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DECARBONISATION OF KAZAKHSTAN'S ECONOMY: FROM CLIMATE GOALS TO PRACTICAL OUTCOMES

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ABSTRACT

Purpose of the research – This study examines the decarbonization implementation gap in resource-rich Kazakhstan, understood as the distance between formally stated climate ambition and observed emissions outcomes. Using the United Kingdom as a contrasting governance benchmark, it investigates how legal anchoring, policy-instrument coherence, Emissions Trading Scheme (ETS) credibility, and enforcement capacity shape the translation of climate pledges into measurable low-carbon outcomes.

Methodology – The paper employs comparative institutional analysis, combining policy document review, case-based evidence, and secondary statistical data. It compares Kazakhstan and the United Kingdom across a governance pathway linking climate targets, legal frameworks, policy instruments, monitoring, reporting and verification systems, enforcement mechanisms, and emissions trajectories.

Originality/value of the research – The study contributes to comparative climate-governance literature by shifting attention from climate ambition to implementation capacity. It extends the implementation-gap perspective to decarbonization as a governance challenge, particularly for resource-rich economies exposed to fossil-fuel dependence, carbon-intensive exports, and external climate-trade pressures such as Carbon Border Adjustment Mechanism (CBAM).

Findings – The analysis shows that Kazakhstan's implementation gap is shaped by weak legal anchoring, fragmented policy instruments, limited ETS effectiveness, uneven Monitoring, Reporting and Verification (MRV) capacity, and limited enforcement credibility. The UK case demonstrates how legally binding carbon budgets, independent oversight, coherent instruments, credible carbon pricing, and MRV systems can narrow the gap between pledges and delivery.

Keywords: decarbonization, governance, policy implementation, Kazakhstan, United Kingdom, energy transition.

INTRODUCTION

Reconciling decarbonization with continued dependence on hydrocarbon wealth is among the most demanding policy challenges facing resource-rich states. These economies are expected to accelerate the low-carbon transition while simultaneously safeguarding growth, fiscal stability, export competitiveness, and social resilience [1; 2; 3]. The difficulty is not only technological or financial; it is also institutional. Announcing ambitious climate targets is comparatively straightforward, but converting those targets into measurable emissions reductions depends on legal frameworks, policy instruments, and enforcement systems that many resource-dependent economies have not yet fully developed. Examining how, and how far, such economies translate climate ambition into measurable outcomes is therefore both analytically important and policy relevant.

Kazakhstan exemplifies this challenge. It has pledged carbon neutrality by 2060 and introduced a growing number of institutional reforms to strengthen environmental governance, yet it remains a hydrocarbon-reliant, export-oriented economy in which decarbonization has so far been expressed more through strategic commitments than through measurable change. Climate targets are embedded largely in strategies and government concepts rather than in binding law, and the systems required to make them credible, in particular monitoring,

reporting, and verification (MRV), remain unevenly developed. These weaknesses are no longer only a matter of reputation. Under the European Union's Carbon Border Adjustment Mechanism (CBAM), the credibility of a country's emissions measurement and carbon pricing increasingly shapes the competitiveness of its exports. The World Bank estimates that Kazakhstan could lose more than USD 250 million a year in export earnings under CBAM, with these losses potentially rising toward USD 1.5 billion should the mechanism be extended to oil and gas [2]. For a carbon-intensive exporter, the distance between stated climate ambition and actual implementation therefore carries a direct and growing economic cost.

The United Kingdom provides a useful contrasting benchmark because it combines a history of North Sea hydrocarbon production with a mature climate-governance architecture, including legally binding carbon budgets, independent oversight, and a functioning carbon-pricing regime. The comparison is not intended to present the UK as a directly transferable model for Kazakhstan. Rather, it uses the UK as a governance benchmark to identify which institutional mechanisms help convert climate ambition into measurable decarbonization outcomes. Both Kazakhstan and the United Kingdom are parties to the Paris Agreement and have adopted long-term net-zero or carbon-neutrality commitments: the UK has legally committed to net-zero greenhouse-gas emissions by 2050, while Kazakhstan has adopted a national strategy to achieve carbon neutrality by 2060 [3; 4; 5; 6]. Yet the two countries occupy opposite ends of the resource-transition spectrum. Kazakhstan remains highly dependent on fossil fuels, with oil and gas central to export revenues and coal accounting for around half of total energy supply and more than 60% of electricity generation [2; 7]. By contrast, the UK has substantially reduced the role of fossil fuels in electricity generation and expanded renewable electricity, with renewables accounting for just over half of UK electricity generation in 2024 and low-carbon sources reaching nearly two-thirds of generation [8; 9]. This contrast allows the paper to examine which fiscal, regulatory, and governance mechanisms help accelerate decarbonization in fossil-fuel-dependent economies.

In Kazakhstan, policy ambition often collides with governance gaps, including shortfalls in rule clarity, monitoring, reporting and verification (MRV), enforcement, administrative capacity, data transparency, sanction credibility, and investor standards [10; 11; 12]. In this setting, the quality of governance determines whether exporters sustain competitiveness as carbon costs are increasingly priced into cross-border trade [1; 13]. By contrast, the United Kingdom is often cited as a paradigmatic case of “governance-led” decarbonization. Since 1990 it has roughly halved its territorial greenhouse gas (GHG) emissions while sustaining economic growth, largely through power-sector decarbonization and a dense web of climate-policy instruments. The Climate Change Act introduced legally binding carbon budgets and established the independent Climate Change Committee (CCC), while the UK Emissions Trading Scheme (UK ETS), Contracts for Difference (CfD) for low-carbon power and sector-specific regulations have created a relatively predictable environment for investors and regulated entities [14; 15; 16; 17].

This study addresses the following research question: How do governance mechanisms shape the decarbonization implementation gap between climate ambition and observed emissions outcomes in resource-rich economies? We address this question through a structured comparison of Kazakhstan and the United Kingdom. Kazakhstan represents a resource-rich economy facing the challenge of translating long-term climate ambition into implementation, while the United Kingdom serves as a contrasting governance benchmark where legally anchored targets, independent oversight, and mature policy instruments have helped narrow the implementation gap. This paper situates Kazakhstan's decarbonization efforts within the broader comparative political-economy literature on resource wealth, institutional quality and climate policy. Building on work on the resource curse [18; 19; 20] and on national institutions and corporate environmental performance [21; 22; 23], we argue that governance structures and policy instruments condition the translation of climate pledges into outcomes.

