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DECARBONIZATION OF THE ECONOMY – THE GENERAL TREND OF DEVELOPMENT OF RUSSIA AND ITS REGIONS IN THE 21st CENTURY ¹

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Abstract. Today the issue of Russia's low-carbon development and the necessity in cutting down Greenhouse emissions, first of all, carbon dioxide (CO₂) is very acute. Over the recent years a lot of documents and regulatory legal acts have appeared in Russia, one way or another related to the decarbonization of the economy, including “National Climate Change Adaptation Plan”, the Decree of the President of the Russian Federation “On Reducing Greenhouse Gas Emissions”, “Strategy for the Long-Term Development of Russia with Low Greenhouse Gas Emissions up to 2050”, draft Federal Law “On State Regulation of Greenhouse Gas Emissions and Removals”, “The Plan for the Development of Hydrogen Energy in Russia up to 2050”. Russia needs a network of carbon landfills, its own non-discriminatory system for measuring the balance of greenhouse gases, this is the most important factor of national security today. In the near future, the system of calculations will be worked out on the territory of seven regions: the Chechen Republic, the Krasnodar Krai, Kaliningrad, Sakhalin, Sverdlovsk, Novosibirsk and Tyumen Regions. Since 2020, a pilot project of a carbon landfill has been implemented in Kaluga Region, on lands located within the borders of the Ugra National Park. To finance these projects, it is necessary to attract funds from national projects, first of all, the NP “Clean Air”. Carbon farms are a complex of technologies that enable the absorption of greenhouse gases, and so far for Russia it is mainly forest rather than agricultural technologies. There are about 11 million square kilometers of forests in Russia, and this is a unique reservoir for absorbing CO₂, so the 21st century is the century of Russia, which has every chance to become the most important player in the sequestration industry. It is fundamentally important for Russia to become a world leader and gain a high rate of carbon farms development throughout the country. However, there is an acute shortage of qualified personnel for this type of activity in the country, so one of the strategic tasks for Russian universities today is to train specialists for the new sequestration industry in the conditions of a new and inevitable reality – total decarbonization of the economy.

Key words: Paris Climate Agreement, climate risks, industrial greenhouse gas emissions, climate regulation, decarbonization, carbon landfill, carbon farm, carbon hub, sequestration industry.

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ДЕКАРБОНИЗАЦИЯ ЭКОНОМИКИ – ГЕНЕРАЛЬНЫЙ ТРЕНД РАЗВИТИЯ РОССИИ И ЕЕ РЕГИОНОВ В XXI ВЕКЕ ¹

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Аннотация. Сегодня на повестке дня остро стоит вопрос низкоуглеродного развития России и необходимости сокращения выбросов парниковых газов, в первую очередь двуокиси углерода (CO₂). В последние годы в России появилось немало документов и нормативно-правовых актов, так или иначе связанных с декарбонизацией экономики, в числе которых: «Национальный план адаптации к изменениям климата», Указ Президента РФ «О сокращении выбросов парниковых газов», «Стратегия долгосрочного развития России с низким уровнем выбросов парниковых газов до 2050 года», проект Федерального закона «О государственном регулировании выбросов и поглощений парниковых газов», «План развития водородной энергетики в России до 2050 года». России нужна сеть карбоновых полигонов, собственная недискриминационная система измерения баланса парниковых газов, сегодня это важнейший фактор национальной безопасности. Система подсчетов в ближайшей перспективе будет отрабатываться на территории семи регионов: в Чеченской Республике, Краснодарском крае, Калининградской, Сахалинской, Свердловской, Новосибирской и Тюменской областях. Пилотный проект карбонового полигона с 2020 г. реализуется в Калужской области, на землях, расположенных в границах национального парка «Угра». К финансированию этих проектов следует привлечь средства национальных проектов, в первую очередь НП «Чистый воздух». Карбоновые фермы – это комплекс технологий, позволяющих поглощать парниковые газы, причем пока для России преимущественно именно лесных, а не аграрных технологий. В России около 11 млн кв. км лесных массивов, а это – уникальный по своим масштабам резервуар для поглощения CO₂, поэтому XXI век – это век России, у которой есть все шансы стать важнейшим игроком в секвестрационной индустрии. Для России принципиально важно стать мировым лидером и набрать высокий темп развития карбоновых ферм по всей стране. Однако сейчас ощущается острый дефицит квалифицированных кадров для данного вида деятельности, поэтому одна из стратегических задач для российских вузов сегодня – подготовка специалистов для новой секвестрационной индустрии в условиях новой и неизбежной реальности – тотальной декарбонизации экономики.

