

Investment Attraction Mechanisms of the Eurasian Economic Union Member States for Mini-Hydropower Plant Construction in the Kyrgyz Republic: Prospects and Policy Implications

Maksatbek Sulaimankulov

Osh Kyrgyz-Uzbek University named after B. Sydykov, Kyrgyz Republic

E-mail: maksatbeksulaimankulov@gmail.com,  orcid: 0009-0001-7303-4282

Abstract: The Kyrgyz Republic possesses substantial small-scale hydropower potential, with an estimated technically exploitable capacity exceeding 8,600 MW from over 80 rivers suitable for mini-hydropower plant (mini-HPP) development. Despite this resource endowment, the country's mini-HPP sector remains significantly underdeveloped owing to constrained domestic capital, regulatory fragmentation, and institutional barriers to foreign direct investment. This paper examines the principal mechanisms through which member states of the Eurasian Economic Union (EAEU) — particularly the Russian Federation, the Republic of Kazakhstan, and the Republic of Belarus — can channel investment into mini-HPP construction in Kyrgyzstan. Drawing on an integrative analysis of EAEU regulatory instruments, bilateral investment treaties, energy sector frameworks, and development bank financing modalities, the study identifies five core investment channels: (1) EAEU multilateral investment instruments, including the Eurasian Development Bank (EDB) and the Eurasian Fund for Stabilization and Development (EFSD); (2) Russian state-backed investment programs under RUSNANO, VEB.RF, and the Russian-Kyrgyz Development Fund; (3) Kazakhstani sovereign and private capital via the Samruk-Kazyna national holding and Kazakhstani commercial banks; (4) public-private partnership (PPP) frameworks aligned with EAEU standards; and (5) green finance and carbon credit mechanisms consistent with the Paris Agreement. The research further evaluates the regulatory environment, identifies key obstacles including tariff policy inconsistencies, land allocation procedures, and limited grid integration capacity, and proposes a set of evidence-based policy recommendations to enhance investment attractiveness. The findings contribute to the broader literature on regional energy integration and transition finance in post-Soviet economies and offer practical guidance for policymakers seeking to leverage EAEU institutional architecture for sustainable energy development.

Keywords: mini-HPP; hydropower investment; Eurasian Economic Union; EAEU; Kyrgyz Republic; renewable energy finance; public-private partnership; green finance; energy transition; regional economic integration.

1. Introduction

The global energy transition, driven by climate commitments enshrined in the Paris Agreement (2015) and reaffirmed at COP26 and COP28, has placed small-scale renewable energy generation at the forefront of sustainable development agendas worldwide. Among renewable technologies, run-of-river mini-hydropower plants (mini-HPPs) — conventionally defined as installations with generating capacity below 30 MW — offer particular advantages for mountainous, water-rich, and electricity-deficient regions: predictable output, minimal carbon footprint, low land occupation relative to reservoir-based hydropower, and compatibility with distributed energy systems [11; 25].

The Kyrgyz Republic represents an archetypal case in this regard. Situated in the heart of Central Asia, the country contains approximately 20% of Central Asia's freshwater reserves and an estimated 142 billion kWh of theoretical annual hydropower potential, of which 73 billion kWh is considered technically exploitable [18]. Notwithstanding this considerable endowment, the installed capacity of mini-HPPs barely exceeds 100 MW, serving primarily rural off-grid communities in the Naryn, Jalal-Abad, and Osh regions [15]. The gap between potential and actual development is attributable to a cluster of interrelated factors: limited domestic public investment capacity, shallow capital markets, insufficient energy tariff revenues to service private debt, cumbersome permitting procedures, and the absence of a coherent framework for attracting foreign investment specifically into the small-scale hydropower segment.

