“Fulfilling international obligations of the Republic of Kazakhstan toward achieving carbon neutrality: Legal challenges and prospects”

AUTHORS	Aigul Nukusheva Aitugan Abdizhami Saida Assanova Guldana Karzhassova Kargash Akhmetova

ARTICLE INFO	Aigul Nukusheva, Aitugan Abdizhami, Saida Assanova, Guldana Karzhassova and Kargash Akhmetova (2025). Fulfilling international obligations of the Republic of Kazakhstan toward achieving carbon neutrality: Legal challenges and prospects. *Environmental Economics*, *16*(4), 1-14. doi:10.21511/ee.16(4).2025.01
DOI	http://dx.doi.org/10.21511/ee.16(4).2025.01
RELEASED ON	Tuesday, 14 October 2025
RECEIVED ON	Monday, 03 March 2025
ACCEPTED ON	Monday, 28 July 2025

LICENSE	This work is licensed under a Creative Commons Attribution 4.0 International License

JOURNAL	"Environmental Economics"
ISSN PRINT	1998-6041
ISSN ONLINE	1998-605X
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
67	0	0

© The author(s) 2025. This publication is an open access article.

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine
www.businessperspectives.org

Type of the article: Research Article

Received on: 3rd of March, 2025
Accepted on: 28th of July, 2025
Published on: 14th of October, 2025

© Aigul Nukusheva, Aitugan Abdizhami, Saida Assanova, Guldana Karzhassova, Kargash Akhmetova, 2025

Aigul Nukusheva, Candidate of Legal Sciences (Ph.D.), Professor of the Department of Civil and Labour Law, Karaganda University named after Academician E.A. Buketov, Republic of Kazakhstan.

Aitugan Abdizhami, Assistant Professor, Department of Civil and Labour Law, Karaganda University named after Academician E.A. Buketov, Republic of Kazakhstan.

Saida Assanova, Associate Professor, Department of Civil Law and Civil Procedure, Labour Law, al-Farabi Kazakh National University, Republic of Kazakhstan. (Corresponding author)

Guldana Karzhassova, Doctor of Philosophy (Ph.D.) in Jurisprudence, Associate Professor of the Department of General Legal and Special Disciplines, Karaganda University of Kazpotrebsoyuz, Republic of Kazakhstan.

Kargash Akhmetova, Ph.D., Assistant Professor of the Department of Theories and Histories of State and Law, Karaganda University named after Academician E.A. Buketov, Republic of Kazakhstan.

This is an Open Access article, distributed under the terms of the Creative Commons Attribution 4.0 International license, which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.

Conflict of interest statement:
Author(s) reported no conflict of interest

Aigul Nukusheva (Republic of Kazakhstan), **Aitugan Abdizhami** (Republic of Kazakhstan), **Saida Assanova** (Republic of Kazakhstan), **Guldana Karzhassova** (Republic of Kazakhstan), **Kargash Akhmetova** (Republic of Kazakhstan)

FULFILLING INTERNATIONAL OBLIGATIONS OF THE REPUBLIC OF KAZAKHSTAN TOWARD ACHIEVING CARBON NEUTRALITY: LEGAL CHALLENGES AND PROSPECTS

Abstract

Many countries face the need for structural transformation of their economies, particularly in terms of environmental and climate aspects. Global decarbonization initiatives have forced Kazakhstan to revise its economic policy priorities as well as legal regulation in several spheres. The objective of this study was to identify the existing legal challenges confronting Kazakhstan in fulfilling its international commitments to achieve carbon neutrality. The methodological basis is presented by political and legal analysis. Persistent issues in Kazakhstan's pursuit of carbon neutrality include the absence of clear and transparent mechanisms for allocating CO_2 emissions quotas, insufficient harmonization with international law, poor institutional coordination, and a lack of legal instruments to incentivize businesses and ensure public participation. Some decarbonization decisions conflict with other government programs and priorities, such as plans to increase hydrocarbon production. From a formal legal perspective, the key challenges for Kazakhstan include unclear mechanisms for implementing the Nationally Determined Contribution (NDC), the absence of legal tools for abandoning fossil fuels, insufficient transparency of the NDC, and weak formalization of the consultation mechanism with stakeholders (including NGOs and the private sector). Among the challenges identified, there are an absence of an institutional basis for the functioning of a single center for managing climate policy, problems of law enforcement, as well as a lack of generalized judicial practice.

Keywords climate change, decarbonization, nationally determined contribution (NDC), Paris Agreement, regulation

JEL Classification Q01, K20

INTRODUCTION

Against the backdrop of global climate change, sustainable development has become one of the priorities of international policy. A key aspect of this process is achieving carbon neutrality, i.e., a state in which greenhouse gas emissions are offset by their absorption or technological capture (Guo et al., 2023; Tick et al., 2024). The Republic of Kazakhstan, as an active participant in global climate initiatives, has undertaken several international commitments, including the Paris Climate Agreement, which requires a revision of its national legal, economic, and social policies.

In this context, significant legal challenges have emerged: the need to adapt international norms to national legislation, develop incentives for economic decarbonization, support the energy transition, and attract investments in sustainable technologies (Nukusheva et al., 2021).

Additionally, there is a pressing need to establish legal mechanisms that harmonize the interests of the state, businesses, and society during the transition to carbon-neutral development (Bala et al., 2025; Karpuntsov & Veresha, 2022a).

In recent years, Kazakhstan's participation in the global climate agenda has expanded. During the 2024 Conference of the Parties to the Paris Agreement (COP29), an event titled "Supporting Kazakhstani Cities on the Path to Carbon Neutrality" highlighted the growing role of urban areas in achieving national climate goals. An official representative of the central governmental body for environmental policy emphasized the importance of reaching carbon neutrality by 2060 and underscored the pivotal role of cities in this process. Kazakhstan presented ambitious national goals for carbon neutrality, along with discussions on their implementation at the municipal level. Participants, including government officials, international organizations, and Kazakhstani cities, exchanged experiences and best practices in sustainable urban development, focusing on measures for reducing greenhouse gas emissions and adapting to climate change (Azertag, 2024). Earlier, in 2023, Kazakhstan announced plans to develop and adopt a national methane emissions reduction program by 2025. At the 28th Climate Conference in Dubai, agreements were signed with major UAE companies, Masdar and ACWA Power, to construct a 1-gigawatt wind power plant in Kazakhstan's Zhambyl Region (24kz, 2024). Given these ambitious plans, Kazakhstan must structurally transform its economy while integrating environmental and climate considerations. This transformation demands effective legal frameworks for sustainable development, encompassing ecological standards, green financing, legal tools to support new technologies and economic sectors, and relevant scientific research.

The importance of strengthening Kazakhstan's legal and policy mechanisms for sustainable development and carbon neutrality stems from the country's commitment to fulfilling its international obligations under the Paris Agreement (Nukusheva et al., 2023). Moreover, the recent adoption of two strategic documents highlights the need for additional analysis of the regulatory framework and practical challenges posed by newly adjusted or partially adjusted decarbonization policies. This research gap is particularly acute given the lack of comprehensive studies in this area.

