only about 15% of naphtha and 30–35% of LPG, produced in the country, are processes by petrochemical industry (approximately 4–5 million tons per year), the rest goes for import. Ethane is used only in the amount of about 0.5 million tons annually.

Russia does not produce enough of ethylene, the main raw material for petrochemical synthesis. According to Vygon Consulting, the total capacity of all Russian pyrolysis plants for ethylene today is slightly more than 3 million tons per year, and this is below 2% of the world total. Thus, for example, pyrolysis capacity in Japan and South Korea, working on imported raw materials, is about 8 million tons per year. In Saudi Arabia – almost 18 million tons, in the USA – more than 28.

The Russian authorities, seemingly, are concerned about the situation. Over the past few years, the country has adopted a number of documents, including the "Plan for the development of gas and petrochemical industry in Russia up to 2030" (2012), aimed at increasing and upgrading petrochemical capacities, as well as the qualitative transformation of the sector. The formation of several petrochemical clusters in the country should play a key role.

FACTS

1.5%
is the share of the petrochemical industry in Russian GDP

9%
is a share of crude oil in Russian GDP

International experience

The cluster development of petrochemical industry is consistent with the experience of the countries that are major players in the global market, including the global technological leaders of the industry – the USA, the EU countries, and Japan. Large clusters are also created in China, Saudi Arabia, India, Iran and other countries.

In a number of cases, clusters were formed over long periods of time close to the sources of raw materials, markets or in areas of large logistics centers. For instance, the Rhine-Ruhr Petrochemical Cluster is located in the historical industrial zone of Europe.

Some clusters were actually created from scratch according to previously developed plans. This is especially typical of the countries, where petrochemical industry began to evolve later than the one of the "old" leaders. At the same time, western companies, introducing advanced technologies, are widely attracted to the projects.

The Singapore supercluster Jurong is a vivid example. Three large refineries, several petrochemical enterprises, including low-tonnage production were erected on man-made island. The site has its own port infrastructure. An important feature is the attraction of imported raw materials, since Singapore does not have its own resources. The residents include ExxonMobil and Shell, as well as some local companies. Land and infrastructure is owned by the state management company JTC.

The role of the state in the development of clusters may be different. In the most developed countries the government forms a favorable institutional environment, providing fiscal and other advantages, and various forms of public-private partnership are practiced. In other cases, the government itself can participate in projects, usually through the activities of state-owned companies and state-owned banks. This, for example, occurs in China and Saudi Arabia. Thus, in the latter, the government makes a lot of financial contributions into construction of oil and gas clusters infrastructure (Jubail, Yanbu), guarantees the supply of raw materials at reduced prices, provides tax holidays and a number of other incentives.

The experience of Iran, which has been successfully developing petrochemistry, even being under Western sanctions, would also be valuable for Russia. In the Vygon Consulting study (December 2017), the following is highlighted among the most important measures to stimulate the petrochemical sector of the Islamic Republic: regulation of raw materials prices; public financing of petrochemical production projects with a view to further privatization; development (with participation of the state-owned company NPC) of Pars and Makhshekhr petrochemical clusters, which gave a ground for oil, gas and petrochemical industry facilities, energy infrastructure, railways and highways networks.

Now the current total capacity of petrochemical production in Iran exceeds 70 million tons per year, while exports of products exceed 20 million tons. But at the same time, the study noted that most of the announced Iranian projects have not been implemented or introduced with a delay of five or more years, while costing more. As analysts of the agency consider, such delays are caused by insufficiently developed infrastructure, for which the state or state-owned companies are responsible.

Cluster approach in Russia

Six large clusters are being created in the country by the "Plan for development of gas and petrochemical industry in Russia for the period till 2030": North-West, Volga, Caspian, West Siberian, East Siberian and Far Eastern. The Volga cluster, which includes more than 70 operating enterprises in several regions, is the largest.

Clusters will combine petrochemical enterprises, processing enterprises, local governments, as well as organizations engaged in R&D and educational activities. It is implied that residents will use common infrastructure and complement each other, while keeping the competition.

The formation of a complete value chain from the processing of hydrocarbons to the production of high value added end products is implied within clusters.

Such approach is considered as the best option for the country with a huge territory, in which the “mining” and industrialized regions are separated by great distances. Clusters, in accordance with international experience, are formed in the existing centers of oil and gas processing and petrochemical plants, near the resource base or near the market. In such a way, the cluster in the Far East, "aimed" at the countries of the Asia-Pacific region, is strategically important.

FACTS

15%
of naphtha and 30–35% of LPG are processes by petrochemistry

3 million tons
per year is the total capacity of all Russian pyrolysis plants for ethylene

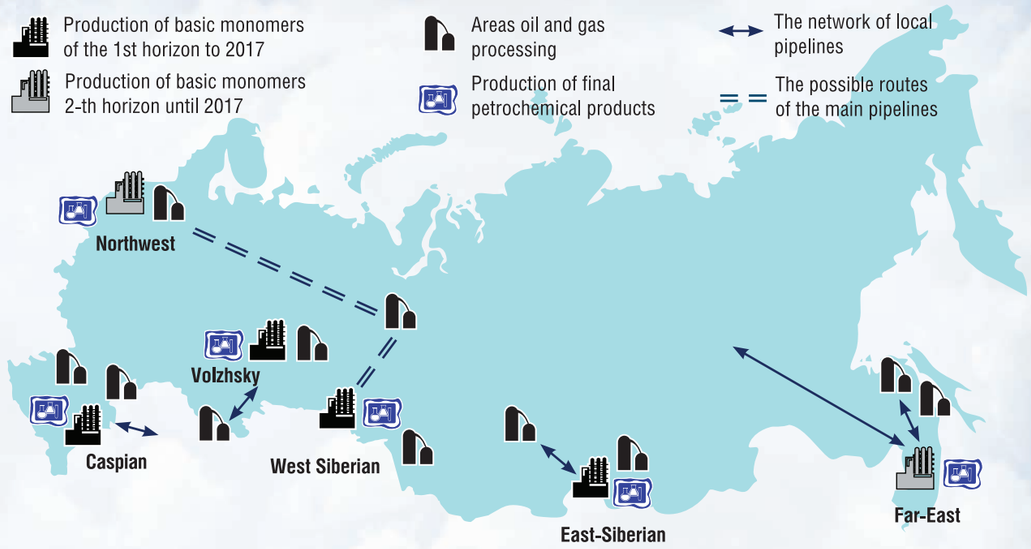
Large pyrolysis capacities – both existing and planned should become the production core of each cluster.

The West Siberian cluster, with involvement of new large capacities, is developing most actively. In 2013, the large SIBUR complex – "Tobolsk-Polymer" (500 thousand tons of polymer products per year) was put into operation, and this year the company is launching the ZapSibNeftekhim hydrocarbon raw materials processing complex (1.5 million tons per year for ethylene, 500 thousand tons for propylene and 240 thousand tons of high marginal by-products).

Some individual entities of the federation have announced the development of their own petrochemical clusters. These are, for instance, the Republics of Tatarstan and Bashkiria, the Omsk Region.

Expectations and reality

However, a large part of key projects is significantly delayed or even remains on paper. Therefore, Rosneft had to reconsider the arrangement and timing for introduction of project of Eastern Petroleum Company, which should become one the most important enterprises in the Far Eastern cluster. First of all, the enterprises were initially going to be launched in 2020, now – not earlier than in 2026. The construction of the Novourengoy gas chemical complex of Gazprom, which is to be included in the West Siberian cluster, is still not completed. The gas monopoly project "Baltic Oil and Gas Company" in the Leningrad Region has been postponed indefinitely. And, on the whole, the formation of the



Northeast cluster is hampered due to insufficient base of raw material and the lack of the necessary transport infrastructure.

The projects were influenced not only by the 2014–2016 recession and sanctions. Experts have pointed out the unresolved issues related to stimulating the industry and developing the infrastructure necessary for clusters, which, as noted above, the government in many countries takes personal charge of.

However, there are some positive shifts. According to the Analytical Center under the Government of the Russian Federation (October 2018), in 2010–2017, the production of large-capacity polymers in Russia grew by 58% and reached 5.4 million tons. The growth was secured by an increase in investment in the industry and by commissioning of new large-scale industries – among others Tobolsk-Polymer. And by 2017, Russia has practically ceased to be a net importer of large-capacity polymers – however, also thanks to a reduction in consumption growth rates.

According to forecasts of Analytical Center, the production of large-capacity polymers in the country will grow to 14.4 million tons until 2030. At the same time, consumption will double.

Other positive results should be anticipated too. Many of the petrochemical projects, planned for implementation, are designed to improve the economics of hydrocarbon production, as noted in last year’s study by PricewaterhouseCoopers. For example, the Amur gas processing plant under construction (with the launch, expected in 2021) will help Gazprom in monetizing the “wet” gas, obtained from the "Power of Siberia" Company.

FACTS

PRODUCTION
of large-capacity polymers in the country will increase up to 14.4 million tons by 2030

Then, new projects will allow the diversification of business portfolio of key players in the industry. Thus, due to the launch of polypropylene

(Tobolsk-Polymer) and PVC (Rusvinyl) production complexes for 2013–2017, the share of

commodity segment in SIBUR revenue has dropped from 45.7% to 40.4%.

Moreover, according to PWC, Russia can become one of the largest players on the global helium market. Such turn will be possible due to Amur GPP (Far Eastern Cluster) with a capacity of up to 60 million cubic meters of helium per year. In 2018 Gazprom Export has already entered into long-term contracts for the supply of products from this Company. The launch of the first stage is scheduled for 2021.

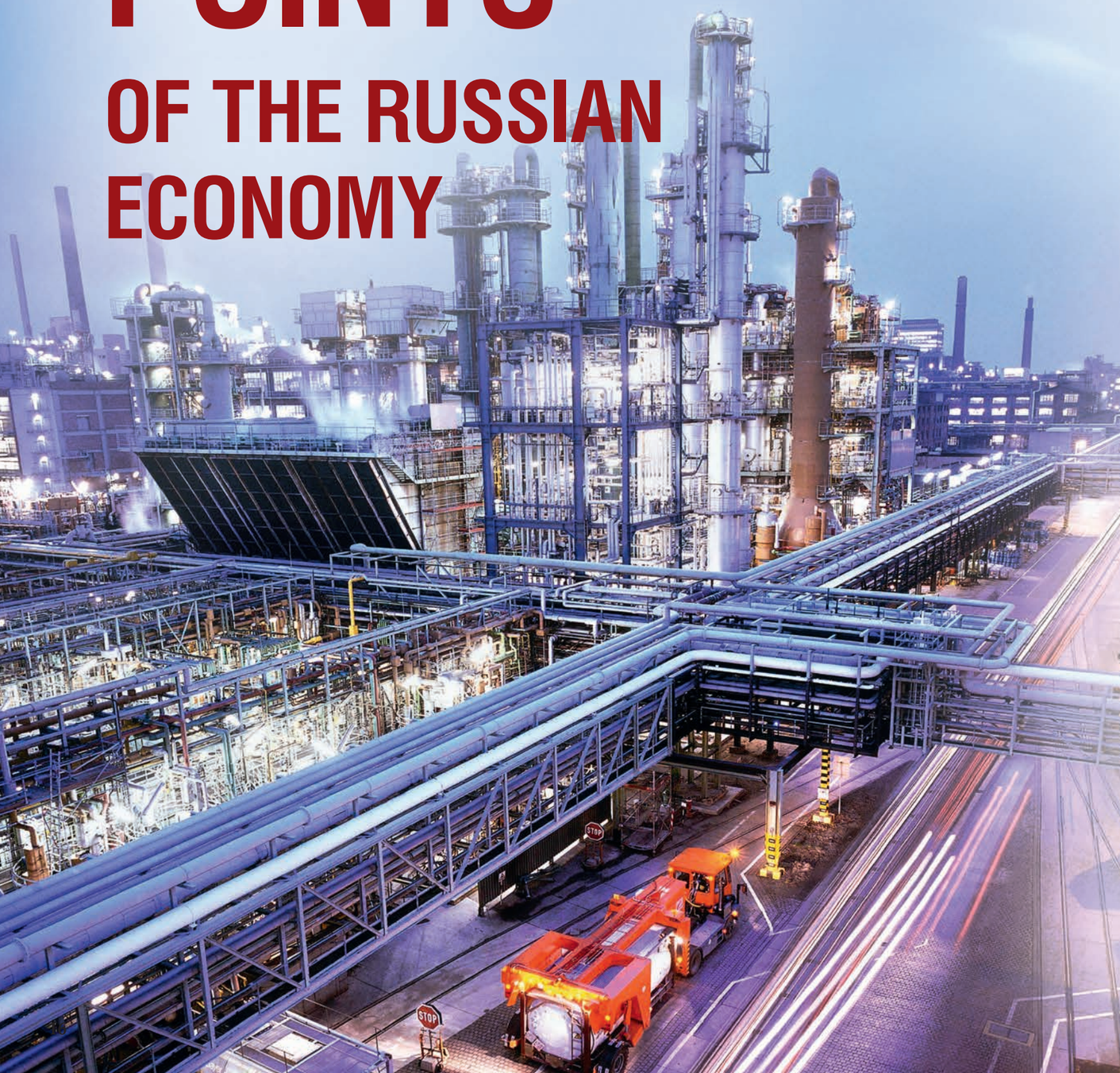
But in the face of increasing global competition, projects should be implemented at accelerating pace. "We conditionally have ten years to actively "start up" the petrochemical industry", said the then-Deputy Energy Minister, Kirill Molodtsov, in the interview with the "Izvestia" newspaper at the end of 2017. And later, according to him, "there will be no need to rush". These words have saved the relevance.

Neftegaz.RU
4/2019

UDC 338.2

BUSINESS-ACCENT

GROWTH POINTS OF THE RUSSIAN ECONOMY



Rustam Minnikhanov,
President of the Republic of Tatarstan

TODAY, THE REPUBLIC OF TATARSTAN IS ONE OF THE MOST ECONOMICALLY SUCCESSFUL SUBJECTS OF THE RUSSIAN FEDERATION. MAJOR OIL & GAS AND PETROCHEMICAL PRODUCTION FACILITIES ARE CONCENTRATED IN THE REGION: OIL PRODUCTION, PRODUCTION OF SYNTHETIC RUBBER, TIRES, POLYETHYLENE AND A WIDE RANGE OF PETROCHEMICAL PRODUCTS. TECHNOLOGY PARKS AND SPECIAL ECONOMIC ZONES GROW RAPIDLY. IN THE STRUCTURE OF THE GROSS REGIONAL PRODUCT OF TATARSTAN, THE SHARE OF INDUSTRY IS 48.1%. THE PRESIDENT OF THE REPUBLIC OF TATARSTAN RUSTAM NURGALIEVICH MINNIKHANOV TOLD US ABOUT WHAT PROJECTS WILL BE IMPLEMENTED IN THE VERY NEAR FUTURE, WHAT HAS BEEN DONE TO ATTRACT INVESTMENTS AND WHAT CHALLENGES THE KEY OIL AND GAS REGION OF THE COUNTRY IS FACING TODAY

KEYWORDS: *oil and gas complex, oil and gas processing, Republic of Tatarstan, special economic zones, import substitution.*

– Tatarstan industry is actively developing, new projects are launched, and existing production facilities are increasing their capacities. What are the main challenges the republic is facing today in the development of oil and gas refining and petrochemical industry?

– The basis Tatarstan economy and the basis of industry of the republic is petrochemical complex. This is our main growth point in accordance with the Strategy of Social and Economic Development of the Republic of Tatarstan until 2030. According to the results of 2018, the enterprises of the petrochemical complex produced 1.68T rubles worth goods, which is about 60% of the republican industrial output. In addition, the enterprises of the industry are the most active investment sector of the economy. Since 1999, 4 programs for the development of the petrochemical complex of the republic of Tatarstan have been successfully implemented. We are in the process of finalizing the fifth program, designed for the period up to 2025. Over the past years, breakthrough high-tech innovative projects for advanced refining of raw hydrocarbons have been implemented. Every year, the enterprises of Tatneft Group, TAIF Group of Companies, and small oil companies absorb more than 160 billion rubles of investment, which is 25–30% of the total annual investment in fixed capital in our republic. In particular, in 2018, at the TANECO Complex of Oil Refining and Petrochemical Plants, four new productions facilities for the production of diesel fuel, jet fuel, and gasoline components were put into operation. The total cost of these projects amounted to 23 billion rubles. Most recently, on February 12, 2019, with the participation of President of the Russian Federation V.V. Putin another new production started at the TANECO Complex – the production of gasoline with a capacity of 1.1 M tons per year. The cost of the project is more than 19.3 billion rubles. Today, TANECO is the first domestic oil refining complex of a new generation with a maximum refining depth of 99% and an oil refining capacity of 8.7 M tons.

FACTS

1,68
T rubles
is the value of products manufactured by the enterprises of petrochemical complex in 2018

4
programs for the development of petrochemical complex of the Republic of Tatarstan have been implemented since 1999

In 2018, a 40 billion rubles worth large-scale program on modernization and expending the capacity of isoprene rubber production up to 330 thousand tons from 270 thousand tons was successfully completed at Nizhnekamskneftekhim. New productions were launched for the production of raw components used in the production of synthetic isoprene rubber – formaldehyde and isobutylene.

Kazanorgsintez completed the next stage of a large-scale investment program for the reconstruction of existing production facilities – in 2018 four new high-selective pyrolysis furnaces for gas raw materials were put into operation, the production of polymer concentrate, a dye, was commissioned.

For the Republic Government and the industry enterprises, the priorities in the work are the goals set by President of the Russian Federation V.V. Putin in the May decree of 2018 “On the national goals and strategic objectives of the development of the Russian Federation for the period until 2024”. In particular, this is the task of increasing non-resource exports. Petrochemical products, despite their initial hydrocarbon origin, have no relevance to primary commodities. We intend to expand our presence in the global petrochemical market, since it is the most receptive, high-tech and dynamically developing sector of the world economy. Therefore,

new projects for the development of oil refining and petrochemical industry are the projects for the further development of the use of oil as the most valuable raw material for petrochemistry. Petrochemistry is one of the few industries that has been growing faster than global GDP over the past 40 years. In addition, the industry has an effective multiplicative social impact – each workplace in the petrochemical industry creates 4–5 new jobs in related industries.

Currently, Tatneft's development strategy suggests an increase in oil production until 2030 up to 38.4 M tons/year along with a 100% replacement of reserves. At the same time, tasks to double the volume of oil refining at the TANECO Complex and to bring it to the level of 15–16M tons per year with a refining depth of 99% were set as a target. The priority of the organization of new petrochemical plants for the production of engineering and structural plastics, a wide range of import-substituting products of high redistribution is important in the Development Strategy of the TANECO Complex.

The projects on building a new Ethylene complex and related production facilities for the refining of pyrolysis products (Nizhnekamskneftekhim), as well as projects on expansion of its own ethylene production and an increase to 1M tons of polyethylene production in Kazanorgsintez are the main objectives of the petrochemical enterprises of the TAIF Group – Nizhnekamskneftekhim PJSC and Kazanorgsintez PJSC. Nizhnekamskneftekhim PJSC started practical work on the implementation of these projects: design engineering is in progress, orders for manufacturing equipment are being placed, a construction site is being prepared. Kazanorgsintez PJSC is in the process of finalizing the business plan for Kazanorgsintez PJSC Strategic Development Program for 2020-2025, the selection of licensors, engineering contractors is in progress.

– Nizhnekamskneftekhim PJSC and NIIK JSC signed an agreement for the development of project documentation for the project on the construction of methanol production with a capacity of 500 thousand tons per year. What will the launch of a new production for the enterprise give?

In the global petrochemical market, Nizhnekamskneftekhim is primarily known as one of the leading manufacturers of synthetic rubbers. Today Nizhnekamskneftekhim PJSC is in the top 10 of the world's major manufacturers of synthetic rubber. In particular, the company is a world leader in isoprene rubber SKI-3, with a 47.5% share in the global market, one of the top three largest global suppliers of butyl rubbers, and provides about 6% of sales of butadiene rubber in the world market. In general, about 84% of Nizhnekamskneftekhim's sales in the segment of synthetic rubbers fall on foreign markets.

In 2017–2018, in order to increase efficiency and reduce isoprene rubber production costs, the company successfully implemented a project on the reconstruction of production and increasing capacity of the isoprene rubber SKI-3 production from 280 to 330 thousand tons per year while simultaneously renovating productive capacities for the production of its raw components. In particular, new facilities for the production of formaldehyde, isobutylene and isoprene monomer were built and put into operation. The company is planing to further increase the capacity of the production of isoprene rubber, in general up to 1M tons capacity for the production of synthetic rubbers. Methanol is the basic raw material for the two formaldehyde production facilities operating at the enterprise. Previously, methanol was supplied from other domestic petrochemical production facilities. Thus, with the formation of a balanced methanol – formaldehyde – isoprene – monomer – rubber SKI-3 chain in Nizhnekamsk, a self-sufficient stable technological scheme will be organized, which will fully satisfy Nizhnekamskneftekhim's need for methanol and increase the competitiveness of the company's products. Dependence on price fluctuations for purchased methanol will be excluded. It is also important that the new production adds another redistribution of hydrocarbons in the republic. About 500M cubic meters of additional natural gas will be yearly sent to refining to produce 500 ths. tons of methanol. I shall note that methanol is also a valuable raw material for the production of high-octane additives to gasoline, acetic acid, an effective inhibitor of hydrate formation during pipeline transportation of gas. The licensor of the process is our long-term technological partner in the field of catalysis and gas chemical production – the Danish company Haldor Topsoe. The design and working documentation will be developed by Research and Design Institute of Urea and Organic Synthesis Products JSC (Dzerzhinsk, Nizhny Novgorod Region), which has proven itself well during the implementation of the Ammonium Complex construction project in Mendeleevsk. The Ammonium Complex includes methanol production with a capacity of 234 thousand tons, also built on the basis of the Haldor Topsoe license. The commissioning of methanol production facility in Nizhnekamskneftekhim PJSC is planned for 2021.

FACTS

In 2018

four new production facilities were put into operation at the TANECO Complex

In 2021

a methanol production facility will be commissioned at Nizhnekamskneftekhim PJSC

– The Republic of Tatarstan is one of the most investment-attractive regions of Russia. What investment projects are being implemented today? What areas are the most interesting for investors? What programs on the improvement of investment climate work in the republic?

Tatarstan has always been distinguished by its dynamic development, domestic political stability and investment attractiveness. Tatarstan is the leading region of Russia in the economy and industry. The republic is ranked 5th among the regions of the Russian Federation for its industrial production, 3 rd place for its agricultural output, 4th place for investment in fixed capital. In the National Investment Climate Rating of the subjects of the Russian Federation over the past 4 years, Tatarstan has been in the top three leading regions.

We have a powerful resource base, developed infrastructure, human resources. The most successful investment sites in Russia operate in Tatarstan – SEZ 'Alabuga', KIP 'Master', Himgrad. We have the largest number of Territories of Priority Social and Economic Development in Russia and the largest number of investments made by their residents.

The geopolitical situation and economic turbulence naturally affected the volume of foreign investment. And at the same time, after the conditions of sanctions crisis for the investment activities of 2014–2016, we are going to grow. Compared with 2017, in 2018, the growth of foreign investment in the republic amounted to 37.5%. In 2018, the volume of foreign investment in the republic amounted to 590.7M dollars. In 2019, we also expect a positive trend. Among the most investor-attractive sectors we should note oil production, oil refining and petrochemistry.

In 2018, major investors in the petrochemical industry of the Republic of Tatarstan were such companies as Tatneft PJSC, TAIF JSC , Nizhnekamskneftekhim PJSC, Septal LLC, Indel LLC, Sch Iken Form RUS LLC, Sheshmaoil JSC, SMIT LLC, KMPO JSC, Polychem Systems LLC and others. In particular, in 2019, TAIF-NK OJSC is completing the implementation of project on the construction of the Complex for Deep Refining of Heavy Refining Residues. This is the largest strategic investment project of the company. Due to the organization of the refining of heavy residues of primary processing, tar and vacuum gas oil, the degree of extraction of light petroleum products throughout the TAIF NK refinery complex will be 98% or more.

Earlier, I listed and gave a detailed description of the ongoing and promising projects at the TANECO Complex, at Nizhnekamskneftekhim PJSC, at Kazanorgsintez PJSC.

The Government of the Republic assists investors in providing infrastructure support, in reducing the length of procedures for providing state and municipal services, in reducing excessive administrative pressure from control and supervisory bodies. The main tool for improving the investment climate, attracting investment on a long-term basis for us is the development of public-private partnerships.

FACTS

1,1 M

tons per year is the capacity of the new gasoline production facility started on February 12, 2019 at the TANECO Complex

38,4 M

tons per year should be the growth of oil production until 2030 according to the Development Strategy of the Tatneft company

– The SEZ 'Alabuga' is the largest Special Economic Zone not only in the Republic of Tatarstan, but also in Russia. Currently, plans for its further development are being considered, including with the involvement of Chinese partners. What joint projects with the Chinese side are to be implemented? In what areas is cooperation planned?

– I note that the SEZ 'Alabuga' is not only the largest Special Economic Zone of the Russian Federation, but also the most effective. In particular, according to the results of the II National Rating of Investment Attractiveness of the Special Economic Zones of Russia, the 'Alabuga' Special Economic Zone took the first place. Among all the Special Economic Zones of Russia, 50% of the revenue and 39% of the actual investments of residents accrue to 'Alabuga'. Today, 30 production facilities have been started here, 6,800 jobs have been created, about 122 billion rubles have been spent by residents, 80% of all investments are made by foreign companies.

The investors, the residents of the Special Zone see the significant development potential of the Elabuga site. In particular, an interest in the development of cooperation was shown by our Chinese partners – the largest and one of the most successful in China, Tianjin Economic-Technological Development Area (TEDA). The experts from PricewaterhouseCoopers developed a business plan for the project. Our long-term plans include joint implementation of projects in the field of petrochemicals refining, machine building and in a number of other areas with our Chinese colleagues.

Neftegaz.RU
4/2019

UDC 330.322

THE MECHANISMS OF AN AUTONOMOUS INDUSTRY: SEZ

Anna Pavlikhina

THE FOCUS ON CREATING AN AUTONOMOUS INDUSTRY THAT DOES NOT DEPEND ON THE VAGARIES OF THE MARKET AND THE POLITICAL CONTEXT RESULTED IN THE FACT THAT VARIOUS TYPES OF SUPPORT FOR DOMESTIC MANUFACTURERS IN OUT COUNTRY HAVE BECOME PARTICULARLY RELEVANT. IN THIS REGARD, IT WOULD SEEM THAT SPECIAL ECONOMIC ZONES SHOULD HAVE RECEIVED A NEW ROUND OF DEVELOPMENT, AS THIS WOULD BE ONE OF THE MECHANISMS TO ARRANGE PRODUCTION AND SOCIAL PROCESSES TO SUPPORT THE ECONOMY. HOW ARE SEZS DEVELOPING TODAY, WHAT ADVANTAGES DO THEIR RESIDENTS RECEIVE, AND WHAT CUMULATIVE EFFECT DO REGIONS AND INDUSTRIES GET FROM THEIR ACTIVITIES?

KEYWORDS: *special economic zones, import substitution, Alabuga, Titanium valley, state support.*

As the name suggests, a special economic zone is a territory with a special status. These characteristics are especially evident in a concessionary taxation system and various preferences, allowing resident companies to function successfully in the market, thus contributing to the efficient development of economy as a whole.

Special, or as they are also called, free zones are not a Russian invention. At the turn of our era, merchants from the Delos island were already exempted from taxes, which made the region a place of brisk trade for a whole century and significantly boosting the coffers. This simple trick is the current operation principle of SEZ.

The first attempt to form free zones in Russia was made in 1994, but the first step is always troublesome. The second attempt was made almost 10 years later.

In 2005, the law "On Special Economic Zones in the Russian Federation" was signed, according to which enterprises investing in the Russian economy were able to use the infrastructure created at the expense of the state budget; this would allow a significant reduction if expenses to create a new production.

Modern special economic zones are mostly located in large industrial regions of the country. They are formed according to a clear geographical principle, the main criteria of which include the proximity to a resource base, required to arrange a particular production and the access to the main transportation arteries. All the necessary infrastructure is built at the expense of funds from the state and regional treasury. This includes power and heat supply systems, gas pipelines, telecommunications, a customs post, a temporary storage warehouse, a water treatment plant, railway, container terminals, not to mention administrative and industrial buildings and facilities. All this significantly reduces costs, and therefore allows increasing competitiveness.

So, what kind of benefits do resident companies get? Due to the free customs zone regime, companies are provided with customs privileges; the "one window" administration system allows simplifying interaction with government regulatory authorities; in addition, companies can enjoy a number of tax preferences (according to the Ministry of Economic Development, the tax system currently operating in SEZ provides a 20-30% benefit). It's much more than that. Depending on the region, the specifics of the work and the sectoral focus, companies receive a number of special benefits in each specific zone. Let's consider them in detail.

FACTS

In 1994

the first attempt was made to form free zones in Russia

Special economic zones in Russia

In addition to Russian residents and among 656 companies developing their business under tax benefits and other preferences, there are companies from 38 countries, which invest in our economy. In total, there are 25 SEZs in Russia today. Among them there is one port-economic zone, 6 technology-innovative zones, 9 tourist-recreational zones and 9 industrial-industrial economic zones. Within the framework of this article, we will be first interested in industrial production special economic zone (IP SEZ).

IP SEZ Moglino

Founded on July 19, 2012 in the Pskov Region. The total area of the Moglino Special Economic Zone is 215 hectares. The area for industrial construction is 150 ha. The size of plots range from 1 to 14 ha. If necessary, the plots can be combined or divided into smaller

ones. The Moglino SEZ allocated 3.2 billion rubles of state investments that are aimed at creating the infrastructure. The preferential tax period for resident companies is set for the entire period of the SEZ's existence – 49 years. During this period, the govermnent acts as a guarantor of the established preferences.

Priority development fields: railway, communal, agricultural equipment, automotive components, electrical and household appliances, building materials, logistics and packaging. Rail tracks run along the northern border of the SEZ, and the A212 federal highway runs along the southern border.

The 16 km distance from the Moglino SEZ to the airport guarantees high transport accessibility at the regional and international levels. The nearest seaports: Ust-Luga – 150 km, St. Petersburg – 280 km, Riga – 260 km, Tallinn – 336 km.

And only 45 km to the European Union border.

