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ANALYSIS OF CAPITAL INVESTMENTS BY TYPES OF NATURE PROTECTION ACTIVITIES IN UKRAINE THROUGH THE PRISM OF ENVIRONMENTAL POLLUTION

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АНАЛІЗ КАПІТАЛЬНИХ ІНВЕСТИЦІЙ ЗА ВИДАМИ ПРИРОДООХОРОННОЇ ДІЯЛЬНОСТІ В УКРАЇНІ КРІЗЬ ПРИЗМУ ЗАБРУДНЕНОСТІ НАВКОЛИШНЬОГО СЕРЕДОВИЩА

The greening of the country's economy during the post-war reconstruction will be one of the main priorities. To accelerate this process, it's worth pursuing a reasonable investment policy for types of environmental protection activities through the prism of environmental pollution in Ukraine.

The purpose of the article is to present a detailed analysis of the volume of capital investments by type of environmental protection activity in Ukraine, taking into account environmental pollution, to determine the volume of carbon dioxide emissions by standard sources in Ukraine and to indicate the threats from them.

To achieve the specified goal, the work used methods of analysis, synthesis, generalization, and comparison, which allowed for a comprehensive processing of the available statistical data on the volume of pollutant emissions from standard sources in Ukraine in 1990–2023 and to outline the prospects for future research.

It's substantiated and revealed why in the near future it's worth developing proposals for a "smart" ecological transition of business activities and increasing the volume of capital investments in the protection and rehabilitation of soil, groundwater and surface waters and waste management in Ukraine. It's indicated that qualitative growth of investments will activate the sphere of atmospheric air protection and allow for the accelerated elimination of the problems of climate change and the purification of return waters in Ukraine. It was found that the smallest amounts of capital investments were traced from 2006 to 2010.

The authors express the opinion that a high-quality institutional policy on capital investments in the protection of the natural environment of Ukraine can allow to fulfill important tasks in terms of developing a national model of ecologization of the country's economy and promote the progressive development of the "green" economy. Scientists believe that an ecological model of business organization can ensure the economy's transition to carbon neutrality and the use of renewable energy sources not only in everyday life, but also in business.

Екологізація економіки країни в часи повоєнної відбудови буде мати чи не одне з головних значень. Аби пришвидшити даний процес варто провадити розумну інвестиційну політику за видами природоохоронної діяльності крізь призму забрудненості навколишнього середовища на території України.

Мета статті полягає в тому, щоб представити розгорнутий аналіз капітальних інвестицій за видами природоохоронної діяльності в Україні, враховуючи забрудненість навколишнього середовища, визначити обсяги викидів діоксиду вуглецю стандартними джерелами і вказати загрози від них.

Для досягнення визначеної мети в роботі використано методи аналізу та синтезу, узагальнення, порівняння, діалектичний та системний підходи, що дозволили комплексно опрацювати наявні статистичні дані обсягів викидів забруднюючих речовин стандартними джерелами в Україні з 1990 по 2023 роки та окреслити перспективи майбутніх досліджень.

Обґрунтовано і розкрито факт того, чому в найближчій перспективі варто напрацьовувати пропозиції до "розумного" екологічного переходу підприємницької діяльності та збільшення обсягів капітальних інвестицій на захист і реабілітацію ґрунту, підземних і поверхневих вод та поводження з відходами в Україні. Вказано, що постійний кількісний та якісний ріст інвестицій активізують сферу охорони атмосферного повітря та дозволяють пришвидшеними темпами усувати проблеми зміни клімату й очищення зворотних вод в Україні. З'ясовано, що найменші суми капітальних інвестицій простежувалися з 2006 по 2010 роки.

