Energy Security for Kazakhstan – Strategy & Energy Trilemma

Introduction

Countries must simultaneously ensure reliable energy supplies to power their economies, maintain affordable access for all citizens, and reduce environmental impacts to meet climate commitments. This challenge, known as the Energy Trilemma, represents one of the most critical policy puzzles now.

States (especially developing ones) blessed with abundant fossil fuel reserves face the challenge of leveraging these resources for economic development while preparing for a global energy transition that may diminish the value of nonrenewable sources of energy. They should build modern energy infrastructure across vast territories, often with limited capital, while ensuring that energy remains affordable for populations still climbing the development ladder. Simultaneously, they face solid international pressure to reduce emissions and adopt «cleaner» energy sources.

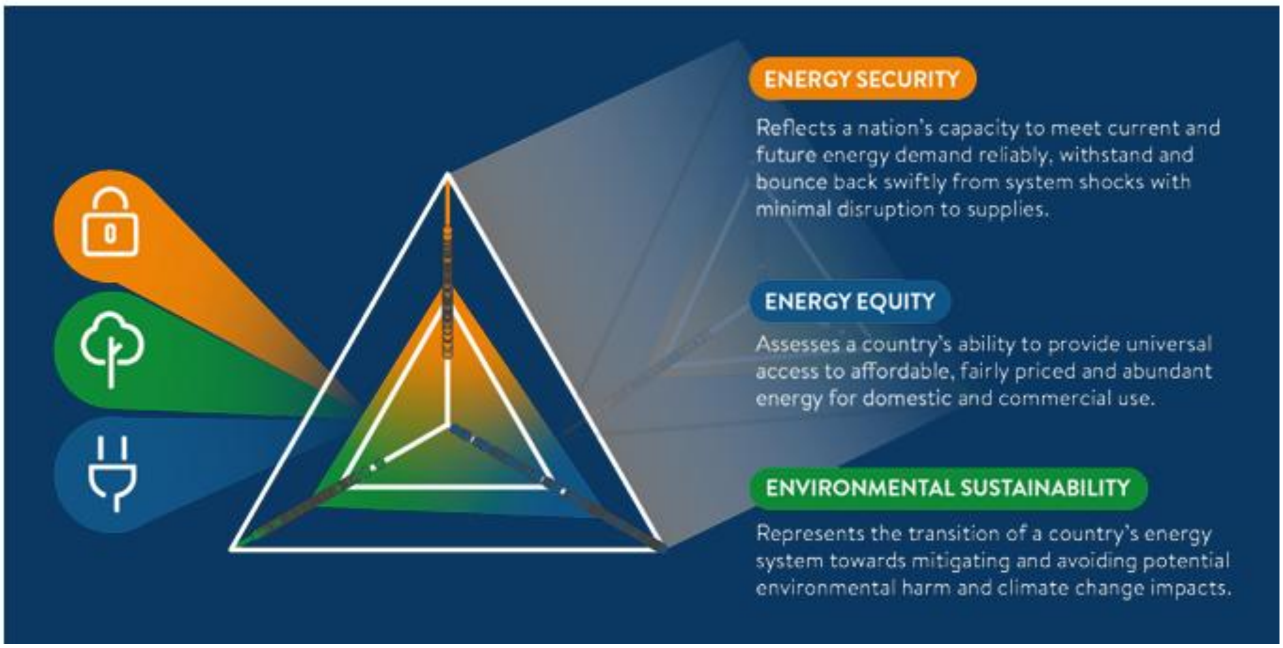
Kazakhstan exemplifies these challenges. As a major oil and gas producer with a coal-dependent electricity sector, the country should navigate the complex path toward a more balanced energy system. However, recent developments, including geopolitical disruptions to export routes, recurring domestic fuel shortages, and electricity deficits, have demonstrated that energy security must serve as the foundation upon which all other energy policy objectives rest. Without a robust energy security framework that ensures reliable supply, diversified infrastructure, and adequate strategic reserves of energy, neither affordability nor a successful energy evolution can be sustained.

Energy Trilemma explained

The Energy Trilemma is a framework developed by the World Energy Council [WEC] that describes the three core dimensions that must be well-adjusted to achieve a resilient energy system. These dimensions work together but often create tensions that policymakers should navigate carefully.

The first dimension is **energy security**, which focuses on ensuring a reliable and uninterrupted energy supply with adequate infrastructure to meet both current and future demand. The second dimension is **energy equity**, which emphasizes making energy affordable and accessible for the entire population so that no one is left without basic energy services. The third dimension is **environmental sustainability**, which aims to minimize negative environmental impacts by reducing carbon emissions and adopting renewable energy sources.

