

# The green game: how digital technology is changing Russia's oil and gas business

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**Abstract.** It is difficult to overestimate the importance of the gas production business for the Russian economy, and therefore ensuring sustainable and innovative development of this sector of the economy is not just important, but a strategic vector of national economic security of the country: in case of a negative technological gap the impact of sanctions in terms of high-tech imports and overall dependence of the Russian economy on the "political mood" of global technological leaders in Western Europe and the United States is exacerbated. In addition, it should be noted the growing tightening of international environmental standards of oil and gas production, which determines the importance of digitalization of the oil and gas sector in Russia for its compliance with the green strategies of the world. The article is devoted to the study of practices of green investment and digitalization of the oil and gas sector in Russia, as well as the problems and prospects of its digital transformation, taking into account the best domestic and international practices of doing business in Industry 4.0. Separately, the article considers scenarios for the implementation of green investments in the oil and gas business in Russia using the "4 worlds" foresight method.

## 1 Introduction

At present, the environmentally responsible development of companies engaged in natural gas production is largely administrative in nature and depends on government funding, while the global practice has been successfully proven public-private partnerships and models of strategic partnerships that allow to address issues of strategic technological superiority through pure market instruments of inter-firm business cooperation.

However, despite the "superiority in quantity", the weak point of the Russian oil and gas business is the level of its technological development: thus, the share of oil and gas businesses that carry out regular technological innovations averaged 8-10% according to

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2018 data (for comparison, the share of innovatively active oil and gas businesses in Germany exceeds 65%, in Sweden - over 50%, in the UK and Portugal - over 40%). Besides, in domestic practice environmental effects from man-made accidents and disasters in oil and gas production and transportation are almost not taken into account (such data as a rule constitute company's trade secret), which is a serious blow to the competitiveness of domestic energy business and its ability to harmoniously fit into the tightened international environmental standards and requirements, and ensure economic profitability of oil and gas business through intensive factors of smart development Taking into account strategic goals and tasks of national economy digitalization and formation of ecologically responsible behavior of Russia to increase its technological autonomy and independence on the world market of innovative technologies transfer, oil and gas sector objectively takes one of the most priority industries for smart development taking into account global trends, set by Industry 4.0.

## 2 Domestic and foreign experience in the formation of "green strategies" in the oil and gas sector

The practice and mechanism for implementing environmental programs and "green investments" vary greatly from country to country. This is explained both by differences in the assessment of the importance of environmental friendliness of doing business, and by the level of economic development of the state. To understand the specifics of ensuring environmentally responsible development of the fuel and energy complex in Russia and the world, we will conduct a comparative analysis of practices and tools to encourage investment in green technologies and business models in Russia and the world leaders in the oil and gas sector (USA, EU, China) (Table 1).

**Table 1.** Domestic and foreign experience in stimulating environmentally responsible development of the fuel and energy complex in Russia and the world [1-4].

Comparative criteria	Russia	the EU	the USA	China
1. The locomotive of digital reforms in the oil and gas sector	Presidential Administration and the Ministry of Economic Development	General Directorate of the Information Society and the EU Information Society Forum; European Commission Department of Energy	U.S. Department of State, U.S. Department of Energy, U.S. Department of Commerce	National Development and Reform Commission of the People's Republic of China (NDRC)
2. Profile program tools for the implementation of "green strategies" in the oil and gas sector	State program of the Russian Federation "Development of Energy" № 335 from 28.03.2019.	- Strategy for the integrated development of the EU energy system; - Hydrogen strategy for a climate-neutral Europe	Development of energy storage in the U.S. to promote renewable energy projects	Oil and gas industry modernization programs (supervised by China National Petroleum Corporation)
3. Mechanism of motivation to implement environmental strategies and	Administrative, dominated by the goals set by national development	Agency: includes both the goals set in the European Commission's policy (EU New	Hybrid: digitalization of the oil and gas industry is a platform for	Public-private + agency: When developing a digitalization strategy, corporate