Авторами висловлена думка про те, що якісна інституційна політика щодо капітальних інвестицій на охорону навколишнього природнього середовища України може дозволити виконати важливі задачі в частині розробки національної моделі екологізації економіки країни та сприяти прогресивному розвитку "зеленої" економіки. Науковці стоять на позиції того, що екологічна модель організації діяльності бізнесу могла б забезпечити економіці країни перехід до вуглецевої нейтральності та використання відновлювальних джерел енергії не лише в побуті, а й у підприємництві.

Keywords: *capital investment, environmental tax, environmental regulation, green innovations, pollutant emissions, wastewater treatment plants, waste management.*

Ключові слова: *капітальні інвестиції, екологічний податок, екологічне регулювання, зелені інновації, викиди забруднюючих речовин, очисні споруди, поводження з відходами.*

Statement of the problem in general terms. Pursuing the goal of greening the economy of Ukraine and achieving the Sustainable Development Goals of the country by 2030, it is worth defining planned tasks regarding the priority of using

instruments to improve the state of the environment. The amount of funding allocated for the construction of treatment plants and the force of the country's legislation on the regulation of environmental protection activities of industry and production play an important role. On the other hand, the volume of capital investments by type of environmental protection activities requires an analysis of the finances already invested in this area and the development of high-quality mechanisms for attracting capital investments from external sources.

It's also worth remembering the need to direct capital investments to air protection and climate change issues and wastewater treatment in post-war Ukraine. Rapid preparation for the greening of production and industry can be facilitated by introducing and adhering to environmental tax rules and regulations at the micro and macro levels.

Analysis of recent research and publications. An analysis of capital budgeting for green industries in innovation and sustainability programs for extractive industries is disclosed in the works of A. Dwiharto and A. Kurniasih [1]. Scientists argue that "land left after mining has the potential to be used as a productive area to increase economic value and overcome environmental problems after mining" [1, p. 8]. Researchers F. Tandioga and B. Prihatin concluded that by implementing green intellectual capital, companies can respond more quickly to environmental changes, reduce operational risks, and create a positive reputation in the eyes of customers and other stakeholders [2, p. 149].

The impact of environmental investments on the economic performance of industrial enterprises in Finland was presented in his work by J. Rahko [3]. In the article titled "Environmental regulations and capital investment: do green innovations enable growth?" its authors U. Farooq, J. Wen, M. Tabash, and M. Fadoul [4], attempted to analyze the positive impact of environmental regulation on green innovation. Scientists have proven a positive moderating/mediating effect of green innovation on the relationship between environmental regulation and capital investment [4].

The main topic of the study by H. Ramírez-Malule, D. Quiñones-Murillo, and D. Manotas-Duque was the presence of pharmaceuticals and personal care products in wastewater and the removal of such pollutants by using adsorption and advanced oxidation processes [5, p. 179].

M. Kida, S. Ziembowicz, and P. Koszelnik studied the issues of emissions of harmful substances and greenhouse gases into the environment through the prism of microplastic decomposition [6]. They investigated the presence and potential for emissions of phthalic acid esters and greenhouse gases from various plastic materials used in the aquatic environment.

The work of a team of scientists led by P. Magliocca is devoted to the issue of effective investment for innovative and digital development through the prism of the Sustainable Development Goals [7]. We consider the publications of a team of authors from Ukraine, namely: K. Kraus, N. Kraus [8], O. Manzhura [9], O. Marchenko [10], to be valuable. The scientists managed to present a thorough analysis of the qualitative use of information for conducting innovation and investment activities through the prism of establishing a "net zero" economy and developing the renewable energy market to achieve carbon neutrality.

Formulation of the article's goals. The purpose of the article is to present a thorough analysis of capital investments in environmental protection in Ukraine over the past 20 years; to indicate capital investments in the protection, and rehabilitation of soil, groundwater and surface water, and waste management in Ukraine; to determine the volume of carbon dioxide emissions from standard sources in Ukraine; and to indicate the threats from them.