Although Kazakhstan has joined international agreements on climate change, such as the Paris Agreement, and set a carbon neutrality target for 2060, its national legal regulation remains fragmented, insufficiently aligned with international standards, and poorly implemented across sectors. As a result, there is a contradiction between the country's international obligations and the actual legal, institutional, and economic readiness to ensure sustainable development. This discrepancy underscores the urgent need for a thorough reassessment of climate policy mechanisms.

1. LITERATURE REVIEW

The current global trends in the legal regulation of decarbonization reflect the systemic transformation of climate-related and environmental agendas into legal norms (Horani et al., 2025). These trends shape key research areas both globally and in individual regions or countries. Major global actors such as the United States and China are developing their own strategies that seek to balance economic and ecological priorities. Europe, traditionally a leader in climate policy, focuses on implementing pan-European rules across individual jurisdictions. In this context, Kazakhstan is working to establish its own position. However, the country's continued economic reliance on fossil fuel exports presents challenges for its transition to carbon neutrality.

Contemporary studies on the legal regulation of decarbonization, both globally and in Kazakhstan, address diverse aspects of climate policy implementation. For instance, researchers have analyzed progress toward carbon neutrality across different regions of the world (Fu & Zhu, 2024). Other studies focus on the implementation of the Paris Climate Agreement within the legal systems of the Eurasian Economic Union (EAEU)

http://dx.doi.org/10.21511/ee.16(4).2025.01

member states (Lifshits et al., 2024). Significant attention is paid to the improvement of legal mechanisms for decarbonization in China and advancements in Kazakhstan's renewable energy legislation (Bakunkin, 2022). Comparative studies also explore decarbonization policies among EAEU countries (Davtyan & Khachikyan, 2024b). Some scholars examine carbon neutrality and digital transformation in Central Asian states (Sulaimanova et al., 2024), while others apply hybrid techno-economic modeling techniques to assess Kazakhstan's medium-term green economy and approach to low-carbon development (Zhakiyev et al., 2024). The body of research in this field also includes analyses of energy efficiency practices on Kazakhstani farms (Esirkepova et al., 2024).

In summary, research primarily focuses on four key areas: international legal mechanisms for decarbonization, national strategies and legislative reforms, carbon regulation in business and finance, and legal instruments for stimulating innovation and renewable energy sources. A review of the literature reveals a growing body of studies on China's experience, with many examining ways to refine its legal instruments to achieve climate neutrality (Chen et al., 2022; He, 2024). Particular emphasis is placed on the need to adopt a dedicated climate law (Zhao et al., 2022). At the same time, Chinese researchers are expanding their focus beyond domestic policies to include global perspectives, as evidenced by studies employing bibliometric analysis and secondary research methods (Zheng et al., 2023; Zhang et al., 2022).

Modern European research has primarily addressed the issues of general EU policy and legal frameworks for decarbonization, as regulations across member states are primarily based on adapting national norms to the *acquis communautaire*. In particular, research interest is centered on plastic recycling regulation (Perissi & Jones, 2022) and the institutionalization of the European Green Deal by implementing its objectives in legislative acts of the highest legal force (Sikora, 2021).

Several studies have explored potential adjustments to EU decarbonization policies, taking into account the consequences of the Russian-Ukrainian war (Biresselioglu et al., 2023; de las Heras, 2024; Sciberras Bray, 2024). Specifically, changes in energy suppliers and the partial reorientation of heavy and manufacturing industries have raised questions about potential relaxations of environmental requirements for manufacturers (Han et al., 2024). The growing body of research in this area represents an emerging trend in European regional studies. Several scholars have examined the comparative aspects of carbon neutrality strategies across the United Kingdom (Shestak & Tsyplakova, 2022), the United States, China, and the European Union (Du & Zhang, 2022; Evro et al., 2024). In Central Asia, research has primarily examined the implementation of nationally determined contributions (NDCs) within the Eurasian Economic Union (EAEU) (Lifshits et al., 2024). Significant attention has been given to conducting comparative analyses of the EAEU energy systems' transition to sustainability (Davtyan & Khachikyan, 2024a) and harmonizing carbon regulation across Eurasia (Shugurov, 2024). Additional research efforts have focused on improving EAEU legal frameworks for sustainable transport systems (Tolochko, 2024a), as well as ensuring environmental compliance in climate agenda implementation (Shogentsukova & Lepshekova, 2024).

Over the past three years, Kazakhstani studies have grown in number, although they tend to emphasize political rather than legal aspects. Researchers argue that the development of ESG (environmental, social, and corporate governance) principles is a primary driver of enterprise competitiveness and must therefore be a priority for domestic production in the context of sustainable development goals (Aubakirova et al., 2023b; Zarubina et al., 2024). They also suggest that pursuing industrial decarbonization strengthens Kazakhstan's position in international production and supply chains (Aubakirova et al., 2023a). Accordingly, Kazakhstan's energy system requires substantial investments to transition to renewable energy sources (Aubakirova et al., 2025). Studies highlight that technological modernization is critical for achieving carbon neutrality by 2060, overcoming key barriers, and advancing low-carbon development (Galiev et al., 2024). Research findings emphasize the importance of aligning strategic documents in the area of decarbonization (Sopykhanova et al., 2023).

The objective of this study is to identify the legal challenges Kazakhstan faces in fulfilling its international commitments toward achieving carbon neutrality. The research tasks included pinpointing key problems in legal regulation, evaluating current practices, and proposing solutions to enhance the efficiency of legal frameworks for carbon neutrality.

2. METHODS

The documentary and analytical basis of this study comprises international instruments on decarbonization and climate regulation (the Paris Agreement under the United Nations Framework Convention on Climate Change), as well as national regulatory acts of the Republic of Kazakhstan in this field. Key national documents include Presidential Decree No. 121 of February 2, 2023, "On Approval of the Carbon Neutrality Strategy of the Republic of Kazakhstan until 2060" (hereinafter referred to as Strategy 2060), and Government Decree No. 313 of April 19, 2023, "On Approval of the Updated Nationally Determined Contribution of the Republic of Kazakhstan to the Global Response to Climate Change." The study also incorporates materials from expert groups in the fields of decarbonization and climate policy, as well as reports from international institutions. These sources include the World Bank report "Mining Sector Diagnostics – Kazakhstan" (The World Bank, 2023).

The methodological framework relies on political and legal analysis, which enables an examination of the interdependence between political decarbonization measures and legal regulation in this domain. This approach aligns with the study's objective: to identify opportunities for enhancing legislative regulation in line with national political priorities amid global challenges. By analyzing political and legal documents, the study pinpoints existing problems in legal regulation in order to propose potential solutions. Structurally, the paper is organized into four blocks:

a. review of Kazakhstan's decarbonization policy in light of existing challenges;

b. analysis of recent political initiatives of Kazakhstan in environmental policy toward long-term carbon neutrality;

c. analysis of the Nationally Determined Contribution (NDC) and its accompanying Strategy 2060, focusing on legislative challenges;

d. analysis and assessment of associated obstacles.

