

ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT

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Abstract

In recent years, the problem of climate change has become one of the most urgent. Its negative consequences will be most pronounced in northern countries with a carbon-intensive economy, such as the Russian Federation, for which an increase in average annual temperature is fraught with the destruction of infrastructure, an increase in morbidity and mortality, and the introduction of climate regulation measures by foreign partners can lead to a decrease in exports, loss of external markets. Accordingly, ensuring the decarbonization of the economy for Russia is an important task. In this regard, the purpose of the work is to identify the problems of decarbonization of the Russian economy. In the course of the analysis of foreign experience, it was revealed that in countries with the largest volumes of greenhouse gas emissions, decarbonization tools are actively used, mainly emission quota systems, carbon taxes, technical standards, and bans on the sale of carbon-intensive products. A distinctive feature of the climate regulation system being developed in Russia is the desire to take into account the assimilation potential of ecosystems. The most promising tools for the decarbonization of the Russian economy are analyzed: quota systems, carbon landfills, the use of technologies for capturing and pumping carbon dioxide into the subsoil, and the development of electric transport. It has been determined that the main problem with the use of these tools is their lack of consistency: the start of their work is scheduled for almost the same time, while their effectiveness depends on the results of each other's work.

Keywords: sustainable development, environmental priorities, economic efficiency

I. Introduction

In 2022, the Russian economy faces unprecedented challenges due to a sharp escalation of geopolitical tensions. The consolidated efforts of economically developed countries aimed at undermining the economic potential of the Russian Federation created an extremely unfavorable background for the country's economic development, which steadily worsened throughout 2022. The following circumstances were of fundamental importance:

1) the freezing of the country's international assets in the amount of more than 300 billion US dollars;

2) the growing sanctions pressure associated both with the restriction of the possibilities for interaction between residents of the sanctions initiating countries with Russian economic entities, and with the extension of relevant restrictions to residents of third countries planning to continue or develop cooperation with the Russian Federation ("secondary sanctions");

3) disconnection of leading Russian banks from international payment systems and the interbank system for transmitting information and making payments SWIFT (with the threat of extending this measure to the entire banking system of Russia);

4) the forced curtailment of energy cooperation (complicated by the destruction of the infrastructure for natural gas supplies to Europe through the pipelines of the Nord Stream 1 and Nord Stream 2 projects), as well as attempts to reduce revenues from Russian energy exports to third countries through the "price ceiling" mechanism ;

5) refusal to cooperate with the Russian Federation in the field of high technologies (primarily dual-use technologies) and the actual coercion of companies from third countries to take similar steps (in connection with which, in particular, Taiwanese and South Korean companies stopped supplying microprocessors and microcircuits to Russia) ;

6) a full-scale attack on Russia's foreign trade relations in both export and import operations (including not only high-tech, but also standard civilian imports), which involves the withdrawal of the most favored nation treatment from Russia in trade (which allows it to apply an increased level of import customs duties to it), as well as the withdrawal of the status of a country with a market economy by the United States in November 2022 (which opens up opportunities for virtually arbitrary determination of the amount of anti-dumping duties against goods of Russian origin).