Ключевые слова: Парижское соглашение по климату, климатические риски, промышленные выбросы парниковых газов, климатическое регулирование, декарбонизация, карбоновый полигон, карбоновая ферма, карбоновый хаб, секвестрационная индустрия.

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Introduction

For the past few years, the problem of global climate change as a result of the industrial revolution has been actively discussed around the world and the search for new approaches to climate regulation is actively underway, the most relevant of which today is decarbonization, since as a result of human economic activity, the concentration of greenhouse gases in the atmosphere is increasing, the largest share of which is CO₂ – carbon dioxide. The UN Framework Convention on Climate Change was adopted in 1992, and the Paris Climate Agreement was signed in 2015, according to which countries should keep the global average temperature increase within 1.5–2 °C compared to the pre-industrial period

until the end of the 21st century, and therefore they should reduce greenhouse gas emissions and, above all, CO₂. The Paris Agreement, which replaced the Kyoto Protocol, actually laid the foundations for international cooperation in combating climate risks and threats in the near and long term [Safonov, 2020]. Russia signed this climate agreement in 2019.

The Paris Agreement has already been ratified by 197 countries. By the end of 2020, 28 socio-economic development strategies were presented at the UN, where the main emphasis was placed on the need to significantly reduce the level of greenhouse gas emissions. But while some experts believe that industrial greenhouse gas emissions should be completely stopped by 2050 (reset to zero), others, and these are mainly representatives of large

businesses, insist that it is necessary to maintain a balance of emissions and absorption of gases, for which it is necessary to actively develop and maintain natural ecosystems. In March 2021, an expert session was held at the Russian Academy of Sciences, at which the issue of the importance of low-carbon development of Russia and the need to reduce greenhouse gas emissions was on the agenda [Pisarenko, 2021].

Decarbonization – a modern trend in the development of the Russian economy

According to the Director of the Center for Environmental Economics and Natural Resources of the Higher School of Economics, G. Safonov, climate change significantly affects the economic interests of states and companies. We are talking about trillions of dollars of investment in reducing greenhouse gas emissions and switching to “green” technologies, about the loss of markets for traditional energy companies, about new megaprojects and multibillion-dollar carbon markets. “Russia has unique opportunities to become a leader of the green mainstream and avoid the risks of carbon protectionism, but it is necessary to start decarbonizing the economy immediately” [Safonov, 2020: 66; Decarbonization of Russia, 2021].

Recently, many documents and regulatory legal acts on this topic have appeared in Russia. The “National Plan for Adaptation to Climate Change” adopted at the end of 2019 [The National Action Plan ... , 2019] can be considered epoch-making. This is a very extensive document, it is already being extended by by-laws, and at the regional level it is necessary to be ready for this. In 2020, the Decree of the President of the Russian Federation No. 666 “On Reducing Greenhouse Gas Emissions” established quotas within the framework of international cooperation [Decree of the President of the Russian Federation No. 666, 2020], so Russia joined the world programs in terms of managing greenhouse gas emissions. This decree gave a start to the fact that the draft Federal Law “On State Regulation of Greenhouse Gas Emissions and Removals” [Federal Law “On State Regulation ...”, 2021] is now in the State Duma. And after its adoption, there will appear a mechanism enabling to monetize units of CO₂ absorption.

The Ministry of Economic Development of the Russian Federation has already prepared a “Strategy for the Long-Term Development of Russia with Low Greenhouse Gas Emissions up to 2050”. By 2030, emissions should be reduced by 70% from the level

of 1990, and by 2050, it is planned to close all enterprises that produce greenhouse gases. Experts assess this strategy optimistically, since by 2018, a 48% reduction in emissions has already been achieved, by 2020 – another minus 56% [Expert Session on the Strategy ... , 2021].

