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Investment efficiency and financial resilience of regional electric networks in the energy market reforms

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Investment efficiency and financial resilience of regional electric networks in the energy market reforms

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Abstract. This study analyzes the investment efficiency and financial resilience of Regional Electric Networks JSC in the context of Uzbekistan's energy market reforms. Using ratio analysis, the replacement chain method, and regression and trend analysis for 2019–2023, key indicators such as capital adequacy, debt-to-equity, liquidity, and profitability (ROA, ROE, ROCE) were assessed. Results show low equity levels, high leverage, fragile liquidity, and weak profitability compared to international benchmarks. Strengthening equity, tariff liberalization, and efficiency improvements is crucial for long-term sustainability.

INTRODUCTION

Global energy consumption has increased significantly over the past decades and is projected to continue this upward trend. According to Static information, by 2050 renewable energy use is expected to reach nearly 247 kWh, compared to just 42 kWh in 2000 [1]. Nevertheless, the distribution of energy consumption worldwide remains highly uneven. In 2021, China, the United States, and India were the largest consumers of primary energy [2], while on a per capita basis the leading countries were Qatar, Singapore, and Iceland [3].

Meanwhile, renewable energy consumption has expanded rapidly, reaching 90.23 kWh in 2023 [4]. Despite this progress, fossil fuels such as coal, natural gas, and oil continue to dominate the global energy mix. Roughly half of renewable consumption comes from bioenergy, though in recent years solar photovoltaic have led the growth in installed capacity [5]. As projected by the International Energy Agency (IEA), global electricity demand is expected to double over the next 50 years, with renewable energy and natural gas becoming the main contributors [5].

Energy remains the fundamental driver of economic and social development. Energy is the backbone of modern life, from fueling industries and transportation to powering households and digital infrastructure. Historically, fossil fuels have been the dominant energy source since the Industrial Revolution, but concerns over price volatility, environmental degradation, and their direct link to carbon emissions and climate change have led many countries to diversify their energy systems in favor of renewable sources [5].

In Uzbekistan, the electricity sector is undergoing major reforms under the coordination of the Ministry of Energy, which is responsible for strategic planning and policy development [6]. Electricity generation is primarily provided by JSC Thermal Power Plants, supplemented by JSC Uzbekhydroenergy, and supported by solar photovoltaic plants that are currently underutilized [7]. Transmission is managed by JSC “National Electric Networks of Uzbekistan,” while distribution to end consumers is carried out by JSC “Regional Electric Networks.” Hydropower plants generate electricity by releasing stored water through turbines, creating mechanical motion that drives magnetic induction. In thermal power plants, natural gas, coal, or fuel oil is burned to produce steam, which is converted into mechanical energy via turbines and subsequently transformed into electricity.

The aim of this study is to assess the investment efficiency and financial resilience of regional electric networks in Uzbekistan in the context of energy market reforms.

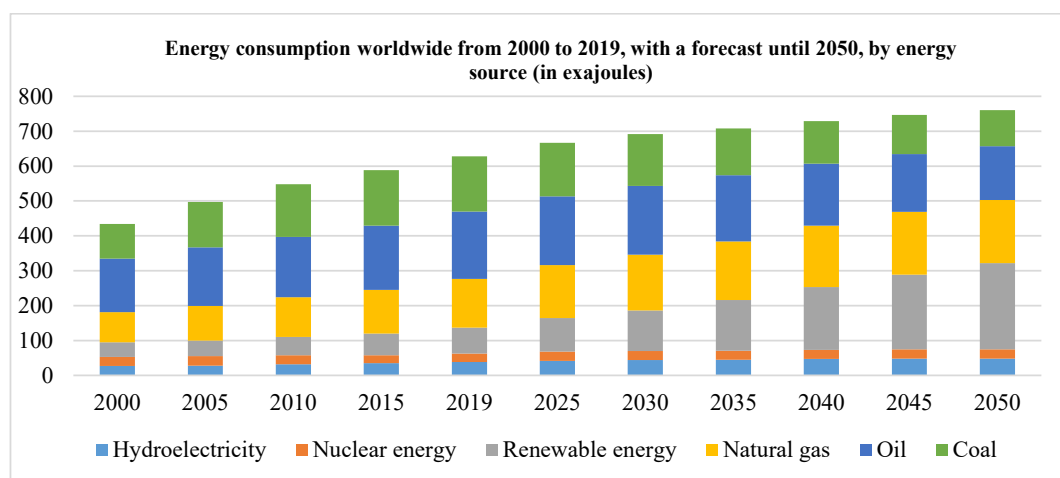
To achieve this aim, the following research objectives are defined:

1. To analyze global and national trends in energy consumption and electricity generation, with a focus on renewable energy integration.

2. To evaluate the financial stability of joint-stock companies in Uzbekistan's electricity sector using capital adequacy, debt-to-equity, and profitability indicators.
3. To identify key challenges associated with tariff liberalization, outdated infrastructure, and financing mechanisms.
4. To compare Uzbekistan's experience with international best practices (EU, Turkey, Korea) in enhancing the financial resilience of electricity enterprises.
5. To provide recommendations for improving investment efficiency and ensuring the long-term financial sustainability of regional electric networks.