"green investments	programs (the National Program "Digital Economy", the Federal Program "Research and Development in Priority Areas of Development of the Scientific and Technological Complex of Russia of Russia for 2014-2021")	Industrial Strategy) and the pool of EU energy companies	political rivalry and lobbying for corporate interests of FAMGA Group companies	interests of business and its industrial and technological potential are taken into account. Corporations also have the right to lobby their interests abroad to improve business competitiveness
4. Sources of funding for green investments and green business behavior	<ul style="list-style-type: none"> <li>- budget funds (70.0% on average);</li> <li>- funds of innovation funds of fuel and energy holdings (25.0%);</li> <li>- non-budgetary sources (5.0%)</li> </ul>	<ul style="list-style-type: none"> <li>- cross-subsidies (up to 65.0%);</li> <li>- European Neighborhood and Partnership Instrument (framework financing - 20.0%);</li> <li>- European Bank loans</li> </ul>	<ul style="list-style-type: none"> <li>- U.S. Energy Development Fund (public-private form)</li> </ul>	<ul style="list-style-type: none"> <li>-Trust funds of state corporations in the oil and gas sector (up to 50.0%);</li> <li>-State investment programs for infrastructure development and sustainable development (30.0%);</li> <li>- Tax and other incentives for environmentally responsible businesses (20.0%)</li> </ul>
5. Strategic goals of programs to improve environmental responsibility of the oil and gas business	<ul style="list-style-type: none"> <li>- technological modernization of the fuel and energy complex;</li> <li>- development of technology import substitution;</li> <li>- search for new markets for products;</li> <li>- improvement of pricing</li> </ul>	<ul style="list-style-type: none"> <li>- development of hybrid forms of energy supply of the countries;</li> <li>- development of energy efficient technologies;</li> <li>- environmental projects;</li> <li>- Increasing the productivity of gas production</li> </ul>	<ul style="list-style-type: none"> <li>- consolidation of rights to the best technological practices in gas production;</li> <li>- Strengthening of presence on the world energy market;</li> <li>- development of technology transfer and patent trade;</li> <li>- -gaining new tools of political and economic pressure on the global energy market;</li> <li>- lobbying corporate interests through instruments of greening the oil and gas sector</li> </ul>	

As the table shows, the practice of regulating environmental strategies in the energy market of Russia, EU, USA and China as world centers is largely similar: administrative leverage has the most direct influence on stimulating environmentally responsible behavior of gas-producing businesses to implement innovative solutions.

But, starting with the issue of financing, there are quite clear differences:

*In the Russian Federation* almost all financing of environmental projects and programs takes place with the participation of budgetary and state non-budgetary sources (for example, Innovation Funds of the leading Russian energy businesses with a dominant share of state participation in the authorized capital) [4; 5];

In spite of high cross-subsidization share *in the EU* (according to some estimates, its average value is more than 59,0%, and in some countries - 68,0% or even more) Such financing institutions as framework ecological funds, created at the expense of contributions of all member states, actively function, and it is at their expense the payment of expenses on innovative workings out taking into account interest of the majority of the parties [6];

In contrast, *in the United States*, virtually all funding for "green technology" lies directly with public-private and purely private funds, established directly on the basis of the largest energy market agents. It should also be noted that U.S. environmental development programs are based on the bottom-up principle, i.e., businesses form the environmental agenda and then defend it at the U.S. Department of Energy. This helps not only to reduce the likelihood of untargeted financing of green projects, but also to harmonize national interests and the technological capabilities of businesses in the gas production sphere.

And, of course, the differences in the objectives of environmental programs and projects in oil and gas production in Russia and worldwide are very obvious: while in the first case we are talking about a large-scale modernization and technological upgrading of enterprises, taking into account the best international practices and patterns of oil and gas business, in the EU the goal is aimed at "greening and productivity" of gas production and transportation, in the United States and China the leitmotif of development programs is to maintain the position of world leader in the holding of patents and licenses for innovative solutions

### 3 Green investments in the Russian oil and gas business: how much does ecology cost?

Based on the data of Vygon Consulting report, "TEK-Rating" Public Association, as well as analytical reviews of Cornell University and INSEAD, let us consider the volume and structure of green investments in the oil and gas sector of the Russian Federation for 2015 - 2020 years. (estimated value) ( Table 2).

**Table 2.** The volume and structure of green investments in the oil and gas sector of the Russian Federation for 2015 -2020 years (estimated value) [7-10].

