



## Fiscal Instruments for Ensuring Climate Resilience: Practice of EU Member States and Prospects for Ukraine

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**Abstract:** The aggravation of climate challenges and the need to green fiscal policy in the context of European integration necessitate increasing the efficiency of tax and budgetary instruments. The purpose of the study is to analyze the practice of EU member states in using fiscal instruments in the environmental sphere and to substantiate the directions of their adaptation in Ukraine. The methodological basis comprises a systematic approach, comparative and structural-functional analysis, and statistical methods. It has been established that taxes in EU countries perform a dual function – fiscal and regulatory – ensuring the internalization of external effects, the formation of price incentives, and the implementation of the "double dividend" effect due to the dominance of energy and carbon components. In Ukraine, fiscal and regulatory potential is limited by low rates, a narrow base, and insufficient integration with climate policy. At the same time, budget expenditures in the EU act as a catalyst for structural transformation, providing financing for decarbonization, innovation, and adaptation through climate-oriented budgeting. In Ukraine, they are characterized by insignificant scales and fragmentation, which reduce their effectiveness. The need for a comprehensive transformation of Ukraine's fiscal policy is proven, involving strengthening environmental taxation, introducing carbon pricing, and institutionalizing climate-oriented budget expenditures to ensure a coordinated impact on achieving climate resilience.

**Keywords:** fiscal policy, fiscal mechanism, fiscal instruments, environmental taxes, environmental protection budget expenditures, sustainable development, climate resilience, carbon dioxide, decarbonization

### 1. Introduction

In the current context of deepening climate change, accompanied by increased frequency of extreme weather events, ecosystem degradation, and greater economic losses, the issue of developing effective climate resilience instruments is gaining strategic importance. Within the EU, the implementation of the European Green Deal and the achievement of climate neutrality by 2050 underscore the need to transform fiscal policy as a key means of influencing economic agents' behavior (Gilaber, 2022). Fiscal instruments, primarily taxes and budget expenditures, are important mechanisms not only for mobilizing financial resources but also for stimulating the transition to a low-carbon economy.

For Ukraine, this issue is particularly relevant in the context of European integration processes, harmonization of fiscal policy with EU legislation, and the need for post-war reconstruction based on sustainable development. At the same time, climate challenges are combined with limited budgetary resources, underscoring the importance of effectively using fiscal instruments to ensure long-term economic and environmental sustainability.

Despite significant progress in implementing climate-friendly fiscal mechanisms by EU member states, ensuring their coherence, effectiveness, and social fairness remains a challenge. The challenge is to develop a comprehensive system of fiscal instruments that simultaneously:

- 1) contribute to the reduction of greenhouse gas emissions;
- 2) provide stable budget revenues to finance environmental measures;
- 3) minimize negative socio-economic consequences for vulnerable groups of the population and businesses.



In practical terms, this relates to the implementation of international obligations, particularly within the framework of the Paris Climate Agreement, as well as to modernizing national economies and increasing their competitiveness (Sushyk, 2021). For Ukraine, the problem is further complicated by the need to adapt European experience to national institutional conditions, which entails transforming the tax and budget systems.

The purpose of the study is to generalize and systematize the practice of using fiscal instruments to ensure climate resilience across EU member states and to substantiate directions for adaptation in Ukraine, taking into account national economic and institutional characteristics.

To achieve the goal, the following tasks have been defined:

- to analyze the essence and classification of fiscal instruments of climate policy,
- to study the practice of EU member states in the use of tax and budgetary mechanisms in the field of climate resilience,
- to assess the effectiveness of particular instruments from the standpoint of environmental and fiscal results,
- to identify problems and limitations of their application,
- to substantiate promising directions for the implementation of European experience in Ukraine.

The object of the study is fiscal instruments for ensuring climate resilience.

The study examines economic relations arising from the use of fiscal instruments to achieve climate goals.

## 2. Literature Review

It is advisable to begin the study of fiscal instruments for climate resilience with a theoretical and methodological justification of their content and structural framework, as this provides a clear conceptual definition that ensures the correctness of subsequent scientific analysis and applied generalizations. The initial prerequisite for such justification is an etymological and semantic analysis of basic concepts.

In particular, in dictionaries of foreign words, the concept of "fisc" comes from the Latin "fiscus" and is interpreted as "state treasury", which emphasizes the resource base of the state and the mechanisms of accumulation and redistribution of financial resources (Bybyk & Siuta, 2006). At the same time, the etymology of the concept of "instrument" indicates its origin from the Latin "īnstrūmentum" – "instrument", which is associated with the verb "īnstrūo" ("I build, organize, provide"), and in modern scientific discourse is used to denote the means by which a certain goal is achieved (Melnychuk et al., 2006). Synthesizing these approaches, we consider fiscal instruments for climate resilience as a set of means related to the fiscal sphere, through which the state exercises targeted influence on economic agents to prevent climate risks, adapt to climate change, and ensure climate resilience.

The analysis of scientific approaches to determining the composition of fiscal instruments in the environmental sphere shows the presence of multi-vector approaches to their identification and structuring, which complicates the formation of a single theoretical basis for the study. The economic-instrumental approach prevails in the works of European and American scientists, in which fiscal instruments are considered means of influencing the use of natural resources by generating state revenues and allocating them to financing environmental protection measures (Vidal-Hernández et al., 2021). At the same time, considerable attention is paid to environmental taxes as a key element of such a toolkit, capable not only of providing budgetary revenue but also of stimulating employment and achieving environmental policy goals (Postula & Radecka-Moroz, 2020).

At the same time, several studies offer an expanded interpretation of the composition of fiscal instruments, including both tax instruments (taxes, fees) and subsidies, tax breaks, differentiation of indirect tax rates, as well as market mechanisms, in particular emission allowance trading, which operate through the pricing mechanism and contribute to the internalization of externalities (Kosonen & Nicodème, 2009). Within this approach, fiscal instruments are divided into pricing instruments and incentive measures that affect by increasing or decreasing the cost of environmentally significant benefits (Bilgili & Firidin, 2017).

A separate area of research focuses on the role of budget expenditures and transfers as an integral part of the fiscal toolbox, emphasizing their importance in implementing the redistributive, distributive, and stabilization functions of public finances and influencing the structure of production and consumption. Along with this, scientific literature also emphasizes the importance of tax expenditures and subsidies as environmental policy instruments that complement classical tax mechanisms and shape the complex nature of fiscal impact (Morgenroth et al., 2018).

The approaches of Ukrainian scholars are characterized by a more systematic interpretation of the composition of fiscal instruments, which is based on their consideration as components of the state's fiscal mechanism, which includes revenue, expenditure, balancing, and debt elements, reflecting the full cycle of movement

of public financial resources (Melnyk & Rudenko, 2021). At the same time, fiscal instruments in a narrow sense are considered a combination of taxes and budget expenditures that ensure the functioning of public finances (Shaposhnykov et al., 2021).

