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Energy Transition in Azerbaijan: Advantages of System Value Analysis and Strategic Role of the Global Climate Actors

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Abstract

Azerbaijan, a country with hydrocarbon resources, seeks to restructure its economy and energy system to become more resilient to climate change. The European Union's call for international climate action offers opportunities for a green energy transition in Azerbaijan. However, the economic, social, climatic, and environmental elements driving this transition are understudied. This article follows the example of the World Economic Forum's System Value Analysis to study how complementary the impact of policies and solutions targeting sustainable development, the environment, climate action, and the green energy transition is in Azerbaijan. For this purpose, we analyze the energy market in Azerbaijan and the potential of renewable energy resources. The main aim is to reveal not only the economic advantages of the energy transition but also its political and strategic contribution to Azerbaijan. We argue that Azerbaijan's strategic engagement with the EU is crucial, as it serves as a means for Europe to bolster energy security and assist Azerbaijan in its political drive and strategy for transitioning to green energy. Additionally, it fulfills Azerbaijan's commitments to global climate initiatives.

Keywords: Azerbaijan, Energy Transition, System Value Analysis, European Union, International Climate Action, Renewable Energy.

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1. INTRODUCTION

Azerbaijan has followed an oil strategy for economic growth through the process of post-Soviet liberalization since independence in 1991. The oil industry has provided the necessary financial resources to support the newly declared economic and political independence of Azerbaijan through extreme macroeconomic growth. However, Azerbaijan's post-Soviet development, which has prioritized the extractive industry over the real economy, has left the state vulnerable to fluctuating oil prices and led to an imbalance in the state's production capacity. Energy sector preserves its significance for Azerbaijan's national security, yet climate change and the European Green Deal -as Azerbaijan is a trade partner of the EU- need to adapt to the new circumstances. Azerbaijan's dedication to addressing climate change is of utmost importance as it prepares to host the UN Climate Change Conference (COP) in Baku in 2024. Azerbaijan has the capacity to exemplify the feasibility and influence of the European Green Deal framework, thereby implementing its governmental pledge. Once again, Azerbaijan needs to adopt a strategy that will transform the economy and the supporting energy system. The European Union's (EU) call for an energy transition comes with both attractive opportunities and enforcement. This study looks at the economic, social, environmental, and industrial necessities and possibilities for Azerbaijan to make a green transition. The potential green transition in Azerbaijan offers a chance to demonstrate that geopolitics, economic policies, and climate action should not diverge, but rather complement each other.

Climate change is increasing environmental, social, and economic vulnerabilities in Azerbaijan, requiring strategies to build resilience and capacity to adapt. Extreme weather events, such as floods, landslides, mudslides, droughts, and forest fires, harm populations, infrastructure, and the economy. The highest emissions pathway expects Azerbaijan to warm by 4.7°C by the 2090s, faster than the glo bal average. Some regions will become drought-prone, and crop management may worsen precipitation deficits and river surface and subsurface flow deficits (Asian Development Bank [ADB], 2021). Azerbaijan may soon be desertified, and extreme temperatures will significantly impact crop yield, labor productivity, health, and ecological survival (Ministry of Ecology and Natural Resources, Republic of Azerbaijan 2015). To improve resilience and food security, the agricultural sector must adapt, invest in infrastructure, and adopt new and green technology. Farzalieva (2021) states that Azerbaijan's food security depends on agro-food policy and macroeconomic development. In 2014, droughts caused 59 hectares of forest fires, harming Azerbaijan's unique fauna and vegetation (Global Forest Watch [GFW], n.d.). Azerbaijan has successfully eradicated malaria, but climate change and urban heat island effects increase its risk of recurrence (Mammadov et al., 2016). Seasonal migration of agricultural laborers, internally displaced persons, and refugees requires vigilant measures. Public policies must address climate change adaptation for sustainable development and energy transition.

If Azerbaijan makes the right political decisions, it can enhance climate resilience, speed up economic growth, and make clean energy the engine of its economy at the same time. This article aims

to reveal Azerbaijan's strengths and vulnerabilities in the face of climate change and on the path to greening and diversifying the economy. It follows the example of the World Economic Forum's (WEF) System Value Analysis and the call to consider not only the levelized cost of energy but also the broader impact of related policies and solutions on sustainable development, the environment, climate, and humans (Aldersey-Williams & Rubert, 2019; Astariz et al., 2015). Azerbaijan can successfully transition into an energy system based on renewables and storage, following the lead of oil-rich countries such as Norway (Simpson, 2023) and Saudi Arabia (Al-Saidi, 2022). Azerbaijan also needs to put in place effective and targeted policies to reduce emissions. This will give the country a better chance of connecting with the economies of Europe that are changing, creating a more diverse economy, and keeping the country self-sufficient. This study uses the System Value Framework from the WEF to figure out why energy transition is essential and what would happen to the economy, environment, and people if Azerbaijan chose clean energy instead of fossil fuels.