Indicators	2015	2016	2017	2018	2019	2020 (estimated value)
1. Cumulative volume of green investments in the oil and gas industry, mln. USD. Including:	6585,3	7216,6	5229,1	7789,9	4169,9	7001,2
1.1 Improved operational efficiency of the production business model	1692,4	1970,1	1124,3	2173,4	884,0	1820,3
1.2 New exploration technologies	2146,8	2078,4	1542,6	1308,7	754,8	2086,4
1.3 Real time well condition monitoring	1152,4	1414,5	1171,3	2375,9	1396,9	1435,2
1.4 Robotic drilling control systems	678,3	635,1	481,1	950,4	683,9	854,1
1.5 IoT technologies of gas complexes management (unmanned wells)	915,4	1118,6	909,9	981,5	450,3	805,1

As can be seen from the data in the table, there was a fairly steady tendency to invest in green oil and gas production technologies until 2019, but after the COVID-19 pandemic and a certain slowdown in industrial growth of the global economy, interest in such investments has somewhat "subsided," but according to PWC forecasts, a new surge in demand for high-tech solutions is already

expected by the end of 2020. Moreover, if we consider the structure of green investment priorities, we can see that the main interest of gas companies lies in the implementation of new technologies for geological exploration - on average, according to our estimates, this area accounted for 1652.9 million dollars (taking into account the forecast for 2020). In the second place is the use of digital technologies to improve the operational efficiency of gas businesses - \$1,610.8 million (taking into account the 2020 forecast), while in the third place is the use of digital technologies to improve the operational efficiency of gas businesses - \$1,610.8 million. In third place is the use of digital technologies to monitor well condition, timely troubleshooting and accident prevention - \$1,491.0 million. In third place is the use of digital technology to monitor well conditions, timely troubleshooting and accident prevention - \$1491.0 million.

Currently, there are three approaches to the development of green technology in the oil and gas industry (Table 3).

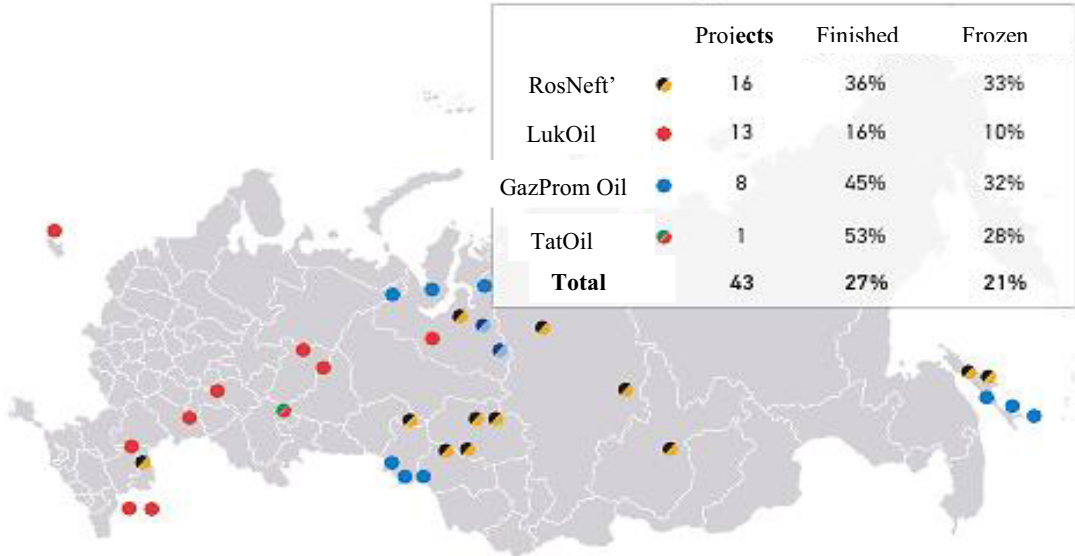
**Table 3.** Approaches to green technology development in the oil and gas sector [11]