Existing scholarship on Kazakhstan's low-carbon transition has concentrated on renewable-energy potential and technical mitigation scenarios, leaving decarbonization largely untreated as a problem of institutional implementation; comparative climate-governance research, in turn, has rarely examined how external carbon-border measures interact with weak domestic governance. Addressing these gaps, this paper makes three contributions. First, it extends the implementation-gap perspective – developed in research on policy implementation, organizational decoupling, and climate-pledge delivery – to resource-rich economies, a setting where

it has not previously been applied and where fiscal dependence on carbon-intensive sectors gives the gap distinctive political-economy roots. Second, it develops a governance-pathway framework that decomposes the gap into three observable stages – legal anchoring, policy-instrument coherence, and MRV and enforcement credibility – and applies it comparatively to two economies at opposite ends of the resource-transition spectrum, converting a diffuse gap between ambition and delivery into a stage-by-stage diagnostic transferable to other cases. Third, it reconceptualizes an external trade instrument – the EU's CBAM – as a *de facto* enforcement mechanism: by attaching a material cost to weak domestic carbon pricing and unverifiable emissions data, CBAM compresses an implementation gap that, in a purely domestic setting, could remain low-cost and largely symbolic. Together, these contributions reframe decarbonization in resource-rich economies as a question of institutional credibility, not climate ambition alone.

Literature review. *Resource wealth and decarbonization constraints*

Resource-rich economies face distinctive decarbonization constraints because climate transition affects not only energy systems but also fiscal revenues, export structures, industrial policy, and state–business relations. Hydrocarbon dependence can slow decarbonization by creating fiscal reliance on fossil-fuel rents, strengthening incumbent interests, and increasing the political cost of rapid transition. In such contexts, the problem is not only whether renewable technologies are available, but whether institutions can manage the distributional and fiscal consequences of moving away from carbon-intensive development. Kazakhstan exemplifies these constraints. Its economy remains strongly connected to fossil-fuel production, carbon-intensive electricity generation, and export structures exposed to changing global climate-trade rules. This makes decarbonization a governance challenge as much as a technological or investment challenge.

International research highlights that hydrocarbon wealth and institutional quality jointly shape the pace and direction of decarbonization. Studies on the “resource curse” show how oil and gas dependence interacts with governance to generate Dutch-disease effects, fiscal volatility and political obstacles to reform [18; 24]. Recent cross-country evidence further suggests that oil-rich countries are, on average, less inclined to adopt and implement stringent climate-change policies than more diversified economies, even when vulnerability to warming is high [20]. Together, this literature implies that technology and income levels are not sufficient to explain decarbonization trajectories; the structure of state–business relations and the distribution of resource rents are critical. Complementary research on the integration of artificial intelligence into renewable-energy deployment in Kazakhstan further shows that technological potential alone is insufficient without supportive institutional capacity, data infrastructure, and governance coordination [25].

A second strand of work examines border carbon adjustments (BCAs) as a response to carbon leakage under unilateral climate policy. Model-based simulations and meta-analyses indicate that BCAs can reduce leakage and competitiveness losses for carbon-constrained economies, but they also redistribute adjustment costs toward trading partners and raise complex legal and administrative questions [26; 27; 28]. For exporters of emissions-intensive goods, the design of BCAs such as the EU's CBAM therefore represents both an environmental and a trade policy shock, especially when domestic MRV systems and carbon-pricing regimes are weak or poorly aligned with international standards.

Climate pledges and the implementation gap

A growing body of climate-governance research shows that national climate pledges do not automatically produce emissions reductions. Many governments announce net-zero targets, a nationally determined contributions, and sectoral strategies, but implementation depends on the institutions that translate ambition into binding commitments, incentives, monitoring systems, and enforcement. The idea that formally adopted commitments need not translate into corresponding practice is well established across several literatures. Research on policy implementation has long examined the implementation gap between legislated intent and administrative delivery [29]. Institutional scholarship analyzes the same phenomenon as decoupling – the separation of formal policy from operational practice – and distinguishes policy-practice decoupling from means-ends decoupling [30; 31]. In climate governance, the distance between pledges and delivery is tracked as an implementation or ambition gap [32; 33]. The decarbonization implementation gap used here builds directly on these traditions; its contribution is not the general idea of a gap, but its operationalization for resource-rich econo-

mies and its connection to the external enforcement pressure exerted by carbon-border measures. We define the decarbonization implementation gap as the distance between formally stated climate ambition and observed emissions outcomes, conditioned by the institutional mechanisms that translate targets into enforceable policy, investment incentives, and behavioral change.

For Kazakhstan, a growing literature documents the technical and economic potential of renewable energy and the barriers to its deployment. Reviews of the national energy system highlight high carbon intensity, dependence on ageing coal-fired power plants and significant wind and solar potential [34; 35; 36]. Scenario analyses and policy simulations show that substantial emission reductions would require large-scale investment in low-carbon generation and stronger regulatory signals, including more predictable carbon pricing and support schemes [2; 3; 37]. Other studies emphasize governance constraints in the renewable-energy sector, such as unstable support instruments, complex permitting and weak coordination across ministries and regions [11; 12; 38]. In the Kazakhstani context, prior research on innovative economic policy suggests that transition-oriented reforms require coordinated institutional support rather than isolated policy instruments [39].

Institutional and management research reinforces the salience of governance quality. Work on emerging markets stresses how institutional voids, political uncertainty and corruption affect investment and corporate social performance [21; 22; 40; 41]. Studies of Kazakhstan link corporate-governance reforms and disclosure practices to improvements in environmental, social and governance (ESG) outcomes [23] and highlight persistent challenges of “bad enough governance” in post-Soviet regimes [42]. Research on global supply chains and private regulation shows that codes of conduct, third-party auditing and buyer pressure can complement state regulation in driving environmental and labor-standard compliance [43; 44; 45; 46]. The implementation gap is particularly salient in resource-rich economies because long-term climate targets often coexist with fossil-fuel dependence, carbon-intensive exports, and fragmented administrative capacity. In such contexts, climate ambition may be politically attractive at the level of strategy, but difficult to operationalize through binding rules, credible instruments, and firm-level compliance.

Governance mechanisms that narrow the gap

A rich literature evaluates climate policy instruments in advanced economies, including the UK. Analyses of carbon taxes and emissions trading schemes find that well-designed price-based instruments can reduce emissions without large competitiveness losses and can stimulate low-carbon innovation [15; 16; 17; 47]. The UK’s framework of legally binding carbon budgets, independent oversight by the Climate Change Committee and long-term contracts for low-carbon power (Contracts for Difference) is widely regarded as an institutional model for embedding climate targets into policy processes [14; 48; 49; 50]. More broadly, research on innovation and regulatory ecosystems suggests that sustainable transition requires not only new technologies or financial instruments, but also governance arrangements capable of balancing innovation, oversight, market development, and public-interest objectives [51].