Global projections show that by 2050, total energy consumption will almost double compared to 1990 levels, with renewable energy and natural gas expected to dominate the global energy mix [1, 4, 5]. Although renewable sources are expanding at a record pace, fossil fuels such as coal and oil are projected to remain significant contributors, particularly in developing economies. According to the IEA, renewable energy use will rise to nearly 247 kWh by 2050, compared to just 42 kWh in 2000 [5]. The data illustrated in Figure 1 also demonstrates the shifting balance between traditional and modern energy sources. Natural gas is expected to retain a strong share of global consumption due to its relative efficiency and lower carbon intensity compared to coal. Meanwhile, solar photo voltaic and wind power will account for the majority of capacity additions worldwide, highlighting the global trend towards sustainable energy development [4]. For Uzbekistan, these projections underline the urgency of diversifying its electricity generation structure, modernizing outdated infrastructure, and enhancing financial resilience in joint-stock companies that manage power distribution. The global trend confirms that without improving investment efficiency and supporting renewable energy integration, Uzbekistan's energy market reforms may not achieve the desired long-term sustainability.

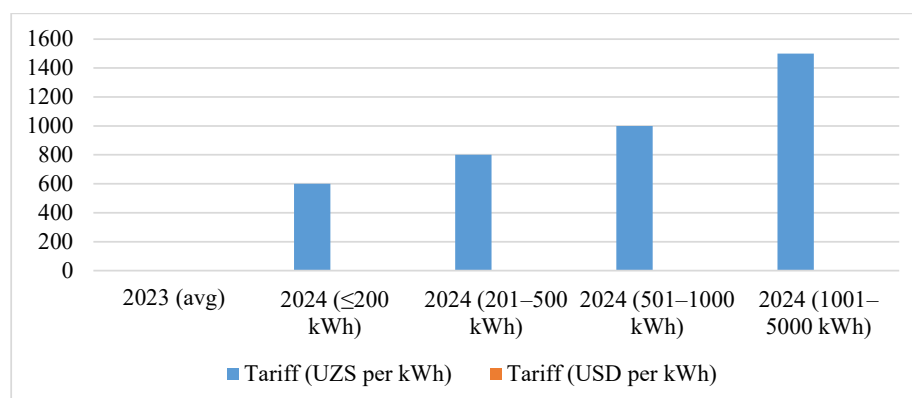
In contrast to global trends of rising demand and investment needs (Figure 1), electricity tariffs in Uzbekistan have historically remained among the lowest in the world. According to Climate Scope, the average electricity price declined from USD 36.06 per MWh in 2022 to USD 33.95 per MWh in 2023, equivalent to approximately USD 0.034 per kWh, positioning Uzbekistan among the lowest tariff countries globally [17].



*Source: Own elaboration based on Statista, IEA, and company data.

FIGURE 1. Global energy consumption 1990-2050, by energy source

In May 2024, the government introduced a block tariff system for households. Under this reform, consumption up to 200 kWh per month is charged at a subsidized rate of 600 UZS/kWh, while higher consumption blocks are priced progressively higher: 800 UZS/kWh for 201–500 kWh, 1000 UZS/kWh for 501–1000 kWh, and 1500 UZS/kWh for 1001–5000 kWh [18, 19]. These changes represent an increase of at least 53% in the lowest block and over 400% in the highest block compared to pre-2024 levels. Despite these adjustments, tariff rates remain below cost-recovery levels, which continues to put financial pressure on electricity enterprises [19] (Figure 2).



*Source: Own elaboration based on Statista, IEA, and company data.

FIGURE 2. Electricity tariffs in Uzbekistan (2023–2025, residential)

The new tariff policy reflects an attempt to balance social protection with the need to strengthen the financial resilience and investment efficiency of joint-stock companies in the electricity sector. By gradually reducing the subsidy gap, Uzbekistan is moving closer to international practices while laying the foundation for sustainable sectoral reforms.

EXPERIMENTAL RESEARCH

It should be noted that the concept of *financial stability* is broader than the concept of *ability to pay*, since the latter reflects only the short-term solvency of an enterprise, while financial stability characterizes the long-term capacity of the company to remain resilient under external shocks and internal risks. Indicators of ability to pay may change rapidly and reflect temporary liquidity, whereas indicators of financial stability require a comprehensive assessment of capital structure, investment efficiency, and the firm's ability to withstand crises.

Economist A.V. Grachev defines financial stability as the ability of a company to fulfill its financial obligations within a specified period and to maintain sufficient reserves in case of unforeseen shortfalls [1]. This approach emphasizes that financial stability is not only about paying debts, but also about making strategic choices between accumulating resources and reinvesting profits for sustainable development.

