Diversifying the Business of Oil and Gas Companies in the Context of Global Climate Policy

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***Abstract* — In 2019, Russia, being a climate-conscious country, ratified the Kyoto Protocol to the UN Framework Convention on Climate Change caused by anthropogenic emissions of greenhouse gases. The increase in the emissions is primarily driven by the advancements in energy production. The existing level of technology for processing and using raw materials in many energy industries leads to dangerous environmental pollution and causes an increase in environmental problems. Many companies have adopted their carbon neutrality strategies to use "green energy" based on ESG criteria, which allows them to increase their competitive advantages. Achieving carbon neutrality involves minimizing direct emissions during production processes or shifting to renewable energy sources. The paper examines the transformation of the oil and gas companies towards cutting greenhouse gas emissions and analyzes the mechanisms for achieving decarbonization. To assess the effectiveness of investment projects in the field of low-carbon energy, the paper analyzes an approach and proposes a dynamic simulation model based on a modification of the discounted cash flow method. The model is tested under the assumption that carbon regulation is carried out through the introduction of a carbon border tax.**

***Index Terms* — Environment, carbon neutrality, energy, greenhouse gases, oil company, efficiency.**

I. Introduction

The world is currently undergoing a significant shift in climate, characterized by rising temperatures coupled with escalating emissions of greenhouse gases (GHG) that trap infrared radiation. The industrial revolution gave impetus to the use of fossil fuels and biomass, along with widespread deforestation. As a consequence, the concentration of greenhouse gases in the planet's atmosphere has increased, resulting in a significant rise in global temperatures.

The main source of greenhouse gas emissions is the energy sector. World's energy generation accounts for 76% of carbon dioxide (CO2) emissions, with a slightly higher share in Russia – 78.7% [1]. The energy sector is the backbone of the Russian economy, sustaining and driving the growth of its other sectors. The main priority of Russia's energy policy in the context of a change in technological structure is to ensure environmental safety, which is largely due to the geopolitical situation and the role of the energy sector in the development of the country. These issues gained the importance with the signing of the UN Framework Convention on Climate Change (UNFCCC, 1992), the adoption of the Kyoto Protocol (1997) and the Paris Agreement (2015). These agreements

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mandate the participants to limit or reduce greenhouse gas emissions, which largely determines the long-term development of global energy towards carbon neutrality.

In this context, an accelerated transition to flexible and sustainable energy began to adequately respond to challenges and ensure environmental safety [2–3]. Many companies have developed programs to reduce greenhouse gas emissions and adopted their green energy strategies based on global standards, in particular ESG (a set of criteria for transitioning to socially responsible corporate management—Environmental, Social and Governance aspects.), which allows them to increase their competitive advantages. The trend towards carbon neutrality is realized by reducing direct emissions from production; transition to renewable energy sources (hydrogeneration, solar energy, wind, water, hydrogen energy); direct capture of CO_2 from the atmosphere (absorption by plants, soil and water masses). One of the economic measures contributing to the transition to green energy is the introduction of a carbon border tax (CBT) - simpler name for the Carbon Border Adjustment Mechanism (CBAM), which is planned to be levied from January 1, 2026 [4]. According to analysts of the international consulting company.

The Boston Consulting Group, the oil and gas industry accounts for 45–53% of all carbon emissions of Russian exporters (45–84 million tons of CO_2) [5].

As a consequence, the development of large oil and gas companies is transforming towards carbon neutrality, which makes it especially important to assess the introduction of a carbon tax on the efficiency of investment projects and the need to choose an adequate approach.

I. Climate Strategy and Transition to a Green Economy

To fulfill the obligations under the Paris Agreement, the European Union approved a strategy aimed at reducing CO_2 emissions by 55% by 2030 and achieving zero greenhouse gas emissions on the continent by 2050 (European Green Deal) [6]. As technological advancements continue to evolve, the processes of environmental pollution accelerate, increasing the likelihood of the land ecosystem degradation in the future, which underscores the importance of transitioning to a green economy.

