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RENEWABLE ENERGY AUCTIONS IN KAZAKHSTAN: INSTITUTIONAL CONSTRAINTS AND PROJECT DELIVERY SUCCESS FACTORS (A REVIEW)

A. S. Khamzina[1*], M. Mukan[2], R. Yu. Tormosov[1]
[1] Astana IT University, Astana, Republic of Kazakhstan
[2]Narxoz University, Almaty, Republic of Kazakhstan

ABSTRACT

Purpose. This paper examines how renewable energy (RE) auction projects can be delivered effectively in Central Asia, with a focus on Kazakhstan, by aligning project delivery practices and procurement rules with local institutional conditions.

Methodology. The study applies a thematic synthesis of peer-reviewed literature and selected industry reports on RE auctions and project delivery. Qualitative coding groups reported drivers and barriers into domains (tender design, risk allocation, grid and regulatory constraints, financial guarantees, EPC/O&M capabilities). A comparative matrix for Germany, Chile and India is then used to derive implications for emerging auction regimes in Central Asia.

Originality/value. This review links auction design to project delivery by showing how institutional conditions shape whether auction portfolios are implemented, shifting attention from bid prices to implementation risk and system integration.

Findings. Germany, Chile and India share objectives of mobilising investment, lowering prices and ensuring delivery, but they rely on different combinations of prequalification, contract models and risk-allocation mechanisms. Across cases, implementation performance depends on: (1) tender design with proportionate requirements and enforceable sanctions; (2) enabling institutional conditions (predictable policy, credible offtakers, and timely grid expansion); and (3) investor-side delivery capability, including EPC and O&M readiness. For Kazakhstan and Central Asia, the main bottlenecks reported in the literature are regulatory volatility, grid and permitting constraints, and limited local EPC/O&M capacity. The paper proposes recommendations on aligning regulatory and project cycles, coordinating grid planning with auction schedules, and calibrating prequalification and guarantees to local risks.

Keywords: renewable energy auctions; project delivery; project management; institutional context; Central Asia; Kazakhstan; success factors; risk allocation.

INTRODUCTION

Global climate imperatives have set new strategic targets and reshaped the architecture of energy governance: governments are locking in long-term renewable energy deployment and re-directing capital flows from fossil fuels towards low-carbon technologies [1,2]. In the European Union, the 2050 climate-neutrality goal functions as an “anchor of expectations” for investors and regulators, stabilising rules and lowering risk premia, which increases the willingness to finance projects [3]. In many developing economies, however, the pace and credibility of reform are constrained by political–economic factors and by how consistently institutions such as regulators, courts and sectoral ministries are able to act [4].

Central Asia illustrates these tensions. The region has substantial solar and wind potential, yet installed capacity remains far below technical estimates, reflecting macroeconomic pressures and the legacy of centralised power systems with ageing networks and carbon-intensive generation portfolios that struggle to absorb variable output [5,6]. In response, governments increasingly rely on renewable energy auctions, which promise

standardised project requirements, comparable bids, stronger competition and cheaper capital through clear entry rules and well-specified offtake commitments [7]. While this logic is consistent with global practice, its effectiveness in the region remains uneven at the implementation stage.

At project level, auctions frequently generate unstable outcomes: schedules and budgets are overrun and target quality indicators are achieved only partially. This pattern suggests not so much the weakness of individual project management tools as the limits of institutional mechanisms. Standard project management guidelines developed in mature jurisdictions often remain poorly adapted to local conditions such as regulatory volatility, deficits in EPC and O&M capabilities, and bottlenecks in grid infrastructure [5–9]. As a result, even when auction procedures are properly designed and bids are awarded, investment decisions stall at the stages of permitting, grid connection, localisation of contractors and financial close. Simply copying "best practices" is therefore insufficient; instead, project management models and procurement design must be aligned with the institutional profiles of Central Asian countries, including coordination between regulatory and project cycles, strengthening managerial and engineering capabilities, and reconciling grid constraints with construction schedules [5–9].

Existing research on renewable energy auctions has largely prioritised tender design and bid prices, whereas evidence on project execution typically appears as fragmented case studies (often limited to one country, one programme or one technology). At the same time, the project management literature offers well-established success-factor and governance perspectives, but it rarely treats auction-based RE deployment as an end-to-end delivery problem shaped by regulators, system operators and offtakers. For Central Asia, empirical work remains scarce and dispersed. This review addresses this gap by synthesising cross-country evidence on how procurement design, institutional capacity and investor-side delivery capability interact to determine implementation performance in RE auction portfolios.

The object of the study is renewable energy auctions in the countries of Central Asia, and the subject is project delivery and project management, understood as the set of factors and success criteria that determine the implementation performance of auction-based RE projects in the region. In this review, a project delivery model refers to the combined design of procurement rules (prequalification, contracts, guarantees) and managerial practices that shape implementation from award to commissioning and operation. The aim of the study is to develop practical recommendations for improving delivery performance in such projects, based on a comparative analysis of global benchmarks and the regional context, with an applied focus on Kazakhstan.

To achieve this aim, the study pursues the following objectives: (1) to characterise the Central Asian context and current mechanisms for renewable energy procurement; (2) to review global benchmarks in terms of auction rules, contract structures and delivery outcomes; (3) to synthesise delivery-relevant success factors and risk drivers reported in the literature; (4) to compare these factors with the institutional profiles of Central Asian countries and identify key implementation gaps; and (5) to formulate recommendations for adjusting the project cycle and procurement design in line with the regional risk profile. In line with these objectives, the research question is formulated as follows: how should project delivery arrangements for RE auctions be adapted in Central Asia in order to increase the likelihood of meeting schedules and budgets while maintaining target quality indicators?