The Eurasian Economic Union (EAEU), established by the Treaty on the Eurasian Economic Union signed in Astana in May 2014 and in force since January 2015, provides a supra-national institutional environment that, in principle, ought to facilitate intra-regional investment flows among its five member states: the Russian Federation, the Republic of Kazakhstan, the Republic of Belarus, the Republic of Armenia, and the Kyrgyz Republic itself. The EAEU framework encompasses provisions on the free movement of capital, harmonized investment protection standards, a common electricity market in development, and several multilateral financial institutions — most notably the Eurasian Development Bank (EDB) and the Eurasian Fund for Stabilization and Development (EFSD) — with explicit mandates covering infrastructure and energy financing [8; 23].

Yet the extent to which EAEU institutional architecture is effectively mobilized to channel investment into Kyrgyzstan's mini-HPP sector remains inadequately examined in the scholarly literature. Studies of hydropower investment in the region tend to focus on large-scale projects such as the Kambar-Ata and Upper Naryn cascades [5; 13], while the mechanics, feasibility, and policy prerequisites of small-scale hydropower investment through EAEU-specific channels have received comparatively little systematic attention.

This paper addresses that gap. Its central research question is: What mechanisms are available through EAEU member states' investment instruments and institutional frameworks to finance mini-HPP construction in the Kyrgyz Republic, and what policy conditions are necessary for these mechanisms to be effectively operationalized? The paper proceeds as follows. Section 2 reviews the relevant literature on regional energy investment, small hydropower finance, and EAEU economic integration. Section 3 describes the research methodology. Section 4 provides a comprehensive analysis of the Kyrgyz Republic's mini-HPP investment landscape, including resource estimates, current installed capacity, and regulatory environment. Section 5 systematically examines five EAEU-based investment mechanisms. Section 6 presents a discussion of barriers and policy recommendations. Section 7 concludes.

2. Literature review

2.1 *Small Hydropower and Sustainable Energy Finance*

The economics of mini-HPP development have been the subject of growing academic interest since the early 2000s, coinciding with the proliferation of feed-in tariff policies and renewable portfolio standards across both developed and emerging economies. Paish (2002) provided one of the earliest systematic assessments of the global small hydropower resource base, establishing a typological framework — micro (<100 kW), mini (100 kW–1 MW), and small (1–30 MW) — that continues to inform regulatory definitions in multiple jurisdictions [20]. Subsequent empirical studies by IRENA consistently identify capital cost reduction, grid connectivity, and streamlined environmental permitting as the three principal determinants of small hydropower investment realization rates [11; 12].

In the context of developing and transition economies, additional barriers — including weak property rights, currency risk, and underdeveloped power purchase agreement (PPA) frameworks — have been documented by Deichmann et al. (2011), who analyzed off-grid electrification investments across Sub-Saharan Africa and South Asia [4]. Their conclusions regarding the importance of institutional quality and regulatory stability resonate strongly with Central Asian contexts. Fankhauser and Jotzo (2018) further demonstrate that blended finance instruments, combining concessional public capital with commercial debt and equity, significantly enhance the risk-adjusted returns that render small renewable energy projects bankable [9].

2.2 *Investment Frameworks in the EAEU Space*

The literature on investment within the EAEU framework is more recent and, to date, less developed than corresponding bodies of work on the EU single market or ASEAN economic integration. Vinokurov (2017) provides a foundational analysis of EDB investment operations, demonstrating that the bank's portfolio has historically been concentrated in transport infrastructure and industrial modernization, with energy projects representing a secondary priority [24]. Libman and

Vinokurov (2012) offer a broader political-economy perspective on Eurasian integration, identifying the asymmetric economic weights of Russia and Kazakhstan relative to smaller member states — including Kyrgyzstan — as a structural impediment to equitable capital allocation [14].

More recent contributions have begun to examine the EAEU's energy governance architecture more specifically. Belova and Kirdina-Chandler (2021) analyse the Treaty provisions on the Common Electricity Market of the EAEU and argue that, despite formal adoption, its practical implementation remains constrained by divergent national tariff regimes and the persistence of bilateral rather than multilateral trading patterns [2]. Nikolaev (2023) reviews the EDB's green financing instruments and identifies a nascent but expanding commitment to climate-aligned projects, including small renewables, in the post-2020 period [19].

