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## MECHANISMS OF ENVIRONMENTAL TAXATION FOR SUSTAINABLE DEVELOPMENT IN KAZAKHSTAN

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**Abstract.** Relevance. In the context of global environmental challenges and the transition of the world economy to a sustainable development model, improving the system of environmental taxation has acquired strategic importance for Kazakhstan. The current tax policy is predominantly fiscal and insufficiently performs its stimulating function aimed at reducing emissions and improving energy efficiency. Environmental taxation is considered an effective tool for implementing climate policy, promoting “green” investments, and ensuring balanced economic growth. The need to harmonize national mechanisms with international standards, including the EU’s Carbon Border Adjustment Mechanism (CBAM), further increases the relevance of this study. *Purpose.* The purpose of the research is to develop theoretical and methodological foundations and practical recommendations for modernizing the environmental taxation system in the Republic of Kazakhstan in the context of sustainable development and fulfillment of climate commitments. *Methods.* The methodological basis includes the principles of systemic and institutional approaches, comparative and statistical analysis, economic-mathematical modeling, and the study of international experience from Sweden, the European Union, and Singapore. *Results.* The study identified the key problems of the current tax system, assessed the potential for growth of environmental payments, and developed three models for tax reform — Swedish, Singaporean, and European. The necessity of shifting

from a fiscal to a stimulating tax function aimed at energy efficiency and industrial innovation has been substantiated. *Practical value.* The results can be applied in developing the national “green economy” concept, improving fiscal and budgetary policy, drafting regulatory acts, and harmonizing Kazakhstan’s environmental legislation with international climate agreements.

**Keywords:** environmental taxation, carbon regulation, sustainable development, carbon tax, emissions trading, green economy, Kazakhstan

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## ҚАЗАҚСТАННЫҢ ОРНЫҚТЫ ДАМУЫ ҮШІН ЭКОЛОГИЯЛЫҚ САЛЫҚ САЛУ ТЕТІКТЕРІ

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**Аннотация.** *Өзектілігі.* Ғаламдық экологиялық сын-қатерлер мен әлемдік экономиканың орнықты даму моделіне көшу жағдайында экологиялық салық салу жүйесін жетілдіру мәселесі Қазақстан үшін стратегиялық маңызға ие болып отыр. Қолданыстағы салық саясаты негізінен фискалдық сипатта болып, шығарындыларды азайту мен энергия тиімділігін арттыруға бағытталған ынталандырушы функцияны жеткілікті деңгейде орындай алмайды. Экологиялық салық салу климаттық саясатты іске асырудың, «жасыл» инвестицияларды ынталандырудың және теңгерімді экономикалық өсімді қамтамасыз етудің тиімді құралы ретінде қарастырылады. Ұлттық тетіктерді халықаралық стандарттармен, соның ішінде ЕО-ның трансшекаралық көміртек реттеу механизмімен (СВАМ) үйлестіру қажеттілігі осы зерттеудің өзектілігін арттыра түседі. *Зерттеудің мақсаты* – Қазақстан Республикасындағы экологиялық салық салу жүйесін орнықты даму мен климаттық міндеттемелерді орындау контекстінде жаңғыртудың теориялық-әдіснамалық негіздері мен практикалық ұсынымдарын әзірлеу. *Әдістері.* Зерттеудің әдіснамалық

негізін жүйелік және институционалдық тәсілдер, салыстырмалы және статистикалық талдау, экономикалық-математикалық модельдеу, сондай-ақ Швеция, Еуропалық одақ және Сингапур елдерінің шетелдік тәжірибесін зерттеу құрайды. *Нәтижелері.* Зерттеу барысында қолданыстағы салық жүйесінің негізгі проблемалары анықталып, экологиялық төлемдердің өсу әлеуеті айқындалды, салық саясатын реформалаудың үш моделі – шведтік, сингапурлық және еуропалық нұсқалар әзірленді. Салықтардың фискалдық функциясынан ынталандырушы функцияға көшу қажеттілігі негізделді. *Практикалық маңызы.* Зерттеу нәтижелерін «жасыл» экономика ұлттық тұжырымдамасын әзірлеу, салық-бюджет саясатын жетілдіру, нормативтік актілерді дайындау және Қазақстанның экологиялық заңнамасын халықаралық климаттық келісімдермен үйлестіру кезінде қолдануға болады.