Deepening research in this area involves detailing the composition of fiscal instruments, including environmental taxes, "green" excise taxes, tax breaks, and energy-efficiency support instruments, particularly state subsidies and preferential lending programs (Yasinovska & Denysiuk, 2025). Additionally, the importance of combining tax incentives, budget subsidies, and compensation mechanisms (in particular, payments for environmental pollution) to shape environmentally responsible behavior among business entities is emphasized (Hrechko et al., 2025). The expansion of the composition of fiscal instruments also occurs by including "green" finance instruments, such as green bonds, green loans, and grants, as well as public finance instruments, in particular budget investments and budget financing (Horyn et al., 2025).

Despite significant scientific achievements, research on fiscal instruments for climate resilience still suffers from conceptual fragmentation and the lack of a unified approach to their structuring. Existing approaches range from a narrow focus on environmental taxes to an expanded one that includes budget expenditures and other fiscal means, making it difficult to identify key fiscal instruments.

In this context, the scientific problem is the need for a comprehensive study of taxes and budget expenditures as basic fiscal instruments for climate resilience, taking into account the practices of EU member states and identifying the possibilities for their effective implementation in Ukraine.

### 3. Methodology

The research methodology combines systemic, institutional, and comparative approaches, enabling a comprehensive study of the role of fiscal instruments in shaping the economy's climate resilience.

First of all, the study is based on a systemic approach, in which fiscal instruments (taxes and budget expenditures) are treated as interrelated elements of a single financial mechanism for climate policy. This allowed us to identify their dual functional nature as instruments of influence on the behavior of economic agents (through the internalization of external effects) and as sources of formation of financial resources for the implementation of climate programs. Within the framework of this approach, logical-structural analysis was used to identify the relationships between the revenue and expenditure components of fiscal policy.

An important place in the methodology is occupied by the institutional approach, which enabled us to examine the peculiarities of fiscal instrument functioning within the institutional models of the EU member states and Ukraine. Thanks to this, the level of integration of environmental taxation into the climate regulation system, the interaction of tax instruments with market mechanisms (in particular, the emissions trading system), and budgetary policy, as well as institutional limitations on the effectiveness of environmental taxation in Ukraine, were analyzed.

The key to the study is a comparative analysis, which was used to compare the practice of using environmental taxes and budget expenditures in the EU member states and Ukraine. The empirical basis of the study was statistical data from international and national institutions (in particular, Eurostat and the Ministry of Finance of Ukraine) for 2020–2024. Within this approach, structural analysis methods and relative indicators (share in GDP, share in tax and budget revenues) were used, enabling assessment of the scale, structure, and effectiveness of fiscal instrument use.

To substantiate the economic nature and mechanisms of influence of environmental taxation, methods of theoretical generalization and abstraction were used, based on the provisions of the theory of external effects, the concept of "double dividend", the theory of motivation, and modern approaches to sustainable development. This allowed us to reveal the mechanism of internalization of environmental costs, the formation of price signals, and the stimulation of environmentally friendly behavior of economic agents.

Separately, the method of structural-functional analysis was applied, with the help of which the structure of environmental taxes (energy, transport, resource) and budget expenditures in the EU countries was studied, and their functional purpose in ensuring decarbonization, energy efficiency, and ecological modernization of the economy was determined.

To formulate practical recommendations, we used a scenario and normative analysis, which enabled us to identify promising directions for transforming Ukraine's fiscal policy, drawing on European experience. In particular, the need for implementing climate budgeting, expanding the tax base, integrating carbon pricing mechanisms, and strengthening the institutional capacity of environmental tax administration was substantiated.

Thus, the proposed methodology is characterized by interdisciplinary and comprehensiveness, combining quantitative and qualitative methods of analysis, which provides in-depth research of fiscal instruments as a key element of the mechanism for ensuring climate resilience, and forms a scientifically sound basis for developing recommendations for their adaptation in Ukraine.

## 4. Results

Taxes occupy a system-forming role among fiscal instruments for ensuring climate resilience, as they combine not only the fiscal function of accumulating budget resources but also a powerful regulatory potential to influence the behavior of economic agents. In modern scientific discourse, environmental taxation is considered one of the most effective mechanisms for internalizing negative externalities arising from economic activity, primarily by establishing an economically justified "price" for environmental pollution (Sandmo, 2011). This approach allows transforming environmental costs from external to internal, which directly affects the cost structure of economic entities and stimulates changes in production technologies toward greening.

In addition, taxes serve as long-term price signals for the market, influencing investment decisions and consumer preferences, thereby contributing to the development of low-carbon technologies and increasing energy efficiency. After all, the introduction of taxes on energy resources, greenhouse gas emissions, and other environmentally harmful factors not only contributes to reducing pollution but also creates the prerequisites for structural modernization of the economy, stimulates employment in "green" sectors, and ensures the achievement of strategic environmental policy goals (Tchorzewska et al., 2022).

An important characteristic of taxes as a fiscal instrument for climate resilience is their dualistic motivational nature, which is consistent with the provisions of the theory of motivation (Bandhu et al., 2024). Therefore, in the financial mechanism, taxes have both negative and positive impacts. Negative impacts are manifested through increased tax burdens (in particular, carbon taxes, environmental fees, and pollution charges), but since these activities are environmentally destructive, the role of financial sanctions is actually performed, and actions are given a deterrent and disciplinary character. Such a mechanism contributes to the attribution of responsibility to business entities for the environmental consequences of their activities and implements the "polluter pays" principle.

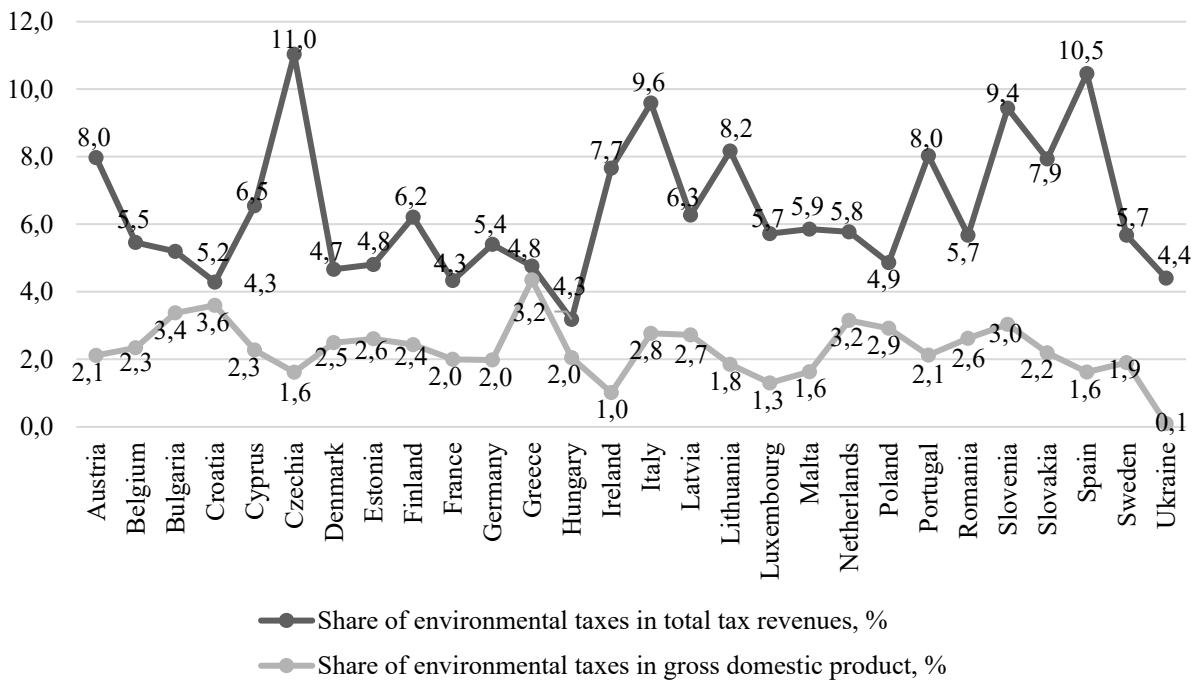
At the same time, taxes can also have positive impacts through tax breaks, tax credits, accelerated depreciation, or reduced tax rates for entities that implement environmentally friendly technologies or invest in energy efficiency. In this case, taxes serve as an incentive, reducing financial barriers to "green" investments and promoting the spread of innovations (Sapar & Kusuma, 2025). Therefore, such fiscal incentives can significantly increase the competitiveness of environmentally friendly businesses and create a favorable environment for sustainable development.