This article argues that it is important for Azerbaijan to achieve a green energy transition for economic diversification and comply with the EU's neighborhood policy and international climate action. In the second part, the study introduces the System Value Framework developed by the WEF as an alternative to cost-benefit analysis, presents a literature review on Azerbaijan, mostly studied as a significant hydrocarbon energy producer, and gives examples of the country analyses by the WEF. Then the article analyzes the Azerbaijani energy market with reference to the system value framework. The study also evaluates the country's renewable energy resource potential. In the third section, the article examines the significance and advancement of Azerbaijan's energy transition policies, taking into account the country's clean energy market potential. This is done in tandem with the country's strategic relationships with the EU and its national commitments to international climate action. The study ends with an evaluation of Azerbaijan's overall situation in terms of green energy transition and presents concluding reflections on its strengths and weaknesses. Hence, this study aims to contribute to revealing how an oil-producing country might transform its economically profitable sector through a comprehensive transition process that also provides an advantageous position in its international relations.

2. LITERATURE REVIEW

Although Azerbaijan has rich oil and natural gas resources, the country has also faced the severe impacts of the climate crisis and its social and economic consequences. Additionally, the phase-down and out processes discussed in global climate negotiations challenge Azerbaijan as an oil-producing country. By considering other oil-rich countries' energy transition plans, such as Norway (Simpson, 2023) or Saudi Arabia (Al-Saidi, 2022), Azerbaijan could also launch a transition process for energy systems based on renewables and storage. In this context, Azerbaijan also needs to put in place effective and targeted policies to reduce emissions. This will give the country a better chance of connecting with

the economies of Europe that are changing, creating a more diverse economy, and keeping the country self-sufficient.

The performance of the current energy systems and the favorable environment for the energy transition are the components of the energy transition index framework. A country's system performance reveals the ability of a country's energy system to promote economic development and growth, ensure that everyone has access to a safe and reliable energy supply, and maintain environmental sustainability along the energy value chain. The goal of a nation's energy transition should be to simultaneously address these three issues and maintain a balanced "energy triangle". The energy transition is a planned shift to a broader, sustainable, economical, and secure energy system that addresses global energy concerns while adding value to business and society without undermining the energy triangle's balance. How far a nation's energy transition can advance depends on its ability to build a robust and enabling environment. The transition readiness score of a country evaluates the following enabling dimensions: energy system structure, capital and investment, regulation and political commitment, human capital and consumer participation, infrastructure and innovative business environment, and institutions and governance (WEF, 2020a). 40 indicators make up the composite score of the energy transition index. The indicators are standardized, grouped, and assigned equal weight to generate scores for higher-order dimensions. These are then used to calculate scores for the system performance and transition readiness subindices. These two sub-indices are added together to create the composite energy transition index score. With a transition readiness score of 49%, a system performance score of 67%, and an energy transition index value of 58%, Azerbaijan ranks 44th out of 115 nations in 2020 (WEF, 2020a). This section focuses on the literature on clean energy transitions. First, the advantages of System Value Analysis rather than Cost & Benefit Approach are examined; then the literature on Azerbaijan's transition is assessed.

2.1. Looking Beyond Cost & Benefit Analysis in Clean Energy Transition

Cost & benefit analysis is a widely used method for organizations to determine the best projects or programs to conduct and allocate investable funds. It considers net benefits rather than business improvements. (Mishan & Quah, 2021). This technique simplifies public policy decisions by identifying the differences in net benefits between two scenarios based on economic and environmental forecasting. The choice rests mainly on monetized benefits and costs, "consisting largely of well-defined monetary expenditures on facilities, collection vehicles, and labor" (Ackerman, 2008, p. 25). However, this approach omits environmental impacts, which do not have market prices.

In the past, the cost of a project or an investment has been an important factor, today -in the age of climate change- it is crucial that we assess the energy system to achieve economic success and limit global temperature increases to 1.5 degrees that is targeted through the Paris Agreement. Therefore, a new perspective that places an emphasis on a range of benefits and wider value is required to accelerate

activities and investments toward a future with net zero carbon emissions. We refer to this new framework for decision-making as System Value (WEF, n.d.). System Value is a comprehensive framework for assessing the technical, social, economic, and environmental effects of proposed energy solutions. The framework aspires to broaden the political and economic discussion beyond price to cover value. It is possible to examine policies, investments, and solutions to determine how they will affect various outcomes (WEF, n.d.). The WEF uses the System Value framework to direct discussions and initiatives that aim to promote the clean energy transition. The framework assists in concentrating on such solutions and actions that help lower emissions, besides bringing economic advantages like job creation and improving health due to better air quality (WEF, n.d.).

The System Value framework examines possible energy solutions across markets more comprehensively by considering their technological, social, economic, and environmental effects. The WEF, with the cooperation of Accenture, carried out a study across numerous geographies as part of market evaluations that looked at recovery potential to speed up economic growth and the clean energy transition. The framework's adaptability allows for the inclusion of both quantitative and qualitative analysis.

System Value analysis considers twelve economic, environmental, societal, and energy value dimensions (WEF, 2020b): carbon dioxide emissions, job creation, water footprint, air quality, electricity availability, energy productivity, resilience, security, foreign direct investment, service quality, flexibility, improved system adaptation, and cost and investment competitiveness. The System Value dimensions differ by geography and time frame (WEF, 2020b). These dimensions help determine the benefits of energy transition, renewables, and sustainable development. By focusing on these dimensions, organizations can enhance their overall value and contribute to a more sustainable future.

Expanding renewables, improving efficiency, upgrading the grid, and enhancing interconnection are essential components; the electricity transition contributes 20-30% of annual renewable energy to the generation mix. Power market reform, smart flexibility solutions, demand optimization, and electrification for end users are the transformational elements. Enhancing systemic effectiveness through solutions, partner cooperation, and digitalization provides a net-zero integrated energy system (WEF, 2020b).