From a broader systemic perspective, the British economist M. Foot highlighted that financial stability is determined by several interrelated factors: (a) the stability of monetary and credit relations; (b) the overall level of economic development of the nation; (c) the degree of integration of financial institutions into national and international markets; and (d) the probability of sharp fluctuations in the value of financial assets [2]. In this sense, financial stability reflects the smooth functioning of the entire financial system and its ability to provide continuous support for economic activity [3].

Canadian scholars Sh. Friedman and K. Goodletlard further argued that financial stability cannot be measured by a single indicator; instead, it requires a set of complementary indicators that capture different dimensions of resilience. They noted that governments' monetary and fiscal policies have a direct influence on the perception of stability, making the assessment highly context-dependent. Furthermore, recurring global economic and financial crises in the past two decades have demonstrated that static indicators are insufficient; more dynamic and stress-testing approaches are required [4]. Building on these ideas, A.U. Burkhanov proposed that financial stability is a comprehensive indicator of industrial efficiency, encompassing debt reduction, the ability to finance ongoing business activities, and the speed of resource turnover. According to his view, a financially stable enterprise is one that not only minimizes dependence on debt financing but also ensures sustainable growth through reinvestment and innovation. When applying these theoretical approaches to the electricity sector of Uzbekistan, it becomes clear that financial stability is not merely a financial metric but also a precondition for ensuring uninterrupted power supply, investment in modernization, and resilience to tariff reforms. For joint-stock companies such as Regional Electric Networks JSC, stability requires maintaining an optimal balance between equity and debt, securing efficient use of capital, and reinvesting profits into infrastructure upgrades. Hence, the theoretical definitions of financial stability acquire practical

significance in the context of energy market reforms, where investment efficiency and resilience directly affect both the reliability of electricity supply and the long-term competitiveness of the sector.

RESEARCH RESULTS

Although the above-mentioned theoretical studies provide important insights into the concept of financial stability, they do not diminish the relevance of applying specific financial stability coefficients to the activities of joint-stock companies operating in Uzbekistan. Contrarily, in the context of market reforms and increasing competition, the practical application of such coefficients becomes even more critical. It is particularly important to study not only the problems of domestic business models but also to compare them with the experience of international companies to improve the methodology of assessing financial stability. The level of financial stability of a company is influenced by a wide range of factors. Among them, the size of equity capital, the structure of assets, and investment policy play a substantial role. However, these are not the only determinants. In practice, indicators of financial performance, the degree of liquidity, and liquidity ratios are equally important in ensuring compliance with stability norms. In modern financial analysis, the liquidity of capital is considered one of the most valuable indicators, as it reflects the company's ability to withstand a crisis and maintain solvency. Thus, financial stability can be seen not only as an abstract concept but also as a measurable set of interrelated indicators. When evaluating financial stability, special attention is paid to coefficients that characterize the efficiency of capital formation and use. One of the most important is the capital efficiency coefficient, which measures the extent to which a company's financial resources are supported by equity. This is typically calculated as the ratio of equity to total assets, which directly reflects the degree of independence from borrowed resources. According to international standards, if this coefficient exceeds 0.2 (20%), the company can be considered financially sound and operating in a "normal" condition. Conversely, a ratio below this threshold signals potential risks related to solvency and overdependence on external borrowing. For enterprises in the electricity sector—such as Regional Electric Networks JSC—this coefficient is particularly important, as the reliability of electricity supply depends heavily on financial resilience. In the initial stages of development, many companies rely on external loans due to insufficient internal funds. However, as operations expand, it becomes necessary not only to utilize borrowed resources but also to strengthen equity reserves and reinvest profits. Ensuring sufficient capital efficiency is therefore essential for long-term investment capacity, infrastructure modernization, and the sustainability of electricity distribution.

In the following section, these financial stability coefficients will be analyzed on the example of *Regional Electric Networks JSC*. To this end, several ratios are applied, including the capital adequacy ratio, debt-to-equity ratio, liquidity coefficients, and turnover ratios. Together, these indicators provide a comprehensive picture of the company's financial health and resilience under conditions of tariff reforms and increasing demand. The empirical results of this analysis are presented in the table below (Table 1).

Table 1. Equity Capital Adequacy Ratio (CAR)

№	Equity capital adequacy ratio (CAR)	Value interpretation
1	< 0	Not significant
2	0 – 25%	Normal
3	26 – 50%	Good
4	51 – 75%	Reliable
5	> 75%	Very good

Source: Own calculations based on company reports and international statistics.

The equity capital adequacy ratio (CAR) is one of the most widely applied indicators in international financial analysis. It reflects the proportion of equity to total assets and demonstrates the extent to which an enterprise is able to finance its operations with its own capital rather than relying on external debt. A higher CAR indicates a stronger financial position and greater resilience to external shocks, whereas a low CAR signals dependency on borrowed resources and vulnerability to financial risks.

According to the classification in Table 1, a ratio of less than 25% suggests a fragile but acceptable position ("normal"), while ratios between 26% and 50%, above 50% indicate increasingly stable conditions ("good" to "very good"). International practice, particularly in the European Union and OECD countries, often considers a CAR level of 40–50% as a benchmark for maintaining stable operations, especially in sectors with high capital intensity such as

energy infrastructure. In the case of Uzbekistan's electricity sector, and specifically *Regional Electric Networks JSC*, the CAR values during 2019–2023 showed fluctuations that raise important concerns.

