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FROM 100 MW DEMONSTRATIONS TO A 1 GW WIND AND STORAGE
PLATFORM: SCALING RENEWABLE ENERGY DEVELOPMENT IN
KAZAKHSTAN

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Abstract: Kazakhstan's renewable energy transition is entering a scale at which the governance unit can no longer be a single wind farm. This study asks how experience from 48 MW, 50 MW, 100 MW, and 220 MW developments can inform the formation of a 1 GW wind and storage platform. It applies longitudinal public document analysis to official laws, system operator data, multilateral development bank disclosures, accountability records, and corporate releases available through 10 August 2026. Reflective practitioner observation is used only to interpret recurrent coordination problems and supplies no confidential data or independent verification. The evidence traces capability accumulation through Zhanatas, Shokpar, Arkalyk, Dostyk, and the CPIH 220 MW portfolio. It also separates two dated public records: a 2023 announcement for a 1 GW wind and storage program whose first 500 MW was planned in Zhambyl Region, and 2026 announcements for a 1 GW wind project with 300 MW of storage near Ekibastuz in Pavlodar Region. Because the reviewed sources do not establish legal continuity, the study treats them as evidence of program evolution. The paper develops a four pillar platform governance model comprising institutional alignment, grid and storage integration, industrial localization, and portfolio governance. It argues that scale becomes governable when these pillars are synchronized through evidence gates, common data standards, and phased investment decisions. Six theoretical propositions connect project capability, ecosystem alignment, and system integration. The resulting framework offers a practical route from repeated project delivery to a locally embedded renewable energy platform while preserving strict boundaries between public evidence, practitioner interpretation, and future design recommendations.

Keywords: Kazakhstan; wind power; battery energy storage; platform governance; project capabilities; grid integration; localization

1. INTRODUCTION

Kazakhstan has built a statutory renewable energy framework around long-term offtake, competitive selection, and centralized settlement [1]. The policy direction is reinforced by the national objective of carbon neutrality by 2060 [2] and a 2030 renewable electricity target of 15 percent [3]. Yet capacity addition alone does not define transition success. A power system must absorb variable production at the right locations and times, investors must coordinate with public institutions, and local industry must convert construction activity into durable operating capability.

The scale of this coordination challenge is visible in current system data. KEGOC reports that Kazakhstan generated 123,110.9 million kWh and consumed 124,606.5 million kWh in 2025. Wind contributed 5,400.7 million kWh, while solar and bioenergy brought the combined wind, solar, and bioenergy share to 6.1 percent [4]. As of 1 January 2025, wind capacity was 1,525.7 MW within total installed capacity of 25,314.2 MW [5]. A single 1 GW development would therefore be systemically material rather than a simple replication of a 100 MW plant.

This paper addresses one question: how can accumulated experience from project-scale wind developments be converted into a governable 1 GW wind and storage platform in Kazakhstan? It makes three contributions. First, it treats scaling as an organizational and institutional transformation, not a multiplication of turbines. Second, it develops a four pillar platform governance model that links institutional alignment, grid and storage integration, industrial localization, and portfolio governance. Third, it proposes an evidence-gated sequence through which sponsors and public partners can preserve option value while progressively committing land, grid, capital, supply chain, and stakeholder resources.

The analysis remains deliberately bounded. It does not calculate project returns, disclose internal decisions, or claim that public announcements represent completed outcomes. It uses the cases as evidence of capability accumulation and as a basis for propositions that future research can test.

2. FROM PROJECT DELIVERY TO PLATFORM GOVERNANCE

2.1 Theoretical foundation

Large energy transitions combine technological change with shifts in regulation, markets, and infrastructure. The multilevel transition perspective explains why new technology succeeds when niche learning connects with wider regime change [6]. At the firm level, dynamic capabilities describe the capacity to sense opportunities, invest, and reconfigure resources [7]. Project-based firms face a related problem: experience created inside temporary organizations can disappear when teams disperse. Repeatability arises when lessons become routines, partner interfaces, and decision rules [8] [9].