2.2. Limits of Literature on Azerbaijan's Energy Transition

The WEF and Accenture have conducted research on recovery prospects for economic growth and clean energy transition using the System Value framework in selected countries, except Azerbaijan, a major hydrocarbon resource exporter. Through system value analysis, the WEF proposes solutions for countries and regions such as Brazil, the United States, India, and Europe. Potential solutions recommended for Brazil, include focusing on developing non-hydro renewable energy sources, digitalizing transmission and distribution systems, and energy-efficient urbanization. The United States

is advised to invest in renewable capacity, smart buildings, and energy infrastructure to enhance system durability. India's investments in renewable resources will benefit from renewable energy zones, distributed solar systems, and the shutdown of coal power plants. Solutions for Europe to achieve the 2030 target include a green hydrogen market, renewable energy use, and a digital energy ecosystem. China's distributed energy will almost triple by 2030, if it achieves increased solar and wind power capacity, digital grid transformation, smart grid technologies, and electric charging infrastructure. Denmark and Europe are advised to accelerate their transition to a low-carbon economy through smart digital technologies, supply-demand equilibrium, renewable energy sources, decarbonization, sustainable practices, and green fuel for transportation and aviation (WEF, n.d.).

Literature on the economic, social, climatic, and environmental factors pushing for Azerbaijan's transition to clean and green energy systems is limited. The existing literature primarily focuses on Azerbaijan's role as a significant oil and gas producer (Hoffman, 1999; Ciarreta & Nasirov, 2012; Bayulgen, 2005), the existing and prospective pipeline projects that extend from Baku to Europe over Turkey (Najman et. al., 2007), Azerbaijan's oil politics, energy diplomacy, and the geopolitics of energy (Ipek, 2009; Kubicek, 2013; Yesevi & Tiftikcigil, 2015; Aydin, 2019; Sanili Aydin & Uste, 2022). Few studies have examined the socioeconomic effects of declining oil and gas demand and prices on the sustainable energy transition in the Eurasian petrostates, as noted by Skalamera (2022). He argues that the clean energy transition in the EU will cause distress, particularly in Azerbaijan, as it remains committed to westbound energy markets rather than China (pp. 1645-1646). Additionally, the impacts of climate change on an oil-dependent state exacerbate its political, socioeconomic, and environmental vulnerabilities. Therefore, it becomes crucial for Azerbaijan to seek out alternative economic sectors and energy resources.

However, Azerbaijan's renewable potential is understudied. Azerbaijan National Academy of Sciences, Mustafayev et al. (2022), Karimov (2015), and others have conducted a few studies in this area. These studies confine the issue to technicalities or economics (Vidadili et al., 2017). Few studies have examined the impact of renewable energy on social, environmental, and economic vulnerabilities in the country. Guliyev (2021) indicates that Azerbaijan has progressed in enacting laws to support the transition to renewable energy. Rasoulinezhad and Taghizadeh-Hesary (2022) confirm that affordable, clean energy is essential for poverty reduction and equitable growth in the Commonwealth of Independent States (CIS). Once again, this study does not incorporate environmental and climate-related impacts on various sectors in its analysis. Cholewa et al. (2022) reveal the obstacles to the energy transition in Azerbaijan. Hasanov et al. (2023) examine the role of renewable energy in reducing GHG emissions and reveal that its utilization in Azerbaijan has been limited compared to the available sources. Thus, the study of reports, decrees, statements, and policy papers related to the governance of the energy transition in Azerbaijan makes a useful contribution to filling a gap in the literature and provides valuable insight to analyze the country's transition to renewables.

3. AZERBAIJAN'S ENERGY MARKET ANALYSIS

The energy sector has strategic importance for the national economy and the formation of GDP. Almost 90% of the nation's exports come from the oil and gas sector, which supplies one-third of the GDP of the nation (The State Statistical Committee of the Republic of Azerbaijan, 2023; Central Bank of the Republic of Azerbaijan, n.d.). The rich energy resources of Azerbaijan, especially oil and natural gas, made a significant contribution to the economic development of the country after gaining its independence in 1991 and the signing of the "Contract of the Century" in 1994 (Huseynli, 2023). Azerbaijan signed this contract with 13 world-renowned oil companies in 1994 and then signed 27 more contracts with 41 oil companies from 19 countries. These agreements have been effective in increasing the growth performance of the Azerbaijani economy since 2006. The GDP has grown from around 3 billion USD (1995) to 75 billion USD (2014) thanks to the Contract of the Century, which created new opportunities for the country to export its natural resources to the global market (World Bank, 2021). With the completion of the Baku-Tbilisi-Ceyhan pipeline in 2005, the country's oil was eventually able to reach world markets (Grant Thornton, 2019).