IP SEZ Alabuga

One of the largest zones of this type is Alabuga. Its total area is 3 903.5 ha. It accounts for 59% of the total revenue of all SEZs of the country; private investments account for 39% of all funds invested in Russian SEZs. The total amount of investments for 2019 equals179.8 bln.Rubles, of which 121.6 bln.Rubles were spent; among the largest foreign investors there are Dutch and Turkish companies.

Automotive cluster is formed in the Republic of Tatarstan, therefore the projects of current and potential resident companies are mainly related to the production of components for this industry. The localization of component production is also explained by the fact that it is based on products of deep oil refining, petrochemistry, which are manufactured in sufficient quantities in the Republic of Tatarstan. Auxiliary production units are also located on the territory of the SEZ; the manufactured output is used in consumer goods industry and construction industry.

FACTS

25

SEZs operates in Russia today

656

Resident companies are functioning in SEZs

By now, 22 residents have been registered, including Ford Sollers Elabuga, a joint venture of Ford and Sollers for the production of cars and engines with a design capacity of 85 ths. cars and 185 ths. engines per year; Air Liquide Alabuga is a subsidiary of Air Liquide for the production of industrial gases. Among the residents there is also P-D Tatneft-Alabuga Steklovolokno, an enterprise for the production of fiberglass and fiberglass-based products, and other companies.

The location of the SEZ gives access to rail, air and water transport.

Enterprises registered in the territory of the SEZ will receive a number of preferences.

In particular, it is a free customs zone regime in which foreign equipment is placed and used within the SEZ without paying customs duties and VAT; the abolition of export duties on the export of manufactured products; exemption from property tax from the moment the property is registered and from land tax from the moment of the emergence of the title to the land plot. The republic provides for a full exemption from transport tax to be credited to the budget of the republic.

Research and development costs are assigned to the reporting period, in which they were incurred, in the amount of the actual costs. Residents are removed from restrictions on the transfer of losses incurred in the previous tax period.

A 100% shareholder of the management company of Alabuga special economic zone is the Ministry of Land and Property Regulations of the Republic of Tatarstan.

Lipetsk IP SEZ

The total area is 2 298.3 ha. Among the 64 residents there are companies such as: Solinkom, engaged in the production of ingots and plates of multicrystalline silicon for solar energy; Yokohama RPZ, producing Yokohama car tires; ABB Electrification Products (production of electrical distribution and control equipment); Radalit Schlumberger (production of components of electrical centrifugal pumps); Tsifrovyye tekhnologii (creation of the production of specialized computing facilities for distributed data storage and organization of data center of Tier III standard) and others.

Among the main activities of companies the following should be emphasized: production of energy equipment, elements and systems of alternative energy; production of machinery, equipment, automotive components, household appliances, medical equipment, as well as production of bio-and nanomaterials.

Through contributions to the authorized capital of the management company 6.109 bln. Rubles of the funds from the federal budget and the budget of the Lipetsk region (for the creation of infrastructure facilities) were invested for the development of the SEZ. The ratio of public to private investments is 1:3.5.

IP SEZ Kaluga

Founded on December 28, 2012 on the territory of Lyudinovsky District, the Kaluga Region. The area of the SEZ is 1042 ha; the planned state investment equal to 2 600 mln. Rubles.

Priority development fields: production of automotive components, machinery and equipment, woodworking, agriculture.

It has two sites: Lyudinovskaya and Borovskaya. A line of tax benefits is used for companies: 0% property and transport taxes for 10 years, 0% land tax for 5 years, 0% customs duty and VAT. Income tax for the following economic activities: production of machinery and equipment, wood processing and production of wood products; production pf parts and accessories for cars and engines. For other economic activities: 5% until December 31, 2022, 9% for 2023-2026, 13.5% until the end of the existence of the SEZ. The location of production in the SEZ allows increasing the competitiveness of products on the Russian market by reducing costs up to 30%.

IP SEZ Tolyatti

Founded on the territory of the Samara region on August 12, 2010 The area is 660 ha. Declared investment – 22.9 bln. Rubles.

FACTS

253

special economic zones operate in the USA

30

SEZs are established in the United Kingdom

There are 21 companies operating on the territory of SEZ Tolyatti, the main activities of which are focused on such spheres as automobile manufacturing, automotive components, construction materials, engineering, chemistry, packaging, pharmaceuticals, consumer goods

Benefits and preferences for residents: property tax – 0% for 10 years. Transport tax and land tax are not paid for the first 5 years. Accelerated procedure for recognition of research and development expenses, preferential terms of rent, possibility of buying out a land plot.

Titanium Valley IP SEZ

The total area is 721,4 ha. The volume of investments in projects approved by the Supervisory Board exceeded 8,7 bln. rubles. Today there are two residents on its territory: Zibus plant – the production of medical instruments and implants, launched in summer of 2018, and Ural Boeing Manufacturing plant (titanium machining for Boein aircrafts) – SP VSMPO Avisma and Boeing Company, opened in September 2018.

Resident companies receive the following tax benefits: exemption from property tax for 10 years, reduced rates of contributions to social funds.

A SEZ resident may apply accelerated depreciation by setting a multiplying factor for its own fixed assets.

Stupino Quadrat IP SEZ

SEZ Stupino Quadrat stands out from other zones. This SEZ was established in 2015 upon an initiative of private investors and does not have state participation in its origin.

SEZ in the world

In the first decade of the third millennium, the number of special economic zones increased significantly throughout the world.

Currently, about 3 000 SEZs operate in the world. The leading regions in terms of number is the Middle East, where 528 SEZs are located. Among the countries in this region Turkey and Egypt can be marked for the number of SEZs. There are 253 special economic zones in the USA, 30 in the United Kingdom, and 17 in South Korea.

The main types of free economic zones in the world practice are trade and warehouse zones, industrial or export production zones, complex zones.

Enterprises are being created in industrial zones, including knockdown production companies, which produce goods for export on the basis of imported semi-finished products. A situation, when export products are manufactured on the basis of local raw materials with imported equipment and technology, is also possible. Such forms of industrial companies largely occur in Asia, Africa and Latin American countries, as well as in Hungary, Romania, Yugoslavia, China, United Kingdom and the USA.

In the Middle East, in particular, in Turkey, SEZs are located near the major Turkish ports of the Mediterranean, Aegean and Black Seas, which provide access to international trade routes. Resident companies are exempted from the payment of duties, corporate income tax for industrial companies, payment of VAT, and payroll tax.

In the USA, the majority of SEZ residents are employed in oil, automotive, pharmaceutical industries and in electronics manufacturing. Most of the products are consumed by the domestic market. Special economic zones in the USA contribute to the economic strengthening of the territories on which they operate (depressed old industrial or backward regions), or of the industries, and in some cases of specific enterprises. When selecting a region to create a SEZ, unemployment rate and monetary incomes of the population are used as criteria.

FACTS

17

SEZs are established in the South Korea

In the countries of Southeast Asia, there are about five hundred SEZs. They are also based around major seaports and airports, which have been converted into tax-free zones in order to develop the national economy. In industrial areas, almost all enterprises are focused on the export of industrial products, which are made mainly on the basis of imported raw materials.

The experience of the creation and operation of a SEZ in China is especially remarkable. At the beginning of the 80s, the Chinese economy was based on a closed model and was characterized by low growth rates. In order to avoid a sharp transition from a closed to an open economy, the government decided to create a SEZ in the eastern and southern coastal parts of the country, where special tax, customs and foreign exchange regimes were introduced in order to attract foreign investors to this region.

In general, it should be noted that SEZs, created in the donor regions, where the selection criteria include the unemployment rate and the average income per capita, contribute to the development of the national economy.

Today, Russia ranks No. 5 in the world in the amount of technology parks, but their material and financial base does not allow for the intensive development of small high-tech innovative enterprises. Nevertheless, the possibilities of SEZs are wide enough and their creation will be successful, if we manage to create a transparent and efficient economic system with a well-developed regulatory framework, minimal bureaucratic mechanisms and maximum competition.

Neftegaz.RU
4/2019

THE ROLE OF INDUSTRIAL PRODUCTION LOCALIZATION IN THE POLICY OF IMPORT SUBSTITUTION

Igor Ishchenko,
Acting Director General of Special Economic Zone "Technopolis "Moscow"

SINCE 2015, ABOUT 1,200 IMPORT SUBSTITUTION PROJECTS HAVE BEEN IMPLEMENTED IN THE COUNTRY, SOME OF THEM BY SEZ RESIDENTS. THE GOAL OF LOCALIZATION OF INDUSTRIAL PRODUCTION FACILITIES IN SEZ IS TO CREATE A COMPETITIVE PRODUCT. AND TO DO THIS, IT IS NEEDED TO REDUCE THE TIME AND COST OF ALL TECHNOLOGICAL AND BUSINESS PROCESSES. HOW'S THIS ACHIEVED IN THE "TECHNOPOLIS "MOSCOW" SEZ?

UDC 330.322

KEYWORDS: *import substitution, industrial enterprises, state regulation, cost reduction, localization of production.*

BUSINESS-ACCENT

The main idea of import substitution is the need to use the benefits associated with the effect of the devaluation of national currency. The problem of import substitution should be solved in a fairly short time, since the effect of devaluation, according to estimates by various experts, lasts for 3–5 years. It became economically profitable to produce products in Russia – the cost of the product has become significantly cheaper. In many ways, this is happening due to the implementation of a number of federal target programs that create a favorable background for the formation of competitive industries both Russian and with foreign capital.

Special economic zones have become one of the tools to achieve the determined goals. SEZ residents are offered a set of preferences, well-developed infrastructure and unlimited opportunities for cooperation.

FACTS

Tax burden was reduced to 47% for SEZ residents

SEZ for import substitution

In special economic zones, a nutritional environment is created for the development of Russian high-tech business. It all starts with infrastructure. So, for example, in the 'Technopolis 'Moscow' SEZ potential residents can choose a suitable localization format: brownfield (construction inside the facility) or greenfield (construction on the ground). Both in the first and in the second case, the management company provides the full range of necessary legal, engineering and energy solutions. This is a primary infrastructure.

The secondary infrastructure is the creation of conditions for comfortable work: customs complex and the possibility of carrying out STZ (free customs zone) procedure, parking, food courts, fitness centers, congress centers, a hotel complex, an online personal account, a personal manager etc. The goal of management company is to ensure that the employees of resident enterprises do not have to spend personal resources on solving everyday problems.

In addition, a set of benefits has been implemented in SEZ, which allows businesses to reduce the tax burden up to 47%.

Thus, there are conditions in special economic zones making it possible to save money, look for partners and invest in the creation of new products or development.

Foreign production facilities in Russia

About 30% of the residents of metropolitan SEZ are companies with foreign participation. As a rule, these are large players in their markets who are interested in localization of production on a prestigious site, looking for a long-term presence in the Russian market and are loyal to a rather long cycle of entering the SEZ site.

A management company should not focus on attracting foreign companies, but there is a steady interest and this, in turn, also works for the import substitution program. High-tech players such as ABB, Shneider electric, Mapper open their production in Russia and become a part of the city's economy, in addition, they bring professional standards of a qualitatively different level to the Russian market.

Clustering principle

In order for a business to cooperate and create products for the implementation of an import substitution program, the principle of clustering operates in SEZ.

Companies operating in the same or related markets are invited to create a common alliance for implementing partnership projects and solving industry problems.

In December last year, a biopharmaceutical cluster was created in the 'Technopolis 'Moscow' SEZ. The agreement on entering was signed by 21 resident companies from the industry of medical technology, equipment and biopharmaceutics. Mikhail Getman became the chairman of

the Biopharmaceutical Cluster Board, he noted that the cluster's mission is a platform open to dialogue, a structure that can include not only residents, but also other Moscow companies working in health care.

Already in February, 'Technopolis 'Moscow' signed an agreement with ATEM Capital (USA) and TPP Healthcare (China), providing for financial support for export-import operations of cluster members in the markets of China, Canada and the USA. It is expected that by 2023 they will be able to receive up to $ 500 M for development.

In the near future, a cluster of microelectronics will appear in SEZ.

"Import Substitution" in Education

Localization of industrial production in SEZ allows, among other things, to train our own staff to work in high-tech industries.

Colleges and universities prepare specialists of the required profile, but most often the technological base of an educational institution does not keep pace with updates of real production facilities. This is especially true for working professions. As a result, companies get employees whose knowledge does not meet the real requirements of businesses and are often forced to invite foreign specialists to work.

FACTS

30 %

residents of metropolitan SEZ are companies with foreign participation

Localization of residents with training centers in SEZ and interaction with foreign universities creates a qualitatively different education standards, now teaching methods for students and for retraining people of pre-pension age are developed in SEZ.

Educational programs, where teachers are representatives of real industries, already exist in SEZ. Students receive applicable and relevant knowledge first-hand, in addition, they practice on the most modern equipment. Science and practice are no longer separated from each other, which in perspective gives an impulse to the development of both academic and business communities.

Thus, the localization of enterprises in SEZ contributes to the import substitution of human resources and increases the prestige of working specialties.

Neftegaz.RU
4/2019

UDC 330.322

BUSINESS-ACCENT

CLUSTER APPROACH

Genady Shmal,
President of the Union of Oil and Gas Industrialists of Russia

IN 2011, THE MINISTRY OF ENERGY OF THE RUSSIAN FEDERATION HAS DESIGNED A PLAN FOR DEVELOPMENT OF THE PETROCHEMICAL INDUSTRY IN THE COUNTRY UNTIL 2030 BY THE ORDER OF V. PUTIN. CONSIDERING THE AVAILABILITY OF FACILITIES, PROXIMITY TO SOURCES OF RAW MATERIALS AND DISTRIBUTION CHANNELS, SIX PETROCHEMICAL CLUSTERS WERE IDENTIFIED: WEST SIBERIAN, POVOLZHSKIY, CASPIAN, EAST SIBERIAN, NORTH-WEST AND FAR EASTERN. BY CREATING CLUSTERS, THERE WAS MADE AN ATTEMPT TO CLOSE THE GAP WITH WORLD LEADERS AND TO ACCELERATE THE INNOVATIVE DEVELOPMENT OF THE INDUSTRY. EIGHT YEARS HAVE PASSED FROM THAT PERIOD. WHAT WAS REALIZED DURING THIS TIME? THE JOURNALIST OF NEFTEGAZ.RU HAS DISCUSSED THIS WITH THE PRESIDENT OF THE UNION OF OIL AND GAS INDUSTRIALISTS OF RUSSIA, GENADY IOSIFOVICH SHMAL

KEYWORDS: *petrochemical clusters, oil refining, state regulation, processing plants, development priorities.*

– Gennady Iosifovich, cluster approach is not a new phenomenon in petrochemistry. Almost 8 years have passed since these principles were initially implemented in Russia. What have we managed to achieve due to the cluster principle of organization?

– The cluster approach is not a new phenomenon neither in petrochemistry nor in industry and economy as a whole. The cluster principle involves the creation on a single site of a number of industries that are similar in technology and purpose. In such a way, for example, KAMAZ was created, being surrounded by the factories producing the related products: engines, bridges, etc.

International and Russian practice has proven the consistency of the cluster approach. After all, when a product of one company is a raw material for another, their location on the same site will give a synergistic effect. In fact, it is obvious that it is necessary to sell oil refined products which have added value, but not oil itself. First of all, such approach must be implemented in oil refining. By now, Tatarstan is an example for creation of clusters in our country. In recent years, significant changes have taken place there. A few years ago, chemical industry of the republic produced only individual monomers. After some time, there have appeared more complex products – polymers, and by now many enterprises produce finished products. For example, the automotive cluster for production of a whole line of cars from dump trucks to all-terrain vehicles was created in Naberezhnye Chelny.

For Russian petrochemistry, the cluster concept of organization is the most appropriate. The site in Tobolsk can be taken as an example. Initially, it was a petrochemical complex, which began to be built in the 70s. Soon there will begin work the company Zapsibneftekhim and a huge site for the production of polymers is arranged nearby. In essence, the totality of these productions forms a cluster.

FACTS

In 2011

a plan for development of petrochemistry involving the formation of 6 petrochemical clusters was made

280 million tons

of oil was processed in 2017

Another example is the construction project for a gas processing plant in the Amur Region. If the plant is finished, it will become one of the largest in the world. Petrochemical plant of Sibur Company is located nearby.

Creation of oil and gas processing in one place is the right approach, with allowance for the specificity of deposits, the sources of raw materials. The fact is that in Eastern Siberia, there are primarily oil and gas deposits, and secondarily, with a high content of useful substances – helium, ethane, etc. Therefore, it shouldn't be allowed to start their mining as, for example, in Tyumen. The integrated use of all components should be taken into account.

Today, three objectives must be set for the oil producers: discovery of large deposits, the maximum use of resources already open, i.e. increase in oil recovery index, as well as developing complex oil refining of all extracted resources. But, unfortunately, for many years we have not paid close attention to the use of ethane, however it is possible to receive ethylene from it, as the Americans do. In Russia, ethylene is produced from naphtha, i.e. from refined petroleum products, which is 30 percent more expensive than production from gas. By the way, plant in Amur Region is designed with the ability to fully extract ethane, helium, etc.

– In addition to the cluster principle, what other steps, in your opinion, should be done to develop the processing industry?

– In 2017, Russia produced 547 million tons of oil, and processed 280 million tons. In terms of the country needs, there is no need for more. But if we could process all the oil we produce, then GDP would be much higher. I believe that it is necessary to process as much as possible inside the country and supply the products of processing abroad. Today, we export almost half of the oil produced in the country, and thus we are developing other nations' economies.

At the same time, the products of the Russian oil refining are readily bought abroad, while oil in a large part of the fields is high-sulphur and it is quite problematic to sell it.

– Today we can supply oil to the West with a sulfur content of under 1.8%, but we have already reached this figure. Therefore we need to look for new technologies that will reduce the sulfur content. And such technologies exist today, but so far only in laboratories. We need to work in this direction, because due to the high sulfur content, the Urals brand is cheaper, we lose about $1.5–2 per each barr.

– Turning back to the refining, which results have we achieved for today?

– The quadripartite agreement for modernization of oil refineries was signed in 2011. Much has been done for today, but not all the the plans have been executed. Over the past three years, investment in refining has decreased threefold, so the launch of a number of plants was postponed to 2021, 2022, 2023. However, an important task has been solved: all plants produce gasoline and diesel fuel of the 5th class. But there is a mismatch: Russian transport is about 60% ready to operate on 2nd and 3rd class. On one side, we invested 3 trillion rubles in modernization of production and have made a lot – there have appeared the secondary processes (hydrocracking, catalytic cracking). On the other hand, the transport is not prepared at all. That is why I always ask: "Why do we need Top Tier diesel fuel in backward regions today?" In the United States, each state makes an independent decision which gasoline to use for transport, which is appropriate from the economic point of view.

FACTS

60%

of Russian cars operate on Tier 2 and 3 gasoline

– Speaking of foreign experience, how do you assess the implementation of the cluster approach in other countries?

– The most successful example here is Germany. For example, BASF enterprises are disposed on a cluster basis. A similar approach in the development of chemistry and petrochemistry is practiced in China – they widely create such clusters and obtain high-level petrochemical products. Today, the country produces petrochemical products in the amount of $1 trillion 500 billion. In Russia, this figure is $ 80 billion.

Large centers of oil refining and petrochemistry were built in the USA. The number of gas processing plants alone reaches 700, while we have 30. In Russia it is necessary to develop the strong sites, such as Tobolsk, Stavropol and Amur. The rest of what we have are separate plants.

– In other words, despite many years of work in this direction, we are still at the beginning of our way?

– Yes, today we need to determine where to create such clusters. At the time, Valery Veniaminovich Babkin has developed a clustering program for chemical industry, only it was not in demand from those who make decisions.

THE RAW BLOOD OF ECONOMY

TODAY, THE OIL AND GAS INDUSTRY FACES THE PROBLEM OF TRANSITION TO A DIGITAL ECONOMY, A COURSE HAS BEEN SET FOR THE MODERNIZATION OF PRODUCTION FACILITIES, AND IMPORT SUBSTITUTION HAS BEEN BROUGHT TO THE RANK OF MAIN PRIORITIES. HOW DOES ONE OF THE LEADING STATE DEVELOPMENT INSTITUTIONS, THE INDUSTRY DEVELOPMENT FUND, PARTICIPATE IN THE TRANSITION OF RUSSIAN OIL AND GAS ENTERPRISES TO A NEW LEVEL?

UDC 330.322

Ключевые слова: *the oil and gas industry, the digitalization, the Foundation of industrial development, import substitution, preferential financing.*

Alla Yudina

It would be hard to overestimate the importance of oil and gas complex for the well-being of our entire country. It is one of the key sectors of the Russian economy. Oil and gas money made up about 36% of the revenue part of the Russian budget for 2018.

At the same time, one of the positive results of the beginning of 2019 in the oil and gas sector was, of course, a gradual increase in world oil prices (from $ 53.8 in December 2018 to $ 67.4 in March 2019), which again underlines the export orientation of the entire industry. In fact, we returned to January 2018, having regained the fall in prices that began in September 2018.

In this regard, it is very important to realize that high results in the oil and gas sector were achieved thanks to the truly titanic work of several generations of geologists and builders who discovered new fields and created the fuel and energy complex from scratch. Meanwhile, today, the domestic oil and gas industry has practically exhausted the possibilities of growth due to the old resource base and outdated technologies. In this context, we should not forget about the imposition of sanctions against Russian oil and gas industry by our Western partners.

Modernization is everything

In the context of current macroeconomic situation, the Russian raw material model of economy, in which the well-being of the country and its citizens directly depends on international oil prices, has become not only non-prestigious, but also ineffective.

Therefore, speaking of the state of the oil and gas industry, it should be noted that in the very near future, the modernized, high-tech and export-oriented oil and gas complex is vital.

The Industry Development Fund (IDF) was established on the initiative of the Ministry of Industry and Trade of the Russian Federation to modernize Russian industry, organize new production and ensure import substitution

Russian President Vladimir Putin earlier announced the main strategic objectives of the industry – a systematic introduction of innovative solutions, increasing the science intensity of the industry and diversifying energy markets.

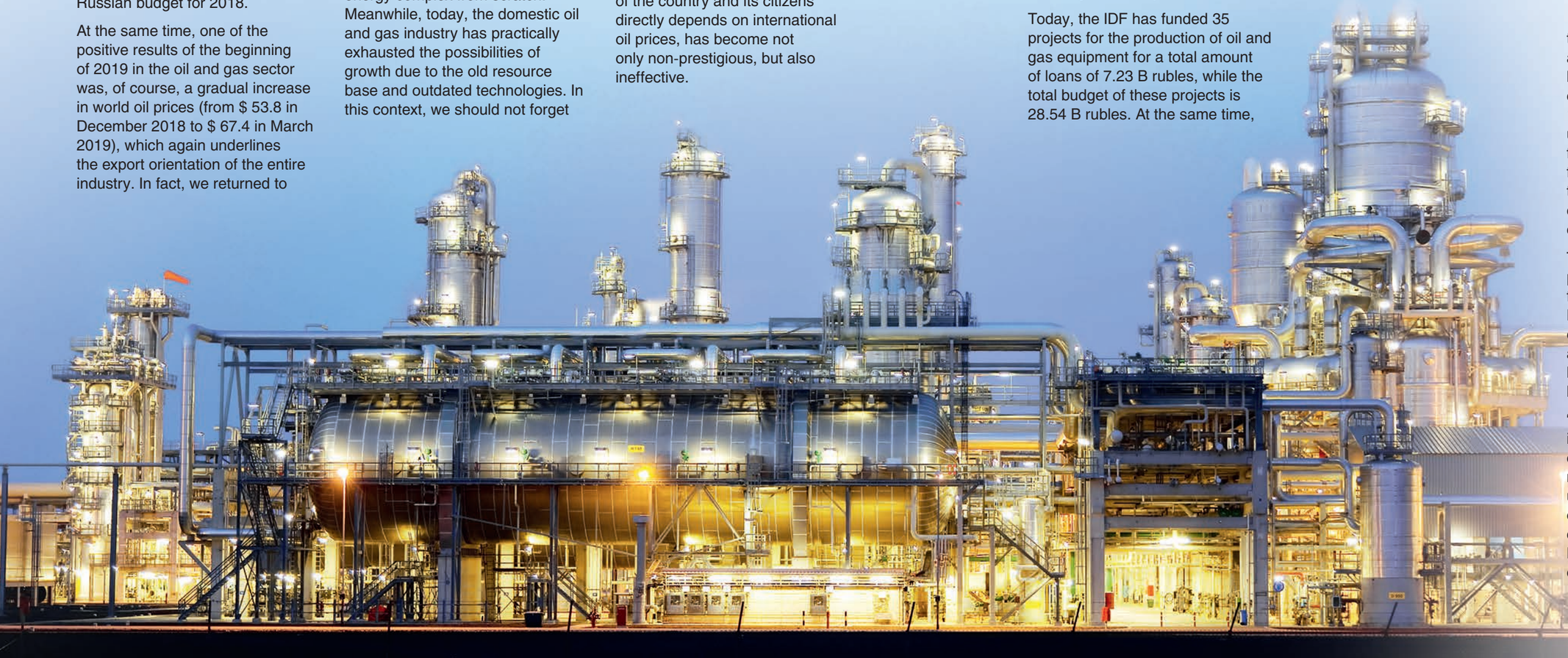
35 friends of IDF

The programs of the Industrial Development Fund do not involve direct financing of mining, but actively assist in the implementation of projects for modernization and development of oil and gas industry.

Today, the IDF has funded 35 projects for the production of oil and gas equipment for a total amount of loans of 7.23 B rubles, while the total budget of these projects is 28.54 B rubles. At the same time, the portfolio of IDF includes 379 projects for a total amount of loans of 86 B rubles, thus the share of oil and gas companies in the total amount is approximately 9% both in quantitative and monetary terms.

It is also worth noting that 18 of these 35 projects belong to companies that are members of the Union of Oil and Gas Equipment Manufacturers. The Union enterprises received loans of 4.23 B rubles from the Fund, with a total budget of projects 15.88 B rubles.

The IDF programs allow Russian enterprises to gain access to concessional loan-based financing necessary to start the production of unique domestic products, as well as the analogues of advanced international developments



Program preferences

The IDF informed that all borrowers of the Fund from the oil and gas sector took concessional loans under the three programs “Development Projects”, “Leasing Projects” and “Components”.

“Most of the projects, 17, were financed under the IDF “Development Projects” program, this is not surprising, since this is the Fund’s flagship program, the “Development Projects” ensure about 70% of the total loan portfolio, all other programs are branches with additional bonuses to the development of any particular industry,” – noted the Director of IDF Roman Petrutsa.

The “Development Projects” program is aimed at creating new industries and introducing new technologies. The maximum loan amount is up to 500 M rubles. The base rate is 5% per annum, but it can be reduced to 3% and even to 1%, for example, if the borrower uses a bank guarantee as collateral for a loan, the rate drops to 3% for the first three years of using the loan. Concessionary rates for exporters and buyers of domestic equipment are also provided.

The Fund clarified that an important principle of the program was co-financing. In the “Development Projects” program, it constitutes over 50% of the project budget, also the investor must invest at least 15% of the loan amount from his own funds.

“The program “Leasing projects” is very popular with oil and gas companies” – 14 loans. The maximum size of the IDF loan under this program is up to 27% of the total cost of industrial equipment. At the same time, the IDF is ready to finance up to 90% of the initial contribution (advance)

of the lessee. For example, with the equipment cost of 100 M rubles and an advance of 30%, the IDF is ready to finance 27 M rubles at 1% per annum, another 3 M rubles is co-financed by the company, and the remaining 70 M by leasing company at a market rate of 7-8% per annum. Thus, even with a minimum amount of own funds, an enterprise can think about modernizing its production facilities," – said Roman Petrutsa, the Director of the IDF.

Regional aspect

The Fund added that another 4 loans of the company were taken under the "Components" program. The program is aimed at stimulating the production of the final product components, for which Russia has a shortage. The list of these products is governed by Resolution No. 719, it is very long, and includes machine tools, pharmaceuticals, electronics. Co-financing by the borrower also starts from 20%, the rate is 1% for the first three years and 5% for the remaining loan term, all other conditions are similar to the Fund's main program "Development Projects".

"It is noteworthy that all these 4 loans were taken not just in the framework of the program "Components", but in its federal-regional format. In the framework of the programs "Development Projects" and "Components" IDF finances projects from 100 M rubles. However, there are many promising regional projects with budgets of less than 100 M rubles, so it became necessary to scale up the experience of the IDF to the regions. Today, about 60 regional funds (RIDF), which are independent organizations operating on the principles of IDF, have been created. At the same time, about 50 RIDFs have already concluded agreements with IDF for issuing joint loans," – said the Director of IDF Roman Petrutsa.

Federal and regional funds provide joint loans for the implementation of projects under the "Development Projects" and "Components" programs in the ratio of 70% (federal funds) to 30% (regional funds). RIDF is a tool for scaling up the RIDF model to regions for relatively small projects up to 100 M rubles. The lion's share of work here is done by the regional fund, and the IDF gives the lion's share of money.

Real success stories

Practically all projects (30 projects) for manufacturers of oil and gas equipment financed by the IDF belong to the machine building industry, and are aimed at import-substituting production of various equipment for the oil and gas industry, in particular, cranes, valves, pumps, compressors, as well as other equipment for the extraction of minerals by closed and open methods.

The borrowers of the IDF from the oil and gas sector are also large companies such as JSC Concern CSRI Elektripribor, JSC HMS Livgidromash, JSC AEM-Technology, LLC NPP BURINTEKH, and medium-sized businesses CJSC NPO Regulator, LLC FPK Kosmos-Neft-Gaz, LLC Pulsator.

A good example of an interesting project is JSC Concern CSRI Elektripribor, which launched the production of domestic rotary controlled systems (RCS), which provide the controlled change of trajectory directly during the drilling process. This is one of the most rapidly developing technologies in the field of oil and gas production.

The main consumers of RCS are oilfield services companies that provide directional and horizontal drilling for oil and gas companies. Without the use of this technology, it is impossible to implement offshore and shale projects. Prior to that, there were no domestic RCS (comparable with the samples of leading world developers and with standard sizes of 160 mm and 220 mm).

Another interesting project was launched by the IDF borrower, the company Pulsator, which organized the high-tech production of castings for pipeline valves, which is used in the field of oil and gas production, processing and transportation, as well as in the field of nuclear and thermal energy.

The castings can be used for the production of pipe fittings operating in corrosive environments, on the Arctic shelf, at ultra-high and ultra-low temperatures.

NPO Regulator, with the co-financing by IDF, produces axial control valves for various purposes. The design of their valve reduces pressure loss, noise, turbulence, and also prevents erosion.