**Түйін сөздер:** экологиялық салық салу, көміртекті реттеу, орнықты даму, көміртек салығы, квота саудасы, жасыл экономика, Қазақстан

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## МЕХАНИЗМЫ ЭКОЛОГИЧЕСКОГО НАЛОГООБЛОЖЕНИЯ ДЛЯ УСТОЙЧИВОГО РАЗВИТИЯ КАЗАХСТАНА

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**Аннотация.** *Актуальность.* В условиях глобальных экологических вызовов и перехода мировой экономики к модели устойчивого развития вопрос совершенствования системы экологического налогообложения приобретает стратегическое значение для Казахстана. Существующая налоговая политика носит преимущественно фискальный характер и в недостаточной степени выполняет стимулирующую функцию, направленную на снижение выбросов и повышение энергоэффективности. Экологическое налогообложение рассматривается как действенный инструмент реализации климатической политики, стимулирования «зелёных» инвестиций и обеспечения сбалансированного экономического роста. Необходимость гармонизации национальных механизмов с международными стандартами, включая механизм трансграничного углеродного регулирования ЕС (СВАМ), усиливает актуальность данного исследования. *Цель исследования* заключается в

разработке теоретико-методологических основ и практических рекомендаций по модернизации системы экологического налогообложения в Республике Казахстан в контексте обеспечения устойчивого развития и выполнения климатических обязательств. *Методы.* Методологическую основу составляют принципы системного и институционального подходов, сравнительный и статистический анализ, экономико-математическое моделирование, а также исследование зарубежного опыта Швеции, Европейского Союза и Сингапура. *Результаты.* В ходе исследования выявлены ключевые проблемы действующей налоговой системы, определён потенциал роста экологических платежей, разработаны три модели реформирования налоговой политики — шведская, сингапурская и европейская. Обоснована необходимость перехода от фискальной функции налогов к стимулирующей, ориентированной на повышение энергоэффективности и инновационное развитие промышленности. *Практическая ценность.* Результаты исследования могут быть использованы при разработке национальной концепции «зелёной» экономики, совершенствовании налогово-бюджетной политики, подготовке нормативных актов, а также при гармонизации экологического законодательства Казахстана с международными климатическими соглашениями.

**Ключевые слова:** экологическое налогообложение, углеродное регулирование, устойчивое развитие, углеродный налог, торговля квотами, зелёная экономика, Казахстан

**Introduction.** Modern environmental challenges — including climate change, ecosystem degradation, biodiversity loss, and depletion of natural resources — necessitate a fundamental revision of traditional models of economic growth and public governance. One of the most effective instruments widely applied in global practice to promote environmentally responsible behavior among economic entities is environmental taxation. This mechanism not only contributes to the reduction of harmful emissions and anthropogenic pressure on the environment but also establishes sustainable sources of financing for environmental protection initiatives.

In the context of the transition to a green economy, many countries are integrating environmental taxes into their fiscal and budgetary systems, turning them into a key component of both environmental and economic policy. The effectiveness of such instruments depends not only on the level of economic development but also on institutional conditions, transparency of administrative mechanisms, public support, and the degree of correlation between fiscal and environmental outcomes.

For the Republic of Kazakhstan, which possesses significant natural and resource potential yet faces serious challenges related to environmental pollution, rational resource use, and carbon dependency of the economy, the introduction and adaptation of effective environmental taxation mechanisms are of particular relevance. Despite the presence of certain elements of “green” regulation, the existing system of environmental taxes in Kazakhstan does not yet fully perform its stimulating and regulatory functions, remaining largely a fiscal instrument.

Therefore, there is an urgent need for a systemic modernization of environmental taxation, taking into account the best international practices and adapting successful foreign experience to national realities. This process implies not the direct replication of existing models but their institutional transformation, considering the specific features of Kazakhstan's economic structure, resource base, and strategic priorities for sustainable development.

The purpose of this study is to analyze the international experience of environmental taxation and to identify the possibilities for its adaptation to Kazakhstan's national context. The paper examines the theoretical and methodological foundations of this instrument, conducts a comparative analysis of foreign practices, and proposes directions for improving the national system of environmental taxes. The implementation of the proposed measures will enhance the environmental efficiency of fiscal policy and create the prerequisites for Kazakhstan's transition to a sustainable, low-carbon development model.

