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Self-Reinforcing Mechanisms and Energy Policy: The Case of Uzbekistan's Gas Sector

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ABSTRACT

This study examines Uzbekistan's energy policy and the causes of its transition from a gas exporting to a gas importing country. Although Uzbekistan possesses vast natural gas reserves, its production has steadily declined since 2019, and in 2023 country became a net gas importer for the first time in its history. By utilizing process tracing method within a single case study design, we reformulated the casual sequence that induced this outcome. We argued that Uzbekistan's energy crisis is the consequence of a path-dependent process driven by self-reinforcing mechanism. In this context, self-reinforcing sequences, which, although historically increased the source of income, once Uzbekistan as an exporter country, this choice turned the country into a closed path. As a result, the sequence of events culminated in an import crisis by 2023.

INTRODUCTION

In 2021-2022, the global energy market experienced severe disruptions due to post-pandemic recovery and the Russian-Ukraine war. Natural gas prices have reached record highs, resulting in significant disruptions to electricity markets. Climate change and frigid winters are contributing to a significant increase in demand for energy supplies. Another reason for the energy crisis is the failure to address the shortcomings in the efficient infrastructure reserve. Additionally, energy shortages and reliance on external gas supplies have affected even industrialized nations. European states are notable examples of this dynamic, having progressively transitioned from coal to natural gas in pursuit of reduced greenhouse gas emissions and environmental sustainability objectives. The United Kingdom, for instance, has relied almost entirely on gas-fired generation for the past decade, with a substantial share supplied through imports from Russia (Proctor, 2020). However, since 2021, demand for natural gas has increasingly outpaced supply, resulting in shortages (Tsafos, 2021). While recurrent gas deficits are well-documented in Western contexts, similar challenges are emerging across developing Asian economies. Countries such as the Philippines and Vietnam illustrate this trend, as they encounter significant barriers to expanding gas turbine infrastructure and securing reliable energy provision. According to the Institute for Energy Economics and Financial Analysis, the Philippines is unlikely to have any liquefied natural gas (LNG) power plants in operation for the next 10 years due to financing difficulties in its gas-to-electricity projects. This is a sign that the slowdown in natural gas expansion in the region is raising doubts about gas as a reliable fuel. Although shortages in natural gas supply may serve as a catalyst for accelerating the adoption of renewable energy in Asian economies, the financial feasibility of initiating such projects in the near term remains uncertain.

During the ongoing global energy shortages, Central Asian states-including Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan—have not been exposed to its repercussions. These countries, contending with persistent disruptions and intensifying energy demand, have endured recurrent energy crises. The winter of 2022-2023 presented significant issues for the region, and the disruption of gas and electricity has complicated the economies and social lives of these countries. Although these countries are rich in energy resources and are major exporters of hydrocarbons, many of them have suspended gas exports because of the severe energy crisis. The shortage has posed severe threat for Uzbekistan, where domestic demand continues to rise even as the country struggles to balance internal consumption with external export commitments, resulting in energy deficit. Although energy crises have become common issues around the world, examining Uzbekistan's case in the landscape of energy security offers valuable insights. This case underscores the intersection of geopolitical reconfiguration, political economy constraints, and unforeseen drawbacks associated with energy transitions. Such an analysis underscores the broader implications of energy insecurity in shaping both domestic stability and regional dynamics. Uzbekistan is recognized as a major natural gas producer and one of the Central Asia's net exporters. According to World Bank statistics, Uzbekistan exported 581 million tons of gas to China in 2021 (World Bank 2021). However, rising domestic demand and winter shortages have significantly curtailed exports to China, which remains one of Uzbekistan's principal energy

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partners. The contraction in gas exports from Central Asia to China, together with the broader disruption of regional supply flows, has necessitated increased reliance on the global liquefied natural gas (LNG) market. This reallocation of resources has, in turn, diminished energy availability in Europe as competition for LNG intensifies (Akos Losz & Tatiana Mitrova, 2023). Secondly, the country's unstable geopolitical situation, including pressure from Russia, could worsen the energy crisis. As great powers compete for Uzbekistan's abundant gas reserve, this competition has the potential to spark political tensions. Thirdly, the reliable and uninterrupted supply of energy resources such as gas and oil from the Central Asian countries is significant. In this context, increasing energy demand from nations like India, China, and other Asian countries represented the geostrategic significance of Uzbekistan. Considering the energy-seeking of these countries to secure energy demand, Uzbekistan plays a crucial role in supplying energy in the region. (S Khodjaeva, 2021). Notably, the crisis offers clear evidence that risks of poor resource management exist due to an over-reliance on a single resource without planning for demand growth and resource depletion. In this case, Uzbekistan is an example of real-time lessons for over-dependency in a single-fuel economy.

Uzbekistan possesses substantial proven reserves of fossil fuels, primarily in the form of natural gas and coal. Notably, the country's natural gas reserves account for approximately 0.89 percent of global totals, underscoring its significance within the international energy landscape (Advanced Energy Technology). In 2021, the proven gas reserve was estimated at 1.86 trillion cubic meters. Uzbekistan's draft government resolution in 2020 projected that natural gas reserves would increase by about 361 billion cubic meters between 2020 and 2025, reflecting ambitious exploration and development targets set by the State Committee for Geology and Mineral Resources (The Tashkent Times, 2021). According to the Institute of Energy, Uzbekistan's proven natural gas reserves totaled 1.97 trillion cubic meters at the end of 2024. Currently, Uzbekistan ranks 16th globally in gas reserves with 1.84 trillion cubic meters (International Trade Administration, 2025). In 2025, Uzbekistan discovered an immense gas reserve by drilling 6.500 meters deep, as President Shavkat Mirziyoyev announced (Kun.uz, 2025). Additionally, the Uzbek government considers Uzbekistan one of the few countries in the world with sufficient energy reserves to meet its energy needs, and it is described in many publications as rich in natural resources. In 2020, Uzbekistan exported approximately 10 to 15 billion cubic meters of gas to Russia and 4.5 billion cubic meters to Central Asia. At the end of that year, proven natural gas reserves in Uzbekistan were reported to be 1,86 trillion cubic meters (Uzbekistan Energy Information Administration, 2022).

Although Uzbekistan placed 16th globally in terms of huge gas reserves, and the government claims to have sufficient energy resources, the country has faced an energy crisis since 2022. Gas production has been steadily declining since 2019, and the correlation between consumption and production maintained positive surpluses from 2010 to 2019. In fact, the Uzbekistan government implemented an import policy since 2021(because of seasonal demand and temporary gas crisis), but the figures in the table indicate a deficit began from 2023 (-0.85). However, in 2023, gas production volume fell below consumption for the first time, and a deficit began, as consumption reached its peak demand. The main crisis and gas shortage from 2024 production recorded the lowest volume (44.67), and consumption indicated a high level (54.69) with the largest deficit (-10.02) for the first time in its history (Figure 1).

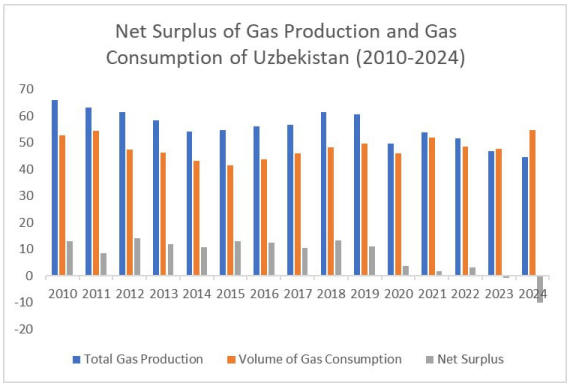


Figure 1: Uzbekistan Gas Production & Gas Consumption Volume

For the first time in history, Uzbekistan has transitioned from a gas-exporting country to a gas-importing country. By 2024, the share of imports had grown to $1.365 billion in January-October, 2.4 times more than in the same month of 2023, when it imported $561.7 million in gas. In October 2023, Uzbekistan began importing gas from Russia and signed a contract to purchase 9 million cubic meters per day, or 2.8 billion cubic meters per year. By 2026, this figure is expected to quadruple to 11 billion cubic meters per year (Kun.uz, 2023). From the above analysis, Uzbekistan, one of the main gas exporting countries in Central Asia, has been steadily increasing its import volume. Historically, despite being a gas exporter and having huge gas reserves, Uzbekistan has started importing gas, this study demonstrates dynamic shifts in energy policy in Uzbekistan.