The main consumers of axial-type control valves are enterprises of gas and oil industries. JSC NPO Regulator is planning to replace up to 50% of the axial valve import. ●

OPTIMAL EJECTOR SYSTEMS DESIGN EXPERIENCE AT HIMMASH-APPARAT LLC

HIMMASH-APPARAT LLC IS A LEADING PRODUCTION AND ENGINEERING COMPANY IN RUSSIA, WHICH CARRIES OUT THE DESIGN, MANUFACTURE AND SUPPLY OF HIGHLY EFFICIENT EQUIPMENT FOR OIL AND GAS, PETROCHEMICAL, ENERGY AND NUCLEAR INDUSTRIES: CAPACITIVE, COLUMN, FILTRATION, MACHINE, MASS AND HEAT EXCHANGE, STIRRING, INCLUDING BLOCK-MODULAR VERSIONS OF EQUIPMENT. A SEPARATE AREA OF ACTIVITY IS THE DEVELOPMENT AND SUPPLY OF EJECTORS, HYDROELEVATORS, VACUUM GENERATING EJECTOR SYSTEMS. THE SIMPLICITY AND EFFICIENCY OF EJECTORS RESULTED IN THEIR WIDE APPLICATION IN AVIATION AND SPACE TECHNOLOGY, REFRIGERATION AND VACUUM EQUIPMENT, CHEMICAL, OIL AND GAS, METALLURGY AND OTHER INDUSTRIES

KEYWORDS: *ejector systems, high-performance equipment, capacitive, column, filtration, machine, heat exchange equipment.*

UDC 533.697

Sergey Agaurov,
General Director
"HIMMASH-APPARAT" LLC

Igor Laskin,
Head of Research and Development Department
"HIMMASH-APPARAT" LLC

The quasi-one-dimensional analytical theory developed in the leading research institutes of aerospace industry, TSAGI and TSIAM, is applied as a mathematical model in the design of ejectors. The direct challenge in calculating the ejector is narrowed down to solving the system of nonlinear algebraic equations for unknown gas-dynamic parameters in the ejector [1–2].

In practice, actual, but much more complex in mathematical terms is the problem of designing the optimal ejector for given parameters. In particular, it is interesting to create an ejector with a maximum degree of compression at a given ejection or an ejector with maximum efficiency [3]. The problem is narrowed down to finding the conditional extremum of the functional using the Lagrange multiplier method. In the first case, the value of backpressure is the functional, and the system of nonlinear equations of a direct problem is limitations in the variational problem. CDF analysis is used to test the ejectors with real gases and complex geometry. Figure 1 presents the results of mathematical modeling of gas-dynamic processes in the ejector.

Further, the high-demanded equipment in the petrochemical industry are multi-stage steam-ejector vacuum generating systems (VGS), which consist of sequentially included by the ejectable environment steam jet ejectors and heat exchangers-condensers (see diagram in Figure 2).

FIGURE 1. Mathematical modeling of the ejector. Pressure field

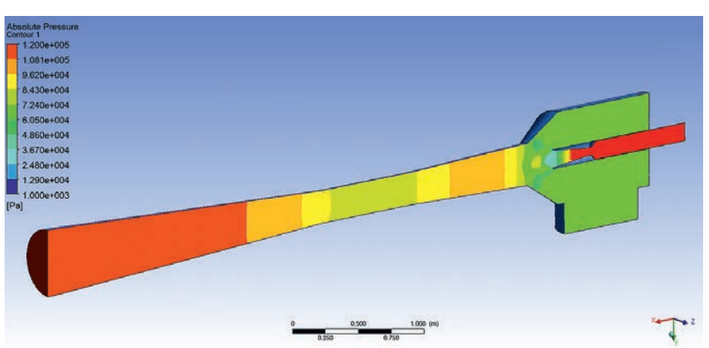


FIGURE 2. Typical scheme of steam-ejector VGS with vertical feed of the active medium

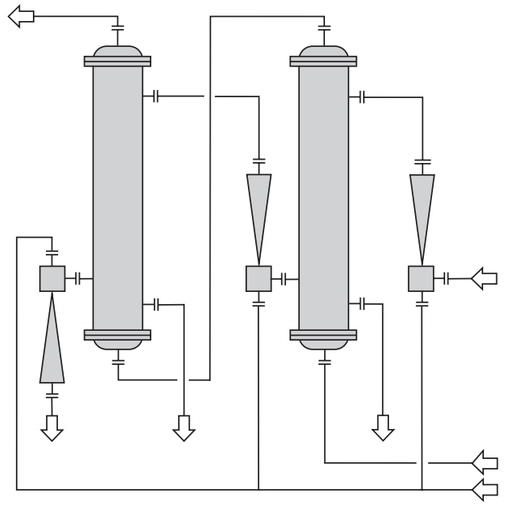
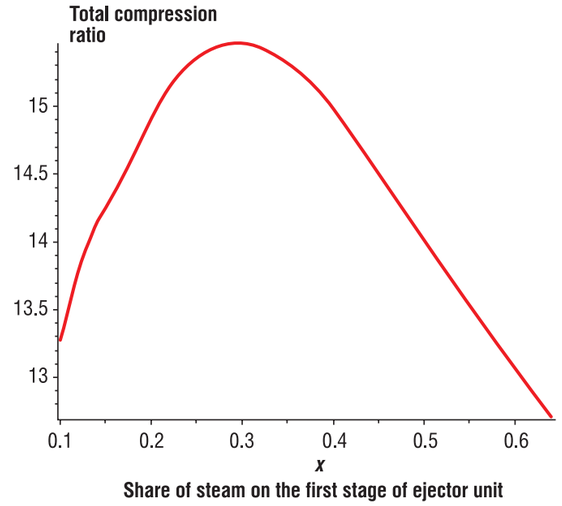


FIGURE 3. Dependence of pressure increase in two-stage ejector system on the proportion of steam directed to the first stage



Designing VGS is a much more complex task [4]. The calculation is not only multifactorial, but also optimizing. Joint calculation of both ejectors and heat exchangers is required. The optimization is to achieve the maximum total compression ratio while minimizing the steam supply, as well as the optimal distribution of the steam supply among the steps. Thus, Figure 3 shows the dependence of pressure increase in a two-stage ejector system without intermediate condensation on the fraction of steam (the total amount is fixed) directed to the first stage. As can be seen from the figure, the optimal distribution of steam among the steps is 30% on the first and 70% on the second one. This ratio provides maximum compression in the system.

The main problem in the design of VGS in practice is that the parameters of the active steam are often in the vicinity of saturation (close to condensation). In this case, to prevent condensation before the critical section of the nozzle, the entrance to the nozzle throat is designed short and smooth (Vitoshinsky profile). The critical section increases compared to the ideal nozzle theory, and the expansion diameter decreases.

Another practical difficulty is that, on the basis of size and installation considerations, the largest first stage ejectors are desirable to be positioned vertically with the supply of active steam "bottom – up". For dry steam, it doesn't matter, but for steam on the saturation line, it creates a problem – condensate in the nozzle leads to a clogging effect and vacuum failure. Separator installation helps to reduce condensate at the entrance to the first stage ejectors.

As you can see, despite the apparent simplicity of ejector devices, their design requires a high scientific and technical potential of the design companies, as well as a lot of experience in the use of ejectors in various processes.

Ejector systems produced by HIMMASH-APPARAT LLC are thoroughly designed with a due consideration of high scientific level researches. Cooperation with leading design institutes and major machine-building plants allows us to design, manufacture and supply ejector systems of any complexity. ●

References

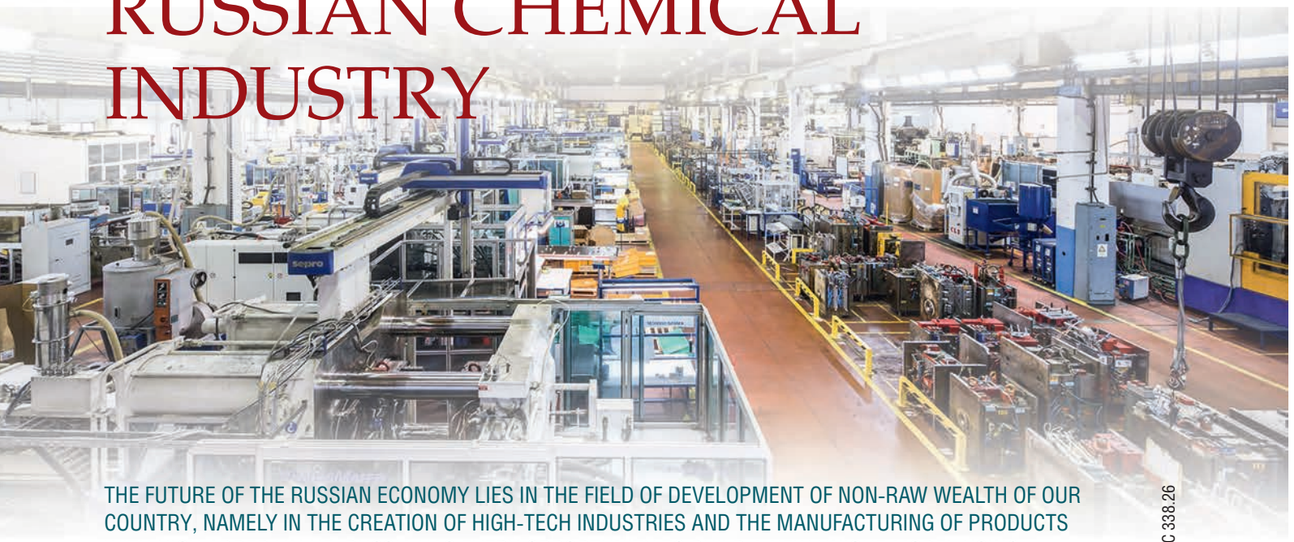
1. *Abramovich G.N., Applied gas dynamics, M.: GITTL, 1953.*
2. *Sternin L.E. Fundamentals of Gas Dynamics, 2012, Moscow, Vuzovskaya Kniga.*
3. *Aleksandrov V.Yu., Optimal ejectors. Theory and calculation, M.: Mashinostroyeniye, 2012.*
4. *Uspensky V.A., Kuznetsov Yu.M. Ejector vacuum pumps, M.: Mashinostroyeniye, 1973.*

HIMMASH APPARAT

Industrial Engineering

You can order steam-ejector units by sending a request with specifications to our e-mail ***info@him-apparat.ru*** *or by phone* ***(495) 2 680 680, (495) 669 93 35***

THE POTENTIAL OF THE RUSSIAN CHEMICAL INDUSTRY



THE FUTURE OF THE RUSSIAN ECONOMY LIES IN THE FIELD OF DEVELOPMENT OF NON-RAW WEALTH OF OUR COUNTRY, NAMELY IN THE CREATION OF HIGH-TECH INDUSTRIES AND THE MANUFACTURING OF PRODUCTS WITH HIGH ADDED VALUE. RUSSIA HAS EVERY OPPORTUNITY TO BUILD A NEW UNIQUE MODEL USING NATURAL RESOURCES AND ATTRACTING TALENTED PEOPLE TO SOLVE THE TASKS

UDC 338.26

Keywords: *: petrochemicals, raw materials processing, economy, value added products, chemical industry.*

Maria Ivanova,
Vice President
Russian Union
of Chemists

The chemical industry is one of the main branches of the Russian economy. Today it is represented by more than one thousand large and over several thousand small and medium enterprises. The human capital of the domestic chemical industry is more than 600 thousand people. It is worth noting that the growth of chemical production comprises annually over 4% which is higher than the industrial growth rates as a whole.

In the situation of considerable global restrictions and against the background of a general reduction in investments into manufacturing, investments in the chemical complex within the past 6 years have grown 2.7 times and already amount to 1.6 trillion rubles. But despite the high performance, it is clear that investment needs to be increased even more. It is worth recognizing that domestic chemists are dealing with strategically important tasks for the implementation of government priorities in import substitution and protection of national interests of the country.

Most of the chemical industries went bankrupt or were eliminated in the 1990s, and only in recent years there is some slow recovery of lost segments. There is a lot of work ahead, first of all on the development and launch of the production of low-tonnage chemistry. This segment of the chemical and petrochemical complex represents the production of high-margin products of raw materials deep processing. For example, the benefits from the sale of low-tonnage chemistry products can be 5-6 times higher than in large-tonnage chemistry.

Investments in the chemical complex in the last 6 years have grown 2.7 times

In the economies of China or the United States, the share of the chemical industry in the GDP reaches about 15%, while in Russia this figure does not exceed 1.4%. This is the point of growth for further development and support from investors and the government. Mineral fertilizers and polymer industries show vivid examples of major investment projects and it is very gratifying to observe growing production data. But we should always remember that further development of chemical technologies and industry in general is impossible without stable and robust low-tonnage chemistry. The key import items are mainly products of this segment; and this puts domestic industry in a vulnerable position taking into account unstable and high prices in the global market.

The share of chemical industry in Russian GDP does not exceed 1.4%

The key to the development of any sector of the national economy in our country lies in high-quality domestic chemistry: reagents, catalysts, dyes, inhibitors, adhesives, paints, fuel additives, etc. Chemical products surround us everywhere both at work and at home – starting from housing and communal services to food, clothing, medicines and medical products.

The military-industrial complex of our country faces the same tasks to meet the needs of the defense complex providing a whole set of strategical substances, to keep the status of one of the most effective in the world. Many experts agree that in many respects the problem is the gap between the scientific works and the real demand from business and government. We must give credit to active universities and scientific associations who are ready in many respects to restructure their work and research to meet the specific needs of the industry.

But in addition to the introduction of the best and modern energy-efficient materials into our everyday life, huge tasks can be solved by adapting imported technologies to domestic production conditions, so called technology transfer. This will allow us not to depend on the "mood" of the global political community, not to endanger the security of the country, to provide ourselves with all necessary materials and substances, this will also allow us to enter global markets with absolute competitive unique products.

Measures laid down by the Strategy-2030 led to an increase in consumption of products per capita from 223 kg/person to 440 kg/person; the consumption of plastics and polymers has increased 2.5 times and fibres and yarns – 3.5 times; the use of mineral fertilizers has reached 55.7 kg/ha

It is worth noting that at the federal level, the chemical industry was supported by the Strategy for the Development of Chemical and Petrochemical Complex for the period up to 2030, which was developed and approved.

A whole range of measures is planned to strengthen national security and support strategic sectors of high-quality special chemistry for the military-industrial complex. For example, the following can be indicative criteria for the implementation of this strategy: increase in consumption of products per capita from 223 kg/person to 440 kg/person; the consumption of plastics and polymers has increased 2.5 times and fibres and yarns - 3.5 times; the use of mineral fertilizers has reached 55.7 kg/ha etc.

In addition to direct investments, one of the most effective tools for the implementation of import substitution is the so-called cluster approach which significantly optimizes the costs of product development and further scaling. These clusters unite various manufacturing facilities in all stages of production from raw materials to final product. Successful examples are Povolozhsky cluster, Volgograd industrial hub, Dzerzhinsky petrochemical pad, etc.

Of course, it is not possible to completely replace all imports, and we do not have such a task. The focus should be on those substances without which further processing and production is not possible in order to implement a complete chain of manufacturing of the final product from the base raw material. The farther we go along the stages of raw materials processing, the stronger and more stable economy we get and the more comfortable life for the population of our country we can provide. ●

Getac

Rugged Mobile Computing Solutions

SECURE OIL AND GAS SOLUTIONS

F110-EX Tablet

High performance, maximum security.

Equipped with an 11.6" widescreen display. Certified in accordance with ATEX and EAC TR CU 012/2011 for use in Zone 2/22.

EX80 Tablet

LEADER OF INDUSTRY.

Certified in accordance with ATEX and TR CU 012/2011 for use in Zone 1.

Windows 10 Pro

Getac recommends Windows 10 Pro.

A popular and multifunctioned operating system compatible with the most home and office computers – Windows 10 Pro is installed on a secure Getac tablet.

Getac Russia Office

127106, Moscow, Altufievskoe shosse, 1/7, off. 218 (BC "Beta-Center")
Phone: +7 495 755 90 96
Sales: alex.kuznetsov@getac.com
https://ru.getac.com/aboutgetac/about.html

Visit our website for a brief analytical report on oil and gas market

RuggedSolution.getac.com/RussiaOil

Getac

Rugged Mobile Computing Solutions

Protected devices for difficult situations

ADS

BUMPER TO BUMPER

Full service cycle
Best support
Cornerstone of durability

Grow with us

Benefit from the new portal for GETAC partners

Getac Russia Office

127106, Moscow, Altufievskoe shosse, 1/7, off. 218 (BC "Beta-Center")
Phone: +7 495 755 90 96
Sales: alex.kuznetsov@getac.com
https://ru.getac.com/aboutgetac/about.html

ON THE WAY TO TECHNOLOGICAL INDEPENDENCE

TODAY, THE TASK OF CREATING IMPORT-SUBSTITUTING INDUSTRIES IS ONE OF THE PRIORITY DIRECTIONS IN THE DEVELOPMENT OF THE COUNTRY'S ECONOMY. IS THE DEFINITION OF THIS TERM CORRECT? DO WE REALLY NEED TO STRIVE FOR FULL IMPORT SUBSTITUTION? WHAT ROLE DOES THE STATE PLAY IN THE ORGANIZATION OF IMPORT-SUBSTITUTING INDUSTRIES? WE ARE DISCUSSING THESE ISSUES WITH SERGEY ARKHIPOV, THE HEAD OF TECHNOLOGY PARTNERSHIPS AND IMPORT SUBSTITUTION, PJSC GAZPROM NEFT

KEYWORDS: *import substitution, state support, oil industry, innovation, fuel and energy complex.*

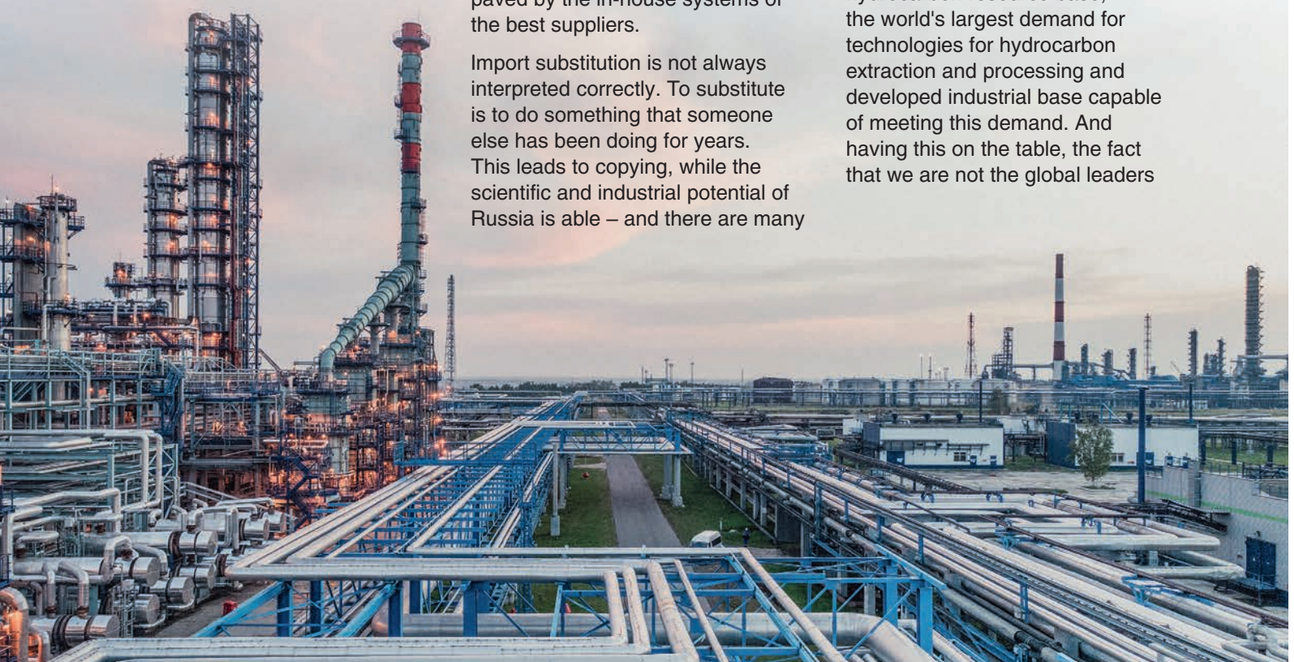
Arkhipov Sergey,
Head of Technology Partnerships and Import Substitution,
PJSC Gazprom Neft

Politics or economy?

Talking about systematic work to increase the power and scientific potential of the supplier system at any company, whose competitiveness depends on the quality of suppliers, we should bear in mind that it is a pure economic and strategic business task. This is the basis of competitiveness. Numerous scientific researches and an enormous number of implemented practices turning common companies into global giants, prove that. Examples include Toyota and Amazon. The way to global leadership for them was paved by the in-house systems of the best suppliers.

Import substitution is not always interpreted correctly. To substitute is to do something that someone else has been doing for years. This leads to copying, while the scientific and industrial potential of Russia is able – and there are many examples to prove – to compete successfully in global markets. It would be more logical and also correct to speak not about import substitution, but about the development of the system of suppliers and the implementation of their export potential, about technological and supply security, about technological independence in the end, but definitely not about substitution. We do not need to catch up. We need to compete as equals and overtake the leading technological powers in the field of fuel and energy.

Russia owns the largest hydrocarbon resource base, the world's largest demand for technologies for hydrocarbon extraction and processing and developed industrial base capable of meeting this demand. And having this on the table, the fact that we are not the global leaders in the whole set of technologies for the oil industry means of course, our mistake, which must be recognized, must be remembered for the future, not to repeat but to correct.



Having a huge solvent demand for the products of fuel and energy complex, business logic suggests the need to have both a huge production of physical products and a first-class scientific potential to meet technological demands in the industry and provide for successful competition in global markets. Only nations capable of providing national supply of key components to their flagship industries can ensure long-term competitiveness and thus increase the welfare of citizens. It's important to remember.

> It would be more logical to speak not about import substitution, but about the development of the system of suppliers and the implementation of their export potential, about technological and supply security, about technological independence

Answering the question about the essence of the import substitution concept, I can say that this is a bad terminology, wrongly trying to cover a more complex fundamental activity on technological development and technological leadership which the Russian oil industry is effectively implementing. And here it is a good time to ask: is import substitution an innovation in the oil industry of the Russian Federation? The essence of innovation is an efficiency suggestion which brought about a joke in Soviet times that the number of efficiency suggestions should have multiplied the GDP of the USSR. Which obviously didn't happen. This example shows how important precise terminology is. We need specific products to meet specific technological challenges, and these challenges demand working in high-tech and innovation industries. Our work requires exceptional innovation, not just something new.

Import substitution tasks, and in fact – what we have discussed above – the task of development of the national system of suppliers, is being solved in many oil-producing countries, from Norway to Saudi Arabia. Some like Norway, for example, managed to turn from a fishing country into a recognized world leader in offshore mining technologies, and some are only beginning this journey. Some solved this task by building up the scientific potential – like Norway, and some – by the production of "hardware", like Brazil. The approach that relies on scientific potential wins this competition.

> Only nations capable of providing national supply of key components to their flagship industries can ensure long-term competitiveness and thus increase the welfare of Russian citizens

Do we need to strive for 100 percent?

Even during the Cold War, nuclear scientists of the USSR and the United States actively interacted, for example, in the MIT campus in Boston. This was how the issues of complex technology security and mutual security were solved.

Autarchy is the way to degradation. Nature and evolution require interaction of systems. Lomonosov was a student of the German school, Kapitsa was a student of Rutherford, and Uralmash in the era of the Stalin Iron Curtain was home to hundreds of foreign specialists, and that, by the way, was much more than today.

Our optimum and our goal is to develop Russian technologies to be successfully used throughout the entire production chain in fuel and energy complex worldwide, it is also the availability of domestic competitive solutions in every critical part of any technological and production process, it is the triumph of the Russian engineering school and thought. And this is not castle-building – the world's first oil tanker developed by Shukhov, the gas turbine of Kuzminsky, seismic by Golitsyn – this is Russian science and technology. At the beginning of the twentieth century, Russia was the technological leader in the global oil industry. Oil technologies of that time are like today's artificial intelligence technologies: a cherry on cake. With such roots, we can well return Russia to the status of a global technological leader in fuel and energy sector; it is important to look up to decent examples of building something new, but not just straight copying, examples of which are abundant in recent history.

State stimulation measures

Most of the existing government stimulation measures are aimed at creating supply, although it may eventually not be demanded. But the fundamental engine of progress is demand, not supply. It is very important to stimulate demand for national technological products. Our company has been tirelessly talking about this for many years and we offer specific tools to stimulate demand.

By the way, methods of state support to American technology companies have long been practiced for both supply and demand. Moreover, the latest methods of American state support to high-tech companies include support to those manufacturers of the cutting-edge product who sell more. Roughly speaking, they are intensively feeding the cow that gives more milk – and so they help American new technologies to conquer world markets. This looks unusual for us, the heirs of the equalizing socialist past, but just think about that – what

a deep common sense is embedded in such approach.

Stimulating the appetite for technological risk in the oil and gas sector certainly requires support at the state level. Mergers and acquisitions in the technological sector of oil and gas in Russia are almost impossible, while in the US hundreds of transactions happen annually – service and mining companies buy new technology all over the world. Fears of new technologies are overcome by economic stimulus. The process of Vertically Integrated Oil Companies purchasing more expensive first

Stimulating the appetite for technological risk in the oil and gas sector certainly requires support at the state level

batches of products previously not produced in Russia, or investment in knowledge-intensive developers may be encouraged by the state by granting profit tax benefits, and such stimulation of demand for new Russian products is not difficult to implement.

The issues of testing and eliminating risks of using "first batch" products are also important. Time, being the most important resource, is often spent on protracted search for test sites and subsequent installation or use of new equipment – few people want to risk testing something new. This can be significantly simplified by stimulation and state co-financing to shared test centers or virtual test ranges providing tax incentives for testing at existing facilities. In addition, we suggest and are already actively discussing with the Ministry of industry and trade of Russia the mechanism of state compensation of insurance expenses for the first batch high-tech products risk of operation.

I need to mention educational challenges as well. In the modern world, the most successful solutions are obtained at the intersection of industries. For that reason there is such a big demand for specialists who are able to see the structure of the entire energy balance and interconnections of different technologies of the energy mix, to understand the basics and principles of technological interaction with other industries to solve the problems of the fuel and energy sector. Masters programs at technical universities specializing in fuel and energy technologies could give us such technical specialists with a broad view – specialists of the 21st century.

What is slowing down the process?

In our work, the widespread transition from the phase of identification of target areas to direct work on the implementation of projects required a significant growth of all types of resources involved, including human resources. This situation is not unique for the fuel and energy sector. Federal authorities, as sources of state support, in the current configuration do not have sufficient human resources to support the management in the external projects being implemented. They need extra support. Following the suggestion of the General Director of our company, centers of additional resources are already being created. These are competence centers in the fuel and energy complex of the Ministry of industry and trade of Russia and the Ministry of Energy of Russia. The discussed configuration of powers and areas of responsibility should allow the center of the Ministry of Energy of Russia to effectively consolidate the demand in the industry and further transfer it to the subsequent implementation by the industry on principles of project management to the center of the Ministry of industry and trade of Russia.

Leading representatives of the industry are also making additional consolidated efforts to improve the efficiency of the process of increasing technological leadership – the programs of joint tests, acceptance of tests conducted in other oil companies, interdepartmental task forces, and much more.

Program Horizon

Keeping up to the pace we can expect to reach parity in technologies with world leaders of the industry by 2025. In figures: in more than 200 nomenclature groups identified as lacking domestic solutions, about 50 have been established to date. But parity is not leadership, so there is still a lot of work ahead. A journey of thousand miles begins with a single step. ●

HOW THE RUSSIAN GAS PIPELINE DRIVES A WEDGE BETWEEN THE US AND ITS ALLIES

THE WALL STREET JOURNAL.

Bojan Pancevski

Before the visit to the White House last spring, A. Merkel and her advisers agreed on a priority: do not talk about the Nord Stream-2. The German-Russian pipeline project was a bone of contention between Berlin and Washington, which fears that its implementation will make Europe's largest

economy excessively dependent on Russian gas. According to eyewitnesses of the meeting, D. Trump told Merkel that she "should stop buying gas from Putin". A year has passed, but the work on the pipeline construction continues. The dispute blares up, and it serves as a good example of how Russia's alienation from the West, instead of bringing its members closer together, drives a wedge between the closest allies. The representative of the US security service, who informed Trump on this issue, said that president believed that Nord Stream-2 was incompatible with the military shield that America held over Europe.

RUSSIA, WITH ITS ARCTIC LNG PROJECT, WANTS TO SEDUCE JAPAN EXPERIENCING ENERGY HUNGER

日本經濟新聞

Hirofumi Matsuo

The first gas liquefaction project on the Yamal Peninsula was commissioned in 2017. Novatek company invited Japanese trading houses Mitsubishi and Mitsui to participate in the second project, and Tokyo considered this step positive. Russia invites Japan to participate in polar energy projects, as this world's largest exporter of natural gas faces increasing competition from the US and looks to Asia in an attempt to diversify supplies. There are two trends forcing Moscow to look to the East. They are the concern of European countries about excessive dependence on Russian gas and strengthening the position of the US as a major oil and gas producing country.

Having been faced with Western sanctions, Moscow seeks to earn support of Asian gas buyers, and in particular Japan, which is the world's largest importer of LNG.