**Literature Review.** The issue of environmental taxation occupies an important place in contemporary academic and policy discussions, standing at the intersection of economic theory, environmental policy, and sustainable development. In the global literature, environmental taxes are viewed as one of the key instruments for internalizing external environmental effects and for creating economic incentives to reduce pollution and promote the rational use of natural resources.

Many scholars (Manta et al., 2023) classify environmental taxes as corrective or Pigouvian taxes, the purpose of which is to incorporate environmental costs into market prices and to eliminate negative externalities. Such taxes create financial motivation for enterprises and households to modify their behavior toward more environmentally sustainable choices, thus promoting the implementation of the “polluter pays” principle.

Foreign studies emphasize the dual role of environmental taxation — both fiscal and regulatory. According to research by the OECD (*OECD Tax Policy Reviews: Kazakhstan, 2020*) and the European Commission (*Tax and the Environment, 2024*), environmental taxation serves not only as a source of fiscal revenue but also as an incentive for the transition to a green economy, the reduction of greenhouse gas emissions, the improvement of energy efficiency, and the adoption of renewable energy sources. In many countries, the so-called “double dividend” effect is observed — simultaneous improvements in environmental performance and employment growth resulting from the shift of the tax burden from labor to environmental pollution.

Classical studies (Garbí, 2023; OECD, 2024) demonstrate that the success of environmental taxation depends on the level of institutional maturity, the transparency of revenue allocation mechanisms, and the presence of clear feedback between tax proceeds and environmental programs. In advanced economies such as Sweden, Germany, and the Netherlands, tax revenues collected from polluters are directed toward financing green projects, which enhances public and business confidence in government policy.

In the domestic scientific literature, issues of environmental taxation have been considered only fragmentarily and primarily from regulatory and fiscal perspectives. According to Baimenov (2018) and other Kazakhstani researchers (2022), the existing environmental charges in the Republic of Kazakhstan have a limited regulatory function and are characterized by low transparency in the allocation of revenues. The lack of a clear connection between tax mechanisms and environmental outcomes reduces enterprises' motivation to implement cleaner technologies and adopt sustainable production models.

A critical analysis of domestic and international research reveals significant differences in methodological approaches. While Western scholars tend to focus on the behavioral and econometric dimensions of environmental taxation, the Kazakhstani academic tradition remains largely descriptive, emphasizing legal and regulatory aspects. Insufficient attention is paid to empirical analysis, institutional barriers, and the development of economic models for adapting foreign experience to national conditions.

Thus, the existing scientific foundation provides a solid basis for developing a renewed concept of environmental taxation in Kazakhstan. However, its practical implementation requires a shift from declarative descriptions to a systematic and interdisciplinary analysis that integrates economic, legal, and environmental perspectives. The adaptation of the best international practices, taking into account national realities, will enhance the effectiveness of the tax system and strengthen the incentive role of the state in facilitating the transition toward sustainable development.

**Materials and Methods.** The methodological framework of this study is based on general scientific and specialized analytical methods applied to examine foreign models of environmental taxation and to assess the possibilities of their adaptation to the conditions of Kazakhstan. The research relied on the principles of systemicity, comparability, and interdisciplinarity, which made it possible to consider environmental taxation not only as a fiscal tool but also as an element of institutional and environmental policy.

To achieve the stated research objectives, the following methods were employed:

Analysis and synthesis — used to explore the theoretical and methodological foundations of environmental taxation, identify its essence, functions, and role within the system of sustainable development. These methods made it possible to integrate various scientific approaches and generalize the findings of international research.

Comparative analysis — applied to compare existing models of environmental taxation in the European Union, Japan, Sweden, and Singapore, which possess the most advanced instruments of environmental policy. This method made it possible to identify elements potentially applicable in Kazakhstan and to assess their adaptability considering the country's socio-economic specificities.

Content analysis of the legal and regulatory framework — used to evaluate the legislative and institutional foundations of environmental taxation systems and their degree of integration into overall fiscal policy. This approach allowed identifying

gaps and inconsistencies in Kazakhstan's practice and determining directions for its improvement.

