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Green Finance Instruments as a Factor of Increasing Industrial Waste Utilization in Russia

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ABSTRACT

Influenced by the governmental policy of national economy decarbonization and greening fundamentally new institution of green finance is currently developing in Russia. One of the key areas for the development of green finance is industrial waste disposal. The **aim** of the paper is to determine the efficiency of green financing of industrial waste utilization projects in Russia. The **methodological basis** of the paper consists of domestic and foreign scientific articles in the field of green financing and waste disposal, regulatory legal acts of the Russian Federation, as well as Rosstat data on the volume of industrial waste disposal. As a **research method**, the authors applied an analytical approach to systemize green finance concept definitions, and analyzed foreign experience of using green financial instruments in the industrial waste management industry. The article represents the **content analysis** of the Russian taxonomy of green and adaptation projects, as well as an assessment of the industrial waste utilization volumes that can potentially be achieved due to the implementation of projects within the framework of taxonomy areas. The **results** of the analysis show that through the implementation of green and adaptation projects, it is possible to additionally dispose of about 91 million tons of industrial waste, or 2.5% of the total volume of waste generated. Such a low recycling rate is a result of the limited amount of industrial waste types, the utilization of which is included in the taxonomy. It is necessary to expand the list of industrial waste, the disposal of which can be recognized as an independent project or a criterion for the implementation of projects within the framework of the taxonomy.

Keywords: green economy; green finance instruments; industrial waste; waste disposal

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INTRODUCTION

Today in Russia one can observe the formation of a fundamentally new institution of green finance. This trend is primarily associated with the increased attention of state policy to decarbonization and greening of the national economy [1]. Thus, in July 2020, Methodological recommendations for the development of investment activities in the field of green finance in the Russian Federation[1] and criteria (taxonomy) for the implementation of green and adaptation projects[2] were published. В ноябре 2021 г. In November 2021, the Bank of Russia also published a Glossary of terms in the field of sustainable development, which contains the main concepts related to the sustainable development agenda.[3]

Among one of the most relevant areas of green financing in Russia, it is necessary to highlight the processing of industrial waste. About 7 billion tons of production and consumption waste are generated annually in the country. At the same time, less than half of the generated volume is utilized. According to the Industry Development Strategy for the Processing, Utilization, and Treatment of Production and Consumption Waste for the period up to 2030, by the end of 2030, 70% of all waste generated in the country should be disposed of.[4] The world's experience shows that the transformation of the waste management system cannot be carried out without targeted support measures.[5]

Due to the relevance of waste management tasks, the purpose of this article is to substantiate the effectiveness of green financing for industrial waste management projects in Russia. The resource base of the study was domestic and international scientific articles in the field of green financing and waste management, regulatory legal acts of the Russian Federation, as well as Rosstat data.

LITERATURE REVIEW

Numerous attempts have been made in the academic literature to define the concept of green finance. Many authors agree that green finance involves investing in projects aimed at improving the state of the environment and combating climate change [2–4]. Summarizing the definitions of various researchers, N. Lindenberg came to the conclusion that the concept of "green finance" consists of a combination of three components [5] (*Fig. 1*):

1) private green investments: investments aimed at organizing the production of goods and services with low / zero anthropogenic impact, as well as in projects to prevent, minimize and compensate for environmental damage;

2) measures of state support: state stimulation of projects to reduce harm to the environment, provision of benefits, reduction of tax rates for organizations engaged in activities to reduce the anthropogenic footprint;

3) greening the components of the financial system: the creation of green funds and the development of green financial instruments, such as green bonds, green loans, etc.

[1] VEB.RF. Guidelines for the development of investment activities in green finance in the Russian Federation. 2020. URL: https://veb.ru/files/?file=1cc7ffec701762260d130988dafca0cf.pdf (accessed on 01.10.2021).

[2] Decree of the Government of the Russian Federation as of September 21, 2021 No. 1587 "On approval of the criteria for sustainable (including green) development projects in the Russian Federation and requirements for the verification system for sustainable (including green) development projects in the Russian Federation". 2021. URL: http://static.government.ru/media/files/3hAvrl8rMjp19BApLG2cchmt35YBPH8z.pdf (accessed on 01.10.2021).

[3] Bank of Russia. Sustainable Development Glossary. 2020. URL: https://cbr.ru/develop/ur/faq/?fbclid=IwAR 0iGY 1xeYDW0JE-Q9Cz_2ter3sfJ-y8r-3VaA86NIppOuMlAqZ-sB 2gn1k (accessed on 01.10.2021).

[4] Ministry of Industry and Trade of Russia. Industry Development Strategy for the Processing, Utilization, and Treatment of Production and Consumption Waste for the period up to 2030. 2018. URL: http://static.government.ru/media/files/y8PMkQGZLfbY 7jhn6QMruaKoferAowzJ.pdf (accessed on 06.08.2021).

[5] OECD. Waste Management and the Circular Economy in Selected OECD Countries: Evidence from Environmental Performance Reviews, OECD Environmental Performance Reviews, OECD Publishing. Paris. 2019. URL: DOI: 10.1787/9789264309395-en

It is important to note that the components that make up the concept of green finance are interrelated. Thus, an increase in government support is an incentive for increased green investment from private investors. This, in turn, affects the development of green instruments in the financial system.