OPEC AND RUSSIA RESIST TRUMP

Frankfurter Allgemeine

Christian Siedenbiedel

The exchange of blows between the US President Donald Trump and the Organization of Petroleum Exporting Countries caused significant fluctuations in the oil market. Prices for crude oil, boiler fuel and gasoline went up again. However, OPEC is determined to reduce oil production and does

not yield to pressure from the United States. Via Twitter Trump spread the message that OPEC should restrain itself in its pricing policy. "Oil prices getting too high, OPEC, please relax and take it easy. World cannot take a price hike". On Monday, this tweet temporarily lowered the price of oil by more than 3%. But OPEC and Russia rendered blow for blow. The Russian Minister of Energy A. Novak said that his country had reduced oil production by 140–150 thousand barrels per day compared with December. The Saudi Minister of Energy Khalid Al-Falih said that it was important for oil producing countries to restrain production in the second half of 2019. ●

MESHCHERIN INDEX

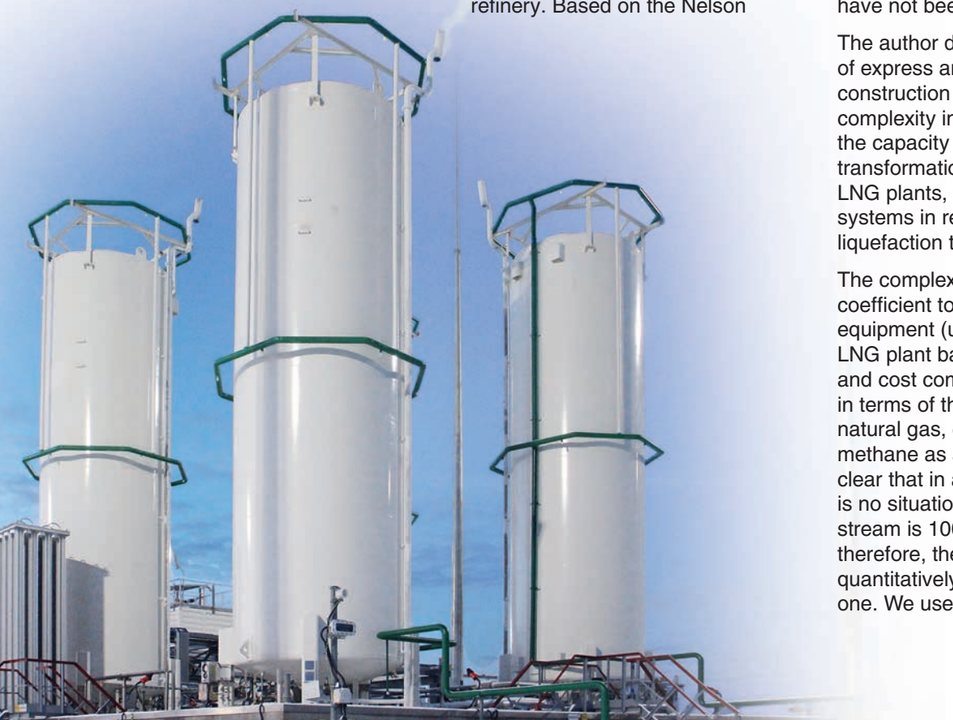
Complexity index for LNG plants and installations

TODAY, THE COMPLEXITY FACTOR OF THE OIL REFINERY IS WIDELY USED, WHICH IS BASED ON THE USE OF NELSON COMPLEXITY INDICES REASONED AND CALCULATED BACK IN THE 1960S. BUT SUCH STUDIES FOR GAS PROCESSING PLANTS, ESPECIALLY FOR LNG PLANTS HAVE NOT BEEN CONDUCTED. THE AUTHOR OF THE ARTICLE DEVELOPED THE PRINCIPLE OF EXPRESS ANALYSIS OF LNG PLANTS CONSTRUCTION PROJECTS USING THE COMPLEXITY INDEX, WHICH ASSESSES THE CAPACITY LEVEL OF PRIMARY TRANSFORMATIONS OF RAW GAS AT LNG PLANTS, STORAGE AND SHIPMENT SYSTEMS IN RELATION TO THE FINAL LIQUEFACTION THROUGHPUT CAPACITY

UDC 665.725

Ключевые слова: *Nelson index, LNG, gas processing plant, Express analysis, plant design.*

Meshcherin I.V,
Associate Professor of Gas Chemistry Department Gubkin Russian State University of Oil and Gas National Research University, Candidate of technical sciences,
President of the National Chamber of Engineers



In the global design and research practice, the complexity factor of a refinery is widely used, which is based on the use of the Nelson indices reasoned and calculated in the 1960s, which are the ratio of the unit costs on building the unit of any of the processes used at the refinery to unit costs on the installation of primary oil refining.

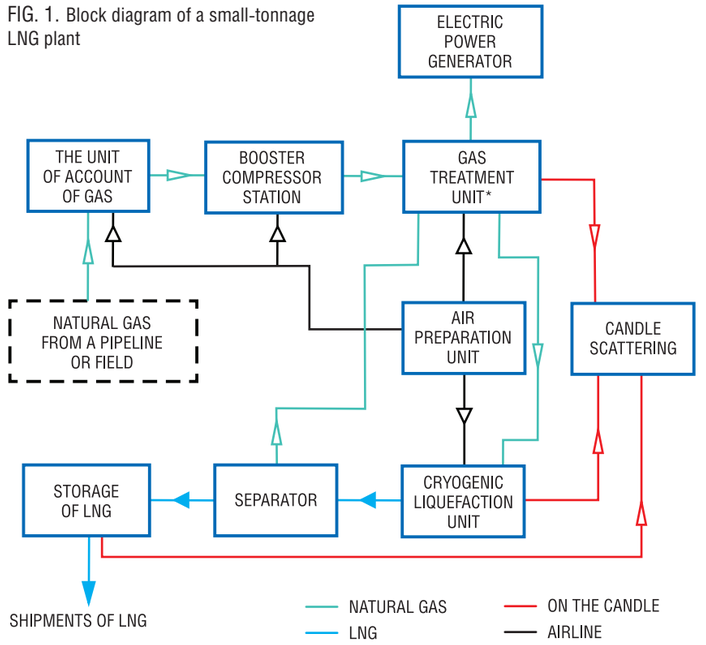
These complexity factors make up the basic element of the developed by V. Nelson methodology for assessing the complexity of a refinery. Based on the Nelson indices and the shares of individual processes, calculated in relation to the capacity of the primary oil refining, the complexity rating of a refinery is determined. It is formed as the sum of the products of the complexity coefficients of each process in a refinery to the share of this process. In essence, this is a relative weighted average capital intensity of oil refining at the plant with this technological scheme [1].

Such studies for gas processing plants, especially for LNG plants have not been conducted.

The author developed the principle of express analysis of LNG plants construction projects using the complexity index, which assesses the capacity level of primary transformations of raw gas at LNG plants, storage and shipment systems in relation to the final liquefaction throughput capacity.

The complexity index assigns a coefficient to each unit of the main equipment (unit, module) in the LNG plant based on its complexity and cost compared to the simplest, in terms of the production of liquid natural gas, cold box using pure methane as a raw material. It is clear that in actual practice there is no situation when the raw gas stream is 100% methane, and therefore, the effluent LNG flow is quantitatively equal to the influent one. We use the ideal situation

FIG. 1. Block diagram of a small-tonnage LNG plant



for the purposes of the study, and assign a coefficient of complexity 1.0 to such a cold box.

The actual composition of the raw gas stream at the entry to the liquefaction plant will always differ from the ideal in varying degrees. In practice, to improve the quality of raw materials, various units are used, extracting mechanical impurities from it, water, condensate, acid gases, sulfur-containing elements, mercury, nitrogen, helium, and non-methane hydrocarbon gaseous fractions.

The complexity of each such unit is proposed to be calculated by multiplying the coefficient reflecting its cost by the coefficient of negative impact on the quantity of the final product – LNG – due to throughput capacity losses at the plant's output.

Summing up the complexity values obtained for each piece of equipment, including the cold box, we determine the total “complexity of the LNG plant by index”.

The complexity index indicates not only the intensity of investment or the level of capital investment in the construction of the LNG plant, but also its potential added value. The higher the index, the higher the relative cost of the LNG plant, the lower its relative throughput capacity and the lower the competitiveness of its products.

To calculate the complexity of the unit for an ideal cold box, we apply the formula [3]:

$$N = \frac{P}{Q}, \qquad (1)$$

where N – complexity factor;

P – the cost of capital investments in the construction of a cold box, mln. rub.;

Q – the throughput capacity of a cold box by raw material, equal to its throughput capacity by the output product, t/h.

Next, we consistently calculate coefficients for each unit that is part of a liquefaction plant:

$$N_i = \frac{P_1 + P_i}{P_1}, \qquad (2)$$

where N_i – the coefficient taking into account increase in capital investment caused by the construction of the i-th installation as part of a plant.

For example, the cost of construction of a cold box with a capacity of 5 t/h amounts to 310.12 mln. rubles. Unit costs on its construction amount to:

$$\frac{310.12 \text{ m r}}{5 \text{ t/h}} = 62.02 \frac{\text{m r h}}{\text{t}}.$$

We accept the investment index for a cold box equal to 1 and equate to the value obtained:

$$60.02 \frac{\text{m r h}}{\text{t}} = 1.$$

When adding a gas sweetening unit, the plant's raw material throughput capacity is still 5 t/h, the cost of unit together with the liquefaction block will be 310.12 + 8.85 = 318.97 mln rubles. Unit costs on construction will amount to:

$$\frac{318.97 \text{ m r}}{5 \text{ t/h}} = 63.79 \frac{\text{m r h}}{\text{t}}.$$

The costs on construction of a plant with this unit are 1.03 times higher than on construction of a single cold box. Consequently, the cost growth ratio for the selected blocks is 1.03.

Losses at each block of unit will be taken in accordance with the standards of technological design of gas processing plants. [3] Taking them into account, let's calculate the index of throughput capacity losses:

$$s = \frac{Q - q}{Q}, \qquad (3)$$

where q – the losses of throughput capacity by output product.

For example, for gas sweetening, this index will amount:

$$s = \frac{5 - 5 \cdot 0{,}4}{5} = 0{,}6.$$

The complexity of the unit is calculated by the formula:

$$C = N \cdot S. \qquad (4)$$

For gas sweetening unit, this value will amount:

$$C = 1{,}03 \cdot 0{,}6 = 0{,}62.$$

To assess the complexity of the entire plant, it is necessary to sum up the complexity values calculated similarly for each unit, as shown in Table 1.

Complexity index:

$$\sum_{i=1}^{n} N_i S_i \rightarrow C_n = \sum_{i=1}^{n} N_i S_i \qquad (5)$$

For a full assessment of the degree of the perfection of LNG plant technological structure from an economic point of view, indices and complexity ratings may not be

TABLE 1. Sequence of calculations

Cost, mln. rub	P_1	P_2	...	P_i
Throughput capacity, t/h.	Q	$Q - q_2$	...	$Q - q_i$
Cost growth ratio	$N_1 = \frac{P_1}{Q} = 1$	$N_2 = \frac{(P_1 + P_2)}{P_1}$	...	$N_i = \frac{(P_1 + P_i)}{P_1}$
Throughput capacity reduction ratio	$S_1 = \frac{(Q - q_1)}{Q}$ в общем случае $q_i = 1$	$S_2 = \frac{(Q - q_2)}{Q}$	…	$S_i = \frac{(Q - q_i)}{Q}$
Complexity index	$C_1 = N_1 S_1$	$C_2 = N_2 S_2$	…	$C_i = N_i S_i$

sufficient for all their independent value. It is known that liquefied gas can have different compositions and temperatures. The complexity rating can be achieved by completely different technological means. In addition, the amount of the final product (LNG) will be different from the amount of input raw gas by the amount of separated impurities, losses in the apparatus and energy consumption. These losses are included in the formula.

Let's consider the approximate parameters of two small-tonnage LNG plants.

Option 1 – with a throughput capacity of 5 t/h, designed to liquefy the raw gas at the field.

Option 2 – with a throughput capacity of 2 t/h, designed to liquefy the raw gas from the Unified Gas Supply System (UGSS).

Figure 1 shows the block diagram for the two options.

Tables 1 and 2 present the composition of the raw gas and LNG at the exit of the cool box for each of the options.

It is quite difficult to calculate the cost of equipment and installation correctly. Especially general construction work, the cost of land and bringing service lines. Tables 4 and 5 present approximate calculations of the complexity index for new small-tonnage LNG plants in configurations that demonstrate the inherent features of each option.

Thus, for a plant with a throughput capacity of 5 t/h, the complexity index amounts to 6.26, and for a plant with a capacity of 2 t/h, it is 2.61.

Obviously, the construction of an LNG plant using raw gas obtained from the field is more complicated than using raw materials obtained from the UGSS, since this gas has already been treated for the mainline transport. However, the composition of the raw gas from different fields can also be quite different, which will affect the complexity index. It should be expected that for small-tonnage LNG production facilities using open and closed cycle technologies, when choosing a liquefaction technology, the complexity rating values can provide information for decision making at the early stages without costly calculations.

The cost of gas treatment often depends on the liquefaction technology. For example, for a high pressure cycle, most of the water 'falls out' when compressing gas to 200 bar. In addition, at such a high pressure, the dimensions, and accordingly, the cost of adsorbers for cleaning and dehydration, becomes significantly less than at a pressure of 40–50 bar, as in full liquefaction plants operating in a mixed or nitrogen cycle.

At gas distribution stations of liquefaction plants that use open cycles, it is necessary to dry and clean much more gas than LNG is produced. These technologies

TABLE 2. Component composition of natural gas at the entry and exit of the gas treatment unit for a plant with a throughput capacity of 5 t/h

Component	Entry	Exit
Methane	90.92	91.78
Ethane	4.89	4.99
Propane	0.78	0.80
I-butane	0.12	0.13
N-butane	0.18	0.18
I-pentane	0.05	0.06
N-pentane	0.00	0.04
N-hexane	0.05	0.04
N-heptane	0.06	0.03
N-octane	0.02	0.02
Nitrogen	2.31	1.93
Helium	–	–
O_2	–	–
H_2	0.02	0.00
H_2O	0.02	0.00
H_2S	0.18	0.00
CO_2	0.39	0.00

TABLE 3. Component composition of natural gas at the entry and exit of the gas treatment unit for a plant with a throughput capacity of 2 t/h

Component	Entry 2 t	Exit 2 t
Methane	95.47	96.36
Ethane	1.92	1.82
Propane	0.51	0.52
I-butane	0.08	0.08
N-butane	0.08	0.08
I-pentane	0.02	0.02
N-pentane	0.00	0.02
N-hexane	0.01	0.01
N-heptane	–	–
N-octane	–	–
Nitrogen	1.39	1.08
Helium	0.02	0.00
O_2	0.01	0.01
H_2	0.00	0.00
H_2O	0.00	0.00
H_2S	0.00	0.00
CO_2	0.50	0.00

TABLE 4. Indicators of liquefaction plant with a throughput capacity of 5 t/h

Unit	Cost, M Rub	Throughput capacity, t/h	Cost growth ratio	Throughput capacity losses, %	Throughput capacity losses coefficient	Complexity index
Coll box refrigeration system with refrigerant compressors	310.12	5	1.00	0	1	1
Gas cleaning unit	12	5	1.04	0	1	1.04
Gas sweetening unit	8.85	5	1.03	0.4	0.6	0.62
Gas dehydration unit	13.275	5	1.04	0.3	0.7	0.73
Hydrogen sulfide removal unit	17.7	5	1.06	0.4	0.6	0.63
Mercury removal unit	4.425	5	1.01	0.3	0.7	0.71
Fractionation unit	19.9125	5	1.06	0.5	0.5	0.53
					Total:	6.26

TABLE 5. Indicators of liquefaction plant with a throughput capacity of 2 t/h

Unit	Cost, M Rub	Throughput capacity, t/h	Cost growth ratio	Throughput capacity losses, %	Throughput capacity losses coefficient	Complexity index
Coll box refrigeration system with refrigerant compressors	120	2	1.00	0.00	1	1.00
Adsorption gas dehydration and gas cleaning unit	50	2	1.42	0.50	0.5	0.71
Boosting compressor station (BCS)	34	2	1.28	0.30	0.7	0.90
					Total:	2.61

are designed in such a way that the entire gas stream entering the unit must be dehydrated, and approximately 30% of the input stream must be cleaned of CO_2. At the same time, the liquefaction coefficient is only 10–12%. That is, for a unit with a throughput capacity of 5 t/h for LNG, dehydration works for 50 t/h for raw gas, and CO_2 removal – for 15 t/h. All treated but still cold gas is discharged into the low-pressure network.

When working on this indicator, a significant inconvenience for the author was the lack of correct data on capital investments and losses, therefore, on complexity indices for some of the processes that can be used at the considered plant.

Indices and complexity ratings of LNG plants are convenient for a rapid assessment of necessary investments in the construction of both small-tonnage and medium- and large-tonnage plants, which is most important for the examination of the feasibility studies of new construction and reconstruction projects. The proposed indicators have a feature conditioned by their relatively narrow purpose: they characterize the measure of the complexity of LNG plants technological structure from the cost point of view (in terms of capital intensity), taking into account productivity losses in terms of the quality of raw materials. This is not a disadvantage, but a specific function of these indicators.

The proposed approach allows to take into account the complexity of construction, taking into account, for example, the cost of land, or the cost of electricity supply, for which similar coefficients can be calculated and added to the ideal case. Throughput capacity in this case will not be affected.

The problem is solved in general, therefore it seems possible to apply the proposed approach for plants of any capacity. In the case of calculating a complexity index for a large-tonnage production, it will be important to know gas losses in each unit, including in the cool box. Unfortunately, such data are not available in open sources, which limits the possibilities for conducting scientific work. ●

References

1. *O. Braginskii. Spravochnik khimika. Koeffitsiyent slozhnosti protsessa [Chemist Handbook. Process complexity coefficient] https://www.chem21.info/info/671230/.*
2. *Engineering Design Standards for Gas Treatment Plants http://blueline.ru/press-center/library/regulatory-support/%D0%A0%D0%94_39_135_94.pdf.*
3. *Z.I. Safin, A.F. Kemalov, R.A. Kemalov, N.A. Terentyeva Kompleksnaya otsenka neftepererabatyvayushchikh zavodov i zavodov po pererabotke tyazhelykh neftey i prirodnykh bitumov [Comprehensive assessment of refineries and plants for the processing of heavy oils and natural bitumen] https://cyberleninka.ru/article/n/kompleksnaya-otsenka-neftepererabatyvayuschih-zavodov-i-zavodov-po-pererabotke-tyazhelyh-neftey-i-prirodnyh-bitumov.*

METHIONINE PRODUCTION AS AN EFFICIENT WAY TO PROCESS HYDROGEN SULFIDE

RUSSIA HAS LARGE RESERVES OF UNIQUE MERCAPTOACETATE RAW MATERIALS IN THE FIELDS OF THE CASPIAN SEA REGION. THE MAIN PRODUCTS OF THE PROCESSING OF HYDROGEN SULFIDE AT THE GAS PROCESSING PLANTS TODAY ARE GAS SULFUR AND SULFURIC ACID, INEXPENSIVE PRODUCTS, THE SUPPLY ON WHICH IN THE MARKET EXCEEDS DEMAND. IN VIEW OF THE HIGH PROFITS FROM THE PRODUCTION OF METHIONINE, THE AUTHORS OF THE ARTICLE EXPRESS AND JUSTIFY AN OPINION THAT IT IS NECESSARY TO DEVELOP METHIONINE SYNTHESIS TECHNOLOGIES FROM THE AVAILABLE SULFUR AND NITROGEN-CONTAINING SUBSTANCES, AS WELL AS THE NEED TO ORGANIZE LARGE-SCALE INDUSTRIAL PRODUCTION OF METHIONINE IN SOUTHERN RUSSIA

Keywords: *mercaptoacetate raw materials, processing of hydrogen sulfide, gas processing, production of methionine chemical synthesis.*

UDC 66.01

Kozlov Andrei,
Associate Professor of Oil and Gas Processing Equipment Department, Candidate of technical sciences

Karpov Alexei,
Assistant Professor of Oil and Gas Processing Equipment Department

Kondratenko Andrei,
Engineer

Kosheleva Yulia,
Candidate for a Master's Degree of Oil and Gas Processing Equipment Department

Gubkin Russian State University of Oil and Gas (National Research University)

Today, the main products of hydrogen sulfide gas processing at GPPs are gas sulfur and sulfuric acid. These processes have been used in industry for a long time, but the cost of products is extremely small (the cost of 1 ton of gas sulfur does not exceed 5 thousand rubles, and 1 ton of sulfuric acid – 15 thousand rubles), and in the market the supply often exceeds demand, which leads to the reduction of manufacturer's profit. Nevertheless, there are high liquidity products of hydrogen sulfide processing, the cost of which exceeds 150 thousand rubles per ton, one of which is an indispensable amino acid widely used in the industry, methionine (2-amino-4-(methylthio) butanoic acid, figure 1).

Like any amino acid, methionine is an expensive product that is mainly used in the production of modern compound feeds for agriculture, as well as in the pharmaceutical industry, therefore the main consumer of methionine is the production of premixes and ready-made feeds for livestock, poultry, and, most recently, fish farming. This is due to the fact that the basis of the protein part of modern feeds is soy protein, which is deficient in sulfur and to obtain stable weight gain it is necessary to add methionine to the protein concentrate. It should be noted that methionine is added to the composition of sport nutrition, which also expands the sales market.

It should be noted that methionine consumption is closely related to income level and preferences in meat food of people living in countries (figure 2). In light of the increase in wealth and, as a result, the consumption of meat products in Asia, this continent is the leader in consumption of this amino acid, the use of which exceeded 390 thousand tons in 2018. However, the European market will be developing

FIGURE 1. L,D-methionine

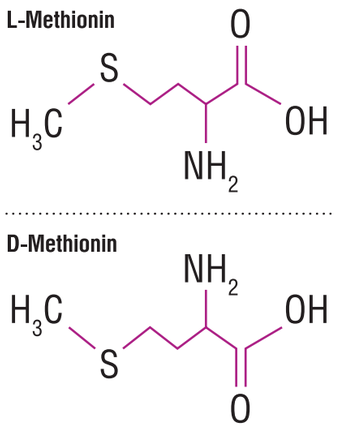
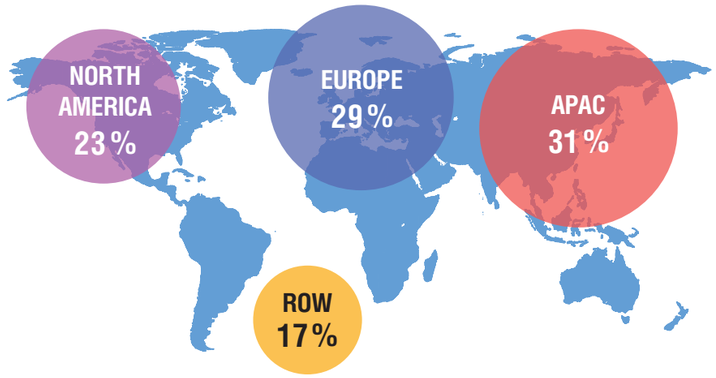


FIGURE 2. Distribution of methionine consumption by continents



and by 2025, consumption will exceed 500 thousand tons, which is associated with an increase in livestock efficiency and feed structure optimization. Thus, the methionine market will not be excessive in supply and is relevant for new players.

A feature of methionine is the availability of two stereoisomeric forms – L and D (these forms are specularly reflected). In many organisms of living beings only the L-form can be taken up, and that is what the body use to synthesize hormones, ferments and proteins, and to use the D-form, it needs to be converted to the L-form. Currently, the main capacities are synthesizing methionine by chemical means using multistage chemical synthesis and using acrolein, hydrocyanic acid and methylmercaptan a mixture of isomers is obtained, despite the increased cost of pure L-methionine. Therefore, the release of L-methionine, which is synthesized enzymatically, as a more expensive product, to the market is also relevant.

In industry, there are two methods for the synthesis of methionine – biotechnological and chemical. The general principle of the first method is based on the artificial cultivation of a certain type of strain in a nutrient medium with a constant carbon source, for example, starch syrup. Bacteria with disturbance in nitrogen metabolism secrete one amino acid in large quantities into the fermentation solution, after which it is isolated using chemical method. On the one hand, the fermentation method is quite simple, it is performed on small-sized equipment, carried out in one or two stages, and ecologically harmless. But on the other hand, microorganisms are very sensitive to changes in process conditions, in particular to pH, temperature; in addition, the method has a low selectivity, due to which the concentration of the obtained α-AA (amino acid) is rather low. Therefore, this method is not so widespread in large-scale production.

Chemical synthesis is more versatile and gives a much greater output and better quality of the target product. But the process is multistage, requires large amounts of capital and energy. The determining factor is usually the economy. As practice shows, in large-scale industrial production, chemical synthesis is justified. At the moment, there are several patented methods for the chemical production of D, L-methionine. Various organic and inorganic compounds (propylene, L, D-homoserine, hydrocyanic acid, ammonia, potash, alkalis) can be used as reagents, but in all methods at the initial stage of the synthesis the main participant is gas raw material (propylene and mercaptan), and of all the homologues of mercaptans,

TABLE 1. Distribution of methionine production capacities

Manufacturer	Location	Capacity, ths. t/year
Arkema	Malaysia	80
ChemChina-BlueStar	China	70
	France	n/a
	France	77
	France	n/a
	Spain	105
	USA	24
Evonik Degussa	Singapore	430
	Germany	
	Belgium	
	USA	
Evonik Rexim	China	3
Metabolic Explorer	Malaysia	n/a
Nisso	Japan	250
Unisplendour Tianhua Methionine	China	60
Sumitomo Chemicals	China	20
	Japan	140
Volzhsky Orgsynthese	Russia	23
Others		300

only methylmercaptan is used. Methylmercaptan with acrolein is converted to 3-methylthiopropionic aldehyde. This operation can be organized directly at the plant receiving the natural methylmercaptan, which will exclude the transport of toxic mercaptan.

Considering that methionine can be attributed to large-tonnage products, large-tonnage chemical synthesis plants (table 1) predominate, however small-tonnage fermentation productions appear too. Despite the official interviews of the representatives of companies about the benefits of classical methionine synthesis, all of them have a large baggage of patents on fermentation synthesis and are expanding it. Thus, the fermentation method is currently promising, especially with relatively small production volumes. However, despite the high concentration of capacities, the price of methionine amounted more than 180 thousand rubles per ton with fluctuations corresponding to the cycles of production and consumption of animal protein. Currently, cost indicators are similar, and therefore there are no prerequisites for reducing the price of amino acids and the profits of methionine synthesis production.

However, in Russia, the production of sulfur-containing amino acids is traditionally limited and existing production does not significantly increase product output, and given the introduction of new and modernization of existing facilities for highly productive poultry and livestock, imports of methionine are growing annually.

The reason for the limited production of methionine is the presence of only one production at JSC Volzhsky Orgsynthese with a capacity of about 23 thousand tons per year. Initially, installations with a capacity of 3.5 thousand tons per year were built in 1964, and upgraded (and in fact a second production was built) in 1987 by specialists from the French company Rhone Poulenc. However, production capacity is not enough and about 33 thousand tons of methionine (i.e. more than what is produced) are exported to Russia (but it should also be noted that with simultaneous import, Russian methionine is exported, too). The main company importing methionine in Russia is Evonik, but given that the bulk of methionine is imported from Belgium, the cost of the product correlates with the European average. Thus, in Russia there is a market niche for import substitution of about 30–35 thousand tons of methionine, as well as opportunities for exporting this product.

Russia has large reserves of unique mercaptoacetate raw materials from the Caspian Sea region and these resources (30 thousand tons/year) are at the level of their global production by synthetic means, therefore, the organization of large-scale industrial production of methionine in southern Russia should be considered first. In this case, taking into account the low cost, it is possible to consider methionine synthesis not only for domestic market, but also for export, which creates an economic effect due to the high conversion of hydrogen sulfide.

Considering the high profits from methionine production and the existing market niche, methionine synthesis technologies should be developing from available sulfur and nitrogen containing substances (hydrogen sulfide, mercaptans, urea, ammonia), which are produced at gas processing and gas chemical enterprises of Russia, and methionine production plants can be integrated into existing productions both to reduce capital and operating costs, and to reduce the release of cheap gas sulfur or sulfuric acid.

KEYWORDS: *mercaptoacetate raw materials, processing of hydrogen sulfide, gas processing, production of methionine chemical synthesis.*

APPLYING OF PHONON DIAGNOSTICS TECHNIQUE ON MAIN PIPELINES

THE ARTICLE PRESENTS THE FUNDAMENTAL PRINCIPLES OF PHONON DIAGNOSTICS TECHNIQUE, ITS TECHNICAL CAPABILITIES AND SCOPE OF APPLICATION. IT DESCRIBES THE APPLICATION OF PHONON DIAGNOSTICS TECHNIQUE ON ONE OF THE MAIN GAS PIPELINES

UDC 622.692

Keywords: *sensor, defect, inspection, testing, material, load, object, pipeline, phonon, characteristic, emission.*

Gennady Korobkov,
Professor of the Department of Oil and Gas Transport and Storage, Ufa State Oil Technical University
Doctor of Technical Sciences, Professor

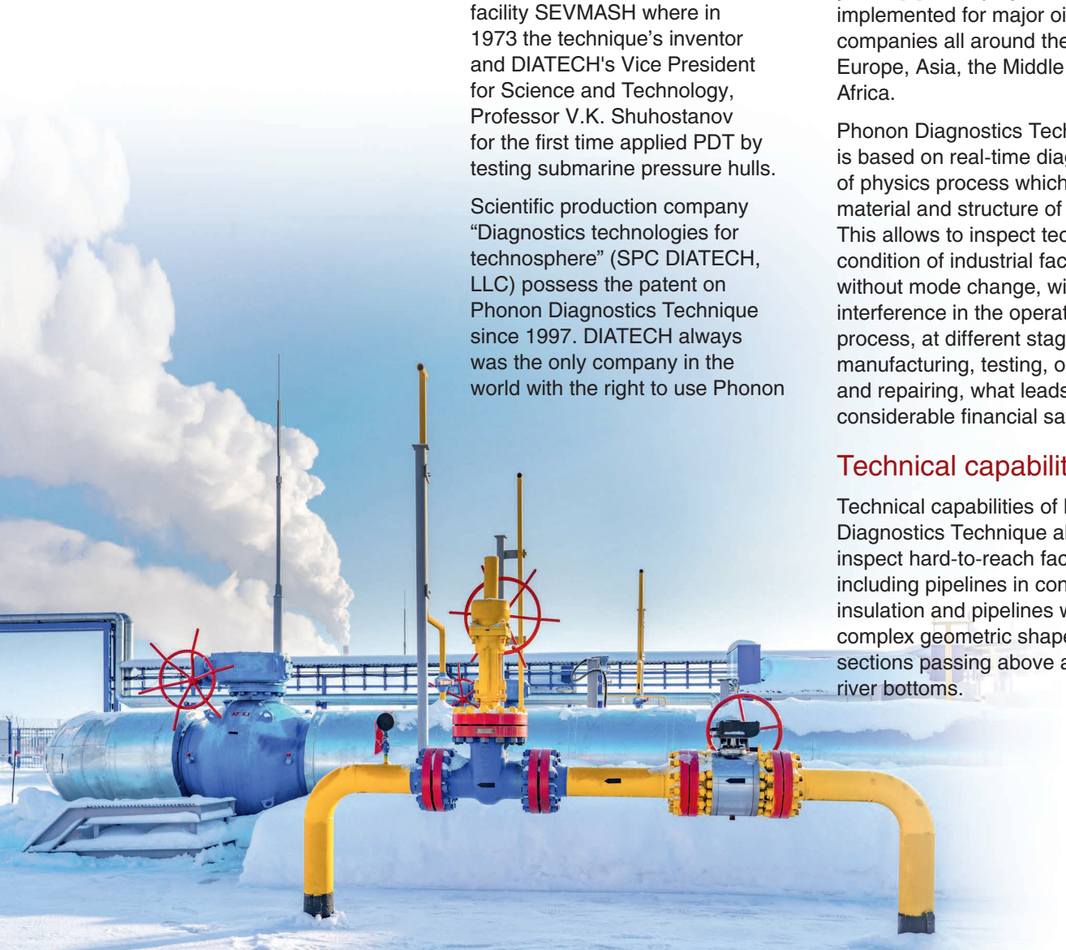
Origin of PDT

Phonon Diagnostics Technique (PDT) originate from scientific and technical achievements of Soviet Union's defence industry.

