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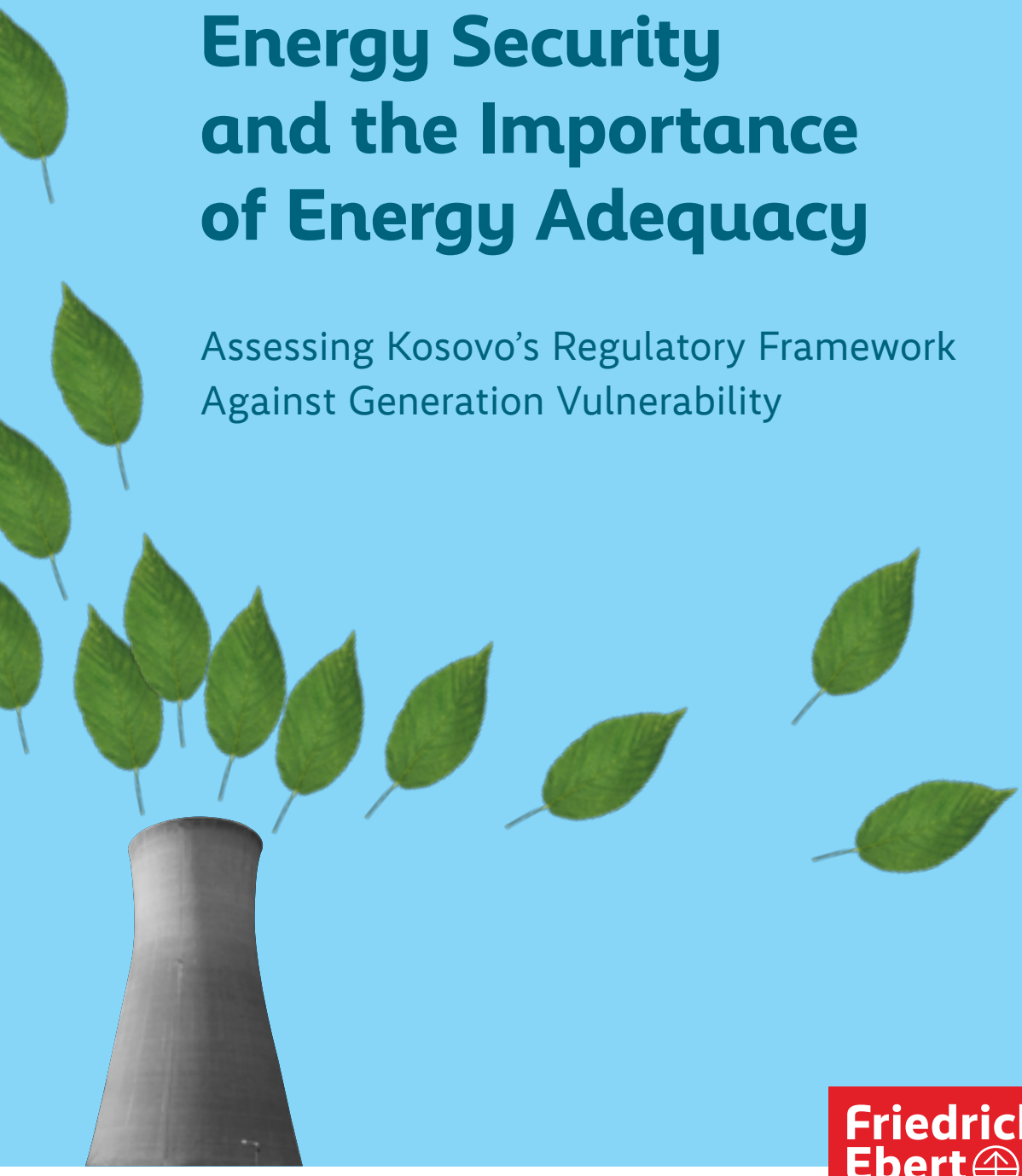
Energy Security and the Importance of Energy Adequacy

Assessing Kosovo's Regulatory Framework Against Generation Vulnerability



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Content

Key Recommendations

The following key recommendations are proposed to build a more resilient regulatory framework to cope with energy adequacy shock:

- The development of new domestic generation capacities is essential to increase system resilience and security of supply. It is crucial that the energy sector of Kosovo reduces the dependence on the existing coal power plants and diversifying energy supply sources (generation and flexibility sources). Therefore, policymakers should establish a stable regulatory framework that ensures the rapid and replicable deployment of new projects. A broad political consensus among parties is necessary to protect long-term investments and ensure that energy projects are not exposed to political risk.

- Strengthening institutional capacities and designing adaptive policies: Policymakers should increase institutional redundancy and strengthen its ability to respond to shocks by establishing dedicated energy task forces and designing smart and adaptive policies.

- Policymakers and institutions should develop comprehensive risk-preparedness action plans to anticipate and manage risks against future potential shocks. They should draw the lessons from recent years (high energy prices or frequent outages) to shift from a reactive to a more proactive planning approach.

Acknowledgement

- This policy brief was developed as part of the project “Assessing the Resilience of Kosovar Society to Ecological and Institutional Shocks”. A comprehensive scoring database, which underpins the analysis presented herein, is available upon request. Please send your requests to info@re-actlab.org.

Introduction

The vulnerability of energy systems to external shocks has been evident for several decades. Starting in 1973 where the world faced a major energy crisis and an increase in energy prices after Arab nations cut oil supplies to the United States and several other countries in response to their support for Israel during the Yom Kippur War. Just a few years later, another crisis was followed by the Iranian Revolution in 1979, leaving the global population short of energy supplies and struggling with price surges. Despite ongoing efforts to adopt cleaner energy alternatives, such as renewable sources, oil and gas will continue to play a crucial role in the global energy mix. Therefore, sustained attention to their stability remains essential, as experts warn that future supply disruptions may be even more likely than today.

Recently in Europe, the Russian invasion of Ukraine in 2022 has once again exposed Europe's dependency on gas imports and shown the vulnerability of the energy sector to volatile gas supplies, which resulted in increased energy prices. The resulting energy price spikes affected most of Europe, including Kosovo, leaving households and businesses financially strained and insufficiently protected. Such crises indicate the importance of resilience of current energy systems when exposed to external shocks, and the need to develop policies and programs that can mitigate and manage their consequences in times of crisis.

"Nowadays, a broader and more multidimensional concept has emerged, energy resilience, which describes the ability of a system to absorb, adapt to, and recover from shocks."

Traditionally, energy security was a concept focused mainly on ensuring that the population has a continuous, stable, and affordable energy supply, with the primary concern being the availability of oil and gas and dependence on imports. However, over the years, energy systems have undergone transformation influenced by an increase in renewable energy sources (such as solar and wind), increased electrification, digitalisation, and interconnectedness, leading to significant changes in the nature of risks that energy systems can be exposed to. Nowadays, a broader and more multidimensional concept has emerged, energy resilience, which describes the ability of a system to absorb, adapt to, and recover from shocks. It includes not only technical, but also institutional, social, and economic capacities to manage disruptions arising from various types of

shocks, including environmental, geopolitical, cyber, and economic or market-based events.

In the context of Kosovo, the electricity system is highly dependent on lignite-based generation from the ageing Kosovo A and Kosovo B power plants. Installed generation capacity is dominated by coal with around 960 MW, followed by wind (140 MW), hydro (130 MW), and PV (30 MW). Due to the high capacity factor, coal accounts for more than 90% of total electricity production. The electricity system is therefore characterised by base-load generation, resulting in an inflexible energy system where imports typically occur during peak hours and exports during late-night hours. Electricity consumption differs significantly across seasons, with cold winters resulting in high demand (driven mainly by heating), while summers have been characterised by lower consumption. However, for the latter, due to heatwaves and rising cooling needs the demand and particularly peak demand is increasing. The level of renewable capacity remains limited despite high technical potential. Policymakers are aware of these challenges, therefore, strategic documents include plans to refurbish Kosovo A and Kosovo B units, develop new generation capacities, reduce energy losses, enhance system flexibility, and modernise electricity networks. However, these planned reforms are long-term, and Kosovo's resilience still depends on their eventual progress.

The remainder of this policy brief is structured as follows: we begin with a short overview of the methodology, which draws on the 4Rs resilience framework. This is followed by the regulatory framework section, where we identify and analyse the key documents (laws, regulations, and strategic documents), shaping Kosovo's response to this shock. Then, we apply the policy analytical framework and discuss the key findings. Finally, we draw our conclusions and recommendations.