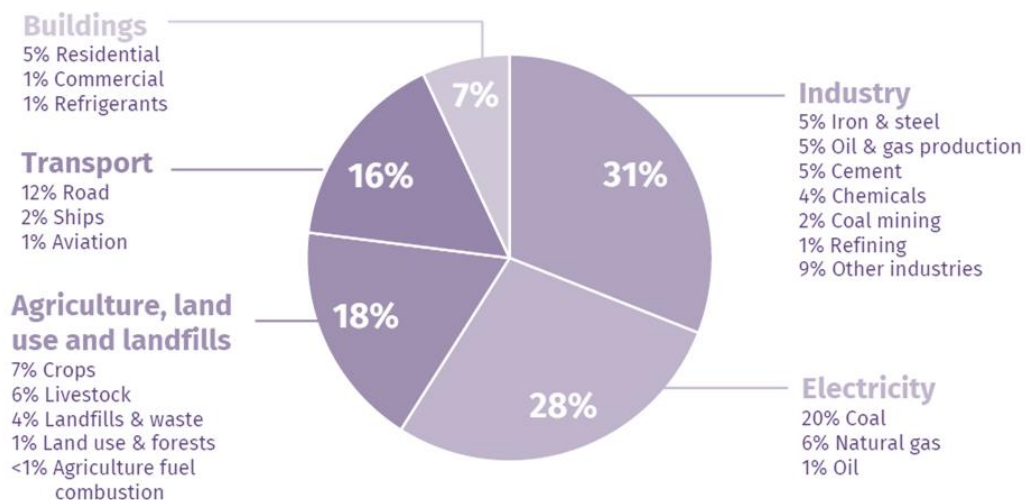
II. Methods

The problem of climate change is one of the most urgent in the world. To reduce its negative impact on socio-economic systems, two groups of measures are distinguished: decarbonization and adaptation. Adaptation refers to "the adjustment of natural, social or economic systems in response to actual or expected climate change and its consequences". Among the adaptation measures, they consider the creation of protective systems from floods, early meteorological warning systems, cool zones, and the improvement of forest fire protection. These measures are not universal and largely depend on the specifics of a particular territory. The importance of such adaptation is generally recognized, but at the same time, external instruments of stimulation or pressure are not used for its implementation, which cannot be said about the decarbonization of the economy. Currently, climate change is recognized as irreversible, but in order to minimize the negative consequences, it is necessary to limit the temperature rise to 1.5–2 °C. To do this, it is important to reduce GHG emissions and their concentration in the atmospheric air, therefore, in many countries, priority is given to decarbonization. Thus, the UN Framework Convention on Climate Change set the goal of stabilizing the level of greenhouse gas emissions into the atmospheric air, and adaptation is mentioned only in passing. The Kyoto Protocol already pays more attention to adaptation, including international cooperation in preparing adaptation measures for individual territories. The Paris Agreement, in order to achieve the goal of "increasing the ability to adapt to the adverse effects of climate change", calls for developed countries to provide support (mostly financial) to developing countries in relation to both reducing greenhouse gas emissions and adapting to the effects of climate change . At the same time, another goal of the Paris Agreement is "changing the trajectory of financial flows towards a low-carbon economy" (respectively, their withdrawal from the economy based on the use of fossil fuels), which is already observed not only in the domestic, but also in the foreign economic policy of a number of countries. For example, the European Union (EU) has been practicing domestic carbon regulation through carbon taxes for about 30 years. The average size of such a tax in Europe is about 50 euros per tonne of CO₂-eq. Due to strict domestic regulation, the European Union is faced with the phenomenon of "carbon leakage" - the transfer of carbon-intensive industries to countries with friendly environmental regulation and more favorable conditions for doing business, which reduces revenues a certain amount of income into the EU economy, and also reduces the number of jobs. Moreover, goods produced in countries with lower

environmental requirements are cheaper and therefore more competitive, pushing European manufacturers out of the market [1]. Therefore, to neutralize these risks, the EU adopted the Green European Deal. As a key tool to protect against “carbon leakage”, a cross-border carbon tax (CAR) is proposed, which will be imposed on carbon-intensive products in accordance with the amount of greenhouse gas emissions associated with their production. Currently, the amount of CAR is not set, according to preliminary estimates, it will be from 25 to 75 euros per tonne of CO₂-eq. In addition, the European Commission has developed a plan to bring the EU economy out of the crisis caused by the coronavirus pandemic, where ET will be a significant source of income (5-14 billion euros per year in 2021-2027). There is also a certain likelihood that similar CARs will be introduced by the United States and some Asian countries, including China. In autumn 2021, the 26th Conference of the Parties to the UN Framework Convention on Climate Change was held. As a result, a number of agreements were signed. For example, 40 countries signed the Coal Agreement, under which they pledged to abandon coal energy during 2024–2040. (Russia, USA, Australia have not signed this document). The Transportation Agreement was also signed, according to which the parties must ban cars with internal combustion engines by 2040 (this agreement is not signed by China, Germany and the United States). In addition, the Methane Emissions Reduction Agreement was signed (China, India and Russia did not sign), obliging the parties to reduce methane emissions by 54%, and the Agreement to Stop Deforestation, under which 12 states (including Russia) will allocate \$12 billion and private companies \$7 billion. A significant achievement of the climate dialogues in 2021 was the increase in the number of countries committed to achieving carbon neutrality: in 2019, only 17 states announced this, in 2021 - already 152. In addition, it is noted that business is increasingly involved in such negotiations. It is worth emphasizing that within the framework of the climate dialogues, China and the United States – world leaders in greenhouse gas emissions (Fig. 1) – signed a joint declaration on the expansion of climate action in 2020 based on the results of their closed negotiations. The parties have pledged to keep the temperature rise "well below" 2°C.