There is also an extensive institutional literature on how national governance systems shape corporate environmental and social performance [22; 23; 52]. This work shows that transparency requirements, enforcement capacity and civil-society pressure can complement formal climate policy in steering firms toward lower-carbon practices. Studies of private regulation and global supply chains - codes of conduct, third-party auditing and disclosure mandates - reinforce the idea that “governance” encompasses both state and non-state instruments [43; 45; 46; 53].

Kazakhstan, CBAM, and external pressure

CBAM has moved beyond proposal and transition. Its transitional, reporting-only phase ran from October 2023 to December 2025, and its definitive regime began on 1 January 2026. Ahead of that phase the EU adopted a simplification ('Omnibus') amendment – Regulation (EU) 2025/2083, in force from October 2025 – which introduced a single mass-based de minimis threshold of 50 tonnes per importer per year (replacing the former €150 value exemption), postponed the purchase and surrender of CBAM certificates to February 2027, and reduced quarterly compliance obligations. Although certificate purchases are deferred, financial liability accrues for goods imported from January 2026 [54].

CBAM creates an external test of domestic decarbonization governance because it links trade exposure to the credibility of emissions measurement, carbon pricing, and sectoral transition policies [28; 55]. For ex-

porters such as Kazakhstan, the issue is not only whether national climate targets exist, but whether domestic carbon-pricing, MRV, and sectoral decarbonization systems are credible enough to be recognized by external markets [2; 3; 13]. In this sense, CBAM transforms domestic implementation weaknesses into trade-competitiveness risks, especially for emissions-intensive exporters whose market access increasingly depends on verifiable carbon performance [27; 28; 55]. Where MRV systems are weak, exporters may struggle to demonstrate product-level emissions performance, and where carbon-pricing systems are unstable or poorly aligned with international standards, domestic climate effort may not translate into reduced CBAM exposure [3; 13; 33]. CBAM therefore increases the cost of the implementation gap by linking export competitiveness to verifiable emissions governance [55; 56]. For Kazakhstan, this is especially important because EU-bound exports remain concentrated in carbon-intensive sectors, while CBAM-covered products such as aluminum, iron and steel create concentrated regulatory risk despite representing a smaller share of total export value [57; 58]. Even where CBAM-covered sectors represent a limited share of total export value, they expose firms and policymakers to a new form of regulatory pressure: climate credibility becomes a condition of market access [2; 3; 59].

Viewed through the decoupling lens, symbolic climate commitments are sustainable mainly when they are inexpensive and unverified: where no external actor prices or audits the gap between pledge and practice, decoupling can persist [31]. CBAM removes both conditions. It attaches a material cost to weak domestic carbon pricing and conditions market access on verifiable, product-level emissions data. In this sense CBAM functions as an external enforcement mechanism for domestic decarbonization governance, compressing a gap that domestic institutions alone have been unable, or unwilling, to close.

Research gap and analytical positioning

Building on this definition, the literature suggests that implementation gaps emerge when climate ambition is not matched by binding legal commitments, coherent policy instruments, credible MRV/enforcement, and investment incentives capable of changing firm and sectoral behavior. Existing studies provide important insights into Kazakhstan's energy transition, resource dependence, and the UK's climate-governance architecture. However, existing work has not applied the implementation-gap lens to resource-rich economies through a structured governance pathway, nor theorized how external carbon-border measures act as enforcement mechanisms for domestic climate decoupling. This paper addresses that gap by examining how legal anchoring, policy-instrument coherence, and MRV/enforcement credibility shape the translation of climate ambition into observed decarbonization outcomes in a resource-rich economy. The UK is not used as a direct model for replication, but as a contrasting governance benchmark that helps identify mechanisms through which the implementation gap may be narrowed.

RESEARCH DESIGN

Governance pathway framework

To analyze decarbonization governance comparatively, we employed a five-stage pathway that links high-level commitments to observable outcomes. Each stage is populated with country-specific institutions and instruments (e.g. the Climate Change Act, CCC, UK ETS and CfDs in the UK; the Environmental Code, KAZ ETS and renewable-energy auctions in Kazakhstan). This structure (Table 1) allows us to move beyond a simple comparison of targets or emissions and instead diagnose where along the pathway implementation gaps emerge.

Table 1 – Five-stage pathway for operationalizing the decarbonization implementation gap

Element of definition	How this paper observes it
Formally stated climate ambition	NDCs, net-zero pledges, national strategies
Institutional mechanisms	Legal anchoring, policy instruments, MRV/enforcement, investment incentives
Firm and investment responses	ETS participation, renewable-energy investment, sectoral policy response, CBAM readiness
Observed emissions outcomes	CO ₂ /GHG trajectories, per-capita emissions, power-sector mix
Implementation gap	Divergence between ambition and realized outcomes
Note – compiled by the authors	

Rather than testing pre-specified hypotheses, the comparative case design structures a disciplined, stage-by-stage comparison of the two cases, from which a set of propositions is developed. The framework is informed by classic institutional and organizational theories of implementation and isomorphism [60; 61; 62], as well as by recent work on political and administrative capacity in post-Soviet settings [42] and on climate-policy implementation in complex governance systems [12].

Each stage of the governance pathway was assessed qualitatively against the criteria set out in Table 2. For each country, the governance dimensions – targets and strategy, legal anchoring, policy instruments and coherence, carbon-price credibility, and MRV and enforcement – were classified as strong, partial, or weak relative to the indicators in the rubric, drawing on the regulatory documents, independent scorecards, and statistical sources described above. To limit subjectivity, classifications were cross-checked against independent third-party assessments – the ICAP ETS factsheets, Climate Action Tracker country assessments, and OECD reviews – rather than resting on the authors' judgment alone. The coding is qualitative and interpretive; the rubric is provided to make the basis of each classification explicit and the comparison replicable.