A significant advantage of taxes as a fiscal instrument is also their universality and scalability, which allows them to be applied at different levels of the economic system – from local to national and supranational (in particular, within integration associations such as the EU). They not only directly affect producers' and consumers' behavior but also provide a financial basis for implementing climate programs through budget expenditures, thereby creating synergy between the revenue and expenditure components of fiscal policy.

In the modern fiscal practice of EU member states, environmental taxes are an integrated element of climate policy and are characterized by a relatively high share of tax revenues and high functional efficiency (Fig. 1).

In EU member states, environmental taxes, on average in 2020–2024, accounted for a relatively significant share of tax revenues – mainly 4–8%, with some exceptions. Thus, the highest values of the specific weight of environmental taxes in tax revenues are observed in the Czech Republic (11.0%), Spain (10.5%), Italy (9.6%), and Slovenia (9.4%), which indicates the active use of taxes to regulate the environmental behavior of economic agents. At the same time, in countries with lower shares of environmental taxes in tax revenues (for example, Hungary – 3.2%, France – 4.3%, Croatia – 4.3%), environmental taxation plays a more supporting role in the structure of fiscal instruments. Such differentiation is due to both the characteristics of tax systems and the structure of the economy, in particular, the level of energy dependence and the intensity of natural resource use.

The share of environmental taxes in the GDP of EU member states is more stable and, on average, fluctuates between 2% and 3%, indicating the institutional maturity of this fiscal instrument. At the same time, individual countries demonstrate significantly higher values – Greece (4.3%), Croatia (3.6%), Bulgaria (3.4%), and the Netherlands (3.2%) – which are associated with both higher tax rates and a broader tax base. On the other hand, in countries with a high share of environmental taxes in budget revenues (e.g., the Czech Republic, Spain), their share in GDP is relatively low (1.6%), indicating the structural features of tax systems and the relationship between different types of taxes.



**Fig. 1.** Average share of environmental taxes in total tax revenues and GDP of EU member states and Ukraine in 2020–2024  
Source: Compiled by the authors based on [Eurostat; Ministry of Finance of Ukraine].

Against this background, Ukraine differs significantly in both the level and the functional role of environmental taxation. The share of environmental tax in tax revenues is 4.4%, which corresponds to the lower limit of the European range, but its share in GDP is critically low – only 0.1%. This indicates an extremely limited impact of environmental taxation on macroeconomic processes and climate policy in general.

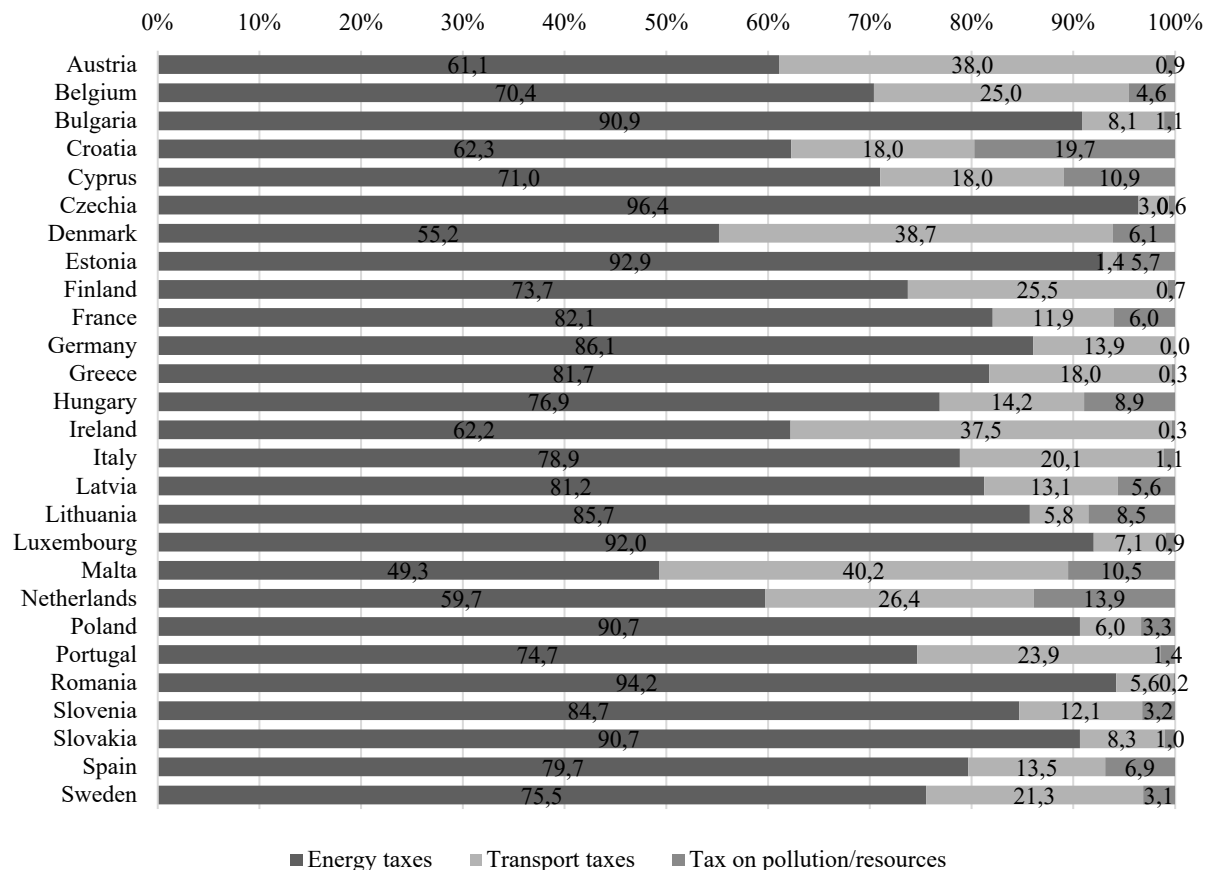
The specificity of the environmental tax in Ukraine, in our opinion, lies in several key aspects. Firstly, it is paid exclusively by legal entities that emit pollutants into the atmosphere from stationary sources of pollution; discharge pollutants directly into water bodies; waste disposal (except for the disposal of certain types of waste as secondary raw materials, which are placed on the own territories of business entities); generation of radioactive waste (including already accumulated); temporary storage of radioactive waste by its producers beyond the period established by the special conditions of the license (Verkhovna Rada of Ukraine, 2010). Such a collection mechanism indicates that the tax is mainly focused on local environmental problems rather than on global climate challenges, particularly the reduction of greenhouse gas emissions. Secondly, the rates of the environmental tax in Ukraine remain relatively low and economically insufficient to ensure a significant stimulating environmental effect. This reduces its role as a tool for internalizing externalities and effectively limits its functioning to a fiscal instrument with little regulatory impact. Thirdly, unlike the practice of EU member states, in Ukraine there is no systematic integration of environmental taxes with other climate policy instruments, particularly carbon pricing mechanisms or large-scale decarbonization programs. In addition, the targeted use of revenues from the environmental tax to finance environmental protection measures is insufficient, reducing its effectiveness.