Based on process tracing method, we draw casual inference of Uzbekistan's energy crisis and try to answer how Uzbekistan turning from gas exporter to importer. In this study, we argue that foreign-investor-led and export-oriented gas development reinforced structural vulnerabilities. In doing so, we use a single case study to examine path formation of energy policy and main drivers which caused to import dependency.

In the next section, we represent a literature review on Uzbekistan's gas crisis consequences and presents the main causes that lead to energy shortages. Then we discuss the role of foreign actors in the gas industry of Uzbekistan and consider how these actors have caused

the gas crisis. Finally, to examine the dynamic shifts of Uzbekistan's energy policy from gas exporter to importer, we draw upon analytic framework of path dependency. Our findings shed light on Uzbekistan's energy crisis is a historical situation caused by a series of decisions and country's reliance on external actors did not provide it with sufficient domestic supply.

LITERATURE REVIEW

After the collapse of the Soviet Union, each Central Asian country developed its own energy policy. Central Asian countries, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, acknowledging that energy resources emerge as dominant global trends in the near future and their leaders anticipated that energy will be pivotal suppliers in the international gas market. Accordingly, each country formulated their national strategies and put own position in the global energy market. In particular, the priority of the Uzbek government's energy policy was self-sufficiency and freedom from import dependence in energy. This is because during the Soviet Union, oil and other energy sources were imported to Uzbekistan by Soviet Russia. In this context, self-sufficiency refers to the ability of the state that to meet energy needs without depending on external sources. Uzbekistan depended on importing energy from Russia. The country focused on developing its domestic energy resources to mitigate the risks associated with potential energy supply interruptions. In doing so, gas production size has increased significantly during 2000-2010s. After this process, Uzbekistan achieved complete self–sufficiency in energy and became a net energy exporter country for the first time in its history (J. Sagdullayev & Bozkho, 2010). In this case, Uzbek government considered self-sufficiency would be achievable by promoting policy which focused on increasing gas extraction. However, enhancing energy efficiency, creating additional and alternative energy sources would be only way to avoid single source dependency and increase export potential that Uzbek government ignored from beginning (Bozkho, 2009). One of the important priorities for the government of Uzbekistan in achieving self-sufficiency and ensuring energy stability is the establishment of state sovereignty in the energy sector. Therefore, Uzbek government sought to preserve both administrative authority and operational control over all strategic sectors and major projects related to the extraction and exportation of natural gas. Nevertheless, this approach led to the postponements of privatization of state-owned companies in the gas industry, thereby stagnation domestic market liberalization and obstruction foreign capital inflows (Bozkho, 2009). The initial focus on high volumes of hydrocarbon extractions over the past decades (2000 and 2010s) was secured by the need to gain macroeconomic stability and prevent significant production drops and social unrest. Despite achieving economic growth and energy independence, the government has succeeded in establishing and maintaining a monopoly on the energy industry. Although self-sufficiency was accomplished, the financial model lacked long-term viability. It implies that, as domestic prices were kept artificially low by government policy, Uzbekneftgas, a state-owned company, was forced to rely on exports for a large portion of its revenue, which was then diverted to support the domestic market. This left energy infrastructure without the capital to reinvest in new production. Furthermore, many scholars state that the post-independence energy and fuel industry is characterized by state's monopoly over energy resources (J.Sultanbaevich & K. Boltaboyevich). The state monopoly in the gas industry was unable to compensate for the shortage of geological exploration equipment, modern drilling platforms, and the necessary equipment for gas production.

Postponement in modernization process, along with the absence of rational strategic orientation in the gas industry have been described as the main factor in the government policy orientation. Notably, structural instability of market institutions caused high domestic consumption and low energy efficiency have been identified as structural deficiencies in Uzbekistan energy policy. Collectively, these shortcomings have hindered the development of a competitive energy economy, limited opportunities for integration into global energy networks, and restricted the flow of foreign capital and technological innovation (S. Abdurasulova). Crucially, the government delayed liberalizing the domestic gas market and improved pricing policy to adequately reflect the total energy costs of each enterprise in the gas system (Rakova, E. & Ferdinand P, 2010).

Such domestic reforms created their own consequences. Firstly, the Uzbek gas sector has remained unattractive to foreign investors, because of having no path-market-based returns (Rakova, E, & Ferdinand P, 2010). Secondly, Uzbekistan's domestic gas market does not meet real market requirements, as the Ministry of Finance and the Ministry of Energy regulate artificially low gas prices. Consequently, the huge difference between export and domestic prices, the government pays attention to expanding its exports (OECD, 2004, Hirschhauser, Christian von, & Engerer). Due to factors such as climatic variability, the structure of industrial production, and the energy inefficiency of much of the infrastructure inherited from the Soviet era, Uzbekistan has maintained a high level of dependence on natural gas (OECD, 2004). Despite the high profits from exports, this country was torn apart by its infrastructure, preserved since the Soviet era, which is one of the factors that led to the gas crisis. Generally, this is a classic case where common for poor and middle-income countries, governments prioritize rent distribution via low prices, as seen in Uzbekistan. Another factor constraining the development of Uzbekistan's energy policy considered fiscal challenges and infrastructure inefficiency. Uzbek gas, due to its high sulfur content, requires advanced technology and complex infrastructure. Pipeline infrastructure

is a critical issue for Uzbekistan, as the country has a clear dependence on this energy transmission method to deliver natural gas to consumers. This reliance is further exacerbated by Uzbekistan's double landlocked geography, which restricts alternative export routes and increases vulnerability to transit restrictions imposed by neighboring countries (Bozkho, 2009). Uzbekistan's energy sector is structurally tied to pipelines, leaving little room for diversification into liquefied natural gas (LNG) or other flexible modes of transport. The country has also been described as geopolitically vulnerable due to its location. With its dual landlocked status, Uzbekistan must rely on at least two transit countries to access its seaports, increasing its dependence on regional neighbors and reducing its bargaining power. Uzbekistan's capacity to expand natural gas exports is confined by high domestic consumption, which means that the government's neglection to diversifying alternative energy sources, and substantial transmission losses stemming from aging pipeline infrastructure. While exports to Russia have gradually increased, Uzbekistan continues to supply natural gas to Kazakhstan, Kyrgyzstan, and Tajikistan. Prospects for further expansion remain modest, with Russia representing the most probable destination for incremental trade flows (Sobit Bagirov). This export orientation underscores Uzbekistan's dependence on traditional pipeline routes and highlights the challenges of achieving broader market diversification in the absence of structural reforms and investment in alternative energy strategies. Gas is the main source of electricity generation, which is characterized by the implementation of a gasification policy in the provision of thermal energy to the population. Despite the high nominal production capacity, actual production is much lower, reflecting the obsolescence and need for extensive repairs of many large plants and power transmission lines (Sobit Bagirov). Persistently low domestic energy prices are expected to generate significant quasi-fiscal activity in Uzbekistan's energy sector. Such artificially suppressed pricing structures create hidden subsidies, distort market signals, and impose hidden financial burdens on state-owned enterprises. Over time, these quasifiscal transactions undermine financial transparency, reduce incentives for efficiency, and constrain the sector's ability to attract foreign investment and modernize infrastructure (S. Bagirov).

Scholarly analyses of Uzbekistan's energy crisis frequently underscore the influence of global and geopolitical dynamics as a central explanatory factor. These external forces, ranging from volatility in international energy markets to regional energy competition and transit dependence, are considered crucial in shaping the structural vulnerabilities of Uzbekistan's energy sector. By explaining the country's problems in this broader geopolitical context, the literature has highlighted that domestic policy constraints are compounded by external pressures, thereby limiting Uzbekistan's energy security and ability to diversify its market.