The theoretical foundation draws on (i) the literature on project critical success factors and project governance, including the time–cost–quality triad and post-project stakeholder satisfaction metrics; (ii) an institutional approach to renewable energy policy, regulation and contract enforcement; and (iii) ideas of value co-creation and stakeholder management in complex infrastructure projects [10]. The expected results include a typology of delivery success factors adapted to Central Asian conditions at the stages of project initiation, procurement and electricity delivery; a comparative assessment of their relevance across institutional settings; and practical recommendations for adjusting auction design, prequalification parameters and risk allocation in contractual arrangements. The novelty of the work lies in a cross-country examination of RE auctions that explicitly links delivery choices to institutional constraints in an under-researched region, whereas existing studies are often limited to single-country cases or thematically fragmented reviews. The practical relevance is reflected in the applicability of the results for energy regulators, system operators and settlement centres when developing auction and prequalification regulations, planning grid infrastructure and connection timelines,

standardising EPC contracts and service-level agreements, and preparing bankable packages that can reduce the cost of capital for RE projects.

Research methods

The study is based on a thematic synthesis of peer-reviewed publications and selected industry reports. Searches in Web of Science and Scopus were conducted in English and Russian using combinations of the keywords renewable energy auctions, project management, critical success factors, risk allocation, Central Asia, and Kazakhstan. The reviewed corpus comprises 15 core sources listed in the References and additional background materials used to interpret institutional and market features where necessary. Sources were included if they: (1) analyse renewable energy auctions or competitive mechanisms for electricity procurement; (2) report implementation-related evidence (timelines, contract performance, enforcement, grid connection, permitting, financing, or institutional constraints); and (3) are relevant to Central Asia and/or provide transferable mechanisms for comparable emerging-market settings.

Qualitative coding followed a hybrid logic: an initial deductive codebook was derived from auction lifecycle stages (design, prequalification, award, construction, commissioning, and O&M), and inductive sub-codes were added as recurring implementation themes emerged in the corpus. Examples of codes include: permitting lead time, grid-connection readiness, offtaker creditworthiness, guarantee size and triggers, milestone monitoring, EPC capacity, O&M capability, and renegotiation risk. Codes were then consolidated into five domains (tender design, risk allocation, grid and regulatory constraints, financial guarantees, EPC/O&M capabilities). On the basis of these domains, a qualitative comparative matrix was constructed for the benchmark countries. The matrix is descriptive (it does not apply numerical weights); it is intended to make visible the configuration of mechanisms and the plausible pathways through which they affect delivery outcomes in different institutional settings.

Germany, Chile and India are selected as complementary benchmarks with differing institutional profiles. Germany represents a mature EU market with high regulatory predictability, a sliding premium model and strict pre-qualification; this case illustrates how auctions operate under strong institutions and well-prepared projects. Chile exemplifies technology-neutral auctions with time blocks of delivery and contracts in hard currency—an example of a relatively small but institutionally resilient system in which the combination of a low entry threshold and strict contractual discipline ensures a high rate of project realisation. India demonstrates the large-scale deployment of renewables in a major developing economy characterised by stringent guarantee requirements, record-low tariffs and pronounced infrastructure and off-taker risks. This three-way comparison covers a spectrum of conditions from “mature” to “transitional” and allows a more robust assessment of which elements of project management for auctions can be adapted for Kazakhstan and the countries of Central Asia.

MAIN PART

Renewable energy (RE) auctions are a competitive electricity procurement mechanism whereby the state or the regulator invites potential investors to bid a price for the supply of a specified volume of “green” electricity. Unlike fixed tariffs (for example, the feed-in tariffs widely used in earlier phases of RE support), auctions allow the market to set the price through competition among bids, which usually leads to a lower cost of support and a more efficient allocation of risk [3]. The winners, who offer the lowest tariffs, conclude long-term power purchase agreements (PPAs) or receive a premium on top of the market price, thereby securing predictable revenue streams and project bankability [10]. This reverse-auction format has become the preferred method for large-scale RE deployment in many jurisdictions because of its transparent rules, downward pressure on prices and the flexibility with which auction parameters can be aligned with policy objectives [3, 11]. For example, in the United Kingdom, contracts for difference (CfDs) awarded via competitive rounds have delivered very low tariffs for offshore wind, while in India regular tenders have produced some of the most competitive solar prices globally [3].

RE auctions are typically organised as descending-price tenders (that is, the lowest bid wins), whereas in classic sales auctions the highest price prevails. Moreover, the object of an RE auction is not a one-off commodity, but a long-term commitment—the right and obligation to build and operate a generating asset and to sell its output at a contract tariff. This brings RE auctions close to project finance: the winning bid effectively

fixes project cash flows 15–25 years ahead, which attracts investors by providing long-term revenue visibility [4, 12]. At the same time, through auction design the state can control the volume of capacity or energy to be procured, commissioning deadlines and minimum quality standards for projects. In this way, auction mechanisms link market-based price formation with the pursuit of public policy goals, such as regional distribution of projects, technological diversity or alignment with broader sustainability transitions [1, 9].

The stages of an RE auction usually include: (1) announcement and design—government definition of the auction volume, eligibility criteria and tender rules; (2) prequalification—imposition of threshold technical, financial and legal criteria on participants to filter for reliable contenders; (3) bid submission—participants offer a tariff (for example, a price per kWh or per MW of capacity); (4) selection of winners—typically based on the lowest price, subject to all other conditions being met; (5) contract award—such as signing a PPA for 15–20 years; and (6) project implementation—financing, construction and commissioning of plants within the specified time frame [3, 11]. Once a plant is commissioned, the focus shifts to operation and maintenance (O&M) and to whether contractual obligations are actually being met. In robust tender schemes, late commissioning or persistent underdelivery triggers penalties or the forfeiture of bid bonds, so that enforcement is built into the auction rules rather than left to ad hoc negotiation [4]. Taken together, the pre-bid, construction and operating phases turn an RE auction into a multi-stage project that needs competent management from initial planning to post-completion control [11].