The key difference between green finance and traditional finance is to achieve a positive effect on the environment, in addition to providing a return on investment.[6] Traditional financing involves only obtaining financial profit, taking into account possible financial risks [6]. Green finance, in addition, includes an environmental component, in which, together with financial benefits, positive environmental effects are achieved.[6] Therefore, it is often defined as part of sustainable financing, in which adherence to the principles of ESG is mandatory.[7]

At the same time, green finance instruments do not differ in their structure from traditional ones. Any traditional financial instrument can be used as a green instrument, provided that it is aimed at implementing green projects.[8] The main green finance instruments today are green loans and green bonds [7]. The main difference between the two is that green lending is a banking instrument, while green bonds are exchange-traded.

To date, most empirical studies of the impact of green finance instruments have examined the impact on reducing the carbon footprint of national economies and enterprises [8, 9]. M. S. Meo and Abd Karim M. Z. using the example of 10 countries,[9] leading the world in terms of the level of development of the green finance market, came to the conclusion that there is a negative correlation between green finance and greenhouse gas emissions — as the volume of green finance increases, CO_2 eq emissions decrease. [9]. Using quantile regression and data from 2008 to 2019 (monthly), the authors found that for all the countries studied, an increase in green finance leads to a decrease in greenhouse gas emissions. The strongest correlation between the two variables was found in the US and Sweden, and the weakest in New Zealand and Norway. According to the study, green finance is the best financial strategy for reducing greenhouse gas emissions.

C. Tolliver et al. calculated that for the period from 2008 to 2017, due to the issuance of green bonds by the world's largest financial institutions, the reduction of greenhouse gas emissions amounted to 108 million tons [8]. Considering the fact that total greenhouse gas emissions during this period amounted to 341

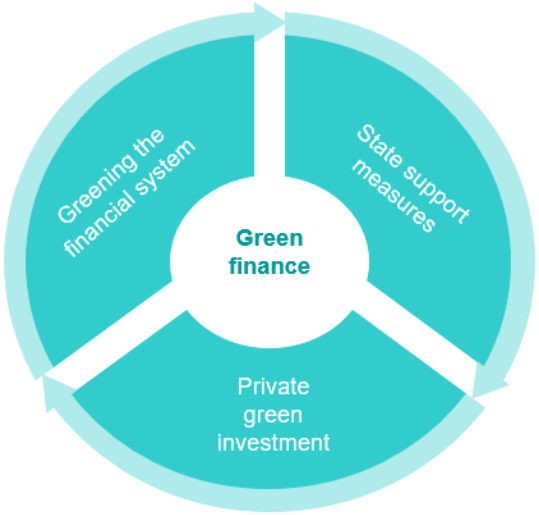

Fig. 1. **Components of the green finance concept**

Source: compiled by the authors based on [5].

[6] Asian Development Bank. Green Finance, Explained. Development Asia. 2018. URL: https://development.asia/explainer/green-finance-explained.

[7] ESG (Environmental, Social, Governance) principles — the principles of the company's activities based on environmental protection, the creation of favorable social conditions, a conscientious relationship with employees and customers, and proper corporate governance; IMF (International Monetary Fund). Global Financial Stability Report Lower for Longer. 2019. URL: https://www.imf.org/en/Publications/GFSR/Issues/2019/10/01/global-financial-stability-report-october-2019#Chapter6.

[8] Working group on ecology and nature management of the Expert Council under the Government of the Russian Federation. Russian Green Bank concept. 2017. URL: https://nangs.org›news›association›download (accessed on 07.09.2021).

[9] Canada, Denmark, Hong Kong, Japan, New Zealand, Norway, Sweden, Switzerland, UK, and USA.

billion tons,[10] the activities financed by green bonds managed to reduce emissions by 3%.

A summary list of definitions of the green finance concept is presented in *Table 1*.

INTERNATIONAL PRACTICES

Currently, the global financial community does not have generic rules and standards for classifying financial instruments and projects as "green". In this regard, many international organizations and countries issue their own classifiers and taxonomies to define green economic activities. The most famous of them:

- Climate Bonds Taxonomy;
- EU Taxonomy;
- China's Green Bond Endorsed Project Catalogue (hereinafter referred to as the "PRC Taxonomy").

In each of the named taxonomies, financing of waste disposal and recycling projects is singled out as one of the most relevant areas. For example, the *Climate Bonds Taxonomy*, developed by the international non-profit organization *Climate Bond Initiative*, lists assets and projects aimed at recycling, reusing, and other waste management methods.[11] The *EU Taxonomy* defines the following criteria for green waste management projects[12]:

- use of waste as secondary energy resources;
- recovery of materials from non-hazardous waste.
- The main areas of green financing in terms of waste management, according to the PRC Taxonomy, are:
- production of equipment for obtaining technogenic materials through waste processing;
- complex utilization of industrial waste;
- creation of technoparks.

As noted earlier, green bonds and loans are the two most popular green finance vehicles today. In the world over the past decade, there has been a stable trend towards an increase in the volume of circulation of green bonds and green loans. Green bonds, however, are the more common instrument.