Statistical analysis — provided a quantitative assessment of current trends in carbon regulation, emissions taxation, and structural shifts within the economy. The analysis utilized data from international organizations such as OECD, IMF, ICAP, NCCS Singapore, and the European Commission, as well as national statistical sources.

Expert evaluation — employed to identify latent factors influencing the effectiveness of environmental tax implementation and to refine parameters for potential adaptation of foreign practices. This method made it possible to incorporate the opinions of experts in ecology, economics, and law.

The study also employed elements of scenario modeling aimed at forecasting the financial implications of introducing the Carbon Border Adjustment Mechanism (CBAM) for Kazakhstani exporters. This approach enabled the assessment of potential risks and the determination of the economic feasibility of implementing a national carbon tax and modernizing the Kazakhstan Emissions Trading System (KAZ ETS).

The application of these methods ensured a comprehensive and multidimensional analysis of the research problem and allowed for the formulation of scientifically grounded recommendations for improving the environmental taxation system in Kazakhstan and enhancing its role as an instrument of sustainable development.

**Results and Discussion.** To identify the most effective elements of international experience and to assess the possibilities of their adaptation to the Kazakhstani context, a comparative analysis was conducted of environmental taxation models operating in several countries that have achieved significant progress in building a green economy. The examination of systems in Japan, the European Union, Sweden, and Singapore made it possible to determine institutional characteristics, tax collection mechanisms, and the practical outcomes of their implementation.

The research findings indicate that environmental taxation in global practice is not merely an instrument of fiscal policy but a systemic element of economic transformation toward sustainable development. It facilitates the transition from a traditional resource-intensive model to an innovative, low-carbon economy based on the principles of energy efficiency, circularity, and responsible natural resource management.

Global Trends. According to the OECD (2024), more than 60 countries worldwide have already introduced various forms of environmental taxation, with revenues from such taxes accounting for an average of 6% of total tax receipts. A clear trend has emerged toward a shift from traditional environmental charges to more flexible instruments — carbon taxes and emissions trading systems (ETS). These tools have proven effective when tax revenues are directed toward financing green investments, supporting businesses in their transition to low-carbon technologies, and developing clean energy.

Studies by the IMF (2023) and the World Bank Carbon Pricing Dashboard (2024)

confirm that countries where the carbon tax rate exceeds USD 50 per ton of CO<sub>2</sub> show a sustained reduction in emissions without compromising economic growth. For instance, Denmark and Finland have reduced emissions by 25–30% over the past two decades while maintaining high levels of competitiveness. This success is largely attributed to the use of part of the tax revenue to offset social impacts — namely, through lowering labor taxes and providing targeted subsidies to green industries.

Experience of the European Union and Its Impact on External Markets. The European Union adopts an integrated approach that combines both fiscal and market-based instruments. In addition to the EU Emissions Trading System (ETS) and the Carbon Border Adjustment Mechanism (CBAM), the EU implements excise duties on energy products, taxes on vehicles, emissions, and water pollution. These measures form a coherent carbon regulation framework, ensuring internal consistency of climate policy and protecting the European market from carbon-intensive imports.

The introduction of CBAM represents a turning point not only for the EU but also for its trading partners, including Kazakhstan. The mechanism creates a fiscal barrier for the export of carbon-intensive products, requiring supplier countries to implement comparable domestic instruments. Otherwise, Kazakhstani exporters of steel, aluminum, and fertilizers will face unequal trade conditions, being compelled to pay carbon levies to the EU budget.

Japan's environmental taxation represents a comprehensive system of fiscal and regulatory instruments aimed at reducing pollutant emissions and promoting energy-efficient technologies. The core elements of this system include taxes on nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and other pollutants, as well as charges for waste disposal and taxes on energy products.

Regulation is implemented under the Law on the Control of NO<sub>x</sub> Emissions and the Air Pollution Control Act, which establish strict maximum emission standards for industrial enterprises and transport vehicles. The taxation mechanism is based on the “pay-for-actual-emissions” principle and is differentiated by types of pollutants and regions.