The history of PDT began in the well-known submarine facility SEVMASH where in 1973 the technique's inventor and DIATECH's Vice President for Science and Technology, Professor V.K. Shuhostanov for the first time applied PDT by testing submarine pressure hulls.

Scientific production company "Diagnostics technologies for technosphere" (SPC DIATECH, LLC) possess the patent on Phonon Diagnostics Technique since 1997. DIATECH always was the only company in the world with the right to use Phonon Diagnostics Technique, PDT equipment and PDT software, to train PDT specialists. DIATECH's Research and Training Department has been improving company's technologies, developing software and hardware for more than 20 years. [3]. PDT projects were implemented for major oil and gas companies all around the world: in Europe, Asia, the Middle East and Africa.

Phonon Diagnostics Technique is based on real-time diagnostics of physics process which goes in material and structure of facilities. This allows to inspect technical condition of industrial facilities without mode change, without interference in the operating process, at different stages of manufacturing, testing, operating and repairing, what leads to considerable financial saving.



Technical capabilities

Technical capabilities of Phonon Diagnostics Technique allow to inspect hard-to-reach facilities including pipelines in concrete insulation and pipelines with complex geometric shapes, pipe sections passing above and below river bottoms.

Phonon Diagnostics Technique is applicable in a wide range of temperatures and pressures. The temperature of the working environment when installing Phonon Emission Transducers directly on the inspected component's surface can vary from -20 to +70 °C. Temperature of the operating fluid when installing transducers using waveguides can be from -80 to +400 °C.

PDT fully covers the common range of pipeline diameters and wall thicknesses without restrictions in their length.

Phonon Diagnostics Technique detects following types of defects: loss of metal of corrosive origin (extensive anomaly), single and group pits, cracks, stress-corrosion cracking and others. PDT allows to identify defects by size and depth, type and severity, to determine quantity and location. Application of innovative Phonon Diagnostics Technique is possible in combination with conventional inspection techniques.

Phonon Diagnostics Technique does not require point measurements on surface, instead of this phonon emission is recorded in whole of inspected component. The product flow rate does not affect inspection results.

Working principle

Onstream industrial facilities (such as pipelines), rather the materials from which they are made, are influenced by effects of different types such as mechanical, thermal, magnetic, i.e. energy effects them from outside. The materials themselves have internal energy, including the energy of the crystal lattice bonds – phonon emission.

There is an interaction of material and energy appears in a component under operating conditions, i.e. the energy (*E*) supplied from the outside interacts with material (*M*). As a result of this energy interaction, there are processes of redistribution, concentration and release (emission) of energy by the material i.e. phonon emission *PhE* is formed in the material and around it.

The universal reaction of interaction in terms of "material (structure) – energy" can be written as follows:

$$E + M = PhE$$

As a result of interaction between energy and material is various physical processes – corrosion damage, thinning, fatigue damage, and destruction. Phonon emission is most intense and concentrated in places where corrosion, damage, defect formation and destruction are occurring.

Distribution, intensity, concentration and other parameters of phonon emission directly characterize the processes occurring in the structure, determine the state of the material, characterize the technical condition of the structure.

The most important part of Phonon Diagnostics Technique are the advanced software technologies. The software developed by SPC DIATECH, LLC forms the basis of technique. Among other things, detection of defects by PDT is based on the component topology in the process of data collection and processing.

PDT inspection steps

PDT inspection of a pipeline includes: PDT desk set-up, determination of installation location of phonon emission transductors and following inspection steps. The pipeline is divided into sections up to 1 km long in case if phonon emission transducers are installed right on the surface of inspected component. It is possible to carry out inspection of longer areas using waveguides – concentrators of phonon emission (so-called "phonon crystals"). Phonon emission trunducters are installed on cleaned pipeline surface in pits. The duration of phonon monitoring of each site is usually from 1 to 4 hours depending on the geometry and operating conditions of the facility. [4]

During first steps of inspection a PDT mathematical model of the object is developed and so-called full-scale calibration for each area of the object are carried out.

Phonon emission active areas are image on phonon maps presented in pipeline drawings in real-time during monitoring. Active areas position determines the places of known defect formation, unknown defect formation, as well as indications of other character. Thus, by occurrence, position and intensity of an active area,

FIGURE 1. The landslide slope of the Kama River

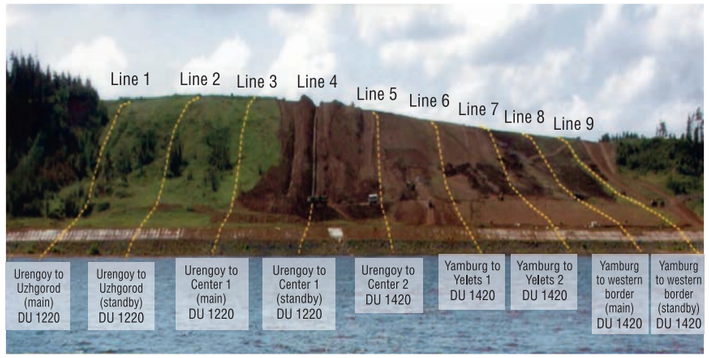
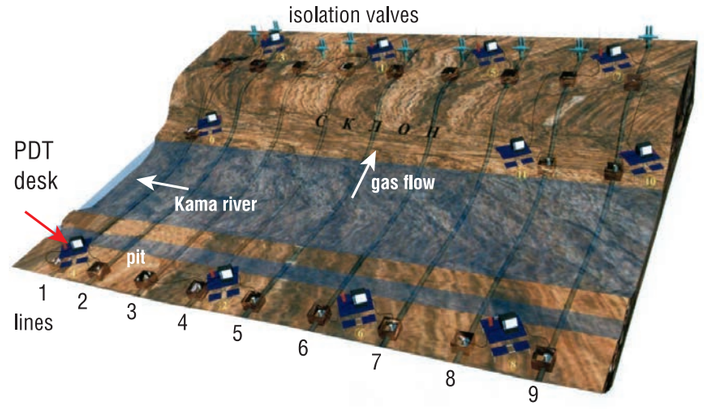


FIGURE 2. PDT inspection and monitoring of gas pipelines on a landslide slope



the analysis of defect formation and location of defects along the length of the pipeline is carried out, a phonon map is created for each inspected area.

Next step is a detailed analysis of each phonon-active area performed with the help of the software developed by SPC DIATECH, LLC. This process determines the way of phonon emission distribution in each area. The physical processes occurring in the defective areas, dimensional characteristics, activity and severity of defects are evaluated based on the analysis results, the further development of defects is forecast.

A good example of PDT applying on the main pipelines is the project performed on gas pipelines located on a landslide slope of Kama river [2], which are part of the 9-lines Uzhgorod corridor (see Figure 1).

The arrangement of the system equipment is shown in Figure 2.

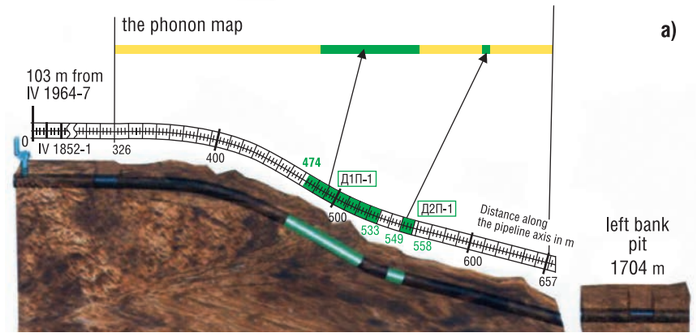
Example of presentation PDT inspection and monitoring results for Line 1 (Urengoy-Uzhgorod gas pipeline) on the landslide slope at the first (a) and second (b) stages of inspection is shown in Figure 3.

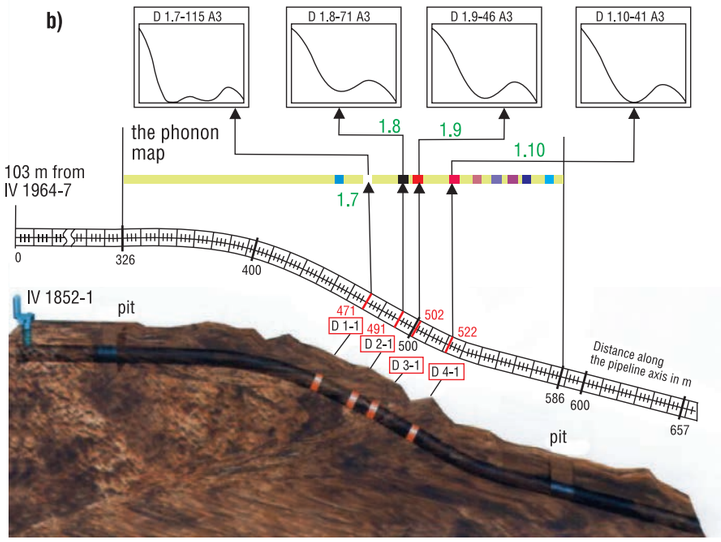
Phonon Diagnostics Technique is implemented as follows [1]. Phonon emission sensors should be installed on the inspected component. Data collection units should be connected to the power source. PDT software should run. Radio synchronization system should be installed at opposite ends of the pipeline to connect PET systems, the protection of radio channels against industrial interference should be evaluated. PET and data collection units should be connected. Inspected object should be calibrated using ready-made models and unique data for each facility. Test monitoring should be performed for 30 minutes to determine the accuracy of calibration for the inspected object and the operability of phonon emission sensors in the data collection mode and the quality of the received signals in the information processing mode. Next step is 2 hours PDT monitoring including collection and processing of information to assess the operation of the registration scheme. If necessary, the monitoring time can be increased. The accuracy of defects location during PDT inspection can be less than 0.15% of the distance between sensors.

In case if the in-line inspection of oil and gas pipelines is impossible or financial unprofitable, Phonon Diagnostics Technique is the only way to inspect the facility. Phonon Diagnostics Technique does not require mechanical movement of equipment or trunducters installation on the facility surface. There are no obstacles to inspect pipeline sections with curved bends, pipes with complex geometric shapes, flanged connections, elbows, etc.

Despite the fact that Phonon Diagnostics Technique is not a scanning, but a screening technique, its results are not only comparable to conventional diagnostic techniques (including in-line inspection), but also surpass them by a number of measures.

FIGURE 3. PDT inspection and monitoring results of the gas pipeline from Urengoi to Uzhgorod (line 1) on the landslide slope at the first (a) and second (b) steps of inspection





Phonon Diagnostics Technique provides quick and hight quality of information processing, reducing of preparation and inspection terms, reducing the complexity of inspection and results processing; this contributes to the expansion of technique application areas.

Since PDT inspection can be provided during operating of a facility, there are no financial losses upon the work completion.

Conclusions

Phonon Diagnostics Technique allows to carry out real-time inspection of physical processes occurring in the structure. Distribution, level, intensity, concentration and other parameters of phonon emission determine the state of the material, characterize the technical condition of the structure.

Unlike in-line inspection, Phonon Diagnostics Technique does not require significant costs for pipeline preparation and allows to reduce customers costs.

Phonon Diagnostics Technique is actively developing and it's successful applied on different types of facilities including main pipelines, what is confirmed by such well-known international organizations as Bureau Veritas, Russian Maritime Register of Shipping, as well as by numerous reviews of global oil and gas companies: Total, Conoco Phillips, Cepsa, Repsol, SINOPEC, Gazprom, Rosneft, Lukoil and others. ●

References

1. *Patent RU 2576470 C2 Method of phonon emissive diagnostic. 29.01.2014.*
2. *Shammazov A.M. Calculation and provision of reliable pipelines in geotechnical conditions. Part 2. Evaluation and maintenance of pipeline strength in difficult engineering and geological conditions / A.M.Shammazov, R.M. Zapirov, V.A. Chichelov, G.E. Korobkov – M.:»Inter», 2006. – 564 c.*
3. *http://diatech.ru/company/.*
4. *Technosphere materials science: encyclopedic reference / comp. Vladimir Perinsky, V.K. Shukhostanov, V.N. Lyasnikov, A.V. Glukhov – Saratov: Sarat. state. Techn. UN-t, 2007. 147 p.*

PROTECTION OF FUEL AND ENERGY ENTERPRISES

Ultra reliable Getac equipment for extreme conditions

PRODUCTION AND OCCUPATIONAL SAFETY AT INDUSTRIAL SITES ARE REGULATED BY INTERNATIONAL STANDARDS AND VARIOUS CERTIFICATION SYSTEMS. IN PARTICULAR, STRICT REQUIREMENTS APPLY TO ELECTRICAL EQUIPMENT AND OTHER TECHNOLOGICAL PRODUCTS THAT CAN BE USED, FOR EXAMPLE, IN EXPLOSIVE ATMOSPHERES. IN SUCH CASES, PROTECTED COMPUTER PRODUCTS SHOULD BE USED. THE HEAD OF BUSINESS DEVELOPMENT AT GETAC IN RUSSIA ALEXANDER VIKTOROVICH KUZNETSOV TOLD ABOUT PROTECTED COMPUTER EQUIPMENT, ITS ADVANTAGES AND THE MAIN CRITERIA OF CHOICE, TO NEFTEGAZ.RU CORRESPONDENT

UDC 004.38

Keywords: *protected computer equipment, occupational safety, industrial facilities, electrical equipment, explosive atmospheres.*

Alexander Kuznetsov,
Head of Business Development at Getac in Russia

– Alexander Viktorovich, why hazardous industries offer no opportunity to work on conventional computers or tablets? How are protected products different from conventional ones?

– What is a hazardous production facility? It is the one with high or low temperatures, explosive mixtures, dust, dirt, moisture, etc. Conventional computers were originally designed to work in "ivory towers" – normal room temperature, no moisture and a minimum of dust and dirt, as well as no mechanical influences such as blows or vibration. Outside of these conditions, conventional user devices almost immediately fail, which leads to downtime in production and increased costs.

The protected devices are initially designed taking into account the fact that they will be operated under sufficiently harsh conditions. The embedded solutions can successfully confront external aggressive factors.

– What are the advantages of protected computer models?

– There are several key benefits when using protected devices.

First of all, the shell. Usually the shell is made of magnesium or aluminum alloys, or of especially strong plastics, rubber bumpers are frequently added. The shell design already includes solutions to improve its strength and stiffness, so that it can withstand various types of loads. A mandatory requirement for shells and devices as a whole is to provide protection against water and dust – IPxx rating.

> All Getac products are initially designed as protected and safe. They pass extensive testing in authorized and own laboratories

Second, the screen. Since normally protected devices are operated outside, the screen should provide sufficient brightness to work in sunlight and also be operative when using gloves or during rain. Therefore, all Getac solutions provide high brightness screens with special technologies that ensure operation under any conditions.

Third, the rechargeable battery. Based on operating conditions – staying away from power sources – rechargeable batteries should provide long operating times, as well as the possibility to quickly replace the battery without interruption. All Getac solutions are equipped with high capacity batteries and provide a "hot" battery change option during operation.

Fourth, product compliance with strict military standards for strength and protection from external influences. This includes testing the assembled devices for protection against vibration, shock, low and high temperatures, salt mist, and many more. All Getac products are tested and certified for compliance with standards in third-party laboratories, which confirms their quality and reliability.

And the guarantee, of course. Any earnest manufacturer of protected solutions provides product warranty for at least 3 years. The minimum warranty period for Getac products is 3 years, the maximum is 5 years. Our warranty includes even bumper-to-bumper protection*.

– Tell us about Getac models that are popular among companies in the oil, gas and energy industries?

– I would like to mention 3 tablets which are now the most popular. They are F110-Ex, ZX70-Ex, and EX80. All models have the Russian EAS TR CU certificate 012/2011 (working in explosive atmospheres) and are ideal for the oil and gas industry with strict safety requirements.

S410 laptop has been very popular for working outside hazardous areas. It is a semi-protected laptop that combines a sufficient degree of protection from the environment with a very attractive price for this class of devices. The same models in their usual versions are great for power engineers.

In general, the choice of a particular model depends on the tasks to be solved with the help of this device.

– How do you make your users confident in the absolute security of the devices? How do you test your products?

– All Getac products are initially designed as protected and safe for users. From the original idea to production, Getac is guided by the standards set for this class of devices in a variety of industries, thus providing unrivaled quality, reliability and safety.

As I mentioned before, all Getac products are first subjected to extensive rigorous testing in the company's own laboratories and then transferred to a third party authorized organization for repeated certification tests and certification itself.

This approach ensures the purity of the results and guarantees that the products comply with the stated characteristics.

– Getac is a global brand. What are your plans in the Russian market? What ways to move forward do you plan?

– The Russian market is important for our company. We have been showing a steady growth through years. It is a secret to no one that the key consumer of devices like ours, is military sector.

But, the trends are showing that our country is entering the era of Digitalization – Industry 4.0, Digital Oil Field, and IoT. These trends are pushing us to more active operations in non-military markets like oil and gas, industry, transport, etc.

Next year we are planning to take part in several thematic events both independently and with our partners.

Also, several advertising campaigns in industry journals and online resources are planned.

We are sure that our company will be able to reach a new level in the Russian market, and even more companies will learn about our products and will be able to use their advantages.

** Except for S410 laptop model.*

Getac

Getac Russia Office
127106, Moscow, Altufievskoe shosse, 1/7, off. 218 (BC "Beta-Center")
Phone: **+7 495 755 90 96**
Sales: alex.kuznetsov@getac.com
https://ru.getac.com/aboutgetac/about.html

THE FUTURE OF RUSSIAN ENERGY

Open Day was held at MIEP MGIMO

NINETEEN YEARS AGO, FOLLOWING THE INITIATIVE OF THE LARGEST ENERGY COMPANIES IN RUSSIA MGIMO ESTABLISHED THE INTERNATIONAL INSTITUTE FOR ENERGY POLICY AND DIPLOMACY (MIEP). THE PURPOSE OF THE INSTITUTE WAS TO TRAIN PERSONNEL FOR THE DEVELOPMENT OF INTERNATIONAL ENERGY COOPERATION. ON MARCH 22, THE MIEP MGIMO HOSTED AN OPEN DAY AND NEFTEGAZ.RU JOURNALISTS JOINED THE EVENT

UDC 378

Keywords: *energy policy, energy diplomacy, open Day, university, education.*

The International Institute of Energy Policy and Diplomacy is considered not only the best in the field of training specialists for the fuel and energy industry of the country, but also unique because nowhere else in the world they train specialists in the field of energy diplomacy.

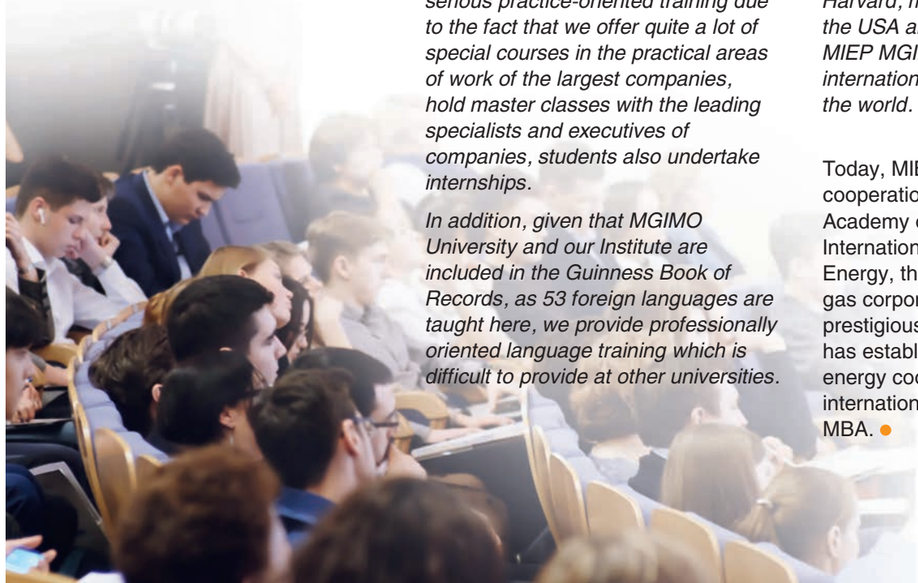
A huge stair-step assembly hall was filled with people long before the event. The guests of the faculty on this day were about 700 entrants and their parents, who listened with no less awe to speeches of members of the presidium than future diplomats.

Traditionally, the event was opened by the 'Energy' performance group. While the enthusiastic students were singing the anthem of Alma Mater on stage, voices were heard from different parts of the hall taking up familiar lines of the anthem. Apparently, graduates of past years and senior students came to look at future colleagues.

This year the students took an active part in the Open Day. In their speeches they described how important it was for them to receive the desired education, to understand the responsibilities they faced as graduates, given that they would have to work in the largest companies around the world.

Members of the Presidium told about how to become students of MIEP MGIMO, about the admission conditions and tests rules, how many points the academic competitions and quizzes give.

The Presidium was headed by Valery Ivanovich Salygin, Director of the International Institute for Energy Policy and Diplomacy of the MGIMO of the Ministry of Foreign Affairs of Russia, who is also Vice President of the International Academy of fuel and energy complex, a corresponding member of the Russian Academy of Sciences, a doctor of technical sciences, a professor, an outstanding scientist and a big specialist in the field of energy diplomacy and geopolitics, systems analysis, corporate governance and regulation of international fuel and energy issues.



At the end of the official part Valery Ivanovich told the Neftegaz.RU journalist about the projects where the students are involved today:

«We have got five departments: international relations, international law, world economy, international management and public relations. Our graduate receives a high level of practice-oriented training and, in fact, two educations: MGIMO graduate diploma in the relevant specialty in the field of energy diplomacy and geopolitics and serious practice-oriented training due to the fact that we offer quite a lot of special courses in the practical areas of work of the largest companies, hold master classes with the leading specialists and executives of companies, students also undertake internships.

In addition, given that MGIMO University and our Institute are included in the Guinness Book of Records, as 53 foreign languages are taught here, we provide professionally oriented language training which is difficult to provide at other universities. That is, we provide targeted training for the specific tasks of large companies.

Our students actively participate in the work of scientific clubs: the Arctic Club, the World Energy Policy Club and recently we opened the MIEP Innovation Club. Leading industry experts are involved in the work of the club. Our students take part in the works carried out by our center – research of transboundary deposits in the Arctic. Recently, our students visited the University of Alaska, Harvard, major research centers in the USA and in the EU countries. MIEP MGIMO students participate in international projects around the world.»

Today, MIEP works in close cooperation with the Russian Academy of Sciences, the International Academy of Fuel and Energy, the world's leading oil and gas corporations. MIEP together with prestigious universities of Europe, has established 5 institutes of energy cooperation and a number of international master programs and MBA.

REINDUSTRIALIZATION in USA and in RUSSIA

THE ARTICLE LOOKS INTO THE MOST IMPORTANT ASPECTS OF THE WORLD ECONOMY REINDUSTRIALIZATION ON THE EXAMPLE OF CURRENT REINDUSTRIALIZATION IN THE US. GIVEN THE US EXPERIENCE IT HAS BEEN REVEALED THAT THE REINDUSTRIALIZATION OF RUSSIA'S ECONOMY SHOULD COMBINE ACTIVE MODERNIZATION OF THE EXISTING PRODUCTION CAPACITY AS WELL AS SHAPING NEW INDUSTRIES ON THE BASIS OF TECHNOLOGIES OF THE SIXTH TECHNOLOGY WAVE

UDC 338

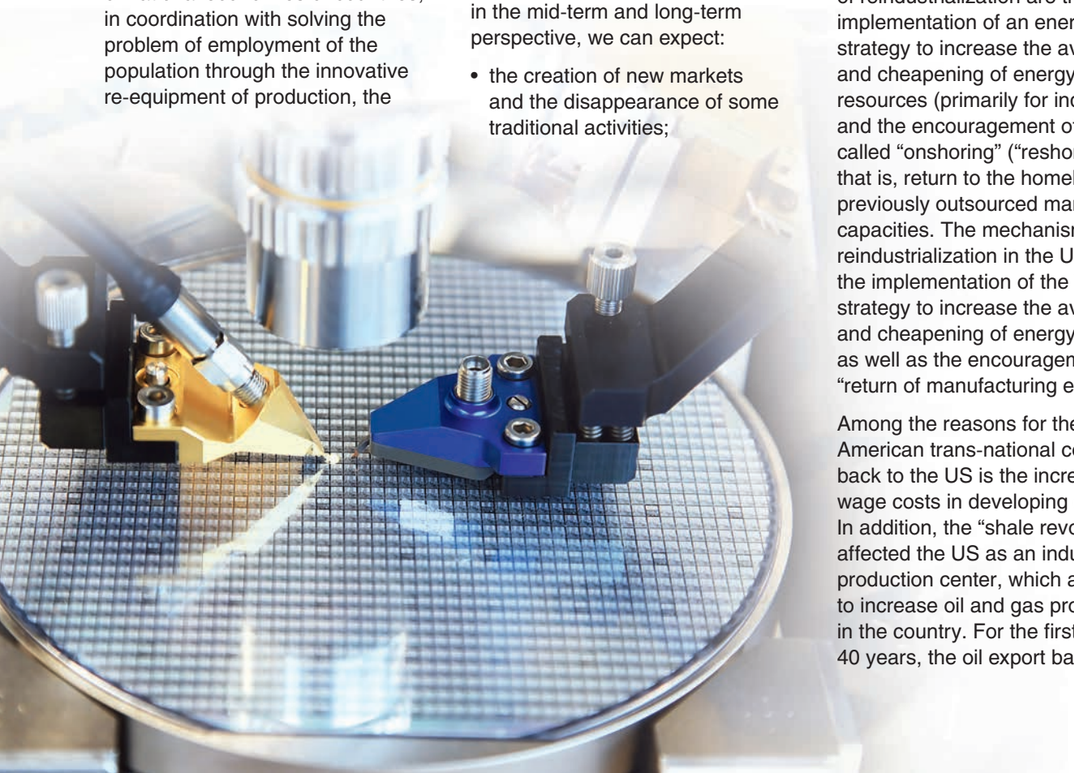
KEYWORDS: *reindustrialization, sustainable development, competitiveness, technological structure, resourcing, USA, Russia.*

Zakharov Aleksandr,
Doctor of Economics, Professor,
The World Economy Department
of Moscow State University
of Foreign Affairs of the Ministry
of Foreign Affairs
of the Russian Federation

The developed countries of the world understand reindustrialization as the implementation of a policy capable of changing the downward trend in the real sector of national economies of countries, in coordination with solving the problem of employment of the population through the innovative re-equipment of production, the optimization of production chains. Reindustrialization programs primarily affect those industries that are experiencing the strongest competition with imported goods. In the process of searching for the points of economic growth, we observe not only the return of production to the developed countries and the restoration of industrial activity on an innovative basis, but also the formation of new industries.

According to experts, as a result of reindustrialization in the framework of the fourth industrial revolution in the mid-term and long-term perspective, we can expect:

- the creation of new markets and the disappearance of some traditional activities;
- the formation of the areas of rapid industrial growth;
- the transformation of a sustainable system of countries' industrial specialization by eliminating the obsolete elements of technological chain;
- reduced need for the unskilled types of labor and growing global unemployment problem;
- the extension of the technological superiority of industrialized countries.



In the US, the main directions of reindustrialization are the implementation of an energy strategy to increase the availability and cheapening of energy resources (primarily for industry) and the encouragement of so-called "onshoring" ("reshoring"), that is, return to the homeland of previously outsourced manufacturing capacities. The mechanisms of reindustrialization in the US are the implementation of the "energy strategy to increase the availability and cheapening of energy carriers", as well as the encouragement of the "return of manufacturing enterprises".

Among the reasons for the return of American trans-national corporations back to the US is the increase in wage costs in developing countries. In addition, the "shale revolution" affected the US as an industrial production center, which allowed to increase oil and gas production in the country. For the first time in 40 years, the oil export ban was lifted, and the ambitious goal of transforming the US from the main consumer of oil into its exporter was set. However, since there is no infrastructure for the export of oil and gas, the prices of energy resources on the domestic market have noticeably decreased. The cheapness of gas and oil in the US domestic market means that industrial companies have an energy price advantage of 60–70% compared with competitors in China, Japan, South Korea and Europe. The long-term perspective of low prices is already attracting industrial companies to invest in the expansion of capacities in the United States. As a result, cheap gas can become the powerhouse of the reindustrialization of the US. This is especially true for energy-intensive heavy industry, as well as for chemistry and petrochemistry.

The US, as the leader of new technologies, especially in the sphere of information and communication, has been most successful in the introduction of the Internet of things, including through the active use of the public-private partnership and environmental management, which Russia needs to develop. As arguments in favor of the reindustrialization in the US, the following can be noted. First, manufacturing industry generates the effects of spreading new knowledge to the rest of the economy. New knowledge and technologies, management forms used in the production of new products will inevitably spread to other business projects. Second, a decline in market share in knowledge-based industries has a negative effect on the entire economy. So, if a country loses aerospace industry, then the entire innovation ecosystem degrades, which hinders the development of new enterprises and the generation of new technologies. If technological capabilities in one of the industries are lost, then it is almost impossible to revive it. This hinders the growth of other industries, which weakens the overall competitiveness. Third, if production is outsourced, then innovation usually follows the same way, weakening the country's international competitiveness.