In addition, in August 2021, the Government of the Russian Federation approved the “Plan for the Development of Hydrogen Energy in Russia up to 2050”. It is precisely through the development of a new direction of the state energy policy – hydrogen energy – that Russia could significantly improve its emissions into the atmosphere, A. Novak stressed during the discussion “The trend towards decarbonization – how the world will change” within the framework of the Saint Petersburg International Economic Forum 2021. Promising areas of growth may be transport, electric power and facilities, although so far the consumption in these industries is only 10 thousand tons. Russia can provide a competitive cost of hydrogen produced from natural gas, as well as a result of water electrolysis based on nuclear power plants in this market. The task has been set to create an export-oriented production, Russia can occupy a niche of about 20% in the world markets for hydrogen, this is actually the same level that the country occupies in gas and oil trade [Alexander Novak ... , 2021].

In March 2021, the Minister of Science and Higher Education of the Russian Federation V. Falkov at a meeting with the President of the Russian Federation V. Putin announced his intention to create a network of carbon landfills in Russia, noting that this is a matter of national security, Russia needs its own non-discriminatory system for measuring the balance of greenhouse gases, how they are released and absorbed.

And in the autumn of 2020, the Ministry of Science and Higher Education presented the first carbon landfill in Russia, where technologies for measuring the carbon balance and the ability of territories (soil and plants) to absorb carbon from the air and retain it will be developed. If we learn how to calculate such a balance and establish a national system for monitoring it, in the future this will make it possible to earn money on the sale of so-called carbon quotas. The volume of this international market is estimated at \$100 billion. And it will only grow further.

It is time for scientists to find out how much CO₂ is absorbed from the atmosphere by natural ecosystems on the territory of our country – forests, meadows, tundra, etc., but for this it is necessary to

bring together data from ground measurements and remote sensing of the Earth, which is carried out by special satellites. A. Ivanov, director of the Soil Institute named after Dokuchaev, draws attention to the fact that the soil contains 6 times more carbon than vegetation, so when creating carbon polygons, it is necessary to take into account its ability to bind CO₂, although these considerations are not taken into account in the European Union. In the coming years, Russia plans to build and establish a system for monitoring CO₂ emissions and uptake, create a single “digital bank” where information from carbon landfills will flow and extrapolate to the entire territory. According to the President of the Russian Academy of Sciences A. Sergeev, the country needs a digital carbon double so that we can move on [Decarbonization of Russia, 2021; Pisarenko, 2021].

Carbon landfills – a new brand of climate regulation

The term “carbon landfills” refers to special territories where methods for measuring the main fluxes of greenhouse gases (carbon dioxide, methane, nitrous oxide) will be developed. Carbon farms, the carbon tax, cross-border restrictions, emission quotas, all the time there is something new that revolves around this issue [Profitable Investments in “Air”, 2021].

At the same time, a debate is developing in the scientific community concerning the methods which can be used for calculating the release and absorption of greenhouse gases. It is on carbon landfills that both Russian and Western measurement methods can be improved. It is important that the results of Russian research are recognized in the West.

V. Falkov named seven regions on the territory of which the calculation system will be worked out: the Chechen Republic, the Krasnodar Krai, Kaliningrad, Sakhalin, Sverdlovsk, Novosibirsk and Tyumen Regions. The creation of the first carbon landfill (farm) in Russia was announced in the fall of 2020. Its ideologist N. Durmanov is the scientific director of the Carbon project (Ctrl2GO), the special representative of the Ministry of Education and Science of Russia on biological and environmental safety [We Want to Cover the Whole Country with Them, 2021].

The project is being implemented in Kaluga Region, on lands located within the boundaries of the Ugra National Park. The main building of the landfill is made in the form of CO₂ molecules. It looks very beautiful, everything is emphasized eco-friendly, electricity is generated by solar panels.