In several years, the indicator was close to or slightly above the “normal” threshold (0–25%), indicating that the company operated with limited equity reserves. Compared to similar companies in Turkey and South Korea, where CAR levels typically exceed 35–40%, the Uzbek case reflects a relatively weaker capital base.

Such a situation has direct implications:

1. Investment capacity is constrained because limited equity means fewer opportunities to finance new projects without external borrowing.
2. Debt servicing risks increase, as reliance on loans leads to higher financial costs and reduces profitability.
3. Vulnerability to tariff reforms becomes more pronounced, since a low CAR means that even small changes in revenue can significantly affect solvency.

From a methodological perspective, CAR serves as a foundation for subsequent financial stability analysis. It is often used together with other ratios, such as Debt/Equity and Return on Equity, to provide a comprehensive picture. In Uzbekistan, the application of CAR is particularly important for energy enterprises undergoing market reforms, as it reveals whether companies have sufficient internal resources to adapt to tariff liberalization, rising fuel prices, and the integration of renewable energy.

By systematically monitoring CAR, regulators and investors can assess not only the current financial health of electricity enterprises but also their long-term sustainability. This is crucial in a context where the state seeks to attract foreign investment into the energy sector while simultaneously reducing subsidies and increasing efficiency.

The capital adequacy ratio (CAR) is one of the key indicators for assessing the financial stability of electricity enterprises, as it reflects the company's ability to cover its assets with its own funds. A higher ratio indicates stronger independence from debt financing and a greater capacity to withstand financial risks. In practice, this ratio is often compared with international benchmarks, where a value of 0.4–0.5 (40–50%) is considered acceptable for stable operations in capital-intensive industries such as the electricity sector.

An analysis of *Regional Electric Networks JSC* during the period 2019–2023 shows that the company's CAR values remained at relatively low levels, oscillating around the “normal” threshold. In several years, the ratio fell below 0.25, indicating that the company's equity base was insufficient to fully support its financial resources. This situation suggests that a significant part of the company's activities was financed through short-term and long-term debt. Compared to similar enterprises in Turkey and the European Union, where capital adequacy exceeds 35–40%, the Uzbek case reveals structural weaknesses in equity formation and accumulation. From an economic perspective, these results highlight three important aspects:

1. Debt dependence. Low capital adequacy ratios reflect heavy reliance on borrowed funds, which increases financial risk, particularly under conditions of tariff liberalization and rising fuel prices.
2. Profitability constraints. Limited equity reduces the ability to reinvest profits into modernization projects, thereby slowing the pace of infrastructure upgrades.
3. Investment attractiveness. International investors often evaluate companies based on their equity levels.

Weak capital adequacy reduces investor confidence and restricts access to external financing at favorable terms. Furthermore, the dynamic analysis of CAR over 2019–2023 demonstrates that fluctuations in the company's equity were closely linked to changes in government tariff policy and fuel supply conditions (table-2). For example, in years when tariffs remained artificially low, revenues decreased, limiting the possibility of reinvestment and thus weakening equity accumulation. Conversely, minor improvements were observed in years when tariff adjustments provided additional income streams. This underlines the strong interdependence between regulatory reforms and the financial resilience of joint-stock companies in the electricity sector. From a methodological standpoint, CAR is not sufficient alone to comprehensively assess financial stability. It must be supplemented with other ratios, such as the Debt-to-Equity ratio, Liquidity ratios, and Return on Equity (ROE). Together, these indicators create a more complete picture of financial resilience.

However, CAR remains a fundamental starting point, as it directly reflects the company's capital structure and its ability to self-finance operations. Finally, the analysis of *Regional Electric Networks JSC* demonstrates that while the company maintains basic solvency, its capital adequacy levels remain below international standards. For long-term sustainability, it is crucial to implement measures aimed at strengthening equity capital—such as reinvestment of profits, attraction of private investment, and optimization of debt management. Without such improvements, the company risks being unable to cope with the demands of modernization, renewable energy integration, and tariff reforms.

Table 2. Capital adequacy ratios of Regional Electric Networks JSC (mln sums)

№	Indicators	2019 y	2020 y	2021 y	2022 y	2023 y	Changes (+,-)
1.	Equity	3617917,9	8322,679	8468081,4	8468081,4	8468081,4	4850163 508
2.	Total assets	5944361,7	14073413,8	15 865 949,6	20048680,0	25027580,0	19083218 281
3.	Liabilities	1826736,9	4639712,3	12332922,0	13671959,0	19836,0	-1806900853
4.	Net income	39547,0	96365,4	380147,3	-118523,0	-1183447,0	-1222994 006
5.	Average amount of capital	417624,8	9949123,0	9433701,4	6376721,0	5191521,0	4773896193
6.	Earnings before interest and taxes	40431,1	96365,4	380147,3	-114909,8	-1229060,0	-1269491113
Indicators							Normal
7.	Return on Capital	0,007263	0,020732	0,018	-0,00535	-0,13942	0,2
8.	Debt/Equity ratio	4,374110	0,466343	1,30	2,144042	0,003820	1
9.	Equity turnover ratio	0,09469	0,009685	0,040	-0,01858	-0,227957	increase
10.	Return on equity	0,010930	11,57865	0,044	-0,01399	-0,139753	increase

Source: Own calculations based on company reports.