We should note that EU member states use a comprehensive and structurally balanced model of environmental taxation, dominated by energy taxes as a climate policy tool (Fig. 2).

In most EU member states, energy taxes account for the majority of environmental taxation, with shares exceeding 70% and, in some countries, reaching critically high levels: Czech Republic – 96.4%, Romania – 94.2%, Estonia – 92.9%, Luxembourg – 92.0%, and Bulgaria – 90.9%. Such concentration indicates a strategic orientation of fiscal policy towards taxation of energy consumption, primarily fossil fuels, as the main source of greenhouse gas emissions. Accordingly, it is through energy taxes that the basic mechanism for internalizing climate externalities and forming price signals for the decarbonization of the economy is implemented.

At the same time, a relatively more balanced structure is observed in several EU Member States, where transport taxes play a significant role in the structure of environmental taxes. In particular, in Austria, their share is 38.0%; in Denmark, 38.7%; in Ireland, 37.5%; and in Malta, 40.2%, i.e., approaching or even exceeding a third of environmental tax revenues. This indicates the active use of fiscal instruments to regulate the transport sector as one of the key sources of carbon dioxide emissions, including taxation of vehicle ownership, registration, and fuel use.

The third component of environmental taxes in EU member states is pollution and resource taxes. They have the smallest share in the structure of environmental taxation, which in most countries does not exceed 5%. At the same time, some exceptions demonstrate a more active application of taxes on pollution and resources: Croatia (19.7%), the Netherlands (13.9%), Cyprus (10.9%), and Malta (10.5%). This indicates the use of a broader range of fiscal instruments to regulate local environmental problems, such as waste management, water use, and other aspects of resource efficiency.



**Fig. 2.** Structure of environmental taxes in EU member states and Ukraine on average in 2020–2024

Source: Compiled by the authors based on [Eurostat; Ministry of Finance of Ukraine].

Unlike EU member states, Ukraine applies a single environmental tax, which significantly narrows the functional and structural diversity of fiscal tools for ensuring climate resilience. This model fundamentally differs from the European one, where environmental taxation has a diversified structure and a clear focus on key sources of emissions, primarily energy and transport. In Ukraine, a narrowly focused approach prevails, focusing mainly on addressing pollution rather than preventing it through fiscal incentives.

It is worth noting that the best practices of environmental taxation in EU member states have emerged from a long evolution of fiscal policies aimed at achieving climate goals through a combination of market mechanisms and state regulation. Their key features are their systematic nature, coherence with other climate policy instruments, and a high level of institutional support.

The integration of environmental taxation into the overall climate regulation system is characteristic of EU member states, reflecting the transition to a comprehensive decarbonization model. Tax instruments are combined with market mechanisms for pricing emissions, primarily the EU Emissions Trading System (EU ETS), which allows for both stable price signals and flexibility in achieving environmental goals (Rogge & Reichardt, 2016). At the same time, their interaction with energy policy contributes to transforming the structure of energy consumption, developing renewable energy sources, and increasing energy efficiency. An important component is also the combination with budgetary instruments, when revenues from environmental taxes and emissions trading are directed to financing "green" investments and innovations (Flues & Thomas, 2015). As a result, a coordinated system is formed in which environmental taxation does not operate in isolation but reinforces the action of other instruments, ensuring a more effective impact on the economy and the achievement of climate goals.

In EU member states, energy and carbon taxes dominate environmental taxation, indicating a targeted focus on key sources of greenhouse gas emissions, primarily in the energy, transport, and industry sectors. This structure arises because fossil fuel consumption accounts for the largest share of anthropogenic emissions, and therefore the tax impact on these resources provides the most tangible environmental effect. In many EU member states, differentiated tax rates are applied depending on the carbon intensity of energy resources, their environmental characteristics, and the scope of their use, which allows for a more accurate reflection of real environmental costs in prices (Kettner-Marx & Kletzan-Slamanig, 2018). This approach generates clear, long-term price signals for economic agents, stimulating reductions in the consumption of high-carbon resources, the modernization of production processes, and the introduction of energy-efficient technologies. At the same time, it contributes to the redistribution of investment flows toward renewable energy sources and innovative decarbonization solutions, ensuring the gradual transformation of the energy system and increasing the economy's climate resilience.

A common practice in EU member states is to use taxes as a tool for the so-called "double dividend", which involves the simultaneous achievement of environmental and economic effects. On the one hand, environmental taxes reduce pollution by increasing the cost of environmentally harmful activities and creating incentives to change producers' and consumers' behavior. On the other hand, they generate stable budget revenues that can be used to reduce the tax burden on labor, capital, or other factors of production, thereby increasing economic activity and employment (Goulder, 1995). In addition, a significant portion of these revenues is directed to financing environmental investments, developing renewable energy, increasing energy efficiency, and supporting innovation, thereby enhancing the long-term impact of decarbonization. This approach allows for minimizing the potential negative socio-economic consequences of tax reforms, ensuring a more equitable distribution of the tax burden, and increasing their public acceptability. As a result, environmental taxation is transformed from a purely fiscal instrument into a multifunctional mechanism capable of simultaneously ensuring environmental efficiency and economic feasibility of state policy.

In EU member states, various tax incentive mechanisms are widely used and serve as an important tool for implementing environmental and innovation policies. These include tax breaks, tax credits, accelerated depreciation, reduced tax rates, as well as targeted preferences for investments in "green" technologies, energy efficiency, and renewable energy sources (European Commission, 2025). Such a system allows for the formation of a balanced model of state influence on the economic behavior of business entities, combining restrictive (fiscal and regulatory) instruments with positive (stimulating) financial incentives. This not only reduces environmentally harmful practices but also increases investment activity in priority sectors of the "green" economy. Such mechanisms must form long-term behavioral models of economic agents that are focused on environmental responsibility, energy efficiency, and innovation. As a result, taxes in EU member states perform not only a fiscal function but also act as a tool for strategic regulation of sustainable development, ensuring the coordination of the economic interests of business, society, and the state.