Methodology

The policy brief is part of a larger research conducted on institutional shocks that Kosovo faces. The research employs a systematic policy analysis framework designed to assess the resilience of Kosovo's existing regulatory framework (policies, laws, bylaws, strategies, governmental documents, etc.) against several shocks. The research process followed a structured process consisting of three main phases: (i) identifying the nature of the shock, (ii) assessing the current policy responses through a scoring system, and (iii) developing recommendations based on the findings and best practices.

The classification of the nature of the shocks is based on the framework developed by the OECD in 2014, as explained in the table below:

Table 1. Classification of shocks

Type of shock	Characteristics	Examples
Covariate Shocks (Widespread, Sys-tem-ic and Infre-quent)	Large-scale events that affect a large portion of the population at once. They are not frequent, but their impact is widespread and systemic.	Violent Conflict and political crises, pandemic and health crises, large-scale natural disasters, cybersecurity and hybrid threats.
Seasonal Shocks (Recurring, Predictable and Localised)	Periodic shocks that occur at regular intervals, often linked to seasonal changes or climate patterns. Usually predictable, but inadequate preparedness can exacerbate their impact.	Annual floodings and droughts, heatwaves and cold snaps, seasonal food insecurities, recurring health risks.
Long-Term Stressors (Gradual, Cumulative and Systemic Erosion of Resilience)	Unlike shocks, long-term stressors develop slowly over time and weaken societal systems. These are often structural, environmental, economic or social shocks requiring policy responses.	Environmental degradation, demographic shifts, economic stagnation and inequality, weak institutions and governance.

To evaluate the effectiveness of the regulatory framework in countering various shocks, we build upon the 4Rs of Resilience framework. This framework assesses policies against four key dimensions of resilience:

Table 2. The 4Rs of Resilience Framework

Framework	Category	Definition
4Rs of Resilience	Robustness	The strength, or the ability of elements, systems and other units of analysis to withstand a given level of stress or demand with-out suffering degradation or loss of function.
	Redundancy	The availability of alternative resources in the recovery process of a system.
	Resourcefulness	The capacity to identify problems, establish priorities, and mobilise resources when conditions exist that threaten to disrupt some element, system, or other unit of analysis.
	Rapidity	The capacity to meet priorities and achieve goals in a timely manner in order to contain losses and avoid future disruption

Each source identified as part of the regulatory framework addressing the shocks is evaluated against the 4Rs framework using a structured scoring system, as explained below:

Table 3. Scoring system based on the 4Rs Framework

Scoring	
Robustness	0: No robustness—policy does not address stability in the face of shocks. 1: Weak or symbolic measures with little enforcement. 2: Moderate mechanisms exist, but they are inconsistently applied. 3: Strong, well-enforced mechanisms ensuring stability.
Redundancy	0: No redundancy—failure of the main system leads to collapse. 1: Minimal or informal alternatives that are unreliable. 2: Some redundancy, but gaps exist in coverage or efficiency. 3: Well-integrated redundancy ensuring continuity under stress.
Resourcefulness	0: No resourcefulness—reactive rather than proactive approach. 1: Limited adaptability - response mechanisms are weak or ad hoc. 2: Moderate ability to mobilise resources, but gaps remain. 3: Highly flexible and well-coordinated response mechanisms.
Rapidity	0: No rapid response mechanisms—delayed or absent reactions. 1: Slow and bureaucratic response with major inefficiencies. 2: Moderate speed, but some bottlenecks exist. 3: Highly efficient, fast-track response ensuring swift action.

The total policy resilience score (0-12) is then normalised into a percentage, enabling comparative evaluation across different policies and sectors.

Resilience score = SUM (Total score/12) x 100

Table 4. Scoring interpretation

Scoring Interpretation		
0-25% (0-3 points)	Very Low Resilience	The policy makes the society highly vulnerable to shocks, offering little protection or response capability.
26-50% (4-6 points)	Low Resilience	Some resilience measures exist, but they are either weak, inconsistent, or incomplete.
51-75% (7-9 points)	Moderate Resilience	The policy provides a reasonable level of preparedness and response, but some critical gaps remain.
76-100% (10-12 points)	High Resilience	The policy is well-designed, with strong mechanisms ensuring stability, adaptability, and quick response.

For more detailed research methodology, please refer to the Policy Analysis Framework developed for this research. You can find it in this link.

Uncertainties and Shocks in Energy Sector

The electricity sector in Kosovo is one of the key pillars of the overall energy sector. The consumption side is relatively highly electrified (e.g., thermal demand such as space heating and domestic hot water, and cooling), whereas the operation of electricity sector is highly dependent on the old and unreliable coal power plants, which results in frequent outages. One critical component of energy resilience is electricity supply adequacy, which is defined as the ability of the system to guarantee an electricity supply that meets demand at all times, including during peak load periods or unexpected generation shortfalls. While adequacy focuses on the capacity to generate sufficient electricity to meet demand, reliability refers to maintaining a stable and continuous delivery of electricity to consumers. As we saw previously, recent global events have proved the importance of these concepts and the need not only to monitor such shocks but also to design effective measures, as power plant failures or generation deficits have direct economic and social impacts on people's lives. On the other hand, energy shocks differ in their origin, intensity, and duration, yet all have the potential to disrupt the stability of national energy systems and generate economic and social effects.

Literature suggests that shocks can be categorised according to their speed of onset, scale, and scope of disruption. For instance, environmental shocks, such as extreme weather events including heatwaves, storms, floods, or droughts, can damage energy infrastructure, interrupt transmission lines, or force power plant shutdowns. Geopolitical shocks arise from conflicts, trade embargoes, or fuel supply restrictions, which can limit imports or increase prices, as demonstrated by the 2022 gas crisis in Europe. Cyber shocks have become increasingly relevant with the growing digitalisation of electricity systems, which exposes grids and generation units to the risk of cyberattacks and data manipulation. Economic or market shocks, on the other hand, stem from demand surges, price volatility, or technological lags that weaken system flexibility and investment capacity.

In recent years, global and regional institutions have increasingly emphasised energy resilience as a core policy priority. The European experience following the 2022 gas crisis demonstrated how external shocks can expose structural vulnerabilities within interconnected energy markets. As gas shortages and price surges affected both importing and non-importing countries, the European Commission and the International Energy Agency (IEA) developed emergency measures and longer-term strategies

to enhance system resilience and prevent similar crises in the future. At the EU level, initiatives such as AggregateEU or REPowerEU were established to reduce dependency on gas imports by diversifying supplies, increasing gas storage and cooperation in gas purchasing, and promoting energy efficiency and renewable energy sources among Member States. These measures reflect a broader policy response to strengthen crisis response mechanisms by shifting toward higher energy security of supply. Internationally, countries have adapted their approaches according to their specific contexts. For instance, Germany has prioritised diversifying gas imports and accelerating renewable integration, whereas Japan has selectively restarted nuclear units to balance cost efficiency and energy security. These experiences show that there is no universal model for resilience, as each country must tailor reforms to its resources, infrastructure, and institutional capacity. Nevertheless, they all converge on a shared lesson: enhancing supply adequacy and energy resilience requires a combination of diversified energy sources, transparent markets, and flexible systems capable of rapid recovery when disruptions occur.

Within this spectrum, in the energy system of Kosovo, adequacy shocks or sudden generation shortfalls such as unexpected outages of power plants, represent a particularly critical form of disruption, as they directly affect the system's ability to meet electricity demand. The functioning of the electricity sector remains highly dependent on the operation of its ageing coal units (Kosova A and B), making the system particularly sensitive to such shocks. When these units fail, especially during critical periods such as high regional electricity prices or consumption, the country is faced with either rely on expensive imports or load shedding. Figure 1 shows net-production (brown bars), coal generation operation (orange line), and electricity consumption (blue bars) between 2022 and 2025. The winter season remains particularly challenging, as the country often experiences energy deficits when consumption rises due to heating needs, while domestic generation capacity and production remain limited. This occurs even though coal power plants typically operate at higher levels during winter compared to summer, as shown in Figure 1, whereas maintenance are typically done during summer months when consumption is lower.

Overall, the electricity system remains influenced by the availability of Kosovo A and B, and is therefore vulnerable to coal plant outages. For example, in April of 2025, a noticeable amount of deficits occurred associated with the lower coal plant availability (orange line), compared to previous years (e.g., 2022 and 2024), when Kosovo typically exports. Limited domestic generation has broader implications, as it increases reliance on imports and exposes the system to a higher risk of supply interruptions, particularly during periods of high regional electricity prices. Moreover, in recent years, this vulnerability has become more pronounced due to limited generation capacities combined with rising domestic electricity consumption, partly driven by electrification trends. .