In the USA, according to the calculations of the author, from 2009 to 2016, the manufacturing sector of the industry grew by 20%. As a result of the growth of this industry sector, it is possible to note the appearance of 900 thousand new jobs in the period from 2008 to 2016, 80 thousand of which were created as a result of a direct return from abroad. At the same time, in 2016, the US GDP grew by more than 3%, and production in the manufacturing industries increased by 3.5%. Among reindustrialization stimulation measures undertaken by the US government, one can mention the use of the scientific and technical base of US universities. For example, in the United States, a consortium was established headed by the LSU College of Engineering and Science, and consisting of five universities (LSU, Louisiana Tech, Grambling, Southern and University of New Orleans), to support promising technologies and teaching them. In addition, the Massachusetts Institute of Technology has developed a number of programs to support next-generation production. In addition, many other programs are being implemented in the United States, including regional ones aimed at expanding the possibilities of using the country's collective potential.

Representatives of the middle and working class of the US have not felt an increase in income over the past twenty years. Moreover, the deindustrialization of America took place symmetrically with the growth of the industrialization of China and other developing countries, such as Mexico, and the growth of the incomes of their middle class. Therefore, the decision of the US President D. Trump to return production to the US looks more than logical from the standpoint of the middle and working class.

The relocation of production to the US is encouraged by restrictions in the form of an increase in the import tax, and also by the introduction of incentives – actual privileges on energy prices for industries within the country. When the Carrier equipment manufacturer, whose products are heaters and air conditioners, announced in February 2016 the decision to relocate 1,400 jobs to Mexico, the US authorities, through the negotiations with the company's management, achieved that in exchange for a proposal to lower taxes, the company announced intent to save 1,000 jobs in the United States. Although it should be mentioned that the company United Technologies, whose subsidiary is Carrier as a manufacturer of military equipment, is significantly dependent on government procurement (10% of its sales fall to the share of US state companies).

As another example of attracting production in the US, we can mention the Taiwanese company Foxconn, engaged in the assembly of high-tech products of the American Apple (it is the company's largest client). Foxconn already has production departments in the US and has decided to create an assembly plant there. Strictly speaking, this is not a direct relocation of activities, since the company does not provide for simultaneous "disinvestment" in Taiwan, but in anticipation of the growth of the American market and the establishment of trade barriers, the creation of a full-fledged production in the US can be a very advantageous step for Foxconn.

In the mid-term and long-term perspective, the automotive industry will be one of the main US industrial sectors. While the automotive industry is now highly globalized, in 2017, Ford Motors decided to cancel its $ 1.6 billion project on building a plant in Mexico and announced an investment of $ 700 million in a plant in the United States focused on construction of electric vehicles and autonomous vehicles (i.e., vehicles with a fully automated control system). Despite the fact that the automotive company has not yet completely given up on its plans to transfer its production capacities to Mexico, and the decision it made is more like redistributing the company's production than relocation, the analysis shows that the US uses protectionist measures, for example, by increasing the duties

on import of vehicles from Mexico and Canada.

In addition, the increase in duties can help the competitiveness of American automotive industry in domestic market, as it frustrates the plans of potential competitors, in particular, the leading German automotive companies that invested heavily in the production of automobiles in Mexico and planned to strengthen their positions in the US market, including through cost reduction.

Let's note that although the return of production in the US will entail a reduction in energy and tax costs for carmakers, this can significantly increase the cost on wages for workers (manufacturers costs on wages in the US per hour are equivalent to the wage costs in Mexico per day).

Let's also add that the US has a strong position in the world markets on the production of metals, chemical industry products, as well as other manufacturing industries, in which the share of energy costs in the cost of production is high (in the chemical industry – 12.5%, metallurgy – 9 %, in some sectors of the manufacturing industry – about 10%). Therefore, reducing the cost of energy in the US is an important argument for these industries in favor of developing production on the territory of the US. The return of production in the US will entail a reduction in energy and tax costs, but may again increase the costs on workers' wages. Thus, the US expects to ensure the success of reindustrialization due to such factors as attracting qualified personnel and an increase in the number of people employed in industry; technological leadership in major industries (including the use of public-private partnership mechanisms for the transfer of scientific and technological advances to production); reducing the cost of energy resources within the US.

In the context of the current constraints, most of the components of the proposed industrialization strategy are difficult for Russia.

The Russian Federation faced a situation where carrying out reindustrialization, which implies, among other things, reliance on the import of high technologies, is complicated by an unfavorable foreign economic and policy situation (the policy of sanctions against Russia). In this context, the intensive development of the Russian industry due to the acquisition of new technologies and equipment abroad is limited.

Thus, in the process of reindustrialization, we observe an increase in the share of the manufacturing industries, there is a shift to capital-intensive industries (first of all, to chemistry, machine industry and metalworking), and in the developed countries – to high-tech industries (electronic engineering, aerospace, biological, pharmaceutical industry, etc.), capable to become the basis of growth and effective adaptation of the economy to the processes of global transformation in the future.

In its turn, the high share of energy costs in the cost of production in terms of energy efficiency compared with the US, significantly reduces the competitiveness of the Russian Federation. The share of costs for the acquisition of electricity and gas in the cost of certain types of products of manufacturing industry is about 10% (chemical industry – 12.5%, metallurgy – 9%).

It seems that, for Russia, the reindustrialization of the economy should imply the active modernization of existing production capacities. The reformatting of industry also implies the formation of new industries based on the use of the technologies of sixth technology revolution. According to the author, for the Russian Federation, in this direction, it is necessary to develop the so-called “transitional period” technologies, i.e. to identify technologies of those industries which development intensity already allows not only to achieve tangible results, but also to create a solid foundation for future achievements based on them. In this context, the drivers of new industrialization in the mid-term and long-term perspective should be high-tech industries, which absorbed the latest technology and the largest number of highly qualified personnel, particularly in the defense industry, while ensuring the transfer of scientific advances to the civilian industry. Along with this, Russia needs to retrofit the rural sector, expand and realize the existing transit potential, including based on the technologies of sixth economic revolution. It is necessary to implement an approach that involves identifying leading industries with domestic demand and export potential, as growth drivers, while simultaneously developing the related industries.

For example, developing the rural sector, the demand for products of which both domestically and abroad is significant, it is necessary to simultaneously develop the chemical industry in terms of fertilizers, environmentally friendly additives that stimulate the growth of agricultural crops, etc.

It is also necessary to simultaneously develop the production of agricultural machinery. An important condition for the effectiveness of the policy of the industry and economy renewal is the ability of the state to provide conditions for fair competition of enterprises, including in the domestic market, to implement measures for effective encouragement of the production of innovative products.

In the mid-term perspective, in the context of the development of digital economy, the key to the competitiveness of countries will be the seller’s ability not only to quickly introduce products to the market, but also to offer related services. In this situation, an important aspect of reindustrialization, including the transition to digital economy, is the consistency of the choice of the main directions of the industries and services development, implemented on the basis of a new technological wave. In addition, in order to develop mutually beneficial cooperation, the Russian Federation should more actively use the interest of the European business community in reliable energy supplies, as well as a growing understanding of the economic inexpediency of the policy of sanctions against Russia.

In this situation, an important role in the mid-term and long-term perspective for reindustrialization in Russia will be played by the mechanism of public-private partnership, in which the role of the state is important not only in financing scientific organizations, but also in developing a strategy and laws for the development of high-tech production and exports, as well as innovations support infrastructure. Tangible benefits in reindustrialization can be achieved by increasing the efficiency of the interaction of state with more mobile and receptive to innovations private sector in implementing projects that transfer the results of the latest scientific research to production. Within the framework of public-private partnership projects, the state and the private sector are co-financing R&D on current issues. The task of joint actions of the Russian state and business will be the formation of a strategy for the reindustrialization of the economy to create an effective environment for a full development cycle – from the development of theoretical postulates of reindustrialization to their practical implementation.

Using the experience of the US in organizing the transfer of scientific advances and developments to industry, including through the implementation of PPP projects, may be of considerable interest for the reindustrialization of Russia.

At the same time, it should be noted that the import of technologies associated with direct investment reduces the demand for participation of national scientific and technical resources in the R&D. The wide import of technologies reinforces the technological dependence, allowing to quickly increase the technical level of production, expand the product range, but also preserves the “technological gap” between the state exporting technologies and the states - recipients of these technologies. “Technological import” washes away national capital from industries related to the production of this final product, and, therefore, is able to slow down its reindustrialization.

Thus, the analysis of the reindustrialization strategy in the USA showed that for effective reformatting and modernization of industry Russia needs to ensure: training of highly qualified scientific personnel to participate in the creation of new industries and specialists who are able to work effectively in the production sites of Industry 4.0; building a system to transfer the results of the latest scientific research to production (from the formation of a strategy for industrial reindustrialization based on the technologies of the sixth wave of innovation (Industry 4.0) to release the products to the domestic and export markets);releasing innovative products and increasing productivity in the industry through attracting investment; developing technologies of the sixth wave of innovation (Industry 4.0), incl. robotics, 3D printing, the Internet of things, etc.; the modernization of traditional industries taking into account the transition to new generation technologies, incl. machine building (machine tool industry, toolmaking industry, instrument engineering, agricultural machinery); the conditions of fair competition of enterprises, including in the domestic market; simultaneous development of traditionally strong industries (including mining, agro-industrial sector, while ensuring high product standards, etc.); increasing energy efficiency in manufacturing industries; providing access to foreign markets, including growing markets in developing countries. ●

References

1. *Bodrunov S.D. Imperativy, vozmozhnosti i problemy reindustrializatsii. [Imperatives, possibilities and problems of reindustrialization.] [Electronic resource]. Access mode: https://inir.ru/wp-content/uploads/2014/02/09_Императивы-возможности-и-проблемы-реиндустриализации.pdf (accessed 01.03.2018).*
2. *Bodrunov S.D. Integratsiya proizvodstva, nauki i obrazovaniya kak osnova reindustrializatsii RF. [Integration of production, science and education as the basis for the reindustrialization of the Russian Federation.] Mirovaya ekonomika i mezhdunarodnye otnosheniya. 2015. No. 10. Pp. 94–104.*
3. *LSU Faculty Lead Efforts To Win $20 million Grant From Lousiana Advanced Manufacturing Consortium. [Electromic resource] // EurekAlert. – 3 August 2015. – URL: https://www.eurekalert.org/pub_releases/2015-08/lsu-lfl080315.php (accessed 01.03.2018).*
4. *Vishnevskaya N. Mobil'nost' rabochikh mest i rabochey sily [Mobility of workplaces and labor power.] Mirovaya ekonomika i mezhdunarodnye otnosheniya. 2015. No. 10. Pp. 62–75.*
5. *Zagashvili V. Zapadnyye sanktsii i rossiyskaya ekonomika.[Western sanctions and the Russian economy.] Mirovaya ekonomika i mezhdunarodnye otnosheniya. 2015. V. 59. No. 11. Pp. 67–77.*
6. *Zakharov A.N. Ratsional'noye prirodopol'zovaniye v usloviyakh globalizatsii: mezhdunarodnaya praktika i rossiyskaya deystvitel'nost' [Environmental management in the context of globalization: international practice and Russian reality.] Russian foreign economic bulletin. 2003. No. 8. Pp. 38–45.*
7. *Zakharov A.N. Rol' mekhanizmov gosudarstvenno-chastnogo partnerstva v reshenii ekonomicheskikh i sotsial'nykh problem Rossii. [The role of public-private partnership mechanisms in solving Russia's economic and social problems.] Mirovoye i natsional'noye khozyaystvo. 2011. No.1. Pp. 2–7.*
8. *Schwab K. Chetvertaya promyshlennaya revolyutsiya [The Fourth Industrial Revolution]: translation from English. – Moscow: Izdatel'stvo “E”, 2017. 208 pages.*

Sergey Bednov:
«EXHIBITION INDUSTRY IS A SPECIAL SEGMENT IN THE ECONOMY»

Sergey Bednov,
General Director
of JSC Expocentre

NEFTEGAZ EXHIBITION HELD IN EXPOCENTRE ON KRASNAYA PRESNYA BECAME A KEY EVENT FOR THE RUSSIAN AND WORLD FUEL AND ENERGY COMPLEX. THE EVENT TRADITIONALLY GATHERS REPRESENTATIVES OF THE LARGEST COMPANIES IN THE INDUSTRY, PROVIDING THEM WITH AN EXCELLENT OPPORTUNITY TO DEMONSTRATE THEIR PROFESSIONAL ACHIEVEMENTS, SHARE BEST PRACTICES IN THE FIELD OF EXPLORATION, PRODUCTION, PROCESSING AND TRANSPORTATION OF HYDROCARBONS, AND TO DISCUSS THE PROBLEMS AND PROSPECTS OF THE OIL AND GAS INDUSTRY. SERGEY SERGEYEVICH BEDNOV, GENERAL DIRECTOR OF JSC EXPOCENTRE, TELLS ABOUT THE ROLE OF THE NEFTEGAZ EXHIBITION IN THE DEVELOPMENT OF OIL AND GAS INDUSTRY OF THE COUNTRY

UDC 061.4

KEYWORDS: *Neftegaz exhibition at Expocentre, oil and gas companies, business community, industry dialogue, national oil and gas forum.*

– Since distant 1978 and to this day, the Neftegaz exhibition has always been held by Expocentre. Has the concept of the event changed significantly over the years?

– Indeed, this year the Neftegaz exhibition celebrated its 40th anniversary. I would like to remind you that the first exhibition took place in 1978 in Baku. This was the first truly international exhibition in the USSR to show the achievements of the oil and gas industry to further expand cooperation with leading foreign participants in the global fuel and energy market. All-Union Association Expocentre was entrusted with the organizational issues. That's how our company was called. 78 companies from 10 countries including West Berlin came to the Baku exhibition premiere. The next Neftegaz, which was also held in Baku in 1983, gathered 174 participants from 19 countries.

Expocentre Central Exhibition Complex on Krasnaya Presnya became home to Neftegaz in 1992, then the exhibition became biennial. Since 2016 the exhibition has become annual.

Speaking about the concept of the exhibition, it was always ment to meet the needs of the time. Each time the exhibition was formed to serve as a visual barometer of the industry reflecting not only its current state but also allowing to see the prospect of further development.

Today Neftegaz is among the top ten world industry expos enjoying the participation of foreign and domestic leaders in the oil, gas and energy industry.

Expocentre hosts Neftegaz in partnership with the German exhibition company Messe Dü sseldorf GmbH with the support of the Ministry of Energy of the Russian Federation, the Ministry of Industry and Trade of the Russian Federation, Union of Machine Builders of Germany (VDMA), under the patronage of the Chamber of Commerce and Industry of Russia.

By the way, the decision to make the exhibition annual was made in response to the demands of the industry and the market, our and foreign exhibitors, as well as due to the increasing number of challenges facing today fuel and energy complex of Russia in the current difficult economic and geopolitical conditions. After all, the economic prospects of the country and the welfare of the Russian society depend largely on modernization and innovative development of domestic fuel and energy complex.

The format of the exhibition has also been expanded. For four years in a row it has been held at Expocentre simultaneously with the National Oil and Gas Forum. These two major events of the industry complement each other, ensuring effective interaction between authorities and industry associations, business and science in solving strategic tasks. The exhibition and forum are attended by members of the government, heads of relevant ministries and departments, leaders of expert and business community. According to the experts of the fuel and energy complex, the association of the exhibition and forum led to the creation of the largest demonstration and communication platform for the oil and gas industry in our country.

To substantiate my statement, let me introduce the latest data. 552 companies from 27 countries including 311 Russian companies participated in Neftegaz-2018 exhibition in April. The area of 30 thousand square meters hosted foreign and domestic manufacturers and suppliers of oil and gas equipment, oil and gas production and processing companies, oil service and geological exploration organizations to demonstrate the latest developments and technologies. The national exhibition sections were organized by Germany, China and the Czech Republic.

We expect that the next exhibition Neftegaz-2019, which will be held at Expocentre on April 15-18 next year, will be no less representative, and most importantly – effective both for exhibitors and for the industry as a whole.

– What role does exhibition activity play in the economic and social development of the country?

– To be brief – a huge one. Exhibition industry is a special segment in the economy. Exhibitions stimulate production and trade, export growth, innovation, development of business and infrastructure of large cities, increase in direct and indirect financial revenues to the budgets of all levels, and job creation. Large-scale industry exhibitions influence the formation and saturation of markets with new goods and services.

And for our country, in the face of anti-Russian sanctions and economic instability, they become even more important for maintaining a high level of business activity, and international economic cooperation.

According to expert estimates, the turnover of the Russian exhibition market is about 600 million dollars at the current exchange rate, which corresponds to the seventh place in the world after the USA, Germany, France, Great Britain, China and Italy. But at the same time, only two percent of the total area of exhibition centers in the world accrue to Russia. This is very little, given the size of our country.

In various interviews I have repeatedly drawn the attention of both authorities and business representatives to the fact that investing in exhibition and congress activities is beneficial from all points of view. It has been estimated that one ruble invested in the development of exhibition and congress infrastructure gives a total return of up to six or more rubles to the economy of the region. After all, many people come to large exhibitions and congresses – both participants and guests. They bring considerable additional income which goes to local budgets from hotels, transport, restaurants, souvenir trade and much more.

Talking about the interests of exhibitors directly, the main advantage of participation in the exhibition is the high concentration of the target audience, who can get a full idea of the products in live mode. It is no coincidence that the demonstration of goods at the exhibition, according to international research, is 6 times more conducive to sales than other means of promotion. Exhibitions are the main place for business meetings and making profitable deals in both domestic and foreign trade.

EXPERT APPROACH TO MECHANIZED MINING

RUSSIA IS IN THE POSSESSION OF ENORMOUS STORE OF HYDROCARBON RESERVES: WHICH ARE ESTIMATED AT 14.47 TRILLION M³ FOR GAS, AND 9.04 BILLION TONS – FOR OIL. HOWEVER, EXTRACTION OF SUCH RESERVES IS BECOMING INCREASINGLY DIFFICULT. THERE IS A GROWING INTEREST IN EXTRACTION OF HIGH-VISCOSITY OIL, WHILE, THE PROFITABILITY OF PRODUCTION STILL DECREASES. THE PROBLEM OF REDUCING PROFITABILITY FOR DEPLETED WELLS IS PARTICULARLY CHALLENGING. WHAT IS THE ACTUAL STATE OF THE WELL STOCK TODAY, WHICH IS THE PERIOD BETWEEN OVERHAULS (TURNAROUND TIME) FOR WELL OPERATION, HOW WILL THE MARKET FOR MECHANIZED PRODUCTION CHANGE IN THE COMING YEARS AND WHICH ARE THE MAIN FACTORS AFFECTING OIL PRODUCTION IN RUSSIA? THESE AND OTHER ISSUES WERE DISCUSSED BY LEADING INDUSTRY EXPERTS AT THE 16TH INTERNATIONAL PRACTICAL CONFERENCE "MECHANIZED OIL PRODUCTION-2019"

UDC 622.276

KEYWORDS: *mechanized production, oil service, well, oil and gas companies, fuel and energy complex.*

Anna Pavlikhina

State support

Russia is the concentration of the largest oil reserves, its production is growing in excess of the tolerated threshold of 550 million tons. This is made possible now due to the measures to stimulate the oil industry, which have been undertaken in recent years by the government – said Andrei Vasilyevich Tereshok, the Deputy Director of Oil and Gas Production and Transportation Department of the Ministry of Energy of Russia, who spoke about the main trends in the oil and gas industry and measures of state support for the production of high-capacity mining.

Among the main measures of state stimulation of oil production, the speaker noted a number of initiatives undertaken: measures to support production in Eastern Siberia, remissions in natural resources production tax, export duties, a unique tax regime for offshore fields with liberal rates, and a system to support the production of unconventional oil.

Recently, the state in particularly stimulates geological exploration. A special income tax coefficient was introduced for costs associated with geological exploration on the continental shelf as part of support, (in the future it is planned to extend this measure to on-shore deposits) and to increase the coefficient within the continental shelf, since the current level of coefficient is relatively low and does not create enough incentives – as it was noted by A. Tereshok.

The speaker put emphasis upon the road map, which was adopted in order to stimulate oil production at the end of 2018, comprising the several sections: the first one is based on a physical verification of all major fields with a total volume of reserves, exceeding 5 million tons in terms of the economic profitability. The work should be completed by the summer of this year, there will be obtained a list of all the main targets for exploitation and given assessment of their economic profitability based on the results of inventory. At the second stage, specific tax tools will be selected to maximize the difference between the technologically achievable and economically sound profile. There will be also held a job related to the support of oil production in Western Siberia.

Today everyone is talking about the low profitability of development in that region, but only few people pay attention to the main advantage, which is a developed infrastructure in the oil production location. The regional reserves are rather considerable, but the need for additional drilling concurrent with current tax environment is low, hence the creation of additional incentives will upscale the production and increase the level of investment.

Speaking about the prospects, A. Tereshok has emphasized that work for raising incentives for geological exploration will be continued, with a discussion of problem of expanding the scope of Excess-Profits Tax. In addition, it is planned to create a more equitable system of tax incentives for Eastern Siberia. At present, the Mineral Extraction Tax (MET) privilege for the region is calculated from the date of license issuance – which is unfair, as minimum 4 or 7 years are required from the moment of obtaining the licenses to the actual commissioning of a field to industrial development. Accordingly, the effective period of tax privilege is lost and, in fact, when it comes to the commercial production, the company loses any MET exemption by the moment the field is being drilled. The speaker noted that the Ministry is planning to make changes to the Tax Code for the dates of reference in terms of Mineral Extraction Tax redemptions for the new production regions begin from the moment of actual industrial production, i.e. from one percent of depletion, as has already been done for some offshore fields.

Separately, there was noted the need to create incentives for application of enhanced oil recovery techniques. The use of enhanced oil recovery techniques (EORT) dramatically increases the cost, especially at the initial stage, until the technology has not been well developed. Their further replication should be linked to the provision of certain tax remissions. The administration scheme is not yet thoroughly apprehended, but the key point is that all additional mining, base upon these methods, should be taxed at a reduced MET rate.

Separately focusing on stimulating production at small fields, the speaker has identified two problems. First, the tax concessions for deposits with the reserves of less than 5 million tons is currently included in the Tax Code. However 5 million tons are determined by a specific date, therefore there are some deposits that fall out this benefit. Secondly, deposits of 10 and 15 million tons of the initially recoverable reserves can be attributed to the small ones.

The speech has raised many questions. Chairman of the Expert Council for Mechanized Oil Production, R.S. Kamaletdinov, became interested in indicators of specific energy consumption by oil companies and asked to clarify the opportunity to expand the list of reports of the Central Control Administration of Fuel and Energy Complex (CCA FEC).

Mr. Tereshok promised in case of request, this question will be worked out, making a reservation that the main source of information – is oil companies, therefore it is impossible to give a clear answer about the availability of such reports, frequency of reporting and about the level of detailization.

Other participants in the discussion were more interested in government support measures. Tarasov Maxim Anatolyevich, head of the Surgutneftegaz production department, asked the speaker to clarify the issue of benefits related to the production of high-viscosity oil: “We plan to start the Timan-Pechora province mining, where there are complicating factors – highly viscous oils. Do you plan to introduce any benefits, because mining at the moment is not profitable there?”

– For highly viscous oils, there are concessions for mineral extraction tax, deduction for export duties for oil with viscosity above 10,000 MPa. As a part of our work, these deposits will get into the inventory period.

There were questions regarding whether the government’s policy towards shale oil production would change?

– High-capacity oil resources is partly similar to shale oil. There are benefits for MET – they are sufficiently large – from zero rate to 20%. The issue of developing the Bazhenov formation is relevant for a number of regions and the solution is related to field test sites where technologies can be worked out properly.

Well stock

Questions associated with the production of high-capacity oil are in concern not only in terms of the benefits provided for their development. Today, one of the main trends in the oil industry is reduction in share of high-quality reserves according to ABC 1 categories, two thirds of which, precisely, 12 billion tons, are classified as high-capacity oil, Rustam Sagaryarovich Kamaletdinov has stated in his report on the main indicators of mechanized well stock.

Among other trends, he noted the dominance of state-owned oil companies in the structure of oil production, low growth in proven reserves due to reduced investment in exploration, consolidation of the oilfield services industry and, of course, in active introduction of digital technologies.

Since 2007, oil production in Russia has increased to 517 million 483 thousand tons. Over the past year, the increase was by 1.7%. An increase in oil production over the past 5 years has been achieved by Rosneft, Gazpromneft, Tatneft and Bashneft. Over the past 5 years,Lukoil, Surgetenftegaz, Slavneft, and Rusneft companies have reduced the production of liquid hydrocarbons.

The total stock of wells providing products has increased by 18% over the past 11 years.

The speaker cited interesting data, concerning the Oil-well fund.

Thus, the number of wells equipped with ESP has increased by 55% in 11 years. The producing wells

OIL PRODUCTION BY RUSSIAN COMPANIES in 2014 – 2018, thousand tons

COMPANY	2014	2015	2016	2017	2018
Rosneft	189 431.6	186 824.6	185 688.9	207 006.7	210 663.4
LUKOIL	86 496.9	85 502.5	82 867.3	81 422.9	81 682.2
Surgutneftegas	61 425.0	61 621.5	61 848.7	60 544.9	60 886.2
Gazprom Neft	33 596.4	34 601.9	37 669.8	39 144.1	38 967.2
Tatneft they. After V.D. Shashin	26 529.2	27 248.6	28 698.6	28 939.4	29 533.4
Bashneft	17 940.8	19 481.9	21 380.1	–	–
Slavneft	16 185.6	15 475.3	15 001.3	14 303.7	13 814.2
RussNeft	8 529.2	7 318.5	7 017.3	6 990.7	7 082.2
NOVATEK	1 068.8	1 251.6	4 784.7	4 782.6	4 708.0
Operators PSA	12 176.5	12 774.6	13 879.6	14 536.7	16 683.5
Other manufacturers	42 833.9	44 534.3	48 430.1	51 064.5	53 465.0
total in Russia	**496 213.9**	**496 635.3**	**507 266.4**	**508 736.2**	**517 485.3**

Note: 1. Gazprom Neft has an equity stake in the production of Slavneft (50 %).
2. Rosneft acquired a controlling stake in the company on October 12, 2016 Bashneft

Information Central dispatching control of the fuel and energy complex

stock with sucker-rod pumping units (SRPU) was amounted to 57393 wells at the beginning of 2008. If 10 years ago, SRPU was accounted for 51% of the stock, now this figure has grown up to 67%. This long-term trend is caused by the need to ensure the maximum well sampling. Today, the SRPU plants produce 81% of the oil from cumulative oil production.

Considering the well stock, producing oil for the large oil companies at the beginning of the current year, the speaker noted that the producing wells stock, equipped with SRPU in Rosneft at the beginning of the year, was 38,303 or 37%. According to Surgetneftegaz – 25,626 wells or 20%, PJSC Lukoil – 19,499 19%, Gazpromneft – 7,350 (7%), Tatneft – 4,285, Slavneft – 3,687, Rusneft – 1,796 wells. Well stock equipped with SRPU: Tatneft – 15850 (35%), Rosneft – 14753 (32%), Lukoil – 7214 (16%), Surgutneftegaz – 1446 (3%).

R. Kamaletdinov has considered the questions of the overhaul period of wells operation of the entire oil fund with a division into electrical submersible pump units (ESPU) and SRPU. The turnaround (time between overhauls) of the oil fund over the past 10 years has increased by 48%. The turnaround of the stock, equipped with ESPU units was increased by 49%, SRPU – by 59%.

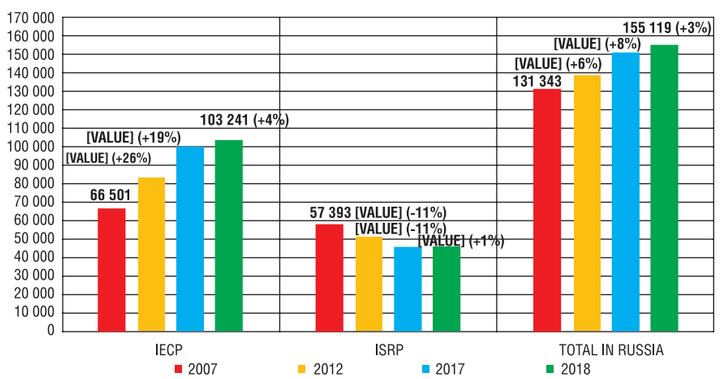
Mentioning the companies that significantly increased the long-term industrial activity of wells, equipment throughout the fund over the past year, the speaker noted that last year Gazpromneft has achieved the largest increase – 15%, Rusneft – 13% and Tatneft – 10%. In general, the increase in the entire well stock was 6%. The highest ESPU turnaround by January 1, 2019 was reached in Surgetneftegaz – 1122 days, then Bashneft – 962 days, Gazpromneft – 889 days, Slavneft – 848, Rosneft – 795, Lukoil – 657 and Rusneft – 704.

The turnaround for ESPU at the beginning of the year, reached by Bashneft – 1126 days, then Tatneft – 1109, Lukoil – 813, Rosneft – 747, Surgutneftegaz – 525, Rusneft – 469 and Slavneft – 247 days.

Considering the world production market, the speaker analyzed the dynamics of its segments. Thus, in 2007, the total global service market was $276 billion. In 2008, it has reached $324 billion. During the crisis, there is a decrease of 16%, after which there is a significant increase to 464 billion in 2014. The crisis in 2015 leads to a fall by 28% (to 336 billion), the following year the decline continued and reached 33%, in 2017 there was a growth by 5% compared to 2016, and in 2018 – an increase by 10%.

Mentioning that in 2009 the Russian service market occupied 5% of the global volume, R. Kamaletdinov focused on the segment of mechanized mining in more detail. In 2007, the market amounted to 6 billion 240 million USD, in 2008 it grew up by 23%, reaching the maximum in 2014 and being estimated at 15 billion 293 million USD, upon which it went down in 2015 with 27%, in 2016 fell lower by another 28%; in 2017 was an

OIL PRODUCTION BY RUSSIAN COMPANIES in 2014 – 2018, thousand tons



Note: the percentages of increase/decrease to the previous period are given in brackets

increase by 9%; and in 2018 – by 13% to 9 billion 920 million USD.

The speaker has noted an interesting fact: Today, three companies, Halliburton, Schlumberger and Baker Hughes, account for 58% of the market; their total revenues amount to $5.7 billion, but also, with a great pleasure, he emphasized that there are Russian companies: Borets and Novomet, which revenue last year amounted to $940 million (9.5% of the total world market).

Summing up, R. Kamaletdinov concludes that today it is possible to predict significant changes in the market of mechanized production for the coming years. However, for the unconditional implementation of the state strategy to develop the program of the fuel and energy complex of Russia, it is necessary to revise approaches to the regulation and functioning of the service market of artificial lift mining.

Equipment and Technologies

The reports of the second session were devoted to new technologies and equipment.