Gigawatt scale introduces an ecosystem dimension. Strategy depends on whether interdependent actors can reach compatible states of readiness, including ministries, regional authorities, the grid operator, financiers, equipment suppliers, communities, and project companies [10]. Collaborative governance research further suggests that institutional design, trust-building, shared facts, and credible commitment influence whether diverse actors can act jointly [11]. Polycentric governance adds that complex systems benefit from coordinated decision centers rather than a single command point, provided information and accountability travel across levels [12].

These perspectives lead to a distinction between a portfolio and a platform. A portfolio groups assets for capital allocation. A platform also contains shared rules, data, infrastructure interfaces, stakeholder mechanisms, and learning routines through which multiple assets can be developed and operated coherently. Exploration and exploitation remain in tension [13]. Standardization reduces transaction costs, while contextual adaptation protects the platform from rigid replication. Dynamic capabilities therefore require identifiable organizational processes, yet their value depends on market position and path [14].

2.2 Four pillar model

This study defines platform governance as the coordinated design of decision rights, evidence standards, interfaces, and learning mechanisms across multiple renewable assets and their shared system environment. The four pillars are mutually dependent. Institutional alignment creates legal and stakeholder legitimacy. Grid and storage integration creates electrical feasibility. Industrial localization creates delivery resilience and local value. Portfolio governance converts multiple assets into a disciplined capital and knowledge system.

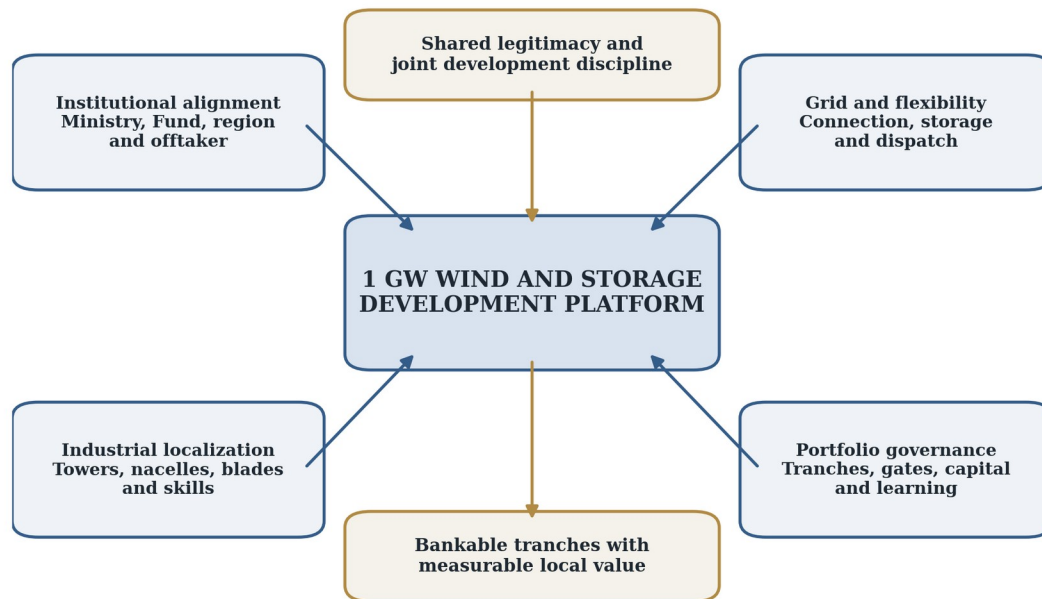


Figure 1. Four pillar governance model for a 1 GW wind and storage platform
Source: Developed by the author.

3. RESEARCH DESIGN AND EVIDENCE BOUNDARIES

The research uses a longitudinal qualitative design. The document corpus contains Kazakhstan legislation and government releases, KEGOC system and strategy materials, KOREM auction records, AIIB and EBRD project disclosures, an EBRD accountability record, and official sponsor, insurer, and equipment-provider publications. Documents were selected when they identified a project, dated a material milestone, described a governance interface, or provided a system-level parameter. The information cutoff is 10 August 2026.