For this reason, project management is not an add-on but a precondition for auction success. At the planning stage, authorities must design the tender, map and allocate risks, and produce coherent documentation, with unambiguous requirements, timelines and stakeholder responsibilities [4, 11, 13]. During implementation, the familiar "time–cost–quality" triad remains the core benchmark: in practical terms, this means bringing plants online as scheduled, within the agreed budget, and with the promised performance and reliability levels [4].

Finally, the post-project phase involves ensuring stable plant operation, fulfilment of PPA conditions (for instance, annual generation profiles) and the satisfaction of stakeholders, including the state, investors and consumers (Bos-de Vos et al., 2025). Delays or cost overruns in the implementation of auctioned projects not only damage individual investors but also erode confidence in the auction mechanism itself. Empirical work on Central Asia and Kazakhstan shows that insufficient attention to risk management, resource planning and performance control can contribute to stalled or cancelled projects, particularly where regulatory uncertainty and infrastructural bottlenecks are pronounced. Without effective project management, even successfully awarded contracts may become stuck at the stages of permitting, grid connection, contractor mobilisation or financial close. For this reason, project management in RE auctions is treated as an end-to-end process that spans institutional preparation, competitive procedures and the full implementation cycle of projects [4].

Conceptual map of the interrelationships between RE auction stages, project factors and outcomes.

To identify best practices, we analyse the implementation features of RE auctions in Germany, Chile and India—countries that serve as benchmarks in Europe, Latin America and Asia respectively. In each case, particular attention is paid to institutional mechanisms, risk-allocation schemes, participant requirements and contract types, as well as to the ways in which project management tools support or impede successful outcomes [14].

Germany

Germany was among the first EU countries to move from guaranteed feed in tariffs to auctions for large scale renewables [1,2]. Since 2017, the Renewable Energy Sources Act (EEG) has required capacity quotas for solar, wind and other renewables to be allocated through competitive tenders run by the Federal Network Agency (BNetzA). Several tenders per year are announced for specified capacity volumes. The shift to auctions aimed to reduce the cost of renewable support and to align deployment with planned development corridors for the sector [1,2].

To enter an onshore wind auction, investors must first obtain a permit under the Federal Immission Control Act (BImSchG), which in practice means passing environmental review and securing approval for turbine construction. Permitting often takes more than a year and requires significant expenditure, which signals the seriousness of bidders. Each project is registered in the BNetzA database and must post a bid bond of 30 EUR per kW of planned capacity in escrow as performance collateral. Bids are ranked by the offered tariff, and in

the case of a tie the project with the smaller capacity is preferred [1,3]. Winners receive support in the form of a sliding market premium for 20 years, similar to a contract for difference, which guarantees a top up when the wholesale price is below the strike price and reduces support when market prices rise. Producers therefore obtain stable revenues while remaining responsive to market signals [1,3].

Strict prequalification and financial guarantees mitigate the risk of non completion, yet implementation challenges have persisted. In several auction rounds in 2018 and 2019, part of the tendered volume remained unallocated because too few projects had permits in place, and some "citizen" projects lacked sufficient preparation [2,4]. In response, the rules were adjusted: preferential treatment for such projects was removed so that all participants now need permits before bidding, and maximum tariff caps were raised to stimulate participation. Winning wind farms must be commissioned within 30 months for standard investors or 54 months for citizen cooperatives. If deadlines are missed, the contract is cancelled, the 30 EUR per kW bond is forfeited and large projects pay additional penalties. During the support period, plants must deliver their output to the grid rather than using it for self consumption. Overall, auctions have driven down support levels, but project management issues linked to permitting, local opposition and grid constraints have required institutional responses such as grid expansion, faster administrative procedures and harmonised rules for different participant types [2,4,5]. The German case highlights the importance of thorough project preparation, robust financial discipline and systematic stakeholder engagement for successful auctions [3,5].

Chile

Chile was one of the first countries where renewable generation competed on equal terms with conventional power in unified energy tenders [6,7]. Since 2006, the government has organised auctions for electricity supply to regulated consumers, aggregating the demand of distribution companies. Tenders are technology neutral, so any generation source can participate, which encourages renewable projects to offer prices comparable to fossil fuel plants. An innovative system of time of day and seasonal supply blocks divides contracts into hourly and seasonal segments. Solar and wind plants can commit to daytime or seasonal blocks, while thermal plants cover other periods. This structure allowed the variability of renewables to be reflected in bids without direct subsidies, and by 2017 the weighted average tariff had fallen by about three quarters compared with 2013, reaching around 32 USD per MWh [6,7].

Chile emphasised open access to tenders while relying on strict implementation discipline. Prequalification requirements are limited: bidders must register a local project company and demonstrate a minimum credit rating, without local content rules or mandatory prior experience in renewables, which attracted many foreign investors [6,8]. Bidders submit a plan showing how they will deliver the contracted energy, specifying generation sources, grid connection, commissioning schedule and key financial information. Financial guarantees are provided in two stages. First, a bid bond is posted at the time of submission. Second, after the award, a completion bond is required, with both guarantees set at substantial levels per contracted gigawatt hour. Bonds are returned if a bidder loses or, in the case of winners, once a minimum construction milestone is reached. If the project is not completed by the agreed start date, the completion bond is confiscated. Winning bidders sign 20 year power purchase agreements in US dollars that are indexed to inflation, which limits exchange rate risk and facilitates international financing [6,8,9]. Generators must supply the contracted volume in the specified time blocks at the agreed price. Under delivery obliges them to buy electricity on the spot market to cover the deficit, which creates a strong incentive for adequate capacity and storage. Demand and payment risks are modest because distribution companies are legally required to purchase the contracted volumes and retail tariffs are regulated so that these costs are recovered [6,8].