Vladislav Viktorovich Kirichenko, Head of the Central Escort Service of PJSC Surgutneftegaz, spoke about the operation of ESPU of the company's low-yield well stock. He noted that the annual growth of well stock, equipped with ESPU, is up to 4%, and the annual growth of the marginal fund – is up to 8%. As a solution for improvement of operating efficiency of the low-yield wells with ESPU, the speaker proposed the following: constructive improvement of equipment, organizational solutions and the search for alternative ESPU equipment.

In more detail, the speaker focused on the operation of the ESPU unit at the well stock of the Oktyabrsky District, where production is complicated by elevated reservoir temperature and intensive scaling. 100% completion by heat-resistant equipment and equipment with enhanced wear resistance was made in order to improve operational performance since 2015, which has formed a positive trend in non-failure operation time of ESPU systems.

Since 2017, the increased reliability equipment has been applied at other fields of the company's complicated well stock. The volume of implementation of equipment of increased reliability in 2018 reached 5480 units, depending on complicating factors, or about 12.5% of the annual volume of installations – said V. Kirichenko

He also noted that the company has an operation support service under the Central Production Service Base for (Rental and Repair of) Electric Submersible Installations (CPSB ESI), which controls the operation of the ESI, makes recommendations to the Oil-and-Gas Production Department (OGPD) services for current operation, analyzes the causes of failures and risks of complications during the operation of the ESPU, and also develops special ESPU configurations.

In the conditions of one hundred percent coverage of the mechanized well stock by a remote control system and remote control, the operating parameters of ESPU are monitored. Since 2017, the program "Identification of deviations in the work of the ESPU and the prediction of possible failures" has been put into commercial operation in the company. A timely response to changes in the operating conditions of the ESPU system helps to prevent equipment failure. In 2018, over 900 deviations were identified and eliminated at the well stock of more than 6000 wells, creating the risk of premature equipment failure.

About the results of work of JSC Zarubezhneft mechanized well stock for 2018 the Deputy Head of the Oil and Gas Production Department Salomov Iskander Pulatovich has stated the following.

Speaking about the performance of the mechanized well stock of LLC "IC Rusvietpetro", he noted that 46 failures of downhole pumping equipment (DPE) have occurred for the twelve months period by 01.01.2019. The main share of failures is attributable to a decrease in insulation resistance (R-0) and as a result of preventive maintenance for 14 failures. The increase in performance of preventive maintenance for geological and engineering operations is associated with the general aging of well stock, which average time is 2035 days.

The main potential problem areas – is a struggle with complications: Asphaltene-resin-paraffin deposits, insufficient inflow, viscosity, scaling, as well as optimization of the setting depth of ESPU. Considering the indicators of "Zarubezhneft-Mining Kharyaga", the speaker has underlined that, in general, there is a decrease in the average bottomhole pressure and dynamic level, which are conditioned by the natural depletion of layers. For 2018, there is a positive trend in mechanized well stock performance, an indicator of the average runtime was met, which is associated with a decrease in the number of failures for the last twelve months. Analysis of the operation of the mechanized well stock of LLC "Zarubezhneft-Mining Samara" shows the stabilization of average

oil and fluid flow rates, possible due to introduction of new wells No. 3P of the Pashkinsk field (JSC Orenburgnefteotdacha), No. 2R of the Nizhnemazinsk field (JSC Ulyanovskneftegaz).

Well operation conditions are characterized by low bottomhole pressures.

New Developments

The third session was devoted to new developments, which appeared in the equipment manufacturers. Representatives of leading industry participants have presented their new products. The head of the development department of JSC “RIMERA” Alexey Vladimirovich Trulev has delivered a report

about the experience of operating a new generation of hydroprotection with a dynamic maze. The head of the central engineering technology service of the Research and Production Company "Packer", Zmeu Artem Aleksandrovich spoke about the new technologies of RPC "Packer".

The session also included a report by the head of the bureau of the Innovation Development Department of Novomet-Perm JSC. Mikhail Vasilyevich Panachev, spoke about Novomet volumetric pumps for viscous oil production.

During the operation of the sucker rod pumping unit (SRPU), a number of problems and limitations should be taken into account, to which, first of all, high capital costs and a long period of development of a new well, complex installation of ground equipment, limited in depth of descent and curvature of the well, abrasion of tubing, restrictions on temperature and gas content. There is a need to select rubber materials and the gap between the rotor and the stator to a specific well fluid – said the speaker.

For the production of viscous oil, the company has developed a new design of a volumetric pump plate type, allowing to replace the screw pumps with top drive. The equipment has already been used at the East-Messoyakhskoye field, complicated by a large number of mechanical impurities.

On the prospects for increasing the resource of high-speed submersible pumps, the Ph.D. Smirnov Nikolay Ivanovich, leading researcher Institute of Machines Science them. A.A. Blagonravova of Russian Academy of Sciences.

Based on the results of the experiments, the speaker makes a number of conclusions that when the rotational speed is changed twice at the same flow rate, the impeller wear rate increased 2.6 times, the guide vanes 10.9 times. The value of the exponent at the flow rate of fluid with abrasive particles for powder materials is 2.5-3; for guide vanes, it is about 3.4. A change in consumption by half, ceteris paribus, does not lead to a significant difference in wear rate. Estimated change in the intensity of erosive wear of a pump stage of one standard size with a nominal diameter of 75 mm: in increasing the rotational speed from 2870 rpm to 10,000 rpm together with the exponent 3, the intensity will increase 42 times. The peripheral velocities are respectively 9.25 m/s and 11.3 m/s.

Round table

The final stage of the conference was the round table “Innovations in oil production”, which was attended by Oleg Pertsovsky (Skolkovo), Danila Shaposhnikov (venture fund Phystech Ventures), Konstantin Nadenenko (venture fund “Leader”), Nina Feodosiadi (Accelerator of the Ural Federal University), Andrei Kuznetsov (innovator).

Participants discussed the problems of venture funds, investment in new projects, as well possible solutions. Thus, D. Shaposhnikov identified the lack of investment funds as one of the main problems, explaining this by the reluctance of oil and gas companies to invest in new technologies, and by the strive to support only custom R&D, consequently leaving the technology inside the company. Most majors have their own corporate funds: Like BP, Total, etc. It is necessary to look at the experience of foreign colleagues – the speaker suggested, noting also that the pilot-industrial introductions take a long time because of bureaucratic delays. However, in recent years the situation has improved: oil and gas companies have begun to explore new technologies more actively.

A somewhat different point of view was voiced by K. Nadenenko, who believes that the key problem of sectoral investments is not that there is not enough money, but the lack of projects that can be brought to court by external investors. Currently, the venture capital fund "Leader" is launching a new project in collaboration with the Chinese managing company, the purpose of which is to invest the output of Russian technologies to the Chinese market.

The conference lasted for three days, during which the participants of the sessions discussed issues related to energy-saving and digital technologies, issues related to complicated operating conditions, and also held the twenty-first meeting of the expert council on mechanized oil production. More about this we will tell in the following numbers. ●

WHAT Neftegaz.RU WROTE ABOUT 10 YEARS AGO…

Gazprom opened the era of LNG in Russia

On April 6, 2009 the first tanker with Sakhalin liquefied gas of Gazprom arrived in Japan. Thus, the company began their own era of LNG production and sales. With Energy Frontier Japan received 67 thousand tons of gas. It was also reported that gas tankers from Japan to Russia would become regular. Gazprom stressed that they were planning to expand their presence in the LNG market.

• Comment
Neftegaz.RU

Currently, Gazprom's LNG portfolio includes: Baltiysky LNG, Vladivostok-LNG, the project of LNG supply to the Kaliningrad region, and Sakhalin-2 which is the first LNG production plant in Russia. It is interesting to note that February 18, 2019 marked exactly 10 years since the start of LNG deliveries to Sakhalin-2. At the end of 2018 Sakhalin Energy shipped 100 million tons of LNG from two production lines to customers. There are talks about the construction of the third line of the plant, but no real steps have been taken yet.

LUKOIL equips a new field

On April 24, 2009 LUKOIL started towing the LSP(ice-resistant platform)-2 support block from Astrakhan to Yuri Korchagin field in the Caspian Sea. The support block weighing 1,340 tons was launched at the beginning of April 2009 and by means of tugs delivered to the installation point, filled with water and attached to the bottom of the sea by fifteen piles. LUKOIL is planning to commission the field in December 2009.

• Comment
Neftegaz.RU

The deposit named after Yu. Korchagin is the first activity of LUKOIL in the North Caspian oil and gas province. The field was put into operation a little later than planned – in 2010. To date, the accumulated oil production at the field is more than 8.6 million tons. In July 2018 LUKOIL completed the drilling of the first production well within the second stage. In total, LUKOIL explored 6 large multi-layer deposits in the Russian sector of the Caspian Sea - named after V. Filanovsky, named after Yu. Korchagin, deposit named after Kuvykin (Sarmatskoye), Khvalynskoye, Rakushechnoye deposits, deposit 170 km.

Kazakhstan joined third in Caspian pipeline

On April 27, 2009 Kazakhstan has ratified an agreement with Russia and Turkmenistan on cooperation in the construction of the Caspian gas pipeline. It was supposed that the implementation of this project will increase gas transit through the territory of Kazakhstan to 20 billion m3/year of which 10 billion is from Turkmenistan, 10 billion is from Kazakhstan.

It was planned to carry out gas transportation to Russia from the fields of the Caspian Sea and other fields in the territories of Turkmenistan and Kazakhstan.

• Comment
Neftegaz.RU

Kazakhstan hopes to earn on the transit of Turkmen gas through its territory to Russia have not come true. The beginning of the project was repeatedly postponed and an expected result of the October visit of Russian President D. Medvedev

to Turkmenistan in 2010 was the decision to freeze the project. Later, Gazprom intended to take part in the construction of another similar project – East-West gas pipeline, but the countries failed to agree, and Turkmenistan decided to build the gas pipeline on their own. East-West gas pipeline is designed to unite all major gas fields of Turkmenistan. ●

RECULTIVATION OF SOILS OF THE ISLAND BELY (KARA SEA)

RECULTIVATION OF PHYSICALLY DISTURBED AND COAL POLLUTED SOILS OF THE ISLAND BELY (KARA SEA) IS CONNECTED WITH USING PEAT AS THE BIOORGANIC FERTILIZER PROMOTING RESTORATION OF THE BIOGEOCHEMICAL CYCLES OF SUBSTANCES AT THE LEVEL OF MICROBE POPULATIONS WHICH FUNCTIONING IS DIAGNOSED THROUGH THEIR BIOCHEMICAL ACTIVITY. EFFICIENCY OF THE SOIL RECULTIVATION, WHICH IS CARRIED OUT TAKING INTO ACCOUNT THEIR FULL MOISTURE CAPACITY IN THE CONDITIONS OF IN VITRO EXPERIMENT, IS ESTIMATED BY MEANS OF THE DEHYDROGENASE ENZYME ACTIVITY ANALYSIS. IT PRESENTS THE REQUIRED INFORMATION FOR LARGE-SCALE RECULTIVATION OF SOILS BY USING LOCAL PEAT IN MIXTURE WITH THE DISTURBED SOIL

UDC 631.4:502.76

KEYWORDS: *physically disturbed and coal polluted soils, full moisture capacity, recultivation, local peat, biochemical activity.*

Rauf V. Galiulin,
Doctor of Science (Geography), Leading Scientific Worker of Institute of Basic Biological Problems of Russian Academy of Sciences

Vladimir N. Bashkin,
Doctor of Science (Biology), Chief Scientific Worker of «Gazprom VNIIGAZ» LLC and Institute of Physicochemical and Biological Problems of Soil Science of Russian Academy of Sciences

Roza A. Galiulina,
Scientific Worker of Institute of Basic Biological Problems of Russian Academy of Sciences

Anatoly K. Arabsky,
Doctor of Science (Engineering), Deputy of Chief Engineer of «Gazprom Dobycha Yamburg» LLC

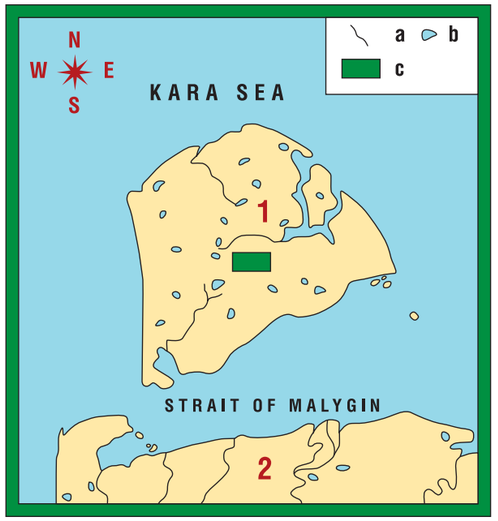
Introduction

The Island Bely (The Yamalo-Nenets Autonomous Okrug, 67°15' N, 74°40' E) is in the Kara Sea and separated from the Yamal Peninsula by the Strait of Malygin (Fig. 1). The area of this island makes 1900 km^2 with hills up to 12 m, and its surface is covered with tundra vegetation. On the island there are a lot of thermo-karst lakes, which are originating in the ground depressions formed in the melting processes of underground ice. The surface of this island on a relief flat, gradually going down to a south, and northern and east coasts are low and sandy, on the west and southern bank are meet breaks up to 6 m high in places. Since 1933 on the island there is the polar meteorological station named after M.V. Popov. Public attention as it is chosen to start implementation of the program for cleaning of the Arctic from garbage and waste, which has collected in the course of functioning of polar infrastructure is drawn to this island now [1, 2].

The recent examination of a part of the territory of the island conducted by us has shown that there are sites as with physically disturbed soils that is deprived of a vegetable cover and the top organogenic layer and with the polluted soils, for example, owing to warehousing of fuel on them in the form of coal. The geoenvironmental problem demanding operational permission to avoid full degradation of a soil cover has resulted, and, therefore, to keep native flora and fauna of the polar island.

Meanwhile, the soil has the self-restoration capacity, which is happening by its gradual settling by plants, receipts of a vegetable debris, development of soddy process and accumulation of a humus. However in the conditions of severe climate of the Far North a soil self-restoration will demand the long time measured decades. In this regard it is represented quite rational to accelerate restoration of a soil cover of the Island Bely by the acceptable technology of recultivation as physical disturbance and pollution of soils is among essential factors of undermining the normal biogeochemical cycles of substances in the nature. The acceptability of recultivation technology can be estimated by means of the key biochemical indicators reflecting restoration of soil fertility.

FIG. 1. Map-scheme of research territory



1 – The Island Bely (73°15' N, 70°50' E); 2 – The Yamal Peninsula; a – rivers; b – lakes; c – area on assessment of recultivating potential of physically disturbed and coal polluted soils

The purpose of this work was development *in vitro* conditions the recultivation technology for physically disturbed and coal polluted soils of the Island Bely, by means of use of local peat in mixture with the recultivated soil taking into account a full moisture capacity of the last. Here the full moisture capacity is understood as that greatest quantity of moisture, which contains in the soil at full saturation of all its pores. Such methodological approach allows to obtaining necessary information for implementation of *in situ* large-scale soil recultivation by using local peat. At the same time the efficiency evaluation of soil recultivation is made by means of dehydrogenase enzyme activity analysis.

Concept of recultivation technology of the Island Bely soils

The essence of the concept of recultivation technology of physically disturbed and coal polluted soils of the Island Bely consists in formation of idea about influence of a soil full moisture capacity and use of local peat for this process. It is known that the soil at full saturation by moisture of all its pores turns into the two-phase system consisting of a solid and liquid phases, except for insignificant on volume the sorbed or clamped amount of the air which has remained in the soil. Use of such criterion of recultivation as full moisture capacity isn't casual as the phenomenon of a so-called hydromorphism, i.e., the temporary or constant remoistening covering a season-smelting layer when the amount of moisture exceeds 70–80 % of a full moisture capacity is characteristic of the Far North soils.

As for use of peat, this organogenic rock consists not only of not completely decayed of plant remains, but also of a product of their degradation in the form of the humus including, in particular, the humic acids which are characterized by the high content of carbon and all nutritious elements, necessary for plants. From such three nutrient elements as nitrogen, phosphorus and potassium, the content of nitrogen in peat is maximal (to 3.5%). Besides peat possesses a certain pool of various physiological groups of the microorganisms (ammonifiers-aerobes, sporous bacteria, oligonitrofila, fungi, nitrifiers, denitrifiers, butyric-acid bacteria) participating in degradation of peat organic substance that makes available nutrient elements for plants [3]. In this regard peat introduction as bioorganic fertilizer to physically disturbed and coal polluted soils will promote restoration of a biogeochemical cycles of substances at the level of microbe populations which functioning is diagnosed through biochemical activity [4].

Value of microbe populations consists not only in quantity of the delivered biomass, in one year reaches 20–50 t/ha, that approaches with land biomass of plants, and mainly in that work which they perform on a mineralization of plant remains in the soil. Dying off, microorganisms release various elements, which enter new cycles of circulation. It is remarkable also that dark color of peat promotes absorption of heat and rapid warming up of the soil that is especially important in case of its recultivation in the conditions of the Far North.

In our case, an efficiency evaluation of peat use for soil recultivation is performed by means of dehydrogenase enzyme activity analysis. This enzyme catalyzes dehydrogenation reactions, i.e., a hydrogen splitting off of the organic substances (carbohydrates, alcohols and organic acids) arriving with a plant remains to the soil and in practice is successfully used as a key biochemical indicator of restoration process of soil fertility.

Adequacy of use of dehydrogenase activity in case of an efficiency evaluation of recultivation of physically disturbed and coal polluted soils with various full moisture capacity by means of peat introduction was proved earlier by carrying out the correlation and regression analysis of experiment data on enzyme activity and full moisture capacity of tundra soils of the Taz Peninsula (68°09' N, 76°02' E; The Yamalo-Nenets Autonomous Okrug) [5]. So, calculation of the coefficient of correlation indicating the direction and degree of an associativity in variability of signs has shown existence of strong essential correlation dependence between dehydrogenase activity and a full moisture capacity of soils (r = 0.95). The corresponding formula of correlation dependence, i.e., the equation of linear regression allowing judging how the productive sign (y) quantitatively changes at changing factorial sign (x) on a unit of measure had the following appearance:
$y = 7.71 + 0.15x$.

As it has appeared, the more there was a full moisture capacity of soils, the higher there was their dehydrogenase activity. The leading value of humidity for dehydrogenase activity of the soil is connected with the fact that moisture defines a normal physiological state of microorganisms and plants producing enzymes in the soil, and also supports enzymes and their substrata (carbohydrates, alcohols and organic acids) in a reactionary state.

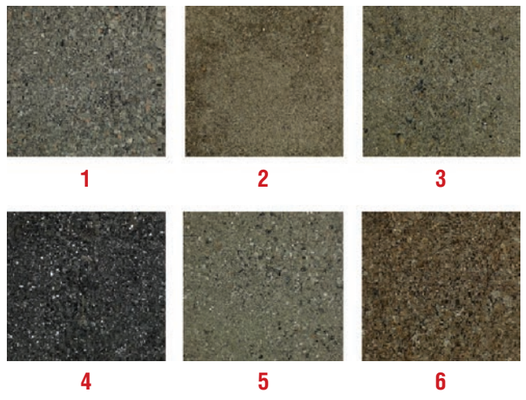
So, with increase in a full moisture capacity of physically disturbed and coal polluted soils and introduction of peat dehydrogenase activity shall increase as such that allows using quite reasonably this indicator for an efficiency evaluation of soil recultivation.

Technology of soil recultivation of the Island Bely

1. Preparatory phase for soil recultivation

In the territory of the Island Bely 5 samples of physically disturbed and coal polluted soils have been selected, Fig. 2 (Table 1). It should be noted that color of these soils is the most available, and first of all, the evident morphological feature characterizing their physical disturbance and also pollution. From these, 4 samples on granulometric composition represented loamy sand and 1 sample – consolidated sand, which is selected from the polluted site where earlier coal was stored. Here loamy sand is understood as the content of physical clay of it, i.e., particles <0.01 mm in quantity of 10–20%, and under consolidated sand – the content of physical clay of it in quantity of 5–10%.

FIGURE 2. Color of the physically disturbed soils (1, 2, 3 and 5), coal polluted soil (4) and peat (6) from the Island Bely



Soils differed also on other indicators: on the full moisture capacity, actual acidity (pH_{water}) and potential acidity (pH_{KCl}). Here actual acidity is understood as the acidity of soil solution created by carbonic acid (H_2CO_3), water-soluble organic acids and hydrolytic sour salts and which exerts direct impact on development of soil microorganisms and plants. Potential acidity, i.e. acidity of a soil solid phase, is meant as the acidity caused by existence of ions of hydrogen (H^+) and ions of aluminum (Al^{3+}) in the absorbed state.

Meanwhile it should be noted close connection of a soil moisture capacity with granulometric composition of the studied soils. So, easy soils, i.e. consolidated-sandy and sandy-loaming granulometric composition differ in low values of a moisture capacity, the content of a humus, plant nutrient elements and absorbing ability, and peat introduction as recultivating means, can significantly raise these indicators.

In our case we consider the use for soil recultivation of local peat, i.e., from the nearest regional areas, the Yamalo-Nenets Autonomous Okrug. It isn't casual because local peat has zonal signs proved by the analysis of content of aliphatic, aromatic, polysaccharide and carboxyl carbon atoms in structural fragments of humic acids of a peat humus by method of nuclear-magnetic-resonance ^{13}C-spectroscopy [6]. So, statistically significant distinctions in the content of some types of carbon in humic acids of a peat humus from the Yamalo-Nenets Autonomous Okrug and adjacent the Khanty-Mansi Autonomous Okrug (62°15' N, 70°10' E) have been established [7], Table 2. These distinctions are noted, first of all, in the prevailing content of aliphatic carbon of relatively aromatic carbon in peat from the Yamalo-Nenets Autonomous Okrug as the most significant indicator of structure of a carbon skeleton of humic acids that has allowed presenting the received result as the first zone sign. The established ratio of carbon two types demonstrates the disturbed hydrophilic and hydrophobic balance as aliphatic fragments of humic acids are carriers of hydrophilic properties unlike hydrophobic aromatic fragments.

While almost identical level of aliphatic and aromatic carbon content in peat from the Khanty-Mansi

TABLE 1. Physicochemical properties of physically disturbed and coal polluted soils from the Island Bely

№ of sample	Classification		Full moisture capacity, %	pH_{water}	pH_{KCl}
1	by granulometric composition	loamy sand	67.9	7.9	7.6
2		loamy sand	48.4	6.5	5.5
3		loamy sand	40.3	7.0	5.9
4		consolidated sand	49.5	6.7	6.2
5		loamy sand	44.6	8.0	7.6
6	by organogenesis	peat	177.0	4.3	3.6

TABLE 2. Comparative assessment of content of different types of carbon (%) in structural fragments of humic acids of peat humus from the Yamalo-Nenets Autonomous Okrug (67°15' N, 74°40' E) and the Khanty-Mansi Autonomous Okrug (62°15' N, 70°10' E)

Type of carbon	The Yamalo-Nenets Autonomous Okrug [6]	The Khanty-Mansi Autonomous Okrug [7]
Aliphatic	37.9–54.0	42.2–47.1
Aromatic	14.1–23.2	36.3–42.1
Polysaccharide	23.1–26.8	5.5–13.3
Carboxyl	7.9–10.1	4.7–8.8

Autonomous Okrug proves existence of its hydrophilic and hydrophobic balance [7]. Essential distinctions are noted in relatively bigger content of polysaccharide carbon in peat from the Yamalo-Nenets Autonomous Okrug, than in peat from the Khanty-Mansi Autonomous Okrug that indicates a significant role of polysaccharides in formation of humic acids in local peat that has allowed to present the received result as the second zone sign.

In general, the revealed zone signs of humic acids of a peat humus from the Yamalo-Nenets Autonomous Okrug confirm its "compatibility" with a soil-vegetable cover and form a strong reason for use of local peat as bioorganic fertilizer for recultivation of physically disturbed and coal polluted soils of the Island Bely. So-called "compatibility" of local peat with a soil-vegetable cover of the Yamalo-Nenets Autonomous Okrug is caused, in particular, by universal distribution on undisturbed mineral and organogenic (peat) soils of this region of such perennial plant as the sphagnum moss (*Sphagnum*). This plant, accumulating the mineral substances arriving with rainfall and decaying upon completion of life cycle, gives them to the spreading soil together with the biomass and is an important source of formation of local peat.

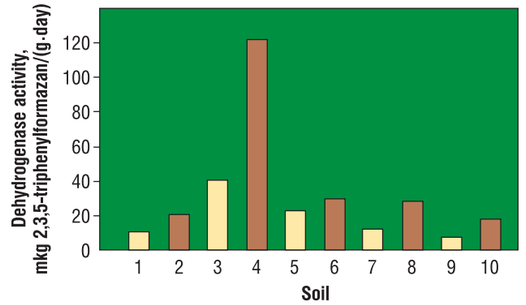
2. Base phase of soil recultivation

For direct carrying out recultivation of physically disturbed and coal polluted soils from the Island Bely the necessary peat:soil ratio was chosen on an indicator of a full moisture capacity from Table 3. In this case, this ratio for the soil No. 1 constituted 1:6, for other soils – 1:4. Further for confirmation of efficiency of use of mixture of local peat with the recultivated soil we carried out the comparative dehydrogenase activity analysis of this mixture with enzyme activity of physically disturbed and coal polluted soils in controlled hydrothermal conditions by the spectrophotometry method [5]. As a result of carrying out 30 daily experiments have been established that introduction of peat stimulates dehydrogenase activity by 1.3–3.0 times depending on the soil kind that allows to speaking about a real possibility of use of peat as recultivating means (Fig. 3).

TABLE 3. Peat:soil ratio depending from full moisture capacity of physically disturbed and coal polluted soils

Classification of soil on the level of its full moisture capacity	Full moisture capacity, %	Ratio of peat:soil
Low	40–50	1:4
	50–60	1:5
Middle	60–70	1:6
	70–80	1:7
High	80–90	1:8
	90–100	1:9

FIGURE 3. Dehydrogenase enzyme activity of physically disturbed and coal polluted soils from the Island Bely



1, 3, 5, 7 and 9 – soils (control); 2, 4, 6, 8 and 10 – soils with addition of peat

Conclusion

Thus, realization of recultivation technology of physically disturbed and coal polluted soils from the Island Bely in the conditions of *in vitro* experiment has shown that there is an possibility of not only rational local peat using but also to proposing remediating means for the *in situ* large-scale soil recultivation to accelerate a restoration of biogeochemical cycles of substances originally at the level of microbe populations, for avoiding full degradation of a soil cover as a basis of existence of native flora and fauna. Such recultivation will be an impulse to the subsequent restoration of various links of biogeochemical cycling at the levels of invertebrate organisms and vegetable biogeocenoses.

References

1. *Tomashunas V.M., Abakumov E.V. Content of heavy metals in soils of the Yamal Peninsula and the Island Bely // Hygiene and Sanitation, 2014. № 6. P. 26–31.*
2. *Vasilchuk A.K., Vasilchuk Yu.K. Engineering-geological and geochemical conditions of polygonal landscapes of the Island Bely (The Kara Sea) // Engineering Geology. 2015. № 1. P. 50–65.*
3. *Emelyanova T.Ya., Kramarenko V.V. Substantiation of a studying technique of peat deformation properties taking into account change of its decomposition extent // News of the Tomsk Polytechnical University. 2004. № 5 (307). p. 54–57.*
4. *Bashkin V.N., Galiulin R.V. Geoecological Risk Management in Polar Areas. Cham: Springer Nature Switzerland AG, 2019. 156 pp.*
5. *Galiulin R.V., Bashkin V.N., Galiulina R.A. Biogeochemical control of peat-based recultivation process of disturbed tundra soils varying in granulometric composition and full moisture capacity // In: Biogeochemical Technologies for Managing Pollution in Polar Ecosystems. Cham: Springer International Publishing Switzerland, 2017. P. 201–209.*
6. *Alekseev A.O., Bashkin V.N. NMR ^{13}C measurements for assessing humates from tundra peats // In: Ecological and Biogeochemical Cycling in Impacted Polar Ecosystems. New York: Nova Science Publishers, 2017. P. 101-128.*
7. *Sartakov M.P. Spectroscopy of nuclear-magnetic-resonance spectroscopy ^{13}C of humic acids of peat of the Middle at Ob // Chemistry of Vegetable Raw Materials. 2008. № 3. P. 135–139.*

GEOENVIRONMENTAL RISKS ON THE BACKGROUND GEOPOLITICAL CHALLENGES FOR THE OIL AND GAS INDUSTRY IN THE ARCTIC

THE ARTICLE IS DEVOTED TO THE ISSUES OF GEOECOLOGY AND GEOPOLITICS IN THE ARCTIC. THE AUTHORS REVEAL THE NEED TO CONSIDER GEOPOLITICAL CHALLENGES IN THE ANALYSIS OF GEOENVIRONMENTAL RISKS (GER) OF OIL AND GAS DEVELOPMENT OF THE ARCTIC REGION. THIS IS DUE TO THE INTERSECTION HERE OF THE STRATEGIC INTERESTS OF SEVERAL STATES AND THEIR FOCUS TO PROVE THE INABILITY OF RUSSIA TO ENSURE ENVIRONMENTAL SAFETY IN THE DEVELOPMENT OF ARCTIC FIELDS. THE SUBJECT OF GER IS USED AS A GEOPOLITICAL TOOL AGAINST RUSSIA DUE TO THE PROBABILITY OF IT BECOMING A KEY PLAYER IN THE REGION. THE AUTHORS PROPOSE A MODEL FOR THE ANALYSIS OF GER, WHICH IS BASED ON CRITICAL LOADS (KN) OF ACIDITY OF POLLUTANTS AND INCLUDES 2 STAGES: 1) THE STAGE OF QUANTITATIVE ASSESSMENT OF GER, WHICH ALLOWS TO CALCULATE NOT ONLY THE MAGNITUDE OF THE PROJECTED CHANGES IN THE STATE OF THE ARCTIC ECOSYSTEMS, BUT ALSO THE PROBABILITY OF THEIR OCCURRENCE; 2) THE STAGE OF MANAGEMENT OF GER TAKING INTO ACCOUNT GEOPOLITICAL FACTORS, ASSUMING A QUALITATIVE EXPERT ASSESSMENT, WHICH IS A PROCEDURE FOR MAKING A MANAGEMENT DECISION TO ACHIEVE ACCEPTABLE LEVELS OF THE TOTAL GER

UDC 631.4:502.76

Keywords: *geoenvironmental risk, geopolitical challenges, oil and gas industry, Arctic.*

O.P. Trubitsina,
PhD (geography), Ass. Prof., Northern (Arctic) Federal University, Arkhangelsk

Vladimir N. Bashkin,
Dr.Sc. (biology), Prof., LLC "Gazprom VNIIGAZ", FSIS Institute of physicochemical and biological problems in soil science RAS, Moscow region, Pushchino

Acknowledgment: *The given researches were supported by Ministry of Science and Higher Education of the Russian Federation, topic "Physical-chemical and biogeochemical processes in anthropogenic polluted soils", No AAAA-A18-118013190180-9*

Introduction

Risk management in the Arctic for the implementation of the activities of oil and gas industry is associated with the adoption and realization of decision-making which aimed at reducing the likelihood of an adverse result and minimizing possible losses of the project caused by its implementation.