The analysis followed three steps. Dated events were arranged from Zhanatas through the announced gigawatt developments. Evidence was coded under the four pillars and by project stage. Cross-case pattern matching then identified transferable routines and conditions requiring local redesign. Missing public information is coded as not publicly observable and is never interpreted as failure.

Reflective practitioner observation is limited to interpreting interfaces, evidence quality, and sequencing. No interviews, confidential meeting content, internal financial metrics, or unpublished results are used.

Practitioner observation by the author. As project scale grows, coordination effort tends to migrate from bilateral problem solving toward interface design. This observation motivates the model, but the project facts and numerical claims in this paper remain supported by public sources.

This design supports analytical generalization to a governance model. It does not establish causal effect sizes or comparative project performance.

4. KAZAKHSTAN'S SYSTEM CONTEXT

The public record presents a dual reality. Kazakhstan has established long-term renewable purchasing and competitive auctions [1], while its power system still faces regional imbalances, aging assets, and the need for additional flexibility. KEGOC's 2025 statistics show wind generation at 5,400.7 million kWh and solar at 2,074.6 million kWh [4]. These sources are already material, but their combined share also indicates that the more demanding integration phase lies ahead.

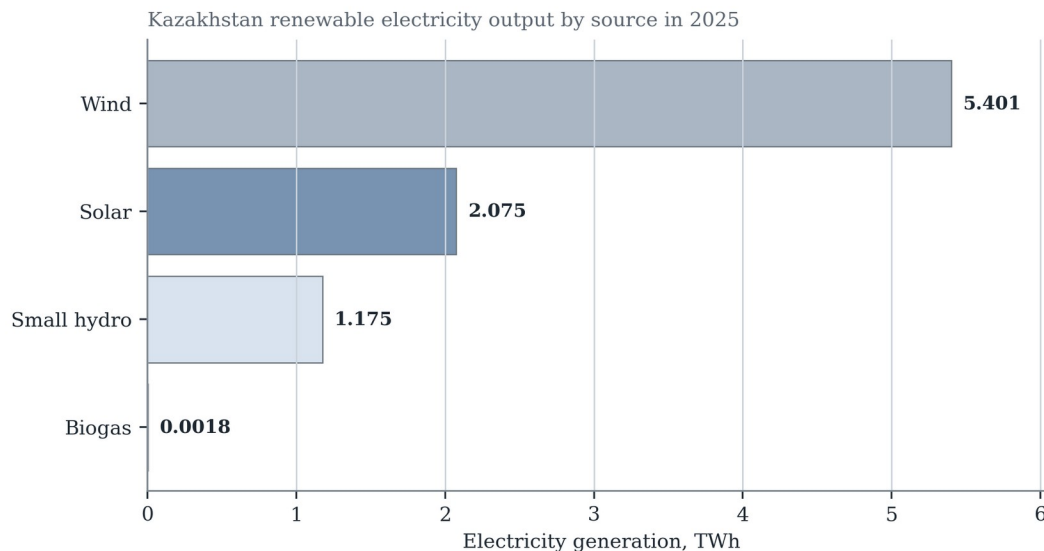


Figure 2. Kazakhstan renewable electricity generation by source in 2025

Source: Compiled from KEGOC official statistics.

The policy logic is consequently changing. Early support answered whether renewable projects could obtain revenue certainty. Current policy and system questions concern where new generation connects, how deviations are balanced, which network reinforcements are required, and how storage will create measurable system value. At platform scale, a project schedule cannot be separated from a power-evacuation schedule. Likewise, a storage capacity in MW does not disclose energy duration, control mode, cycling regime, or contracted service. Those parameters require evidence before investment approval.

5. CAPABILITY ACCUMULATION ACROSS THE PROJECT SEQUENCE

5.1 Zhanatas and Shokpar

Zhanatas established a visible project-finance and delivery reference. AIIB discloses a 100 MW facility southwest of Zhanatas, with a 233.5 hectare lease and Category B environmental and social classification [15]. EBRD records Zhanatas Wind-Power Station LLP as borrower, with CPIH holding 80 percent and Visor 20 percent at financing [16]. A USD 95.3 million package brought together EBRD, AIIB, ICBC, and the Green Climate Fund [17]. AIIB later stated that all 40 turbines had operated since 2021 [18]. The capability signal is broader than construction completion: a sponsor consortium aligned land, safeguards, grid connection, multiple lenders, and a project company within one bankable structure.