In 2013, the volume of issuance of both financial instruments was approximately the same and did not exceed $ 15 billion (*Fig. 2*). Over 7 years, the volume of green bond issuance increased by more than 20 times, amounting to $ 305.3 billion by the end of 2020.[13] The volume of issued green loans at the same time increased only 7 times and amounted to $ 80.3 billion.[14]

Today, the world market leaders in the issuance of green bonds are the United States, China and European countries (*Fig. 3*). In 2019, the US accounted for 20% of all green bonds issued globally, worth more than $ 50 billion. The second place belongs to China ($ 31.5 billion), the third — France ($ 30 billion). The volume of green finance in Russia remains insignificant compared to the world, which is associated with the low level of development of the green finance market in the country.

In 2019, the global volume of green financing in the industry of industrial and consumer waste processing amounted to $ 6.8 billion, or about 4% of the total volume of issued green bonds [10] (*Fig. 4*). In most European countries (France, UK, Sweden, etc.), the issue of green bonds is more typical for business representatives, and in

[10] Based on Statista URL: https://www.statista.com/statistics/264699/worldwide-co2-emissions/ (accessed on 10.11.2021).

[11] Climate Bonds Initiative. Climate Bonds Taxonomy. 2021. URL: https://www.climatebonds.net/files/files/CBI_Taxonomy_Tables-2June21.pdf.

[12] EU Technical Expert Group on Sustainable Finance. Taxonomy: Final report of the Technical Expert Group on Sustainable Finance. 2020. URL: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf.

[13] Argus Media. Green bond issuance surges in 2020. 2021. URL: https://www.argusmedia.com/en/news/2178514-green-bond-issuance-surges-in-2020#:~: text=The%20%24305.3bn%20in%20green, data%20from%20Bloomberg%20BNEF%20showed (accessed on 12.2021).

[14] Bloomberg Green. The Sustainable Debt Market Is All Grown Up. 2021. URL: https://www.bloomberg.com/news/articles/2021–01–14/the-sustainable-debt-market-is-all-grown-up (accessed on 10.12.2021).

Table 1

Consolidated list of green finance concept definitions by international organizations, national institutions and various research papers

Author	Definition
International organizations	
G20[a] Study Group	Green finance is an investment that provides the following environmental benefits: reduction of pollution of the atmosphere, water, and land; reduction of greenhouse gas emissions; increase of energy efficiency when using existing natural resources; climate change mitigation and adaptation
OECD[b]	Green finance aims to achieve green economic growth driven by reduced pollution and greenhouse gas emissions, reduced waste, and more efficient use of natural resources
IMF[c]	Green finance is part of sustainable finance, incorporating ESG principles into business decision-making, economic development, and investment strategies
European Commission[d]	Green finance is a component of sustainable finance that supports economic growth while reducing environmental pressures, taking into account social and governance aspects
National institutions	
People's Bank of China[e]	Green finance is financial services provided for economic activities that: contributes to the improvement of the environment; favors the efficient use of natural resources; mitigates the effects of climate change
GIZ[f]	Green finance is a strategic approach to engage the financial sector in the transition to a low-carbon and resource-efficient economy, as well as climate change adaptation challenges
Chartered Banker Institute[j]	Green finance is any financial initiative, process, product, or service designed to protect the environment or to manage its impact on finance and investment
Research papers	
S. Khosla et al. [2]	Green finance is invested in projects and initiatives aimed at: sustainable development; ecological products; fight against industrial pollution, water disposal; protection of biodiversity; prevention of the consequences of climate change
U. Volz et al. [3]	Green finance includes all forms of investment and lending that have an impact on the environment and enhance environmental sustainability
M.B. Ghoul [4]	Green finance is the link between the financial industry, the environment, and economic growth
N. Lindenberg [5]	Green finance is a combination of green investments, public policies, and components of the financial system

Source: compiled by the authors based on the literature review.

Notes: [a] Green Finance Study Group. G20 green finance synthesis report. 2016. URL: https://unepinquiry.org/wp-content/uploads/2016/09/Synthesis_Report_Full_EN.pdf.; [b] OECD. Green Finance and Investment. Developing Sustainable Finance Definitions and Taxonomies. OECD Publications. 2020. URL: https://www.oecd-ilibrary.org/fr/environment/green-finance-and-investment_24090344; [c] IMF (International Monetary Fund). Global Financial Stability Report Lower for Longer. 2019. URL: https://www.imf.org/en/Publications/GFSR/Issues/2019/10/01/global-financial-stability-report-october-2019#Chapter6; [d] European Commission. Overview of sustainable finance. 2021. URL: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/overview-sustainable-finance_en; [e] The People`s Bank of China. Guidelines for Establishing the Green Financial System. 2021. URL: http://www.pbc.gov.cn/english/130721/3133045/index.html; [f] GIZ. Green Finance An Innovative Approach to Fostering Sustainable Economic Development and Adaptation to Climate Change. 2011. URL: https://www.greengrowthknowledge.org/sites/default/files/downloads/resource/Green_finance_GIZ.pdf; [j] Chartered Banker Institute. The Green Qualifications Workbook. file:///C:/Users/YVNikitushkina/Downloads/The%20Green%20Qualifications%20Workbook%20-%20Chapter%201%20(1).pdf.