Figure 3: World Energy Trilemma



Source: WEC, World Energy Trilemma 2024 [April 2024]

The fundamental challenge of the Energy Trilemma is that improving one dimension often creates trade-offs with others. For instance, relying on «cheap» fossil fuels may improve affordability and accessibility, but it simultaneously harms environmental sustainability through increased emissions.

To help countries navigate these complex trade-offs, the WEC developed the Energy Trilemma Index. This regular ranking tool measures and compares how well different countries balance the three dimensions of the trilemma. The index scores countries on each of the three pillars using various indicators such as energy import dependency, electricity access rates, CO_2 emissions intensity, and energy affordability. By providing an overall ranking, the index identifies global leaders in energy policy and highlights areas where individual countries need improvement.

2023 Country rankings

Index rank	Country name	Balance grade	Trilemma score	Energy security score	Energy equity score	Enviromental sustainability score
1	Denmark	AAAa	83.2	72.2	95.8	83.5
1	Sweden	AAAa	83.1	73.4	93.4	85
2	Finland	AAAa	82.7	75.9	92.3	80.8
3	Switzerland	AAAa	82.1	64.5	98.1	85.7
4	Canada	AABa	81	76.6	96.2	72.8
5	Austria	AAAa	80.9	71.8	95.3	78.6
6	France	AAAa	80.6	69.4	93.7	83.2
51	Kazakhstan	BBDc	63.4	62.4	79.8	52.5

Source: WEC, World Energy Trilemma 2024 [April 2024]

Countries that achieve high Energy Trilemma Index rankings share several interconnected characteristics and strategies that enable them to balance energy security, equity, and environmental sustainability effectively.

The foundation of success for top-performing nations lies in maintaining a diversified energy mix rather than relying heavily on a single energy source. This diversification enhances energy security by reducing vulnerability to supply disruptions and price volatility. Denmark, which topped the ranking, exemplifies this approach through its combination of offshore wind power, international interconnectors like the Viking Link with the UK, and flexible energy systems that can adapt to changing conditions.

Leading (as per the index) nations have made substantial long-term investments in renewable energy infrastructure, particularly in wind and solar power. The Nordic countries of Sweden, Denmark, and Finland consistently rank at the top of the index due to their robust renewable energy frameworks developed over decades. These countries have created comprehensive policy environments that support renewable adoption while simultaneously maintaining grid reliability and resilience. Energy efficiency represents another critical factor distinguishing high performers from other nations. Countries that rank well demonstrate significant improvements in energy intensity, meaning they use progressively less energy per unit of economic output. France's entry into the top five performers was specifically attributed to its effective energy efficiency policies, which resulted in a twelve percent reduction in energy intensity. This improvement not only reduces environmental impact but also enhances energy security by decreasing overall demand and improves equity by lowering energy costs for consumers and businesses.