Shokpar, the adjacent 100 MW follow-on project, shows reuse combined with reconfiguration. AIIB describes a 7.6 km, 220 kV double-circuit line, transformers, substation expansion, and KEGOC-approved connection conditions [19]. EBRD identifies a financing-stage ownership structure of CPIH 63 percent and Visor 37 percent, and 22 Envision turbines [20]. Shared regional experience could reduce some discovery costs, but Shokpar also demonstrates that repeated development does not remove environmental and social uncertainty. EBRD's accountability mechanism records an open complaint involving alleged biodiversity and bird-collision risks. Problem solving ended without agreement in June 2026, and compliance assessment remained underway at the cutoff [21]. These are allegations under review, not a final finding. Their governance implication is that cumulative biodiversity evidence and adaptive monitoring should become platform-level assets.

5.2 Arkalyk, Dostyk, and the 220 MW portfolio

The 48 MW Arkalyk project near Arkalyk city adds a smaller greenfield configuration. The Kostanay regional government identifies KazWindEnergy as investor, reports 10 turbines, investment above KZT 24 billion, construction from April to December 2023, and commissioning in early December 2023 [22]. Public evidence reviewed here does not establish CPIH ownership. Arkalyk is therefore used only as contextual capability evidence associated with the author's



professional background. It must also be distinguished from Arkalyk Wind Power Plant LLP, a three-turbine, 15 MW subproject in CPIH's Akmola portfolio.

Dostyk adds an acquisition path. SANY's official project list identifies a 50 MW development associated with China Power International Holding and SI-172625 turbines [23]. A Sinasure case note states that CPIH acquired the project during construction and later used buyer-credit insurance to support renminbi project financing from China Construction Bank Astana Branch [24]. The public record does not disclose seller, acquisition price, exact closing date, or debt terms. Dostyk therefore supports a bounded lesson: platform capability must include technical, legal, schedule, counterparty, and stakeholder due diligence for partially completed assets.

The CPIH 220 MW Akmola portfolio adds aggregation. AIIB approved USD 88 million of non-sovereign financing for five wind plants, 44 turbines, and shared network works including a 42 km, 220 kV line [25]. Its public documentation indicates that portfolio governance must coordinate several project companies while preserving asset-level accountability. This is a bridge between single-project delivery and platform management.

Table 1. Public evidence of capability accumulation across Kazakhstan wind developments

Case	Publicly documented configuration	Capability signal	Evidence boundary
Zhanatas	100 MW; 40 turbines; multi-lender project finance	Bankability across land, grid, safeguards, and finance	Generation estimates differ across disclosures
Shokpar	100 MW; adjacent development; 220 kV works	Reuse of regional experience with redesigned grid and finance interfaces	Actual final outcomes and open accountability process require continued verification
Arkalyk near Arkalyk city	48 MW; 10 turbines; commissioned in 2023	Compact greenfield delivery in a regional setting	CPIH ownership and the author's precise role are not established publicly
Dostyk	50 MW; construction-stage acquisition; insured RMB financing	Acquisition diligence and post-acquisition integration	Price, seller, and detailed finance terms are not public
CPIH Akmola portfolio	220 MW; five project companies; shared 220 kV network works	Aggregated financing and multi-asset coordination	Asset-level operating performance is outside the disclosed evidence

6. THE PUBLIC RECORD OF THE 1 GW DEVELOPMENTS

The dated evolution requires careful treatment. In December 2023, Samruk-Kazyna announced cooperation on a 1 GW wind and storage program and stated that the first 500 MW was planned in Zhambyl Region. The release cited a memorandum in May 2023, a roadmap in June, and a joint development agreement in October [26].