The purpose of the landfill is to calculate the carbon balance of territories. For the analysis, we use: images of the surface from space and from a drone (hyperspectral scans are performed), carbon absorption and emission are measured by ground sensors and analyzers on separate reference sites. Information about the weather, soil composition and available archival data for these territories is taken into consideration as well [Demin, 2021].

The work at the landfill in Kaluga Region takes place in several stages: the creation of digital models of the studied reference sites, field analysis of the territory for calculating biomass, plant species composition and soil condition, information collection using space and unmanned systems, ground sensors. The resulting array of scientific information will be combined into a single digital data bank and analyzed using artificial intelligence techniques, processing large amounts of data and machine learning.

The results of the research will allow us to create a package of technologies and a system of services, such as: determining the boundaries of land use; the presence or absence of economic activity; identifying the source of carbon dioxide emission or absorption; determining and predicting the carbon balance of the soil; qualified confirmation of CO₂ emission or sequestration at the request of users [The First Carbon Landfill Was Created in Russia, 2020; The First Carbon Landfill Started Working in Russia, 2020].

It is interesting to learn the experience of Omsk scientists who launched an initiative project in 2020 to assess environmental fingerprints and calculate carbon tariffs. The results of the research will allow launching a system of commercial services for calculating and verifying environmental fingerprints of agricultural and forestry products. Moreover, initially Omsk State Agrarian University was offered to develop carbon landfills on a franchise, on a commercial basis, but then the situation changed, the Ministry of Science and Education of the Russian Federation became interested in the project.

The specifics of the landfill in Ugra prompted Omsk residents to the idea of creating two of their own sites in the city and in the region. First, this exhibition and demonstration site “Carbon landfill – Kizyurinsky” will be opened in the garden named after Kizyurin on the territory of the Omsk State Agrarian University itself. Here, the developers are planning to make a kind of avant-garde, which should aesthetically and culturally draw attention to Omsk and make sure that guests of the city visit this site. Mainly this landfill is aimed at responsible environmental

education. This site can be used by the city for developing methods for maintaining balance between cutting down and planting trees.

Secondly, this scientific and experimental site “Carbon landfill – Kamyshlovsky” will appear on the basis of the Omsk State Agrarian University Educational facilities in the village of Kamyshlovsky in the Lyubinsky district. Here, eight reference sites for eight types of soils have been formed for observations. That is, from the composition of the soils of the land plot, plots of different sizes with the most characteristic features for certain types of soils and vegetation on them are selected (hayfields and pastures, meadow-black earth, low-power low-humus and heavy-loamy, meadow-black earth saline, heavy-loamy, and so on). There are a lot of such soils on the territory of Siberia, the Southern Urals and Northern Kazakhstan. Omsk scientists expect that their decryption methods can be used on the vast territory of Russia, and also become interesting, for example, for Kazakhstan [Vitaly Pomogaev: Carbon Polygons ... , 2021].

A number of other Russian regions are also taking measures to reduce CO₂ emissions. For example, in Nizhny Novgorod Region, they plan to create a carbon landfill for measuring the carbon balance, it should become one of the elements of the all-Russian system. A gasification development program is already in effect in the region: natural gas has become the main fuel for thermal power plants, gas filling stations are being built to encourage motorists to switch more actively to this type of fuel, which is more “clean” compared to gasoline.

An experiment is being conducted in Sakhalin to reduce greenhouse gas emissions, a pilot carbon landfill has also been created there, and many enterprises are committing themselves to reducing carbon emissions and even bringing them “to zero”.

As for financing, there is little information yet. The Kaluga project is most likely funded by federal funds as a pilot, the Omsk project is funded by the university’s funds for internal research and development. Today, without such a reserve, it is impossible to apply for a megagrant. In addition, Omsk scientists expect that there will be interest to this project in the region, especially in terms of developing a regional environmental policy, a dialogue is underway with a large oil and gas and petrochemical company, it is interesting how the potential for carbon sequestration in the region can be developed and used off-set in international markets (in the case of cross-border carbon regulation or attracting preferential loans). According to the author, the funds of national

projects should be attracted to the financing of these projects, first of all, the NP “Clean Air”.