For EU member states, an important characteristic of environmental taxation is the transparency of fiscal mechanisms and a clear targeting of tax revenues, which involves their use mainly for financing decarbonization measures, the development of renewable energy, increasing energy efficiency, and environmental modernization of the economy (Kalaš, 2025). This approach ensures accountability of state institutions, clarity for taxpayers regarding the direction of fund use, and, accordingly, increases trust in fiscal policy. At the same time, it enhances the effectiveness of environmental taxation by establishing a direct link between tax revenues and the achievement of specific climate and environmental goals within the framework of EU strategic initiatives.

The prospects for the development of environmental taxation in Ukraine should be considered an element of the systemic transformation of fiscal policy toward greening and harmonization with the approaches of EU member states to sustainable development. In this context, strengthening the regulatory potential of the environmental tax through the gradual adjustment of tax rates, primarily for greenhouse gas emissions, with an orientation towards approaching the average European level, is of key importance. Such a policy will contribute to the real consideration of environmental externalities in market prices and an increase in the stimulating role of the environmental tax.

Another important direction is the structural modernization of the environmental taxation system, which involves expanding the tax base and gradually introducing comprehensive carbon pricing, consistent with European Union mechanisms, in particular the Carbon Border Adjustment Mechanism (CBAM) (Rodgers & Kendall, 2023). This lays the groundwork for Ukraine's integration into the European climate space and minimizes the risk of trade restrictions linked to product carbon footprints.

A significant way to increase the effectiveness of environmental fiscal policy is to strengthen the link between tax revenues and budget expenditures of an environmental nature. This involves institutionally anchoring part of the revenues from environmental taxes to finance energy efficiency programs, the decarbonization

of the economy, the development of renewable energy sources, and measures to adapt to climate change, thereby increasing the effectiveness of state policy in this area.

At the same time, it is advisable to ensure a balance between the fiscal and incentive functions of environmental taxation by expanding the tax benefits system for businesses that implement environmentally friendly technologies and innovations. This allows for the formation of positive economic incentives for "green" investment and technological modernization of production.

No less significant is the increase in the institutional capacity of environmental tax administration, including the development of a system for monitoring and verifying emissions, the digitalization of environmental tax administration processes, improvements in analytical control tools, and strengthened mechanisms for compliance with environmental standards. The comprehensive implementation of these areas lays the groundwork for increasing the effectiveness of environmental taxation as a tool for sustainable development and for Ukraine's integration into the European environmental and fiscal space.

Thus, treating taxes as a fiscal tool for ensuring climate sustainability allows us to identify their dual function: on the one hand, they create incentives for changing the behavior of economic agents by internalizing environmental externalities; on the other, they generate financial resources for the public sector. However, the limitation of purely tax instruments is that they cannot independently provide the necessary scale of structural transformations, especially in areas with high capital intensity, long investment cycles, and significant institutional barriers.

In this context, budget expenditures are an important fiscal instrument. While taxes primarily serve to contain and correct market imbalances, budget expenditures provide active support for environmentally friendly changes through financing public goods, infrastructure projects, innovations, and adaptation measures. It is through the expenditure part of the budget that the state can purposefully accumulate and redistribute resources to implement long-term decarbonization strategies, develop renewable energy, increase energy efficiency, and strengthen the climate resilience of territories.

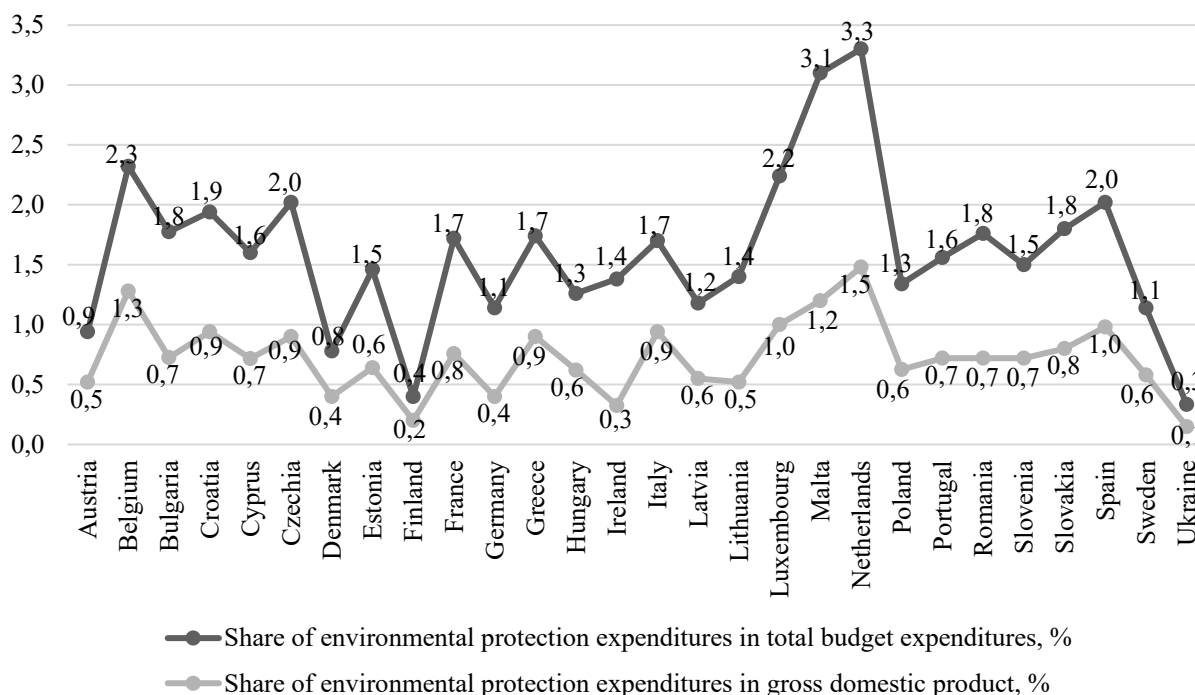
In this context, budget expenditures perform a dual motivational function in the climate policy system. On the one hand, positive motivation is implemented through financial incentives for environmentally responsible behavior of economic agents, in particular through the provision of subsidies, grants, compensation mechanisms, and targeted financing of "green" investments. This approach reduces the barriers to entry for environmental innovations and forms the economic feasibility of the transition to resource-efficient technologies (Daron et al., 2012). On the other hand, negative motivation is manifested through the indirect impact of budget policy, which restricts certain practices. Still, if they are inefficient or environmentally harmful, then reductions or reallocations of budget expenditures are accompanied by an increase in the cost of environmentally unfriendly behavior due to the combination of budget decisions with fiscal and regulatory instruments (Kalmey & Rausch, 2025). Taken together, this forms a system of "double pressure", in which the market is simultaneously stimulated to environmental innovations and gradually abandons high-emission technologies.

From a macro-financial perspective, budget expenditures also ensure the internalization of climate externalities, compensating for market failures associated with the underestimation of environmental risks. Through the program-targeted budgeting method, they integrate climate priorities into the budget process, transforming it into a strategic climate resilience management tool that reconciles economic growth, environmental security, and social sustainability.

The experience of EU member states demonstrates that budget expenditures are an important, but not isolated, instrument for ensuring climate resilience, functioning alongside tax, market, and institutional instruments (Fig. 3).