Name of approach	Approach characteristic
1. Automation of business processes of oil and gas production and refining	- implementation of cloud platforms to implement Big Data analysis; - introduction of a system of control and measurement sensors; - development of autonomous management systems for individual business processes of oil and gas production and refining
2. Digitalization of the business model of the oil and gas business with the implementation of green technologies in company management	-formation of a unified information space for managing business processes of oil and gas production; - creation of digital twins of oil and gas refineries and storage facilities; - development of an IoT system to monitor oil and gas equipment for leaks, irregularities in the rhythm of operation, and the threat of accidents
3. Digital transformation of the business model of oil and gas holdings based on global best practices of green strategies	-formation of autonomous gas production control systems using AI; - formation of industrial-digital eco-systems of GHG extraction and production; - development of the "manless wells" format

The global experience of digitalization of gas producers has quite different points of view on the processes of introducing digital solutions into such a complex and problematic sphere as the mining industry [9; 13; 15]. Based on a review of green technologies development practice, we found that each of the approaches today has a kind of curator in the person of the largest gas producing and gas processing companies in the world: the first model is represented by companies such as Shell. Chevron: the second is BP and Petoro, the third model has now reached only StatOil.

At the next stage, we will consider the practice of developing green technologies in the oil and gas sector and the Russian Federation. According to the data at the end of 2020, 43 points were identified in the Russian Federation for the potential introduction of green oil and gas production technologies (Figure 1). As follows from the data of the above map, Rosneft and PJSC Lukoil, PJSC Gazprom, are the key player in introducing green technologies in the field of gas production, despite their absolute leadership and the status of the national gas operator, is in third place.

However, a reservation should be made here: the map reflects all projects that have at least one significant characteristic related to the digitalization of business processes, and Rosneft PJSC and Lukoil PJSC have the largest number of production licenses, in addition, they specialize primarily in oil production, and the associated gas condensate, in fact, is an indirect product that previously had to be burned for safety work [12].



**Fig. 1.** Map of potential natural gas and oil fields for green technology implementation

As follows from the above figure, it is PJSC Gazprom that is the legislator of green fashion in the field of natural gas and oil production - the share of green investments of this company in the analyzed period of time was more than 75,0% of all environmental projects, moreover, by the decision of the Board of Directors, the Center for Digital Innovations of the company was created on the basis of the subsidiary of Gazprom Neft, which allows not only to centralize the financing of environmental projects, but also to coordinate the green development of the entire holding.

#### **4. Environmental tomorrow of Russia's oil and gas business: obstacles and solutions**

The main reasons hindering the development of green investments in the Russian oil and gas sector are the following

1) currently there is no unified state program of greening and introduction of green technologies in oil and gas sector of economy, and all projects on digitalization of these businesses occur within the departmental project of the Ministry of Energy of the Russian Federation "Digital energy" (2018 - 2021);

2) Absence of the provision on application nature of environmental R&D on the principle of "one window" by analogy with China, India, USA and EU, which could allow to use scientific potential of RAS institutes and oil and gas universities;

3) lack of state and (or) departmental initiative in the issue of working out a state program of aerospace and nuclear technologies incorporation in the projects of gas fields development in Russian Arctic (at present there is only one functioning project based on strategic partnership between FSUE "Space Communication" and JSC "Gazprom Space Systems" (GSS), implementing the geolocation and aerial imagery of high resolution ice migration, using low orbit satellites)

4) financial encumbrance, labor- and time-consuming creation of national protocol of Big GeoData exchange with simultaneous restriction of RF access to international oil-gas data exchange standards (POSC) based on American software.

According to a press release of the Ministry of Energy in 2021 will begin planned work to create a national standard for environmental certification of equipment and communication protocols on the basis of the Institute of Oil and Gas Technology Initiatives;

5) lack of methodological basis for the implementation of projects in terms of optics of gas production facilities (currently in Russia only Gazprom has a working prototype of a digital platform, which is based on the best practices of optics of industrial facilities) [13,14].

In conclusion, the author formulated four main scenarios for the formation of environmentally responsible behavior in the oil and gas business of the Russian Federation, using the method of Foresight "4 worlds" (Table 4).