3. RESULTS AND DISCUSSION

Since the mid-20th century, Kazakhstan has experienced the adverse effects of climate change. Since 1940, the country's average annual temperature has been increasing by 0.28°C per decade (President of the Republic of Kazakhstan, 2023). According to various estimates, approximately half of Kazakhstan's territory is affected by desertification, which poses significant threats to agriculture and ecosystems. The degradation of pastures and a decline in soil fertility have reduced agricultural production, particularly in southern regions (Bocharova, 2019). One of the most serious consequences of human activity and climate change is the catastrophic desiccation of the Aral Sea. This has created severe environmental and social challenges, including air pollution, diminished quality of life for local populations, and biodiversity loss. Additionally, the country has witnessed more frequent droughts, floods, high-intensity winds, and temperature anomalies. These phenomena negatively impact agriculture, infrastructure, and public health (Karpuntsov & Veresha, 2022b).

Worsening living conditions in rural areas have also prompted migration to urban centers, accelerating urbanization. At the same time, the depletion of water resources and declining crop yields threaten food security and economic stability. These challenges require increased expenditures for mitigating the consequences of climate-related events, particularly floods and droughts. Urban areas have also been affected by the intensified urban heat island effect, particularly during the summer months (Khalabuzar, 2024). Rising temperatures drive higher energy consumption through air conditioning systems, further exacerbating greenhouse gas emissions.

Nevertheless, recent years have shown positive trends in reducing anthropogenic environmental impacts (President of the Republic of Kazakhstan,

http://dx.doi.org/10.21511/ee.16(4).2025.01

2023). Government data reported in Strategy 2060 indicated a reduction in greenhouse gas emissions observed in 2019. Emissions amounted to 364.7 million tons of CO_2, which was 9.2% lower than in 2018 and 4.5% lower than in 1990. This reduction resulted from decreased fuel consumption, largely due to the COVID-19 pandemic's effects. In 2020, the national net emissions fell further to 351.2 million tons, representing a 12.6% decrease from 2018 and an 8% decrease compared to 1990 (President of the Republic of Kazakhstan, 2023).

In November 2024, the 29th United Nations Climate Change Conference (COP 29) was held in Baku, the capital of Azerbaijan. Prior to the conference, environmental organizations and expert communities convened in Astana, the capital of Kazakhstan, to formulate their positions and key messages. The discussions primarily focused on Article 6 of the Paris Agreement, which governs international cooperation in combating climate change, achieving carbon neutrality, and supporting developing countries (Kazakevich et al., 2024; Kolosovskaya, 2024). The primary challenges were limited regional understanding of decarbonization objectives, inadequate tactical planning for implementing national carbon strategies, and difficulties in reconciling economic needs with job preservation (particularly in mining and processing industries) and sustainability goals. Alongside criticisms and suggestions, experts generally acknowledged the government's commitment to decarbonization and climate neutrality (Kolosovskaya, 2024). At the preceding climate conference in the UAE, the president of Kazakhstan (Kassym-Jomart Tokayev) reiterated the country's pledge to meet its national climate commitments and execute the Carbon Neutrality Strategy by 2060. Throughout 2023, Kazakhstan achieved notable progress in improving environmental policies, broadening its political objectives, and establishing foundations for a robust legal framework.

In the first half of 2023, Kazakhstan adopted two key decarbonization policy documents that outline the country's long-term strategy in this domain. However, according to representatives of Kazakhstani NGOs (non-governmental organizations), both documents faced substantial criticism from local experts and international observers. Concerns were raised regarding the documents' perceived lack of ambition and conservatism. Analysts suggest that these documents reflect compromises with mining industry representatives and nuclear energy lobbyists (Climate Net of Central Asia, 2023). Nevertheless, by defining their goals as national priorities, the adoption of these documents entails a range of legal implications, including the establishment of binding mechanisms to ensure their implementation.

One of the most significant strategic approaches to decarbonization is the Nationally Determined Contribution (NDC), which serves as a detailed action plan for reducing emissions and adapting to climate change. Under the Paris Agreement, each party is required to develop an NDC and update it every five years (UN, 2021). The adoption of the NDC by the government indicates that Kazakhstan remains committed to its climate policy, maintains a steady course toward achieving global decarbonization priorities, and fosters international cooperation in this domain. It reflects the country's recognition of both new and existing challenges while committing to international obligations. The NDC also underscores Kazakhstan's adherence to international climate initiatives such as the Paris Agreement.

In this context, the establishment of clear emission reduction targets through 2030 emerges as an essential step toward enhancing the country's reputation on the global stage. The plan has been widely criticized, often with well-substantiated arguments. Nevertheless, before critically evaluating the NDC and the associated challenges and initiatives, it is important to highlight the positive aspects of its adoption.

With the adoption of the NDC and the accompanying Strategy 2060, Kazakhstan has explicitly articulated its long-term objective of achieving carbon neutrality, confirming a strategic vision for the country's development in this direction. This commitment could serve as a foundation for attracting international investments and technologies aimed at decarbonizing the economy.

The emissions trading system outlined in Strategy 2060 reinforces Kazakhstan's position as one of the first countries in the region to implement such

a mechanism. This, in turn, lays the groundwork for Kazakhstan's integration into international carbon markets, which is expected to attract additional funding for climate-related projects. As the country transitions to renewable energy sources, the government emphasizes the importance of advancing carbon capture, utilization, and storage (CCUS) technologies to minimize emissions generated by coal, oil, and gas industries. Beyond emission control, the deployment of such technologies also facilitates employment preservation in the hydrocarbon sector, as demonstrated by leading global practices (Official Information Resource of the Prime Minister of the Republic of Kazakhstan, 2021). Overall, Kazakhstan's NDC reflects an effort to balance climate ambitions with an economy reliant on coal and hydrocarbon energy. A phased approach to emission reductions is intended to mitigate social and economic risks (Shestak & Savenkova, 2023). Despite its moderate targets, the NDC provides a foundation for future adjustments and the strengthening of climate policy. In this regard, the gradual development of legislative and institutional frameworks is necessary to implement more ambitious climate plans in the future.

NGO representatives and experts have noted that the process of aligning the documents with relevant authorities has been particularly complex, emphasizing numerous institutional and practical difficulties. Attempts to achieve a compromise led to the exclusion of all quantitative target indicators from the NDC section titled "Ambition and Fairness of the Goal in the Context of National Conditions." Similarly, all sector-specific target indicators for the decades leading up to 2060 were omitted from Strategy 2060, which complicates its implementation.

The NDC should be supplemented by the approval of an accompanying roadmap, which will likely serve as an action plan for the strategy's implementation through 2030, including all target indicators, responsible parties, and further details. To implement the strategy, Kazakhstan needs to focus on the conditional NDC target of a 25% reduction in greenhouse gas emissions relative to the 1990 baseline by 2030, rather than the unconditional target of a 15% reduction. This is confirmed by modeling results conducted by both international and domestic experts as part of projects by the German Society for International Cooperation (GIZ) and the World Bank.

Currently, the Institute of Economic Research, which has refined the strategy and shaped the contours of climate policy through 2060, is awaiting the allocation of governmental funding to commence the development of an updated roadmap (Climate Net of Central Asia, 2023). One of the current risks is the potential shortage of natural gas for decarbonizing the energy sector. In the event of a gas deficit for expanding flexible power capacity, an increase in hydropower generation is planned. However, this option is expected to be more expensive than gas-fired power generation. At the same time, coal generation will be limited. There is also a risk that new hydropower projects may face future water scarcity, as nearly half of the river runoff comes from neighboring upstream countries, which increases water withdrawals.