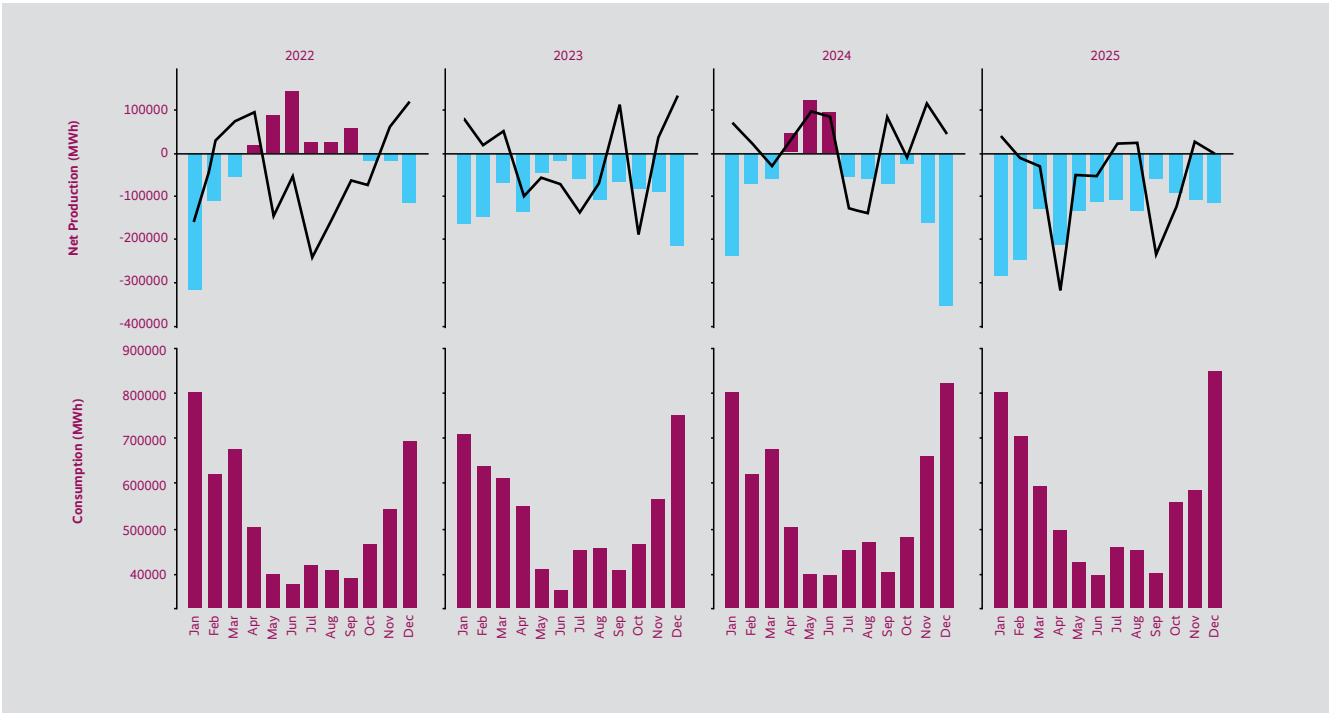


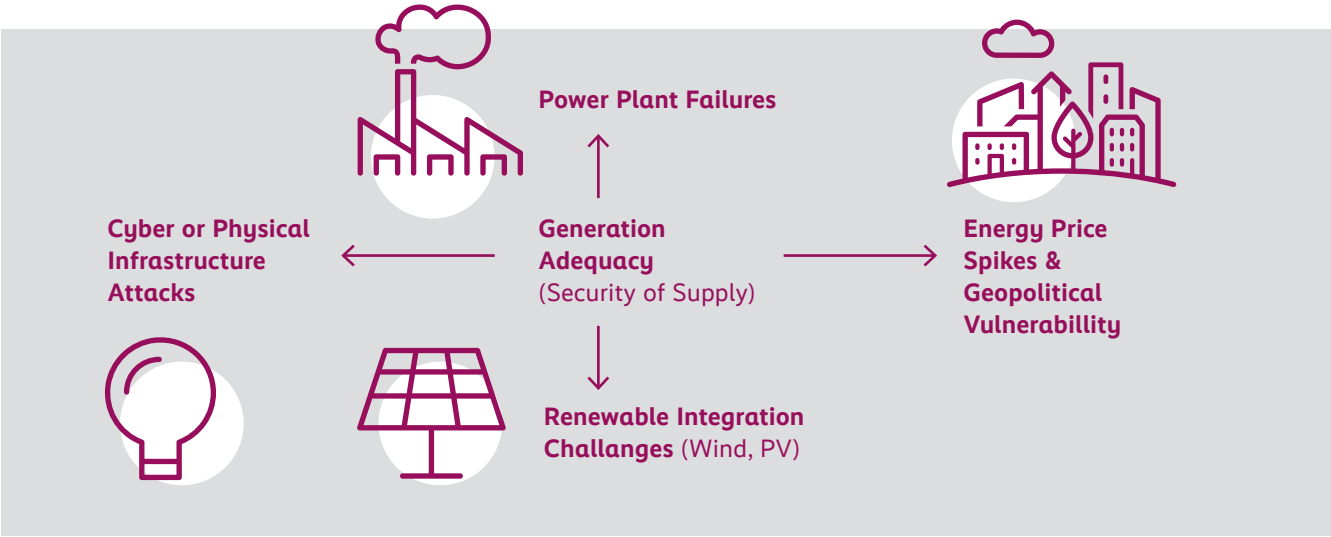
Figure 1. An overall trend of the electricity sector in Kosovo (2022-2025) of net-production (brown), capacity factor of power plants (blue) and consumption across month of the year (x-axes). Data used from ENTSO-e and own calculation.

According to the OECD classification (see Table 1), these events constitute a covariate shocks, as they occur suddenly, have widescpread impacts, and disrupt the system at national scale. This results in consequences that extend beyond technical failures, affecting national productivity, public services, and household welfare. As a result, designing resilience against these shocks requires coordinated action across technical, institutional, and regulatory dimensions, ensuring that energy systems can absorb, adapt, and recover effectively when disruptions occur. Additionally, aging domestic generation capacities and limited investment in new capacities, combined with increased electricity consumption throughout the year, intensify the severity of this shock and constitute a long-term stressor.

Strategic documents, including the Energy Strategy 2022–2031 and the National Energy and Climate Plan (NECP), acknowledge these challenges and outline reforms aimed at strengthening system resilience. Planned measures include refurbishing the Kosovo A and Kosovo B units, investing in new generation capacities, reducing technical and commercial losses, enhancing system flexibility, and modernising the transmission and distribution networks. Although these reforms set a clear direction for modernisation and increased system adequacy, they are long-term in na-

ture, and the effectiveness of Kosovo's resilience still depends on their successful implementation. In the short term, the system continues to face the risk of sudden generation shortfalls, which result and cause serious socio-economic consequences. Therefore, adequacy shocks remain a crucial aspect for the well-functioning not only of the electricity system but also extending further into other sectors. It should be mentioned that the adequacy shock referred to in this policy brief is defined as an unexpected outage of the existing power plants, and is distinguished from the overall system adequacy, which relates to the long-term assessment of the generation and consumption.

Figure 2: Overview of the Shock Generation Adequacy and its links with other shocks/impacts (Source: Own Creation).



Regulatory Framework

The existing regulatory framework of Kosovo for ensuring generation adequacy and managing power plant failures consists of laws, national strategies, and planning documents. To analyse this shock, we reviewed the key strategic documents that regulate the proper functioning of the sector and ensure a reliable and continuous supply of energy. This step is essential, as understanding the current framework allows us to identify where gaps exist, assess the regulatory framework using the 4R methodology, and clarify which areas require improvement. While some of the documents, particularly the laws, were developed before recent supply shocks, they still define the institutional landscape that shapes the country's ability to anticipate shortages and maintain electricity security. The key challenge is that the framework remains in transition: some components are strong on paper, while others rely heavily on future investments, donor-driven projects, or regional mechanisms. Assessing the future-proofness of this regulatory framework identifies institutional gaps as well as chances to improve resilience in the electricity sector.

Although the Constitution of the Republic of Kosovo does not explicitly regulate electricity generation or security of supply, several articles indirectly indicate that the State is responsible for managing generation shortages and power plant failures. Constitutional provisions on sustainable development, rational use of natural resources, and access to essential public infrastructure and services create a basis for long-term planning of energy resources and the expectation of reliable electricity for citizens. Other articles also emphasise good governance, protection of the citizens' welfare, and the independence of regulatory bodies, which together align with the mandate of institutions such as the Energy Regulatory Office, which oversees supply security, grid operation, and crisis response. When addressing threats to generation adequacy and power plant failures, Kosovo's energy legislation and plans must function within the higher-level framework provided by these constitutional principles.