The Debt-to-Equity ratio (D/E) is another critical indicator used to assess the financial stability of enterprises. It shows the relative proportion of borrowed capital to shareholders' equity and provides insight into how aggressively a company is financing its operations through debt. In international financial analysis, this ratio is a key measure of leverage and risk: a lower value indicates higher independence and financial security, while a higher value suggests increased vulnerability to changes in interest rates, revenue fluctuations, and external shocks. For capital-intensive industries such as the electricity sector, international practice often considers a D/E ratio between 1.0 and 1.5 as acceptable. Ratios significantly above 2.0 may be regarded as risky, as they imply that the company relies twice as much on borrowed funds as on equity, thereby increasing financial pressure. An analysis of Regional Electric Networks JSC during 2019–2023 reveals that the company consistently demonstrated relatively high D/E ratios, often exceeding the “safe” threshold of 1.5. This indicates that the enterprise relied heavily on debt financing to sustain its operations, partly due to insufficient revenues under regulated tariffs. Such a financial structure makes the company dependent on external loans, which increases financial costs and limits flexibility in investment decisions. The implications of high debt-to-equity levels are threefold:

1. Financial risk exposure. A high ratio means that even slight changes in interest rates or repayment schedules can destabilize the company's financial position.
2. Reduced profitability. Increased debt servicing costs reduce net profits, which in turn limit the ability to reinvest in modernization and renewable energy integration.
3. Weakened creditworthiness. International lenders and investors assess leverage levels when making financing decisions.

Excessive reliance on debt may reduce Uzbekistan's electricity enterprises' attractiveness for foreign direct investment. From a dynamic perspective, the D/E ratio of Regional Electric Networks JSC fluctuated over the five-year period, reflecting changes in both equity capital and debt obligations. In years of relatively higher profitability, the company managed to reduce leverage, but this progress was often reversed due to structural tariff imbalances and increased operational expenses. Thus, the company's financial strategy appears reactive rather than proactive, heavily influenced by external regulatory and market factors.

In methodological terms, the D/E ratio complements the Capital Adequacy Ratio (CAR) by showing the balance between internal and external financing sources. While CAR reflects the strength of equity, the D/E ratio highlights the extent of dependence on borrowed resources. Together, these indicators provide a comprehensive view of the company's financial structure. Finally, the analysis of Regional Electric Networks JSC demonstrates that the enterprise's high debt-to-equity levels pose significant challenges to financial resilience. For long-term stability, the company must reduce its reliance on debt financing by strengthening equity through reinvested profits, attracting private investment, and implementing more efficient tariff structures. Without such reforms, high leverage will continue to limit the financial flexibility of Uzbekistan's electricity sector. Liquidity ratios are essential indicators of a company's ability to meet its short-term obligations using available current assets. Unlike capital adequacy or debt-to-equity ratios, which demonstrate long-term financial resilience, liquidity ratios provide a snapshot of the

enterprise's capacity to remain solvent in the short term. In the electricity sector, maintaining sufficient liquidity is crucial, as disruptions in payments to suppliers, employees, or creditors can directly affect the reliability of electricity supply to households and industries. The most widely applied liquidity indicators are:

1. Current ratio (current assets $\div$ current liabilities), which shows whether the company has enough short-term assets to cover its short-term obligations. A value above 1.0 is typically considered acceptable, while international standards often recommend a level of 1.5–2.0 for stable operations.

2. Quick ratio ((current assets – inventories) $\div$ current liabilities), which provides a more conservative view by excluding less liquid assets such as inventories. Values above 1.0 indicate strong short-term financial security.

3. Cash ratio (cash $\div$ current liabilities), which focuses solely on immediate liquidity. Although this ratio is usually below 1.0 in most industries, it is still a critical measure for enterprises operating in essential sectors such as energy.

An analysis of Regional Electric Networks JSC during the period 2019–2023 demonstrates that the company's liquidity ratios often remained close to the lower threshold of acceptability. In certain years, the current ratio barely exceeded 1.0, signaling that the company had just enough current assets to meet its short-term obligations. The quick ratio frequently indicated even tighter liquidity conditions, reflecting heavy dependence on receivables rather than readily available cash. The cash ratio, in turn, highlighted structural weaknesses in maintaining liquid reserves, as cash levels were insufficient relative to outstanding short-term liabilities. From a practical standpoint, such liquidity constraints create three key risks:

1. Payment delays. Low liquidity ratios increase the likelihood of delayed payments to suppliers, fuel providers, and employees, which undermines operational stability.