The scientific work used various methods, in particular the grouping method, to present the volumes of pollutant emissions by standard sources in Ukraine from 1990 to 2023. The methods of analysis and synthesis were used to present the importance of increasing capital investments in environmental protection. The comparison method helped to indicate the volumes of capital investments in air protection and the problems of climate change and wastewater treatment in Ukraine.

Presentation of the main research material. Industrial activity, rapid urbanization, intensive agriculture, and overconsumption have led to ecosystem degradation, air and water pollution, habitat loss, and increasingly extreme climate change, ultimately contributing to environmental degradation [2, p. 148]. In modern economic conditions, businesses and entrepreneurs that invest in environmental protection increase their turnover compared to control enterprises, and their labor productivity increases. "Economic benefits are greater when investing in environmental protection" [3, p. 1].

Analyzing the volume of pollutants from standard sources in Ukraine over 23 years, it's worth noting that they decreased by 8 214.9 thousand tons and amounted to 1 224.2 thousand tons in 2023 (Fig. 1).

The most dramatic reduction was observed from 1990 to 2000. A somewhat slower trend, but in the direction of reduction, was observed from 2015 to 2023. This is caused by the effective action of norms, rules, and laws that have been implemented in Ukraine for three decades. From Fig. 1 we see that due to the war on the territory of Ukraine, there is some inability of pro-government institutions to fully control the volume of emissions of pollutants from standard sources, which influenced their increase in the first year of the war by 34.6 thousand tons.

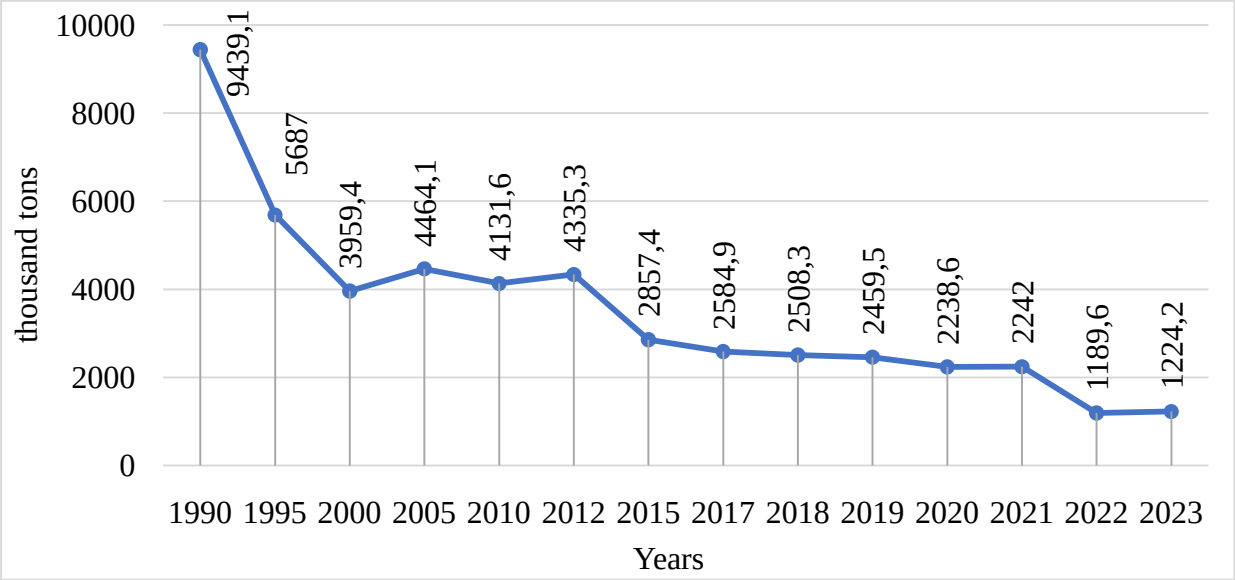

Fig. 1. Volume of pollutant emissions by standard sources in Ukraine from 1990 to 2023

Source: compiled based on the source [11].