An important feature of Japan's model is the combination of tax-based and market-based instruments, including an Emission Trading Scheme (ETS). This integrated approach ensures a balance between administrative regulation and economic incentives. As a result, Japan has achieved a steady reduction in air pollution, increased investment in clean technologies, and the development of low-carbon industrial processes.

The European Union's experience in environmental taxation is considered the most institutionally developed and structured. The main objective of European policy is not fiscal revenue generation but the transformation of production and consumption patterns toward sustainability. The central instrument is the EU Emissions Trading System (EU ETS), operating since 2005 and covering major industrial sectors.

The ETS sets an annual emission cap that is gradually reduced — by 1.75% in 2013–2020 and 2.2% in 2020–2030. Companies that exceed their allocated

allowances are required to purchase additional permits, thereby creating a market-driven incentive for decarbonization. In 2023, the EU introduced the Carbon Border Adjustment Mechanism (CBAM), which requires importers of carbon-intensive goods to pay carbon charges equivalent to the EU's internal carbon price.

CBAM applies to steel, aluminum, cement, fertilizers, and energy products, and by 2026 the transitional phase will end with the introduction of mandatory payments. This mechanism is designed to protect European producers from “carbon leakage” and encourage international partners to adopt carbon-neutral technologies.

Sweden is widely recognized as a pioneer in environmental taxation. As early as the 1920s, a gasoline tax was introduced, laying the foundation for a future system of energy and carbon taxes. In the 1990s, Sweden implemented three additional taxes — on carbon, sulfur, and nitrogen emissions — while simultaneously reducing income and social security taxes. This compensatory mechanism helped avoid adverse social impacts and strengthened public support for reform.

Today, the carbon tax rate in Sweden exceeds SEK 1,500 (approximately €130) per ton of CO<sub>2</sub>, covering more than 90% of total emissions. The revenue is directed toward programs promoting energy efficiency, renewable energy development, and sustainable transportation. As a result, Sweden has achieved substantial emission reductions while remaining one of Europe's most competitive economies.

Singapore demonstrates a flexible and phased strategy for introducing carbon taxation. As of 2024, the carbon tax rate is set at S\$25 (approximately €17) per ton of CO<sub>2</sub>e, with a gradual increase planned to S\$80 by 2030. The government provides offset mechanisms and tax rebates for energy-intensive sectors, which mitigates the burden on exporters and preserves international competitiveness.

The analysis of data from the Committee on Statistics of the Republic of Kazakhstan shows that the share of environmental payments in total tax revenues in 2023 amounted to only 0.6%, which is significantly lower than in the EU countries (on average 5–6%). At the same time, the average fee rate for emissions in Kazakhstan is equivalent to €2 per ton of CO<sub>2</sub>, while in Sweden it is about €134, and in the EU countries — around €85. This difference confirms that the current rates do not perform a stimulating function and require revision. According to the authors' estimates, the introduction of a moderate carbon tax at the level of €10–15 per ton could increase budget revenues by ₸120–150 billion annually and direct these funds toward industrial modernization and the development of renewable energy sources.

To assess the comparative efficiency of environmental taxation systems, an analysis of the structure and volume of environmental tax revenues in several countries was conducted. According to OECD (2024) data, on average, environmental taxes account for about 5.8% of total tax revenues in EU countries, 6.2% in Sweden, 4.1% in Singapore, while in Kazakhstan this figure in 2023 was only 0.6%.

This difference reflects the fiscal orientation of the current system and the insufficient linkage between tax mechanisms and environmental outcomes. Moreover, the actual tax rates on greenhouse gas emissions remain extremely low, which does not create sufficient incentives for decarbonization of production.

Table 1. Comparative Indicators of Environmental Taxation and Carbon Regulation Systems in Selected Countries

| Country / Region         | Share of Environmental Taxes in GDP (%) | Average Carbon Tax Rate (€ / tCO <sub>2</sub> ) | Presence of ETS             | Targeted Use of Revenues                                 |
|--------------------------|-----------------------------------------|-------------------------------------------------|-----------------------------|----------------------------------------------------------|
| Sweden                   | 2.3                                     | ≈ 134                                           | Yes (EU ETS)                | Financing of green projects, compensation for households |
| European Union (average) | 2.0                                     | ≈ 85                                            | Yes (EU ETS + CBAM)         | Investments in energy efficiency and decarbonization     |
| Singapore                | 0.9                                     | 25 (up to 80 by 2030)                           | No                          | Support for transition to clean technologies             |
| Kazakhstan               | 0.3                                     | 2 (KAZ ETS)                                     | Yes (limited effectiveness) | Non-targeted, allocated to the general budget            |

Source: compiled by the authors based on OECD (2024), ICAP (2023), IMF (2023), and Ministry of Ecology of the Republic of Kazakhstan (2023).