This combination of low entry barriers and strict enforcement has enabled Chile to attract a wide range of investors and achieve very low prices with limited project cancellations. Most contracts have been realised, although some projects experienced commissioning delays that triggered penalties or bond seizures [7,10]. Pricing in US dollars and clear contractual rules helped to draw international developers and keep them accountable, while minimal bureaucratic hurdles at the bidding stage shortened preparation. At the same time, responsibility for execution rests largely with investors, which is feasible in a context of relatively strong legal institutions and creditworthy buyers. The Chilean experience shows how flexible auction design with time blocks and technology neutrality can function effectively when combined with credible sanctions and well designed risk allocation [9,10].

India

India is one of the largest markets for renewable energy auctions and has tendered tens of gigawatts of solar and wind capacity [11,12,13]. The shift from administratively set tariffs to auctions started in the early 2010s and accelerated after ambitious national targets were announced. Auctions are held at the central level through agencies such as the Solar Energy Corporation of India and state owned utilities, and also at the level of individual states. The Ministry of New and Renewable Energy provides the overall framework and model bidding documents, while both central and state entities run frequent tenders. By 2023, India had contracted more than 100 gigawatts of solar and wind capacity, and several auction rounds achieved record low tariffs close to 0.03 USD per kWh. Transparent rules and frequent tenders attracted domestic and foreign investors and enabled rapid growth of renewable generation [11,12,13].

Participation rules aim to filter out financially weak or technically unprepared bidders. Tenders usually set minimum net worth thresholds per megawatt of proposed capacity and require an earnest money deposit in the form of a bank guarantee. After capacity is awarded, winners must achieve financial close within a defined period and provide a performance bank guarantee, often at levels that are high compared with many mature markets. These guarantees encourage discipline but also limit participation by smaller players. Analysts note that very high guarantees and tight timelines can discourage investors and contribute to undersubscribed tenders [11,14]. Developers are responsible for securing land and permits by the time plants are commissioned, and in some tenders they must connect to designated substations or ensure that transmission infrastructure is ready. Delays in transmission expansion have led to cases where completed plants could not inject power into the grid on time, underlining the need to coordinate auction schedules with network development and echoing similar challenges in other emerging energy systems, including Kazakhstan [11,14].

Winning bidders typically receive 25 year power purchase agreements with fixed prices in national currency and no inflation indexation. The offtaker is either a central public entity that signs back to back sales agreements with states, or a state level distribution company. To mitigate the financial weakness of many distribution companies, payment security mechanisms such as letters of credit and state guarantees are required, although payment delays still occur from time to time [11,12]. If a project delivers less than the guaranteed annual volume beyond a tolerance margin, penalties apply. Under generation is often compensated at a multiple of the tariff, which creates strong incentives for robust project design and accurate forecasting [11,12,15]. Construction deadlines are generally around 18 months for solar and 24 months for wind from contract signing. Delays trigger partial encashment of performance guarantees, and persistent delays can lead to contract termination and re tendering of the capacity. In recent years, India has also experimented with hybrid projects that combine solar, wind and storage and with round the clock renewable supply contracts. These tenders impose demanding availability requirements and higher penalties for deviations, which improve system reliability but increase project risks and require more sophisticated risk management [12,15].

Indian auctions have driven rapid capacity additions but have also revealed important project management issues. Sharp tariff declines were sometimes linked to aggressive underbidding, and in some cases developers chose to cancel projects and absorb penalties because they could not secure financing at the bid prices. The authorities responded by introducing tariff caps to discourage unrealistic bids [11,13]. Infrastructure related delays, particularly in transmission, have postponed commissioning even when projects were physically ready, while some states have sought to renegotiate or delay contracts after changes in political leadership, which has increased perceived political risk [11,14]. Reforms now under way include more centralised payment security mechanisms, improvements in transmission planning and further standardisation of auction procedures across the country [12,14]. Domestic engineering, procurement and construction companies have built significant capabilities, which has lowered costs and shortened construction times [12,15]. The Indian experience underscores the importance of carefully calibrated guarantees and penalties, realistic planning that takes grid and offtaker constraints into account, and broader sectoral support, including access to finance and local manufacturing. These lessons are highly relevant for other emerging regions that seek large scale renewable deployment, including Central Asia [11,12,13,15].

Comparative analysis: auction models and success factors

Linking the coded evidence to the comparison, we treat auction performance as a delivery outcome driven by three interdependent building blocks: (1) procurement design and enforcement (entry requirements,

guarantees, milestones, sanctions); (2) enabling institutional conditions (policy stability, permitting and dispute resolution, grid planning, and the credibility of offtakers); and (3) investor-side delivery capability (bankability, EPC readiness, and O&M capacity). This framing is used to interpret Table 1 and to identify which mechanisms can be transferred to Kazakhstan and which require prior institutional strengthening.

The case studies presented above illustrate the diversity of approaches to project management in renewable energy auctions. The key parameters of the practices observed in Germany, Chile and India are summarised below, allowing for a structured comparative analysis.