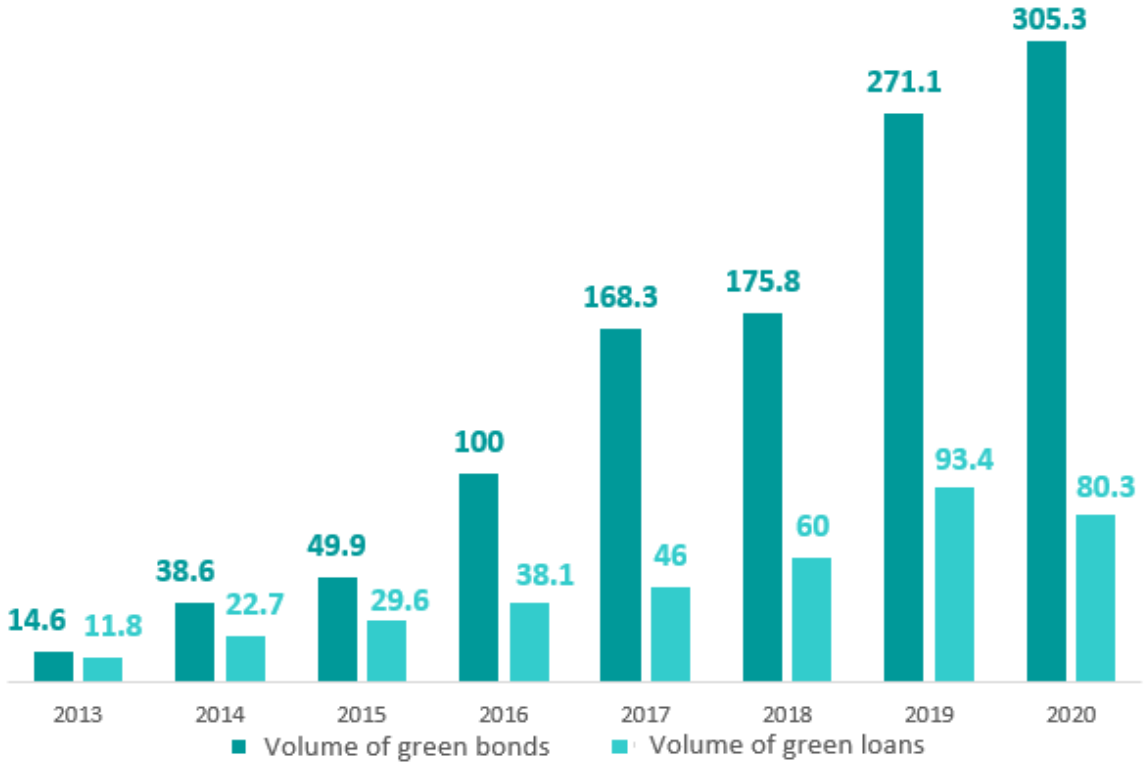

Fig. 2. **The volume of green bonds and green loans issuance in the world, 2013–2020, USD billion**

Source: compiled by the authors based on Investinfra. URL: https://investinfra.ru/novosti/v-2019-godu-mirovoj-obem-emissii-zelenyx-obligaczij-dostig-rekordnogo-pokazatelya-v-$255-mlrd.html (accessed on 09.06.2021).

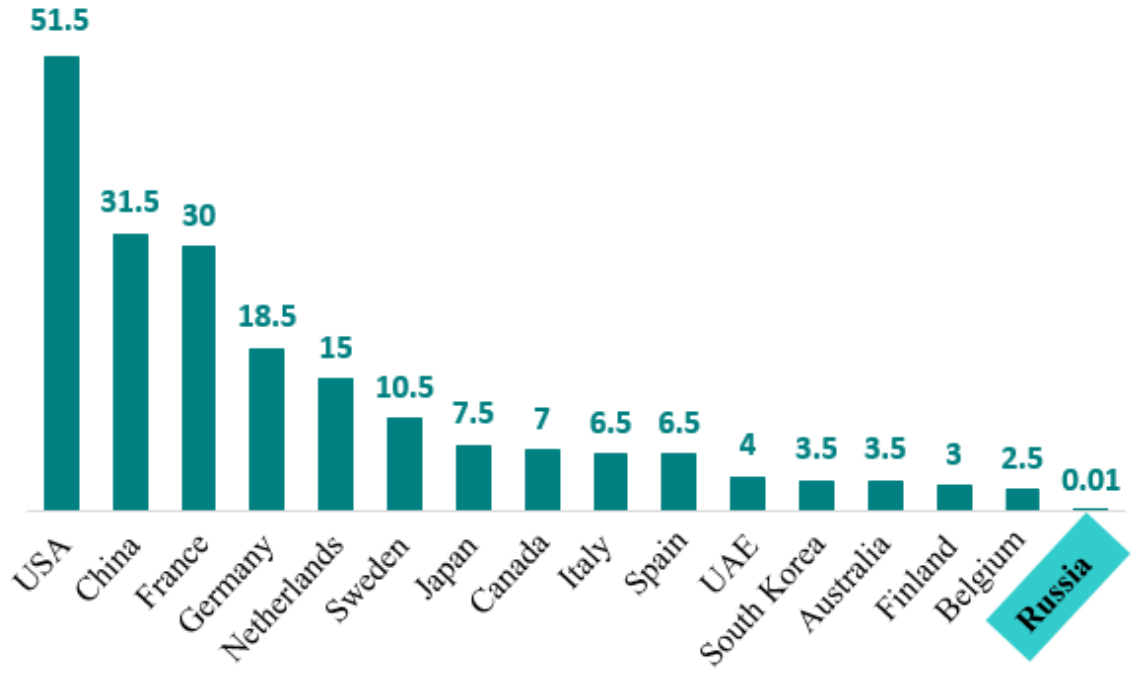

Fig. 3. **Comparison of Russia and 15 countries with the largest green bond issuance in 2019, USD billion**