Table 2 – Criteria for assessing the governance pathway

Governance dimension	Indicators of strong governance	Indicators of weak governance
Targets & strategy	Long-term net-zero/neutrality target with binding or quasi-binding status; defined intermediate milestones; sectoral decarbonization pathways	Long-term aspiration expressed in strategy or declaration only; no enforceable intermediate milestones; limited sectoral specification
Legal anchoring	Target and intermediate trajectories codified in framework climate legislation; statutory independent advisory/oversight body; mandatory, regular progress reporting to the legislature	Targets located in strategies, government concepts, or executive decrees rather than framework law; no independent statutory oversight; reporting ad hoc or discretionary
Policy instruments & coherence	Carbon pricing, regulatory standards, and financial/support instruments form a mutually reinforcing package, coordinated across ministries, with stable and predictable rules	Instruments fragmented or working at cross-purposes; weak inter-ministerial coordination; frequent, unpredictable changes to rules and support schemes
Carbon-price (ETS) credibility	Tightening emissions cap; allowances allocated by auctioning or stringent benchmarks; price high and stable enough to influence investment; broad sectoral coverage	Loose or frequently revised cap; largely free allocation; low or volatile price with limited effect on investment; narrow coverage
MRV & enforcement	Detailed MRV rules and technical guidance; independent accredited verification; complete registry; defined compliance cycles; proportionate sanctions applied consistently; adequate regulator capacity	MRV rules adopted but data reliability uncertain; verification weak or not independent; enforcement uneven across regions/sectors; sanctions weak or inconsistently applied; limited administrative capacity
Note – compiled by the authors		

Congruence is assessed as the degree of alignment across the pathway – between stated ambition, the institutional mechanisms intended to deliver it, and observed outcomes. The implementation gap is judged large where high ambition coexists with weak delivery mechanisms and outcomes diverge from the stated trajectory, and small where ambition is matched by strong mechanisms and outcomes track the trajectory. The gap is therefore read from the consistency between ambition, mechanisms, and outcomes, not from emissions levels alone.

Comparative case design and data

Empirically, we triangulate public regulatory documents, independent scorecards and international statistical sources. On the regulatory side we review Kazakhstan's 2021 Environmental Code, its implementing by-laws and official MRV and ETS circulars, as well as UK climate legislation and guidance issued by the UK ETS Authority and the Environment Agency and devolved administrations. These sources are complemented by cross-national scorecards (International Carbon Action Partnership ETS factsheets; OECD and EU transparency portals) and macroeconomic and trade datasets (IMF World Economic Outlook for fiscal buffers; World Bank, IEA and Energy Institute data for emissions, energy use and carbon intensity; UN Comtrade and UNCTAD for EU-bound exports in CBAM-covered HS chapters).

Using these sources, we construct descriptive trajectories of total and per-capita CO₂ emissions for Kazakhstan and the UK, compare national climate targets and recent emissions, and qualitatively code key governance features including target-setting, legal anchoring, policy instruments, MRV/enforcement, and observed outcomes. The analysis focuses on identifying congruence between targets, instruments, and outcomes, and on assessing which elements of the UK governance model are plausibly adaptable to Kazakhstan's institutional context.

We conceptualize decarbonization governance as a pathway that links high-level climate pledges to observable outcomes through five stages: Targets and strategy – long-term climate goals, intermediate milestones and sectoral transition strategies. Legal anchoring – the extent to which targets and mandates are codified in binding legislation and enforceable rules. Policy instruments – the mix of carbon pricing, regulatory and financial tools (e.g. ETS, taxes, feed-in tariffs, Contracts for Difference). MRV and enforcement – monitoring, reporting and verification systems, sanctioning mechanisms and administrative capacity. Outcomes – realized trajectories of emissions and the power-sector mix over time. This pathway serves as an a priori but provisional framework [63]: it guides the comparison stage by stage without fixing the analysis in advance, and it is refined in light of the case evidence. Because absolute emissions levels are shaped by income, economic structure, and energy endowment, the analysis focuses on the mechanisms in the governance pathway rather than on the size of the emissions gap itself; it asks whether each stage plausibly translates ambition into outcomes, not how much of the observed gap governance explains.

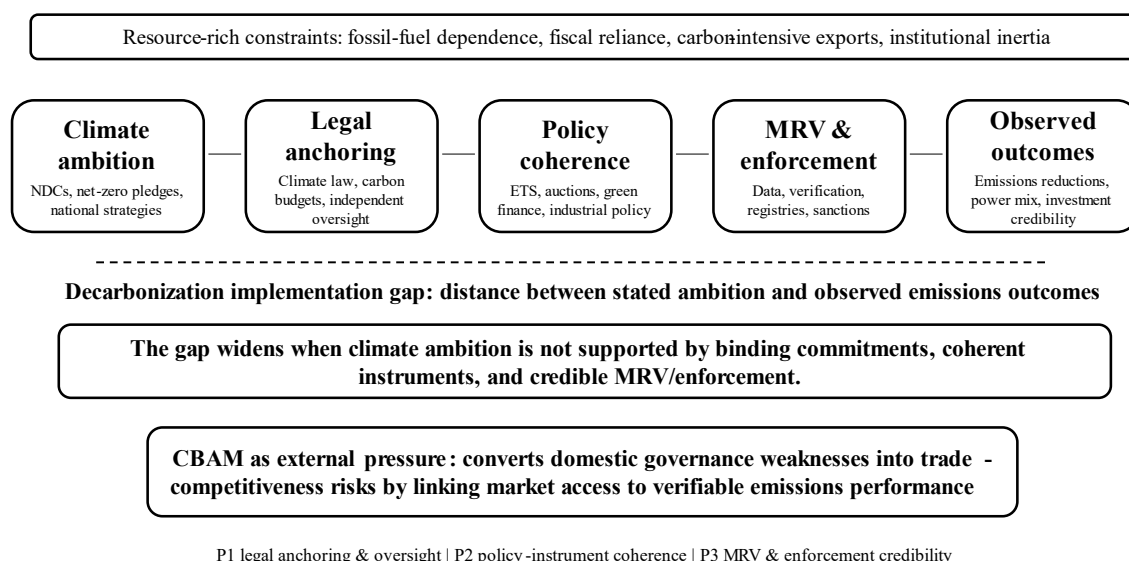


Figure 1 – Decarbonization implementation gap framework

Note – compiled by the authors

The framework shows how resource-rich constraints widen the gap between climate ambition and observed outcomes. Legal anchoring, policy coherence, and MRV/enforcement credibility operate as governance mechanisms that can narrow this gap, while CBAM increases external pressure by linking market access to verifiable emissions performance. Figure 1 sets out the five stages – targets and strategy, legal anchoring, policy instruments, MRV and enforcement, and outcomes – and how differences in institutional design help explain divergent decarbonization trajectories.