Table 1 – Comparison of renewable energy auction mechanisms in Germany, Chile and India (auction design, requirements and risk allocation)

Aspect	Germany	Chile	India
Regularity and scale of auctions	Periodic technology-specific tenders (wind, solar) with annual quotas defined by the EEG Act. For example, 2.8 GW/year for wind; separate rounds for other renewables.	Annual (or, as needed, ad hoc) auctions for electricity procurement to supply consumers. Technology-neutral; the volume is determined by the aggregated demand of distribution companies.	Numerous tenders at the federal and state levels, totalling 5–15 GW per year. Most rounds are technology-specific (separate for solar PV and wind), while in recent years mixed "hybrid" schemes and auctions with storage have appeared. Targets are set by the government (500 GW by 2030).
Institutional framework	Statutory requirement to conduct auctions (EEG). The auctioneer is the Federal Network Agency (BNetzA), operating under transparent rules. Strong enforcement institutions (regulation, courts).	Auctions are organised by the National Energy Commission (CNE) together with the Ministry of Energy; contracts are signed with distribution companies. Auction rules and results are published; enforcement is ensured through legislation and regulatory monitoring.	The central government sets the framework; the key organiser is SECI (Solar Energy Corporation of India). In the states, local power utilities run tenders. Contracts are standardised; enforcement relies on the court system, but the recovery of penalties is complicated by the weakness of some institutions.
Participant prequalification	Substantive: requirement to hold a permit for the project under the BImSchG before entering the auction—this serves as a filter based on project readiness. Financial: a guarantee deposit of EUR 30/kW submitted together with the bid. Exception (2017): "citizen energy cooperatives" were temporarily allowed to participate without a permit and were given 54 months for commissioning (the exemption was later revoked due to abuse).	Minimal substantive requirements: a project description and company registration are sufficient. No requirements for local experience or licences. Financial: large guarantees—200 UF/GWh (≈ USD 7,800) at bid submission, refunded to unsuccessful bidders, and 600 UF/GWh (≈ USD 47,000) after award, refunded upon completion of construction. A company credit rating of at least BB+ is required.	Substantive: evidence of land availability for the project and completion of basic permitting procedures (especially for large parks). Financial: a high Earnest Money Deposit (EMD) at bid submission—for example, ₹1–2 million/MW—and a Performance Guarantee of around ₹3.4 million/MW (> USD 35,000/MW) at award. Bidders must demonstrate sufficient equity and/or credit lines. The period allowed for financial close is 6–12 months, after which the award may be revoked.
Contract model and payment	Sliding Feed-in Premium for 20 years. Generated electricity is sold on the market; the state pays a premium equal to the difference up to the winning tariff (if the market price is lower) or pays nothing (if the market price exceeds the tariff). This makes revenues predictable while preserving market integration. Payments are in euros, funded via the EEG levy.	20-year PPAs in USD with indexation. The buyers are distribution companies that pay a fixed price for energy blocks (daytime/night-time, seasonal). Contracts include indexation to U.S. inflation, eliminating exchange-rate risk. Energy is delivered according to a schedule: if the RE plant does not generate, the company must purchase electricity on the market to meet its contractual obligations (effectively bearing the price difference as a penalty).	25-year PPAs in INR (without indexation). The offtaker is a central public intermediary (SECI) or a state-owned utility. The tariff is fixed in rupees, so the investor bears both inflation and currency risks (for imported equipment and O&M). In some schemes (RTC), an annual tariff escalation of a few per cent is allowed for the first 15 years, but classic schemes have fully fixed tariffs. Settlements are in the national currency, and devaluation risk lies with the investor.

Aspect	Germany	Chile	India
Risk allocation	Price risk: the investor is protected against price drops (the premium tops up to the tariff), but when market prices rise above the tariff, the generator forgoes upside, which discourages overbidding. Construction risk: borne by the investor, but mitigated by the requirement that the project already has a permit. Financing risk: moderate, as banks take into account the guaranteed EEG premium and overall low country risk. Grid risks: partly on the investor, who must arrange for grid connection, although in Germany network capacity is usually available.	Price risk: essentially absent (the contract is fixed in USD for 20 years and is insulated from local market volatility). Demand risk: absent (the contracted volume is purchased under the PPA; any excess is borne by the generator). Construction risk: fully on the investor—large guarantees and penalties for non-completion shift responsibility to developers. Regulatory risk: low; contracts are stable, with clauses for price review in case of regulatory change. Currency risk: borne by the state/consumers, as payments are in USD, which has been a major attraction for investors.	Price risk: the investor bears the full long-term price risk over 25 years (the tariff is fixed and does not adjust for changes in technology costs or carbon pricing). However, the tariff is protected against downward revision, except in extreme force-majeure circumstances. Demand risk: moderate—some states face surplus capacity and have attempted to back out of offtake; contracts are usually "take-or-pay" with a minimum guaranteed payment. Payment risk: significant, but mitigated through letters of credit and government guarantees. Construction risk: on the investor; failure to commission on time leads to forfeiture of guarantees and possible reallocation of capacity in new tenders. Infrastructure risk: partly on the investor (who must secure land and permits), but delays in public grid expansion can interfere, and contracts increasingly attempt to account for this.
Measures against project failure	Strict prequalification (only ready-to-build projects with permits) already screens out weak participants. The financial deposit of EUR 30/kW is withheld if commissioning deadlines are breached. In addition, large projects incur penalties for delays of more than 24 months (support rates are reduced and the contract can be terminated). As a result, more than 95% of projects are realised; however, in 2017–2018 a problem was identified: leniencies for "citizen" projects without permits led to delays, and the rule was abolished.	Low entry barriers are offset by strict sanctions: in total, about USD 55,000/GWh of guarantee payments is lost in case of non-performance. Contracts provide for a penalty of 15 UF (≈ USD 588) for missing interim construction milestones and 10 UF/GWh for each month of commissioning delay. Under-delivery of energy is penalised by requiring the supplier to pay the difference between the spot and contract prices (effectively a 100% penalty on the shortfall). These measures have proven effective: the project realisation rate is high while entry conditions remain attractive for a wide range of companies.	The main instruments are high bank guarantees (EMD, PBG) and penalties. If the developer refuses to sign the PPA or fails to complete the project, guarantees amounting to millions of rupees per MW are unconditionally encashed. The penalty for energy under-delivery is typically 1.5× the tariff (150%) annually or higher. In the case of prolonged delays, disqualification and re-tendering of capacity are possible. In practice, however, there have been instances where firms preferred to forfeit the deposit rather than build a loss-making project—an indication that some risks (for example, ultra-low tariffs) remain under-mitigated. Tariff caps and requirements to demonstrate financing are now being introduced to reduce the likelihood of non-viable, overly aggressive bids.
Key success factors	Reduction in the cost of RE support (around 50% savings compared with previous tariffs); high investor confidence in the mechanism due to stable regulation. However, further wind deployment is constrained by non-financial factors, indicating the need for improvements in permitting management and community engagement.	Achieved prices below those of conventional power without subsidies and attracted global players. Flexible auction design (time blocks) enabled the integration of renewables. A critical factor is strict enforcement of contractual discipline—a case study in effective risk management (lower entry thresholds offset by higher penalties). Analysts note that Chile's experience is most applicable to countries with robust institutions; otherwise, there is a high risk of non-compliance without similarly strong enforcement mechanisms.	Massive mobilisation of investment and record-low RE prices driven by competition. A new sector of the economy (the solar industry) has emerged. However, several bottlenecks have been identified: provision of infrastructure (grid), the financial health of offtakers, and the need for realistic risk assessment (avoiding unrealistically low bids). Continued success requires constant adaptation of tender conditions (for example, reserving grid capacity, enhancing payment security) and strengthening of institutions (contract law, dispute resolution and arbitration).
Note – Sources: adapted from [1],[8]			