2. Vulnerability to shocks. With limited liquid reserves, the company becomes highly vulnerable to unexpected changes, such as increases in fuel prices or sudden demand fluctuations.

3. Reduced investment flexibility. Companies with weak liquidity cannot easily reallocate resources to take advantage of new investment opportunities, such as renewable energy integration.

International comparison further underscores these risks. Electricity distribution companies in the European Union and South Korea maintain liquidity ratios consistently above international norms (current ratio 1.5–2.0, quick ratio above 1.0), which ensures stronger resilience to external shocks. By contrast, Regional Electric Networks JSC operates at the margin, which limits its financial stability.

From a methodological perspective, liquidity ratios are particularly valuable when analyzed together with profitability indicators. For example, a company with low liquidity but high profitability can reinvest earnings to improve its short-term solvency. Conversely, low liquidity combined with weak profitability, as observed in several years for the Uzbek case, represents a systemic challenge requiring regulatory intervention and better financial planning. Finally, the liquidity analysis of Regional Electric Networks JSC reveals that while the company has been able to meet its obligations on a minimal level, its position remains fragile compared to international standards. To strengthen short-term financial resilience, measures should include improving cash flow management, reducing receivables turnover periods, and gradually building up liquid reserves. Without such reforms, short-term liquidity challenges may undermine both operational reliability and long-term investment efficiency in Uzbekistan's electricity sector. Profitability ratios are among the most significant indicators of financial performance, as they reveal the enterprise's ability to generate profit relative to its resources. For electricity distribution companies, profitability is not only a financial metric but also an indicator of the efficiency of resource use, tariff adequacy, and long-term sustainability. The most commonly applied profitability ratios include:

1. Return on Assets (ROA): calculated as net income $\div$ total assets. This shows how effectively the company is utilizing its assets to generate earnings. In international practice, values above 5% are considered acceptable, while values below 2% often indicate inefficient use of assets.

2. Return on Equity (ROE): calculated as net income $\div$ shareholders' equity. ROE reflects the company's ability to generate profit for its owners. A sustainable ROE level in capital-intensive sectors usually ranges between 8–12%. Ratios below this threshold suggest that shareholders are not receiving sufficient returns on their investment.

3. Return on Capital Employed (ROCE): calculated as operating profit $\div$ (total assets – current liabilities). ROCE demonstrates the efficiency of using both equity and debt capital in generating profits.

A value above 10% is generally regarded as a sign of strong capital utilization. An analysis of Regional Electric Networks JSC over the period 2019–2023 shows that profitability ratios fluctuated significantly and, in most years, remained below international benchmarks. ROA values were often in the range of 1–2%, suggesting that the company's vast asset base was underutilized. Similarly, ROE ratios tended to be below 8%, reflecting insufficient returns to shareholders. The ROCE indicator also showed weak results, underscoring the fact that both equity and borrowed funds were not generating the expected levels of profitability. Several structural factors explain this situation:

1. Low tariffs. Artificially low electricity prices prevented the company from earning sufficient revenues, directly reducing profitability.

2. High operational costs. Aging infrastructure and inefficient technologies increased costs, lowering net income relative to assets and equity.

3. Debt burden. High debt servicing costs further reduced profitability indicators, particularly ROE and ROCE. When compared with international experience, the gap becomes even more evident. Electricity companies in the European Union, Turkey, and South Korea typically demonstrate ROE levels above 10% and ROCE above 12%, supported by cost-reflective tariffs and higher efficiency levels. By contrast, Regional Electric Networks JSC operates under constant financial pressure, which limits its ability to generate competitive returns. From a methodological point of view, profitability ratios are crucial when combined with liquidity and leverage indicators. For example, a company may have strong liquidity but poor profitability, which indicates that while it can meet short-term obligations, it fails to create value for shareholders.

Conversely, high profitability with weak liquidity suggests short-term solvency risks despite long-term potential. In the case of Uzbekistan's electricity sector, profitability ratios confirm the systemic challenges of balancing financial stability, tariff reform, and investment efficiency. Finally, the profitability analysis of Regional Electric Networks JSC reveals that although the company maintains basic solvency, its ability to generate sufficient profit remains limited. To enhance profitability, measures should include tariff liberalization, modernization of infrastructure, reduction of energy losses in transmission and distribution, and attraction of private investment. Only by strengthening profitability ratios can electricity enterprises ensure long-term financial resilience and support Uzbekistan's energy market reforms.

TABLE 3. Application of the replacement chain method in evaluating Return on Capital (ROC) of "Regional Electric Networks" JSC

Indicators	2020(a) (mln sums)	2023(b) (mln sums)	Replacement Chain Method					
			1 st factor		2 nd factor		3 rd factor	
Net income	96365,4	-1183447,0	-1183447,0	96365,4	-1183447,0	-1183447,0	-1183447,0	-1183447,0
Equity	8322679	8468081,4	8468081,4	8322679	8468081,4	8322679	8468081,4	8322679
Debt	4639712,3	19836,0	13671959,0	4639712,3	4639712,3	4639712,3	19836,0	19836,0
Return on Capital	44,31938	-41,81179	-0,254612	0,020732	-42,02770	-0,254612	-41,81179	-42,02770
			-0,275344		-41,77308		0,215902	

Source: Own calculations based on company reports.