According to BP, the country's total proved oil reserves account for 7 trillion barrels, and its natural gas reserves are 46.6 trillion cubic feet (British Petroleum, 2018). Azerbaijan has one of the highest levels of energy self-sufficiency in the world, producing around four times as much energy as it uses. In recent years, Azerbaijan has exported around 40% of natural gas and over 90% of oil (International Energy Agency [IEA], 2022). The country's leadership acknowledges the fact that it can continue to rely on natural resources. However, this also implies that Azerbaijan will remain vulnerable to fluctuations in the global energy market, similar to what happened in 2014-2015, when the country faced two consecutive devaluations due to a decline in oil prices, and experienced its first economic recession in 20 years (CESD, 2015). The volatile oil prices in 2020 and 2021 have once again demonstrated the necessity of promoting productive, private sector-led development and diversification in Azerbaijan. The newly declared decarbonization goals in an increasing number of nations that import oil and gas support this idea. However, economic diversification remains a significant challenge, and the country's dependence on the oil and gas sector is likely to persist for some time (IEA, 2022). Reducing the share of the oil industry both in public revenues and in the country's GDP is the only way to reduce the country's reliance on oil and natural gas export revenues. Another problem is the high share of the energy sector in the country's GHG emissions. The energy sector is responsible for approximately 80% of the country's total emissions in 2020 (The State Statistical Committee of the Republic of Azerbaijan, 2022). Although Azerbaijan has an insignificant share in global warming (only 0.15% of the estimated emissions worldwide in 2016), the country's physical and geographical characteristics make it highly vulnerable to the effects of climate change, so a long-term strategic approach is crucial for Azerbaijan.

Azerbaijan's total export of goods in 2021 is worth 21 billion dollars, of which 19 billion dollars belong to the oil and gas sector. In the first three quarters of 2022, goods exports reached 30 billion dollars; 28.6 billion dollars covered the oil and gas sector exports, and the exports of this sector corresponded to 93% of the total goods exports. The export of the oil and gas sector has significant importance as it provides Azerbaijan's foreign trade surplus (Central Bank of the Republic of Azerbaijan, n.d.). Undoubtedly, oil and gas have an important share in Azerbaijan's economy in terms of exports and public revenues, but considering the targets of major importing countries to achieve zero greenhouse gas emissions by 2050, Azerbaijan's need for a long-term energy transition plan becomes important. Additionally, the fluctuation in oil prices seen in 2020-2021 made it more important than ever for the private sector to lead product diversification, which would boost productivity (IEA, 2022).

State-owned monopoly companies predominate and manage Azerbaijan's energy sector. The State Oil Company of Azerbaijan Republic (SOCAR) and its subsidiaries control the production, storage, transmission, distribution, and supply of oil and gas. Azerenergy and its subsidiaries provide electricity generation and transmission, heat power generation, and sales; Azerishiq provides electricity distribution, supply, and small-scale electricity generation; Azeristiklijhizat provides heat power generation, transmission, distribution, and supply; and heated water production, distribution, and supply (IEA, 2022).

In 2021, Azerbaijan achieved a total energy production of 66,202 thousand TOE, of which 35,583.1 thousand TOE came from crude oil, 30,395.6 thousand TOE from natural gas, and 223.3 thousand TOE from renewables and waste. The country exported 48,552 thousand TOE of its production, resulting in a total energy supply of 17,556.6 thousand TOE. Additionally, 59.5% of total exports, which were 48,552 thousand TOE in 2021, consist of crude oil, 36.7% of natural gas, 3.5% of petroleum products, and 0.3% of electricity (The State Statistical Committee of the Republic of Azerbaijan, 2022). While fuel sources -particularly natural gas, which is the main source of domestic total energy supply- provide almost all the energy supply, renewable energy only accounts for 1.3% of the total energy supply, as can be seen in Table 1.

Table 1. Total Energy Supply in 2021

	Thousand TOE	Share in total energy consumption%
Gaseous fuels	12,115.6	69
Liquid fuels	5,222.1	29.7
Solid fuels	3.8	0
Renewable energy	225.1	1.3
Total energy supply	17,566.6	

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

Table 2 displays the allocation of Azerbaijan's renewable energy supply based on generation resources in 2021. While the use of wind and solar energy among renewable energy sources remains at a very low level, the share of hydropower, biomass, and waste usage is around 95%. The share of ~~total~~ renewable energy supply in total energy use is only 1.3%.

Table 2. Renewable Energy Sources in 2021

	Thousand TOE	Share in total renewable energy supply%	Share in total energy consumption %
Hydropower	109.8	48.7	0.6
Biomass and waste	102.6	45.5	0.6
Wind power	7.9	3.5	0.1
Solar power	4.8	2.1	0.0
Total renewable energy supply	225.1		1.3

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

To secure an energy transition, it is crucial for Azerbaijan to reduce greenhouse gas emissions by lowering the use of fossil fuels in the production of electricity and restricting freshwater use in hydropower plants to reduce water scarcity. The distribution of electricity generation in Azerbaijan over time is shown in Table 3, along with the various types of power plants. Most of the electricity is produced in thermal power plants, where natural gas consumption has climbed and oil use has dropped since 2001. Thermal power plants produce more than 90% of their electricity using natural gas (IEA 2022). While biomass, wind, and solar power plants have significantly increased their electricity production since 2016, only 5.8% of 2021's electricity came from renewable sources, including hydropower.

Table 3. Production of Electricity by Type of Power Plant (Million Kwh)

	Thermal	Hydro	Biomass	Wind	Solar
2010	15,263	3,446	-	0.5	-
2015	22,859	1,638	181	0.4	4
2020	24,398	1,069	200	95	47
2021	26,238	1,277	193	91	55

Source: The Ministry of Energy of the Republic of Azerbaijan, n.d.