Following the Russian-Ukrainian war, western scholars observed a Russian pessimistic geostrategic solution to mitigate its energy losses by exporting gas to Central Asian nations. On the other hand, some scholars argue that the conflict forces Central Asian leaders to rethink relations with Moscow. Despite ongoing challenges, high-level diplomatic engagement between Moscow and the Central Asian states has persisted, reflecting the enduring strategic ties that shape regional energy and security relations (Barrios, Ricardo, Blackwood, Maria A, Nelson, Rebecca M, Sutherland, & Michael D, 2023). During 2022, Russian President Vladimir Putin made official visits to each of the Central Asian countries and held more than 50 official meetings with their leaders (Temur Umarov, 2022). Some analysts have interpreted this process as a manifestation of a new geopolitical turn by Russia towards the Central Asian states. Apart from this, some analysts have noted that the participation of all Central Asian presidents in the ceremony held in Moscow on May 9, 2023, commemorating the victory over the Nazis in World War II, is a sign that Russia's influence over the Central Asian states is still ongoing (Chris Rickleton, 2023). In this case, Central Asian countries are trying to balance the intensity of their relations with Russia in the context of controlling domestic political pressure and maintaining an authoritarian system (Luca Anceschi, 2022).

Although the energy deficit in Central Asian countries, particularly Uzbekistan, and the Russia-Ukraine crisis seemed to unfold at the same time, this led to various theories among scholars. Many researchers have evaluated that Uzbekistan's energy crisis and the increase in demand for gas imports are due to changes in Russia's geostrategy towards Central Asia (Mikhail Strokan). Russian researchers stated that the idea of selling gas in the Central Asian market has become an alternative way to avoid Western sanctions for Russia due to the Russia-Ukraine conflict (Mikhail Strokan, Tatiana Mitrova, Anne-Sophie Corbeau, Marcin Popławski & Filip Rudnik).

After losing much of its gas European market, Gazprom needs a new export route, including in Central Asia. Some analysts suggest that Central Asia appears poised to once again serve as a geopolitical arena for great power rivalry—this time marked by strategic competition between Russia and China (H. Brands). Indeed, Russia, not limited to just gas exports, has proposed a political idea of a "trilateral alliance" to Uzbekistan and Kazakhstan. This means that Russia, using the infrastructure in Uzbekistan, will soon be able to export gas to China. In general, both countries have stated that they are willing to trade energy with Russia but are not in favor of creating any "political union". Although the ``Triple Gas Alliance" failed, Russia managed to increase the volume of gas exports and became the main supplier of the Central Asian gas market. While both countries were facing a deficit in energy supply and meeting export obligations to China, it came to the proper time for Russia to offer its gas export strategy (Marcin Popławski & Filip Rudnik, 2023).

Knowing that Russia has been exporting gas to Europe around 480 billion cubic meters and 570 billion cubic meters (M. Fulwood & J. Sharples, 2023) compared to Central Asian countries, Uzbekistan started importing 2 billion cubic meters, it is impossible to cover the Russian loss in the European market.

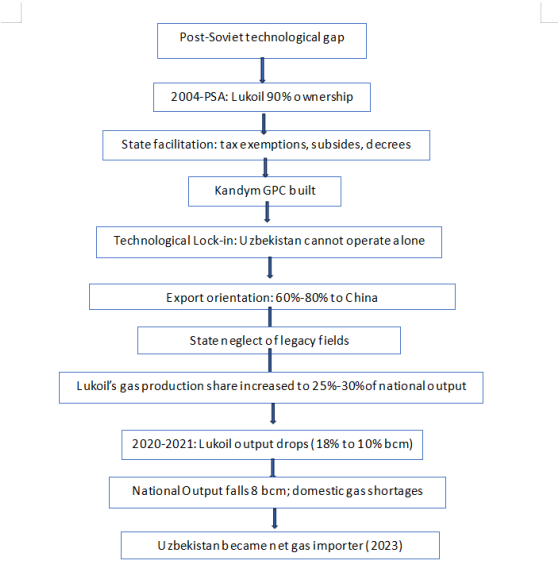
Mikhail Strokan offers another alternative scenario, which explains the reasons for Uzbekistan's gas imports from Russia. An alternative gas pipeline route from Uzbekistan to Afghanistan to Pakistan is possible, passing through the city of Termez in Uzbekistan and then to Kabul. This is considered the Trans-Afghan railway line, which was concluded under a new agreement. This gas pipeline will cover only Uzbekistan and Kazakhstan. This situation will reduce the reliance on Chinese gas exports and the influence of Turkmenistan, which is a competitor for South Asian markets. However, this agreement has not yet been publicly announced. In any case, this gas pipeline could make Uzbekistan an energy hub in Central Asia. It also serves as an alternative route to avoid sanctions by allowing Russian gas to be mixed with Uzbek gas. Apart from geopolitical pressure and did not announce publicly yet, this project faces a major obstacle. The political situation in Afghanistan and its impact on the security of the gas pipeline system put the implementation of this project in doubt. Based on comprehensive review of the scholarly literature reveals that post-independence policy shortcomings, administrative and institutional challenges, fiscal regime constraints, infrastructural inefficiencies, and external geopolitical pressures are identified as core drivers of Uzbekistan's energy crisis. Nevertheless, we highlighted a notable literature gap in the existing research that Uzbekistan's over-dependence on foreign actors caused from gas exporter to importer country.

MATERIALS & METHODS

Case selection

This study is a single-case study of deviant case. Uzbekistan possesses abundant gas reserves yet became a net importer, an outcome that contradicts the expected pattern of resource-rich countries achieving energy self-sufficiency. The deviant nature makes it suitable for explaining casual mechanisms (George & Bennett, 2005). Most resource-rich countries export energy and satisfy domestic demand through exports. Uzbekistan has large reserves, with proven gas reserves of 1.1 trillion cubic meters, but it will become a net gas exporter by 2023. This result contradicts the expected model of resource abundance and energy self-sufficiency. Therefore, the Uzbekistan case is seen as a deviant case that challenges conventional. Even, resource curse theory predicts economic problems, but not physical import dependency. For this study, the supporting documents include the Production Sharing Agreements between the Government of Uzbekistan and Lukoil (amended in 2004, 2016) taken from Lukoil's annual reports and approved by the ADB project documents. Government decisions were taken from the LexUz legal database. Production statistics for 2010-2024 were compiled from Uzbek State Statistics Committes and BP statistical Review of World Energy and Lukoil's Annual Reports. When analyzing projects with the Chinese and Korean governments, information was taken from CNPC and KOGAS press releases, ADB reports, and public information reports. To establish legal and policy framework, PSA, government decrees, laws and contracts is considered as primary documents. For secondary source, I utilize academic articles, reports and industry journals to illustrate context-based explanation, historical background and rival explanation. In order to quantify dependence and outcome, I employ statistical data calculating production level, export and volume.

Process Tracing of Uzbekistan gas dependency



Process tracing is an analytical tool for drawing descriptive and casual inferences from diagnostic evidence and often understood as a part of temporal sequences of events or phenomena (David Collier). It can strengthen casual inference in small N designs by matching and contrasting case designs that are great value, but whose contribution to casual inference is urgently needed withing-case analysis (J.S. Mill 1974 , Przeworski & Teune 1970). Process Tracing considered core method for testing casual mechanism. Within-case analysis in political science often relies on techniques such as process tracing, which are emphasized in leading works on qualitative methodology. This approach involves the systematic use of specific data and evidence to draw causal inferences about an individual case, thereby illuminating the mechanisms that shape political and institutional outcomes. David Collier argues that process tracing is foundational case analysis method for examining diagnostic evidence to find casual inference in the studies and involves temporal sequence and mechanisms for analyzing key tests (Collier's, 2011). Advantageous of process tracing is that capability of both describing political and social phenomena and evaluating

casual chain. By utilizing process tracing method, I will explain casual chain of Uzbekistan's import dependency and evaluate the main outcome of why Uzbekistan is importing gas even though it has rich gas reserve. I observe casual process starting from post-Soviet technological gap and invitation to foreign investors. To evaluate this process, I also use government statements, World Bank reports to check whether lack of national sour-gas processing capacity. Furthermore, Production Sharing Agreements, government decrees, contract terms via Energy Charter, foreign investors annual reports are the main sources examining casual mechanism.