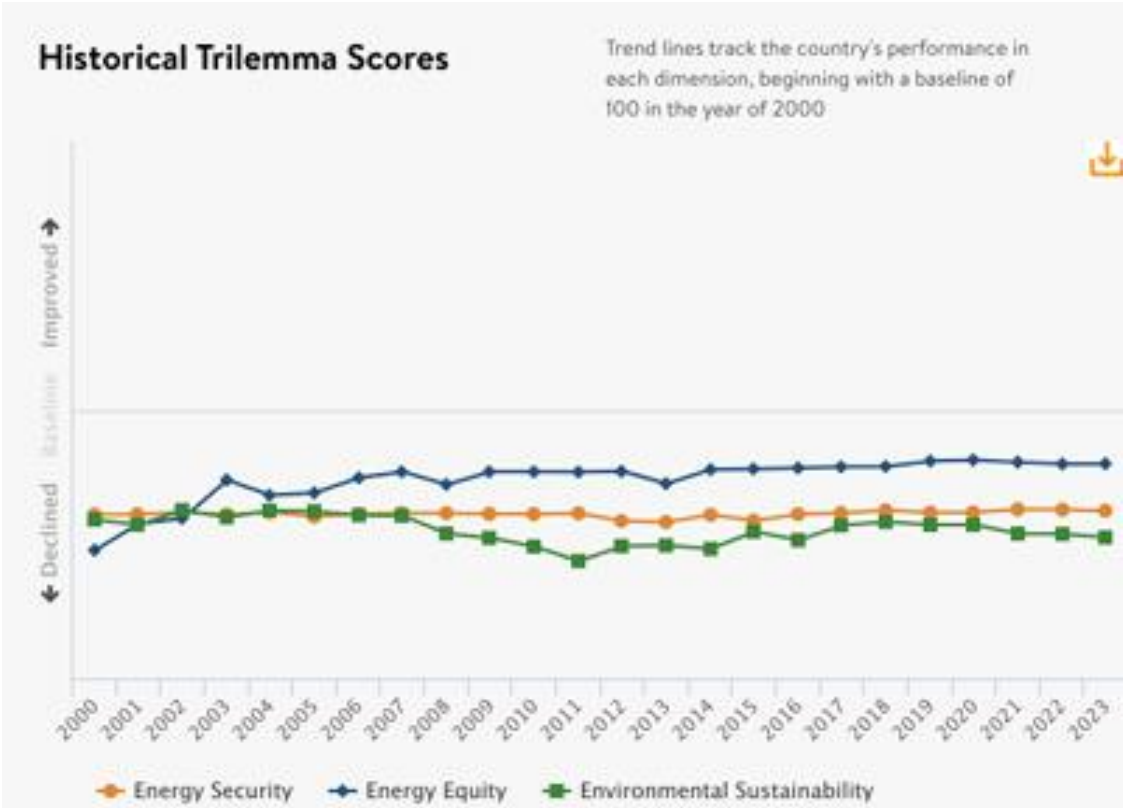
The regulatory environment plays an equally important role in enabling strong performance at the Energy Trilemma Index. Top performers establish clear, stable regulatory frameworks that encourage private sector investment in sustainable energy by reducing uncertainty and investment risk. This includes streamlined permitting processes for renewable energy projects, long-term policy commitments that provide investment certainty, and transparent governance structures that ensure fair treatment of all market participants.

Despite their focus on sustainability and security, high-ranking countries do not neglect the equity dimension of the trilemma. These nations ensure that energy remains accessible and affordable for all segments of their population through policies that balance market efficiency with social considerations. According to the WEC, successful countries ensure that including «cleaner» energy doesn't disproportionately burden lower-income communities, recognizing that public support for energy transition depends on maintaining affordability and universal access. Infrastructure modernization represents another key investment area for leading countries. High performers invest in modern, resilient energy infrastructure capable of integrating variable renewable sources through international interconnectors, smart grid technologies, and energy storage systems.

The common feature among all high-performing countries is their ability to view the three dimensions of the energy trilemma not as competing priorities requiring difficult trade-offs, but as interconnected goals that can be advanced simultaneously through thoughtful policy design, sustained political commitment, and strategic investment in infrastructure.

Kazakhstan's Energy Trilemma

Kazakhstan holds a middle position in the Energy Trilemma Index (51 rank in 2023). The WEC's 2024 report includes Kazakhstan among the countries analyzed, highlighting particular strengths in energy equity due to relatively affordable energy prices for its population, but also noting considerable obstacles to achieving energy security and environmental sustainability that prevent it from reaching the performance levels of top-ranked nations.



Source: WEC, Country Profile: Kazakhstan

The National Energy Report KAZENERGY 2023 [NER 2023], prepared by the KAZENERGY Association in cooperation with S&P Global, is dedicated to global energy trends, including energy transition and energy security. The key recommendation of this report is the need for Kazakhstan to develop and adopt an official Energy Security Strategy. NER 2023 further notes that an effective energy security strategy for Kazakhstan is one that satisfies domestic energy resource needs, maintains affordable prices for them, ensures their widespread availability to consumers, and contributes to significant progress in achieving a «clean» energy future. Regardless of whether Kazakhstan (or any other country) can meet its obligations to reduce emissions in strict accordance with performance indicators and implementation schedules, it is important to continue making progress while meeting the diverse energy needs of the country's population and businesses. This requires an approach to national energy security based on the principle of an optimal combination of traditional and renewable primary energy sources.

Diversification of energy imports and exports is a core pillar of energy security, helping countries manage geopolitical shocks, market volatility, and technological dependencies. For importers like China, the EU, and the US, it means spreading risks across multiple suppliers, routes, and supply chains. For exporters like Kazakhstan, it involves securing access to diverse markets and transport routes to prevent production from being stranded due to (geo)political tensions, sanctions, or technical issues. Kazakhstan's oil sector illustrates this challenge: historically reliant on Russian transit via the Caspian Pipeline Consortium [CPC] route, repeated disruptions since 2022 prompted the pursuit of alternatives like the Caspian Sea route to Azerbaijan's Baku-Tbilisi-Ceyhan pipeline and increased use of the Kazakhstan-China pipeline. However, alternative capacities remains limited, requiring significant investments for expansion, while declining production from mature domestic fields adds further risk.