In 1972, the United Nations Environment Program, established by the United Nations as the leading global environmental authority, formulated a broadly applied generalized definition of the concept of a green economy – an economy characterized by low carbon emissions, efficient resource utilization, and a commitment to serving the interests of society as a whole [7]. According to the forecast, the global energy landscape is expected to change by 2040 with a significant shift towards clean fuels. The share of natural gas is anticipated to increase to 25%, renewable sources are projected to reach nearly 15%. In contrast, oil may decline from 32 to 27%, although it will remain a dominant energy source [8].

The Russian Federation is actively involved in the implementation of the climate strategy. The Paris Agreement was signed in 2016 and ratified in 2019. In 2021, the Strategy of Russia until 2050 was approved, introducing two country's development scenarios, including inertial and intensive. The intensive scenario is supposed to be taken for implementation [9]. The inertial scenario is aimed at fulfilling national goals and objectives. It does not explicitly outline programs for reducing greenhouse emissions and relies on planned modernization and replacement of outdated equipment. The scenario activities fail to encourage companies to adopt low-carbon technologies, which increases the risks of slowing down the development of green technologies. The intensive scenario was constructed to ensure the compliance of Russian climate regulation with international standards, including ESG. It takes into account economic development opportunities in the context of the global energy transition to green technologies with low CO_2 emissions, alongside the principle of return on the investment made in them. It suggests reducing the share of “traditional” industries by 9.4% in 2050 compared to 2020.

The fundamentals of carbon regulation in Russia are established by Federal Law No. 296-FZ “On the Limitation of Greenhouse Gas Emissions” of July, 2 2021 [10]. The carbon unit indicator and the term "greenhouse gas reduction target" were introduced. Entities with high emissions are required to submit reports. The law primarily seeks to provide entrepreneurs with the opportunity to implement investment projects aimed at reducing GHG emissions. The document advises state corporations, companies, and joint-stock companies with state involvement to revise their strategies to align with initiatives that promote the national economic growth while maintaining low carbon dioxide emissions.

II. Mechanisms for Achieving Carbon Neutrality

Carbon neutrality means that in the process of production activities the company reduces carbon dioxide emissions and its analogues to zero or compensates for emissions through the implementation of carbon-negative projects [11].

Common regulatory mechanisms include greenhouse gas emission quota systems, carbon taxes and fees, and product labeling that reflects carbon footprint level based on national environmental and energy efficiency standards. Additionally, there are prohibitions on the sale (use) of carbon-intensive products and establishment of technical standards to limit the level of GHG emissions from automobiles, which aims to reduce the reliance on internal combustion engines (Norway, Denmark, United Kingdom, Spain, France, China, Germany). Mixed forms of regulation are also widely used. The mechanisms considered cover about 21% of global greenhouse gas emissions, which makes it possible to reduce the carbon footprint of production and involve interested companies in decarbonization, thus contributing to the transformation of the energy system, the use of new technologies and capacities, and the development of renewable energy sources, including hydrogen. The main mechanisms for cutting carbon emissions are the emissions trading system (ETS) and the carbon border tax (also known as carbon border adjustment mechanixm), which is calculated based on the carbon intensity of each product. The two instruments are not mutually exclusive; in some jurisdictions, both are applied simultaneously.

Of interest is the establishment of a Russian carbon quota system and a mechanism for trading emission permits, considering the specific features of the energy development. Sberbank of the Russian Federation put forward a proposal to partially compensate for investments in decarbonization through trading in emission permits. The bank is also keen on expanding ETS to encompass the entire Russian economy [12].

Russia is set to implement fees for GHG emissions, introducing several pricing options. One of these options aligns with the European model, which employs a marginal pricing system based on established quotas (85% of quotas are free, 15% of quotas are sold on the market at €50–55 per ton of CO_2). The average pricing option is €5–7 per ton of CO_2 [13]. The first attempts to assess the consequences were made for electricity. Most experts expect a significant increase in the wholesale price of electricity, forecasting the rise up to 9% with mandatory payment of only 10% of emissions at a price of €60 per ton. Furthermore, if the emissions are fully paid at €50 per ton CO_2, the cost of electricity from coal-fired power plants will increase by 5.3 times, and that from gas-fired plants – by 2.7 times [14].