RESULTS & DISCUSSION

LUKOIL as Gatekeeper for Export Security

Since 2000, Uzbekistan has been working to attract foreign investors to its oil and gas industry. The first Production Sharing Agreement (PSA) between Lukoil and Uzbekistan was signed in 2004 to develop the Kandym-Khauzak and Shady gas fields located in the Bukhara and Khiva regions. The PSA was concluded in 2004, and the contract remains valid until 2046, with Lukoil owning 90% of the project and Uzbekneftgas, a state-owned company, owning the remaining 10% (Lukoil Annual Report, 2007). The Kandym-Khauzak-Shady is Lukoil's highest-performing natural gas asset in Uzbekistan, and natural gas was delivered via the Central Asia-Center pipeline which transports gas from the Bukhara production area through Tashkent, Bishkek, and Almaty to the Uzbek border, where all gas is contractually sold to Gazprom, historically. The Kandym project was launched in 2014, targeting the Kuvachi-Alat area, with an annual gas production of 1.5 billion cubic meters, and the northern part of the Shady area, with an annual gas production of 0.7 billion cubic meters (Lukoil Annual Report, 2012). The second PSA-based project is South-West Gissar, which is in the Kashkadaryo Region, in Uzbekistan, and this asset was concluded in 2007, and it is valid till 2043. Below, the map illustrated main gas assets of Lukoil in Uzbekistan.

After signing the PSA agreement with Uzbekneftgas, a state-owned company, on the Kandym-Khauzak-Shadi field complex, LUKoil acquired 90% of the rights, and Uzbekneftegaz acquired the rights to own the remaining 10% of the operating company developing the area. In exchange for Uzbekneftegaz's agreement to increase LUKoil's share from 70% to 90%, LUKoil initially assumed responsibility for all investments amounting to approximately $1 billion. The production share was set at "50% to 80%" taking into account the profitability of the project (Michael P. Barry, 2009). Total gas reserve output in the Bukhara-Khiva regions is estimated at 280 billion cubic meters and 8 million tons of gas condensate. Of these, the largest gas field is the Kandym field, the initial gas reserve of which exceeded 150 billion cubic meters (Lukoil, 2009). The company increased the investment amount for the Khausak-Shady-Kandym project by an additional 500 million, contingent upon the size of the gas field. The investment amount in the project was considered a loan investment, and Lukoil incorporated lending consortiums such as international financial organizations (ADB, KDB, IDB, Crédit Agricole CIB, & UniCredit Group) to the project (Lukoil, 2011). It implies that Lukoil was guaranteed to repay the amount of its investments because a loan investment, as a form of debt, must be repaid by law, regardless of the investment's performance. Additionally, the Uzbekistan government made amendements on tax system to support foreign investors. In particular, by decree of the President of Uzbekistan, a law was signed on amendments to Article 256 of the Tax Code. According to the law, non-resident participants in gas PSAs received exemptions from excise duty in the amount of 25% of the customs value of natural gas for a period of 10 years from the date of signing the PSA. However, during this period, the company Lukoil, which was one of the first foreign investors in gas production, has also benefited from receiving tax incentives. Usually, depending on the relationship between the host country and the foreign investors, tax holidays and incentives are designed to lower operational costs and encourage foreign direct investment flow to the industry, which the government often provides to the investors. Even though Lukoil's investments were mostly defined in the form of loans, the government tried to keep the company in the industry by reducing tax conditions.

The government continued systematic legislative support for foreign companies in the gas and oil sectors. Decree of the President " On measures for attraction of foreign direct investments in exploration and extraction of oil and gas" and several other documents to support this sector. Next government degree for stimulating direct private foreign investments by providing tax incentives, legal protection, and modernizing production. Government implemented "On Additional Measures for Incentives in Attraction of Direct Private Foreign Investments "(DP-3594 No, 11.04.2005). Additionally, "On Order for Application of Customs Privileges to Goods Imported by Foreign Investors in Uzbekistan for Own Productional Needs" (Decree of CM of Ruz No-249, 2007). Based on government decisions adopted in 2020, foreign companies engaged in oil and gas exploration were granted preferential treatment. Specifically, they received exemptions from all forms of taxation during the geological exploration phase, as well as relief from customs duties on imported equipment, materials, technical resources, and services required for exploration and related activities.

After these reforms, foreign investors began to participate in oil and gas production projects. In 2008, Lukoil has owned acquisition 100% in PSA for the Gissar project, and from 2011, the early gas project started with 0.98 bcm gas production, reaching cumulative over 7bcm in 2017(Lukoil Annual Data, 2016). The annual capacity of Gissar is considered 4 billion cubic meters.

Project Name	Timeline	Details	PSA
Kandym-Khauzak-Shady-Phase 1	2004-2007	The PSA was signed 2004 and production began November 2007. In 2008, project reached its initial projected output around 4bcm	Export-driven
South-West Gissar Project	2008-2017 In 2017, main commissioning	Lukoil commenced Gissar project in 2008, and major facilities were officially launched in 2017	Export-driven
Kuvachi-Alat Field (Kandym-Khauzak-Shady PSA-Phase 2	2013-2015	This project is the part of Kandym Eraly gas projcet, located northern part of the Shady filed started in 2013, and production was achieved in 2015.	Export-driven
Kandym Gas Processing Complex	2016-2018	The biggest GPC in Central Asia, capacity is 8.1bcm per year, began at 2016. The first phase was commissioned ahead of schedeled time in 2017	Export-driven
Akkum, Parsankul, Khodshi and West Khodzhi fields	2019-Present	Ongoing procedura, this project is iterative development of exisiting wells, and cumulative production exceeding 134 bcm July, 2024	Export-driven

As shown in the table, historically, Lukoil has dominated in the gas-rich fields and heavily invested in this sector, with favorable PSA terms, which are focused on export. As illustrated in the map, Lukoil controls strategically important upstream assets, the location of these projects at the heart of the Central Asia-China pipeline, allowing the company to export gas easily and inexpensively. Furthermore, long-term investment committees reached a cumulative level of over $10 billion over 20-years, and advanced technology and long-term PSA contracts have laid the foundation for the company's continued gas production.

Gas produced by Lukoil has made a significant contribution to Uzbekistan's total gas production from 2010 to 2024.

Year	Lukoil's gas production (bcm)	Uzbekistan total gas production (bcm)	Lukoil's Share (%)
2010	2.6	65.9	3.9%
2011	2.63	63.0	4.2%
2012	4.25	61.5	6.9%
2013	4.8	58.3	8.2%
2014	4.0	54.1	7.4%
2015	4.71	54.6	8.6%
2016	5.09	56.1	9.1%
2017	8.1	56.6	14.3%
2018	13.4	61.5	21.5%
2019	16.0	60.7	26.4%
2020	18.0	49.7	36.2%
2021	10.0	53.8	18.6%
2022	13.0	51.6	25.2%
2023	13.0	46.7	27.8%
2024	12.0	41.5	28.9%

Source: Uzbekistan statistical committee and Lukoil's annual reports. However, Lukoil's gas production for 2023 and 2024 is not publicly available; the author calculated it based on Lukoil's projects' capacities as the company continued production volume: Kandym GPC 8.1 BCM, Gissar 5.0 BCM, and Khauzak Shady cluster 1.0 BCM, with a total output estimated at 12-13 BCM

From 2010 to 2016, Lukoil's gas production output averaged 3.9%-9.1%. The company's gas production output was incremental relative to the national output, which was controlled by legacy Uzbek fields. However,

the company's strategic pillars have changed dramatically since 2017. Lukoil's share surged from 9.1% to 36.2% by 2020. These indicators are due to the successes of Lukoil's flagship Kandym Gas Processing Complex, which is the only and largest GPC in Central Asia, and the Gissar projects. According to the table, Uzbekistan's national gas production peaked at around 62-65bcm (2010-2012), and has been declining significantly since 2018, falling to 41.5bcm in 2024. Crucially, Lukoil's gas production increased inversely to this national gas output of the period, especially in 2018-2019. It implies that Uzbekistan's gas production depended on Lukoil's gas output, and the company's expansion has directly mitigated the severity of Uzbekistan's overall production decline. Notably, the data shows that fluctuations in Lukoil gas production impacted total national gas production. For instance, a sharp drop in Lukoil's production output to 18bcm in 2020, and 10 bcm in 2021 (because of the pandemic crisis and low demand from China), which contributed to an 8 bcm drop in national gas output to 53.8 bcm. Now, Uzbekistan's gas production level is dependent on Lukoil's operational stability. Practical evidence shows that for almost over 20-years, Uzbek gas volume covered by Lukoil's gas production, and the company secured export commitments from the country.