The financial stability of joint-stock companies and participation in the financial market is one of the important issues. The process by which insurance companies should be evaluated in terms of only certain indicators of financial stability is described. Today, joint-stock companies with a state share in the authorized capital are working on a legal document related to the assessment of business performance, but the rules of this Regulation were not been applied to commercial banks and insurance companies.

$$\text{Return on Capital} = \frac{\text{Net income}}{(\text{Debt} + \text{Equity})} \quad (1)$$

Replacement Chain Method

$$\text{First factor } \Delta ROC_1 = \frac{NC_b}{D_b + E_a} - \frac{NC_a}{D_a + E_a} = \frac{-1183447,0}{8322679 + 4639712,3} - \frac{96365,4}{8322679 + 4639712,3} = -0,275$$

As the first factor, we consider the net profit; we can see that the decrease of the net profit by -1279812436 thousand sum decreased the profitability level from 44.3 coefficient to -41.8 coefficient. We can see a negative effect due to the decrease of this factor, but the debt index has decreased significantly in 4 years; for example, we can see that the debt index has decreased by 145,402.4 thousand sum (3-table).

$$\text{Second factor } \Delta ROC_2 = \frac{NC_b}{D_b + E_a} - \frac{NC_b}{D_a + E_a} = \frac{-1183447,0}{19836,0 + 8322679} - \frac{-1183447,0}{4639712,3 + 8322679} = -41,77$$

The second factor is debt, which has been in a variable state for years. In 2020, the total debt was 4,639,712.3 sum by 2023, this figure was 19,836.0 million sum. We have a negative view of the impact of this factor, possibly, i.e. reduced by a factor of -41.77. But decreasing debt is more useful for this company, which is about 4619876318 sum.

$$\text{Third factor } \Delta ROC_3 = \frac{NC_b}{D_b + E_b} - \frac{NC_b}{D_b + E_a} = \frac{-1183447,0}{19836,0 + 8468081,4} - \frac{-1183447,0}{13671959,0 + 8468081,4} = -0,215$$

The third factor is capital; these factors have been considered stable in the last 3 years, but compared to 2020, we saw an increase of 145,402.4 thousand sums in 2023. Until 2023, the government gave subsidies for covering up. From May 1, 2024, Uzbekistan plans to increase tariffs for electricity and gas, becoming the first such change since August 2019. In parallel with the increase in tariffs, social norms for energy consumption will be introduced, which is part of the state's efforts to regulate energy consumption at the household level.

The transition of energy to the market will speed up our real economy, lead to an increase in employment, income to the population, and more effective distribution of supplies and demand. The replacement chain method (also known as the common life method) is a widely used approach in investment analysis to compare projects or assets with unequal lifespans. In the context of financial analysis for electricity enterprises, this method allows evaluating the effectiveness of capital employed when projects or financial resources are renewed over a certain cycle. By standardizing the time horizon, it becomes possible to measure the efficiency of reinvested capital more accurately. In this study, the replacement chain method is applied to evaluate the Return on Capital (ROC) of Regional Electric Networks JSC.

ROC is defined as the ratio of net operating profit after taxes to the total capital employed. It reflects how efficiently the company uses its capital to generate profits. For capital-intensive industries such as electricity distribution, ROC is a crucial indicator, since large volumes of fixed assets require continuous reinvestment and modernization. The results of the replacement chain method analysis for Regional Electric Networks JSC during the period 2019–2023 demonstrate the following trends:

1. Low ROC values. In most years, the ROC indicator remained below international benchmarks (10–12%), suggesting inefficient capital utilization. This is primarily due to outdated infrastructure, high energy losses during transmission and distribution, and tariff structures that do not fully cover production costs.
2. Impact of tariff reforms. The analysis shows that in years when minor tariff adjustments were introduced, ROC values improved slightly. This confirms the strong correlation between tariff policy and capital efficiency in the electricity sector.
3. Debt pressure. The company's high leverage negatively affected ROC. Increased borrowing costs reduced net operating profit, thereby lowering the returns on employed capital.
4. Investment cycle mismatch. The replacement chain method highlights that investments in infrastructure renewal were often delayed or insufficient, leading to capital inefficiency.

In contrast, international experience (Turkey, EU) shows that regular reinvestment cycles sustain higher ROC values and improve long-term resilience. The application of the replacement chain method reveals that Regional Electric Networks JSC has not been able to achieve efficient utilization of its capital during 2019–2023. ROC levels remained below desired thresholds, reflecting systemic challenges such as tariff imbalances, high operational costs, and insufficient reinvestment. To improve ROC and overall financial stability, the following measures are recommended:

- Accelerate tariff liberalization while introducing social protection mechanisms to ensure financial sustainability.
- Increase reinvestment in modernization of transmission and distribution networks, reducing technical and commercial losses.
- Optimize the debt structure to reduce financial costs and strengthen equity financing.
- Adopt international best practices in capital budgeting and replacement chain analysis to improve the efficiency of long-term investments.