In EU Member States, on average, in 2020–2024, a stable, moderate level of financing for the environmental sector is observed: the share of relevant expenditures in the budget structure mainly varies between 1.0–2.0%, while in relation to GDP it ranges between 0.5–1.0%. At the same time, there is a pronounced inter-country differentiation, reflecting different models of climate policy implementation. Thus, the highest values of the share of budget expenditures in total budget expenditures and GDP are demonstrated by the Netherlands (3.3% and 1.5%), Malta (3.1% and 1.2%), Belgium (2.3% and 1.3%), and Luxembourg (2.2% and 1.0%), which indicates the active use of budget expenditures as a tool for financing decarbonization, the development of renewable energy, and environmental modernization. At the same time, in several economically developed countries, these indicators are relatively lower (Finland – 0.4% and 0.2%, Denmark – 0.8% and 0.4%, Germany – 1.1% and 0.4%). This situation reflects the specifics of the European model of climate policy, where budget expenditures are not the only or dominant instrument, but function in close interaction with market mechanisms (primarily the emissions trading system), tax instruments, and private investments. Therefore, a lower share of budget expenditures in total budget expenditures and GDP does not mean less effective cli-

mate policy, but indicates its diversified nature. The countries of Central and Eastern Europe (Bulgaria, Romania, Poland, Slovakia) exhibit average values for the studied indicators (1.3–1.8% and 0.6–0.8%), reflecting convergence toward European standards. They are characterized by greater reliance on budget financing for environmental measures, often in combination with EU funds for infrastructure modernization and energy efficiency improvements.



**Fig. 3.** Average share of environmental protection budget expenditures in total budget expenditures and GDP of EU member states and Ukraine in 2020–2024

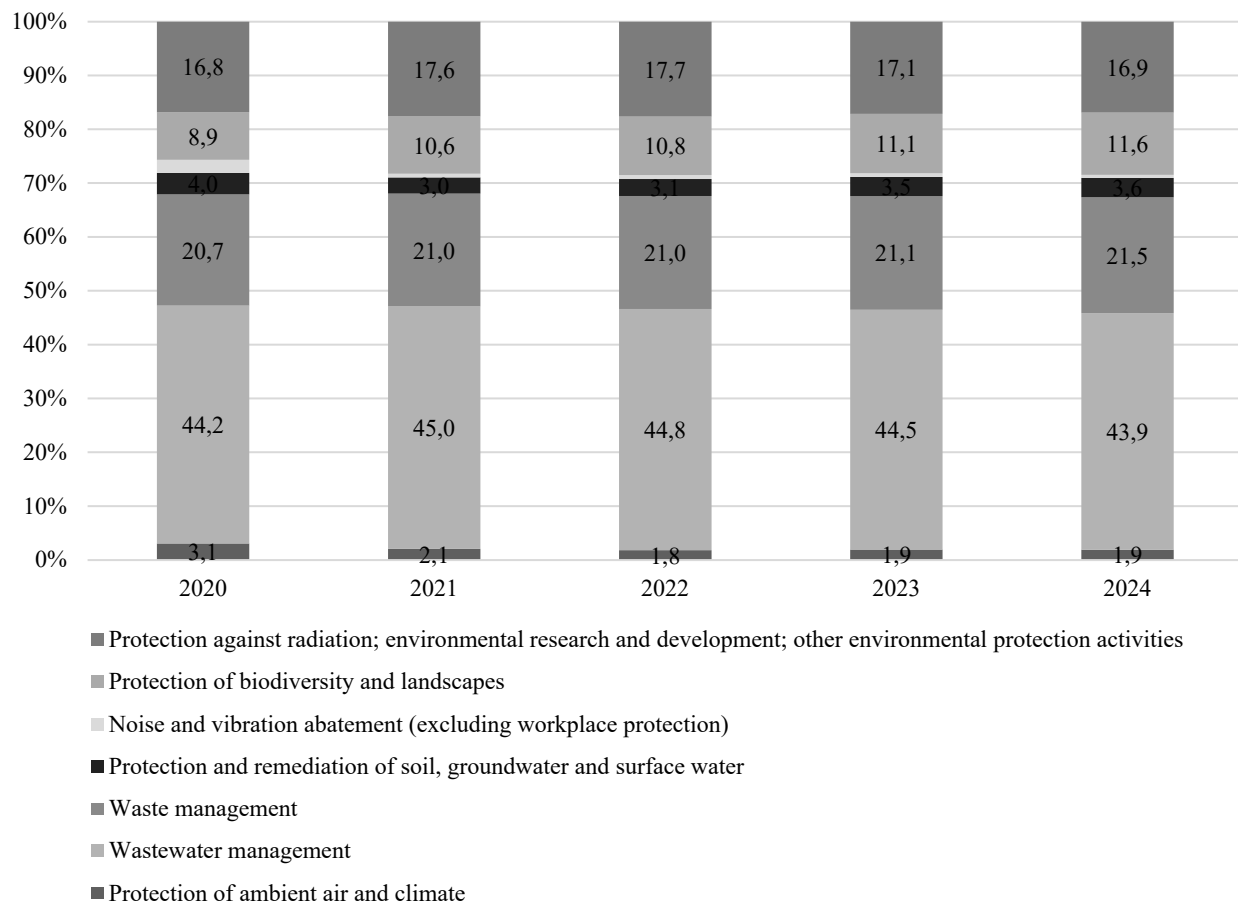
Source: Compiled by the authors based on [Eurostat; Ministry of Finance of Ukraine].

In general, the EU member states' budget expenditures on environmental protection act as a catalyst for structural change; however, not in isolation, but as an element of a comprehensive climate regulation system (Oberthür & von Homeyer, 2023). They are combined with environmental taxation, carbon pricing, and state support instruments for innovation, which provide a multiplier effect in achieving climate goals.

Against this background, Ukraine has critically low indicators: the share of environmental protection expenditures is 0.3% of total budget expenditures and only 0.1% of GDP. This indicates the state's limited fiscal capacity to ensure ecological transformation and the insufficient institutional integration of climate priorities into the budget process. Unlike EU member states, where budget expenditures are part of a comprehensive system to stimulate decarbonization, in Ukraine they remain fragmented, focused mainly on financing current environmental protection measures rather than long-term investment projects.

The structure of budget investments in the field of environmental protection, on average for 2020–2024, across EU member states demonstrates a clearly diversified and functionally balanced nature, which corresponds to the COFOG classification approaches and the strategic guidelines of the European Green Deal. Structurally, budget expenditures are distributed across several key areas, among which waste management and wastewater management dominate (Fig. 4). This is explained both by the high capital intensity of the relevant infrastructure and by the strict EU regulatory requirements for water treatment and circular waste management.

The structure of budget investments in environmental protection in EU countries, on average for 2020–2024, indicates a clearly hierarchical model of resource allocation, with infrastructure and service-oriented areas dominant. The average distribution of environmental budget investments shows that the largest share falls on wastewater management (44.5%), reflecting the systemic nature of investments in water treatment infrastructure and compliance with strict EU environmental standards. The second most important is the field of waste management (21.1%), which is functionally related to implementing the principles of the circular economy and minimizing the negative environmental impact.



**Fig. 4.** Structure of environmental protection budget expenditures in EU member states and Ukraine on average in 2020–2024

Source: Compiled by the authors based on [Eurostat; Ministry of Finance of Ukraine].