In order to support the growth of foreign investment in the gas sector, the government continued to expand its strategic relations with foreign investors in the gas sector, in particular with Lukoil. Notably, the Uzbek government signed an amendment with Lukoil on a large gas project in 2016 (Lukoil press center, 2016). According to the documents, the amendment involved several adjustments to the economic indicators of Kandym-Khauzak-Shady-Kungard PSA. Such adjustments created more favorable project implementation conditions for the investor. After this agreement, Lukoil continued the expansion of projects in the country's gas sector. In 2017, Lukoil officially launched new facilities at the Gissar cluster. By commissioning new operational facilities at the South-West Gissar project, the nominal gas capacity of this field was estimated at 4.4 bcm, and the company achieved a gas production level of 5 bcm a year (Lukoil press center, 2017). According to Lukoil's press releases, the company's more than half of total volumes of natural gas, from its international projects, comes from its Uzbek assets. As a result, Lukoil's cumulative gas production in Uzbekistan reached 45 billion cubic meters in 2017. This was due to PSA amendments and several agreements with the government.

On October 19, 2018, Lukoil and Uzbekneftgas, a state-owned company, signed a Memorandum of Understanding (MoU) in Tashkent, and the agreement aimed at expanding strategic cooperation in the oil and gas sector of Uzbekistan (Lukoil press center, 2018). This agreement defines a high level of bilateral cooperation. The signing ceremony was part of the Russia-Uzbek negotiations, attended by Russian Federation President Putin and the Republic of Uzbekistan President Shavkat Mirziyoyev (World Oil, 2018). Key features of the MoU involve expanding geological exploration and assessment of new blocks. Agreements provided for the evaluation of the potential of new investment blocks for future gas exploration and production process.

Following the MoU agreement, Lukoil commenced the Kandym Gas Processing Complex, demonstrating Lukoil's continued investment strategy in the country's infrastructure. Kandym Gas Processing Complex (GPC) is a large-scale project that symbolizes the strategic, yet complex, partnership between the Republic of Uzbekistan and PJSC Lukoil. The new gas processing facility has an annual processing capacity of 8 billion cubic meters of natural gas and is oriented to convert gas from the Kandym fields cluster to marketable gas, stable gas condensate, and commercial sulfur. Development of the Kandym field cluster involved drilling with 77 wells completed, and the establishment of a gas gathering facility (Lukoil press releases, 2018). The Kandym GPC project with Lukoil laid the foundation for the Uzbek government to develop the high-sulfur gas fields in the Kandym group of fields. These types of fields are characterised by being geologically challenging and requiring substantial capital investment for Uzbekneftgas to develop alone. Furthermore, substantial extracted gas from Kandym GPC served as an export enabler by addressing any shortages in gas delivery. By adding more than 8 billion cubic meters of processed, commercial gas per year to the national grid, GPC supplied the target volume needed to accomplish Uzbekistan's prolonged export contract with China without compromising domestic scarcity. It successfully served as the foundation gas supply for the Central Asia-China Pipeline.

Kandym GPC was also considered a strategically important project, so the government supported the project by providing extra preferences and benefits for the successful implementation of the project. According to Resolution of the Cabinet of Ministers of the Republic of Uzbekistan "On the Organization of Construction of External Infrastructure Facilities of the Kandym Gas Processing Plant," the government provides support legally and financially (Resolution of the Cabinet of Ministers of the Republic of Uzbekistan, dated May 17, 2015, No 127). In pursuance of the Decree of the President of Uzbekistan "On additional measures to ensure the timely implementation of the Kndym GPC project" give extra preferences to Lukoil access to infrastructure facilities (Decree No PP-2338, dated April 24, 2015). According to this decree, Lukoil provided easy access to roads and transport infrastructure of the gas processing plant, involving internal plant roads, procurement of the power supply facilities, and railway transport infrastructure of the Kandym GPC. Such opportunities in the degree have provided the company with easy access to state infrastructure. Financially, the Ministry of Economy and the Ministry of Finance, based on investment programs for 2015-2017, provided funds for the design, purchase, and construction of external power supply facilities for

the railway transport infrastructure of Kadym GPC. Also, the framework under PSA related to Kandym fields, Khauzak-Shady fields, and Kungard fields, Lukoil was exempted from customs duties on imported goods until April 1, 2019. Furthermore, Uzbekneftgas and Uzbekenergo were tasked with constructing the intersections of existing gas pipelines and high-voltage power lines at their own expense. It implies that such a project was a strategic necessity for Uzbekistan, which lacked the capital and technology to secure resource sovereignty and future revenue. Thus, the government supported Lukoil both legally and financially. Overall, Lukoil fundamentally covers Uzbekistan's gas production volume, and it secured long-term export agreements.

Other Foreign Stakeholders: Contrasting Roles in Uzbekistan's Gas Dependency

Foreign actors play a crucial role in Uzbekistan's natural gas sector by providing investment, foreign capital, technological capabilities and specialized expertise required maintain production and ensure long-term resource security. In the Uzbek case, although Lukoil remains the key driver of gas production, the engagement of additional external actors has constructed diverse forms of dependency, which are examined in this section. Russia (Gazprom), China (CNPC), and South Korea (KORGAS) are emerging as key influencers, each shaping Uzbekistan's energy trajectory through various channels of financial, technological, and geopolitical ties.

Gazprom: Export Route Controller

Gazprom's role in Uzbekistan energy industry has never been about production. Unlike Lukoil, Gazprom has limited itself to minority holdings, often through partly owned subsidiaries and has mainly invested in small gas fields in western Uzbekistan, which are close to export pipelines to Russia.

Gazprom's Gas Production Share from 2010-2019

Year	Uzbekistan's Total Gas Production (bcm)	Gasprom's Total Gas Production in Uzbekistan (bcm)	Gasprom's Share (%)
2010	65.9585	1.500	2.27%
2011	63.0409	0.280	0.44%
2012	61.5310	0.300	0.49%
2013	58.3054	0.315	0.54%
2014	54.1612	0.1102	0.20%
2015	54.6005	0.350	0.64%
2016	56.1321	0.360	0.64%
2017	56.6422	3.500	6.18%
2018	61.5855	0.360	0.58%
2019	60.7119	0.176	0.29%

Source: Gazprom's Gas Production Share from 2010-2019

Between 2010 and 2019, Gazprom's share of gas production is negligible and has remained consistently below 1%, except in 2010 (2.27%) and 2017 (6.18%). This indicates that Gazprom's gas volume share does not contribute significantly to Uzbekistan's total gas production. The company's core role is as a transit operator on the Central Asia-Center pipeline, with a marketing strategy focused on purchasing gas via pipeline. Unlike Lukoil, which continuously contributes around 28%-36% of Uzbekistan's gas production via PSA contracts, Gazprom's gas strategy shows sustained minimal production volume while controlling pipeline infrastructure and marketing leverage. Gazprom's coercive strategy has evolved over the years. The first official cooperation between Uzbekistan and the Gazprom Group began in December 2002, and it was the Agreement on Strategic Cooperation in the gas industry. This agreement demonstrated long-term purchases of Uzbek gas from 2003 to 2012, the involvement of Gazprom in gas production projects under the Production Sharing Agreement, and a partnership for the development of gas transport infrastructure (Gazprom, 2002). According to the agreement, gas export from Uzbekistan to Russia was around 8.2 billion cubic meters from 2005, and it reached over 10 billion cubic meters by 2010 (Gazprom Annual report, 2005). Through a long-term agreement (2003-2012), Gazprom bought Uzbek gas at discounted prices (42$-100 per thousand cubic meters, compared global prices above 200$) (Murat Lamulin, 2006). This discriminatory pricing starved Uzbekneftgas of reinvestment capital, contributing to the neglect of legacy fields. Initially, in 2005, Gazprom developed a plan for the phased implementation of a project to develop oil and gas fields in the Ustyurt region of Uzbekistan, where gas reserves are estimated at 120 billion cubic meters. As a result of this work, a Production Sharing Agreement and two geological exploration agreements were signed in January 2006. The development of the fields in the Ustyurt region was based on the goal of increasing Uzbekistan's export potential by 8-9 billion cubic meters in 2010-2020. In 2006, Product Sharing Agreements were signed for the Urga, Kuanish and Akchalak fields located in the Ustyurt region and an Agreement on the Principle of Geological Exploration in