Official materials in 2026 describe a 1 GW wind project in Pavlodar Region. Samruk-Kazyna stated that an integrated development agreement had been signed in 2025, wind masts installed, and a power-evacuation scheme agreed with KEGOC, with commissioning scheduled for the second quarter of 2029 [27]. Samruk-Energy subsequently announced a construction launch near Ekibastuz with SPIC, 300 MW of storage, and expected investment of approximately USD 1.2 billion [28]. The Chinese Embassy placed the project on approximately 32,000 hectares and emphasized equipment-manufacturing and industrial cooperation [29].

The documents demonstrate evolution in location, partnership articulation, and development maturity. They do not prove that the 2023 Zhambyl program and the 2026 Pavlodar project are the same legal project. Accordingly, this paper treats them as related evidence of program evolution and avoids merging their project companies, land rights, permits, or agreements. This distinction is

more than editorial caution. Platform governance needs configuration control so that every public milestone is attached to a specific legal entity, site, scope, and evidence date.

7. FOUR PILLARS OF A 1 GW WIND AND STORAGE PLATFORM

7.1 Pillar 1: Institutional alignment

Institutional alignment converts broad political support into executable rights and responsibilities. At 1 GW scale, this includes national energy policy, an investment agreement, regional land and infrastructure coordination, KEGOC connection studies, market participation, environmental approvals, and a transparent stakeholder process. A single steering committee is insufficient. Decision rights should be distributed to legally competent institutions, while a joint program office maintains one evidence register and escalation protocol.

Stakeholder governance should begin before major layout choices become costly. Regional authorities, local communities, land users, grid institutions, lenders, and environmental stakeholders hold different knowledge and risk exposure. The Shokpar accountability record shows why grievance data and biodiversity concerns need a route to design decisions [21]. Platform legitimacy grows when engagement can change siting, mitigation, monitoring, or benefit-sharing choices, with those changes documented.

7.2 Pillar 2: Grid and storage integration

Grid integration is the platform's physical operating system. KEGOC's storage pilot with CPID and CPIH refers to a planned 3.45 MW, 7.72 MWh battery and development of automatic frequency and power-control algorithms [30]. This small pilot is not evidence for the final design of a 300 MW system. It is evidence that control logic, telemetry, dispatch interfaces, and operating protocols can be learned before scale deployment.

KEGOC reports that southern network reinforcement increases North-South transfer capability by 440 MW and that its development program through 2035 includes more than 17,000 km of line construction or reconstruction coordinated with 26 GW of planned generation [31]. Kazakhstan also implemented a Single Buyer model and real-time balancing market from 1 July 2023 [32]. The platform should therefore co-optimize wind layout, interconnection, storage power and duration, forecast quality, outage schedules, balancing exposure, and staged energization. Each storage use case needs a measurable value stream, such as ramp control, reserve, congestion management, curtailment reduction, or time shifting.

7.3 Pillar 3: Industrial localization

Localization should be treated as capability formation rather than a percentage attached to procurement. The Ekibastuz announcement links the project with equipment manufacturing and industrial cooperation [29]. A credible localization plan separates components by technical complexity, transport economics, quality criticality, and realistic market volume. It then connects procurement to supplier qualification, workforce certification, warranty responsibility, and long-term service capability.

The platform can create a ladder of participation. Early packages may prioritize civil works, logistics, electrical installation, and technician training. Later packages may deepen tower, balance-of-plant, control-system, or component-service capability where quality and volume justify investment. Common technical specifications can increase addressable volume for local suppliers, while competitive tendering and independent quality assurance protect lifecycle performance. Local value should be measured through certified skills, supplier reliability, outage response, and retained service capacity, alongside expenditure.

7.4 Pillar 4: Portfolio governance

Portfolio governance provides the capital and knowledge discipline that binds the platform. Each asset should retain a clear project company, risk register, approvals path, and accountability. The platform layer should standardize data definitions, interface documents, procurement families, environmental monitoring protocols, and lessons learned. This preserves local accountability while enabling repetition.

Capital allocation should follow evidence maturity. Projects with stronger land, resource, grid, safeguard, and offtake evidence can advance, while uncertain blocks preserve options. The



principle is staged commitment, not uniform speed. Common dashboards should distinguish physical progress, evidence completeness, risk retirement, and forecast confidence. A turbine delivery percentage cannot compensate for unresolved grid or land rights.