Another identified risk is the potential for socio-political instability, which could arise from increases in fuel and energy prices. Such increases may be triggered by the introduction of a carbon tax on energy consumption, which is necessary to regulate rising emissions from producers not covered by the national emissions trading system. Reinvesting carbon revenues into the decarbonization of the housing and utilities sector would mitigate this risk (Climate Net of Central Asia, 2023).

The analysis of the NDC and the closely interconnected Strategy 2060 provides a basis for identifying multifaceted problems (political-economic and socio-political) that may pose obstacles to legislative regulation. These issues pertain both to the development of new comprehensive and coherent decarbonization frameworks and the improvement of existing ones. At the current stage, the NDC has been criticized for several reasons, including its lack of ambition, unclear implementation mechanisms, and limited support from stakeholders. The goal of reducing greenhouse gas emissions by 15% by 2030 compared to 1990 levels has faced criticism for being inadequate in relation to global objectives, particularly in comparison with countries pursuing more ambitious targets. For instance, the collective commitments of EU member states include a 42% reduction in

http://dx.doi.org/10.21511/ee.16(4).2025.01

annual greenhouse gas emissions by 2030 and 57% by 2035. Furthermore, the proposed 25% emissions reduction "subject to international support" has raised concerns, given the absence of a clear strategy for attracting climate finance.

Another issue is the vague implementation instruments. The NDC does not provide detailed and realistic roadmaps describing exactly how emission reduction goals can be achieved. While the program envisions a marked increase in the share of renewable energy sources, there are no clear steps to support this sector, such as subsidies or tax incentives. The analysis or revision of roadmaps in this regard would establish the basis for amending the legal instruments for subsidizing the renewable energy sector. This scenario would necessitate amendments to the Republic of Kazakhstan's Law "On Support for the Use of Renewable Energy Sources" (July 4, 2009, No. 165-IV), the Law "On the Electric Power Industry" (July 9, 2004, No. 588-II), and the relevant sections of the Land and Water Codes.

The lack of detailed plans for the gradual phase-out of coal has also been a point of criticism in relation to the NDC. Kazakhstan remains heavily dependent on coal-based energy, which is the primary source of emissions. The NDC does not include sufficient measures for a transition away from coal, which contradicts both global decarbonization trends and the World Bank's recommendations for Kazakhstan (The World Bank, 2023). At present, the CCUS technologies proposed as part of the solution may be perceived as insufficiently developed and excessively costly. Despite the limited public discussion on these matters in Kazakhstan, it can be inferred that financing such projects may encounter public opposition due to their high costs and the complexity of implementation. Furthermore, a serious challenge in this context is that many outdated production facilities may no longer be economically viable due to the financial burden they impose. The closure of these facilities could result in substantial social problems, primarily in mono-industrial towns, where unemployment could become a major issue (The World Bank, 2023).

In light of the aforementioned aspects, another issue that warrants attention is the limited involvement of civil society and the business sector. The development of the NDC has been criticized for its lack of transparency and insufficient consultation with stakeholders: NGOs and the private sector. The business community has highlighted the absence of clear incentives for active participation in climate projects (Abibulloeva & Amanbaiuly, 2024; PAGE, 2020).

There is an urgent need to devise clear and consistent financing strategies. The successful implementation of the revised NDC demands substantial financial inflows, yet the methods for attracting investments and international climate funding remain inadequately defined. Analysis of reports and analytical materials from international stakeholders, such as the Partnership for Action on Green Economy and the World Bank, reveals the lack of structured mechanisms for deploying "green" financial instruments, including green bonds or climate funds (The World Bank, 2023; PAGE, 2020).

Another concern is the inconsistency within the policy. Certain provisions of the NDC contradict other government programs and priorities, such as plans to expand oil and gas extraction (PAGE, 2020). This discrepancy raises questions about whether the country is genuinely committed to long-term carbon neutrality goals or merely creates the appearance of such commitment. United Nations experts and international environmental organizations have highlighted that Kazakhstan's stated objective of achieving carbon neutrality by 2060 will be extremely difficult to accomplish without more ambitious short-term targets. For instance, the NDC lacks specific details regarding the modernization of coal-fired power plants and the level of investment planned for the development of renewable energy sources (Abibulloeva & Amanbaiuly, 2024; PAGE, 2020; Shestak & Postoeva, 2022). Thus, to foster greater trust in Kazakhstan's NDC, the country must reassess its climate goals, making them both more ambitious and realistic, while also improving dialogue with stakeholders and devising more detailed action plans.

The challenges associated with the academic analysis of decarbonization issues, both in Kazakhstan and globally, are closely tied to dynamic changes and the constant adaptation of policies in this sec-

tor. These challenges also give rise to difficulties in forecasting and preparing hypothetical scenarios. The NDC and the Decarbonization Strategy 2060 were adopted relatively recently, leaving little time for in-depth research. Both documents require interdisciplinary analysis, which is challenging to organize in a timely manner. These factors contribute to the limited scope of research in this field within Kazakhstan. Between 2023 and 2024, more than 40 countries adopted their NDCs (UN, 2024), and there are currently few comprehensive studies dedicated to analyzing these documents. The same applies to Kazakhstan. However, attempts have already been made to conduct comparative analyses of policies in Central Asian countries (Davtyan & Khachikyan, 2024b; Lifshits et al., 2024). Scholars have also evaluated the readiness of digital infrastructure within this framework and performed techno-economic modeling of decarbonization strategies (Sulaimanova et al., 2024; Zhakiyev et al., 2024). The analysis of contemporary Central Asian research offers deeper insights and systematizes issues related to decarbonization in the legal field, which, however, must be considered in conjunction with the ongoing national policies. The issues identified through the analysis of the NDC and Strategy 2060 provide a basis for highlighting several problems directly related to legal regulation in this sector and, consequently, to lawmaking. The challenges predominantly include inadequate harmonization with international law, deficiencies in regulatory instruments, poor institutional coordination, and the lack of incentives for businesses and the public. Although this list is not exhaustive, an attempt can be made to examine these issues in more detail and present them systematically. For example, Kazakhstan's international commitments under the Paris Agreement have not been fully integrated into national legislation (Davtyan & Khachikyan, 2024b). Gaps persist in the regulatory framework for emissions trading, decreasing the effectiveness of market-based mechanisms for emissions reduction. In practice, there are no transparent policies for the allocation of quotas, which reduces trust among market participants (Tonkonog, 2024). Transaction data on the emissions trading system are not always accessible to the public, which limits the system's transparency and accountability.

Additionally, there are no clear criteria for the allocation of quotas to companies, nor are there established tools for redistributing unclaimed quotas or adjusting them in response to economic fluctuations or changes in enterprise emission levels. It is also important to highlight the limited availability of legal tools for utilizing international climate financing. From a purely legal standpoint, addressing these issues may not require the creation of new regulations but could instead necessitate amendments to the existing Environmental Code.