Resilience, another key dimension highlighted in NER 2023, refers to an energy system's ability to recover swiftly from shocks, encompassing strategic fuel storage, electrical grid reliability, and policy resilience. Strategic hydrocarbon storage protects against disruptions, e.g., the Strategic Petroleum Reserve Programme by the International Energy Agency [IEA] mandates 90 days of oil imports, exemplified by the 120-million-barrel release in April 2022. While operational oil storage suffices for short-term issues, Kazakhstan lacks strategic crude reserves and needs to expand gas storage from 2.5 billion cubic meters to 3-4 billion cubic meters now and 6-7 billion cubic meters by 2030, including new sites like Zhezkazgan-Karakoinsky salt deposits.

Electrical grid reliability is critical as electrification leans toward net-zero. According to the IEA, by 2050 electricity will comprise half of global energy consumption, requiring trillions in investment for «clean» generation and strategies like flexible generation, grid interconnections, capacity markets, digitalization, and long-duration storage. Until advanced low-carbon assets emerge, nuclear and natural gas remain essential. Kazakhstan's July 2023 MAEK power station shutdown, causing widespread outages and requiring Russian imports, underscores the need for robust power infrastructure.

Energy policy resilience requires ensuring affordable, reliable energy access to maintain public support. Kazakhstan ranks high in energy equity but must balance affordability with effective pricing to avoid backlash due to deficits.

Open information sharing (transparency) is vital for energy security, enabling informed decisions and preventing panic. The IEA's 1974 creation post-Arab Oil Embargo demonstrated this. The crisis highlighted that reliable data helps markets work better, reduces panic, and limits speculation that can worsen price spikes, volatility, and shortages. Since then, data from organizations such as the IEA, OPEC, the International Gas Union, and the World Nuclear Association have supported better government, industry, and consumer decisions on production, demand, reserves, and pricing.

In Kazakhstan, similar data transparency could be achieved through systematic, state-level disclosure about the condition and performance of the national oil and gas sector. This would include regular, detailed, and publicly accessible information on production volumes, export levels, infrastructure status, investment plans, and reserve estimates. By ensuring that market participants, investors, and consumers have timely and comprehensive data, the state would allow the market to self-regulate more effectively, improve investor confidence, and reduce the risk of abrupt price fluctuations driven by uncertainty rather than fundamentals.

Internal vulnerabilities flagged in NER 2023 have begun to surface more clearly. The lack of sufficient strategic fuel storage and the dependence on imported refined products have contributed to repeated periods of tight supply and price pressure, particularly during refinery maintenance. By late 2025, the government was forced to freeze prices for key fuels such as AI-92 gasoline and diesel and to suspend planned utility tariff increases in order to contain inflation and protect households, a move that implicitly acknowledges how thin the buffer is between normal operations and domestic fuel stress.

Kazakhstan faces notable electricity deficit. This shortage stems largely from aging infrastructure and overwhelming reliance on coal-fired generation, which accounts for the majority of electricity production. At the same time, concerns in NER 2023 about the aging power system, low energy efficiency, and the difficulty of integrating growing volumes of renewable energy into an already strained grid are being borne by continuing incidents such as large-scale outages in western regions following failures at key power plants. Taken together, these recent developments show that the risks identified in NER 2023 were not theoretical: several have already begun to materialize, turning from long-term vulnerabilities into concrete constraints that now shape Kazakhstan's day-to-day energy and economic policy choices.

Therefore, Kazakhstan needs to place energy security at the center of its national agenda, treating it as a core strategic priority in today's turbulent geopolitical and economic environment. Some of the developments of the last few years have shown that the country's current energy system is vulnerable to shocks. Strengthening energy security is therefore not an abstract policy goal, but a prerequisite for economic stability, social cohesion, and a successful, orderly energy evolution.

The first pillar of this effort is to increase the system's resilience. Kazakhstan remains heavily dependent on a small number of large power and refinery assets, as well as transit routes for exporting oil and importing electricity and gas. Disruptions in any of these segments can quickly translate into shortages, price spikes, and/or outages. Repeated unplanned shutdowns at major refineries have historically contributed to seasonal fuel deficits, forcing the government to resort to import increases and temporary export bans to stabilize the domestic market. Building greater "margins of safety" through diversified generation sources, more flexible grids, larger and better-managed crude and fuel reserves, and accelerated modernization of key assets is essential if Kazakhstan wants to avoid recurring crises.