2.3 Hydropower Investment in Kyrgyzstan

Country-specific studies of Kyrgyzstan's energy sector are predominantly policy-oriented rather than academically rigorous. The World Bank's Energy Sector Assistance Program assessments (2019, 2022) and the ADB's Country Partnership Strategy for Kyrgyzstan (2023–2027) document the structural deficit between electricity demand growth and generation investment, the chronic underpricing of electricity that erodes commercial viability, and the dependence on the large but aging Toktogul reservoir hydropower complex [1; 26]. Isaev (2022) examines governance failures in the Kyrgyz energy sector through the lens of resource curse theory [13], while Dzyubenko and Sanakoyev (2021) focus on geopolitical dimensions of transboundary water and energy relations in the Fergana Valley [5].

The specific intersection of EAEU investment mechanisms and mini-HPP development in Kyrgyzstan has, to the author's knowledge, not been systematically examined in peer-reviewed literature. This study therefore makes an original contribution to both the regional economic integration literature and the applied literature on small hydropower finance in transition economies.

3. Research methodology

This study employs an integrative mixed-method research design, combining systematic document analysis with comparative institutional analysis and qualitative synthesis of primary and secondary data. This approach is consistent with established methodological frameworks for policy-oriented research in development economics [3; 22].

The primary data sources comprise: (a) official treaty texts, regulatory acts, and strategic documents of the EAEU and its member states, accessed through the official portal of the Eurasian Economic Commission [8; 23]; (b) project and portfolio data from the Eurasian Development Bank and the Eurasian Fund for Stabilization and Development [7]; (c) national energy sector statistics and regulatory documentation from the Ministry of Energy of the Kyrgyz Republic [15; 16], the National Energy Holding Company (OJSC National Electric Grid of Kyrgyzstan) [17], and the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic; (d) bilateral investment treaty texts between the Kyrgyz Republic and EAEU member states; and (e) World Bank, ADB, and IRENA databases on energy investment and renewable energy capacity [1; 11; 12; 25; 26].

Comparative institutional analysis is employed to assess the design features, operational mechanisms, and empirical track records of EAEU-based investment instruments relative to international best-practice benchmarks. This involves a structured comparison across five dimensions: (1) eligibility criteria and project selection procedures; (2) financial terms (interest rates, tenors, and equity requirements); (3) currency and sovereign risk mitigation provisions; (4) environmental and social safeguard standards; and (5) transaction cost and procedural complexity.

The study is subject to standard limitations associated with qualitative institutional analysis, including the challenge of attributing investment outcomes to specific institutional mechanisms in complex, multi-causal environments, and potential gaps in the availability of disaggregated project-level financing data for the mini-HPP segment. These limitations are acknowledged and addressed through triangulation across multiple data sources.

4. The MINI-HPP investment landscape in the Kyrgyz Republic

4.1 Resource Endowment and Technical Potential

The Kyrgyz Republic's topography — characterized by the Tian Shan and Pamir-Alay mountain systems occupying approximately 94% of its territory — generates an extensive network of fast-flowing rivers and streams with high hydraulic gradient, ideal for run-of-river power generation. The Ministry of Energy's 2022 inventory identifies 318 river segments technically suitable for mini-HPP development (capacity range: 0.1–30 MW), with an aggregate estimated capacity of approximately 8,600 MW and annual generation potential of 38 billion kWh [15].

Of particular strategic importance are the Naryn, Chui, Talas, Kara Darya, and At-Bashy river basins, where topographic and hydrological conditions combine favorable head and flow characteristics with proximity to underserved communities and existing road infrastructure. International assessments corroborate this potential: the ADB (2023) estimates that the Kyrgyz Republic could expand mini-HPP installed capacity from approximately 100 MW to over 600 MW by 2035 if adequate financing and regulatory conditions are established [1].