The volume of carbon dioxide emissions from standard sources in Ukraine increased from 2005 to 2012 and amounted to 198.2 million tons (Fig. 2). But in the following years, up to 2022, we observe a sharp reduction in carbon dioxide emissions by 134.8 million tons. During the first year of the full-scale invasion, the volume of carbon dioxide emissions from standard sources increased by 4.2 million tons and amounted to 67.6 million tons in 2023.

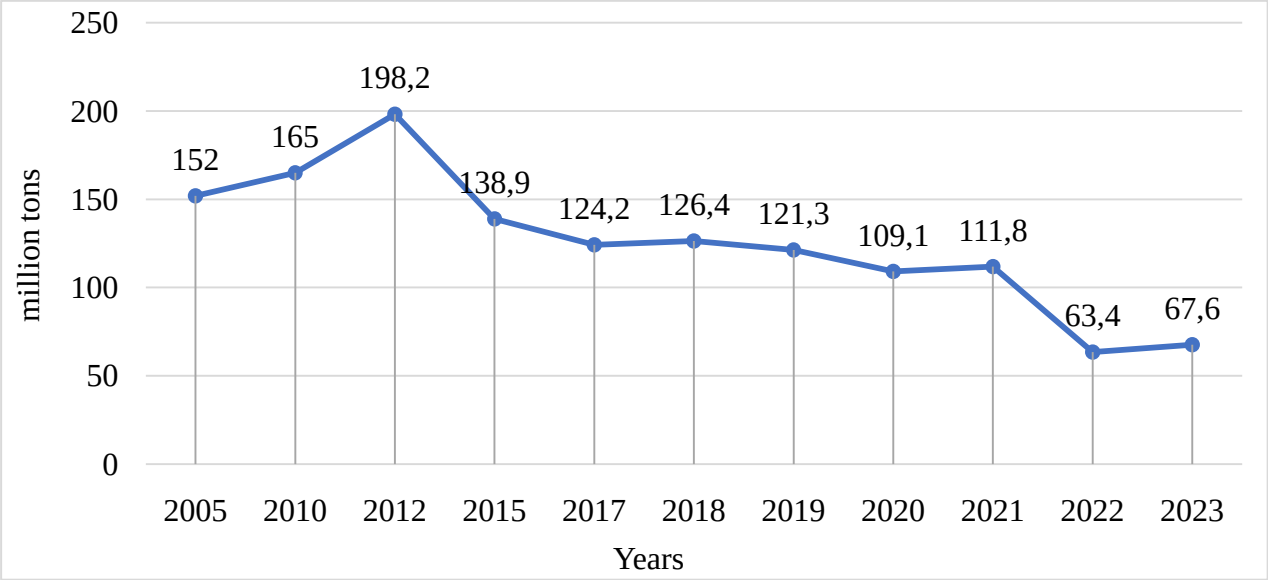

Fig. 2. Carbon dioxide emissions by standard sources in Ukraine from 2005 to 2023

Source: compiled based on the source [11].

In order to achieve maximum achievement in implementing the Sustainable Development Goals, the Ukrainian government should pay more attention to the qualitative aspects of implementing the country's environmental policy. In order to improve the state of the environment, namely, to reduce pollution of soils, water bodies, and atmospheric air, it's necessary to increase funding for the installation of treatment facilities; to develop mechanisms for high-quality purification of water bodies and restoration of soil conditions; and to develop a number of rules and norms for enterprises in the field of environmental protection of production processes and the development of closed industrial production. Currently, there is a need to develop a system of fines for failure to comply with environmental standards by enterprises and businesses.

To improve the environmental friendliness of production and industry in Ukraine, it's worth modernizing the infrastructure, carrying out its digital transformation. In conditions of martial law, in order to quickly implement this

issue, adequate funding is needed, either state, or through international grants, or through the implementation of a high-quality investment policy of the country. From 2006 to 2021, we observed an increase in the total amount of capital investments in the protection of the natural environment of Ukraine by UAH 11,919 million (Fig. 3).