A further concern is the low level of detail in decarbonization strategies, as highlighted by contemporary scholars (Doczi, 2024; Sulaimanova et al., 2024). This conclusion is also corroborated by the Partnership for Action on Green Economy (PAGE, 2020). Specifically, Kazakhstan's legislation lacks clearly articulated long-term plans for achieving carbon neutrality, which complicates the effective implementation of climate policy. At present, there are no specific regulations governing the deployment of CCUS technologies. Furthermore, there are no comprehensive mechanisms in place to incentivize the transition to renewable energy sources, such as tax benefits and subsidies. The absence of real incentives for businesses, particularly small and medium-sized enterprises, makes their engagement in decarbonization efforts more challenging. The regulation of incentives for the private sector, such as green bonds or tax breaks for investments in sustainable technologies, remains inadequate (Bertaeva et al., 2024).

Some studies point to weak institutional coordination (Begimbay et al., 2024). While this issue is often viewed through the lens of governance efficiency, it also holds significant legislative implications. The lack of a centralized body tasked with overseeing climate policy has hindered alignment across various ministries and levels of government. Moderate critiques and proposals from both NGOs (Climate Action Tracker, 2024) and the United Nations reports underscore that the development and implementation of regulatory acts are impeded by the disjointed coordination between environmental, energy, and economic sectors.

Drawing from the perspectives of contemporary researchers and public experts, the list of issues can be further expanded to include another critical aspect: the low level of law enforcement (Gogoleva

http://dx.doi.org/10.21511/ee.16(4).2025.01

et al., 2024; Kuur et al., 2024; Tolochko, 2024b). In particular, there is a need for effective instruments for monitoring compliance and ensuring accountability for violations of environmental requirements (Yesekina et al., 2024). Moreover, analysts highlight the limited enforcement of sanctions in cases of emissions quota violations or non-compliance with environmental standards. This observation is supported by the fact that reviews or summaries of judicial practice concerning relevant cases are not reflected in the publicly available analytical materials of the Supreme Court (Supreme Court of the Republic of Kazakhstan, 2024).

Certain issues, while not directly stemming from policy and legal regulation in the field of decarbonization, nonetheless complement the broader challenges within the sector. These include deficiencies in educational and informational initiatives, as well as limited support for innovation (Esirkepova et al., 2024; Xenarios et al., 2024). Current legislation does not contain explicit provisions aimed at fostering educational programs and raising public awareness regarding carbon neutrality. Although such measures are not strictly required under legal formalism, they could strengthen sectoral policies and align Kazakhstan with international best practices. A similar model has been successfully implemented in Scandinavian countries. For example, Sweden has introduced a range of programs and legislative initiatives designed to elevate public awareness and promote education on climate change (UNESCO, 2024). Regarding the insufficient support for technologies and innovations, the legal framework remains underdeveloped with respect to the integration of advanced solutions such as hydrogen energy or smart grid systems. There is a lack of established mechanisms that enable innovative projects to secure priority funding or legal protection. While these aspects may not constitute legal shortcomings in a narrow sense, they reveal the multifaceted deficiencies in climate policy and highlight potential avenues for its improvement.

CONCLUSION

In light of the study's objectives, which focus on identifying the legal challenges facing Kazakhstan in the context of its international obligations to achieve carbon neutrality, the study identifies several key issues. In general terms, these are the lack of comprehensive legal mechanisms for implementing political plans to achieve carbon neutrality, problems with institutional coordination, and the lack of formalized mechanisms for abandoning fossil fuels. Based on the analysis of initiatives undertaken in recent years, despite all the advancements, the emphasis appears to remain on formal compliance, as unresolved issues persist within both policy and legislative regulation. In terms of policy formation, key challenges include the limited integration of decarbonization objectives at the regional level, insufficient elaboration of tactical measures necessary for implementing national carbon strategies, and the difficulty of reconciling economic imperatives with job preservation and associated concerns. An analysis of Strategy 2060 and the Nationally Determined Contribution (NDC) revealed inconsistencies in the prioritization of decarbonization, particularly the expansion of extractive industries. Given the substantial contribution of these sectors and raw material exports to the national economy, the challenge of balancing economic development with environmental sustainability remains particularly complex.

In relation to the NDC, the document does not present comprehensive or feasible roadmaps outlining the pathway toward emission reduction targets. Comparable planning algorithms are also absent in other related strategic documents. This deficiency reflects broader structural limitations in the legal framework. Other key issues include the continuing regulatory challenges of emissions trading, the lack of clear legal instruments for the use of international climate finance, and the lack of legal solutions for the implementation of carbon capture and storage technologies. In addition, there are no effective incentive mechanisms for the transition to renewable energy sources, including tax incentives and subsidies. Additionally, problems with institutional coordination for implementing carbon policy, law enforcement issues, and a lack of standardized judicial practice in addressing these problems have also been noted. At the same time, Kazakhstan's difficulties in advancing decarbonization should not be

interpreted as a reflection of governmental reluctance but rather as indicative of limited expert support and the ongoing search for a balance between socio-economic stability and carbon neutrality. Herewith, there are ongoing efforts to align legislation with political objectives in the field of decarbonization. In this context, further research should focus on implementing national strategic goals and analyzing law enforcement practices, with particular attention to relevant international experiences.

AUTHOR CONTRIBUTIONS

Conceptualization: Saida Assanova.
Data curation: Aitugan Abdizhami.
Formal analysis: Aigul Nukusheva, Guldana Karzhassova.
Funding acquisition: Kargash Akhmetova.
Investigation: Aigul Nukusheva, Guldana Karzhassova.
Methodology: Saida Assanova.
Project administration: Kargash Akhmetova.
Resources: Aitugan Abdizhami.
Software: Aitugan Abdizhami, Saida Assanova.
Supervision: Kargash Akhmetova.
Validation: Aigul Nukusheva.
Visualization: Guldana Karzhassova.
Writing – original draft: Aitugan Abdizhami, Saida Assanova, Kargash Akhmetova.
Writing – review & editing: Aigul Nukusheva, Guldana Karzhassova.

ACKNOWLEDGMENT

This research has been/was/is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP23490668). Project IRN AP23490668 "Legal aspects of processing and disposal of solid municipal waste in the Republic of Kazakhstan: problems and prospects".

REFERENCES

1. 24kz. (2024, November 12). *Uglerodnaya neytralnost: Chto predprinimayet Kazakhstan* [*Carbon neutrality: What Kazakhstan is doing*]. (In Russian). Retrieved from https://24.kz/ru/news/social/item/680250-uglerodnaya-nejtralnost-chto-predprinimaet-kazakhstan
2. Abibulloeva, A., & Amanbaiuly, M. (2024). *Youth involvement in climate issues in Kazakhstan and Tajikistan: Illusion or reality?* CABAR. Retrieved from https://cabar.asia/en/youth-involvement-in-climate-issues-in-kazakhstan-and-tajikistan-illusion-or-reality
3. Aubakirova, G. M., Biryukov, V. V., Isataeva, F. M., & Mazhitova, S. K. (2023a). Dekarbonizatsiya ekonomiki Kazakhstana: Perspektivy energeticheskogo perekhoda [Decarbonization of Kazakhstan's economy: Energy transition prospects]. *Economy: Strategy and Practice, 18*(4), 55-72. (In Russian). https://doi.org/10.51176/1997-9967-2023-4-55-72
4. Aubakirova, G. M., Isataeva, F. M., & Biryukov, V. V. (2025). Prioritetnyye napravleniya dekarbonizatsii energeticheskogo sektora Kazakhstana [Priority directions for decarbonizing Kazakhstan's energy sector]. *Central Asian Economic Review, 5,* 6-19. (In Russian). https://doi.org/10.52821/2789-4401-2024-5-6-19
5. Aubakirova, G. M., Isataeva, F. M., Mazhitova, S. K., & Togaibayeva, L. I. (2023b). Dekarbonizatsiya gorno-metallurgicheskogo sektora: Opyt Kazakhstan [Decarbonization of the mining and metallurgical sector: Kazakhstan's experience]. *Turan University Bulletin, 4,* 54-69. (In Russian). https://doi.org/10.46914/1562-2959-2023-1-4-54-69
6. Azertag. (2024). *Kazakhstan predstavil na COP29 plany po dostizheniyu uglerodnoy neytralnosti* [*Kazakhstan presents plans for achieving carbon neutrality at COP29].* (In Russian). Retrieved from https://azertag.az/ru/xeber/kazahstan_predstavil_na_cop29_plany_po_dostizheniyu_uglerodnoi_neitralnosti-3298340
7. Bakunkin, A. N. (2022). Ekologizatsiya zakonodatelstva Respubliki Kazakhstan o vozobnovlyayemykh istochnikakh energii: Novyye