The two cases differ on dimensions other than governance, and these differences must be acknowledged. The United Kingdom is a high-income, service-oriented economy whose post-1990 territorial emissions decline was driven substantially by structural factors – the 1990s shift from coal to gas in power generation, the long-term contraction of heavy industry and the offshoring of some emissions-intensive production, and the decline of domestic coal – as well as by climate policy. Kazakhstan, by contrast, carries a post-Soviet

inheritance of an energy-intensive, coal-dependent capital stock, a colder climate and larger distances, lower income, and an economy structurally dependent on hydrocarbon extraction. The comparison therefore cannot isolate the causal effect of governance on emissions outcomes; it is used to illustrate and refine governance mechanisms, not to estimate their independent contribution.

RESULTS

The analysis follows the governance pathway, reporting for each country its stated ambition, the institutional mechanisms intended to deliver it, and observed outcomes. Each governance dimension is classified as strong, partial, or weak against the rubric in Table 2; the section closes by drawing these classifications together into a summary of the implementation gap.

Stated climate ambition: targets and commitments

Both countries have adopted long-term net-zero or carbon-neutrality commitments alongside intermediate reduction targets (Table 3). The difference lies less in the existence of targets than in their institutional status. In the United Kingdom, the long-term target is set in primary legislation and underpinned by legally binding interim carbon budgets. In Kazakhstan, climate ambition is expressed through a Nationally Determined Contribution (NDC), strategic documents, and the 2060 carbon-neutrality strategy, but the legal and institutional mechanisms for delivery are far less developed.

Table 3 – Comparative decarbonization targets, the United Kingdom and Kazakhstan (1990–2060)

Country	Base Year	Target Year	Target	Level
United Kingdom	1990	2030	Economy-wide GHG reduction (NDC)	≥ 68% below 1990
	1990	2035	GHG reduction (NDC, submitted Jan 2025)	~ 81% below 1990
	1990	2050	Net-zero GHG (Climate Change Act)	Net Zero
Kazakhstan	1990	2030	Unconditional GHG reduction (NDC)	-15% below 1990
	1990	2030	Conditional GHG reduction (NDC, with international support)	-25% below 1990
	-	2060	Carbon neutrality (national strategy)	Net Zero

Note – Compiled by the authors based on [5; 6; 33; 64].

Institutional mechanisms: legal anchoring, policy instruments, and MRV

Table 4 reports the governance pathway for both countries, with each dimension classified against the rubric. The United Kingdom is rated strong at every stage. Kazakhstan is rated partial or weak throughout: targets exist but are not anchored in framework law, the instrument mix is fragmented, and MRV and enforcement remain uneven. The contrast is not one of ambition but of the institutional machinery that converts ambition into enforceable obligation.

Table 4 – Governance pathway from decarbonization targets to outcomes in the United Kingdom and Kazakhstan

Pathway stage	United Kingdom	Kazakhstan
Targets & strategy	Strong – net-zero by 2050 in the Climate Change Act; multi-decade pathway of five-year carbon budgets advised by the independent CCC.	Partial – NDC targets and a 2060 neutrality strategy with sectoral "green economy" concepts, but milestones set out in strategy rather than law.
Legal anchoring	Strong – Climate Change Act 2008 gives legal force to the target and carbon budgets, establishes the CCC, and requires reporting to Parliament.	Weak – the 2021 Environmental Code regulates ETS and MRV, but climate targets sit in strategies and decrees rather than framework climate law; no independent statutory oversight.
Policy instruments & coherence	Strong – UK ETS, Contracts for Difference, carbon price support and efficiency standards form a coordinated, predictable package.	Weak – KAZ ETS, renewable-energy auctions, green finance and Best Available Techniques (BAT) obligations exist but are fragmented and not embedded in a coherent cross-ministerial framework.

Carbon-price (ETS) credibility	Strong – tightening cap, partial auctioning, a price high enough to influence investment, broad coverage.	Weak – generous free allocation, modest cap stringency, low and volatile prices, narrow coverage.
MRV & enforcement	Strong – detailed MRV rules, accredited independent verifiers, electronic registry, clear compliance cycles and credible penalties.	Partial – MRV rules updated under the 2021 Environmental Code, but data reliability is uneven, enforcement varies by region, and sanctions are weak or inconsistently applied.
Outcomes (emissions & power mix)	Territorial GHG emissions roughly half of 1990 levels; low-carbon sources about 65% of electricity in 2024.	Emissions only modestly below 1990 levels; coal still dominant; renewables about 5–6% of electricity in 2023–2024.
Note – compiled by the authors based on [13; 33; 48; 50; 64; 65].		

A central difference lies not in the existence of emissions trading but in the credibility of the carbon-price signal. Kazakhstan operates an ETS, but generous allowance allocation, modest cap stringency, low and unpredictable prices, and limited sectoral coverage mean it has not yet created a strong incentive for firms to abate; in rubric terms it is classified weak. The system therefore functions more as a formal instrument than as a binding constraint on carbon-intensive producers. This bears directly on CBAM exposure: where the domestic carbon price is weak, or not recognized as equivalent to external regimes, exporters remain liable for carbon costs at the EU border.

Observed outcomes: emissions trajectories and power-sector transition

Table 5 reports total greenhouse-gas emissions per capita at selected years. Between 1990 and 2023, the United Kingdom's per-capita emissions fell by about 58% (13.3 to 5.5 t CO₂e); Kazakhstan's fell by about 21% (21.0 to 16.6 t CO₂e) and remain well above the UK level.

Table 5 – Total greenhouse-gas emissions per capita in Kazakhstan and the United Kingdom (selected years, 1990–2023)

Country	1990 (t CO ₂ e per capita)	2000 (t CO ₂ e)	2010 (t CO ₂ e)	2023 (t CO ₂ e)	Change 1990–2023 (%)
United Kingdom	13.3	11.7	9.3	5.5	–58.6
Kazakhstan	21.0	11.8	19.4	16.6	–21.0
Note – Compiled by the authors based on [5; 33].					

Figure 2 shows the continuous trajectory of carbon-dioxide emissions per capita and complements Table 5 by displaying the full 1990–2024 path. The per-capita values in Figure 2 are lower than those in Table 5 because Figure 2 reports carbon dioxide only [66], whereas Table 5 reports total greenhouse gases in CO₂-equivalent terms, including methane and other gases; the two series are therefore not directly comparable. The figure shows a steady, sustained decline for the United Kingdom and a higher, slowly declining path for Kazakhstan that remains close to its 1990 level.