Energy Security - Path Forward for Kazakhstan

For Kazakhstan, making energy security a priority means more than just avoiding blackouts or fuel shortages. It requires a rational strategy that simultaneously boosts resilience, raises efficiency, manages complex trade-offs, and reforms subsidies in a socially sensible way. If these steps are taken proactively, the country can not only reduce its exposure to external shocks and domestic bottlenecks but also create a stronger foundation for a gradual, orderly energy evolution that supports long-term economic development and social stability. Many governments worldwide prioritize energy security by integrating it into national policy for economic resilience and geopolitical stability.

The United States' National Security Strategy views energy security as crucial for national security and economic competitiveness, focusing on scalable and resilient energy infrastructure and energy dominance. The European Union's REPowerEU plan aims to reduce reliance on Russian fossil fuels, diversify gas supplies, and accelerate renewables and energy efficiency. The British Energy Security Strategy emphasizes boosting domestic low-carbon generation, enhancing system flexibility, and reducing exposure to volatile fossil fuel markets. The Russian Federation's Doctrine of Energy Security outlines national interests, threats, and priorities in energy, focusing on domestic supply, export protection, and risk management. These examples demonstrate that comprehensive energy security strategies are standard practice, recognizing energy's role in national sovereignty, economic stability, and sustainability.

For Kazakhstan to strengthen its energy security in a lasting way, it is not enough to invest only in infrastructure and fuel reserves; the country also needs to build solid organizational foundations that govern how risks are assessed, how priorities are set, and how crises are managed. A key starting point is a comprehensive assessment of Kazakhstan's "margin of safety" for key energy commodities: crude oil, natural gas, electricity, and refined products. This means systematically evaluating reserves, production, and transport capacity, infrastructure constraints, and demand trends to determine how many days or months the country could continue to function (relatively) harmlessly if supply chain disruptions or internal failures occurred. On this foundation, Kazakhstan can then develop a dedicated Energy Security Strategy that explicitly links current and target levels of "margin of safety" to concrete policy measures. Such a strategy would define acceptable risk levels for different energy sources and regions, specify how much and where strategic storage is needed, and clarify the roles of ministries, regulators, state-owned companies, and regional authorities in maintaining energy security. By anchoring decisions in an agreed strategic document, Kazakhstan can move from reactive crisis management to proactive risk mitigation and ensure that short-term measures do not undermine long-term resilience.

The Bottom Line

The path forward for Kazakhstan requires assigning energy security as a core strategic priority in today's unstable geopolitical and economic environment. While the country should continue to balance all three dimensions of the Energy Trilemma, recent developments have demonstrated that without a robust security foundation, neither affordable prices nor successful energy development can be sustained.

To strengthen this foundation, Kazakhstan needs to move beyond reactive crisis management and build solid organizational capacity for proactive risk mitigation. This begins with developing a comprehensive assessment of the country's "margin of safety" for key energy commodities and services via systematically evaluating how long the system can function under various disruption scenarios.

On this basis, the government should adopt a dedicated Energy Security Strategy that defines acceptable risk levels, specifies required strategic storage capacities, and clarifies institutional responsibilities across ministries, regulators, and state-owned enterprises. Finally, Kazakhstan should develop both an energy continuity plan to deal with emergencies and an energy's disaster recovery plan to manage crises when they occur. By anchoring decisions in these specific documents, Kazakhstan can transform energy security from an abstract policy goal into a concrete prerequisite for economic stability, social cohesion, and a successful, orderly energy transition.

ENERGY Insights & Analytics

Analytical center "ENERGY" LLP (ENERGY Insight & Analytics) is a joint venture between the KAZENERGY Association and the IT company AppStream. The company aims to become a priority source of data, analytical information, and recommendations for Kazakhstan's oil, gas, and electric power industries, allowing decision-makers to analyze and predict the most significant industry indicators with details on leading market players. Activities of ENERGY Insight & Analytics incorporate the whole analytics cycle with consequent stages: Descriptive, Diagnostic, Predictive, and Prescriptive analytics.

The key tool and product of ENERGY Insight & Analytics is internally developed software - the Analytical Platform EXia, aimed to identify, localize, format, and present data most efficiently for the specified use cases.

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