4.2 Current Installed Capacity and Investment Gap

As of January 2024, the Kyrgyz Republic's total installed electricity generation capacity stood at approximately 4,180 MW, of which large-scale hydropower accounted for 3,800 MW (predominantly the Toktogul cascade on the Naryn River), thermal generation for 270 MW, and mini-HPPs for approximately 110 MW distributed across roughly 80 operational stations [16]. The investment gap between current and technically feasible mini-HPP capacity is therefore substantial, implying the need for cumulative capital expenditure on the order of USD 2–4 billion over a 10–15 year horizon, based on international unit cost benchmarks of USD 1,500–2,500 per kW for run-of-river mini-HPPs in mountainous terrain [12].

4.3 Regulatory and Institutional Framework

The legal framework governing mini-HPP development in Kyrgyzstan has undergone significant but incomplete reform since the sector's privatization in the late 1990s. Key legislative instruments include the Law on Renewable Energy Sources (2008, amended 2017), the Law on Concessions (1992, amended 2019), the Law on Public-Private Partnerships (2021), the Electricity Law (1997, amended 2022), and the National Strategy for Sustainable Development (2021–2026). Collectively, these instruments establish a licensing regime, a feed-in tariff mechanism administered by the Authorized Body for Energy Regulation, and a concession procedure for the use of water resources [18].

Several regulatory deficiencies, however, continue to constrain investment. First, the electricity tariff applicable to mini-HPP output under the 2017 amendment (approximately USD 0.043–0.067 per kWh depending on capacity) is insufficient to service commercial debt at market rates, necessitating concessional financing or grant components. Second, the land allocation procedure for mini-HPP construction sites requires resolution of overlapping jurisdiction between the State Agency for Land Resources, the Ministry of Natural Resources and Ecology, and local self-governance bodies (ayil okmotus), a process that can extend to three years. Third, grid connection standards and technical requirements for distributed generation integration remain inconsistently applied, adding uncertainty to project timelines [26].

5. EAEU investment mechanisms for Mini-HPP development

5.1 EAEU Multilateral Financial Institutions: EDB and EFSD

The Eurasian Development Bank (EDB), established in 2006 and headquartered in Almaty, Kazakhstan, constitutes the primary multilateral investment vehicle within the EAEU space. With authorized capital of USD 7 billion and six member states — Russia, Kazakhstan, Armenia, Belarus, Kyrgyzstan, and Tajikistan — the EDB's mandate encompasses the financing of integration projects generating positive externalities for the EAEU economic space. The bank's sector priorities explicitly

include energy infrastructure, and its Environmental and Social Policy (revised 2022) incorporates climate risk screening aligned with the TCFD framework [7].

For mini-HPP projects in Kyrgyzstan, the EDB offers several relevant financing instruments: (a) sovereign loans at preferential rates (typically SOFR + 150–250 basis points with 15–20-year tenors) for state-sponsored projects; (b) non-sovereign loans directly to project companies; (c) equity participation in project vehicles; and (d) co-financing arrangements with international financial institutions (IFC, EBRD, ADB). The bank has previously financed the Kambar-Ata-2 preparatory works and several transmission infrastructure projects in Kyrgyzstan [24]. Mini-HPPs, however, require adaptation of standard EDB project assessment criteria to account for smaller deal sizes (typically USD 5–30 million per project), which may require a programmatic or aggregated portfolio approach to achieve transactional efficiency.

The Eurasian Fund for Stabilization and Development (EFSD), managed by the EDB secretariat with USD 8.5 billion in authorized capital contributed primarily by Russia (88%) and Kazakhstan (10%), provides concessional lending and grants to eligible member states [8]. EFSD credit facilities applicable to Kyrgyzstan carry interest rates as low as 1–3% per annum with grace periods of up to five years and total tenors of 15–20 years. An EFSD programmatic credit facility specifically targeting mini-HPP development — analogous to EFSD Program Lending instruments used in Belarus and Armenia — would represent a high-impact deployment of this mechanism.