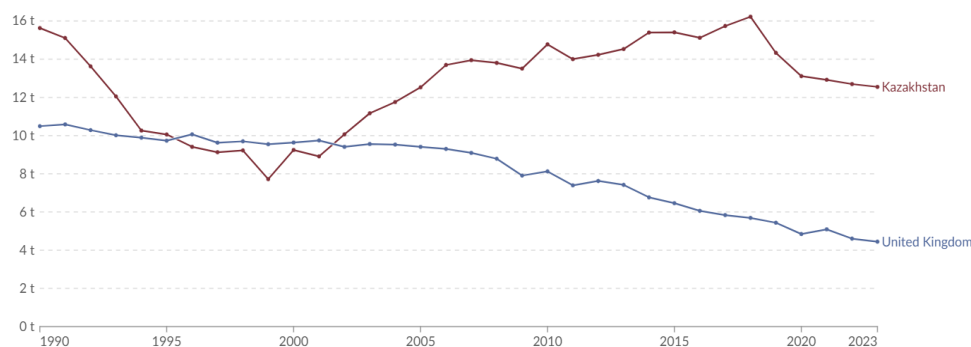


Figure 2 – Carbon-dioxide emissions per capita, Kazakhstan and the United Kingdom, 1990–2024.

Note – Compiled by the authors based on [66].

Part of the UK's territorial decline reflects the contraction of heavy industry and greater reliance on imported goods, so that some emissions were displaced abroad rather than eliminated; on a consumption basis, UK emissions have fallen considerably less than the territorial figures suggest [4]. Read against the pathway, both countries express clear ambition, but the United Kingdom's outcomes track its targets far more closely than Kazakhstan's.

Trade exposure under CBAM

Table 6 reports Kazakhstan's goods exports to the EU by product group and their CBAM status. EU-bound trade is overwhelmingly concentrated in fuels and mineral products, which are not directly covered by CBAM, while the CBAM-covered sectors – aluminum, iron and steel, and fertilizers within chemicals – account for a small share of export value. Their importance is disproportionate to that share: because CBAM liability depends on verified, product-level emissions, exposure in these sectors concentrates regulatory risk on precisely the governance weaknesses identified above – ETS credibility and MRV.

Table 6 - Kazakhstan's exports to the European Union by main product group (goods, 2024)

Product group (exports from Kazakhstan to EU)	EU imports from Kazakhstan, 2024 (EUR million)	Approx. share of total EU goods imports from Kazakhstan (%)	CBAM exposure status (definitive regime, from 2026)
Fuels and mineral products	31,800	~95.0	Not directly covered by CBAM, but strongly affected by EU climate and energy policy
Non-ferrous metals (incl. aluminum)	410	~1.2	Partially covered (aluminum products, Harmonized System HS 76)
Iron and steel	204	~0.6	Covered
Chemical products	667	~2.0	Partially covered (fertilizers)
Other semi-manufactures	95	~0.3	Not currently covered
Machinery and transport equipment	60	~0.2	Not currently covered

Note – Compiled by the authors based on [57; 58]. A December 2025 Commission proposal would extend CBAM to downstream products from 2028; not yet adopted

Diagnosing the implementation gap

Drawing the classifications together, Figure 3 summarizes the implementation gap by pathway stage. The United Kingdom is strong across all dimensions; Kazakhstan is partial on targets and MRV and weak on legal anchoring, policy coherence, and ETS credibility. The gap is therefore widest at the stages that convert ambition into enforceable obligation – legal anchoring, instrument coherence, and carbon-price credibility – and narrower, though still present, on target-setting and MRV.

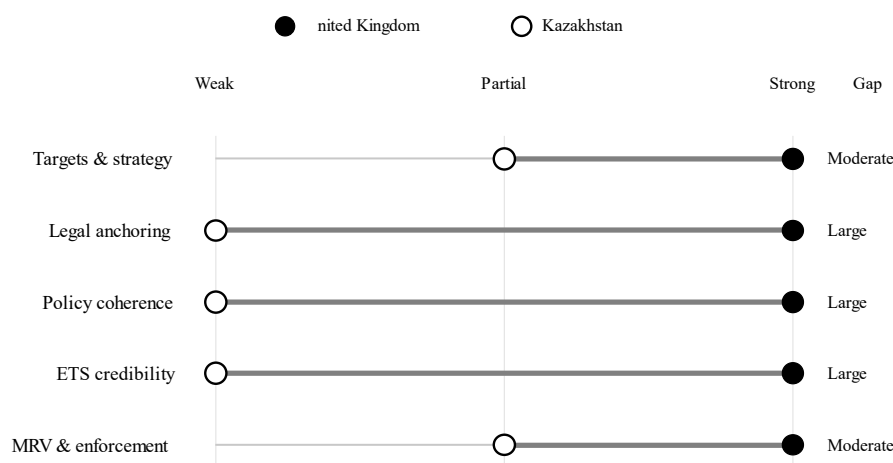


Figure 3 – The decarbonization implementation gap by governance pathway stage.

Note – compiled by the authors

Figure 3 makes the pattern visible: the UK column sits flush at "strong" throughout, while Kazakhstan's markers fall away in the middle three stages – legal anchoring, policy coherence, and ETS credibility – which is exactly where the gap is widest. The two "moderate" stages (targets and MRV) bracket the three "large" ones, so the figure shows that the gap is concentrated in the delivery mechanisms, not in ambition or measurement.

DISCUSSION

The comparative evidence points to a clear implementation gap in Kazakhstan's decarbonization strategy. Despite adopting long-term neutrality goals and operating one of the first emissions trading systems in the region, Kazakhstan has not yet achieved substantial reductions in either total or per-capita emissions [3; 33]. By contrast, the United Kingdom combines similar net-zero aspirations with an institutional architecture that constrains short-term policy choices and investment decisions in line with long-term targets [14; 64]. Three governance lessons emerge from the comparison.

Legal anchoring narrows the commitment gap

Legally binding carbon budgets and independent oversight help translate targets into credible commitments [14]. In the UK, the Climate Change Act establishes multi-year carbon budgets that are set well in advance and reviewed by an independent Climate Change Committee; government departments must prepare policies consistent with these budgets, and periodic progress reports provide a transparent basis for course correction [64]. Kazakhstan's strategies and ETS caps are more discretionary and have been revised frequently, which weakens expectations and hampers long-term planning by firms [13; 33]. Introducing medium-term emission-reduction trajectories anchored in law, supported by an independent advisory body and regular public reporting, would narrow the space between high-level goals and day-to-day decision-making. This reasoning – that binding legal anchoring, medium-term carbon budgets, and independent oversight reduce the distance between stated targets and day-to-day policy choices – is developed formally in Proposition 1, below.