The Ministry of Natural Resources of the Russian Federation proposes establishing negotiable fines for over-emissions and charge for exceeding quotas based on the world average price for GHG emissions of $2 per ton of CO_2 and the average quota price in the European quota trading system of €25 per ton of CO_2. If the emission limit is not reached, then quota fulfillment units are charged (one "saved" ton of CO_2 is equal to one unit). The entity will be able to sell or count upon repayment of its accumulated quotas [15].

The process of trading emissions permits in Russia has not yet begun. To assess the effectiveness of the CO_2 emission quota mechanism, it is planned to implement regional experiments. The establishment of carbon regulation in test mode can begin on Sakhalin. The purpose of the experiment is to achieve a 10 % reduction in the volume of GHG emissions in the region by the end of 2025 (in 2021, it amounted to 12.3 million tons of CO_2-equivalent, the volume of absorption was 11.1 million tons). To achieve carbon neutrality, the region needs to convert 145 boiler houses from coal to gas, increase the share of environmentally friendly transport to 50%, and boost the share of renewable energy sources [16].

According to assessment conducted by the Ministry of Economic Development of the Russian Federation in 2021, the introduction of a carbon tax is expected to affect exports from Russia in the amount of about $7.6 billion per year. By 2030, annual losses for importers of Russian products due to taxation are projected to range between $3.5 and 6.3 billion [4]. The mechanisms under consideration will reduce the carbon footprint of production and involve interested companies in decarbonization. Moreover, they will contribute to the transformation of the energy system, the use of new technologies and capacities, the construction of facilities based on renewable energy sources, and the development of hydrogen energy.

III. Energy Transformation of Oil and Gas Companies

The energy sector generates a huge amount of environmentally hazardous waste, associated and secondary resources, whose storage and disposal pose an economic challenge on a national scale affecting all sectors of activity and the environment. The accumulation of significant masses of waste in many energy industries stems from the existing level of technology for processing raw materials and the lack of its integrated use. A major problem is the flaring of associated petroleum gas (APG), which leads to environmental pollution and an annual loss of up to 35 billion cubic meters of valuable resources. According to the World Bank, Russia ranks among the top countries with the highest rates of APG flaring. The access of service gas processing companies to burned raw materials and their economic incentives are not regulated by legislative and other regulatory acts. Due to the depletion and qualitative deterioration of oil and high-pressure natural gas resources, the problem of rational and full use of hydrocarbon reserves is becoming especially acute. Under these circumstances, in order to maintain competitive advantages, many oil and gas companies in Russia adopted their strategies for using low-carbon energy based on ESG criteria [17]. In 2022, PJSC Rosneft [18] topped the ranking of Russian companies for achieving carbon neutrality, followed by TATNEFT in the second place, and LUKOIL in the third.

Rosneft's priority, along with high profitability, is the use of environmentally friendly technologies. In 2016–2020, Rosneft invested over RUB 240 billion in green initiatives. The plans for the next five years were to invest another RUB 300 billion [19]. In 2021, the Strategy "Rosneft–2030: Reliable Energy and Global Energy Transition" was approved by the company. The main stages of achieving its targets are aimed at accelerating decarbonization initiatives. The company aims to cut absolute GHG emissions by 5% by 2025 as compared to 2020, exceed a 25% reduction by 2035, and achieve carbon neutrality by 2050 [20].

To achieve these goals, Rosneft develops and implements investment projects that employ various technologies focused on the complete capture and processing of carbon dioxide, the recycling of materials, and facilitate the transition to renewable energy sources. A special plant was designed to convert methane into synthetic liquid hydrocarbons, which was assessed by international expertise as a "high-tech modern solution." Aromatization of methane is carried out, enabling a simultaneous production of hydrogen and aromatic petrochemical products from natural and associated petroleum gas [21].

Infrastructure projects are implemented for the beneficial use of APG in order to reduce emissions of harmful substances generated from the combustion of APG at Rosneft's flares [5].

The largest project of Rosneft is the Vostok Oil project in Taimyr (the confirmed resource base is 6 billion tons of liquid hydrocarbons with a uniquely low-sulfur content of 0.01–0.04%) [20]. As part of the field's carbon management plan, APG will be fully utilized, which will provide the project with a 75% reduction in the carbon footprint. This achievement is a significant advantage when compared to major oil projects globally.