The Law on Energy establishes the foundational legal framework for the energy sector in Kosovo. It defines the key institutions responsible for sectoral governance and sets out the general principles for ensuring security of supply. The Law requires the Energy Strategy to identify challenges and potential shocks the sector may face, maintain a balance between supply and demand, promote diversification of energy sources, and ensure the continuity of energy supply for consumers. It also highlights the importance of regional cooperation and alignment with EU energy policies. In addition, the Law encourages investment in energy infrastructure and renewable energy sources to support long-term sustainability and re-

silience. In cases of extraordinary events or emergencies, whether defined by the Constitution or determined by the Government, the Law authorises the Government to adopt emergency energy measures, including restrictions on supply or special obligations for energy enterprises.

While the Law on Electricity establishes the legal foundation and responsibilities for producers, the Transmission and Distribution System Operators, and the Market Operator as a means of guaranteeing security of supply, resilience to external and internal shocks, and consumer protection. It also emphasises the importance of environmental protection and the efficient use of electricity. Under the Law, security of supply is defined as the ability of the system to meet consumer demand on a continuous basis. The Transmission System Operator (KOSTT) is designated as the authority responsible for maintaining operational network security, managing balancing and frequency regulation, and ensuring sufficient reserve capacity. It also represents Kosovo in ENTSO-E and participates in regional mechanisms that strengthen resilience against shocks. The Market Operator and the Transmission System Operator share responsibility for balancing markets and ensuring supply stability during system fluctuations.

"The key challenge is that the framework remains in transition: some components are strong on paper, while others rely heavily on future investments, donor-driven projects, or regional mechanisms."

On the other hand, the Law on Energy Efficiency sets the legal framework for improving energy efficiency across all parts of the energy chain. As noted above, Kosovo's energy intensity is high, so a key objective is to reduce it and mitigate environmental impacts. Improving efficiency also lowers overall demand, which in turn reduces reliance on imports and decreases vulnerability to external shocks, including global energy price surges. The Law requires structured planning at both national and municipal levels through evidence-based Action Plans. It also establishes the Kosovo Energy Efficiency Fund (KEEF), an independent and autonomous entity that supports the Government of Kosovo in implementing targeted efficiency measures. In addition, the Law promotes greater system efficiency by encouraging cost-effective improvements in energy networks. It further calls for awareness campaigns to inform consumers about energy use, costs, and practical efficiency measures they can apply in their households.

The Law on the Energy Regulator focuses on the powers, duties, and functions of the Energy Regulatory Office (ERO), including licensing, certification of transmission operators, tariff regulation, and market monitoring. It also tasks ERO with monitoring and strengthening the security of

electricity supply and overseeing the Transmission System Operator's ten-year development plan to ensure adequate investment in new infrastructure and supply capacity. The Law authorises ERO to impose public service obligations on suppliers and to regulate customer prices as temporary protective measures during extraordinary events, helping maintain continuity of supply. Its mandate further includes protecting vulnerable consumers, guaranteeing the right of customers to connect to the energy system and receive electricity, and ensuring that both consumers and licensed operators are safeguarded through clear dispute-settlement procedures.

The Energy Strategy outlines Kosovo's long-term vision for the energy system. The 2021–22 crisis exposed several vulnerabilities, including the reliance on old lignite plants, as well as its limited share of renewables and heavy dependence on imports, especially during the winter season. Although Kosovo is not a direct gas importer, it was affected by the value-chain impact of increased gas prices across all European electricity markets, which translated into higher import costs. The Strategy also highlights Kosovo's inefficient energy use, with energy intensity significantly above the EU average. To strengthen resilience, it foresees measures such as expanding renewable capacities to gradually replace lignite, renovating the thermal units Kosova A and Kosova B, promoting efficient heating solutions, enhancing cooperation with neighbouring countries like Albania, and deepening integration into European energy grids to manage supply and demand shocks. It also highlights the supporting households both in coping with high energy bills and in investing in efficiency measures.

Similar to the Kosovo Energy Strategy, the National Energy and Climate Plan (NECP) highlights the challenges of Kosovo's energy system, especially during seasons with high electricity demand, such as winter, due to old lignite-based plants, high network losses, and reliance on imports during peak demand. It outlines priorities to strengthen resilience, such as rehabilitating Kosova A and Kosova B to guarantee operability and reliability of existing capacities, lowering import dependency by diversifying energy sources, and improving cybersecurity in the energy sector. These goals are planned to be achieved through the expansion of renewable energy, investments in battery storage, solar district heating, and the modernisation of city heating, aligning with the energy strategy. Integration into the EU market and cooperation with regional states are also seen as key to mitigating the consequences of energy supply shocks. In addition, incentives for households to invest in efficient energy use and targeted support schemes are mentioned as ways to protect vulnerable consumers. The vision of this plan is to build an energy system that is sustainable and resilient against external shocks.

The National Development Strategy and Plan set Kosovo's long-term vision for achieving sustainable economic development, with the energy sector identified as a key pillar of this goal. The Strategy focuses on improving energy security, sustainability, affordability, integration into regional and pan-European energy markets, increasing renewable sources in the energy mix, and promoting energy efficiency. It also recognises major challenges in

the sector, including an outdated electricity system and infrastructure, continued reliance on lignite plants, high import dependency, especially during winter months, and inefficient energy use, all of which contribute to price volatility and affordability pressures. Progress on these issues is to be measured through several indicators, such as reducing the share of energy costs in total household income from 12.46% to 8% by 2030, and lowering commercial losses from 3.38% to 0%, while transmission losses are expected to remain at 1.75%. Kosovo currently uses only about a quarter of its available cross-border transmission capacity; the Strategy targets an increase to around 40% by 2026 and alignment with the EU minimum of 70% by 2030. In terms of market integration, the plan foresees full integration with Albania by 2026 and aims for participation in the pan-European market area by 2030. For energy efficiency and clean energy, the goals include raising the share of renewables in gross final energy consumption from 24.4% to 32% by 2030, increasing projected energy savings from 2.7 kToe to 217.6 kToe, and reducing energy intensity from 467.2 toe/mEUR to 150–220 toe/mEUR by 2030.

Overall, the regulatory framework of Kosovo provides a structured basis for strengthening energy security, but its effectiveness still depends on new generation capacities, upgrading ageing infrastructure, reducing import dependence, and accelerating integration with regional and European markets. While laws, strategies, and development plans outline clear long-term goals, practical resilience against generation shortages and plant failures remains limited without timely investments, modernisation, and operational backup capacity.

Applying the policy analytical framework

After identifying the key strategic documents relevant to this shock, we now apply the 4R evaluation as outlined in Section 2. Although resilience is often viewed as a qualitative concept, we conduct a quantifiable assessment of the seven documents shortlisted, four laws and three strategies and plans, to measure Kosovo's resilience against generation adequacy challenges. In this section, we present the scoring and justification for each document through the four dimensions of resilience. The aim is to understand in which aspects the current framework performs well and where weaknesses persist, so that the areas requiring improvement can be clearly identified and overall system vulnerability reduced.

Law No. 05/L-081 on Energy

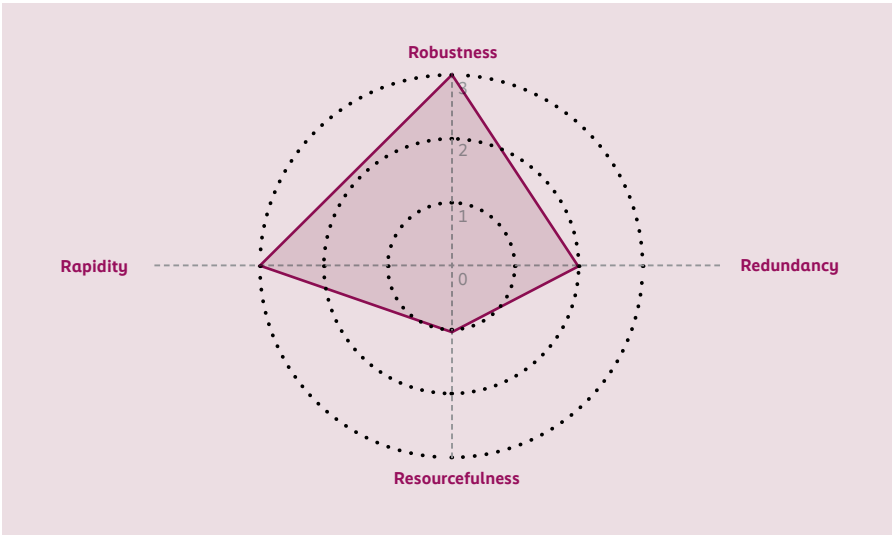


Figure 3: 4Rs Framework Assesment of the Law No. 05/L-081 on Energy (Source: Own creation)

The Law on Energy forms the foundation of Kosovo's energy governance framework, especially in ensuring security of supply and long-term system stability. However, when assessed against shocks such as generation inadequacy or power plant failures, the law demonstrates mixed resilience (overall score of 75%). Its robustness is high (score 3), as it establishes clear legal and institutional mechanisms for system adequacy, including the Energy Strategy, the Strategy Implementation Program, Energy Balances, and mandatory 10-year development plans for transmission and distribution operators. These

instruments establish a strong foundation for planning and supervision to prevent short and long-term generation disruptions.