Utilizing renewable energy sources for electricity generation can help diversify the energy mix and free up natural gas for export and other lucrative uses. According to the State Statistical Committee's 2022 data, Azerbaijan is a country with a very high renewable energy potential, and there have been significant increases in wind and solar power plant capacities in recent years, as can be seen in Table 4, but these capacities are far below their potential.

Table 4. Plant Capacity at the End of the Year (Mw)

	Electric and CHP plants working with fuel	Hydroelectric	Wind	Solar	Solid domestic waste	Biogas
2010	5,401	995	1.7	-	-	-
2015	6,652	1,103	7.7	4.8	37	1
2020	6,326	1,149	66	35	44	1
2021	6,649	1,157	66	47	44	0.7

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

Table 5 shows the shares of renewable energy sources in electricity production and capacity over the last ten years based on the 2022 data retrieved from the International Renewable Energy Agency and the State Statistical Committee of Azerbaijan. Whereas the share of renewable energy sources in electricity production was approximately 8%, it fell over the last three years to 5.8% in 2021. The share of renewable energy sources in electricity capacity was between 15 and 17%.

Table 5. Share of Renewable Energy in Electricity Capacity (%Mw) and Production (%Gwh)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Capacity	16	15	15.2	14.8	15	15	16.3	16.9	17	17.1
Production	7.9	7	6	7.4	8.8	8.1	8.1	7.3	5.5	5.8

Source: International Renewable Energy Agency, 2022; The State Statistical Committee of the Republic of Azerbaijan, 2022

In 2021, the electricity industry used 14% of the supplied electricity to the market, exported 6% of the produced electricity, and lost 8% of the overall supply due to network transmission and distribution losses, with network distribution accounting for roughly 7% of these losses. While households use 34% of the electricity, 32% of the commerce and public services sector, 20% of the industry sector, and 8% of the agriculture sector, other sectors account for only about 6% of total energy consumption (The State Statistical Committee of the Republic of Azerbaijan, 2022).

Table 6. Greenhouse Gas Emissions by Sectors (CO_2 Equivalent Million Tons)

	Energy	Industry	Agriculture	Waste	Land use and forestry	Total land use	Total land use (except forestry)
2005	40.9	1.9	6.5	1	-5.3	50.2	44.9
2010	41	2	7.2	1.2	-5.4	51.4	46
2015	47.7	3.7	8.6	1.3	-7.1	61.3	54.2
2018	47.5	3.4	8.7	1.3	-7.2	60.8	53.6
2019	49	3.3	8	1.4	-7.5	61.6	54.1
2020	49.8	3.2	8	1.4	-8.5	62.4	53.9

Source: The State Statistical Committee of the Republic of Azerbaijan, 2022

Statistics on greenhouse gas emissions reflected on Table 6 demonstrate that the energy sector is primarily responsible for Azerbaijan's emissions (The State Statistical Committee, 2022). With a value

of 49.8 million tons in 2020, the energy sector's greenhouse gas emissions account for 80% of all; when forestry -as a carbon sink- is taken out of the equation, they rise to 92%.

4. THE POTENTIAL OF RENEWABLE ENERGY RESOURCES IN AZERBAIJAN

Azerbaijan's share of global greenhouse gas emissions is merely 0.15%, but by 2030 and 2050, it hopes to have cut those emissions by 35% and 40%, respectively, compared to 1990 levels, and it aims to create a zero-emission zone in the liberated areas (The Republic of Azerbaijan, 2023). Azerbaijan also wants to increase the proportion of renewable energy sources in all installed power capacity from 17% to 30% by 2030 (UN Climate Change, 2021). The government signed contracts for the construction of wind and solar power in early 2020 in addition to enacting legislation to promote the use of renewable energy to meet this goal (IEA, 2022). In addition, precautions such as energy efficiency measures, low-emission solutions in the urban transportation system, the use of technologies that will create low carbon emissions in the industrial sector, the development of the waste management system, and the expansion of forests and green areas are also on Azerbaijan's political agenda. Accordingly, Azerbaijan claims that establishing green energy zones, green agriculture, and green transportation practices, increasing afforestation activities, and building smart cities and smart villages will serve to achieve the goal of "Net Zero Emissions" by 2050 (UN Climate Change, 2022). Furthermore, the government also attaches importance to the goal of accessing affordable, reliable, sustainable, and modern energy sources, which is among the Sustainable Development Goals of the United Nations (IEA, 2022).

To realize the goal of increasing the use of renewable energy in the generation of electricity, it is planned to create a total of 1,500 MW of new generation capacity - 440 MW in 2023, 460 MW in 2023-2025, and 600 MW in 2026-2030. Given Azerbaijan's high potential for renewable energy resources, experts estimate its economically and technically feasible renewable energy resource potential to be 27,000 MW. This potential comes from 23,000 MW of solar power, 3,000 MW of wind power, 380 MW of biopower, and 520 MW of mountain rivers (The Ministry of Energy of the Republic of Azerbaijan, 2022). Further, significant potential for renewable energy is also thought to exist in Azerbaijan's liberated areas. In these regions, it is estimated that there is a potential of over 7,200 MW for solar energy and over 2,000 MW for wind energy, while water resources are also estimated to have significant hydroelectric potential (Azerbaijan Renewable Energy Agency under the Ministry of Energy of the Republic of Azerbaijan, n.d.).