Table 2. Four pillar governance model and observable evidence gates

Pillar	Core governance question	Minimum observable evidence	Principal scale risk
Institutional alignment	Who has authority, responsibility, and voice?	Legal entity map, dated agreements, permit register, stakeholder plan, grievance route	Political support remains disconnected from executable approvals
Grid and storage integration	How will energy and flexibility reach the system?	KEGOC studies, dynamic models, control architecture, storage use cases, market interface	Generation, network, and battery schedules become misaligned
Industrial localization	Which capabilities can be built competitively and safely?	Package strategy, supplier qualification, skills plan, quality and warranty rules	Nominal local content weakens quality or creates stranded capacity
Portfolio governance	How are capital, risk, data, and learning allocated?	Stage-gate manual, common data model, asset risk registers, configuration control	Scale hides asset-level risk and encourages premature commitment

8. PHASED IMPLEMENTATION AND EVIDENCE GATES

A 1 GW platform should progress through five phases. Phase 0 defines mandate and configuration. Phase 1 proves sites, resource, grid pathways, and stakeholder baselines. Phase 2 establishes a bankable reference block and validates storage controls. Phase 3 repeats blocks with controlled standardization and deeper localization. Phase 4 integrates the operating portfolio and continuously updates forecasts, environmental monitoring, maintenance, and market strategy.

The sequence is recursive. Evidence from operation can change development assumptions for later blocks. For example, forecast error affects storage sizing, bird-monitoring evidence affects layouts and curtailment protocols, and supplier performance affects localization decisions. This feedback transforms experience into a platform capability.

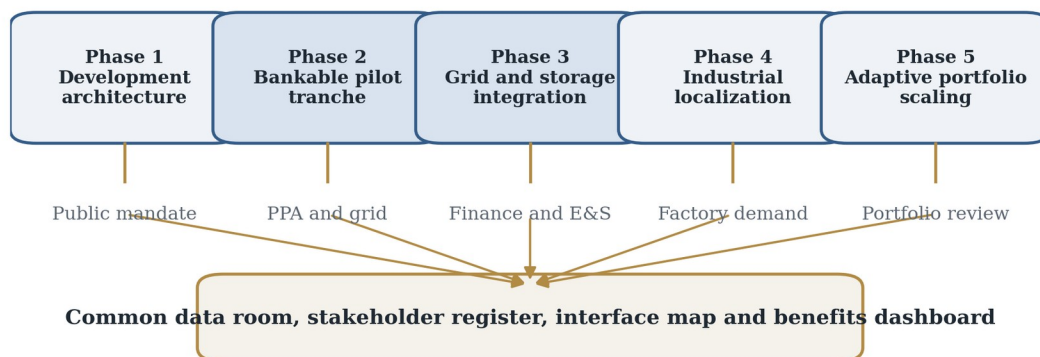


Figure 3. Phased scaling sequence with evidence gates

Source: Developed by the author.

**Table 3. Phased implementation sequence for a 1 GW wind and storage platform**

Phase	Dominant decision	Exit evidence	Commitment logic
0. Mandate and configuration	Define program scope, sites, entities, partners, and decision rights	Approved configuration baseline and source register	Commit coordination resources only
1. Development proof	Test wind, land, grid, E&S, and stakeholder feasibility	Bankable studies, connection pathway, permit plan, engagement record	Preserve alternatives across blocks
2. Reference block	Finance and deliver a representative block plus storage pilot or first tranche	Financial close, construction controls, tested telemetry and dispatch interface	Commit capital to a bounded learning unit
3. Controlled replication	Expand through standardized packages with regional adaptation	Gate approval for each block, qualified suppliers, updated cumulative studies	Release tranches against evidence maturity
4. Integrated operation	Optimize portfolio output, flexibility, maintenance, and local service	Auditable operating data, market results, E&S monitoring, lessons register	Reinvest verified learning in later assets

9. THEORETICAL PROPOSITIONS

The framework produces six propositions suitable for comparative testing.

P1, capability codification. Successive wind projects contribute to platform readiness when lessons are converted into reusable evidence standards, interface documents, and decision rules. Experience retained only by individuals will have weaker scaling value [8] [9].