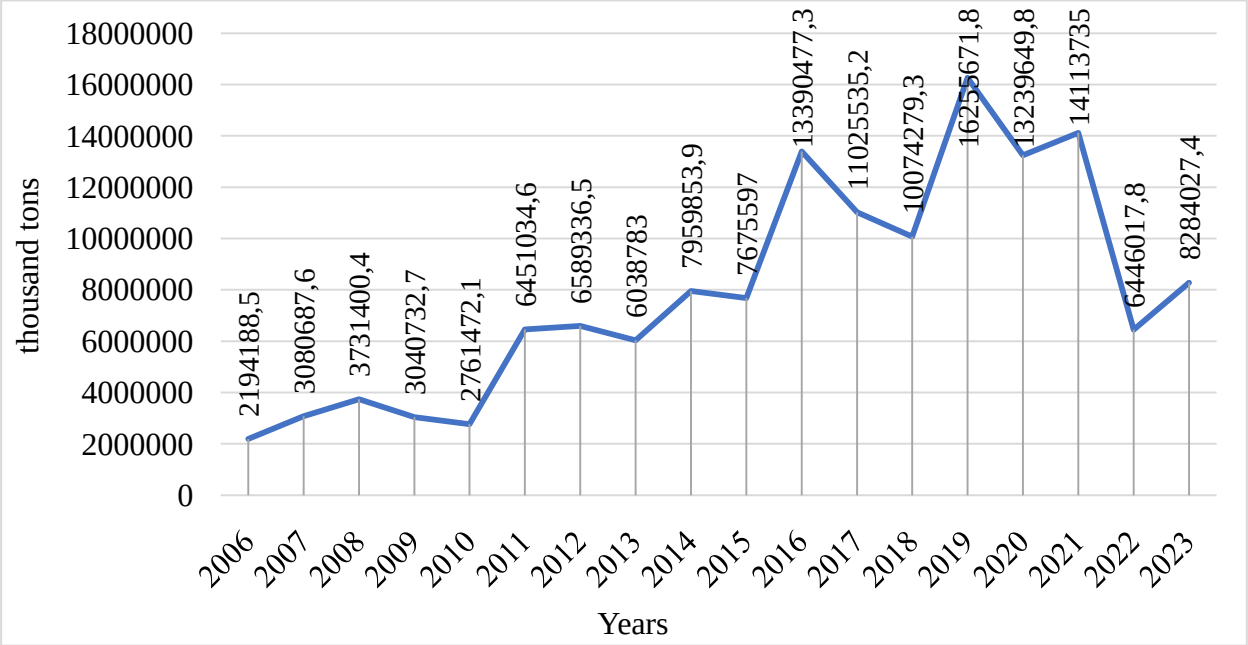

Fig. 3. Total amount of capital investments in environmental protection in Ukraine from 2006 to 2023

Source: compiled based on the source [12].

As of 2023, the amount of capital investments in environmental protection in Ukraine amounted to UAH 8,284.0 million, which is UAH 1,838.0 million more than in 2022, but UAH 5,829.7 million less than in 2021 (Fig. 3). By and large, the total amount of capital investments in environmental protection in Ukraine in 2023 is close to the amount in 2013, which we consider a negative trend for the country.

The economic benefits of investing in environmental protection may vary depending on the industry [3, p. 7]. The state of the environment can be improved by ensuring rational environmental management, which is possible by establishing an effective balance between consumption and compensation, which will be achieved by creating an effective financial mechanism [13, p. 314].

The statistical data on the volume of capital investments in atmospheric air protection and climate change problems and return water purification in Ukraine

from 2006 to 2023 are interesting (Fig. 4), as they indicate a return to the investment volumes of 2015 and 2008 and require immediate measures to improve the government's capital investment policy in the areas of atmospheric air protection and return water purification.