The share of the aggregated category (17.2%) that includes radiation protection, scientific research, and other activities is also significant in the composition of budget investments in environmental protection. This indicates the presence of a certain reserve for institutional support for innovations, although its level is not dominant. At the same time, budget investments in the protection of biodiversity and landscapes account for 10.6% of the total volume of environmental budget investments, with a clear upward trend (from 8.9% in 2020 to 11.6% in 2024), reflecting the gradual strengthening of the ecosystem approach in EU environmental policy.

In contrast, other environmental areas of budget investments have a relatively small share: protection of atmospheric air and climate – only 2.2%, protection of soil and water – 3.5%, reduction of noise and vibration – 1.0%. This structure indicates that the climate component is financed not only through direct environmental expenditures but is also largely integrated into other budget policies (energy, transport, innovation), which aligns with the logic of the European Green Deal.

Comparing the European model of budget investment in environmental protection with Ukraine's practice, it is worth noting significant differences in the structure and priorities of budget investment. Thus, the Ukrainian model of budget investment in environmental protection is characterized by a high concentration of resources in a single consolidated direction – prevention and elimination of pollution, with this share averaging about 75% of all environmental budget investments. This indicates a predominantly reactive nature of budget policy, focused on eliminating the consequences of environmental problems, rather than on their systematic prevention. Unlike EU member states, where funding is distributed between several functional segments (water resources, waste, biodiversity, innovations), Ukraine has insufficient diversification of environmental budget investments. Investments in preserving the nature reserve fund, scientific research, and other environmental measures remain marginal, limiting the development of the ecosystem approach and the innovative component of environmental policy.

The practice of EU member states in using budget expenditures to ensure climate resilience is characterized by the systematic integration of climate objectives into all stages of the budget process, reflecting the transition from fragmented environmental interventions to comprehensive climate-oriented budgeting. A key feature is

the implementation of the principle of "mainstreaming climate action", according to which a significant part of budget expenditures is considered through the prism of their impact on decarbonization, adaptation to climate change, and increasing the environmental sustainability of the economy (D'Alfonso, 2019). In this context, budget expenditures in EU countries increasingly serve not only distributive and socio-economic functions but also as a tool for achieving the goals of the European Green Deal.

The specificity of the EU countries' approaches lies in the combination of supranational financial mechanisms with national budgetary strategies. On the one hand, a significant amount of resources is channeled through the common EU budget, in particular through instruments such as the European Union Solidarity Fund, Horizon Europe, InvestEU programmes, and the Recovery and Resilience Mechanism, which establish mandatory quotas for climate spending (Larosa, 2023). This ensures a unified approach to financing "green" investments, including energy modernization, development of renewable energy sources, sustainable mobility, and increasing energy efficiency. On the other hand, the national budgetary systems of the member states demonstrate different models of implementing climate priorities, which is due to the level of economic development, the structure of the energy sector, and institutional capacity. Some EU member states (including Italy, France, Denmark, Ireland, and the Netherlands) are actively developing the practice of "green budgeting" as an element of medium-term budget planning, and Greece, Latvia, Poland, and Slovenia plan to introduce it in the future. It involves not only labeling budget expenditures by their environmental impact, but also incorporating climate indicators into the system for assessing the effectiveness of public investment projects (OECD, 2021). Thus, the effectiveness of budget expenditures is increasingly measured not only by financial or social indicators, but also by their contribution to reducing greenhouse gas emissions, increasing energy efficiency, and enhancing infrastructure resilience to climate risks.

The Nordic practice of integrating climate resilience into the logic of fiscal risk management deserves special attention. For example, in Sweden and Finland, budget decisions are accompanied by an analysis of long-term climate risks for public finances, including potential costs from extreme weather events, infrastructure degradation, and transformational costs in the energy sector. This allows us to consider climate spending not as expenses in the narrow sense, but as investments in reducing the future fiscal burden. This approach reflects the general transformation of fiscal policy towards preventive risk management, in which the budget serves not only as an instrument for redistributing resources but also as a mechanism for minimizing long-term macro-financial threats. In particular, the above countries apply elements of climate-oriented fiscal analysis, which involve integrating climate change scenario modeling into the process of forming medium-term budgetary frameworks and assessing the sensitivity of public finances to physical and transitional climate risks (Salmon-Genel, 2025). An important component is the inclusion of climate parameters in the system for assessing the effectiveness of public investments, thereby ensuring alignment of budgetary decisions with long-term decarbonization and adaptation goals. In addition, significant attention is paid to the institutionalization of relevant approaches, in particular through the development of "climate risk screening" methodologies for budgetary programs and infrastructure projects, which allows identifying potential fiscal liabilities at the planning stage. As a result, a more sustainable model of public finances is emerging, in which climate expenditures serve as strategic investments to reduce the economy's vulnerability, increase adaptive capacity, and prevent the accumulation of future hidden fiscal risks.

In Southern European countries, such as Spain, Italy, and Portugal, a significant share of budget expenditures is directed toward adaptation measures due to their high vulnerability to climate change. Here, investments in water infrastructure, drought prevention, forest programs, and coastal protection are prioritized. The specificity of this region is that climate policy has a pronounced territorial dimension, and budget resources are often concentrated at the regional and municipal levels. This is due to both the significant spatial heterogeneity of climate risks and decentralized public finance management models that involve the active participation of subnational authorities in the planning and implementation of climate measures. At the same time, these countries tend to combine national budget programs with financing from supranational sources, primarily EU funds, which allows scaling up adaptation investments and ensuring their consistency with pan-European climate goals. Another important feature is the focus on integrated management of natural resources, particularly water basins and coastal zones, which involves the use of intersectoral budgeting approaches. In addition, budget policies in these countries are increasingly taking into account the long-term socio-economic consequences of climate change, including risks to the agricultural sector, tourism, and energy security, which necessitate greater efficiency in public investments and their targeting to increase the adaptive capacity of territories (Cramer, 2018). As a result, a model of climate-oriented budgeting is emerging, in which expenditures serve not only to respond to the consequences of climate change but also as a tool for the long-term structural transformation of regional economies.

At the same time, in Central and Eastern Europe, there is a gradual shift in budget expenditures towards modernizing energy systems and reducing dependence on fossil fuels. Both national budgets and EU funding, in particular through just transition funds, play an important role here. The practice of these states is characterized by a combination of infrastructure investments with social compensation mechanisms to mitigate the consequences of the energy transformation. In a broader context, this reflects the "dual transformation" model, in which budgetary policy simultaneously serves to stimulate decarbonization and to ensure social stability in regions dependent on carbon-intensive industries. In particular, a significant part of the resources is directed to modernizing energy infrastructure, increasing the energy efficiency of the housing stock, developing renewable energy sources, and re-profiling industrial regions that were traditionally based on coal generation. At the same time, instruments for compensating for socio-economic losses are applied, including retraining programs for workers, employment support, and regional investment packages aimed at diversifying local economies. An important feature is that the financial architecture of the "just transition" ensures the integration of the European Union's supranational resources with national budgetary priorities, thereby reconciling long-term climate goals with short- and medium-term socio-economic constraints. As a result, a gradual yet systemic shift in public spending structures emerges, integrating climate policy into industrial, social, and regional policies to ensure a transition to a more sustainable, diversified model of economic development.