P2, pillar complementarity. Platform readiness depends on the weakest critical interface among the four pillars. Strong finance or political support cannot fully offset an unresolved grid, safeguard, or project-entity condition [10].

P3, scale front-loading. As planned capacity increases, grid studies, cumulative E&S assessment, stakeholder governance, and storage architecture move earlier in the development sequence because late redesign costs rise.

P4, option-based phasing. Evidence-gated blocks reduce irreversible exposure under uncertainty while allowing validated designs and contracts to be replicated. This balances exploration and exploitation [13].

P5, functional localization. Localization produces more durable value when it is measured by certified capability, reliability, and lifecycle service performance rather than expenditure alone.

P6, transparent configuration. A platform that maintains dated links among legal entity, site, scope, approvals, and public claims will coordinate stakeholders more reliably than a program governed through aggregate announcements.

These propositions are analytical outputs. The present document study does not statistically test them.

10. DISCUSSION AND RECOMMENDATIONS

The project sequence suggests that scaling is a process of selective reuse. Zhanatas demonstrates multi-institution bankability; Shokpar adds adjacent-site reconfiguration and an ongoing lesson in environmental accountability; Arkalyk offers a regional greenfield reference; Dostyk adds construction-stage acquisition; and the 220 MW portfolio adds multi-entity aggregation. None alone constitutes a gigawatt platform. Together they reveal the capability domains that a platform must coordinate.

Developers should establish a platform program office responsible for configuration control, interface standards, and evidence quality, while statutory and asset decisions remain with competent entities. Storage should follow explicit use cases, simulations, and market rules. A cumulative E&S data architecture should connect biodiversity, land use, grievances, mitigation, and monitoring. Localization packages should follow verified supplier capability and lifetime service demand.

For public institutions and KEGOC, synchronized planning can reduce the gap between generation schedules and network readiness. Transparent assumptions for connection, dispatch, balancing, and storage services would improve investment discipline. For financiers, block-level lending under a common platform framework can preserve asset accountability while rewarding standardized evidence and shared infrastructure. For regional stakeholders, participation should be linked to documented decisions, local skills, service capacity, and accessible grievance mechanisms.

The model also offers an academic contribution. It connects dynamic capability with ecosystem alignment and collaborative governance. Its unit of analysis is the interface between projects and the power system. This helps explain why a developer can repeat construction routines yet still face new coordination risk when capacity, geography, stakeholder density, and infrastructure dependence increase.

11. LIMITATIONS AND FUTURE RESEARCH

The study relies on public documents, which disclose projects unevenly and may lag operational reality. Sponsor and lender releases can contain forward-looking estimates. The cases are associated with one broad corporate network, creating selection and survivor bias. Practitioner reflection can improve contextual interpretation but cannot serve as independent proof. The 1 GW development remains prospective, and its final storage duration, contracting structure, project-company arrangement, and operating model are not publicly established.

Future research should test the six propositions across developers and regions, compare planned with actual gate timing, and examine how balancing prices and curtailment affect storage value. Project-level studies should also investigate cumulative biodiversity management and whether localization produces sustained supplier and workforce capability. Any use of internal data should follow corporate approval, anonymization, and explicit conflict-of-interest disclosure.

12. CONCLUSION

Kazakhstan's move from 100 MW wind projects toward a 1 GW wind and storage development changes the nature of management. The central task becomes alignment across institutions, grid physics, industrial capability, and a portfolio of legal and financial entities. Public evidence from Zhanatas, Shokpar, Arkalyk, Dostyk, and the CPIH 220 MW portfolio shows a sequence of capabilities that can inform this transition, while the changing 2023 and 2026 public announcements demonstrate the need for precise configuration control.

The four pillar model and phased evidence gates provide a disciplined route to scale. They preserve project-level accountability, bring grid and E&S questions forward, connect localization with measurable capability, and make capital commitment conditional on evidence. In this sense, a gigawatt platform is an institutional and learning architecture expressed through physical assets. Its quality will depend on how faithfully experience is converted into transparent, adaptable, and locally embedded operating rules.

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