Redundancy, however, is more limited (score 2). The law does not include comprehensive backup methods for alternative generation or cross-border emergency measures, despite its emphasis on energy diversification, reserve capabilities, and the integration of renewable energy sources. Implementation of redundancy relies heavily on sub-legal acts, investments, and broader sectoral coordination. The law promotes multi-actor coordination between the Ministry, ERO, system operators, municipalities, and private investors, but it lacks clear mechanisms for emergency financing or resource mobilisation during unplanned outages, so resourcefulness is moderate (score 1).

Rapidity scores strongly (3), as Article 25 sets out a clearly defined emergency response framework with time-bound procedures that allow the Government to impose temporary measures, restrict supply, and activate crisis protocols quickly. In times of a significant supply crisis, these measures allow for relatively quick institutional action.

Overall, the resilience of the sector to shocks related to generation is inconsistent, despite the Law on Energy offering a thorough institutional foundation (e.g., through long-term system adequacy planning or energy balances). Although it has robust emergency and planning procedures, redundancy and adaptive resource mobilisation are still lacking, which suggests that additional measures are required to completely mitigate the risks of power plant failures and supply shortages..

Law No. 05/L-085 on Electricity

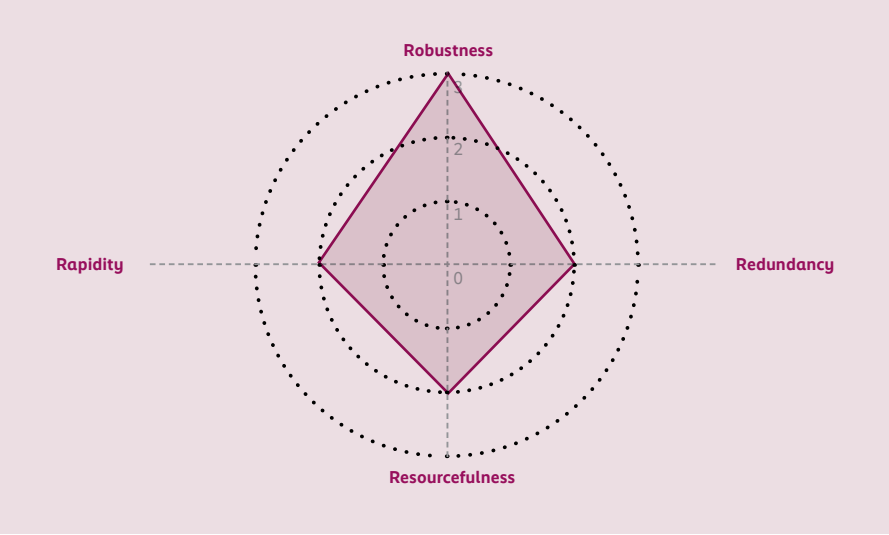


Figure 4: 4Rs Framework Assesment of the Law No. 05/L-085 on Electricity (Source: Own creation)

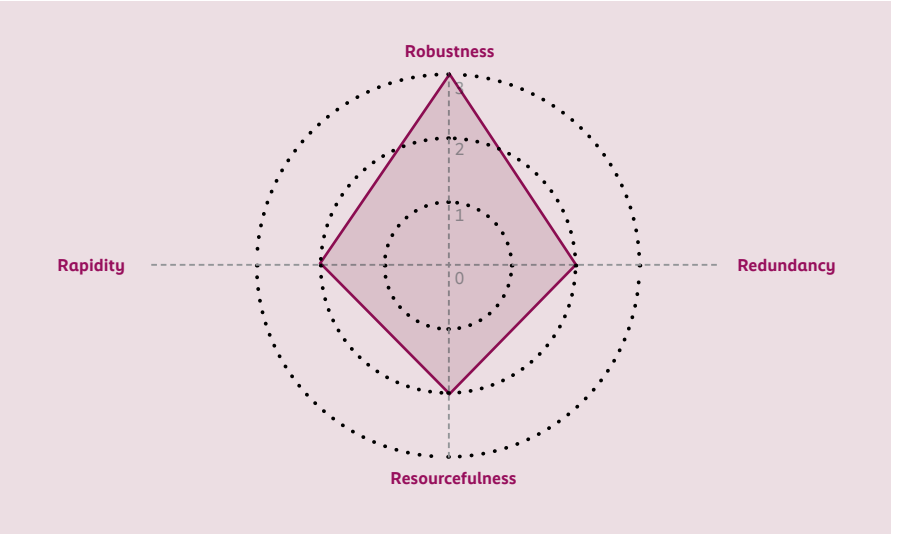
The Law on Electricity provides a comprehensive regulatory and technical framework for the electricity sector of Kosovo, particularly regarding safe, reliable, and high-quality supply. The law demonstrates relatively significant structural resilience (overall score of 75%) when tested against shocks like generation inadequacy or power plant failures. Because it clearly outlines institutional, technical, and legal methods for preserving system adequacy, such as provisions on producers' obligations, fuel reserves, and the Transmission System Operator's (TSO) responsibilities, its robustness is strong (a score of 3). These actions provide a strong basis for energy balance management, generation capacity, and operational safety in accordance with EU electricity market standards.

Redundancy is a moderate level (a score of 2). The law does not outline specific thresholds or storage requirements, but it does mandate reserve capacities, fuel stocks, and source diversification, including cogeneration and renewable integration. Redundancy is therefore mainly conceptual and legal, and its actual application depends on secondary regulations and investment choices, as despite the fact that the Law underpins the importance of reserve capacities and backup systems, there's no thorough plan on their installation and supervision. The law encourages regional collaboration within the context of the Energy Community and permits institutional coordination between the TSO, DSO, Market Operator, and other stakeholders. However, because there are no clear provisions for emergency finance or adaptable financial reallocations that would enable quick recovery during significant generation failures, resourcefulness remains limited (scoring 2).

Rapidity is moderately strong (score 2). In order for the TSO to react fast to

imbalances or unforeseen situations, the law mandates that the Transmission Grid Code have procedures for both regular and emergency system operation. Additionally, fast operational action is made possible by the TSO's capacity to deploy resources, prioritise essential generation units, and start balancing energy bids, however their effectiveness in real-time is reduced by Kosovo's weak balancing capacity, reliance in imports and ageing plants.

Overall, the Law on Electricity offers a well-defined and technically aligned framework for maintaining system reliability, but its resilience to severe generation-related shocks remains uneven. While emergency protocols and robustness are relatively strong, future investments, legislation, and system capacity improvements will play a major role in redundancy and crisis-specific resource mobilisation..



Law No. 06/L-079 on Energy Efficiency

Figure 5: 4Rs Framework Assesment of the Law No. 06/L-079 on Energy Efficiency
(Source: Own creation)

The Law on Energy Efficiency establishes a comprehensive institutional and legal framework aimed at strengthening Kosovo's energy system by reducing demand pressure and improving efficiency, two elements that indirectly support generation adequacy and supply stability. Its robustness is high (score 3), as it mandates national and local energy efficiency objectives through National Energy Efficiency Action Plans (NEEAPs), promotes efficiency in heating, cooling, and energy transformation, and establishes key institutions such as the Kosovo Energy Efficiency Fund (KEEF) and the Kosovo Energy Efficiency Agency (KEEA). These mechanisms institutionalise long-term demand-side planning, reduce peak loads, and help maintain system balance during periods of generation stress, thereby indirectly improving reliability.

Redundancy is moderate (score 2). While the Law does not aim to create new

backup generation, something outside the scope of an energy efficiency law, it contributes to redundancy by lowering system stress during shortages. Measures such as district heating improvements, cogeneration, and demand reduction help reduce pressure on major power plants, while Energy Service Companies (ESCOs), municipal initiatives, and alternative financing (Articles 9–11) provide multiple pathways for reducing consumption when the system is under strain. These forms of demand-side flexibility may act as a buffer during shocks, even though the Law does not include provisions for reserve generation. Resourcefulness is also moderate (score 2). The Law mobilises institutions and funding through KEEF, a revolving mechanism for public and private efficiency projects, and Articles 10–14 expand the range of actors, including municipalities, businesses, and ESCOs, able to implement efficiency measures. Still, Kosovo's law lacks explicit emergency reallocation protocols or backup funding sources.