Among the major trends in ratings of the oil and gas industry risks [1–3 authors identified two dominant positions. They are associated with the geopolitical and geoenvironmental factors. The first position "Health, Safety, and Environment and Legal Compliance Risks" (HSE) is related to the GER. The second one "Access to Reserves or Markets: Political Limitations and Competition for Proven Reserves" (ATR) is related to the GPR. Thus, in the realization of projects for the development of Arctic oil and gas fields from the point of view of environmental and national security, it is extremely important to analyze the GER considering geopolitical challenges.

The Arctic is a territory where, on the one hand, there is a geoenvironmental threat, leading to serious climate change, as the scientific research indicates. On the other hand, it is the climate change and the melting of ice as a result of it that opens the Arctic to the frees access for large-scale arrival of industry here and opens up huge prospects for the development of energy resources. It is the cause of the geopolitical threats due to fact that this area where strategic interests of a number of countries cross each other [4, 5].

Environmental debates are also relatively new intervention in the field of geopolitics, therefore, environment and its impact in different regions including that of Arctic is new in geopolitics modelling. But now, as the impact of climate change and global warming is becoming a reality and the environment geopolitics is increasingly making space the debate of mainstream geopolitics. Therefore, the Arctic being so vast, resourceful, and strategically located is bound to become a topic of geopolitical debate. In near future Arctic region may emerge as core area of geopolitical debates.

The relevance of geopolitics increases significantly with consideration of the generally harsh environmental and climatic conditions in the Arctic regions rich in oil and natural gas resources. This pushes the research of GERs for different oil and gas industry. The GER indicators are defined as risks which occur in the environmental and climatic conditions and the geopolitical conditions of the Arctic in the "industry – environment" system, as related to the mutual impacts of industrial facilities on the environment and of the environment on industrial facilities [2–5, 6]. The evaluation of GERs reflects the nature and extent of interaction in these reciprocal relations between man-made and natural factors. At the same time, the global level of GPRs is associated with the worldwide processes and trends whereby international access is claimed to the Arctic zone and its natural resource potential. A disturbance of the status of strategic stability in the geostrategic domain of the Arctic is considered to be an indicator of possible GPR effects. In this context, the GPR is the probability of a change in the geopolitical situation at the regional and global levels, which can lead to adverse conditions (risk of a hybrid war, military conflicts, etc.) or additional opportunities.

1. Geopolitical challenges of the oil and gas industry in the Arctic: GPR

GPPs are objective, predictable and difficult to quantify risks. They are often only to qualitative expert evaluation, as well as evaluation through historical analysis. If adapted to the new external environment, the GPRs will have a weaker impact in the long term or will be offset by other factors, such as diversification of energy supplies and the development of unconventional hydrocarbons, such as offshore Arctic oil and natural gas resources. For the development of Arctic shelf hydrocarbons, this risk is to a greater extent a risk of uncertainty.

One of the main problems faced by the oil and gas industry facilities in the Arctic is the accessibility to enough reserves of hydrocarbons. It also connected with obtaining control rights over its natural resources. These risks are associated with environmental and geopolitical factors [4, 5]. None of the states that until now have been referred to as Arctic states are wholly “Arctic”. Except for Russia, which has most of her sea territory in the Arctic and Russia is the only oil producer with clear mineral rights.

The Russian Arctic coast joins to the most extensive in the World ocean shelf area with unique resources. According to Russia Arctic is a territory which contains a wide range of threats and challenges for the national interests and security of their country. It includes other countries maintaining a stable interest in the Arctic zone of the Russian Federation (AZRF) and the Northern Sea Route (NSR), which is reflected in the activity of governmental and non-governmental organizations, mainly of the US and Norway, with support from the political and business communities of the West, as well as Japan and China, pursuing projects intended to increase influence on the border regions of the RF, with the goal of transforming the NSR into an international transit line. Russia’s Northern Sea Route will link Russia’s energy rich Arctic zone to the Atlantic and Pacific, potentially creating the third biggest energy corridor in the world. This condition may lead to fierce competition and even conflict among different counties surrounding this region for the control of mining, oil and gas, sea routes and of course territory for military purpose also. This scenario seems to be more realistic as the United Nation law of sea is not clear about the status of the Arctic sea and US has also not ratified the existed law.

Arctic oil and gas resources the greatest extent attract the attention of the main geo-strategic players – the US and Russia. The Arctic is perceived in the US as a region, control over which can significantly impact the balance of power in the world [6]. For the next few decades, Arctic oil and gas exploitation will be predominantly in the Exclusive Economic Zone

(EEZ) of the Arctic five (Russia, USA, Denmark, Canada, Norway) and perhaps further into the Arctic Ocean outside or close to the Arctic Circle. This involves a large amount of proven and estimated oil and gas reserves, primarily to be found within the Russian borders. There are still uncertainties concerning the legal status of the AR, which will undoubtedly increase the current attention of the main geo-strategic and regional players for geo-economic and geopolitical purposes that lead to increasing GPR.

Many experts have even predicted environmental warfare in near future geopolitical scenario. Arctic environment as weapon may be used to destroy enemies and their properties as example like in South Asia, rival countries have been blamed for floods in Pakistan, India, Bangladesh and even China by the media of each country. Indian media claims that China has created some artificial lakes to use against India in war situation. Though, the potential of environmental warfare to destroy the enemies and their property may be debated but it is clear the first causality would the environment and ecology of that region itself. And all these war tactics may possibly be used in the Arctic region also.

The potential of such an environmental war to destroy enemies and their property includes a combination of GER and GPR. Though, the potential of environmental warfare to destroy the enemies and their property may be debated but it is clear the first causality would the environment and ecology of that region itself. And all these war tactics may possibly be used in the Arctic region also. Though, the potential of environmental warfare to destroy the enemies and their property may be debated but it is clear the first causality would the environment and ecology of that particular region itself. And all these war tactics may possibly be used in the Arctic region also. At the same time, the initial damage will be caused to the ecology and environment of the region. In particular, Arctic sea disputes will certainly result in increasing military build-up and related activities in the region and a fair assessment of these activities is compulsory. There is also needed to discuss how submarines, aircraft carriers, thousands of jet fighters and other military activities are responsible for global warming and environmental problems.

At the same time, the issue of the GER is one of the priorities of US attention in relation to Russian actions in the Arctic. The theme of environmental protection is traditionally used to exert pressure on Russia in connection with its plans to develop Arctic infrastructure and construction oil and gas complex. The analysis of the Arctic countries' goals and actions shows that they are aimed at proving that Russia has no legal backing for a claim to develop offshore natural resources and to use the NSR as an internal passage and blame Russia as incapable of ensuring environmental safety in production of natural resources in the region. These aspects show the hybrid nature of the threats that Russia faces in the Arctic.

At present, there is no common understanding of the term "hybrid wars" which denotes a coordinated use of political, diplomatic, informational, psychological, economic tools and force to achieve strategic objectives. However, NATO experts already use the notion of "hybrid wars" when referring to Russia's role in crisis areas. Some of the aspects of the hybrid nature of Russia's threats in the Arctic are presented in the following research of the authors.

Thus, with the melting of ice and the opening of the sea, there will be the development of seaports, pipelines, rail lines, infrastructure and other activities, leading to increased geopolitical competition mainly between Russia and the US, including European countries. This is due to the likelihood of Russia becoming a key player in the region and it will be contested by US and its allies and they may use Arctic region ecology and environment as a geopolitical tool/weapon against Russia.

2. Geoenvironmental challenges of the oil and gas industry in the Arctic: GER

2.1. GER's factors

The specifics of the GER's management with the development of Arctic fields are security problems of their exploitation as natural and human-made objects. World experience of exploration and production development of several oil and gas fields in the North Sea, the Arctic continental shelf of Canada and Alaska indicates unexpected difficulties that may arise in the course of carrying out these works.

Let us review some of the GER's specific factors for oil and gas facilities, operating in the Arctic:

1. Natural-climatic conditions: extreme cold almost all year round, long polar night, the threat of damage to offshore drilling rigs by Arctic ice, deep freezing of rocks, the presence of submarine permafrost and the concomitant hydrate accumulations, swampy tundra and the seasonality of activities in many regions, limited biological activity extremely negative impact on personnel and equipment.

For elements of the technical systems deployed in the North, defining the external factor is the low temperature of atmospheric air, which deteriorates the physic-mechanical properties of structural materials, increases their tendency to brittle fracture as a potential source of possible accidents, which pose a serious environmental hazard. For example, the accidents with destruction of brittle reservoirs involve the ejection of significant amounts of petroleum products. In connection with Arctic's natural-climatic conditions permafrost soils differ of weak resistance in relation to oil pollution. Period of its self-healing there at an average level of pollution with petroleum products different researchers is estimated from 10 to 15 years.

International experience shows that it is possible to collect and dispose of only 10–15% of spilled oil in the Arctic conditions. Residual oil contamination in permafrost conditions can be becoming a source of petroleum hydrocarbons flow from river to the sea and its coastal part for years. Biogeochemical cycling in the primitive Arctic desert and tundra ecosystems can be defined as very depressed which includes a long period of mineralization of organic residues (from 10 to 50 years or more). At the same time the prolonged winter period contributes to the accumulation of various pollutants in the snow cover with their explosive impact on the ecosystem during the spring-summer period.

Thus, the low potential of self-healing for Arctic soils due to the short growing season and low temperatures necessitates the GER analysis, including its assessment and management. GER analysis is required for all industrial-technological stages to preserve the natural communities and the rehabilitation of disturbed ecosystems of the Arctic. The authors offer to use of models for the GER analysis, published in the following sources.

2. On the background of severe climatic conditions a factor of poor infrastructure play important role coupled with significant GER. Special equipment (tankers, icebreakers), summarizing extensive communications, supply and logistics are required for the Arctic.

3. Spills of liquid hydrocarbons: prevention and elimination.

Even a relatively minor spill, depending on the timing and location, can cause significant harm to individual organisms and entire populations. Regarding aquatic spills, marine mammals, birds, bottom-dwelling and intertidal species, and organisms in early developmental stages – eggs or larvae – are especially vulnerable. However, the effects of oil spills can vary greatly. Oil spills can cause impacts over a range of time scales, from only a few days to several years, or even decades in some cases. Conditions in the Arctic may have implications for toxicological effects that are not yet understood [7].

4. Due to the ongoing climatic changes, it is obvious that CH_4 and CO_2 which are being released in large volumes due to the melting of ice, increase the temperature. It can lead to major changes in the distribution of flora: the composition of northern plant species will be suppressed by the migration of those from the southern region. This will impact the existing life, as the insects which are an important pollination carrier, will be endangered. Distribution of plant life also bears upon the distribution of animal life which is directly or indirectly dependent on plants. Fish population as well as migratory birds will also be adversely affected owing to an increase in the sea temperature; and thereby reducing the availability of food and affecting the habitats. Due to higher CO_2 composition, the acidity in the sea water will rise. Many species like walruses will lose their natural habitats as food scarcity mounts. It is premature to estimate precisely the adverse impacts of climate change on the Arctic region. Nevertheless, it will be too late by the time these changes happen.

Thus, in the oil and gas development of the Arctic region, it is globally important to analyze the GER in connection with the above specific factors on the background of geopolitical challenges.

2.2. GER's analysis

The expansion of oil and gas development projects, particularly offshore, on the background of ongoing climatic changes and geopolitical challenges, can aggravate the environmental situation, for example, due to the resulting acid-forming pollutants during the implementation of hydrocarbon production programs. In this regard and taking into account transboundary pollution (circumpolar transport of pollutants from the West) in the Russian Arctic requires monitoring of acid deposition as a component of a unified system of environmental monitoring.

In this regard, the authors propose a model for the GER's analysis from activity of oil and gas industry in the Arctic on the basis of critical loads (CL) of acidity of pollutants. The analysis includes the stages of GER assessment and GER management. Considering to the influence of geopolitical challenges, the choice of evaluation criteria recognized in the world community is extremely important. The proposed GER assessment based on international approaches to the calculation of the CL is made using already established international methodological approaches and the results of the studies [8].

2.2.1. Method assessment of the GER

The methodology is based on [8] and on the understanding of the GER in the narrow sense, namely as a two-dimensional indicator which characterizes the probability of negative changes developing in the condition of ecosystems as the recipients of impact, and the extent of such changes. The quantitative assessment of GER is based on the calculation and dimensional analysis of exceeded CLs for pollutant X ($E_x(X)$) within an area affected by an industrial site. Exceeded CLs reflect the relation between exposure (actual or forecast pollutant load) and safe impact level (pollutant CL value). It is proposed that the impact on ecosystems should be calculated as the percentage of portions where CLs are exceeded in relation to the total area of a given

FIG. 1. Model of the analysis of GER for acid-forming deposition in areas affected by oil and gas industry in the Russian Arctic

STAGES OF GER ASSESSMENT CONTENT OF THE STAGES	STAGES OF GER ASSESSMENT CONTENT OF THE STAGES
I. Hazard Identification	1. Emission sources 2. Possible scenarios of man-induced impact 3. Comprehensive list of pollutants 4. List of acid-forming pollutants 5. List of potential impact recipients and its ranking 6. Sources of uncertainty and reliability assessment
II. Assessment Exposure Assessment	1. Detailed characteristic of the potential recipient groups 2. Determination of the value CL of acid-forming pollutants 3. Calculation of the actual load level of acid-forming pollutants 4. Determination of acid-forming pollutant flows and its boundaries 5. Assessment of the exposure concentrations 6. Sources of uncertainty and reliability assessment of calculations
Impact Assessment	1. Determination of the reference doses 2. Parameterization of the reversible and irreversible impacts 3. Determination of the potential stability of ecosystems 4. Sources of uncertainty and reliability assessment of calculations
III. GER Characteristic	1. Calculation of GER for different groups of effects 2. Calculation of GER for different groups of effects recipients 3. Calculation of GER for different groups of exposure scenarios 4. Uncertainty analysis of the results obtained

STAGES OF GER MANAGEMENT CONTENT OF THE STAGES	STAGES OF GER MANAGEMENT CONTENT OF THE STAGES
I. Identification of Hazard Degree	1. Comparative characteristic of GER for different groups of effects 2. Comparative characteristic of GER for different groups of recipients 3. Comparative characteristic of GER for different groups of exposure scenarios
II. Risk Acceptability	1. The comparison process is based on the “GER - GPR” method. 1.1. Profit from the operation of the oil and gas site in the Arctic region; 1.2. Losses due to operation of the oil and gas site in the Arctic region; 1.3. The availability and ability of regulatory measures to mitigate the negative environmental impact 2. Determination of the type of decision-making: 2.1. Risk is totally acceptable; 2.2. Risk is partly acceptable; 2.3. Risk is totally unacceptable
III. Control Proportions	1. Selection of one of the “typical” measures which reduces (in the first and second cases – 2.1 and 2.2) the GER 2. Selection of one of the “typical” measures which reduces or eliminates (in the third case – 2.3) the GER
IV. Regulatory Decision Making	Determination of the legislative capacity (laws, ordinances, instructions) to implement the “typical” measure which was determined during the previous stage.

group of portions. The selection of acceptability criteria for expected changes depends on the nature of ecosystems involved. The CL values are calculated for internally homogeneous receptor areas (portions) of ecosystems. For example, for ecosystems considered particularly valuable or vulnerable, the CL values must not be exceeded across 100 % of their area. Otherwise, it is proposed to apply the “95 % protection” principle according to which the load level of top pollutants is acceptable if $E_x(X) \leq 0$ for 95 % of the area in question.

It is proposed that the GERs of acid-forming deposition should be calculated using probabilistic modelling of exceeded CLs based on the Monte Carlo method. As opposed to the conventional calculation of exceeded CLs, arrays of bio/geo/chemical parameter values rather than isolated values (default or average) are used as input data for the simulations. Input data arrays can be prepared based on both field survey data and a review of similar projects. The simulation for each individual receptor area results in the array of values for $E_x(X)$. The frequency distribution of these values allows calculating the probability $P(E_x(X) > 0)$ that positive values of $E_x(X)$ will be reached for each of the portions within a given area. Each value of $P(E_x(X)>0)$ will correspond to a value of $M(E_x(X) > 0)$ i.e. the total area of portions with exceeded CLs. The arrays of values (M; P) are used to determine the risk function ($R(X)$):

$$R(X) = F\{M, P\} = F\{M(E_x(X) > 0, P(E_x(X) > 0\},$$

where M is the area of portions with exceeded CLs ($E_x(X) > 0$); P is the probability that CLs will be exceeded.

The GER function is a distribution function. For large receptor areas, the array of values (M; P) can be well approximated by a continuous normal distribution function. If the number of portions is not large, transition to normal distribution is not possible, and the function will be a step function. The distribution function allows to calculate the probability P_1 that CLs will be exceeded in an area smaller than M_1 and for a given range of values M ($M_1 \leq M_i \leq M_2$): $P = P_2 - P_1$.

2.2.2. Model analysis of the GER

Model of the analysis of GER for acid-forming deposition in areas affected by oil and gas industry in the Russian Arctic is shown in Figure 1.

The GER assessment study must be finalized by reviewing the uncertainty of obtained results. For this purpose, the sources of uncertainty must be described for each risk assessment stage and the accuracy of calculation results must be estimated. Результаты оценки ГЭР предлагается использовать для ранжирования отдельных проектных альтернатив и выработки подходов к смягчению воздействий на окружающую среду в рамках процедуры оценки воздействия на окружающую среду намечаемой хозяйственной деятельности.

The GER management for acid-forming deposition in areas affected by oil and gas industry is a decision-making procedure aimed to achieve acceptable levels of total GERs associated with existing or future industrial sites. This procedure considers GER estimation for acid-forming deposition as well as technological and environmental capabilities of risk prevention, reduction, monitoring, response, communication, etc. Geopolitical opportunities and threats are also considered here. Thus, strategic and tactical goals should be laid down in the principles of management of the GER. Strategic purposes should reflect the commitment to achieve the maximum possible level of public welfare in general, tactical purposes should pursue an improvement in the safety of all groups of live forms in the Arctic region [9,10].

Conclusion

Development of Arctic oil and gas fields are interrelated risks of geoenvironmental and geopolitical nature. The melting of ice and the opening of the sea stimulates the development oil and gas infrastructure and other connected activities, leading to increased geopolitical competition mainly between Russia and the US, including European countries. In particular, the environment is used as a tool of geopolitical rivalry and competition of the countries concerned. Therefore, when planning and implementing oil and gas projects from the point of view of environmental and national security, it is extremely important to analyze the GER considering geopolitical challenges.

The proposed GER analysis model allows for quantitative assessment of both the extent of estimated changes to ecosystems, as well as their probability. It provides a detailed profile of an ecosystem as subject to industrial impact. Furthermore, strong interrelation between individual components of land and aquatic ecosystems, as well as the natural variability of parameters characterizing the state of these components, have been considered in this procedure. The findings of GER analysis shall help to make decisions in oil and gas industry projects in such areas with poor accessibility of information and high degree of uncertainty as the Arctic Region.

The model of GER analysis also involves a management step and considers geopolitical factors, including a qualitative expert assessment or evaluation through historical analysis. The principles of GER management should include desire to achieve the highest possible level of well-being of society, as well as striving to increase the safety of all groups of live forms in the Arctic. ●

References

1. *Shvarts E.A., Kniznikov A.Yu., Pakhalov A.M., Sheresheva M.Yu. Assessment of environmental responsibility of oil and gas companies in Russia: the rating method // MSU Vestnik, 2015, Series 6, Economics, No. 5. 46–67.*
2. *Trubitsina O.P., Bashkin V.N. Environmental ratings as a factor of improving investment attractiveness of russian oil and gas companies, operating in the Arctic // Issues of Risk Analysis, 2017, No.2, vol. 14. 98–106.*
3. *Trubitsina O.P., Bashkin V.N. Environmental ratings as a factor of improving investment attractiveness of Russian oil and gas companies, operating in the Arctic In: Bashkin, VN (Ed) Ecological and Biogeochemical Cycling in Impacted Polar Ecosystems, NY: NOVA, 2017, 275–291.*
4. *Trubitsina O.P., Bashkin V.N. Geoecology and geopolitic in the Arctic region: ecological and political risks and challenges // Issues of Risk Analysis, 2017, No.2, vol. 14. 38 – 48.*
5. *Trubitsina O.P., Bashkin V.N. Geoecology and geopolitic in the Arctic region: ecological and political risks and challenges In: Bashkin, VN (Ed) Ecological and Biogeochemical Cycling in Impacted Polar Ecosystems, NY: NOVA, 2017, 217–235.*
6. *Trubitsina O.P., Bashkin V.N. Challenges of the oil and gas industry in the Arctic: geoenvironmental and geopolitical risks // Issues of Risk Analysis, 2018, No.3, vol. 15. 66–75.*
7. *O'Rourke R. Changes in the Arctic: Background and Issues for Congress. Congressional Research Service, January 4, 2018. Available at: https://fas.org/sgp/crs/misc/R41153.pdf /*
8. *Bashkin V.N., Priputina I.V. Management of environmental risks at emission of pollutants. Moscow: Gazprom VNIIGAZ Publishing House, 2010, pp. 189.*
9. *Trubitsina O.P., Bashkin V.N. The analysis of geoecological risks and ratings as a factor of improving investment attractiveness of enterprises. In: Bashkin, VN (Ed) Biogeochemical Technologies for Managing Environmental Pollution in Polar Ecosystems, NY: Spinger, 2016, 141–150.*
10. *Bashkin V.N., Trubitsina O.P. Geoenvironmental and geopolitical risks as the activities' challenges for the oil and gas industry in the Arctic // Neftegaz.RU, 2018, No 6, 82–86.*

Conference participants
Transport Network Russia & CIS

E. Grigoryan

N. Smirnov

Participants and speakers of the 16th
IPC Mechanized Oil Production

E. Yelenskaya

A. Kovalchuk

Y. Vazhenin, A. Mironova, N. Tkachenko

R. Kamaletdinov

M. Kaminsky, S. Shatov

Delegates of the 16th International
Practical Conference MECHANIZED OIL
PRODUCTION 2019

A. Kuznetsov

S. Chernykh

G. Kruglov, A. Idiatullin

Presidium of Transport
Network Russia & CIS
conference

R. Hasanshin,
A. Sabirov

D. Sedov

A. Garifullin

Roundtable participants
Innovations in oil production

S. Lyubarto

B. Aristov

Neftegaz.RU
reader

E. Kibirev

A. Lopanov

M. Ginzburg

S. Medvedev, E. Kibirev

S. Savenok, Y. Makarevich

DRILLING RIG

2. Maintenance, service and technologies in oil, gas and condensate fields

2.1 Oil & gas extraction

2.1.1 Geological exploration

Drilling rigs of FDR (Floating Drilling Rig) series are the basic and the most popular installations applied for prospecting on building materials and gold.

Mechanical transmission, telescopic mast, elementary hydraulic circuit makes FDR is the ideal machine for performing the designated mission. Drilling rigs of FDR series feature the wide options for the realization all basic drilling technologies.

Drilling rigs of FDR series are produced from 1991 and proved themselves as reliable, low-maintenance, effective and easy to operate machine.

Applied drilling technologies:

- standard drilling with the diameter up to 168 mm.
- dry core drilling with the diameters 108…146 mm.
- full-hole auger drilling with the diameter up to 230 mm.
- regular auger drilling with the diameter up to 850 mm.

Positive capabilities of FDR-2:

- As the gear a wide range of wheeled and track machines can be used: ZIL-131, URAL, KAMAZ (as well as double cabin), MAZ, transport track machine TGM-126, MTLBu, tractors TT-4.
- High torque allows building up wells with the diameter up to 850 mm and the depth up to 20 m.
- The availability of the deck diesel decreases the load and increases the gear engine life.
- The most simple mechanical and hydraulic circuits allows the diagnosis and troubleshooting in the minimum terms.
- The installations of such type are applied in the prospecting on the building materials more than 20 years.
- High mass of the drilling rig imparts stability in drilling and moving. ●

SPECIFICATIONS	
PRODUCT ITEM	FDR-2 SERIES 300
FEEDING STROKE, MM	1 800 / 3 500*
FEEDING LOAD, KGF	
UP	3 500–10 000*
DOWN	3 500–10 000*
SPLINDLE ROTATION FREQUENCY, R/MIN	25–430
ROLL TORQUE, KGM	500
MAXIMUM HOISTING CAPACITY, KGF	2 600
NOMINAL DRILLING DEPTH BY, M:	
SCREW CONVEYORS	60
AUGER STEEL	25
AUGER STEEL, SLIDE OVER THE RODS	16
WITH BLOWING	100
WITH CLEANING	100–120
CABLE-TOOL	168
DRILLING DIAMETER BY, MAX, MM:	
SCREW CONVEYORS	400
AUGER STEEL	850
WITH CLEANING	215.9
WITH BLOWING	250
CABLE-TOOL	168

EVENT CALENDAR

14.05

Second International Conference

Natural Gas Vehicle Fuel 2019

Moscow, Hotel Baltschug Kempinski

17.05

XVI International Conference

Development of a Shelf in the Russian Federation and CIS-2019

Moscow, Hotel Baltschug Kempinski

MAY

S		5	12	19	26
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	

20–21.05

Petrochemical & Refining Congress

PRC Europe 2019

Budapest

14–15.05

International Exhibition and the Russian Petrochemical Forum

Gas. Oil. Technologies

Ufa

15.05

International Forum on Renewable Energy

ARWE 2019

Moscow

27–31.05

3rd Science Conference

Horizontal wells 2019

Kaliningrad

May 27 – June 01

The 14th International Science Conference

Current Technologies of Well Workover and Oil Recovery Enhancement. Trends of Development

Rosa Khutor, Sochi

29.05

Russian Energy Summit - 2019 Energy Supply and Efficiency

Moscow, The St. Regis Moscow Nikolskaya

"Within ten years, it will be possible to reach such a level of gasification that would allow one to say that this issue has been completely resolved in the RF"

A. Miller

"It should be remembered that we, as an oil-producing country, have an oil and gas proficit"

V. Putin

"We shouldn't forget that our fuel and energy complex is not only resources, but, above all, the human potential of professionals with serious competencies"

D. Kobylkin

"Russia is rich in talent. When I'm told that there are no decent personnel, I reply that in the 30s the "lapotniki" (bast-shoe makers) were those who carried out the modernization of the country. If today there are no specialists, it means that they can be trained tomorrow. If only there would be a demand for them from business and the state"

Yu. Shafranik

"I don't think this is a serious fall. You can't talk about serious weakening, the ruble fluctuates in the middle of the corridor"

A. Siluanov

"In the foreseeable future, Russian gas will cover a substantial part of the energy needs of European countries"

D. Medvedev

"In the next 5 years, the company may invest a trillion rubles in the development of Siberia and the Far East"

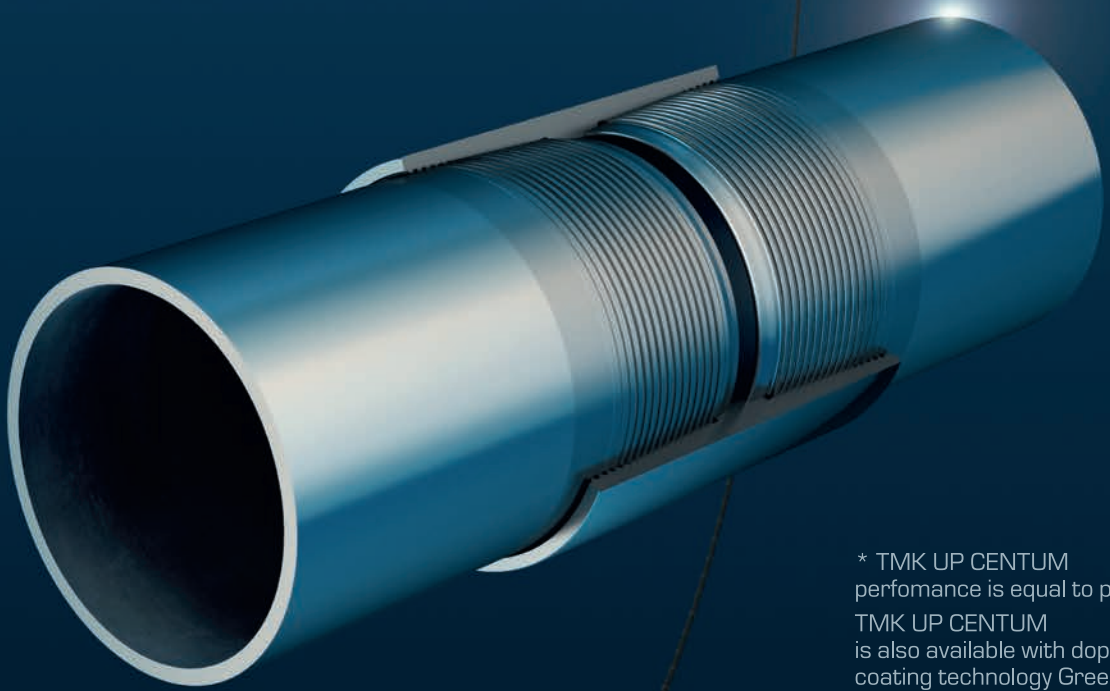
I. Sechin

"The cost of the transportation of gas through the Nord Stream-1 today is almost 2 times cheaper than the cost of transportation through the Ukrainian GTS"

A. Novak

TMK UP CENTUM

100% connection* efficiency



* TMK UP CENTUM
perfomance is equal to pipe body
TMK UP CENTUM
is also available with dope free
coating technology GreenWell

CO_2 CAL-4 Cr 13

TMK
40/2a Pokrovka Street, Moscow, Russia 105062
tel.: +7(495) 775 7600, www.tmk-group.com

Join us at Neftegaz 2019
Expocentre pav. 2, hall 2, **22D10**