In the strategic roadmap of Azerbaijan, renewable energy capacity and the share of renewable energy in total capacity targets for the years 2020, 2025, and 2030 have been determined and shown in Table 7. Renewable energy plant capacity and the share of renewable energy in total capacity data for 2020 and 2021 show that the target is falling behind (Yusifov, 2018).

Table 7. Planned Power Installation (Mw)

	Wind	Solar	Hydro	Bioenergy	Total	Share in total capacity%
2020	350	50	10	20	430	20
2025	440	150	220	30	840	25-30
2030	465	190	220	50	925	35-40

Source: Yusifov, 2018

The World Bank research on the offshore wind potential of Azerbaijan estimates that there is a total of 157 GW of offshore wind potential, of which 35 GW is in shallow waters and 122 GW in deep waters. Natural gas primarily provides electricity production in Azerbaijan, a country with a high renewable energy potential. We expect the utilization of offshore wind potential to present opportunities like decarbonization, increased export potential, workforce transition to clean energy, and competitive pricing. The decrease in the use of natural gas in the electricity generation system and the increase in the use of renewable resources are important for the country to reach its decarbonization targets. By using offshore wind for electricity generation, Azerbaijan can export the gas it no longer uses for electricity generation. In the long run, shifting the workforce from the oil and gas sector to wind farms will create qualified jobs. Although the use of offshore wind creates a higher levelized cost of energy than current costs in the early stages of production, experiences from other countries indicate that the cost will decrease over time with the right policies (The World Bank, 2022).

The World Bank analyzed the effects of the use of offshore winds with two different growth probabilities. In the case of moderate growth, it will be possible to meet 7% of the country's electricity needs in 2040 with a foundation capacity of 1.5 GW. Despite achieving the 2030 renewable energy installation targets, the small scale of offshore winds limits their contribution to job creation, economic value creation, cost reduction, and decarbonization in comparison to the high growth model. The World Bank (2022) estimates that in the scenario of high growth, a foundation capacity of 7.2 GW will meet 37% of the country's electricity needs in 2040.

Interest in the use of renewable energy in Azerbaijan has started to increase in recent years, and it is accepted that the use of renewable resources in electricity production will contribute to the diversification of energy sources and that directing natural gas to more profitable export and use in petrochemicals instead of energy production will contribute to meeting the climate policy objectives. Despite Azerbaijan's strong potential for solar and wind resources, as well as prospects for biomass, geothermal, and hydroelectric resources, achieving economic diversification in terms of realized production and long-term goals will take time, and the economy will remain dependent on oil and gas for a while (IEA, 2022).

5. THE ROLE OF GLOBAL ACTORS IN GREEN ENERGY TRANSITION

Azerbaijan's strategic partnership with the EU is significant because it is both a tool for Europe to enhance energy security and support Azerbaijan's political motivation and planning for green energy transition. It also serves Azerbaijan's national pledges for international climate action. The political commitment and institutional readiness to undertake the green energy transition alone will enable Azerbaijan to take concrete steps towards achieving a more resilient and sustainable economy in the face of climate change, ensuring human and ecological security and the stability of the country. Azerbaijan's progress in terms of political will and practice to comply with the EU and international climate action is one of the complementary variables of the green energy transition and shows how to add tangible detail to otherwise ambitious climate targets at the national level.

5.1. Azerbaijan's Strategic Partnership with the EU

The EU-Azerbaijan Strategic Partnership aims to modernize energy, transportation, and logistics infrastructure, modernize oil and gas extraction, and build an environmentally friendly manufacturing sector. The European Green Deal prioritizes energy efficiency, reliability, and a fully integrated, networked, and digitalized energy market. Azerbaijan contributes strategically with its natural gas, safeguarding EU energy supplies. The partnership focuses on strengthening institutions, governance, economic development, connectivity, energy efficiency, environment, climate action, mobility, and people-to-people relations (European Commission, 2018). Van Gils (2018, p. 1581) states that the bargaining power in EU-Azerbaijan relations indicates "a more symmetrical relationship or at least a less asymmetrical mode than in relations with other states in the Eastern Partnership (EaP)". In van Gils' words (2018, p. 1581) this power rests on several factors, such as Azerbaijan's economic boom due to high oil prices between 2010 and 2015, Azerbaijan's skillful diplomacy demanding "cooperation to take place on a more inclusive, dialogical basis" and domestic expectations for the negotiation process. Today, plummeting oil prices, the demand for dialogical policymaking, and the need for diversification of the economy are the factors driving Azerbaijan to engage in cooperation with the EU. Yet, they herald the potential to extend closer cooperation and dialogue into the field of clean energy transition as well.

The European Commission's Eastern Partnership policy beyond 2020 aims for resilient, sustainable, and integrated economies, accountable institutions, rule of law, environmental and climate resilience, digital transformation, and fair and inclusive societies (European Council, 2022a). The European Commission considers extending the Southern Gas Corridor to Azerbaijan, a country that produces 5% of the EU's energy, to assist neighboring countries in diversifying their economies and temporarily reducing their carbon emissions (European Commission, 2021). The EU gains economically, politically, and strategically from Azerbaijan's involvement in the European Neighborhood Policy and the Eastern Partnership. The Eastern Partnership's core programs include green connectivity, digital connectivity, sustainable, innovative, green, competitive economies,

innovative rural development, and smarter cities, which will benefit Azerbaijan the most through its energy system reforms (European Commission, 2021, p. 24).