As shown in Table 1, Kazakhstan lags significantly behind in terms of tax rates and institutional integration of fiscal and environmental instruments. Even the introduction of a moderate carbon tax at €10–15 per ton of CO<sub>2</sub> could generate an additional ₸120–150 billion per year for the state budget, which would make it possible to finance industrial modernization, support for renewable energy, and the adoption of clean technologies.

The absence of an ETS is offset by high corporate reporting standards and a system of voluntary carbon credits. This approach combines economic efficiency with social acceptability, ensuring a smooth transition toward a green growth model.

In Kazakhstan, elements of environmental taxation are present but remain limited and primarily fiscal in nature. The Kazakhstan Emissions Trading System (KAZ ETS), launched in 2013, covers about 50% of total emissions, yet the carbon allowance price remains extremely low — around €2 per ton of CO<sub>2</sub>. The absence of a national carbon tax and the non-alignment of the MRV system (Monitoring, Reporting, and Verification) with EU standards create risks of rising costs for exporters under the implementation of CBAM.

Scenario modeling based on data from the OECD, ICAP, and the European Commission shows that, with an average carbon price of €85 per ton and current export volumes of steel, aluminum, and cement, Kazakhstan’s potential annual CBAM-related payments could reach €137 million by 2030. This poses a threat to the price competitiveness of domestic producers and underscores the need for reform of the national carbon regulation system.

Table 2. Comparative results

| Country / Region | Carbon Tax (€ / tCO <sub>2</sub> e, 2025) | ETS    | CBAM / Border Mechanism | Key Features                                      |
|------------------|-------------------------------------------|--------|-------------------------|---------------------------------------------------|
| Sweden           | ≈ €134                                    | EU ETS | Not applicable          | 95% emission coverage, combined tax and ETS model |
| Singapore        | €17–€80 (phased)                          | None   | No                      | Gradual rate increase, offsets and rebates        |



|            |                   |               |                         |                                                           |
|------------|-------------------|---------------|-------------------------|-----------------------------------------------------------|
| EU (block) | ≈ €85 (ETS price) | EU ETS        | CBAM from 2026          | Emission regulation and internal market protection        |
| Kazakhstan | None              | KAZ ETS (€/t) | CBAM applies to exports | Requires MRV harmonization and introduction of carbon tax |

Findings of Comparative Analysis: Sweden demonstrates the most resilient and effective model of environmental taxation, combining high rates, broad coverage, and transparent revenue redistribution mechanisms.

Singapore employs a flexible, phased approach, minimizing economic risks during the transition to carbon regulation.

The European Union has integrated environmental taxes with emissions trading and border adjustment mechanisms, creating a strong global incentive for decarbonization.

Kazakhstan, however, requires institutional and regulatory modernization — including the introduction of a national carbon tax, an increase in ETS rates, harmonization of MRV with EU standards, and targeted use of environmental revenues.

The conducted analysis shows that direct replication of foreign practices without national adaptation is ineffective. Kazakhstan needs a gradual and integrated approach based on a combination of tax incentives, digital emission monitoring, and targeted allocation of environmental tax revenues. Such a strategy would not only enhance the environmental performance of the economy but also mitigate external carbon risks under the operation of CBAM.

**Institutional Implications for Kazakhstan.** Kazakhstan possesses certain institutional foundations in the field of climate regulation, including the functioning of KAZ ETS, yet the effectiveness of this system remains low. According to ICAP (2023), the average carbon quota price in Kazakhstan is around €2 per ton of CO<sub>2</sub> — approximately 40 times lower than in the EU. Such a low rate fails to create an economic incentive for decarbonization.

Moreover, the national Monitoring, Reporting, and Verification (MRV) system does not meet EU standards, creating a risk of non-recognition of Kazakhstan's carbon mechanisms in international trade settlements.