In 2020, the best volumes of capital investments were observed in the protection of atmospheric air and climate change problems (5,595.3 million UAH) and purification of return waters in Ukraine (1,578.2 million UAH), as their total amount was 7,173.5 million UAH. Due to martial law in 2022, the amount of capital investments in the protection of atmospheric air and climate change issues and purification of return waters in Ukraine decreased by 2.68 times, and in 2023 by 1.95 times compared to 2021. In general, in 2023, the amount of capital investments in the protection of atmospheric air and climate change issues and purification of return waters was close to the amounts in 2011, 2012, and 2013 (Fig. 4).

Given the increasing generation of wastewater and its accumulation in the environment, it's necessary to develop new strategic measurement methods that will facilitate the detection and monitoring of a wide range of pollutants in the environment in real time. This allows for the control of emissions of new pollutants from various industrial sectors and timely corrective measures. Monitoring can reduce the negative impact caused by the presence of new pollutants and identify the sources of pollution [5, p. 190].

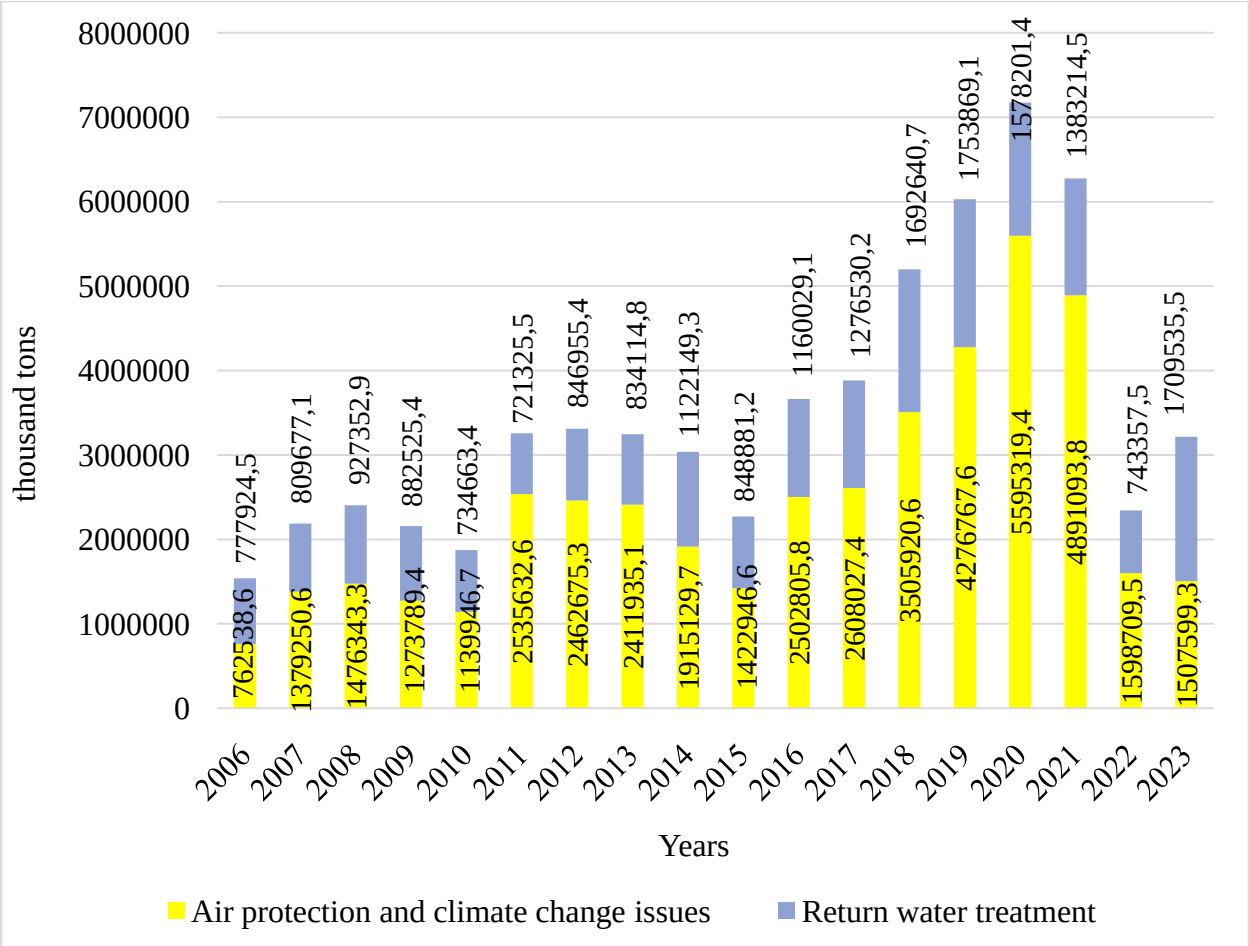

Fig. 4. Dynamics of capital investments in air protection and climate change problems and return water treatment in Ukraine from 2006 to 2023

Source: compiled based on the source [12].

When analyzing the issues of greening the country's economy, it's worth paying attention to capital investments in soil protection and waste management because Ukraine is considered an agrarian country, so land quality is of great importance for the economy and farmers. The largest capital investments in soil protection and rehabilitation, groundwater, and surface waters were in 2020 and 2021 (Fig. 5). The smallest amounts of capital investments were observed from 2006 to 2010. The amounts of capital investments in "smart" waste management were the largest in 2019 and 2021 and amounted to 5,754.2 million UAH and 3,719.6 million UAH, respectively. It's also worth paying attention to the fact that the ratio of capital investments in soil protection and rehabilitation, groundwater and surface waters, and waste management has always remained in favor of soil and water protection.