Source: compiled by the authors based on Investinfra and database Statista.com. URL: https://investinfra.ru/novosti/v-2019-godu-mirovoj-obem-emissii-zelenyx-obligaczij-dostig-rekordnogo-pokazatelya-v-$ 255-mlrd.html; URL: https://www.statista.com/statistics/512030/share-of-green-bond-market-value-globally-by-major-country/ (accessed on 09.06.2021).

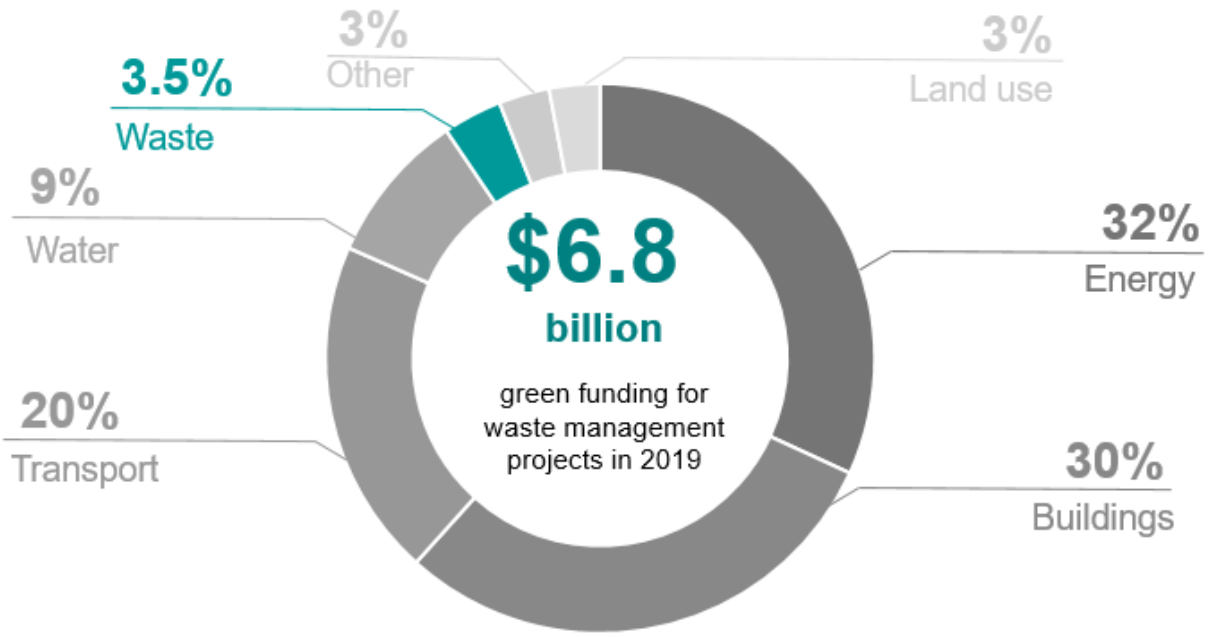

Fig. 4. **Distribution of issued green bonds by sector in 2019**

Source: compiled by the authors based on [11].

the USA and China — for the state. At the same time, it should be noted that most of the ongoing projects relate to solving the problems of utilization of municipal solid waste (MSW) generated as a result of consumption by the population, and not industrial waste.

CONTENT ANALYSIS OF THE RUSSIAN TAXONOMY OF GREEN AND ADAPTATION PROJECTS

In Russia, today the green financing system is in its emerging phase, while the state is actively developing this area. In September 2021, a Decree of the Government of the Russian Federation dated September 21, 2021 No. 1587 "On approval of the criteria for sustainable (including green) development projects in the Russian Federation and the requirements for the verification system for sustainable (including green) development projects in the Russian Federation",[15] which is the regulatory framework for launching the national system for financing green projects and initiatives in the field of sustainable development. Within the framework of this document, criteria for green and adaptation projects (taxonomies) have been developed, according to which companies will be able to attract concessional financing.[16]

The key difference between the two types of projects lies in the guidelines (directions) in the field of sustainable development and ecology, which they must comply with. Green projects must comply with the goals and directions in the field of climate and sustainable development specified in international documents.[17] Adaptation projects, in turn,

[15] Decree of the Government of the Russian Federation dated September 21, 2021 No. 1587 "On approval of the criteria for sustainable (including green) development projects in the Russian Federation and the requirements for the verification system for sustainable (including green) development projects in the Russian Federation. 2021. URL: http://static.government.ru/media/files/3hAvrl8rMjp19BApLG2cchmt35YBPH8z.pdf (accessed on 01.10.2021).