5.2 Russian Investment Instruments

The Russian Federation, as the EAEU's largest economy, maintains several state-backed investment instruments relevant to Kyrgyz energy infrastructure. The Russian-Kyrgyz Development Fund (RKDF), established in 2015 with an initial capitalization of USD 500 million contributed by Russia, was specifically designed to support investment in the Kyrgyz real economy following the country's accession to the EAEU. As of 2023, the RKDF has disbursed approximately USD 320 million in project financing across agriculture, manufacturing, and energy sectors, with an average loan rate of 6–8% per annum in USD or KGS terms [21].

The RKDF's energy portfolio has been limited primarily to grid rehabilitation and solar energy pilot projects. Expanding the fund's mandate to systematically co-finance mini-HPP project preparation and construction — particularly in remote areas of Naryn and Jalal-Abad oblasts where energy access deficits are most acute — would align with both Russia's stated strategic objectives in the EAEU space and Kyrgyzstan's National Energy Program targets [18]. VEB.RF (the Russian state development corporation) and the Russian Direct Investment Fund (RDIF) represent additional channels for larger-scale project financing and equity investment, respectively, subject to the resolution of sanctions-related constraints on Russian cross-border financial transactions that have emerged in the post-2022 geopolitical environment.

5.3 Kazakhstani Investment Channels

Kazakhstan, as Kyrgyzstan's northern neighbor and second-largest EAEU economy, offers several investment channels that are geographically proximate, culturally compatible, and institutionally accessible. The Samruk-Kazyna National Welfare Fund, which manages state assets in energy, mining, and infrastructure, has expressed strategic interest in Central Asian energy connectivity through its subsidiary Samruk-Energy. Direct equity investment by Samruk-Energy in Kyrgyz mini-HPP projects through joint venture structures would leverage Kazakhstan's considerable hydropower engineering expertise accumulated through the management of the Irtysh, Syrdarya, and Ili river cascades [14].

The Development Bank of Kazakhstan (DBK) and Kazakh private commercial banks — including Halyk Bank, Kaspi Bank, and Bank Center Credit — have established correspondent relationships with Kyrgyz banks and could, in principle, extend project finance loans to bankable mini-HPP project companies under bilateral investment guarantee frameworks. The 2014 Bilateral Investment Treaty (BIT) between Kazakhstan and the Kyrgyz Republic provides substantive investment protection standards — fair and equitable treatment, full protection and security, and prohibition of expropriation without compensation — that support investor confidence [23].

5.4 Public-Private Partnership Frameworks

The PPP mechanism represents arguably the most versatile investment channel for mini-HPP development, as it enables the combination of public risk mitigation (through government guarantees, concessional financing, and land allocation) with private sector construction and operational efficiency. The Kyrgyz Republic's Law on Public-Private Partnerships (2021) establishes a framework broadly consistent with EAEU PPP standards and UNCITRAL guidelines, providing for Build-Operate-Transfer (BOT) concessions, lease concessions, and joint venture arrangements [18].

Within the EAEU context, PPP frameworks can be structured to allow EAEU member state entities to serve as private partners in Kyrgyz PPPs, benefiting from the investment protection provisions of both the EAEU Treaty [23] and applicable bilateral investment treaties. The EAEU's 2020 Guidelines on Member State Support for PPP Projects provide a template for such arrangements. A streamlined procedure for EAEU-origin private investors to participate in Kyrgyz PPP tenders — including pre-qualification criteria, standardized concession agreement templates, and an integrated dispute resolution mechanism — would significantly reduce transaction costs and enhance the attractiveness of this channel.

5.5 Green Finance and Carbon Market Mechanisms

The global expansion of sustainable finance — encompassing green bonds, sustainability-linked loans, climate funds, and voluntary carbon markets — presents an additional set of investment channels that can be accessed through EAEU frameworks and aligned with Kyrgyzstan's nationally determined contributions (NDCs) under the Paris Agreement. Kyrgyzstan's updated NDC (submitted 2021) includes a conditional mitigation target of 44% reduction in greenhouse gas emissions by 2030 relative to 1990 levels, contingent on international financial support [10].