the Ustyurt region, and Gazprom invested $400 million (Gazprom Annual Report, 2006 and 2007). Next, on June 22, 2009, the Djel gas-condensate field was found during geological exploration in the Shakhpakhtinsky block of the Ustyurt Plateau. In 2018, the Ministry of Energy of Uzbekistan and Gazprom International Limited signed a Production Sharing Agreement for the Djel field (Gazprom International Limited, 2025). According to Gazprom International, annual gas production at the Djel field was 150 million cubic meters over 2021-2024 and is expected to increase by 300 million cubic meters by 2025. The field's total reserves are 6.4 billion cubic meters of gas and 76,000 tons of gas condensate (Gazprom Annual Report, 2009, & Trend, 2019). Between 2010 and 2017, Gazprom did not sign any long-term contracts, but rather limited gas purchases, which led to a large investment deficit. This means that the small profits received from Gazprom do not cover the costs of exploring and developing massive gas fields. Gazprom's strategy is described as a multifaceted form of forced neglect, which puts the Uzbek government in a difficult investment position due to the lack of funds to develop outdated fields and search for new gas fields to compensate for the gas shortage. Gazprom's unpredictable low gas purchases have deprived the government of the funds needed to finance mega-projects. In addition, the late start of the Dzel gas field, which has 6.4 billion cubic meters of reserves, was 9 years after its discovery.

Gazprom has been limited by the excuses that the geological and gas composition of the project is complex, and the long study time has delayed investment and the commissioning of the gas field. Although the agreement was signed, the terms of the PSA were not disclosed and remained full of uncertainties. The signing of the new PSA agreement did not change Gazprom's strategy in the Uzbek gas industry, and the company reduced gas purchases and restricted itself to many projects and investment activities. According to some experts, this meant Gazprom's exit from the Uzbek gas market. However, Gazprom preferred a passive strategy rather than completely exiting the Uzbek gas market: purchasing less gas and making low-cost investments. Notably, in 2016, Gazprom purchased 6.2 billion cubic meters of gas, and this figure decreased to 5 billion cubic meters in 2017. According to a report by RIA Novosti, the total value of the five-year contract for the supply of 4 billion cubic meters of gas starting in 2018 is $ 2.5 billion. This is significantly lower than the expected volume of gas purchases, and the payment for gas delivery is only $ 125 per 1,000 cubic meters (EurasiaNet, 2017). Thus, the relationship with Gazprom has not been defined as having any economic significance for gas production. In contrast, gas-related agreements and investments with Gazprom have served to keep the company in the Uzbek gas industry, as Gazprom has neither made major investments nor purchased large volumes of gas from Uzbekistan. Consequently, Gazprom's long-standing passive engagement in the Uzbekistan gas sectors come with its own costs; a discriminatory pricing policy leads lack of reinvestment. As a result, Uzbekneftgas was inadequate to fund the import of advanced technology to boost its gas fields and could not afford to explore new gas reserves.

CNPC (China): Export Infrastructure and Financial Dependency

China's entry into Uzbekistan's gas sector began with the Central Asia-China gas pipeline (operating since 2009), which allowed Uzbekistan to diversify away from Russia (CNPC). CNPC signed a contract to supply 10 bln cubic meters of gas per year and invested in upstream projects such as the expansion of the Samandepe field (2018) and Karakul block (Silk Road News, 2017). The project was financed out of the Chinese loans under the guarantee of CNPC. The Uzbek government is encouraging Chinese investment, and the $377.5million capital has entered Uzbekistan's energy sector. This project created jobs and increased state revenues through the sale of gas and condensate. However, these benefits lead to significant long-term strategic risks. Since Uzbek gas companies lack the expertise and advanced technologies to develop gas fields in a complex manner, it is possible to leverage modern drilling, production and logistics capabilities through cooperation with Chinese giants such as CPECC and CNPC. It is worth noting that, while Chinese investment is flourishing, the Uzbek government must also consider financial risk and resource dependence. As mentioned above, the project is financed by Chinese bank loans under the guarantee of CNPC, which will increase Uzbekistan's sovereign debt to China. There is a possibility that a decrease in gas prices or lower-than-expected gas production could lead to bilateral disagreements or make it difficult Uzbek government to repay these loans. The next strategic turning point in Uzbekistan's energy agreements with China was the project to build an underground gas field. This agreement will increase the country's domestic capital by attracting large amounts of Chinese investment and technology. The Ministry of Energy has signed an agreement with China National Petroleum Corporation to construct an underground gas storage facility in the Koson district of the Kashkadaryo region. The facility is based on the Karabayr field. During the exploration period, a suitable location for 12 horizontal UGSs was found in the Karabayr field, and the storage capacity is around 1.5 billion cubic meters of active natural gas (Kun.uz, 2025). This project represents a significant and strategic development in the energy landscape of Uzbekistan. The partnership with CNPC is not a discrete event, but rather a continuation of a deep-rooted energy partnership. The project states that the 1.5 billion cubic meters of active gas potential represent a huge strategic reserve. Although project negotiations are still ongoing, due to high capital intensity, financing requires large amounts of capital. Whether this is a direct loan from China or a direct investment, there is a risk of increasing Uzbekistan's financial dependence on China. If

the project is funded by a Chinese loan that compensates future gas sales, it could lead to contractual obligations to arrange gas production to export to yield profits. Notably, this project is not only bilateral between companies, but also linked to Uzbekistan President Mirziyoye's talks with CNPC on modernizing the gas transmission system and implementing advanced drilling gas technologies. Although the project is highly valued, it is not capable of compensating for gas supply disruptions. Underground gas field projects do not increase the total gas supply, and these fields do not produce new gas. Since the annual production of gas fields in Uzbekistan is decreasing, and its annual consumption is less than the annual demand, the project cannot eliminate the main shortage. The main purpose of the project is to prevent gas shortages in the winter, and this will eliminate the mismatch between stable gas production and peak demand that occurs in winter. However, while it is important to prevent winter gas crises, it cannot provide an additional increase in the total annual gas supply. Therefore, it is not a solution to the main gas supply shortage that exists throughout the year.

Most Chinese projects in the gas sector of Uzbekistan are financed with loans and contractors rather than foreign direct investment. As a consumer, China has reshaped its geo-economic role in the gas industry in Uzbekistan, which may shift regional power relations (L, Lombardozzi, L Calabrese, & R, Jenking, 2024). It was found that during the analysis of China-Uzbekistan gas projects, which are most of the projects aimed at increasing gas production, China is focused on export, and none of the agreements with the Uzbek government are aimed at increasing domestic consumption, or at exploring new gas fields, or at upgrading the old infrastructure in them.

Overall, Uzbekistan does not disclose the annual volume of gas production of the Chinese company; it created barriers to calculating Chinese involvement in the gas industry. There is no direct link Uzbek gas crisis, although China imports gas from Uzbekistan, it does not import a huge volume like Turkmenistan. Like other small players, China's involvement does not define great influence, such as Gazprom and Lukoil.