[16] Decree of the Government of the Russian Federation dated September 21, 2021 No. 1587 "On approval of the criteria for sustainable (including green) development projects in the Russian Federation and the requirements for the verification system for sustainable (including green) development projects in the Russian Federation. 2021. URL: http://static.government.ru/media/files/3hAvrl8rMjp19BApLG2cchmt35YBPH8z.pdf (accessed on 01.10.2021).

[17] Russian Government. The government has approved green financing criteria. 2021. URL: http://government.ru/news/43320/ (accessed on 09.11.2021).

Area	Green projects	Adaptation projects
Waste management* *with municipal solid waste (MSW)	✓	✓
Energy	✓	✓
Construction	✓	✗
Industry	✓	✓
Transport and industrial technology	✓	✓
Water supply and sanitation	✓	✗
Natural landscapes, rivers, reservoirs, and biodiversity	✓	✗
Agriculture	✓	✓
Sustainable Infrastructure	✗	✓

✓ Implementation of projects is possible within the area

✗ Implementation of projects is not possible within the area

Fig. 5. **List of areas for the implementation of green and adaptation projects**

Source: compiled by the authors based on the Decree of the Government of the Russian Federation as of September 21, 2021 No. 1587 "On approval of the criteria for sustainable (including green) development projects in the Russian Federation and requirements for the verification system for sustainable (including green) development projects in the Russian Federation". 2021. URL: http://static.government.ru/media/files/3hAvrl8rMjp19BApLG2cchmt35YBPH8z.pdf (accessed on 01.10.2021).

must comply with Russian priorities in the field of environmental protection. The main directions for the implementation of green and adaptation projects are shown in *Fig. 5*.

Waste management in the Russian taxonomy is singled out as a separate area for project implementation. At the same time, this direction implies only the processing of municipal solid waste (MSW). Utilization of industrial waste in this direction is not provided. The use of industrial waste is provided for within the taxonomy industry areas:

- "Power industry": ash and slag waste from thermal power plants (TPPs);
- "Industry": steel slag and glass cullet;
- "Agriculture": phosphogypsum.

In the direction of production sector and energy, both green and adaptation projects for the disposal of industrial waste can be implemented. As part of waste management, only green recycling projects can be implemented. In agriculture, industrial waste disposal projects can be implemented as adaptation projects.

Only the utilization of ash and slag waste can be recognized as an independent green project, subject to a number of criteria. Utilization of phosphogypsum, steel slag and glass cullet is not recognized as an independent project within the framework of the taxonomy, but is used only as a criterion for the project's compliance with the green or adaptation category.

Ash and slag waste are traditionally a coal combustion by-product at thermal power plants (hereinafter CCP-ASW). Within the

framework of the Russian taxonomy, the construction industry and other industries of industrial production are designated as a priority area for the disposal of CCP-ASW. A key criterion for qualifying eligible projects as "green" is verification of environmental and climate impacts by the reviewing party.

In addition to the fact that projects for the disposal of CCP-ASW can qualify for preferential green financing, the availability of systems and technologies for processing these wastes becomes one of the criteria for the implementation of complex projects within the taxonomy. Utilization of the received CCP-ASW is a key criterion for the recognition of green projects in the direction of waste disposal with energy production. The presence of equipment or installations for the processing of CCP-ASW into secondary material resources is mandatory for adaptation projects implemented in the direction "Cogeneration facilities — new or existing facilities". An optional criterion for recognizing the production of rare and rare earth metals as adaptation projects is the use of technologies for extracting rare earth metals from ash and slag waste.[18]

Steel slag is a waste generated during the smelting of metals from ores. Utilization of this type of waste is an additional criterion for the recognition of green projects for the production of steel and aluminum in modernized and newly built industries. Utilization of sludge from the processing of bauxite and nepheline ores, formed during the production of aluminum, is not provided for by the taxonomy. As an additional criterion, the utilization of steel slag is also used to recognize the following projects as adaptation projects:

- production of iron and steel;
- production of copper;
- production of nickel and cobalt;
- production of lead, zinc. and cadmium.

Glass cullet is a waste generated during the production and processing of glass products. Utilizing glass cullet in the production process is a mandatory criterion for recognizing glass production projects as adaptation projects. Other prerequisites are compliance with resource and energy efficiency indicators and the use of advanced technologies in accordance with ITS 5–2015.[19]

Phosphogypsum is a waste from the production of phosphate fertilizers. This type of waste can be utilized as a part of the implementation of adaptation projects for the chemical reclamation of acidic and saline agricultural lands. The only criterion, in this case, is the restoration of the neutral acid-base balance of the soil solution pH = 6.5–7.0 due to the neutralization of salts and acids accumulating in the soil with the appropriate chemical ameliorant (phosphogypsum or lime).

It is also worth noting that one of the additional criteria for recognizing cement production projects as "green" is the replacement of 10% or more of natural raw materials with waste from various industries. However, within the framework of the Russian taxonomy, specific types of waste that can be used for cement production are not explicitly indicated. It has been repeatedly confirmed in the scientific literature that industrial waste, common for domestic enterprises, is widely used in the construction industry as a substitute for traditional natural resources, in particular:

- CCP-ASW [12];
- foundry sand (waste of metallurgical production) [13];
- phosphogypsum (waste from the production of phosphate fertilizers) [14].