**Table 4.** The main scenarios for the formation of environmentally responsible behavior in the oil and gas business of the Russian Federation [15]

Scenario	Scenario's characteristic
1. The Red World (a bipolar leader's world)	<p><i>Background:</i></p> <ul style="list-style-type: none"> <li>- FAMGA group (USA) and BAT group (China) have become the world centers of the Hi-Tech ecological management;</li> <li>- The Russian Federation could not build an effective national ecological infrastructure and is dependent on the above groups;</li> <li>- EU ecological infrastructure and technologies is managed by the FAMGA group (USA).</li> </ul> <p><i>Characteristics of the world:</i> green investment has become an object and means of influence of world leaders on the behavior of entire states and allied entities, the emphasis on the military and political role of ecological responsibility. Hacking has come under the control of the ecological behaviour and is carried out as a tool to intimidate or subdue the enemy. The political system is built on the principles of digital ecological diktat with the granting of power to the world's largest MNCs that manage the personal data of all citizens.</p>
2. The Yellow World (digital monopoly of Asia)	<p><i>Background:</i></p> <ul style="list-style-type: none"> <li>- BAT group (China) and the new digital giants of Asia (India, Japan) have established world leadership in the Eurasian ecological space and are actively occupying North and South America;</li> <li>- FAMGA Group (US) is partially absorbed by Asian investors and is losing its global monopoly;</li> <li>- The Russian Federation joins the ecological technologies and infrastructure of the Asian group.</li> </ul> <p><i>Characteristics of the world:</i> The Chinese conglomerate pursues a policy of soft takeover of national leaders-producers of green technologies for the oil and gas business. Political management is based on the principle of "divide and conquer"</p> <ul style="list-style-type: none"> <li>- environmental sovereignty in the energy sector becomes an object of bargaining: the higher the "political loyalty" to China, the more advantages its owner has.</li> </ul>
3. 3. Green world (multicentricity of digital ecosystems)	<p><i>Background:</i></p> <ul style="list-style-type: none"> <li>- Countries around the world are actively developing national digital ecosystems based on the largest and most innovative businesses (banks, IT companies, national information infrastructure management companies);</li> <li>- Collapse of oligopolistic power FAMGA group (USA) and BAT</li> </ul>

	<p>group (China).</p> <p><i>Characteristics of the world:</i> the entire world economy is being reshaped into autonomous digital ecosystems, which build relationships between themselves on the principles of win-win partnership, and environmental sovereignty is used to protect their own interests - as a means of economic and technological pressure on opponents or competitors.</p>
4. Blue World (the world of digital ecological colonization)	<p><i>Background:</i></p> <p>Blue World (the world of digital ecological colonization) Background:</p> <ul style="list-style-type: none"> <li>- Growing tensions and the number of hacker attacks have shown the inability of individual states to provide digital security;</li> <li>- Civil protests against the collection and commercial use of personal data.</li> </ul> <p><i>Characteristics of the world:</i> The global community is reshaping standards of cooperation and partnership from a resource-based paradigm to a digital one.</p> <p>The EU is actively implementing programs to support and develop digital environmental infrastructure in Eastern Europe and Africa; the U.S. is actively incorporating its green technology into national security in South America. The Russian Federation is actively developing digital environmental infrastructure in Asian countries (Mongolia, Kazakhstan, Turkmenistan, Tajikistan), which means the formation of a new colonial system built on the basis of green technology.</p>

Each of the scenarios presented above is a likely reflection of future environmental events, but the only certainty remains that the environmental sovereignty of the state will become the object of political and economic struggle not only of the countries' governing elite, but also of the largest businesses in the field of digital technology to strengthen their own influence in the global market

## 5 Conclusion

In order to improve the environmental safety of oil and gas industry enterprises, the development and implementation of scientific and technological innovations associated with the integrated use of hydrocarbon raw materials, implementation of energy conservation and energy efficiency programs, the use of resource-saving, environmental, low-waste and non-waste technologies are brought to the fore. It should be noted that there are currently insufficiently developed theoretical and methodological issues in the field of environmental protection in the Russian Federation.

Theoretical and methodological issues of ensuring environmental safety are insufficiently developed and the methodological and legal framework of regulation is imperfect. There is no strategy to ensure economic development in market conditions, taking into account the requirements of environmental safety, there is no proper accounting of environmental results and consequences of economic activity.

Increased attention of the state to the issues of environmental safety and consolidation of a set of measures for economic stimulation of environmental protection activities will create a reliable basis for the stability of Russian economic development and protection of the health of the country's population and future generations.

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