In 2019, the European Council defined achieving climate neutrality as a major opportunity for the EU. For this purpose, the European Council targets carbon leakage from imports and aims to prevent rising emissions outside the EU from undermining the EU's greenhouse gas reduction efforts (Council of the EU, 2022). Moreover, the EU is expanding its energy acquis to "neighborhood" partners and implementing regional and bilateral programs to simplify environmental and climatic cooperation (European Council, 2022b). EU4Climate and EU4Environment projects aim to integrate low-emissions and climate resilience objectives into development policies and plans in six Eastern Partnership countries.

EU4Climate supports greener decision-making, circular economy, smart environmental legislation, ecosystem protection, and information sharing (UNDP, 2023). It also helps Azerbaijan develop green investment strategies, finalize the Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) laws, reform regulatory regimes, promote compliance assurance, reinforce policy dialogues, support public environmental expenditure management, assess and strengthen administrative capacity, and develop Green Growth Indicators (EU4Climate, 2023).

EU4Environment focuses on environmental, health, and climate aspects in spatial planning (EU4Environment, 2022), protecting Azerbaijan's forests and wildlife. The organization's World Bank-supported guidelines safeguard fragile habitats. Community-driven ecotourism, ecosystem services evaluation, and natural capital conservation will improve policies. EU4Environment-Green Economy aims to improve water resource management, stakeholder involvement, and economic soundness of policies, inspiring eastern partner countries to balance economic development with environmental protection and green transition (EU4Environment, 2022).

Azerbaijan and the EU share environmental, energy, and climate goals. Azerbaijan, a member of the Eastern Europe Energy Efficiency and Environment Partnership (E5P) since 2019, established a new law on energy efficiency and a roadmap for accelerating eco-design and labeling requirements for energy-using products (EU4Climate, n.d.). Azerbaijan also plans to increase energy efficiency in all sectors between 2021 and 2025, resulting in natural gas savings of 3.5-4.2 bcm, improved export revenues of $667-787 million, decreased budgetary subsidies of $491-981 million, new investments of $2.5-3.4 million, and 118,000-123,000 new jobs (EU Neighbours East, 2021).

In 2022, the EU signed a Memorandum on Strategic Partnership in Energy with Azerbaijan, a significant partner in the EU's transition away from Russian fossil fuels (European Commission, 2022), establishing a long-term energy efficiency and clean energy partnership. The policy prioritizes renewable energy development, energy technology cooperation, knowledge sharing, and cross-investment. The partners aim to harmonize Azerbaijani energy legislation, improve energy demand

management, including concrete energy-saving measures, introduce measures to tackle climate change, benefit from relevant mechanisms under the Kyoto Protocol (European Commission, 2022, p. 25), such as carbon trade and converge electricity and gas markets (European Parliament, n.d.). The European Commission (2022) highlights the importance of renewable energy development "to fully reap the synergies between the EU's clean energy transition and Azerbaijan's strong untapped renewable energy potential, in particular in the offshore energy sector".

In conclusion, the EU-Azerbaijan Strategic Partnership provides normative leadership and a plan for developing the country's energy, transportation, transit, and logistics infrastructure. The European Green Deal anchors the Europeanization of external energy policy and extends the EU's acquis for greener and cleaner energy to its eastern neighbors.

5.2. Azerbaijan's National Pledges for Accordance with International Climate Action

Azerbaijan ratified the UN Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol in 1995 and 2000, joining the Non-Annex I Group of countries "especially vulnerable to the adverse impacts of climate change, including countries with low-lying coastal areas and those prone to desertification and drought" and "that rely heavily on fossil income from fossil fuel production and commerce" (UNFCCC, n.d.-a). The country supports a climate change deal and aims to reduce greenhouse gas emissions by 35% by 2030 (UNFCCC, n.d.-b). Azerbaijan has implemented measures like low-carbon, energy-efficient, renewable energy, waste management, and forest growth.

The Deputy Prime Minister leads the State Commission on Climate Change, a technical working group that improves agency relations, encourages participation, and helps achieve UNFCCC commitments (UNFCCC, 2014). It also develops inventory systems and evaluates emission reduction options with an action plan. To meet revised NDC emission goals, Azerbaijan ensures an open climate policy and pledges a 40% GHG emission reduction by 2050 (The Republic of Azerbaijan, 2023).

Azerbaijan has implemented climate change policies, programs, and regulations since 1998, focusing on pollution from industrial production (oil exploration and production, energy, transport, and other sources), the Caspian Sea, forestry, land biodiversity, and institutional development. Azerbaijan is committed to enhancing its water resources, land, forests, and the Caspian Sea, recognizing environmental conditions as both a contributing factor to poverty and a means to mitigate it (Organization for European Cooperation and Development [OECD], 2007, p. 104). Azerbaijan aims to respond to environmentally sustainable energy development concerns with a growing use of renewable energy (Climate Change Laws of the World [CCLW], 2003; ADB, 2005). Hence Azerbaijan neatly links the goals of increasing energy security, attracting investment in renewable energy resources, improving energy efficiency, and creating new sector jobs (IEA, 2021).

The Azerbaijan State Program on Poverty Reduction and Sustainable Development aims to reduce energy sector emissions by 20%, increase renewable and alternative energy sources, reduce fuel-

energy complex environmental impact, create an action plan, and establish a carbon fund for mitigation efforts (CCLW, 2008). Azerbaijan plans to respond to the social and economic needs of Baku and its settlements by developing new power plants, improving infrastructure, and renovating heating facilities (UNECE, n.d.).