Table 1 shows that Germany, Chile and India pursue similar objectives, namely maximising investment, lowering prices and ensuring project delivery, but rely on different combinations of mechanisms [1-3]. Germany stresses thorough project pre development and gradual market integration through a sliding premium, Chile combines low entry barriers with strict result based accountability, and India targets large volumes supported by high guarantees, yet faces persistent infrastructure and financing constraints [1-3].

In all three countries, auction and contract design seeks to allocate risks so that investors can implement projects while the state actually receives the committed capacity [4]. Financial prequalification through deposits and guarantees screens out opportunistic bidders and raises the probability that projects reach commissioning, while penalty clauses and the option to cancel awarded capacity if deadlines are missed form a core element of project control [4-6]. Approaches to substantive prequalification differ: Germany requires projects that are close to ready to build, Chile applies only minimal substantive criteria, and India illustrates the need for balance, since very strict requirements can reduce competition while overly lenient terms can encourage speculative bidding and non implementation [1,2,5]. The relationship between bid competitiveness and implementability is therefore a matter of calibration, and all three countries have adjusted rules, for example by modifying tariff caps, once outcomes began to threaten project bankability [1,2].

External factors also shape success. Falling technology costs have helped push bids down, domestic EPC capacity and contractor experience have accelerated construction, and the financial health of offtakers has affected investor confidence [3,6,7]. Germany and Chile benefitted from relatively stable and transparent institutions, whereas India had to reform its power sector and strengthen payment mechanisms in parallel [7,8]. In general, key success factors for renewable energy auctions can be grouped into three categories: a well designed tender with clear criteria, proportionate requirements and credible sanctions; a supportive institutional environment with predictable policy and timely grid expansion; and effective project management on the investor side that allows plants to be built and commissioned on schedule [9-11]. Where any of these elements is weak, delays and non implementation are more frequent.

Applicability to Kazakhstan and Central Asian countries

Experience from advanced markets offers valuable design choices, yet direct transfer to Kazakhstan and other Central Asian states is constrained by institutional conditions. The region has substantial solar and wind potential and has introduced auction based support schemes, but commissioned capacity still lags behind announced targets and delays are common [7,12]. Evidence suggests that project management recommendations that work in mature jurisdictions are not fully adapted to local realities, which include volatile regulation, shortages of local EPC and O&M capabilities, and infrastructure bottlenecks such as limited transmission capacity and ageing equipment [7,10,12]. As a result, even well conducted auctions often stall at the stages of permitting, grid connection, contractor localisation and financial close [11,13].

To increase the likelihood of successful implementation, global best practices need targeted adaptation to Kazakhstan's institutional profile. Priorities highlighted in the literature include aligning the regulatory cycle with the project cycle so that rules and tariffs remain stable during construction and early operation, strengthening managerial and engineering capacities through experienced international EPC firms and training for local staff, and synchronising grid development with project timelines by planning transmission investments for new plants in advance [9,10,13]. It is also advisable to introduce staged monitoring of project progress with interim milestones, as in Chile, so that lagging projects can be identified early and corrective measures, including replacement of the investor, can be applied [1,6].

Kazakhstan has already introduced several elements consistent with global practice: auction participants provide bid deposits and bank guarantees, standard PPAs include liability for delays, and a settlement centre has been created to guarantee offtake [11]. Nevertheless, slow land allocation and permitting, limited capacity among local contractors and a fragile financial position of power companies still undermine auction effectiveness [7,12]. Analyses by industry associations indicate that a number of projects from the first auction rounds faced problems at the grid connection and financing stages, which led to delays or cancellation, and thus confirm that project management must be embedded in the realities of local institutions and markets [11,13]. Where enforcement, infrastructure or competencies are weak, they need either to be strengthened in advance or explicitly reflected in auction design.

For Kazakhstan, the main implication is that competitive auctions can match the performance of leading countries only if they are combined with robust project management and gradual institutional strengthening. Needed steps include more reliable legislation that protects long term contracts, transparent and predictable permitting procedures, and policies that build domestic capacity in construction and operation of renewable plants [9,10,14]. Instruments such as guarantees, prequalification and standard PPAs already help attract capital, but their calibration must reflect local risks. Requirements and penalties that are too soft invite speculation; excessively strict conditions discourage investors in a high risk environment, so an intermediate level is necessary [3,5,15]. Remaining gaps in knowledge and mechanisms include limited experience with large projects in local conditions, weak coordination between agencies and restricted access to low cost finance. Closing these gaps through pilot projects, international technical assistance and knowledge exchange with countries such as Germany and Chile would help Kazakhstan improve auction performance over time [8,12,14].