http://dx.doi.org/10.21511/ee.16(4).2025.01

vyzovy na puti k dekarbonizatsii [Ecologization of the legislation of the Republic of Kazakhstan on renewable energy sources: New challenges on the path to decarbonization]. *Sustainable Development of the Republic of Kazakhstan in the Context of Transition to the "Green Economy", 1,* 125-127. (In Russian). Retrieved from https://elibrary.ru/download/elibrary_50288195_30795419.pdf

8. Bala, R., Singh, S., & Grima, K. S. S. (2025). Sustainable Finance and Investment Analytics: a Systematic Literature Review and Meta-Analysis Approach. *Journal of Economic Sciences: Theory and Practice*, *82*(2), 89-106. https://doi.org/10.30546/jestp.2025.82.01.091

9. Begimbay, K., Myrzakhmet, M., & Radoshevich, S. (2024). Stsenarnoye prognozirovaniye kak instrument strategicheskogo planirovaniya v obrabatyvayushchey promyshlennosti: Teoreticheskiyeosnovyi metodologicheskiyepodkhody [Scenario forecasting as a tool for strategic planning in the manufacturing industry: Theoretical foundations and methodological approaches]. *International Scientific and Practical Conference "Industrial Policy and Development of Manufacturing Industry: New Methodologies, Foreign Experience and Concepts for Kazakhstan" ALMATAU SYMPOSIUM 2024* (pp. 5-15). Almaty Management University. (In Russian). http://dx.doi.org/10.63881/978-601-7431-79-2.2024.4.001

10. Bertaeva, K., Onaltaev, D., Bakhyt, Y., Kozhakhmetova, M., & Mukhametzhanova, Z. (2024). Green bond market in Kazakhstan: Problems and prospects. In M. Shamtsyan & I. Kulova (Eds.), *International Scientific Conference on Biotechnology and Food Technology (BFT-2024)* (vol. 130, p. 08026). Saint Petersburg: EDP Sciences. https://doi.org/10.1051/bioconf/202413008026

11. Biresselioglu, M. E., Savas, Z. F., & Solak, B. (2023). The dilemma between carbon neutrality and energy security: Understanding the likely impacts of the Covid-19 and the Russia–Ukraine war on the EU climate targets. In E. Akıllı & B. Gunes (Eds.), *World Politics in the Age of Uncertainty: The Covid-19 Pandemic* (vol. 1, pp. 59-73). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-39607-6_6

12. Bocharova, M. (2019). *Manipulyatsiya. Okolo 75% territorii RK podverzheny risku ekologicheskoy destabilizatsii [Manipulation. About 75% of the territory of the Republic of Kazakhstan is at risk of environmental destabilization*]. (In Russian). Retrieved from https://factcheck.kz/ecology/manipulyaciya-okolo-75-territorii-rk-podverzheny-risku-ekologicheskoj-destabilizacii/

13. Chen, L., Msigwa, G., Yang, M., Osman, A. I., Fawzy, S., Rooney, D. W., & Yap, P. S. (2022). Strategies to achieve a carbon neutral society: A review. *Environmental Chemistry Letters, 20*(4), 2277-2310. https://doi.org/10.1007/s10311-022-01435-8

14. Climate Action Tracker. (n.d.). *Kazakhstan. Country summary.* Retrieved from https://climateactiontracker.org/countries/kazakhstan/

15. Climate Net of Central Asia. (2023, December 28). *Nepraktichno soprotivlyat'sya tomu, chto neizbezhno – Gulmira Ismagulova o promedlenii Kazakhstana v prinyatii effektivnoy klimaticheskoy politiki* [*It is impractical to resist what is inevitable – Gulmira Ismagulova on Kazakhstan's delay in adopting effective climate policy].* (In Russian). Retrieved from https://ca-climate.net/tpost/b6zlzoenf1-nepraktichno-soprotivlyatsya-tomu-chto-n

16. Davtyan, V. S., & Khachikyan, S. R. (2024a). Comparative analysis of energy system greening in the EAEU: Prospects for energy transition. *RUDN Journal of Economics*, *32*(3), 447-469. Retrieved from https://doaj.org/article/cacc29fedd20446d81037ad58e93dd25

17. Davtyan, V. S., & Khachikyan, S. R. (2024b). Decarbonization policy in the Eurasian economic union: Meeting the challenge of global climate change (comparative analysis). *Bulletin of Yerevan University D: International Relations and Political Sciences*, *15*(3.45), 35-49. https://doi.org/10.46991/BYSU.D/2024.15.3.035

18. de las Heras, B. P. (2024). EU green transition in times of geopolitical pressures: Accelerating or slowing the pace towards climate neutrality? *European Journal of Sustainable Development, 13*(2). https://doi.org/10.14207/ejsd.2024.v13n2p1

19. Doczi, S. (2024). *Net Zero Energy by 2060: Charting the Path of Europe and Central Asia toward a Secure and Sustainable Energy Future.* Livewire. Retrieved from https://openknowledge.worldbank.org/server/api/core/bitstreams/8992d4d1-226e-4241-9b18-49c8921dad3c/content

20. Du, H., & Zhang, H. (2022). Climate neutrality in the EU and China: An analysis of the stringency of targets and the adaptiveness of the relevant legal frameworks. *Review of European, Comparative & International Environmental Law, 31*(3), 495-509. https://doi.org/10.1111/reel.12453

21. Esirkepova, A. M., Niyazbekova, R. K., & Mahmood, D. M. (2024). Study of the activities of peasant farms in Kazakhstan in the context of efficient energy consumption. *Bulletin of the NAS RK, 411*(5), 318-329. https://doi.org/10.32014/2024.2518-1467.843

22. Evro, S., Oni, B. A., & Tomomewo, O. S. (2024). Global strategies for a low-carbon future: lessons from the US, China, and EU's pursuit of carbon neutrality. *Journal of Cleaner Production, 461,* Article 142635. https://doi.org/10.1016/j.jclepro.2024.142635