Global emissions by sector

Percent share of 2020 net GHG emissions



Source: Rhodium Group

Fig. 1: Global Greenhouse Gas Emissions: 1990-2020 and Preliminary 2021 Estimates

Despite the fact that the United States is still very high in greenhouse gas emissions, with the accession of President George Biden, the country has been very actively engaged in "greening" the economy. Thus, the United States again became a party to the Paris Agreement, two decrees were signed canceling the construction of the Keystone XL oil pipeline and introducing a temporary

moratorium on the lease of subsoil plots for oil and gas production. Changes were also made in the Presidential Administration: the Office of Domestic Climate Policy appeared, all federal bodies and institutions were charged with the duty to cooperate with the Office and provide it with the information, support and assistance that it may request. In addition, the US is developing a climate finance plan and measures to stop international financing of a carbon-intensive economy (Roginko, 2021a; Roginko, 2021b); approved a program to co-finance projects for capturing and injecting carbon dioxide into the bowels of the Earth with a total amount of financing of 270 million US dollars; started in China as well [2]. The country aims to achieve carbon neutrality by 2060 and to reduce CO₂ emissions by at least 65% by 2030 compared to 2005. Thus, according to the International Energy Agency, China is and will remain the leader in introducing renewable energy capacities for at least 5 years. The country currently has 43% of the world's renewable energy capacity installed¹¹. Also in July 2021, China launched a carbon trading system. The Chinese quota mechanism will be the largest in the world and will double the coverage of greenhouse gas emissions. At the same time, Chinese allowances are quite cheap (\$6–7 per tonne of CO₂-eq.), which potentially reduces their effectiveness. At present, China's cap-and-trade system covers about 26% of greenhouse gas emissions in the country and 6.3% in the world. In addition, in 2021, China launched a project to capture and store carbon dioxide on the sea shelf¹², studies on the feasibility of introducing such technologies have been ongoing since 2015 (Burandt et al., 2019). At the same time, China opposes the introduction of a carbon tax both domestically and for external regulation.

III. Results

At the beginning of 2021, consumer prices began to rise in the EU, and since April in the USA as well [3]. Moreover, during the pandemic, inflation was largely determined by rising food prices. However, in the second half of 2021, inflation began to be spurred on by rising energy prices. The large financial support provided to the population and businesses during the pandemic in developed countries and 31 quantitative easing led to a boom not seen since the 1970s. rising inflation. In the US, annual inflation in 2021 (December to December) was 7.0%, while in the European Union it was 5.3%. In 2022, rising energy prices fueled inflation. In the US, by June, consumer prices rose to 9.1%, then inflation began to slow down and in October it was already 7.7% at the annual level. In the future, prices will continue to decline and by the end of 2023 they may return to pre-crisis levels. In the EU, in 2022, prices continued to rise, which was completely determined by the rise in the price of energy resources, followed by an increase in prices for all other groups of goods. As a result, inflation in the EU in October reached 11.5% per annum. If it is possible to stabilize energy prices at the current high level (1200-1300 euros per 1000 cubic meters of TTF gas, 90-95 dollars per barrel of Brent), then it is very likely that prices will slow down, and from the spring of 2023 they will stabilize. However, a return to pre-crisis values is possible no earlier than 2024.

After a 3.0% decline in the global economy in 2020, a rapid recovery followed in 2021 with the global economy growing by 6.0%. In China, GDP growth for 2020 amounted to 2.2%, while in the rest of the world's major economies, a drop in production was observed in 2020. Such large economies as the USA, India, Russia already in 2021 exceeded the indicators of the pre-crisis 2019. The American economy grew in 2021 by 5.9%, the economy of India - by 8.7%, and Russia - by 4.7% . Almost all countries of the world overcame the consequences of the crisis and exceeded the indicators of 2019 in the second quarter of 2022. With the growth of the world economy in 2021 at 6.0%, only the global tourism sector did not reach the pre-crisis indicators, and this level will be exceeded no earlier than 2023. This means that there are significant reserves for the growth of the world economy in the coming years. A fall in world production in the coming years seems extremely unlikely to us.