Gazprom Neft, in partnership with leading companies in aviation industry, is creating a technological alliance to develop green fuel. Solar panels are used in the Kharampursky field development project (Kharampurneftegaz LLC) in the Yamalo-Nenets Autonomous Area. An autonomous hybrid power plant was installed in Yamal, and solar panels were implemented at Rosneft gas stations in Sochi [21].

LUKOIL's priority is to increase production and develop growth projects based on the use of modern technologies to achieve carbon neutrality by 2050. The company's planned investments in renewable energy for the next 10 years surpass the state's allocated support for this sector in Russia by 30% [14].

One of the ways to achieve carbon neutrality is the large-scale introduction of renewable energy sources (RES). In 2018, RES capacities generated about 1 MWh of green electricity, which amounted to 5.2 percent of the total energy generated by the company [22]. The company expands renewable energy capacities for the use of energy for commercial purposes and for auxiliary power supply to its production facilities [23]. The company's Strategy developed in 2021 offered three possible decarbonization scenarios based on the forecast "Prospects for the development of world energy until 2050." These are "Evolution," "Equilibrium," and "Transformation." The Transformation scenario involves the abandonment of hydrocarbons alongside the swift development of electric

transport and renewable energy technologies. It is planned to invest $15 billion in green energy, to implement up to 30 GW of renewable power generation capacity, which will exceed ten times such capacities located throughout the country [24]. This will facilitate the achievement of the goal of decarbonization and reduce the company's dependence on oil prices through business diversification.

NOVATEK works actively in the Arctic to build liquefaction natural gas (LNG) plants in the Yamalo-Nenets Autonomous Area. A new project for LNG facilities is introduced based on innovative gravity-based technology adapted to work beyond the Arctic Circle. This achievement can significantly reduce the scope of work and the cost of liquefaction due to the assembly and installation of the main equipment in the Center for the construction of large-capacity offshore structures. As a result, it also lessens the environmental impact.

It is worth noting that the companies diversifying their business to reducing CO_2 emissions face increased investment, high risks, and long implementation periods. Given these circumstances, the importance of selecting appropriate approaches to assessing the effectiveness of investment projects related to the energy transformation of companies is increasing.

IV. Approaches to Assessing the Effectiveness of Investment Projects

A crucial factor in the process of making investment decisions is the selection of methods for evaluating their effectiveness. Currently, there is a wide range of methods for assessing the effectiveness of investment projects. These are dynamic, static (single-period and multi-period), real-option, and non-economic (social, environmental and budgetary effect) methods, which are selected following the specifics of the investment project in question [25-40]. Static methods are the most prevalent choice due to their simplicity and speed of calculation [22-23]. The real-option method offers significant benefits enabling the companies respond flexibly and quickly to changes in the environment [32-33]. A widely adopted method today is a dynamic approach based on discounted cash flows, recommended by the UN and the World Bank [25, 28-33]. The primary drawback of this approach is its failure to consider social and environmental impacts.

In modern context, economic analysis tends to reflect indicators of environmental sustainability considering social priorities when evaluating investment projects [38-39]. When choosing an effective innovative technology, projects face the problem of low commercial effectiveness, alongside the underestimation of social and environmental impacts. Utilizing the assessment of the public effectiveness of innovative projects is proposed to determine the expected economic effects for supporters and opponents of the technology. This can be achieved by adapting the methodology of project analysis and foresight research, which are used by global financial institutions [40].

A dynamic simulation model based on the method of discounted cash flows is proposed to assess the effectiveness of green energy investment projects of oil and gas companies. The model assumes the involvement of a single investor (a company) along with the implementation of carbon regulation via the introduction of a carbon border tax (CBT) [41]. The novelty of the proposed approach is the modification of the criterion of the basic model by including the CBT and the environmental component in the form of payment for environmental pollution with greenhouse gases. This allows considering economic damage as a cost representation of expenses incurred in preventing the environmental impact of emissions, reflected in the net present value of the investment project.