Policy coherence narrows the investment gap

Kazakhstan's ETS should be treated as a central mechanism in narrowing the implementation gap, but at present it does not yet provide a sufficiently credible carbon-price signal to drive large-scale decarbonization [2; 13]. This creates a policy contradiction: Kazakhstan formally operates a domestic carbon-pricing instrument, yet exporters may still face CBAM-related costs because the domestic system does not fully protect them from external carbon-pricing pressure [28; 55]. In this sense, CBAM exposes the weakness of domestic ETS implementation. It transforms what appears to be a domestic governance issue – weak caps, uncertain prices, limited enforcement and uneven MRV – into an external competitiveness problem [27].

Coordination between climate policy, industrial policy and trade policy is therefore critical under CBAM [28]. CBAM increases the cost of the implementation gap by linking export competitiveness to verified emissions performance, so the issue for Kazakhstan is not only whether domestic climate targets are ambitious, but whether MRV systems, carbon-pricing rules, and sectoral decarbonization policies are credible enough to be recognized in external markets. The UK has linked its carbon-pricing regime to support instruments such as Contracts for Difference, industrial decarbonization funds and innovation programs, thereby aligning incentives for utilities, heavy industry and investors [47; 48]. Kazakhstan has launched important initiatives – the Environmental Code, green-finance instruments and renewable-energy auctions – but they are not yet embedded in a coherent cross-ministerial framework [11; 38; 65]. For a CBAM-exposed exporter, aligning climate and industrial policy means prioritizing decarbonization in sectors covered by the mechanism (steel, aluminum, fertilizers, electricity), integrating MRV requirements into export strategies and using public finance to de-risk low-carbon investment in these value chains. This contrast – between a coherent mix of credible carbon pricing, sectoral support, and investment incentives and a set of fragmented, unstable instruments – provides the basis for Proposition 2, below.

MRV/enforcement narrows the credibility gap

Robust MRV and enforcement systems are central both to domestic credibility and to external recognition of climate effort. The UK's MRV framework rests on clear technical guidance, accredited verifiers and proportionate but credible sanctions for non-compliance [49; 50]. Kazakhstan has made progress in updating its MRV rules under the 2021 Environmental Code and subsequent regulations, yet implementation capacity remains uneven across regions and sectors, and sanctions are often weak or inconsistently applied [33; 65; 67].

Strengthening MRV institutions – through clearer guidelines, capacity-building for regulators and verifiers, and a transparent registry of installations and emissions – would improve data quality, support the ETS and facilitate the demonstration of CBAM-relevant performance to EU partners. This logic – that transparent MRV, independent verification, and credible enforcement turn climate targets into operational constraints for firms and regulators – is captured in Proposition 3, below.

Synthesizing the three governance mechanisms examined above, the comparison yields three propositions that generalize beyond the two cases. Because they rest on a polar-type, two-country comparison, they are offered as analytically grounded claims for testing on larger and more diverse samples [63].

Proposition 1. Legal anchoring and the commitment gap. Resource-rich economies that embed climate targets in binding legal frameworks, medium-term carbon budgets, and independent oversight mechanisms will experience a smaller decarbonization implementation gap than those relying primarily on non-binding strategies or executive declarations.

Proposition 2. Policy coherence, ETS credibility, and the investment gap. Resource-rich economies that align a credible ETS, renewable-energy support, industrial policy, and investment incentives into a coherent policy mix will experience a smaller decarbonization implementation gap than those with fragmented instruments, weak carbon-price signals, or unstable regulatory incentives.

Proposition 3. MRV/enforcement and the credibility gap. Resource-rich economies with transparent MRV systems, independent verification, and credible enforcement mechanisms will experience a smaller decarbonization implementation gap because climate targets become operational constraints for firms, regulators, and investors.

The implementation gap is therefore visible not only in Kazakhstan's slower emissions decline, but also in the limited credibility of the domestic instruments intended to translate ambition into behavioral and investment change – a pattern of policy–practice decoupling in which formal commitments are adopted without the institutional capacity to enact them [30; 31]. Weak ETS effectiveness, uneven MRV, and limited enforcement mean that CBAM functions as an external test of domestic implementation capacity [55]. These lessons need to be adapted to Kazakhstan's political economy, fiscal constraints and administrative capabilities [42]. However, the comparison suggests that incremental improvements in governance – embedding binding budgets, aligning policy instruments and upgrading MRV and enforcement – could have outsized effects on decarbonization outcomes, even before large-scale technological shifts materialize.

For Kazakhstan, the comparison suggests several priorities:

1. Embedding medium-term emission-reduction trajectories in law, for example through carbon-budget-like mechanisms, would narrow the gap between long-term neutrality targets and short-term decision-making.
2. Establishing or empowering an independent advisory and oversight body – perhaps anchored in an existing institution but with a clear mandate to assess progress and advise on policy adjustments – would strengthen accountability.
3. Stabilizing and clarifying the ETS and renewable-energy policy frameworks, including predictable auction schedules and transparent allowance-allocation rules, would reduce regulatory risk and encourage low-carbon investment.
4. Investing in MRV capacity and enforcement, particularly at regional level, would improve data quality and send a clearer signal that environmental rules are not merely symbolic.

These steps do not require Kazakhstan to replicate the UK model wholesale. Rather, they involve adapting core governance principles – binding commitments, transparency, independent scrutiny and policy coherence – to Kazakhstan's constitutional structure, political economy and administrative capacity.

LIMITATIONS

This study has limitations. It compares two deliberately contrasting cases, which sharpens the governance comparison but limits generalizability and means governance cannot be separated from co-varying differences in income, economic structure, energy endowment, and historical starting point. The design supports no counterfactual estimate of how Kazakhstan would have performed under different institutions. For these reasons, the propositions are presented not as tested findings but as analytically grounded claims for assessment on larger and more diverse samples.

CONCLUSION

This paper has conceptualized Kazakhstan's decarbonization challenge as an implementation gap between climate ambition and observed emissions outcomes. Kazakhstan's neutrality pledge and 2030 targets are broadly in line with international expectations, yet they risk remaining aspirational unless embedded in binding medium-term commitments and associated with credible enforcement. Institutional architecture matters. The UK experience suggests that combining framework legislation, independent oversight, robust instruments (UK ETS, CfDs) and strong MRV can create a feedback loop in which climate policy is regularly assessed and adjusted rather than episodic or symbolic. For Kazakhstan, the key challenge is not only to maintain climate ambition, but to make domestic carbon pricing credible enough that CBAM does not function as an external penalty for weak implementation. Strengthening institutional linkages, clarifying roles and enhancing accountability may deliver substantial emissions reductions at relatively low fiscal cost, particularly when combined with international support for capacity-building and investment.