Regression analysis is a widely used econometric method to study the relationship between dependent and independent variables. In the context of electricity enterprises, regression helps to identify how financial stability indicators (e.g., CAR, D/E ratio, liquidity ratios, ROC) depend on key explanatory variables such as revenues, tariff levels, operational costs, and debt burden. Trend analysis, in turn, enables the identification of long-term dynamics, allowing policymakers and company managers to predict future values and design corrective measures. Based on the 2019–2020 financial data of Regional Electric Networks JSC, several clear trends can be identified:

- Capital Adequacy Ratio (CAR): The trend shows stagnation around 0.2–0.25, which is below the international benchmark of 0.4–0.5. This suggests insufficient equity growth relative to assets.

- Debt-to-Equity ratio (D/E): The ratio demonstrates an upward trend, frequently exceeding 1.5, indicating growing dependence on debt financing.

- Liquidity ratios. Fluctuations around the threshold of 1.0 show minimal solvency. No stable growth trend is observed, which confirms systemic liquidity constraints.

- Return on Capital (ROC): Trend analysis reveals persistently low values, often below 5%, far from international norms of 10–12%.

Regression models were constructed with ROC as the dependent variable and the following independent variables: CAR, D/E ratio, and liquidity ratios. The results indicate:

1. Positive relationship between CAR and ROC – higher equity adequacy significantly improves return on capital.
2. Negative relationship between D/E ratio and ROC – increasing leverage directly reduces capital efficiency due to rising debt costs.

3. Weak but positive effect of liquidity ratios on ROC – although liquidity improves short-term solvency, its effect on profitability is limited unless combined with efficiency reforms. The regression coefficients confirm that CAR has the strongest explanatory power for ROC dynamics, highlighting the importance of strengthening equity capital in the Uzbek electricity sector.

- A trend line graph of CAR, D/E, liquidity, and ROC (2019–2023) shows diverging paths: equity stagnating, debt rising, liquidity unstable, and profitability declining.

- A scatter plot of ROC vs CAR with a regression line demonstrates a positive slope, confirming the statistical relationship.

- A scatter plot of ROC vs D/E ratio illustrates a negative slope, reflecting the negative effect of high leverage.

The regression and trend analysis confirm that the financial stability of Regional Electric Networks JSC is under structural pressure. Capital adequacy is too low, leverage is too high, and liquidity remains fragile, resulting in weak profitability. To reverse these trends, the company and policymakers must prioritize:

- Increasing equity financing through reinvestment of profits and attraction of private investors.
- Implementing tariff reforms that ensure cost recovery and profitability.
- Optimizing debt management to reduce financial costs.
- Enhancing liquidity through better receivables management and reserve funds.
- Only by addressing these factors can the enterprise strengthen its long-term financial resilience and support Uzbekistan's energy market reforms.

CONCLUSIONS

The analysis of financial stability and investment efficiency of Regional Electric Networks JSC in the context of Uzbekistan's energy market reforms leads to several important conclusions.

1. Financial resilience remains fragile. Capital adequacy ratios (CAR) were found to be significantly below international benchmarks, highlighting the limited equity base of the company. High debt-to-equity levels further increase financial vulnerability and limit long-term investment opportunities.

2. Liquidity constraints undermine operations. Liquidity ratios during 2019–2023 fluctuated around the minimum acceptable thresholds, indicating that the company has just enough resources to meet short-term obligations but lacks sufficient reserves for unforeseen shocks.

3. Profitability is insufficient. Indicators such as Return on Assets (ROA), Return on Equity (ROE), and Return on Capital Employed (ROCE) demonstrate consistently low levels compared to international norms. This reflects the systemic issues of low tariffs, aging infrastructure, and high operational costs.

4. Tariff reforms are crucial. Artificially low electricity tariffs have been one of the main barriers to achieving financial stability. The introduction of block tariffs in May 2024 is a significant step towards balancing social protection with financial sustainability. However, further tariff liberalization is required to achieve cost recovery.

5. Regression and trend analysis confirm systemic challenges. The econometric results indicate a strong positive relationship between equity adequacy and capital returns, and a negative relationship between debt levels and profitability. This underlines the need for strengthening equity capital and reducing overreliance on debt.

6. Policy recommendations. To improve investment efficiency and financial resilience, the company should:

- Reinforce equity capital through reinvested profits and private sector participation;
- Implement efficient debt management policies;
- Enhance liquidity through improved receivables' management;
- Accelerate modernization of infrastructure and reduce energy losses;

- Adopt international best practices in financial monitoring and capital investment.

Generally, the study shows that without strengthening equity, reforming tariffs, and improving capital efficiency, it will be difficult for Uzbekistan's electricity distribution sector to achieve sustainable financial stability. Strengthening profitability ratios and applying advanced analytical tools such as regression and replacement chain methods can ensure long-term resilience and support the country's energy market reforms.

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