Table 1: GDP growth rates, %.

	IMF assessment		IMEMO assessment	
	2022	2023	2022	2023
World	3,2	2,7	3,3	3,0
Developed countries	2,4	1,1	2,6	1,2
USA	1,6	1,0	2,3	2,0
Japan	1,7	1,6	1,6	1,5
UK	3,6	0,3	3,9	-1,0
Euro area	3,1	0,5	3,2	0,2
EU	3,2	0,7	3,3	0,1
Germany	1,5	-0,3	1,7	-0,5
France	2,5	0,7	2,6	0,5
Italy	3,2	-0,2	3,8	4,4
Developing and countries with emerging market	3,7	3,7	3,8	4,4
China	3,2	4,4	3,5	4,5
India	6,8	6,1	7,5	7,0
Brazil	2,8	1,0	2,8	2,5
Russia	-3,4	-2,3	-2,5	-1,5

Source: IMF WEO Database, IMEMO RAS

The Chinese economy, even with the continued use of lockdowns to combat the coronavirus, the existing economic problems, especially in the real estate market, will develop at a rate of 3-5% in the coming years. The Indian economy will develop at a rate of at least 7% per year. The US economy will grow at a rate of about 2% per year. We see the greatest risks in the development of the European economy [4]. However, according to IMF forecasts, growth in both the EU and WE will be positive. At the same time, in Germany and Italy in 2023, a drop in production by 0.5% and 0.3%, respectively, is possible. It all depends on how these economies go through the winter of 2022-2023. If the closure of entire industries can be avoided, then the economies of these countries can avoid falling. The Russian economy, after a rapid recovery in 2021 (growth by 4.7%), will be in the zone of negative values in 2022. According to our estimates, the fall could be up to 2.5%. In 2023, there will most likely also be a drop in production of about 1.5%. In the future, economic growth will begin, which will be 2-2.5%. World trade. The general situation on the world market is characterized by the action of a number of threats: the epidemiological situation, trade and technological wars, political and military conflicts. At the same time, the effect of factors constraining the growth of trade is intensifying [5]. According to the IMF, the growth rate of world GDP is declining. If in 2021 they amounted to 6%, then in 2022 they are estimated at 3.2%, and in 2023 they are projected at 2.7%. It can be assumed that in 2023 the growth rate of the physical volume of world trade, which in 2022, according to preliminary estimates, decreased from 10% to 4%, will decrease even more and amount to 2-3%. If during the period of recovery growth in 2021 world trade grew approximately 1.7 times faster than world GDP, then in 2022 this ratio was already 1.3, and in 2023 the growth rates of trade and GDP will become extremely close and the elasticity coefficient world trade in terms of GDP, in all likelihood, will be equal to about 1. In subsequent years, the growth rate of world trade will be slightly, 1.1-1.2 times higher than the

growth rate of world GDP. Although global trade has surpassed pre-pandemic levels as early as 2021, the impact of COVID-19 is still being felt. It is especially clearly manifested in the policy of the PRC, which is characterized by extremely strict sanitary measures. The slowdown in China's economic growth observed today and expected next year can play a significant role in curbing world trade.