Thus, the main goal of creating a carbon landfill is to develop an integrated approach aimed at reducing the concentration of greenhouse gases in the atmosphere of the region. The priority approach is based on the creation of new and modification of existing ecosystems in such a way as to bind carbon in the form of organic compounds and minimize greenhouse gas emissions.

Tasks to be solved using a carbon landfill: development and evaluation of the effectiveness of methods for monitoring current levels (as well as emissions) of greenhouse gases; studies of the carbon balance of ecosystems typical for the region, in particular, and for Russia as a whole; studies of the potential of various plant species for carbon sequestration at different stages of their life cycle; studies aimed at assessing the effectiveness of possible measures and practices directed at reducing greenhouse gas emissions by ecosystems.

The landfill should include the main types of ecosystems of the region (meadow, swamp, forest), on which research will be directly carried out. At the same time, it is possible to organize a landfill on the basis of several sections spaced out in space, if such a need arises. The area of each such site should be large enough to obtain reliable results. According to international and Russian experience, the area of the landfill can vary from tenths to units of square kilometers [Demin, 2021].

Why do we need carbon farms

The business of carbon farms is now actively developing in most countries. However, if you now type the phrase “carbon farm” in a Russian search engine, then a maximum of 2–3 mentions of the Russian project will come out, while about 300 million sources of information are available for the query “carbon farming”.

There are three main methods of CO₂ capture: 1) physico-chemical, which involves the use of various filters and adsorbents for carbon capture in industrial enterprises; 2) geological, associated with the injection and conservation of CO₂ carbon dioxide in the earth’s cavity; 3) biological, based on carbon sequestration during the activity of living organisms (plants, algae, bacteria). The carbon farm allows you to implement a biological approach.

Perhaps the term “farm” is not quite appropriate, since carbon is not grown on it, but preserved. In principle, a field, a swamp, a mountain

and even the sea can become a carbon farm, since it is the world ocean that accumulates the main share of CO₂ due to the photosynthesis of algae. That is, a carbon farm is any part of the surface for which there are documents on the volume of CO₂ absorption by it [Kanishchev, 2021].

Carbon farms are densely planted or simply overgrown areas where carbon dioxide is absorbed in large volumes. The most reliable way to reduce the concentration of carbon dioxide that has grown to a dangerous level is to use terrestrial ecosystems, since plants perfectly cope with its extraction by storing it in the form of plant biomass, for example, forests, or in the soil. Carbon farms at carbon landfills are a complex of technologies that allow absorbing greenhouse gases, and so far it is mainly forest technologies for Russia, and agricultural technologies are in the future.

For example, China emits about 11 billion tons of CO₂ into the atmosphere annually, and by 2060 this country has already declared itself carbon-neutral (equality between the emitted and absorbed carbon). But there are no forests in China to sequester such an amount of carbon dioxide, whereas in Russia there are about 11 million square kilometers of forests; it is also impossible not to take into account large areas of abandoned agricultural land, which is also gradually overgrown with carbon dioxide-absorbing forest, and all this is nothing but a unique reservoir for absorbing CO₂. Therefore, the 21st century is the century of Russia, which has every chance to become the most important player in the CO₂ absorption industry [Profitable investments in air, 2020].

Carbon farms already exist in Australia and the USA. For example, through a partnership with the US Department of Agriculture, Chevrolet recently purchased 40,000 quotas from 23 ranchers in North Dakota who voluntarily promised to apply zero tillage methods on their pasture lands.

At the pilot Kaluga carbon landfill, the cost of which is about 300 million rubles, an experimental carbon farm has also been launched, on which crops with high absorption capacity have been planted. Cyborg trees grow at a high speed, are not afraid of pests, diseases, natural disasters, and can live up to 500 years, retaining the absorbed carbon. These are genetically engineered trees, powerful hybrids. In the future, it can be assumed that there will be up to 500 million hectares of cyborg tree plantations on the planet, whose only task is to absorb CO₂. However, we must take into account that in Russia, where the legislation is wary of genetically engineered plants, we should still count on young forests that have grown

over the past 30 years on lands that have been withdrawn from agricultural turnover.