A summary of green and adaptation projects where industrial waste utilization can be applied, is presented in *Fig. 6*.

[18] Ash and slag waste is a hydraulic structure designed for the accumulation / placement of ash and slag from thermal power plants.

[19] Information and technical guide on the best available technologies "Glass production" (ITS 5–2015).

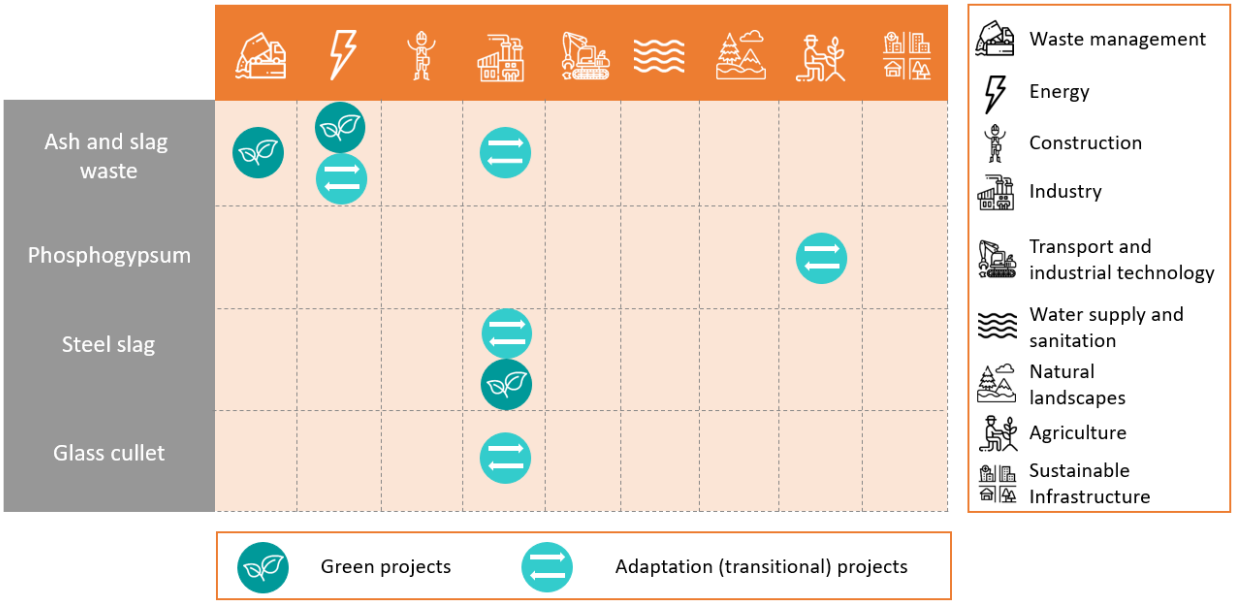

Fig. 6. **Consolidated list of areas for green and adaptation projects where industrial waste utilization can be applied**

Source: compiled by the authors based on the Decree of the Government of the Russian Federation as of September 21, 2021 No. 1587 "On approval of the criteria for sustainable (including green) development projects in the Russian Federation and requirements for the verification system for sustainable (including green) development projects in the Russian Federation". 2021. URL: http://static.government.ru/media/files/3hAvrl8rMjp19BApLG2cchmt35YBPH8z.pdf (accessed on 01.10.2021).

Next, we estimated the volumes of industrial waste utilization that can be covered by the projects indicated in the taxonomy. To do this, the volumes of non-utilizable industrial waste were compared by type of economic activity (OKVED2) and by type of waste within the taxonomy. Based on the data obtained, the percentage of industrial waste that could potentially be disposed of in the process of implementing green and adaptation projects was calculated. The evaluation results are given in *Table 2*.

According to Rosstat, in 2020, 3.5 billion tons of production and consumption waste,[20] or about 50% of the total amount of waste generated, could not be utilized. The percentage of industrial waste that could potentially be utilized in the process of implementing green and adaptation projects was calculated using the formula:

$$x = \frac{\sum_{i=1}^{n} Q_{gen\_taxon\_i} - \sum_{i=1}^{n} Q_{util\_taxon\_i}}{\sum_{i=1}^{n} Q_{gen\_rosst\_i} - \sum_{i=1}^{n} Q_{util\_rosst\_i}} * 100\%,$$

where $Q_{gen\_taxon\_i}$ — the amount of waste generated by the i-th type of waste within the taxonomy directions per year;

$Q_{util\_taxon\_i}$ — the amount of utilized waste by the i-th type of waste within the taxonomy directions per year;

$Q_{gen\_rosst\_i}$ — the amount of waste generated by the i-th type of waste in the framework of economic activity according to OKVED2;

$Q_{util\_rosst\_i}$ — the amount of utilized waste by the i-th type of waste within the framework of economic activity according to OKVED2.

As a result, out of 3.5 billion tons of non-utilized waste within the framework of taxonomy projects, an additional 91 million tons, or no more than 2.5% of the total non-utilized industrial waste in the country, can be utilized. At the same time, it should be noted that 90% of non-utilized waste is overburden. The share of non-utilized non-overburden

[20] Based on Rosstat data. URL: https://rosstat.gov.ru/folder/11194 (accessed on 24.10.2021).