IV. Discussion

The climate agenda and the transition to a green economy. The results of the COP27 climate summit in Egypt in November 2022 reflected the reformatting of the global climate agenda. Developing countries have shifted their focus to the financial aspects of decarbonization and demethanization, making their climate policy directly dependent on receiving financial assistance from developed countries [6]. The latter did not fulfill their own promises made at the Earth Summit in 1992 and at the conclusion of the Paris climate agreement in 2015 to send \$100 billion annually to developing countries to support their decarbonization and demethanization efforts. Rising prices for imported oil and natural gas, the need to repay external debt, weakened by measures to combat COVID-19 are forcing developing countries to develop coal-fired power generation, relying on their own coal reserves. At the global level, the energy transition will take longer and cost substantially more than previously thought. In general, COP27 saw a reorientation of the global climate discussion from the problems of mitigating greenhouse gas emissions by ousting fossil fuels from the economic circulation to the problems of adaptation to global warming. An important breakthrough was the legitimization of the use of so-called natural solutions to achieve the goals of "clean zero". To compensate for the loss of imports of Russian gas, coal, oil, oil products and other raw materials and intermediate goods, the EU is forced to return mothballed coal-fired power plants to operation and extend the life of nuclear power plants, which currently slows down the energy transition. However, the return to fossil fuels and nuclear power will prove to be temporary. State subsidies, investments and other forms of support for green energy continue to grow both at the EU level and in the leading European economies. Moreover, unprecedentedly high gas prices objectively give rise to incentives for the advanced development of solar and wind generation, and also make hydrogen, biomethane and other natural energy sources more competitive in price. The US is accelerating its energy transition, which includes natural gas as well as coal and oil, with widespread use of industrial carbon capture and storage systems [7]. Passed in August 2022, the Inflation Reduction Act calls for more than \$370 billion in tax credits and subsidies from the federal government to support decarbonization and upgrade energy infrastructure to adapt to new renewable energy sources through 2031, and as well as the promotion of electric vehicles. Benefits will be provided exclusively to American and North American companies, as the law requires an increase in national content in the cost of products. In fact, the trend towards political reshoring to North America of critically important for the "green" transition industries has been fixed. Technological and investment protectionism in favor of North American manufacturers also aims to reduce the dependence of the American and global economy on China, the world's largest exporter of environmental products, while at the same time undermining the competitive position of European companies. American "green" protectionism is also directed against South Korea (a major exporter of electric vehicles), Malaysia (solar panels).

In Russia, there is also an increase in activity regarding the development of its own climate regulation system. The first step for this was the Federal Law "On Limiting Greenhouse Gas Emissions", the purpose of which is "to create conditions for the sustainable and balanced development of the economy of the Russian Federation while reducing greenhouse gas emissions." As measures to limit GHG emissions, the law specifies state accounting for GHG emissions, targets and support for activities to reduce them [8]. The law obliges legal entities and

individual entrepreneurs, whose activities are accompanied by GHG emissions of 150 thousand tons and more, to submit reports to the Ministry of Natural Resources. Also, the above entities are allowed to implement climate projects, the positive effect of which will be taken into account when compiling the register of carbon units. The Strategy for Social and Economic Development of the Russian Federation with Low Greenhouse Gas Emissions became the key strategic document to ensure the decarbonization of the national economy [9]. According to this document, within the framework of the target (intensive) scenario, it is necessary to introduce carbon pricing, quota mechanisms, technologies that increase the absorptive capacity of ecosystems, and public non-financial reporting systems for businesses. If this scenario is successfully implemented, by 2050 the following results are predicted: an increase in the share of "post-industrial" industries in the structure of the economy by 11.8 percentage points and a decrease in the share of "traditional" industries by 9.4 percentage points compared to 2020 year; the annual growth rate of non-energy exports is 4.4%; annual economic growth rate - 3%; reduction of GHG emissions by 910 MtCO₂-eq., increase in absorption capacity to 665 MtCO₂-eq [10]. At the same time, decarbonization processes in Russia are just beginning, and foreign experience cannot be called universal, so we consider it appropriate to analyze individual decarbonization measures and the possibility of their application in the Russian Federation.

The trend towards decarbonization and demethanization is observed all over the world. At the same time, its acceleration in developing countries is limited by the cost of technologies and equipment, the macroeconomic situation at the global and national levels (inflation, public debt, slowdown in economic growth), the situation in the energy markets, and the political will of the authorities. According to the report of the Intergovernmental Panel on Climate Change, limiting temperature rise to 1.5°C will require, among other measures, an early phase-out of fossil fuels. The relative cheapness of coal and natural gas has long served as a competitive advantage for developing countries, and the abandonment of these fuels can increase the cost of generating electricity. In addition, the energy transition must be "fair," meaning that the state must assume responsibility for compensating for losses and providing alternatives to affected populations (such as miners or coal-fired workers) [11]. Adaptation measures to date are fragmented and unevenly distributed around the world. For example, African countries most vulnerable to climate change have the least financial resources to build infrastructure that is resilient to climate shocks. In 2022, Russian gas exports declined significantly, however, rising fuel prices avoided serious negative consequences for the budget. Thus, revenues from the sale of oil, oil products and natural gas in the key European market for the country in 2022 are almost twice as high as in the previous year. According to available data, the reduction in pipeline supplies to the EU in the first seven months of 2022 was 40%. For 2022 as a whole, a more significant drop in exports can be expected, since pipeline deliveries to Europe account for 69% of Russian exports.

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