23. Fu, Y., & Zhu, Y. (2024). The international legal path to carbon neutrality under the sustainable development goals. *Lecture Notes in Education Psychology and Public Media, 44,* 82-89. https://doi.org/10.54254/2753-7048/44/20230084

24. Galiev, S., Yessekina, B., Beisengazin, K., & Nurushev, D. (2024). Prioritety tekhnologicheskoy

modernizatsii dlya dostizheniya uglerodnoy neytralnosti ekonomiki Kazakhstana [Priorities of technological modernization to achieve carbon neutrality of the economy of Kazakhstan]. *Public Administration and Civil Service, 3*(90), 160-168. (In Russian). https://doi.org/10.52123/1994-2370-2024-1303

25. Gogoleva, T. N., Kostyleva, V. I., Shchepina, I. N., & Shishkina, N. V. (2024). Mirovoy opyt primeneniya sistem torgovli razresheniyami na vybrosy: Teoreticheskiy i empiricheskiy analiz [Global experience in the application of emission trading systems: Theoretical and empirical analysis]. *Sovremennaya Ekonomika: Problemy i Resheniya – Modern Economy: Issues and Solutions, 2,* 6-18. (In Russian). https://doi.org/10.17308/meps/2078-9017/2024/2/6-18

26. Guo, Y., Yang, Y., Bradshaw, M., Wang, C., & Blondeel, M. (2023). Globalization and decarbonization: Changing strategies of global oil and gas companies. *Wiley Interdisciplinary Reviews: Climate Change, 14*(6), Article e849. https://doi.org/10.1002/wcc.849

27. Han, L., Zhou, Z., Shi, B., & Wang, Y. (2024). Challenges to environmental governance arising from the Russo–Ukrainian conflict: Evidence from carbon emissions. *Journal of Environmental Management, 349,* Article 119481. https://doi.org/10.1016/j.jenvman.2023.119481

28. He, X. (2024). China's adaptation governance in a world of carbon neutrality. *China-EU Law Journal.* https://doi.org/10.1007/s12689-024-00107-w

29. Horani, H. U. R., Amin, M., & Ahmed, F. (2025). Climate Risk Insurance: Bibliometric Review on Present, Past and Future. *Journal of Economic Sciences: Theory & Practice*, *82*(1), 4-18. https://doi.org/10.30546/jestp.2025.82.01.04

30. Karpuntsov, V., & Veresha, R. (2022a). Criminal and administrative aspects of the sociology of law: Opportunities for expanding the research and the field of expertise. *InterEULawEast: Journal for the international and european law, economics and market integrations,* 9(1), 147-165. https://doi.org/10.22598/iele.2022.9.1.7

31. Karpuntsov, V., & Veresha, R. (2022b). The issues of criminological and victimological security and the COVID-19-related quarantine measures. *Journal of Emergency Management, 20*(4), 301-315. https://doi.org/10.5055/jem.0694

32. Kazakevich, A., Hodgson, R., Frost, R., & Orlandi, G. (2024). *COP29 v Baku: Soglasheniye dostignuto, no mnogiye razocharovany [COP29 in Baku: Agreement reached, but many disappointed].* Euro News. (In Russian). Retrieved from https://ru.euronews.com/green/2024/11/24/ru-cop29-climate-talks-conclude-with-300-billion-annual-pledge

33. Khalabuzar, N. (2024, July 10). *Raskalennyye goroda Kazakhstana: Chto pokazyvayet teplovaya karta? [Kazakhstan's hot cities: What does the heat map show?].* RednewsKZ. (In Russian). Retrieved from https://rednews.kz/raskalennye-goroda-kazahstana-chto-pokazyvaet-teplovaya-karta/

34. Kolosovskaya, K. (2024, September 7). *Ugol, klimat i Parizhskoye soglasheniye: Kak Kazakhstan dvizhetsya k realizatsii mirovoy idei [Coal, climate and the Paris Agreement: How Kazakhstan is moving towards the implementation of the global idea].* Ulys Media. (In Russian). Retrieved from https://ulysmedia.kz/analitika/37430-ugol-klimat-i-parizhskoe-soglashenie-kak-kazakhstan-dvizhetsia-k-realizatsii-mirovoi-idei/

35. Kuur, O. V., Varavin, E. V., & Kozlova, M. V. (2024). Faktory ESG-transformatsii ekonomiki Kazakhstana v kontekste ustoychivogo razvitiya [ESG transformation factors of Kazakhstan's economy in the context of sustainable development]. *Economy: Strategy and Practice, 19*(2), 20-40. (In Russian). https://doi.org/10.51176/1997-9967-2024-2-20-40

36. Lifshits, I. M., Smbatyan, A. S., & Salia, M. R. (2024). Implementation of the Paris climate agreement in the legal systems of EAEU member states. *Lex Russica, 77*(1), 103-118. Retrieved from https://ouci.dntb.gov.ua/en/works/lDLw-MOXl/

37. Nukusheva, A., Ilyassova, G., Rustembekova, D., Zhamiyeva, R., & Arenova, L. (2021). Global warming problem faced by the international community: International legal aspect. *International Environmental Agreements: Politics, Law and Economics, 21*(2), 219-233. https://doi.org/10.1007/s10784-020-09500-9

38. Nukusheva, A., Rustembekova, D., Abdizhami, A., Au, T., & Kozhantayeva, Z. (2023). Regulatory obstacles in municipal solid waste management in Kazakhstan in comparison with the EU. *Sustainability, 15*(2), Article 1034. https://doi.org/10.3390/su15021034

39. Official Information Resource of the Prime Minister of the Republic of Kazakhstan. (2021). *Do 2060 goda Kazakhstan pereydet na uglerodnuyu neytralnost [Kazakhstan will switch to carbon neutrality by 2060].* (In Russian). Retrieved from https://primeminister.kz/ru/news/reviews/do-2060-goda-kazakhstan-pereydet-na-uglerodnuyu-neytralnost-1103515

40. Partnership for Action on Green Economy (PAGE). (2020). *Kazakhstan's transition to a Green Economy: A stocktaking report.* Retrieved from https://www.un-page.org/static/f50d1480edb10ffbd09b60eb67133f1a/2020-kazakhstan-stocktaking-report-en.pdf

41. Perissi, I., & Jones, A. (2022). Investigating European Union decarbonization strategies: Evaluating the pathway to carbon neutrality by 2050. *Sustainability, 14*(8), Article 4728. https://doi.org/10.3390/su14084728

42. President of the Republic of Kazakhstan. (2023). *Decree of the President of the Republic of Kazakhstan No. 121 of February 2, 2023, "On Approving the Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan by 2060."* (In Russian). Retrieved from https://unfccc.int/sites/de-

fault/files/resource/Carbon_Neutrlaity_Strategy__Kazakhstan_Ru_Oct2024.pdf

43. Sciberras Bray, N. (2024). *The Russian-Ukrainian war and its effects on the European green deal* (Bachelor's Thesis). University of Malta. Retrieved from https://www.um.edu.mt/library/oar/handle/123456789/129442

44. Shestak, V. A., & Postoeva, E. A. (2022). Ugolovnaya otvetstvennost za nezakonnuyu dobychu uglya: rossiyskoye i inostrannoye pravovoye regulirovaniye [Criminal liability for illegal coal mining: Russian and foreign legal regulation]. *Ugol, 8,* 95-99. (In Russian). Retrieved from https://scispace.com/pdf/criminal-liability-for-illegal-coal-mining-russian-and-2hbgzafj.pdf