Table 2

Estimation of industrial waste utilization volumes (by types and sources of formation), which can potentially be achieved through the implementation of green and adaptation projects

Rosstat data for 2020			Taxonomy content analysis		Share of utilized waste that can be achieved through taxonomy	
Type of economic activity (OKVED2)	Types of waste generated as a result of economic activities	Volume of non-utilized waste by type of economic activity (thousand tons)	Area of implementation of utilization projects / type of waste	Volume of non-utilized waste by type specified in the taxonomy (thousand tons per year)	by type of waste, %	in industry as a whole, %
Agriculture, forestry, hunting, fishing, and fish farming	Phosphogypsum	11,439.5	Agriculture / phosphogypsum	3,430.00 [15]	30	30
	Wood waste				0	
	Grain waste, etc.				0	
Extractive industry						
Coal mining	Overburden and host rock, crush screenings	2,032,608.6	Not applicable	0	0	0
Extraction of crude oil and natural gas		5,636.0		0	0	
Mining of metal ores		1,051,756.0		0	0	
Extraction of other minerals		304,259.6		0	0	
Provision of mining services		2248.1		0	0	

Table 2 (continued)

Rosstat data for 2020			Taxonomy content analysis		Share of utilized waste that can be achieved through taxonomy	
Type of economic activity (OKVED2)	**Types of waste generated as a result of economic activities**	**Volume of non-utilized waste by type of economic activity (thousand tons)**	**Area of implementation of utilization projects / type of waste**	**Volume of non-utilized waste by type specified in the taxonomy (thousand tons per year)**	**by type of waste, %**	**in industry as a whole, %**
Manufacturing industry						
Manufacture of other non-metallic mineral products	Glass cullet	1963.1	Industry/ Glass cullet	1060.21 [16]	54	36
	Sludges and sediments of charge preparation systems.				0	
	Sludge and sludge from dust and gas collection and wastewater treatment systems				0	
	Suspensions for glass grinding and polishing systems				0	
Manufacture of basic metals	Steel slag	70,421.7	Industry / Steel slag	70,421.7 [17]	100	
	Foundry sand			Not available	–	
Other manufacturing industries (excluding the production of other non-metallic mineral products and metallurgical production)	Red mud	127,839.9	Not applicable	0	0	
	Acid sediment mine drainage			0	0	
	Crushed limestone			0	0	
	Jarosite sediment			0	0	
	PCB waste			0	0	
Resource supply industry						
Provision of electricity, gas, and steam; air conditioning	CCP-ASW	15,925.5	Energy / CCP-ASW	15,925.50 [15]	100	100
Water supply; water disposal, organization of the collection and waste management, pollution control activities	Sludge from rainwater treatment plants	–47,530.9	Not applicable	0	0	
	Quartz sand			0	0	
	Hydroanthracite			0	0	
TOTAL		3,576,567.1		90,837.41		2.54

Sources: compiled by the authors based on Rosstat database and research papers [15–17]. URL: https://rosstat.gov.ru/folder/11194 (accessed on 24.10.2021).

waste accounts for about 200 million tons of annually generated. The use of the taxonomy mechanism in full creates the potential for the placement of an additional 45% of industrial waste (excluding overburden) from the annually accumulated waste. This is the maximum limit.

At the same time, within the framework of certain types of waste, thanks to taxonomy, up to 100% of the generated industrial waste can be utilized, as is the case with CCP-ASW and steel slag. In the main industries producing waste, 100% utilization can only be achieved in the power industry. From 30 to 36% of the generated waste can be further used in agriculture and production. The mining industry, which generates half of the country's annual waste, is currently not considered in the taxonomy as industrial waste disposal.

CONCLUSION

Green finance today is a relevant concept, as it is a link between the financial sector and the implementation of projects aimed at protecting the environment. In the context of the greening and decarbonization of the national economy, the development of the green finance system in Russia today is of great importance for the implementation of strategic goals on the federal scale.

In order to increase the volume of industrial waste utilization in Russia, it is necessary to create additional incentives to attract concessional financing. In the current version of the Russian taxonomy of green and adaptation projects, the list of industrial waste is limited to four types. Thus, the potential for utilization through green and adaptation projects remains low. At the same time, in the current version of the taxonomy, only the utilization of CCP-ASW can be recognized as a separate (independent) direction for the implementation of green projects, provided that the criteria are met. In this regard, it is necessary to make additions to the taxonomy in terms of recognizing the utilization of other types of industrial waste as an independent project (similar to the utilization projects of the CCP-ASW).

Within the scope of "Industry", for example, the processing of sands for use in industry and construction can be recognized as an independent project. As part of the "Agriculture" direction, the list of independent projects must be supplemented with the utilization of phosphogypsum for use in industry, construction and agriculture.

The list of criteria for recognizing projects as green or adaptable should also be supplemented with the utilization of other types of industrial waste (in addition to CCP-ASW, steel slag, and glass cullet). In the list of criteria for recognizing a project for the production of mineral fertilizers as green, in particular, it is necessary to include the utilization of waste generated as a result of production (for example, phosphogypsum).

Expansion of the list of industrial waste management projects in the taxonomy will be an additional incentive to intensify activities in this direction, and will also help optimize the waste management system in the country.

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