The broader literature confirms that renewable energy auctions are an effective instrument for promoting renewables and lowering costs in many countries, but success is not automatic and depends heavily on project management quality [1,2,7]. Comparative analysis of Germany, Chile and India shows that transparent and carefully designed tenders, competitive price formation and enforcement mechanisms that combine prequalification with meaningful guarantees significantly increase the share of projects that reach completion [3,6,9]. At the same time, measures that work in one institutional setting may not be directly replicable elsewhere. Designs that rely on strict penalties, as in Chile, presuppose effective enforcement, while very high guarantee deposits, as in some Indian tenders, can raise barriers to entry where capital is scarce [4,5]. Each country must therefore tailor auction parameters to its own context, balancing investor risk, participation by local actors and system needs [10,14]. Gaps and challenges remain even in leading jurisdictions, including underbidding, local opposition and the need for post project monitoring. These issues point to promising directions for further research on how different models of project management affect long term auction outcomes, including generation reliability, life cycle costs and stakeholder satisfaction [9,11,15].

CONCLUSION

For Kazakhstan and similar countries, the main conclusion is the need for a systemic approach: the adoption of global best practices in auction design must be accompanied by the development of local conditions for their implementation. By drawing on international experience, Kazakhstan can gradually build an auction system that is competitive, transparent and effective. However, success will depend on investing not only in RE projects themselves, but also in institutional development—improving regulatory predictability, training human capital and modernising grid infrastructure. Only by combining technical mechanisms (tenders, contracts, guarantees) with institutional improvements can the core objective be achieved: the timely, fiscally sustainable and high-quality commissioning of renewable capacity, thereby bringing the power system closer to sustainability and decarbonisation goals.

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ҚАЗАҚСТАНДАҒЫ ЖАҢАРТЫЛАТЫН ЭНЕРГИЯ КӨЗДЕРІНІҢ АУКЦИОНДАРЫ: ИНСТИТУЦИОНАЛДЫҚ ШЕКТЕУЛЕР ЖӘНЕ ЖОБАНЫ ІСКЕ АСЫРУДЫҢ ТАБЫС ФАКТОРЛАРЫ (ШОЛУ)

С. Хамзина[1]*, М. Мукан[2], Р. Ю. Тормосов[1]

[1] Astana IT University, Астана, Қазақстан Республикасы
[2] Нархоз университеті, Алматы, Қазақстан Республикасы

АҢДАТПА

Зерттеу мақсаты. Мақала Орталық Азия елдерінде, әсіресе Қазақстанда, ЖЭК аукциондары бойынша жобаларды іске асыруға ықпал ететін институционалдық жағдайлар мен жобаны жеткізу (delivery) тәжірибелерін талдайды. Негізгі мақсат – аукцион арқылы іріктелген жобалардың уақытында, бюджет шегінде және жоспарланған сапамен іске асу ықтималдығын арттыру.

Әдіснамасы. Зерттеу ЖЭК аукциондары және жобаларды басқару жөніндегі ғылыми әдебиеттердің тақырыптық синтезіне негізделген. Сапалық кодтау арқылы орындалуға әсер ететін факторлар бес доменге біріктірілді: тендер дизайны, тәуекелдерді бөлу, желілік және реттеушілік шектеулер, қаржылық кепілдіктер, EPC/O&M құзыреттері. Осы негізде Германия, Чили және Үндістан тәжірибелері бойынша

салыстырмалы матрица құрастырылып, алынған сабақтар Орталық Азиядағы қалыптасып келе жатқан режимдермен салыстырылды.

Зерттеудің құндылығы. Шолу аукцион дизайны мен жобаларды жеткізу мәселелерін байланыстырып, институционалдық жағдайлардың аукцион портфелінің орындалуына қалай әсер ететінін көрсетеді. Фокус баға нәтижелерінен гөрі іске асыру тәуекелдері мен энергожүйеге ұзақ мерзімді интеграцияға ауыстырылады.

Зерттеу нәтижелері. Германия, Чили және Үндістан инвестицияларды жұмылдыру, бағаларды төмендету және жобаларды уақтылы енгізу сияқты ортақ мақсаттарға ұмтылады, бірақ алдын ала іріктеу, келісімшарт үлгілері және тәуекелдерді бөлу тетіктерінің әртүрлі комбинацияларын қолданады. Кейстер бойынша табысты іске асыру үш өзара байланысты элементке тәуелді: (1) талаптары мен санкциялары теңгерілген тендер дизайны; (2) қолайлы институционалдық орта (болжамды саясат, сенімді оффтейкерлер, желіні уақтылы кеңейту); (3) инвестор жағындағы жеткізу әлеуеті (банк талаптарына сай құрылымдау, EPC және O&M даярлығы). Қазақстан мен Орталық Азияда негізгі «тар орындар» реттеушілік құбылмалылықта, желілік/рұқсат беру шектеулерінде және жергілікті EPC/O&M құзыреттерінің шектеулілігінде. Мақалада реттеушілік және жобалық циклдерді үйлестіру, желіні жоспарлауды аукцион кестелерімен сәйкестендіру және кепілдік/предквалификация параметрлерін жергілікті тәуекелдерге бейімдеу бойынша ұсынымдар беріледі.

Түйін сөздер: ЖЭК аукциондары; жобаны жеткізу; жобаларды басқару; институционалдық контекст; Орталық Азия; Қазақстан; табыс факторлары; тәуекелдерді бөлу.