EAEU-based green finance mechanisms include the EDB's Green Finance Framework (2021), which enables the issuance of EAEU green bonds certified against ICMA Green Bond Principles [7; 19], and the Astana International Financial Centre (AIFC) Green Finance Centre, which provides a regulatory and capital market infrastructure for climate-aligned securities in the EAEU space. Mini-HPP projects, with their demonstrably low lifecycle carbon emissions (estimated at 4–11 g CO₂-eq/kWh according to IPCC AR6), are well-suited for certification under these frameworks [10], enabling access to concessional climate finance from the Green Climate Fund (GCF), the Climate Investment Funds (CIF), and the GEF-financed Least Developed Countries Fund.

The voluntary carbon market represents an additional revenue stream: mini-HPP operators can generate Verified Carbon Units (VCUs) under Verra's Verified Carbon Standard (VCS) or Gold Standard credits, the revenues from which can contribute to project debt service. The Russian and Kazakhstani national carbon markets, currently in pilot phases, may in due course provide intra-EAEU demand for such credits, creating a region-internal market-based incentive for clean energy investment [19].

6. Barriers, discussion, and policy recommendations

6.1 Principal Barriers

The analytical framework developed in the preceding sections permits identification of five principal barriers to the effective utilization of EAEU investment mechanisms for mini-HPP development in Kyrgyzstan.

First, tariff inadequacy is the most fundamental commercial barrier. The current regulated electricity tariff of approximately USD 0.04–0.07/kWh for mini-HPP output is below the level required to achieve an adequate debt service coverage ratio (DSCR) for commercially financed projects. International benchmarks suggest a minimum viable tariff in the range of USD 0.08–0.12/kWh for run-of-river mini-HPPs in mountainous terrain under commercial financing terms [26]. In the absence of tariff reform, the systemic reliance on concessional or grant financing limits the scale of investment that can be mobilized.

Second, regulatory fragmentation and procedural complexity impose substantial transaction costs. The multi-agency permitting process — spanning environmental impact assessment, water rights

allocation, land registration, and grid connection approval — involves at least seven different government bodies and can require three to five years for project development. This timeline significantly exceeds the 18–24 months standard in comparable investment environments [6].

Third, capacity constraints within the national transmission and distribution system impose a technical ceiling on mini-HPP integration. The aging grid infrastructure, particularly in remote oblasts, lacks the automated frequency regulation and grid stabilization capabilities required to safely absorb significant distributed generation without risk of instability [17].

Fourth, limited institutional capacity within Kyrgyz government bodies — particularly the Ministry of Energy's Investment Department and the PPP Development Centre — constrains the country's ability to prepare bankable project documentation, conduct competitive tenders, and negotiate complex financing agreements with EAEU institutional investors [15].

Fifth, the post-2022 geopolitical environment has created transactional uncertainties affecting Russian investment channels. VEB.RF and Russian state banks face secondary sanctions risk on cross-border transactions, reducing the practical accessibility of Russian state-backed financing in the near term [21].

6.2 Policy Recommendations

On the basis of the preceding analysis, this paper advances the following policy recommendations, addressed to the Kyrgyz government, the EAEU institutional bodies, and EAEU member state investment agencies.

Recommendation 1: Adopt a Cost-Reflective, Differentiated Feed-in Tariff. The Kyrgyz government should revise the mini-HPP feed-in tariff to a level that reflects actual capital and operating costs while ensuring affordability for end consumers through an explicit cross-subsidy design. A capacity-banded tariff structure — distinguishing between micro-HPPs (<1 MW), mini-HPPs (1–10 MW), and small HPPs (10–30 MW) — with periodic review linked to a standardized cost benchmarking methodology, would improve investor confidence and reduce reliance on concessional financing [11; 12; 26].