In this sense, CBAM does not simply impose an external trade cost; it reveals whether domestic climate-governance systems are credible enough to translate pledges into measurable emissions performance. The paper therefore contributes to comparative climate-governance research by showing how the implementation gap in resource-rich economies is produced not by ambition alone, but by the credibility of the institutional mechanisms that connect ambition to emissions outcomes.

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ҚАЗАҚСТАН ЭКОНОМИКАСЫН ДЕКАРБОНИЗАЦИЯЛАУ: КЛИМАТТЫҚ МАҚСАТТАРДАН НАҚТЫ НӘТИЖЕЛЕРГЕ ДЕЙІН

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АНДАТПА

Мақсаты – Зерттеу ресурстарға бай Қазақстандағы декарбонизацияны іске асырудағы алшақтықты талдауға арналған. Бұл алшақтық ресми түрде жарияланған климаттық мақсаттар мен шығарындылардың нақты көрсеткіштері арасындағы айырмашылық ретінде түсініледі. Біріккен Корольдік контрасттық басқару эталоны ретінде пайдаланыла отырып, мақсаттарды заңнамалық бекіту, саясат құралдарының үйлесімділігі, шығарындылармен сауда жүйесінің сенімділігі және құқық қолдану әлеуеті климаттық міндеттемелердің өлшенетін төмен көміртекті нәтижелерге айналуын қалай айқындайтыны зерттеледі.

Әдіснамасы – Жұмыста салыстырмалы институционалдық талдау қолданылады; ол бағдарламалық және нормативтік-құқықтық құжаттарды талдауды, нақты жағдайларды (кейстерді) зерттеуді және қайталама статистикалық деректерді біріктіреді. Қазақстан мен Біріккен Корольдік климаттық мақсаттарды, нормативтік-құқықтық базаны, саясат құралдарын, мониторинг, есептілік және верификация жүйелерін, құқық қолдану тетіктерін және шығарындылар динамикасын байланыстыратын басқару траекториясы бойынша салыстырылады.

Түпнұсқалығы/құндылығы – Зерттеу салыстырмалы климаттық басқару саласындағы әдебиетке үлес қосады: ол назарды климаттық мақсаттардан олардың іске асырылу әлеуетіне ауыстырады және

іске асыру алшақтығы тұжырымдамасын декарбонизацияға, оны басқару міндеті ретінде қарастыра отырып, кеңейтеді. Бұл әсіресе қазба отынға тәуелді, экспорты көміртегі сыйымды және сыртқы климаттық-сауда қысымына, атап айтқанда Еуропалық одақтың Шекаралық көміртекті реттеу тетігі (СВАМ) ықпалына ұшыраған ресурстарға бай экономикалар үшін маңызды.

Нәтижелері – Талдау Қазақстандағы іске асыру алшақтығының климаттық мақсаттарды әлсіз заңнамалық бекітумен, саясат құралдарының бытыраңқылығымен, шығарындылармен сауда жүйесінің шектеулі тиімділігімен, мониторинг, есептілік және тексеру жүйелерінің біркелкі дамымауымен және құқық қолданудың жеткіліксіз сенімділігімен айқындалатынын көрсетеді. Біріккен Корольдіктің тәжірибесі заңды түрде міндеттейтін көміртек бюджеттері, тәуелсіз қадағалау, үйлесімді құралдар, сенімді көміртекті бағалау және мониторинг, есептілік пен тексеру жүйелері міндеттемелер мен олардың орындалуы арасындағы алшақтықты қысқартуға қалай мүмкіндік беретінін көрсетеді.

Түйін сөздер: декарбонизация, басқару, саясатты іске асыру, Қазақстан, Біріккен Корольдік, энергетикалық көшу.

ДЕКАРБОНИЗАЦИЯ ЭКОНОМИКИ КАЗАХСТАНА: ОТ КЛИМАТИЧЕСКИХ ЦЕЛЕЙ К ПРАКТИЧЕСКИМ РЕЗУЛЬТАТАМ

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АННОТАЦИЯ

Цель исследования – Настоящее исследование посвящено анализу разрыва в реализации декарбонизации в ресурсно-обеспеченном Казахстане, понимаемого как расхождение между официально декларируемыми климатическими целями и фактической динамикой выбросов. Используя Соединённое Королевство в качестве контрастного управленческого ориентира, статья рассматривает, каким образом законодательное закрепление климатических обязательств, согласованность политических инструментов, надёжность системы торговли выбросами, а также институциональный потенциал определяют способность государства трансформировать климатические обязательства в измеримые низкоуглеродные результаты.

Методология – В исследовании применяется сравнительный институциональный анализ, сочетающий изучение программных и нормативно-правовых документов, кейс-ориентированный анализ и вторичные статистические данные. Казахстан и Соединённое Королевство сопоставляются через призму управленческой траектории, связывающей климатические цели, нормативно-правовую архитектуру, инструменты политики, системы мониторинга, отчётности и верификации, механизмы правоприменения и фактическую динамику выбросов.

Оригинальность/ценность исследования – Исследование вносит вклад в сравнительные исследования климатического управления, смещая аналитический акцент с формулирования климатических целей на институциональную способность к их реализации. В статье концепция разрыва реализации применяется к декарбонизации как к управленческой задаче, требующей не только стратегических обязательств, но и действенных правовых, регуляторных и институциональных механизмов. Такой подход особенно значим для ресурсно-обеспеченных экономик, характеризующихся высокой углеродоёмкостью экспорта и растущим внешним давлением со стороны климатически ориентированной торговой политики, включая Механизм трансграничного углеродного регулирования Европейского союза (СВАМ).

Результаты – Анализ показывает, что разрыв в реализации декарбонизации в Казахстане обусловлен недостаточно прочным законодательным закреплением климатических целей, фрагментарностью политических инструментов, ограниченной результативностью системы торговли выбросами, неравномерным развитием систем мониторинга, отчётности и верификации. Опыт Соединённого

Королевства демонстрирует, что юридически обязательные углеродные бюджеты, независимый институциональный надзор, согласованные инструменты политики, надёжное ценообразование на углерод и развитые системы мониторинга, отчётности и верификации позволяют сократить разрыв между заявленными обязательствами и их практическим выполнением.

Ключевые слова: декарбонизация, управление, реализация политики, Казахстан, Соединённое Королевство, энергетический переход.

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