V. Evaluating the Effectiveness of Investment Projects in the Field of Alternative Energy

The approach was tested using Rosneft as an example, given that the reduction in the carbon footprint is the main aim of investment projects for energy transformation. The calculations were made on the assumption that all green energy investment projects are represented by one aggregated alternative energy project, GHGs are represented by CO_2 and methane.

The impact of CBT on the effectiveness of the company's development was assessed using two investment scenarios based on the volume of capital investments in green energy in the amount of RUB 300 billion for the period of 2023–2027. Scenario 1 does not introduce CBT; Scenario 2 introduces CBT and factors in the economic costs of preventing air pollution (pollution fee). A comparative assessment of the performance indicators of Rosneft investment projects for the two scenarios is presented in Table 1.

TABLE 1. Comparative Valuation of Investment Projects for 2023–2027, RUB billion

Indicator	Effectiveness of Investment Projects	
	Scenario 1 Without CBT	Scenario 2 With CBT
Investment volume	300	
Free cash flow	8 352	
Operating expenses	1 024.8	
Pollution charges	-	24.4
Sales profit	7 327.2	7 302.8
Taxes (excluding CBT) and customs	3 834.3	
Carbon border tax	-	2 501
Net profits	3 492.9	967.5
Discounted capital investments	208.2	
Discounted cash flow	1 666.9	214.7
Net present value	1 458.7	6.5
Profitability index	5.56	0.72
Payback period, years	3	5

Source: Author's calculations

TABLE 2. Forecast of Environmental and Economic Indicators of Investment Projects for Scenario 2

Indicator	2022	2023	2024	2025	2026	2027	Total for 2023–2027
Volume of direct pollutant emissions, thousand tons							
Carbon dioxide	56 317	55 742	55 167	54 594	53 445	52 296	271 244
Methane	135.7	134.3	132.9	131.6	128.8	126	653.6
Reduction in direct emissions compared to the previous period, thousand tons							
Total	-	576.4	576.4	574.3	1 151.8	1 151.8	4 030.7
Economic costs of preventing pollutant emissions, RUB billion							
Total		5 026.9	4 975.0	4 923.3	4 819.7	4 716.1	24 461.7

Source: Author's calculations

A comparative analysis of the scenarios reveals that with the introduction of CBT, the company's net profit for the period of green energy investment projects decreases by more than 3.5 times – to RUB 967.5 billion, while net present value reaches RUB 6.5 billion. The forecast of emissions and economic costs to prevent air pollution is based on the actual data of Rosneft for 2018–2020 and the climate agenda of Rosneft until 2030, using the methodology for determining the prevented environmental damage (Table 2).

The total volume of direct emissions is reduced by 4 030.7 thousand tons, whereas the pollution fees amount to RUB 24.5 billion. To reduce pollutant emissions by 1 ton, the company needs to invest RUB 74.42 thousand in alternative energy technologies, while the net present value will be only RUB 1.61 thousand per 1 ton, which is unprofitable even for the largest company in the short term. “Green” investments begin to yield returns only in the fifth year of the project, aligning with the company’s long-term profitability expectations.

VI. CONCLUSION

To effectively address the issues of environmental safety in the energy sector, the Russian Federation effectively leverages the specific mechanisms established by the UN Framework Convention on Climate Change and its Kyoto Protocol.

The introduction of carbon regulation, planned as part of the EU climate policy, necessitates a change in the strategy for the energy development towards decarbonization. Incorporating the carbon neutrality criteria into the evaluation of the effectiveness of investment projects is likely to adversely affect the financial performance of oil and gas companies during the initial stage of introducing cross-border regulation.

The proposed approach allows assessing the

effectiveness of green energy investment projects by considering the introduction of CBT and the economic costs of preventing environmental damage in light of global economic development trends.

An effective adaptation of the Russian oil industry to the conditions of cross-border regulation requires a comprehensive state policy. First of all, it is essential to develop a domestic methodology for assessing the carbon intensity of products and, within its framework, to establish a system for tariffing carbon emissions and a procedure for trading rights to greenhouse gas emissions. The decarbonization process can be stimulated by establishing supportive measures from the state for Russian companies that are investing in green energy projects.

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