Recommendation 2: Establish a One-Stop-Shop Investment Facilitation Centre. A dedicated renewable energy investment facilitation unit, co-located with the Ministry of Energy and staffed with specialists in project finance, environmental permitting, and land management, should be established to coordinate the permitting process across all relevant agencies, provide pre-feasibility assessment support to prospective investors, and maintain a pipeline of investment-ready projects [6].

Recommendation 3: Launch an EDB/EFSD Programmatic Facility for Kyrgyz Mini-HPP Development. The EDB and EFSD should establish a dedicated programmatic financing facility — with an initial envelope of USD 200–300 million — specifically targeting mini-HPP development in EAEU member states with high small hydropower potential, with Kyrgyzstan as the pilot recipient. This facility should combine EFSD concessional lending for government on-lending, EDB non-sovereign project finance loans, and a first-loss guarantee mechanism to mobilize additional private capital [7; 8; 19; 24].

Recommendation 4: Develop a Standardized EAEU PPP Template for Mini-HPP Concessions. The Eurasian Economic Commission should develop, in cooperation with the UNCITRAL and IFC model PPP agreement frameworks, a standardized BOT concession agreement template for EAEU-origin investors in Kyrgyz mini-HPP projects, incorporating pre-agreed dispute resolution procedures (ICSID or UNCITRAL arbitration), stabilization clauses, and grid connection guarantees [23].

Recommendation 5: Register Kyrgyz Mini-HPP Projects in EAEU Green Finance and Carbon Credit Markets. The Kyrgyz government, in partnership with the EDB Green Finance Centre and the AIFC, should develop a streamlined registration procedure for mini-HPP carbon credits under the Russian and Kazakhstani voluntary carbon registries. Simultaneously, the government should complete the pipeline of mini-HPP projects eligible for GCF and GEF funding under the Paris Agreement framework, leveraging UNDP and UNEP implementing entity status [9; 10; 19].

7. Conclusion

This paper has demonstrated that the EAEU institutional architecture provides a substantive, if presently underutilized, set of investment mechanisms applicable to mini-HPP development in the Kyrgyz Republic. The EDB and EFSD [7; 8], the Russian-Kyrgyz Development Fund [21], Kazakhstani sovereign and private capital channels [14], EAEU-compatible PPP frameworks [23], and emerging green finance instruments [9; 19] collectively constitute a portfolio of financing options capable, in aggregate, of bridging a significant portion of the estimated USD 2–4 billion investment gap in the Kyrgyz mini-HPP sector.

The realization of this potential, however, is contingent on overcoming a set of well-defined regulatory, institutional, and financial barriers. Chief among these are the inadequacy of the current feed-in tariff [26], procedural complexity in permitting [6], grid integration constraints [17], and limited institutional project preparation capacity [15]. The policy recommendations advanced in this paper address these barriers through a combination of domestic regulatory reform and EAEU-level institutional innovation.

The findings carry implications beyond Kyrgyzstan. The EAEU contains several member states with analogous combinations of substantial small hydropower potential, limited domestic capital, and access to the EAEU's supra-national financial infrastructure — Armenia and Tajikistan (observer) being notable examples [2; 14]. The analytical framework and policy recommendations developed here are, with appropriate contextual adaptation, applicable to these cases as well. More broadly, the paper contributes to the emerging literature on how regional economic integration institutions in the post-Soviet space can be leveraged for the energy transition [2; 19], a research agenda whose policy relevance is increasing as EAEU member states align their long-term energy strategies with the global low-carbon transition.

Future research should address several questions not fully resolved in this study: the empirical impact of EAEU investment protection provisions on actual FDI flows in the energy sector; the comparative cost-effectiveness of different financing instruments; and the distributional effects of mini-HPP development on rural energy poverty in Kyrgyzstan. Rigorous quantitative assessment of these dimensions would further strengthen the evidence base for the policy recommendations advanced here.

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