Rapidity is moderately strong (score 2). The Law facilitates quicker demand adjustments during shortages through smart metering and improved billing systems, which enhance situational awareness and allow faster end-user responses. However, this rapidity remains indirect and depends heavily on long-term structural improvements. Limited smart-meter coverage, combined with the absence of immediate emergency tools, continues to limit real-time responsiveness during severe generation shocks.

Overall, the Law on Energy Efficiency supports system reliability primarily through demand-side resilience, its overall resilience is 75%. While its robustness is strong and it offers meaningful contributions to redundancy and flexibility, its impact during severe generation shocks depends on structural improvements, broader digitalisation, and the development of clearer emergency funding and coordination mechanisms. Additionally, while energy efficiency programmes are designed to reduce energy demand, they should also be designed to reduce electricity peak demands to support the system during critical periods (e.g., outage of power plants).

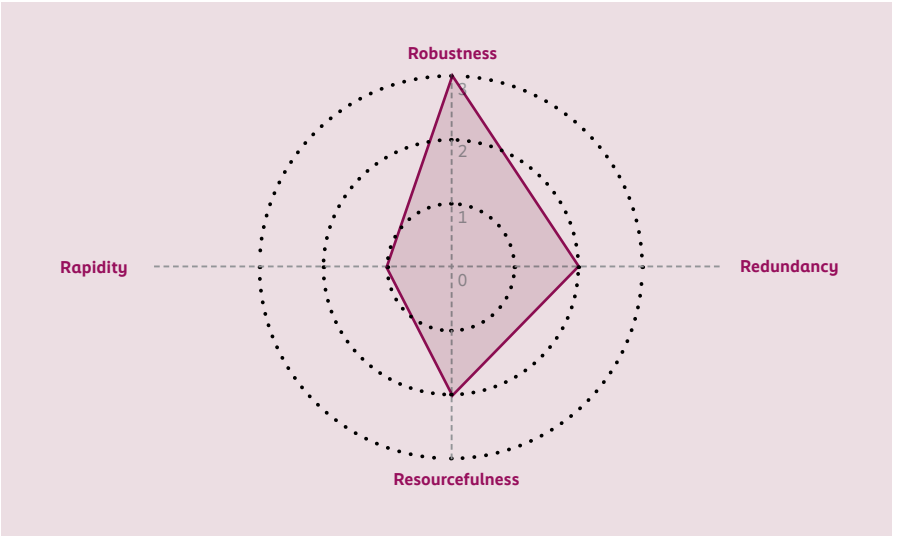


Figure 6 4Rs Framework Assesment of the Law No. 05/L-084 on Energy Regulatory (Source: Own creation)

The institutional, legal, and regulatory framework that the Energy Regulatory Office (ERO) uses to monitor supply continuity, operational reliability, and system adequacy is established by the Law on the Energy Regulator. Its robustness is high (score 3), as the law clearly defines ERO's mandate to monitor and strengthen security of supply, supervise investments in generation and interconnection capacity, and maintain operational and economic stability across the electricity chain. The legislation offers a strong institutional foundation for managing supply and generation risks through duties including approving annual energy balance reports, investment plans, tariff procedures, and balancing mechanisms, as well as its enforcement authority over licensing and compliance.

There is a moderate level of redundancy (a score of 2). Through market diversification, cross-border integration, and regional regulatory cooperation, the law indirectly increases backup capacity. While regional cooperation can provide external protection during domestic generating shortages, provisions on licensing, competitive bidding, and new market entrants enable diversified ownership and increased capacity. Redundancy, however, is primarily based on market dynamics, operator compliance, and regional energy flows rather than dedicated reserve systems because the law does not contain explicit requirements for physical reserve generation or guaranteed backup capabilities.

Resourcefulness also scores moderately (2). The law guarantees some institutional flexibility by establishing ERO as an autonomous, financially self-sustaining organisation with technically trained management. ERO is able to modify licenses, issue sub-legal actions, enforce investments, and penalise non-compliance, all of which enable it to adjust regulatory meas-

ures to new challenges. However, the ability of the system to quickly mobilise resources in the event of generation issues or operational breakdowns is diminished by practical constraints, such as limited technical and human capacity and delays in coordinating with system operators during emergencies.

Rapidity, however, is weaker (score 1). The law provides procedures for expedited decision-making, including defined timelines for dispute resolution and the ERO Board's ability to take binding regulatory decisions. Since this is a legal and regulatory law, its procedures take time and are not designed for rapid decision-making during emergency situations. As a result, although the law provides legal grounds for rapid regulatory action, it lacks useful mechanisms for quick operational measure deployment or crisis management in the event of major generation outages.

Overall, the Law on the Energy Regulator offers a solid institutional and regulatory framework with an overall resilience score of around 67%, but its limited redundancy, difficulties mobilising resources, and slow real-time reaction continue to limit its capacity to handle severe generation-related shocks.

National Energy Strategy 2022-2031

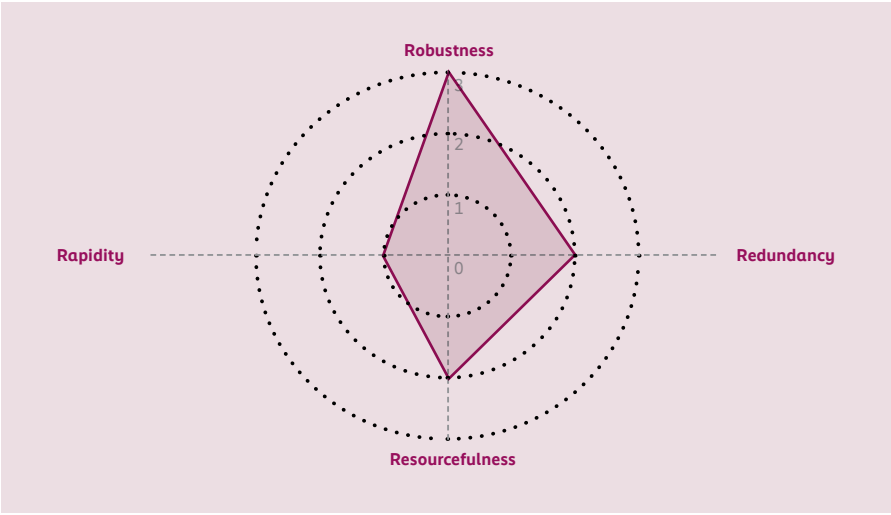


Figure 7: 4Rs Framework Assesment of the National Energy Strategy 2022 - 2031
(Source: Own creation)

The National Energy Strategy shows an overall resilience of around 67%. Because it specifically addresses generation adequacy, highlights weaknesses associated with ageing baseload units, and provides specific actions to guarantee supply continuity, its robustness is strong (a score of 3). These include the planned decommissioning of Kosovo A, rehabilitation of Kosovo B, diversification of the generation mix, and expansion of flexible and renewable capacities. By combining structural reforms with actions that improve operational stability during supply disruptions or plant failures, the strategy additionally calls for

improvements in cross-border interconnection and upgrades in transmission and distribution reliability.

Redundancy is moderate (score 2). The Strategy encourages reserve capacities through diversification, regional integration, and investment in renewable and storage technologies. It sets measurable targets for renewable energy expansion (35–45% RES by 2031) and foresees increased use of cross-border balancing and power exchanges as contingency tools when domestic generation is insufficient. However, redundancy remains dependent on future investments and regulatory developments, particularly regarding storage, reserve plants, and the full utilisation of interconnections, making practical redundancy less secure than its strategic intent.

The Strategy demonstrates moderate resourcefulness (score 2). It demonstrates considerable institutional and financial adaptability by promoting coordinated action among the Ministry of Economy, KOSTT, the Energy Regulatory Office, and donor-supported investment programs. It emphasises the mobilisation of private capital and EU funds for renewable and flexibility projects, while encouraging digitalisation and capacity building to improve monitoring and decision-making. It also integrates demand-side measures through links with the Energy Efficiency and Climate Plan. Still, effective resource mobilisation requires strong inter-agency coordination and sustained institutional capacity, which remain evolving challenges.

Rapidity, however, remains limited (score 1). The Strategy highlights grid modernisation, real-time system monitoring, and emergency management protocols, such as improving SAIDI/SAIFI indicators and strengthening cybersecurity, to enable faster detection and system recovery during outages or unsupplied energy. While these mechanisms are clearly outlined, their effectiveness depends on future investments and regulatory updates that have yet to be implemented. In practice, rapid response is still more aspirational than operational, as Kosovo continues to face interruptions, particularly during high-demand periods (winter) and during major generation plant failures. Even though the Strategy introduces a framework for quicker coordination, real-world response times remain constrained by these underlying system limitations.