Azerbaijan established the State Agency for Alternative and Renewable Energy Sources (SAARES) in 2009 to combat climate change and improve energy management. The 2012-2020 National Strategy aims to boost energy efficiency and use alternative and renewable energy sources for electricity and heat generation. Decree No. 1159 established the Azerbaijan Renewable Energy Agency in September 2020 to manage and implement policy.

Since 2009, Azerbaijan has set goals to diversify its economy, connect to the global market, develop infrastructure, and improve living standards (Azerbaijan Portal, n.d.). Azerbaijan's key policy goal is diversification; therefore, growing the non-oil sector, particularly the green economy, is a priority and an opportunity. Azerbaijan's 2015-2020 State Program for the Development of Industry promotes eco-friendly energy technologies, alternative energy installation and equipment manufacturing, improves existing industrial plants, and launches new ones (Food and Agriculture Organization [FAO], 2014).

Industrial parks like Balakhani promote green growth, job creation, and environmental improvement in Baku. Western countries supply energy-efficient and low-carbon technologies, while EU-funded industrial zones strengthen non-oil sectors and support economic diversification (EU-Azerbaijan Business Forum, 2021). Azerbaijan prioritizes agriculture, food production, tourism, logistics, information and communication technologies, and other light industries for economic diversification (EU4Business, 2021).

Launched in 2015, the Azerbaijan 2020 Outlook for Future Development Concept aims to reduce energy use and carbon dioxide emissions to OECD levels (ADB, n.d.). It also seeks sustained economic growth, social welfare, effective state administration, human rights protection, civil society participation, and food security. Azerbaijan's development goals include bringing environmental protection to European standards, improving energy, transportation, and residents' skills in the countryside, and creating new competitive non-oil industries.

This process will strengthen Azerbaijan's susceptible sectors, help the country combat climate change, and include the country in large-scale EU economic and market developments (FAO, 2023). Azerbaijan's energy transition will take time, but a robust roadmap and normative leadership will help. Thus, promoting a green economy will help Azerbaijan achieve its fundamental goal of a strong, well-functioning economy that can compete globally and develop new partnerships through a transforming energy sector.

6. CONCLUSION

The availability of data limits Azerbaijan's systemic value analysis. The most important factors determining the accessibility of data are the data collection practices of government agencies, transparency and data sharing, or the existence of observable/measurable impacts of a policy since its introduction. Still, the effects of climate change and environmental degradation, market analysis and an assessment of Azerbaijan's renewables potential, the political orientation of the Azerbaijan government, its national pledges for climate action, and the progress to comply with the EU's neighborhood policy allow us to make predictions about the challenges Azerbaijan will face and the benefits it will reap from the green energy transition.

For Azerbaijan to diversify its economy and increase resilience against the global volatility of oil prices, it must increase its energy mix with renewables, encourage private sector-led development, and promote productivity. Diversification of production through renewables will contribute to stable economic growth. Investment in new and green technology will both attract foreign investors and create new jobs. Increasing use of clean energy will motivate adoption of sustainable and green practices in agricultural and industrial sectors, which will increase the resilience of communities and create new jobs.

To achieve this goal, Azerbaijan needs to reduce its reliance on natural gas for electricity production and boost its use of renewable energy sources, thereby increasing its share of natural gas exports abroad. Thus, Azerbaijan will achieve both the greening of its energy sector and economy and save an essential source of income. The more surplus natural gas Azerbaijan has, the better its relations with the EU, which has been shifting toward relatively less polluting energy alternatives as part of climate action. Azerbaijan's partnership with the EU has several benefits, including R&D and technology transfer, foreign investment, trade, and international recognition of political discourse.

Infrastructure upgrades to increase energy efficiency will prevent transmission and distribution losses in Azerbaijan. Legislative and regulatory changes are improving the efficiency of energy production and supply chain. These processes include developing new production capabilities that suit modern energy system requirements, reducing losses in transmission and distribution systems, and restoring and reconstructing current energy production capacities to increase efficiency. However, Azerbaijan must develop energy efficiency at the consumer, industry, and transport levels. For this purpose, Azerbaijan established a Green Energy Zone in the liberated territories, which will be the base for the future application of environmentally friendly and efficient green technologies. Azerbaijan recognizes renewables as an alternative to hydrocarbons, encourages private actors to engage, and provides mechanisms to increase them. However, only a few small private players operate in the energy market due to the incomplete implementation of the regulations.

The ambitious climate action plans of the EU would likely require hefty tariffs on CO2-containing goods and services. If Azerbaijan doesn't improve its exports of CO2-free products, its global exports may drop. Thus, the EU provides both motivation and guidance toward green energy transition through its neighborhood policy and strategic partnership with Azerbaijan.

Although Azerbaijan displays a governmental focus on green energy transition and climate action, society and local communities need to understand and embrace an integrated approach to sustainable development, clean energy use, and the well-being of the ecosystems, including soil, water, air, vegetation, and biodiversity. If Azerbaijan achieves to transform its fossil-fuel-dependent economy into a greener and carbon-neutral one, it will be a good example for other countries and may contribute to expanding the scope of the green transition.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

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The authors declare that they all equally contributed to all processes of the research.

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