АУКЦИОНЫ ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКОВ ЭНЕРГИИ В КАЗАХСТАНЕ: ИНСТИТУЦИОНАЛЬНЫЕ ОГРАНИЧЕНИЯ И ФАКТОРЫ УСПЕШНОЙ РЕАЛИЗАЦИИ ПРОЕКТОВ (ОБЗОР)

А. С. Хамзина[1*], М. Мукан[2], Р. Ю. Тормосов[1]
[1]Astana IT University, Астана, Республика Казахстан
[2] Университет Нархоз, Алматы, Республика Казахстан

АННОТАЦИЯ

Цель исследования. Статья анализирует, как институциональные условия и практики реализации (project delivery) влияют на исполнение проектов, отобранных через аукционы ВИЭ в странах Центральной Азии, с фокусом на Казахстан. Задача — повысить вероятность ввода объектов в срок, в пределах бюджета и с достижением целевых показателей качества.

Методология. Исследование основано на тематическом синтезе рецензируемой литературы и отдельных отраслевых материалов по аукционам ВИЭ и управлению реализацией проектов. С помощью качественного кодирования факторы сгруппированы в пять доменов: дизайн аукциона, распределение рисков, сетевые и регуляторные ограничения, финансовые гарантии, компетенции EPC/O&M. На этой основе построена сравнительная матрица для Германии, Чили и Индии, а их практики сопоставлены с формирующимися аукционными режимами стран Центральной Азии.

Оригинальность / ценность. Шолу связывает дизайн аукционов и реализацию проектов, показывая, как институциональные ограничения определяют исполнение портфеля аукционов. Фокус смещается с ценовых результатов на риски исполнения и интеграцию ВИЭ в энергосистему.

Результаты исследования. Показано, что Германия, Чили и Индия преследуют общие цели (мобилизация инвестиций, снижение цен, обеспечение ввода), но опираются на разные комбинации предквалификации, контрактных моделей и механизмов распределения рисков. Во всех кейсах успешное исполнение зависит от трех взаимосвязанных элементов: (1) продуманного дизайна торгов с соразмерными требованиями и реализуемыми санкциями; (2) поддерживающей

институциональной среды (предсказуемая политика, надежные оффтейкеры, своевременное развитие сетевой инфраструктуры и процедур); (3) достаточного проектного потенциала на стороне инвестора (банкоспособность, готовность EPC и O&M). Для Казахстана и Центральной Азии ключевые «узкие места» связаны с регуляторной волатильностью, сетевыми/разрешительными ограничениями и дефицитом компетенций EPC/O&M. Предложены рекомендации по выравниванию регуляторного и проектного циклов, координации планирования сетей с графиками аукционов и адаптации параметров предквалификации и гарантий к локальному профилю рисков.

Ключевые слова: аукционы ВИЭ; реализация проектов; проектное управление; институциональный контекст; Центральная Азия; Казахстан; факторы успеха; распределение рисков.

ABOUT THE AUTHORS

Khamzina A.S. – PhD student, Astana IT University, Astana, Kazakhstan, email: a.khamzina@astana.edu.kz, ORCID: https://orcid.org/0000-0001-7793-239X*

Mukan M. – PhD, Associate Professor, Narxoz University, Almaty, Kazakhstan, email: moldir.mukan@narxoz.kz, ORCID: https://orcid.org/0000-0001-8930-2176

Tormosov R.Yu. – Doctor of Economics, Professor, Astana IT University, Astana, Kazakhstan, email: ruslan.tormosov@astanait.edu.kz, ORCID: https://orcid.org/0000-0002-0374-0827

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АУЫЛ ШАРУАШЫЛЫҒЫНДАҒЫ МАРКЕТИНГТІК СТРАТЕГИЯЛАР МЕН ӨНІМДІЛІК БАЙЛАНЫСЫ: ЖҮЙЕЛІ ӘДЕБИ ШОЛУ

А. Б. Сманова[1], А. А. Нурпеисова[1*], Н. В. Джангарашева[2]
[1]Нархоз Университеті, Алматы, Қазақстан Республикасы
[2]Тұран Университеті, Алматы, Қазақстан Республикасы

АҢДАТПА

Зерттеудің мақсаты. Маркетингтік стратегиялардың ауыл шаруашылығы өнімділігіне тигізетін ықпалын жүйелі түрде талдау, қолданыстағы зерттеулердің негізгі әдістері мен аймақтық ерекшеліктерін анықтау, сондай-ақ зерттеу олқылықтарын айқындап, болашақ зерттеу бағыттарына ұсыныстар беру.

Әдіснамасы. Бұл мақалада маркетингтік стратегиялардың ауыл шаруашылығының өнімділігіне тигізетін ықпалы жайлы ғылыми еңбектерге жүйелі әдеби шолу (systematic literature review) жүргізілді. Зерттеу барысында Google Scholar дерекқорындағы 2010–2025 жылдар аралығында жарияланған 22 мақала тақырыптық және мазмұндық талдау арқылы талданды.

Зерттеудің бірегейлігі/ құндылығы. Бұл зерттеу маркетингтік стратегиялардың ауыл шаруашылығының өнімділігіне ықпалын кешенді түрде жүйелі шолу арқылы бағалай отырып, дамушы және дамыған елдердегі зерттеу үрдістерін салыстырады және тұрақтылық, өміршеңдік, нарыққа бағдарлану мен жасыл маркетинг сияқты аз зерттелген бағыттардағы олқылықтарды анықтайды. Сонымен қатар, болашақ зерттеулер үшін жаңа бағыттарды ұсынады.

Зерттеу нәтижелері. Талдау нәтижелері “маркетингтік стратегиялар” және “өнімділік” ұғымдарының жиі қатар қолданылатынын, алайда олардың өзара байланысын нақты қарастырған зерттеулер аз екенін көрсетті. Көптеген еңбектерде деректер сипаттамалық және регрессиялық әдістермен талданған. Дамушы елдерде ауыл шаруашылығы маркетингін зерттеу белсендірек жүргізілсе, дамыған