National Energy and Climate Plan (NECP)

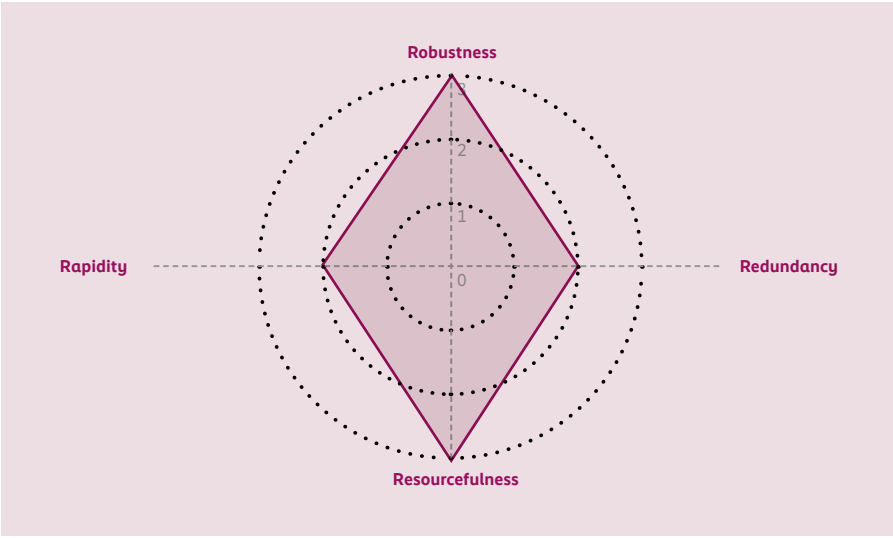


Figure 8: 4Rs Framework Assesment of the National Energy and Climate Plan (NECP)
(Source: Own creation)

The National Energy and Climate Plan builds on the Energy Strategy by combining its long-term goals with Kosovo's 2030 targets, directly addressing supply security and system adequacy. Its robustness is high (score 3), as it proposes concrete measures to strengthen resilience, including the rehabilitation of Kosovo B and partial restoration of Kosovo A (PAM 43–44), alongside cybersecurity improvements, network modernisation, and battery storage investments. The NECP requires ongoing monitoring of the Security of Supply Statement and improved forecasting between generation and demand balance while acknowledging system limitations (aged lignite units, lack of reserve capacity, and reliance on imports, particularly during winter). Together, these actions strengthen Kosovo's institutional capacity to foresee, prevent, or mitigate generation failures.

Redundancy is moderate (score 2). The NECP supports multiple backup pathways through regional coupling, flexibility markets, renewable integration, and battery storage (PAM 47). Market coupling with Albania (PAM 51) provides short-term balancing options, while variable renewables diversify the generation mix. However, redundancy remains strongly dependent on regional exchanges and the rehabilitation of existing plants, as no alternative baseload generation is expected in the near term. Resourcefulness, on the other hand, is strong (score 3). The NECP demonstrates high institutional and financial adaptability by coordinating ERO, KOSTT, and several ministries with international partners such as GIZ, German Energy Transition (GET), European Bank for Reconstruction and Development (EBRD), and Millennium Challenge Corporation (MCC). It outlines mechanisms to mobilise investment through strategic projects and EU or donor-funded programs, while integrat-

ing capacity-building initiatives (PAM 60–61) that strengthen human capital.

Rapidity is moderate (score 2). The NECP still primarily relies on upcoming infrastructure investments like grid automation and storage, although it has procedural mechanisms for operational flexibility and better crisis handling, especially through market-based balancing via Albanian Power Exchange (ALPEX) and increased digital monitoring. Limited domestic reserves and reliance on regional partners mean that responsiveness during deficit periods remains constrained.

Overall, the NECP provides a detailed and coordinated framework that strengthens structural adequacy and institutional resourcefulness (overall resilience score of around 83%). However, its redundancy and rapid response capabilities remain investment-dependent, limiting Kosovo's ability to respond autonomously to sudden generation shocks, while the option left remains reliance on imports as a solution during the deficits.

National Development Strategy and Plan 2030 (NDSP)

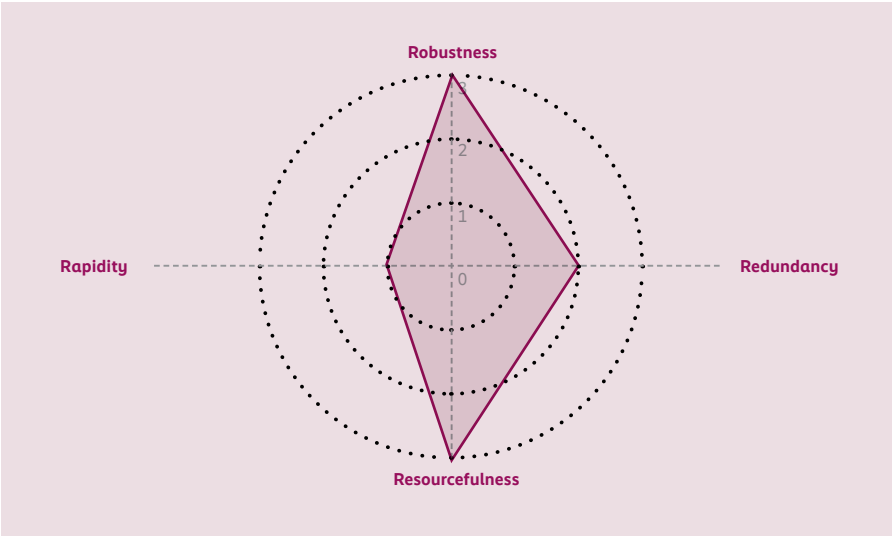


Figure 9: 4Rs Framework Assesment of the National Development Strategy and Plan 2030 (NDSP)
(Source: Own creation)

The NDSP 2030 reinforces generation adequacy and security of supply mainly through Goal 2.1 (Improving energy security, sustainability, and affordability) and Goal 2.2 (Integration into regional and pan-European energy markets). Because it sets measurable objectives that directly promote supply security, like lowering household energy cost share, lowering technical losses, and fulfilling the EU's 70% interconnection utilisation baseline, its robustness is strong (a score of 3). Complementary goals like 3.3 (increasing the renewable share) and 3.4 (energy efficiency) also help reduce reliance on aging plants and balance demand, giving the Strategy a coherent foundation for

long-term system stability during potential plant failures or external shocks.

Redundancy is moderate (score 2). Although it does not specify backup generation or reserve capacity, the NDSP provides alternate supply channels in the event of domestic disruptions by increasing regional integration and renewable capacity. Resourcefulness is strong (score 3), as the Strategy mobilises multiple institutions and aligns with the Energy Strategy and NECP, leveraging donor and EU support to enable flexibility and investment. Rapidity, however, is limited (score 1). While the NDSP promotes smart grids, monitoring, and improved SAIDI/SAIFI indicators to speed up future response times, these mechanisms depend on upcoming investments, meaning real-time emergency readiness remains weak.

Overall, the NDSP 2030 shows relatively strong resilience, with an overall score of 75%. While its strategic goals and coordination mechanisms provide a solid foundation for long-term energy security, weaknesses in redundancy and rapid response limit its ability to handle sudden generation shocks in practice.

Discussing the findings

After completing the 4R assessment of Kosovo's regulatory framework in the context of generation adequacy, the results show that the current legislation demonstrates moderate resilience, with an overall score of around 74%. While the framework displays a certain level of preparedness and response capacity, meaning Kosovo is not highly vulnerable to a similar shock, important gaps, however, remain. Our findings reveal structural weaknesses across the assessed documents that limit the ability of authorities to respond effectively to energy shocks, which continue to pose persistent and growing risks for the country.

Table 5: Total Score of Assessed Policies

#	Policy	Score	Max points
1	Law on Energy	9	84
2	Law on Energy Efficiency	9	
3	Law on Electricity	9	
4	Law on Energy Regulatory	8	
5	Energy Strategy of the Republic of Kosovo (2022-2031)	8	
6	National Energy and Climate Plan (2025-2030)	10	
7	The National Development Strategy and Plan 2030	9	
Total		62	73,8%

When it comes to robustness, our assessment reveals that the regulatory framework is highly robust overall, with most of the assessed documents receiving a score of 3. The legislation clearly defines the role of each authority, many of which function as independent and autonomous organisations, to ensure the continuous security of supply. It also mandates long-term planning, including the rehabilitation of existing generation units (e.g., Kosova A), and sets quantifiable targets such as renewable energy sources capacities, diversifying energy sources, or improving the interruption indicators (SAIDI/SAIFI). However, Kosovo still heavily depends on old lignite plants, whose operation is unreliable (frequent outages), has limited domestic generation capacities, and high reliance on imports particularly during peak demand. To cope with these points, the system requires continuous investment to meet the objectives set out in governmental strategies and plans. Therefore, Kosovo's regulatory framework is structurally robust,

but its practical robustness remains constrained by ageing infrastructure, limited reserves, and reliance on future investments.