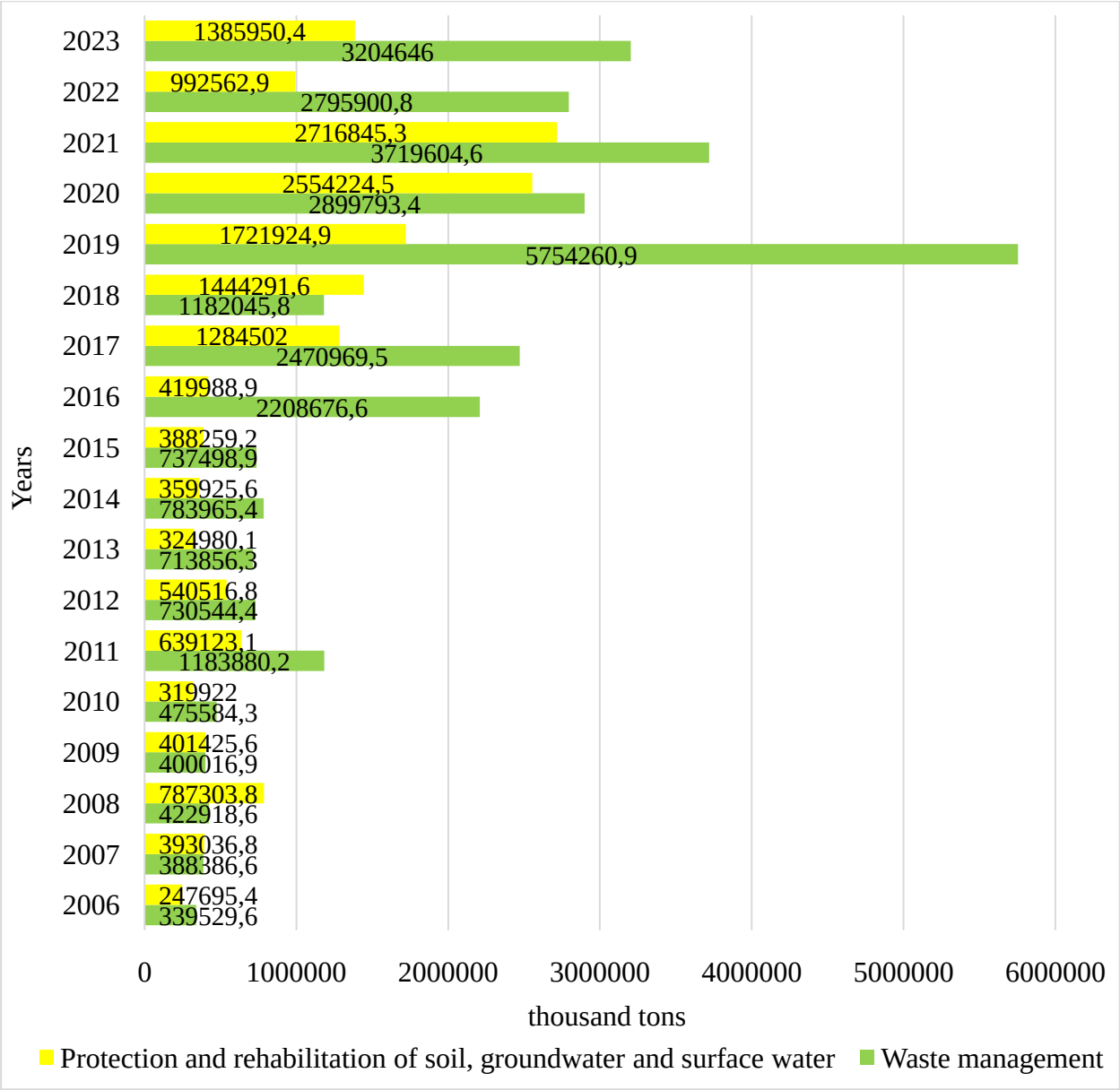

Fig. 5. Dynamics of the volume of capital investments in the protection and rehabilitation of soil, groundwater and surface waters and waste management in Ukraine from 2006 to 2023

Source: compiled based on the source [12].

Good environmental management should be implemented and financed through investment activities in refining and oil refining by allocating funds for environmental management, repairing mine cavities for water storage, and implementing horizontal-flow artificial wetlands at the plantation site, which have a dual function for wastewater treatment and fertilization of plantation crops [1, p. 16].

Investment support for environmental management should be provided from various sources in the following areas: national, local, and international finances – primarily for the restoration of air, water, and polluted areas; own funds and international investments – for the modernization and greening of production. In addition, groups of economists believe that it is precisely "environmental taxes in Ukraine that are an ineffective tool of the financial mechanism for environmental management" [13, p. 314].

Conclusions and prospects for further exploration in this direction. Thus, an ecological model of business organization could ensure the country's economy transitions to carbon neutrality and the use of renewable energy sources not only in everyday life but also in business activities. In the near future, it's worth developing proposals for a "smart" ecological transition of business activities and increasing the volume of capital investments in the protection and rehabilitation of soil, groundwater, surface water, and waste management in Ukraine.

Consistent practice shows that constant quantitative and qualitative growth of investments activates the sphere of atmospheric air protection and allows to eliminate the problems of climate change and return water purification in Ukraine at an accelerated pace. A qualitative institutional policy on capital investments in the protection of the natural environment of Ukraine can allow to fulfill important tasks in terms of developing a national model of ecologization of the country's economy and promote the progressive development of the "green" economy.

Further scientific research should be conducted in the direction of structural transformation of institutions dealing with environmental pollution issues and digitization of their activities. There is an urgent need to review the existing legislative framework regarding the ecological implementation of environmental protection activities in the country, in order to develop high-quality legislative initiatives that will meet EU standards based on this knowledge.

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