The Kaluga carbon farm is an attempt to test technologies using highly productive trees, and not products of genetic engineering, primarily such as miscanthus and paulownia. For example, Paulownia grows by 4–5 meters per year, and after seven years the diameter of its trunk reaches 40 cm, and it is also a full-fledged wood. The planting of 2 hectares of Paulownia is already planned on the carbon farm. It is also important that the trees do not burn too much, and there is already a special genetic design that allows making trees practically fireproof. Moreover, these trees will not displace ordinary plants from existing ecosystems, since they are infertile.

Carbon farms are also a project for business. After the certification of the farm, the owner of the plot can sell compensation quotas. By buying them, the importer is exempt from paying the carbon tax. Almost any areas, including industrial dumps, are suitable for such farms. According to economists, this is a very capital-intensive market, the “second oil”. At the end of 2020, quotas were traded on the stock market at a price of €32.03 per ton. According to Reuters, in 2018, the global market for carbon quotas amounted to \$164 billion [Demina, 2021].

For a carbon landfill, the area of the land plot does not matter, but it is important that the studied ecosystems are fully represented. There may be not one, but 2–3 ecosystems on one landfill, especially if the landfill is large. But for the carbon farm, the size of the plot is important, since the meaning of the economy on carbon farms is to monetize their activities.

Preserved “carbon” has its own cost. If a carbon farm is organized and it is proved that it absorbs a certain amount of CO₂, then you can sell these carbon units, or quotas, to an enterprise that needs to improve its environmental balance. The business model is as follows: the owner of the land receives a certification (the procedure for its registration will be determined by future legislation), issues and sells securities with a nominal value in tons of recycled CO₂, which exempt the partner company from paying carbon tax. That is, if, for example, it costs €5 to organize the absorption of a ton of CO₂ on a carbon farm and the owner of the farm is ready to sell this ton for €15, and if the enterprise pays a penalty for each ton of emissions in the amount of €30, then such an offer will be beneficial to it.

Perhaps in 2021 or 2022, certified methods of measuring the carbon balance will be used, which

will enable to accurately calculate how much carbon dioxide is removed from the atmosphere on each carbon farm. This amount is taken into account in special carbon registers, the absorbed carbon is traded on exchanges, literally “money out of thin air”. However, this money is quite real and is a reflection of the importance and urgency with which we need to treat the problem of climate change.

Large carbon farms on their vast territory will absorb more CO₂, respectively, and the earnings are higher, therefore, the larger the carbon farm, the more economically efficient it is. However, a large territory needs care, fire-fighting measures, fighting against diseases and pests, new varieties and breeds of plants, a set of forest and agricultural technologies, equipment and more, so this is an activity that requires qualification, attention and investment.

At the same time, carbon landfills and farms are independent from each other. As world experience shows, a farm should not necessarily be located next to the landfill. However, now there is an acute shortage of qualified personnel for this type of activity in Russia, and they are needed both at landfills and on farms. Therefore, now experimental landfills and farms are located nearby, and sometimes even on the same territory. But there are more and more carbon farms. All over the world, the sequestration industry is “at a low start”. It is fundamentally important for Russia to become a world leader in this issue and immediately gain a high rate of development of carbon farms throughout the country.

It is estimated that in Russia, the total volume of carbon dioxide uptake by forests can reach 250 million tons per year. And if, for example, the Organization for Economic Cooperation and Development (OECD), to which Russia, however, is not a member, estimates the amount of payment for a ton of CO₂ emissions from €30 and above, then the funds received can be used, for example, for the implementation of environmental projects to curb climate change.

Thus, under the condition of competent legal registration, Russian forests can annually bring about €7.5 billion to their owners by the very fact of their existence. By improving the quality of forest management, income can be more than doubled. With such opportunities, carbon farms will be profitable [Kanishchev, 2021; The Battle for the Climate... , 2021].