In line with EU member-state practice, improving budget expenditures to ensure climate resilience in Ukraine should be understood as a comprehensive transformation of the budget process, encompassing the stages of planning, implementation, monitoring, and evaluation of the effectiveness of state and local budget expenditures. The formation of a new Ukrainian effective model of climate-oriented budget policy requires not point changes, but a systemic restructuring of the architecture of the budget process with the transition from resource-oriented to performance- and risk-oriented approaches.

First of all, it is necessary to institutionalize climate budgeting as a mandatory element of the budget cycle. This means establishing in the legislation the requirement that each budget program undergo a climate impact assessment at the planning, approval, and implementation stages. This approach should ensure the integration of parameters for greenhouse gas emission reduction, energy efficiency improvement, and infrastructure adaptive capacity into the program-target method's logic, enabling the transition from formal financing to climate results management.

The second key area is the introduction of a unified system for climate-labeling budget expenditures. It should be based on a clear classification of expenditures according to the degree of their impact on climate goals and provide for differentiation between expenditures that directly contribute to decarbonization, are neutral, or potentially increase the environmental burden. Such a system has not only analytical but also managerial significance, as it provides a basis for transparency in budget decisions, improves the quality of fiscal monitoring, and enables the reallocation of resources towards environmentally efficient investments.

The third direction involves transforming the system for evaluating budget programs by adopting a performance-based financing model. This means introducing mandatory climate performance indicators that reflect specific quantitative outcomes of implementing state policies, particularly in reducing emissions, increasing the share of clean energy, and reducing the energy intensity of the economy. Such a reorientation will strengthen the link between budget allocations and the achieved social impact, reducing the risk of inefficient use of public resources.

The fourth important direction is the integration of climate risk analysis into the system of medium- and long-term budget planning. This refers to the need to systematically account for the physical, economic, and transformational risks associated with climate change when preparing the budget declaration and strategic development documents. This will allow for a transition to a preventive model of fiscal policy, in which potential budget losses from climate shocks are taken into account at the planning stage, rather than *ex post facto*.

The fifth direction is to strengthen the budget system's investment focus by concentrating resources on structural "green" projects. This involves forming a long-term portfolio of public investments focused on modernizing energy infrastructure, developing renewable energy, improving the energy efficiency of the housing stock, and building a sustainable transport system. Such a reorientation will not only reduce the economy's carbon footprint but also create multiplier effects on economic growth.

The sixth direction is the introduction of budget-financing conditionality mechanisms, under which funding is allocated based on the achievement of specific climate goals. This approach strengthens institutional discipline, increases the efficiency of resource use, and stimulates executive bodies to achieve measurable results, rather than formal disbursement of funds.

Finally, a systemic prerequisite for the successful implementation of these changes is the strengthening of institutional coordination between levels of government. It is necessary to ensure coherence in climate priorities across state, regional, and local levels to improve the targeting and effectiveness of budget decisions. This

involves developing decentralized mechanisms to implement climate programs and forming regional investment platforms focused on the adaptation and transformation needs of territories.

At the same time, the effectiveness of the proposed fiscal instruments of climate policy is determined not only by their economic design but also by the political and institutional factors governing their implementation. The experience of EU Member States demonstrates that the success of environmental tax reforms largely depends on governments' capacity to overcome institutional resistance from vested-interest groups whose activities are directly associated with the use of fossil fuels or other carbon-intensive economic activities. The introduction or increase of environmental taxes is often accompanied by conflicts of interest between the long-term societal benefits of decarbonization and the short-term economic costs incurred by specific sectors of the economy. Under such circumstances, mechanisms of public dialogue, transparency in decision-making processes, and the development of compensation instruments for the most vulnerable population groups and business entities become particularly important.

An equally important factor is the level of a state's fiscal capacity. Implementing a comprehensive climate policy requires substantial financial resources to support the energy transition, infrastructure modernization, the development of emissions-monitoring systems, and the financing of climate adaptation programs. For Ukraine, the issue of fiscal capacity has become especially relevant amid wartime challenges and the considerable pressure on public finances. Consequently, environmental tax reforms should be accompanied by a gradual implementation process, extensive utilization of international financial assistance, blended finance instruments, and public-private partnership mechanisms. Only under conditions of adequate institutional support, broad public acceptance, and sufficient fiscal capacity can environmental taxation evolve from a formal source of budget revenues into an effective instrument for enhancing climate resilience and achieving the strategic objectives of sustainable development.

In the context of European integration, establishing a political consensus on the need to green fiscal policy is also critical for Ukraine. The lack of alignment between strategic climate objectives and current economic priorities may undermine the effectiveness of even well-designed fiscal instruments. Therefore, alongside the modernization of fiscal instruments, it is advisable to strengthen institutional coordination among public authorities, businesses, civil society organizations, and international partners. Such cooperation would enhance the legitimacy of climate reforms, minimize political risks, and ensure their long-term sustainability.

## 5. Conclusions

The study concludes that fiscal instruments are a key element of the climate policy architecture, as they simultaneously shape economic behavior and provide a financial base for implementing decarbonization and climate change adaptation measures. Their effectiveness is determined not only by the level of tax burden or the volume of budget expenditures, but primarily by the degree of institutional integration into the overall system of public administration and consistency with long-term strategic development goals.

Analysis of the practices of EU member states shows that a complex combination of taxes and budgetary expenditures ensures the effectiveness of fiscal policy in climate resilience. At the same time, environmental taxation serves as a price signal that adjusts the behavior of economic agents, while budget expenditures provide the investment basis for the structural transformation of the economy. It is also important to combine the stimulating and disincentive actions of fiscal instruments, which helps ensure a balance between environmental efficiency and the socio-economic acceptability of decarbonization policy.

It has been proven that the most effective models of fiscal support for climate resilience are based on the principle of integrating climate goals into all stages of the budget process. This involves transitioning to climate-oriented budgeting, adopting a system of labeling expenditures by environmental impact, introducing performance financing, and using climate performance indicators. Together, these tools transform the budget from a passive distribution mechanism into an active tool for managing structural economic changes.

Ukraine has been found to have structural and functional limitations in the use of fiscal climate policy instruments, manifested in low shares of environmental taxes and budget expenditures, insufficient diversification of instruments, and weak integration of climate priorities into the budget process. This results in a limited ability of the fiscal system to influence the pace of decarbonization and to increase the economy's climate resilience.

The prospects for the development of environmental taxation in Ukraine are associated with its phased institutional modernization, which should include expanding the tax base, gradually introducing carbon pricing, strengthening the tax incentive function, and integrating with budget mechanisms for financing "green" investments. It is also important to increase the institutional capacity of the tax administration through digitalization, improved monitoring systems, and transparency in the use of environmental revenues.

The priority areas for the development of budget expenditures in Ukraine should be the institutionalization of climate budgeting, the introduction of a system of climate labeling of expenditures, the transition to a performance-based financing model, the integration of climate risk analysis into budget planning, and the strengthening of the investment orientation of the budget system. The implementation of these measures will ensure the transition to a systemic model of public finance management focused on achieving measurable climate results.

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