South Korea and Uzbekistan Relations in Gas Production

Another major player in the Uzbek gas sector is Korea. South Korean involvement in Uzbekistan's gas industry characterized as third model of foreign intervention, distinctive from Russian hegemonic position and Chinese infrastructural debt frameworks. KOGAS is considered the main Korean company which is participating in the gas sector in Uzbekistan, illustrated as a technological partner, providing advanced technology and processing techniques to enhanced petrochemical facilities. Instead of improving gas extraction capabilities, Korean actors focused on converting high-value polymer into the international market. The purpose of examining the Korean case is crucial in three ways. Initially, Uzbekistan pursued a policy of attracting technology-based investments in the gas industry, which contributed to the growth of the economy. Secondly, the involvement of Korean actors presented different mechanisms. While Lukoil begins with interaction gas extraction and production directly, Korean projects involve removing gas and converting it to solids. Thirdly, the Korean case reveals the financial vulnerability, particularly debt issues that are analyzed during case studies. Although the Korean case represents significant impacts, it does not explain the production collapse that forces Uzbekistan to become a gas importer. Since 2005, strategic relations have been established between South Korea and Uzbekistan. As a result, several projects in the gas and chemical sectors have been implemented between the two countries. One of the largest projects implemented by South Korea in the gas and chemical sector is the Surgil project. The Surgil project was established in 2006 by a Korean consortium comprising Lotte Chemical and Korea Gas Corporation. The consortium founded a joint venture between Uz-Kor Gas Chemical and the Uzbekistan state-run company, Uzbekneftgas (The Korean Times, 2017). The Surgil project was mainly financed by debt and equity, as well as private state-owned investors from the Republic of Korea (ADB, 2021). The source of gas came from its own Surgil field, about 3.0 billion cubic meters, and from East Berdakh and North Berdakh fields around 1.5billion cubic meters of Uzbekneftgas. The project involved upstream development and operations at the Surgil field to supply up to 3 billion cubic meters per annum of gas and 115 kilotons per annum of condensate: downstream operations at Ustyurt Gas Chemical Complex, 115 km southwest of the Surgil field, including gas and condensate separation units and polymer plants (ADB annual report, 2021). According to the contract, there is an offtake agreement for the project, which includes offtake contracts for its gas and polymer products. UzTransGas, the branch of a state-owned company Uzbekneftgas, is the main buyer of Surgil processed and unprocessed gas until 2041, and the gas is delivered to the national gas pipeline. The polymer off-takers go to the sponsors. The offtake agreements were carried out with Lotte, Samsung (Samsung C&T purchased the offtake agreements from KOGAS), and Uzbekneftgas, covering a 15-year contract term. It implies that the profitable polyethylene and polypropylene products were sold internationally by a consortium of Korean companies, including Lotte and Samsung C&T, to repay the debt incurred in the project, which provided a revenue stream, while Uzbekistan had a financially difficult fuel component, emphasizing the asymmetry of the benefits. Generally, the scheme was intended for the re-exportation of the gas to Russia, which is under a gas purchase agreement between Uzbekistan and Gazprom. However, Russian demand for gas declined, and Uztransgas had to sell domestically at a regulated price. As a result of the Uzbek government's local currency liberalization in 2017, the Uzbek sum depreciated by 50% against the US dollar in a

day. Consequently, Uzstransgas suffered significant losses when reselling Uz-Kor gas on the local market, as tariffs for Uzbek customers were not indexed to the US dollar. The result of price fluctuations, the Uzbek government suffered significant losses and was unable to pay UzKor the full price specified in the contract. This led to an accumulation of overdue receivables since 2017 (ADB, 2021). On September 7, 2025, the Korean government reported that South Korean companies were ready to receive $1 billion from Surgil project, which had not been paid since 2017, as the two governments had agreed on a payment plan. The agreement was signed in Tashkent by the prime ministers of the two governments. However, full details of the payment plan were not disclosed. In short, the gas from the Surgil field has been converted into polymer and is physically impossible to export to the domestic market. The Surgil project, despite its scale, has contributed to the difficulties in Uzbekistan's energy sector. It is an example of an investment project that did not offer a mechanism to support domestic supply during a period of worsening gas crisis, which has created significant financial constraints due to the constant diversion of large amounts of gas reserves into industrial processes.

The following project between Uzbekistan and Korea is the Aral Sea Project, defined as an international consortium. This project was established by KNOC, Uzbekneftgas, Lukoil (Russia), Petronas (Malaysia) and CNPC (China) in 2006. The project aimed at to conduct geological exploration in the Uzbek sector of the Aral Sea based on a Production Sharing Agreement. However, in 2011 Malaysia's Petronas withdrew from the project, and in 2013, KNOC notified Uzbekneftgas about withdrawing from the Aral Sea project. The main reasons the Korean Company's withdrawal was not announced. The production sharing agreement was signed in August 2006 for a period of 35 years, and the total amount of investment in the project was $110 million (OANA, 2013).

The next Korean company's project in the gas industry of Uzbekistan was Uzunkui Project. This project was related to the development of the Surgil gas field and Ustuyrt gas chemical complex project, although the Uzunkui project itself specifically refers to joint exploration in the Uzunkui Tuarkyr block (KOGAS, 2012). The initial scope of the project was to conduct scientific research in the Uzunkui-Tuarkyr investment block. The project was initiated around 2006-2009. Korean companies, especially KOGAS, are among the world's leading companies in LNG technology, gas field management and digitalization. For Uzbekistan, joint Korean cooperation is very important in developing gas fields with a high sulfur content and requiring complex technology, and to increase gas production. An important point is that, unlike Chinese or Russian companies, Korean companies do not have pipeline projects aimed at gas export. The projects are mainly related to downstream (gas-chemical products), particularly the Surgil gas field, which is one of the largest projects, and is not based on gas extraction, but on the production of high-value polyethylene and polypropylene, which is based on plastic manufacturing. Mainly, Korean companies in energy implemented advanced gas processing and petrochemical technologies in Uzbekistan. Uzbekistan strategically positions its partnership with Korea as a supplier of advanced technology, a source of high-tech and quality. South Korea and Uzbekistan are building on a long history of cooperation, and instead of focusing on raw material extraction, key projects are using Uzbek resources to produce valuable finished products for export in line with the state's economic goals (T.Dadaboyev & N.Djalilova, 2020).

Foreign players other than Lukoil do not have the same level of expertise in gas production and geological exploration. Players such as Korea and China are mainly cooperating in technological terms.

Analytic Framework: Path Dependency

To examine the dynamic shifts of Uzbekistan's energy policy from gas exporter to importer, we draw upon analytic framework of path dependency. Path dependency theory describes provides a reliable lens for analyzing why historical decisions limit future policy options and often lead to suboptimal outcomes (Paul Pierson,1997). In this study, we apply approach of a self-reinforcing sequences to argument how Uzbekistan turned from gas exporter to importer. In this context, we use self-reinforcing sequences that make a chosen path increasingly difficult to exit. Path dependence is a such condition that early decisions made by policymakers create ``self-reinforcing `` mechanisms that gradually narrow future choices to those that are connected with the original trajectory. In this context, Paul Pierson's (2000) framework of maximizing returns is at the heart of this logic. It implies that the benefits of a particular activity accumulate with each successive step, as the marginal costs of deviation increase, actors have a rational incentive to stay on the set path. Over time, this dynamic creates lock-in, in which the costs of switching become very high. Mechanisms such as diminishing investment opportunities, learning effects, coordination effects, and flexible expectations further reinforce the chosen path, making continuation the only viable option despite the availability of more efficient alternatives. We argue that although Uzbekistan has gas reserves and the potential to increase competition by attracting other foreign investors to upstream fields, the decision to rely on a single foreign investment and technology (decisions made in path) leads to import dependence.

Conceptual debate of Path dependence

By defining path dependence, many historical sociologists use broad conceptualization that involves the arguments about past events impact future events (Mahoney, 2000). Terry Karl describes his arguments as path-dependent in her research on oil-producing nations, shows that the

impact of decisions made in the past persist into the present and shape alternatives for the future (Karl).

Generally, the concept of path dependence is commonly used to support several key claims. Firstly, specific patterns of timing and sequences of events is crucial, and a wide range of social outcomes are often possible. In this case, a relatively small and random events that can have major consequences (Mahoney, 2000). Secondly, certain policy directions, once initiated, become very difficult to reverse, even if their long-term consequences turn out to be harmful (Krasner, 1989, Collier, Collier,1991, & Ikenberry,1994). This path-dependent dynamic highlights how political development is linked to critical junctures which moments of decisive choice that establish stable institutional structures and shape the broader contours of social and economic life. Such turning points demonstrate the long-term impact of early decisions, reinforcing the understanding that historical legacies and structural constraints continue to shape contemporary governance outcomes. Paul Pierson states that studies of technological shifts have revealed some of the factors that increase path dependence. According to Brian Arthur and Paul David have founded that the strong dependence of single technology can lead advantages over its competitors, even if it is not the most efficient in the long run (Arthur 1994 & David 1985). If a new technology generates economic growth and raises income levels, it creates strong incentives for states or actors to concentrate on a single alternative and to persist along a particular developmental trajectory (Paul Pierson, 2000). This path-dependent process implies that as incomes grow, dependence on the actors or institutions responsible for generating those incomes increases, thereby reinforcing structural dependency and limiting opportunities for diversification. Such dynamics illustrate how technological innovation can lock economies into specific patterns of growth, with long-term consequences for governance, resource allocation, and external vulnerability.