45. Shestak, V. A., & Savenkova, P. G. (2023). Ugolovnaya otvetstvennost za nezakonnuyu dobychu poleznykh iskopayemykh v Peru i Ekvadore [Criminalization of illegal mining in Peru and Ecuador]. *Ugol, 2*, 72-76. (In Russian). Retrieved from https://cyberleninka.ru/article/n/ugolovnaya-otvetstvennost-za-nezakonnuyu-dobychu-poleznyh-iskopaemyh-v-peru-i-ekvadore

46. Shestak, V. A., & Tsyplakova, A. D. (2022). Features of criminal liability for theft of certain energy resources in the UK. *Ugol, 10,* 72-76. (In Russian). Retrieved from https://cyberleninka.ru/article/n/osobennosti-ugolovnoy-otvetstvennosti-za-hischenie-otdelnyh-energonositeley-v-velikobritanii/viewer

47. Shogentsukova, Z. K., & Lepshekova, R. R. (2024). Ekologicheskiy komplayens v ramkakh klimaticheskoy povestki [Environmental compliance in the climate agenda framework]. *International Agricultural Journal, 65*(6), 1839-1861. (In Russian). Retrieved from https://qje.su/ru/storage/viewWindow/218958

48. Shugurov, M. V. (2024). Gosudarstva – Chleny YEAES i zelenyy klimaticheskiy fond: Perspektivy skoordinirovannogo vzaimodeystviya v sfere klimaticheskogo finansirovaniya [EAEU member states and the green climate fund: Prospects for coordinated climate finance cooperation]. *International Law and International Organizations*, *2*, 12-50. (In Russian). Retrieved from https://nb-publish.com/library_read_article.php?id=71516

49. Sikora, A. (2021). European green deal–legal and financial challenges of the climate change. *Era Forum*, *21*(4), 681-697. https://doi.org/10.1007/s12027-020-00637-3

50. Sopykhanova, A., Maytanov, A., Kiseleva, A., & Zhamiyeva, R. (2023). Problems of legal regulation and state policy measures related to nature management in the framework of achieving the SDGs: Examples from Russia and Kazakhstan. *Sustainability*, *15*(2), Article 1042. https://doi.org/10.3390/su15021042

51. Sulaimanova, B., Sharshenova, A., & Sabyrbekov, R. (2024). *Digitalization of Infrastructure and Decarbonization in Central Asia: Opportunities and Challenges.* Central Asia Regional Economic Cooperation (CAREC) Institute. Retrieved from https://www.academia.edu/download/113236375/CAREC_report_2024.pdf

52. Supreme Court of the Republic of Kazakhstan. (2024). *Obzory sudebnoy praktiki* [*Reviews of judicial practice]*. (In Russian). Retrieved from https://sud.gov.kz/rus/content/obzory-sudebnoy-praktiki

53. The World Bank. (2023). *Diagnostika Gornorudnogo Sektora – Kazakhstan* [*Mining Sector Diagnostics – Kazakhstan]*. (In Russian). Retrieved from https://documents1.worldbank.org/curated/en/099081823001511076/pdf/P176745032752e020ab830aca3807b2afc.pdf

54. Tick, A., Akaev, A., Devezas, T. C., Sarygulov, A., Petryakov, A., & Evgenevich, A. I. (2024). Assessing decarbonization approaches across major economies. *Energies, 17*(17), Article 4381. https://doi.org/10.3390/en17174381

55. Tolochko, O. H. (2024a). Improving EAEU legal norms for greening transport systems. *Bulletin of the Institute of Legislation and Legal Information of the Republic of Kazakhstan, 4*(79), 187-195. https://doi.org/10.52026/2788-5291_2024_79_4_187

56. Tolochko, O. H. (2024b). The role of EAEU law in the decarbonization of energy systems of the member states and sustainable development of the green economy. *Bulletin of the Institute of Legislation and Legal Information of the Republic of Kazakhstan, 2*(77), 238-246. https://doi.org/10.52026/2788-5291_2024_77_2_238

57. Tonkonog, O. (2024). *Minekologii vybirayet birzhu dlya torgov kvotami na vybrosy* [*The Ministry of Ecology chooses an exchange for trading emission quotas]*. Kursiv. (In Russian). Retrieved from https://kz.kursiv.media/2024-11-26/lgtn-carbon-market/

58. UN. (2021). *All about NDCs*. Retrieved from https://www.un.org/ru/climatechange/all-about-ndcs

59. UN. (2024). *NDC Registry*. Retrieved from https://unfccc.int/NDCREG

60. UNESCO. (2024). *Sweden. Climate Change Communication and Education*. Retrieved from https://education-profiles.org/europe-and-northern-america/sweden/~climate-change-communication-and-education

61. Xenarios, S., Sembayeva, A., Tsani, S., Orazagaliyev, S., & Ansaganova, Z. (2024). Clean energy challenges and innovation opportunities in Kazakhstan. *Environmental Research Communications, 6*(11), Article 115009. https://doi.org/10.1088/2515-7620/ad87b5

62. Yesekina, B., Khoroshilova, D., & Safonov, M. (2024). *Kazakhstan: Uluchshaya klimaticheskoye zakonodatelstvo [Kazakhstan: Improving climate legislation]*. Eurasia NET. (In Russian). Retrieved from http://surl.li/orhpyv

63. Zarubina, V. R., Zarubin, M. Y., Esenkulova, Z. Z., & Pritula, R. A. (2024). Prodvizheniye ESG-povestki dlya malogo i srednego predprinimatel'stva Respubliki Ka-

zakhstan v usloviyakh ustoychivogo razvitiya [Advancing the ESG agenda for small and medium enterprises in Kazakhstan within sustainable development]. *Turan University Bulletin, 3,* 84-97. https://doi.org/10.46914/1562-2959-2024-1-3-35-84-97

64. Zhakiyev, N., Sagadatova, N., Ismagulova, G., Bakdolotov, A., & Biloshchytskyi, A. (2024). Hybrid technico-economical modeling of the mid-term green economy and low-carbon development strategy of Kazakhstan. *ES Energy & Environment, 25*. http://dx.doi.org/10.30919/esee1235

65. Zhang, Z., Hu, G., Mu, X., & Kong, L. (2022). From low carbon to carbon neutrality: A bibliometric analysis of the status, evolution and development trend. *Journal of Environmental Management, 322,* Article 116087. https://doi.org/10.1016/j.jenvman.2022.116087

66. Zhao, X., Ma, X., Chen, B., Shang, Y., & Song, M. (2022). Challenges toward carbon neutrality in China: Strategies and countermeasures. *Resources, Conservation and Recycling*, *176*, Article 105959. https://doi.org/10.1016/j.resconrec.2021.105959

67. Zheng, Y., Li, Z., & Chai, J. (2023). Progress and prospects of international carbon peaking and carbon neutral research–based on bibliometric analysis (1991–2022). *Frontiers in Energy Research, 11,* Article 1121639. https://doi.org/10.3389/fenrg.2023.1121639

http://dx.doi.org/10.21511/ee.16(4).2025.01