A key institutional barrier is the lack of targeted use of environmental tax revenues. Unlike in Sweden, where proceeds are directed toward green investments, in Kazakhstan they flow into the general budget, losing their environmental orientation. This reduces both transparency and public trust. Additionally, insufficient inter-agency coordination between the Ministry of Ecology and the Ministry of Finance hinders the integration of environmental goals into fiscal and budgetary strategy.

**Models for Adapting International Experience.** Based on the analysis, three potential models of adaptation can be identified for Kazakhstan:

Swedish model (high rates and social compensation) — implies introducing a progressive carbon tax while simultaneously reducing the tax burden on labor.

This option requires strong political will and broad public support but ensures a sustainable environmental impact.

Singaporean model (gradual and flexible approach) — based on the phased increase of rates and the use of offset mechanisms for businesses. This model is the most realistic for Kazakhstan as it avoids sudden shocks to energy-intensive sectors and maintains export competitiveness.

European model (integration of taxes and ETS) — envisions the creation of a unified carbon market combining quota trading with flexible tax rates. This path is feasible for Kazakhstan in the long term, following MRV modernization and alignment of reporting standards with the EU.

Assessment of Economic Implications. Scenario-based calculations indicate that if Kazakhstan were to introduce a carbon tax of €15 per ton of CO<sub>2</sub>, the state budget could generate an additional ₸150 billion annually, while energy price growth would remain below 3%. If a portion of these revenues were directed toward industrial modernization and renewable energy development, a multiplicative effect could be achieved — reducing emissions, stimulating investment, and enhancing energy efficiency.

The introduction of a carbon tax could also serve as an instrument of external economic adaptation to CBAM requirements, allowing Kazakhstan to offset domestic payments against EU carbon levies. This would reduce direct fiscal losses and preserve export competitiveness in European markets.

Risks and Limitations. The key risks in implementing environmental taxation include:

- lack of accurate data on actual emissions and a transparent verification system;
- potential resistance from industrial lobbies;
- social consequences of higher energy prices and tariffs.

To minimize these risks, a step-by-step implementation strategy is required, which should include:

- development of a national MRV system based on international standards;
- phased introduction of a carbon tax with a moderate rate structure;
- creation of a Targeted Environmental Fund ensuring transparent revenue distribution;
- implementation of pilot “green modernization” projects in metallurgy, energy, and transportation.

**Conclusion.** The conducted analysis has shown that the mechanisms of environmental taxation represent an effective tool for promoting sustainable development in Kazakhstan. Global experience demonstrates that the efficiency of environmental taxes is ensured through a combination of fiscal and regulatory functions, transparent allocation of revenues, and their close linkage to concrete environmental objectives.

The results of the comparative analysis (Table 1) confirmed that Kazakhstan lags significantly behind the European Union, Sweden, and Singapore in terms of carbon tax rates, the share of environmental payments in total tax revenues, and the

degree of institutional integration between fiscal and environmental instruments. In 2023, the share of environmental payments in Kazakhstan accounted for only 0.6%, compared to 5–6% in EU countries. At the same time, the average emission charge rate in Kazakhstan is approximately €2 per ton of CO<sub>2</sub>, which fails to provide a sufficient incentive effect for enterprises.

For a transition toward a low-carbon development model and the establishment of a system comparable to international standards, a gradual modernization of the national tax policy is required. Based on the analysis, the following directions for improvement are proposed:

- the introduction of a carbon tax with a gradual increase in rates and a mechanism of social compensation for households;
- integration of the Emissions Trading System (KAZ ETS) with international carbon mechanisms and harmonization of MRV reporting in line with EU requirements;
- the creation of a Targeted Environmental Fund, ensuring the earmarked use of revenues from environmental payments for projects on energy efficiency, “green” modernization, and R&D;
- the development of a system of tax incentives and benefits for enterprises investing in environmentally friendly technologies.

The implementation of these measures will enhance the effectiveness of Kazakhstan’s fiscal and environmental policy, reduce the national carbon footprint, and strengthen the country’s position in international climate initiatives.

Thus, environmental taxation should be regarded not as a source of fiscal revenue, but as a mechanism for stimulating sustainable development — ensuring a balance between economic interests and the preservation of natural capital.

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