Self -reinforcing is a such approach examines sequences. In this sequences, initial steps in a given direction leads to further action in that direction, so that over time it becomes difficult or impossible to change direction (Mahoney). According to economics, self-reinforcing sequences with the phrase " increasing returns", which states that the probability of further steps along a given path increase with each action until an equilibrium point is reached (Pierson, Arthur and David). While economists often emphasize outcomes such as technological progress or industrial location, many institutional analysts argue that the processes underlying income growth are closely linked to the maintenance of broad social and political institutions (Haydu, Stephen D, Krasner, Pierson, Walter W, Powell & Paul J). Despite disciplinary differences, from an institutional perspective, "institutions" are generally understood as permanent structures that cannot be changed instantly or easily (Robert R. & R Friendland). This inherent stability makes institutions a particularly valuable object of study for scholars studying self-reinforcing sequences, as they provide the framework for the development of path-dependent dynamics and the shaping of long-term developmental trajectories.

Applying path-dependence theory to Uzbekistan: How Self-Reinforcing Sequences Led to Gas Import Dependency.

The evolution of Uzbekistan energy transformation from a gas-exporting country into a net gas importer can be conceptualized as a step-by-step path dependent trajectory. This transformation was determined through series of policy decisions and institutional commitments that gradually strengthened the country's reliance on a single external actor. In this case, direct infrastructure subsidies are considered classic example of path dependence and self-reinforcing approach in which discussed widely through wide range of literature and scholars. Sebastian Pearson argues that government subsidies and infrastructure investments create policy feedback loops that reinforce existing energy pathways. Subsidies engage stakeholders and reduce costs, making deviations from the established path politically and economically costly (Sebastian Pearson, 2023). It implies that past decisions in energy technologies, infrastructure, attracting foreign investments, and policies create self-reinforcing cycle which makes it difficult and makes obstacles to avoid from current trajectory. Furthermore, this position is not only technological inertia, but also complex correlation of economic, social institutional, and political factors that align with existing energy system, establish their dominance and hinder the transition to new paradigms (Sustainability Directory, 2025). While infrastructure investment advocate development, it also leads to cost pressure and institutional dependencies. These capital-intensive investments frequently generate path dependency, by entrenching specific energy or transport architectures and limiting long-term strategic flexibility (Foster, 2023). In the Uzbekistan case, the government builts roads, power lines and railway for Lukoil at its own expense, which led to a sharp increase in costs, making it difficult to change direction (Decree No 127, 2015, and Decree No. PP-2338). Second historical sequences seen as tax incentives (Article 256 Tax Code) and customs privileges (Decree No, 249, 2007), these historical events that creates to huge advantage over any potential alternative operator and reduce state's revenue from the project. In return, Lukoil increased its investment capacity by launching Kandym Gas Processing Complex (GPC), the only facility in Central Asia which is able to processing high-sulfur gas. This created technological lock-in that Uzbekistan can not manage independently this complex.

Next, in 2016, despite clear indications of domestic shortages, the Uzbekistan government amended the Production Sharing Agreement in a way that would further benefit Lukoil, rather that recalibrating the balance of interests. Simultaneously, Lukoil's gas output was as export-oriented in which by 2018, the company's gas output level in its Uzbek projects reached 60-70%,

after that it peaked 80%, was described `` cost-gas``, all the gas oriented to export China (Turan.az, 2018). The Kandim GPC was clearly defined as an "export enabler" for the Central Asia-China pipeline. Domestic supply became available only after export contracts were fulfilled. Government's such path-decision reinforced the existing trajectory and demonstrated path-dependent behavior. This PSA amendments represent historical decision-making time that created critical juncture in which the Uzbek government doubled down on existing agreements instead of diversifying. Paul Pierson argues that political process often ``increasing returns", in which the benefit of staying on a particular path grow over time, while cost of switching are very high. This ``positive feedback`` cycle makes early events more significant than later ones, which is leading to path institutional and infrastructure `` lock-in``. (Paul Pierson, 2000).

Self-reinforcing sequences is a one of the prime drivers of path dependency. In Uzbekistan's case, sunk cost, learning effects, coordination effects and adaptive expectations. Mutual investment by Uzbek government and Lukoil in infrastructure, such as pipelines, roads and the Kandym GPC act as a capital sunk and create high-risk environment of path-dependency. This shared financial commitment effectively ``lock in`` the partnership, as the prohibitive costs of exit provide incentives to continue rather than abandon partnership. Secondly, state-owned company of Uzbekneftgas's technical and management capacity has been depleted as it has handed over operational control to Lukoil. Company's employees have learned to be junior partners, not to manage sour-gas independently. Furthermore, due to the learning effects associated with technological development, the more experience a company has with a technology, the more opportunities it has to learn new problems and obstacles (Arrow, 1962 & Grand).

Thirdly, the effects of coordination were clearly visible in the contractual relationship of Lukoil gas to the Central Asia-China pipeline. Since export flows were locked into long-term contracts with Chinese and Russian partners, alternative buyers or routes could not be activated without complex renegotiations. Therefore, despite the increase in domestic demand for gas, the Uzbek government has limited options to renegotiate contracts with Lukoil or completely stop exports to China. This institutional rigidity reinforced Uzbekistan's dependence on a single export route. It implies that as more participants unite around a single system, it becomes more difficult to deviate, as coordination costs increase. The Uzbekistan case illustrates that Lukoil gas was contractually tied to the Central Asia-China pipeline. Because Lukoil's high-yield gas projects are located on the pipeline route to China, which is convenient and oriented for gas exports. Several agreements with Chinese and Russian partners have tied Uzbekistan to a single export route, which has made finding alternative buyers or routes very difficult. Therefore, despite the entry of other alternative foreign investors, most of them are limited in their position in the gas industry compared to Lukoil. Lastly, adaptive expectations further strengthened the trajectory. The Uzbek government assumed that Lukoil would continue to provide a stable production base. Because the scale of Lukoil's investments and the technological capabilities they brought in had significantly increased gas production. However, this was not strategically sound. Nevertheless, the PSA amendments of 2016 took place, and as a result, Uzbekistan's dependence on foreign actors increased.

Uzbekistan's energy crisis is a historical situation caused by a series of decisions. Self-reinforcing sequences, which, although historically increased the source of income, once Uzbekistan as an exporter country, this choice turned the country into a closed path. As a result, the sequence of events culminated in an import crisis by 2023. We argue that at that time Uzbekistan's reliance on external actors did not provide it with sufficient domestic supply.

CONCLUSION

Uzbekistan's transformation from a gas exporter to a net gas importer is not result of resource depletion, but a political-economic of a path-dependence process. The 2004 Production Sharing Agreement (PSA) with Lukoil marked a significant turning point, as it gave the company ownership of 90 percent of Uzbekistan's largest gas fields. This arrangement entrenched a dependent relationship through self-reinforcing mechanisms such as sunk costs, learning effects, coordination effects, and adaptive expectations. By 2020, Lukoil accounted for 36 percent of national gas output. When production fluctuated between 2020 and 2021, Uzbekistan lacked sufficient domestic capacity to offset the decline, culminating in the 2023 import crisis. Although other foreign actors—including Gazprom, CNPC, and South Korean firms—established varying forms of dependency, none commanded a comparable share of production. In this context, Uzbekistan case extends path dependency theory to the analysis of energy security in a post-Soviet and resource-rich context. While path dependency has been extensively applied in comparative politics and economic history (Pierson, 2000; Mahoney, 2000), its use in examining the dynamics of foreign direct investment, over-reliance on external actor in the gas industry represents a novel contribution. We demonstrate that increasing returns employ not only through technological cases but also through institutional lock-in mechanisms formulated by production sharing agreements (PSA), tax exemptions and infrastructure subsidies. Furthermore, we articulate the conceptualization of self-reinforcing mechanisms by clarifying four distinct modalities: sunk costs (infrastructure investment), learning (erosion of state capacity), coordination effects (export contract lock-in), and adaptive expectations (governmental belief in the continuation of the existing trajectory). Our case is considered applicable mechanism for other cases in which host countries become dependent on a single foreign investor.

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