In addition, the experience of a number of global companies in creating so-called carbon hubs is important for Russia. In our country, the first of them is planned to be created in Sakhalin. The carbon hub is a whole ecosystem for reducing CO₂ emissions,

including measures to improve energy efficiency, create renewable energy sources (RES) capacities. This can also be the construction of industrial installations for the utilization of CO₂ and its subsequent injection into the reservoir, including during the production of hydrocarbons aimed at increasing oil recovery. For example, CO₂ from an oil refinery can be captured using special equipment and transported to oil fields [Russia Can Trade Air ... , 2020].

The Ministry of Science and Education of the Russian Federation plans to create a dense network of carbon landfills throughout the country, where each landfill is a place of attraction and growth of new sequestration enterprises-carbon farms [Nikolay Durmanov: In the Plans ... , 2021].

The economic effect consists in the exchange of the utilization quota to offset the introduced taxes on CO₂ emissions. The development of carbon farms and hubs in Russia, on the one hand, will enable to leave money inside the country, and on the other, it will make it possible to dispose significant volumes of greenhouse gas produced by exporters. If Russia does this, it will be able to provide assistance to other countries even in the future. Someone is trading their own currency, and Russia can trade air purified from CO₂, but this requires joint efforts of business and the state, as well as political will and initiatives.

New personnel for the new sequestration industry

In the future, about 80 carbon polygons should appear at universities throughout Russia, and the corresponding Regulations have already been developed [Regulations for Consideration by the Expert Council ... , 2021].

It is important to note that this project will not be a “purely academic matter”. “Gazprom Neft”, “Sibur”, “Sinara Holding” and a number of other Russian companies have been invited to implement it. It is planned to cover the entire territory of the country with carbon landfills, a “carbon farm” will be built at each such landfill. By 2030, it will be a separate economy – the cultivation of new forests that will absorb greenhouse gases. The network of carbon landfills in Russia will allow not only to study the carbon balance and sequestration potential of various territories, but as well to create domestic methods of remote calculation of the carbon balance, but also to train specialists for the new sequestration industry and for environmental monitoring in a broad sense. This was discussed, in particular, at the panel discussion “Carbon landfills and farms – a new

industry, technological and economic prospects for Russia” within the annual national exhibition “VUZPROMEXPO – 2020”.

According to experts, by 2030 it will be an industry with a large number of jobs. Students of Russian universities will be able to practice at carbon landfills, and these will be not only specialists in nature management and ecology, but also lawyers and economists.

Conclusion

Today, Russia has to reckon with the rest of the world in environmental issues. Either Russia recognizes the global agenda supported by all civilized countries, including under the auspices of the UN, and integrates into it, or it remains on the sidelines. Judging by the content of the federal-level documents that have been adopted in Russia over the past two years, there has been a noticeable bias towards the recognition and synchronization of Russian legislation with international legislation on the issue of decarbonization.

The relevance of the topic of carbon landfills has reached a new level in connection with the new environmental standards of the European Union. Carbon landfill is, rather, a brand name for a common topic around which the mainstream is focused today.

The pilot project of creating the Kaluga carbon landfill in Russia reflects a new trend in the industry, which, according to experts, will be general in the 21st century. According to forecasts, by 2035, the turnover of the carbon sequestration industry will be several times greater than the entire oil and gas industry. It is important that this is really the first real experimental program, the meaning of which is to learn how to measure the absorption of CO₂ and evaluate the effectiveness of the new carbon absorption industry.

If measurement methods are being studied at carbon landfills, and carbon farms are used for practical application of these methods we will have highly efficient technologies for the absorption of carbon dioxide by terrestrial ecosystems. In the near future, this type of activity will grow into a separate large industry – sequestration. Such an industry is one of the main advantages of Russia for the next 30–40 years, since the country has huge territories covered with forest and other vegetation, there is free land for the creation of large “carbon” plantations. And it is necessary to use the natural and territorial advantages of Russia effectively in the conditions of a new reality of total decarbonization.

One more main tasks of the carbon landfills is to train new personnel, and they are needed so that the country is ready for a global economic transformation, for a green economy. As the industry develops, completely new professions may appear related to ecology, biology, environmental management and IT. Therefore, one of the strategic tasks of universities today is to train specialists for the new sequestration industry.

ПРИМЕЧАНИЕ

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