When it comes to redundancy, we saw that the overall regulatory framework performs moderately (overall score 2). Stronger regional integration is encouraged by the legislation and strategies, especially through market coupling with Albania and increased usage of cross-border exchanges. However, while this point requires a political willingness at the regional level, therefore, diversification of the energy mix, expansion of renewable generation, and development of flexibility sources (e.g., battery storage) may help increase redundancy further. In the event when the system faces an unexpected outage of the domestic production plant, these components provide robustness in providing an energy supply. However, currently, redundancy remains largely conceptual and policy-driven rather than fully operational, particularly with limited domestic generation capacities. The absence of clearly defined physical reserves or concrete emergency generation plans significantly limits the system's ability to withstand sudden shocks.

Kosovo's regulatory framework in the context of generation adequacy, the results show that the current legislation demonstrates moderate resilience, with an overall score of around 74%.

In terms of resourcefulness, the regulatory framework shows moderate to strong levels, as many of the assessed documents received a score of 2 or 3. This is mainly due to the establishment and clearly defined duties of several independent and autonomous institutions such as ERO, KOSTT, KEEA, and KEEF. Cooperation with a wide range of stakeholders, including ministries, municipalities, and international development agencies, enables the sector to strengthen its resilience to shocks and mobilise resources across sectors when necessary. Although capacity-building and financing mechanisms are referenced across the documents, they are mainly framed as medium- to long-term objectives rather than operational tools for crisis situations. For instance, the NECP and Energy Strategy do not provide specific or quickly deployable emergency financial instruments, but they do emphasize future investments, donor-supported programs, and gradual institutional building. Coordination between institutions is formally encouraged and supported through established mandates; however, during crisis situations, effective implementation may still face delays due to limited staff availability, technical capacity, and reliance on evolving infrastructure. As also noted in our analysis of labour shortages due to automation, limited digital readiness and insufficient technical upskilling within Kosovo's workforce are persistent challenges; these gaps are also present in the energy sector and further slow operational response times. This suggests that achieving full resourcefulness will require sustained future investment in these areas.

Regarding rapidity, the regulatory framework performs weakly to moderately, as reflected in the majority of documents scoring between 1 and 2. While several strategies and laws outline procedures for faster coordination, such as grid codes for emergency operation, improved monitoring systems, and the use of market-based balancing through regional coupling, these mechanisms remain largely dependent on future infrastructure upgrades and digitalisation efforts. Limited digital skills within parts of the existing (often older) workforce further reduce the effectiveness of these mechanisms in practice, slowing operational response despite the existence of formal procedures. Therefore, investments in upskilling and reskilling the workforce are essential to ensure a fully operational system and improved performance in these areas. In practice, Kosovo still lacks sufficient dispatch reserves and has limited domestic capacity to respond quickly to sudden generation failures of power plants or in the grid infrastructure, for instance, at the distribution level (e.g., transformer congestion), which results in longer interruptions. Real-time crisis management is further slowed by institutional constraints and limited technical readiness to intervene. Strengthening rapidity will therefore require both infrastructure investments and improved operational protocols to enable faster, more effective action during shocks.

Conclusions and Recommendations

In this policy brief, we analysed the adequacy shock (defined as the sudden outage of power plants) as the key energy shock that the electricity system of Kosovo faces. The electricity system of Kosovo is highly dependent on two old coal power plants, which makes the system vulnerable, aligned with the activity of these power plants, due to limited domestic generation capacities and dependence on imports. The purpose of this analysis was therefore to examine the existing regulatory framework and assess its resilience against such a shock, in order to provide well-informed and evidence-based policy recommendations.

To identify and assess adequacy shock, we applied the policy analysis methodology described in Section 2. The process involved identifying and shortlisting the key laws and strategic documents that regulate and govern Kosovo's electricity sector. Four laws and three national strategies and plans were selected based on their direct relevance to adequacy shock, supply security, and long-term planning. Each of these documents was then evaluated using the 4Rs resilience framework: robustness, redundancy, resourcefulness, and rapidity, to determine how well the regulatory framework can anticipate, withstand, and respond to generation-related shocks. This systematic approach allowed us to quantify resilience levels and identify structural gaps in the existing framework.

"For these reasons, the development of new domestic generation capacities is essential to increase system resilience and security of supply."

The overall results show that the current legislation has a moderate resilience with a score of 74%. While the strengths of the frameworks lie in their robustness (with an overall high scoring point), analysis shows that a solid institutional and legal foundation exists with well-defined roles and mandatory planning. Positive elements also appear in resourcefulness, particularly through multi-stakeholder engagement, diverse institutional involvement, and access to external funding. However, significant weaknesses emerge in redundancy and rapidity (marking low scores between one and two out of three) mainly due to a lack of domestic generation capacity reserves, reliance on imports, and limited advances toward new capacities and diversification of energy sources. Further, slow coordination, especially in critical situations that require rapid intervention, and

dependence on future reforms and investments further weaken resilience, with ageing infrastructure making it even more challenging.

The findings of this policy brief paper have practical implications for the energy sector of Kosovo, particularly the electricity sector. The insights from this analysis can be useful for policymakers to treat energy shocks (such as sudden plant outages, extreme weather events) as key elements in ensuring the proper functioning of the electricity sector. Designing policies that increase and promote the resilience of the sector must therefore be a key priority, especially given the significant changes the sector has experienced in recent years. Based on the results, in the following, we discuss the implications and propose three main recommendations.

First, we observed that domestic generation capacities remain limited, and all official documents outline the necessity to invest in new capacity generation. The frequent outages of ageing coal power plants, combined with increased consumption, have made the electricity sector increasingly vulnerable. The lack of flexibility in supply options and the high variability of net generation leave Kosovo heavily dependent on imports, particularly during winter periods when demand rises due to heating needs. In recent years, the effects of climate change have started to emerge, exposing an additional layer of vulnerability for the system. Recent heatwaves have increased summer peak demand due to cooling needs, resulting frequently in generation deficits (increased imports) even during periods in which Kosovo typically exports. Further, increased electrification (e.g., electric vehicles) will result in higher demand, requiring additional capacity expansion, further exposing vulnerabilities if no new generation capacity is deployed.

For these reasons, the development of new domestic generation capacities is essential to increase system resilience and security of supply. Policymakers should therefore establish a stable regulatory framework that ensures the rapid and replicable deployment of new projects. The first competitive solar auction was an important step forward; however, no subsequent auction has been organised. Lessons from the previous auction should be used to design future auctions such that they can be replicated. Considering that the Energy Strategy targets 1400 MW of additional capacity by 2031, the gap between ambition and implementation is still significant. Another factor that may delay or hinder the development of new generation capacities is the political disagreement among political parties (e.g., continuous change of plans and priorities). Over the years, several plans have been proposed, yet have not been realised, largely attributed to political divisions. Therefore, reaching a broad political consensus among parties is necessary to protect long-term investments and ensure that energy projects are not exposed to political risk.

Second, Kosovo should increase institutional redundancy and strengthen its ability to respond to shocks by establishing dedicated energy task forces and designing smart, adaptive policies. In recent years, the energy sector has been exposed to significant changes such as high energy market prices, unplanned outages of power plants, and rising temperatures, all of which re-

quire robust and innovative ad-hoc decision-making. The limited availability of technical expertise within institutions, as well as access to independent expertise, further constrains the ability to respond effectively during critical periods. Enhancing institutional capacities and strengthening access to technical expertise would further improve decision-making processes and contribute to increasing the resilience of the sector. While it is evident that intervention measures in the energy sector are limited (e.g., building a power plant takes several years), however, short-term measures can still help the system cope during critical periods. These include targeted energy efficiency aimed at reducing peak demand, as well as setting targets for energy operators to improve system performance. These types of interventions can lower vulnerability while longer-term investments are being developed.

Third, policymakers should develop comprehensive risk-preparedness action plans to anticipate and manage risks against future potential shocks. Policymakers should draw the lessons from recent years (high energy prices or frequent outages) to shift from a reactive to a more proactive planning approach. Preparing against future shocks requires a systematic assessment of potential risks, such as those related to volatile fuel supply and prices, extreme weather events (e.g., heatwaves), outages of generation units, or regional disruptions (e.g., energy deficits). Such assessments would support energy policymakers to plan in advance through concrete action plans, which may serve to design effective policies, and ultimately strengthen both the energy sector and consumer protection.

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22 LAW NO. 06/L-079 ON ENERGY EFFICIENCY

23 LAW NO. 05/L-084 ON THE ENERGY REGULATOR

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