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Green Finance Instruments for Supporting Solar Energy Development in Azerbaijan

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ABSTRACT

This study examines how green finance tools support the development of solar energy in Azerbaijan. It focuses on how financial methods like green loans, green bonds, power purchase agreements, renewable energy auctions, tax and customs incentives, and international development finance can boost solar energy investments in the country. The research is based on an analysis of official reports and policy documents from the Ministry of Energy of the Republic of Azerbaijan, the Central Bank of Azerbaijan, the State Statistical Committee, Azerenerji OJSC, and the Azerbaijan Renewable Energy Agency. The findings show that Azerbaijan has a lot of solar energy potential and has started a new phase of large-scale solar development with projects like the Garadagh, Gobustan, Shafag, Bilasuvar, and Neftchala solar power plants. The results also indicate that building a sustainable finance system, which includes green taxonomy, green loans, green bonds, and managing climate-related risks, is crucial for making solar energy projects financially viable. The study concludes that solar energy development in Azerbaijan needs a coordinated policy framework that combines government support, private investment, international finance, modernization of the grid, and clear market-based mechanisms.

INTRODUCTION

The shift to renewable energy has become an important goal for countries that want to enhance energy security, cut greenhouse gas emissions, and attract sustainable investment. For Azerbaijan, this shift is especially significant since the country has long depended on oil and natural gas for its energy needs. Recently, however, the national energy agenda has focused more on developing renewable energy, improving energy efficiency, promoting low-carbon growth, and creating green energy zones. Solar energy stands out as a promising area in this transition due to Azerbaijan's geographical conditions, high solar potential, and an expanding project pipeline.

Official data show that Azerbaijan has significant renewable energy potential. The country's economically viable renewable energy potential is estimated at 27 GW, with 23 GW coming from solar energy (Ministry of Energy of the Republic of Azerbaijan, 2026). This indicates that solar energy is not just an environmental opportunity but also a key area for investment. At the same time, Azerbaijan has moved from general policy commitments to launching specific solar power projects. The 230 MW Garadagh Solar Power Plant, implemented with foreign investment, marked an important step in utility-scale solar energy development in Azerbaijan. The Ministry of Energy's recent reports show that new solar projects, including Shafag, Bilasuvar, Neftchala, Gobustan, Shams, and Ufuq, are becoming part of the country's renewable energy portfolio (Ministry of Energy of the Republic of Azerbaijan, 2024, 2025).

The increasing role of solar energy is also evident in electricity generation statistics. In 2022, electricity generation from solar power plants was 60.9 million kWh. This figure rose to 79.4 million kWh in 2023 (Ministry of Energy of the Republic of Azerbaijan, 2022, 2023). A substantial increase occurred in 2024, when solar electricity generation reached 556.3 million kWh, and in 2025 it further climbed to 599.9 million kWh (Ministry of Energy of the Republic of Azerbaijan, 2024, 2025). By 2025, Azerbaijan had nine solar power plants with a total installed capacity of 278.2 MW, while renewable energy sources, including hydropower, made up about 18.8% of total installed capacity (Ministry of Energy of the Republic of Azerbaijan, 2025). These numbers show that solar energy is gradually becoming a visible part of the national electricity system.

Despite this progress, expanding solar energy needs significant financial resources. Utility-scale solar projects usually have high initial capital costs, long payback periods, grid connection needs, land-use arrangements, and regulatory challenges. Therefore, developing solar energy cannot rely solely on public funding. It requires a broader green finance ecosystem that includes private investment, green loans, green bonds, power purchase agreements, renewable energy auctions, tax incentives, and support from international financial institutions. In this context, green finance tools are vital for lowering investment risks, improving the feasibility of projects, and attracting capital for renewable energy initiatives.

The Central Bank of Azerbaijan's Sustainable Finance Roadmap 2023–2026 lays an important policy foundation for this effort. The roadmap highlights sustainable finance taxonomy, green loans, green bonds, climate-related risk management, environmental, social, and

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governance factors, and market transparency as key areas for developing sustainable finance in Azerbaijan (Central Bank of Azerbaijan, 2023). These tools are especially relevant for solar energy because they can help financial institutions better classify, assess, and finance renewable energy projects. For example, green loans might support rooftop solar systems for small and medium-sized businesses and homes, while green bonds might fund larger solar power plants and grid infrastructure projects.

Grid integration is another important aspect of solar energy development. Incorporating variable renewable energy sources requires transmission infrastructure, substations, balancing capacity, digital monitoring systems, and energy storage solutions. The environmental and social impact assessment report prepared for integrating renewable energy into Azerbaijan's power system shows that the planned infrastructure will facilitate the inclusion of 1 GW of renewable electricity, which includes the 315 MW Banka and 445 MW Bilasuvar solar power plants (Azerenerji Open Joint Stock Company, 2024). This indicates that financing solar energy extends beyond generation facilities to include grid modernization and supportive infrastructure.

This study aims to investigate the role of green finance instruments in promoting solar energy development in Azerbaijan. The research examines the relationship between solar energy potential, current and planned solar projects, sustainable finance policy, and investment mechanisms. The main contribution of the study is its integration of official energy statistics, government reports, sustainable finance policy documents, and project-level information to evaluate how green finance instruments can support solar energy development in Azerbaijan. The study relies on document analysis and focuses on practical instruments such as green loans, green bonds, power purchase agreements, renewable energy auctions, tax and customs incentives, international development finance, and grid-related investment mechanisms.

LITERATURE REVIEW

Green finance involves financial tools and systems that direct money towards environmentally sustainable activities. These activities include renewable energy, energy efficiency, low-carbon infrastructure, climate adaptation, pollution reduction, and resource efficiency. In the energy transition, green finance serves as a funding source and as a way to lower investment risks while ensuring capital is allocated to projects that yield measurable environmental benefits. Global experience shows that public finance alone cannot cover the massive investment needed for the energy transition. According to IRENA and CPI, global investment in energy transition technologies hit USD 1.3 trillion in 2022, with about USD 0.5 trillion going to renewable energy. However, this amount falls short of what is necessary to achieve long-term climate and energy goals (IRENA & CPI, 2023).

Solar energy stands out as a crucial sector where green finance can make a direct impact. Utility-scale solar projects often need significant initial capital for land preparation, photovoltaic equipment, grid connection, construction, monitoring systems, and supporting infrastructure. While operating costs are relatively low after installation, the phase of investment is resource-intensive and relies on long-term revenue certainty. The World Bank Group and IFC stress that effective utility-scale solar photovoltaic projects require careful preparation, reliable contracts, trustworthy grid connections, land arrangements, environmental and social assessments, and a clear distribution of risks among public authorities, investors, and lenders (World Bank Group & IFC, 2015). Recent research also indicates that the development of solar energy should not only be considered a generation problem, but also a problem of policy, technology and system integration. Saad & Myat (2025) support that solar power can play a role towards reaching net-zero targets with the help of appropriate policy instruments, technological development, energy storage and integrating with the grid. Furthermore, Mucomole *et al.* (2024) note that variability in solar energy at small scales can impact solar power generation, highlighting the need for flexibility, forecasting, and storage in solar integration.

Green bonds are one of the most relevant tools for funding large renewable energy and infrastructure projects. As defined by the Green Bond Principles, green bonds are debt instruments whose proceeds go solely toward financing or refinancing approved green projects. Renewable energy is a key category under this framework (International Capital Market Association, 2021). For Azerbaijan, green bonds could finance large solar power plants, grid modernization, transmission lines, substations, battery energy storage systems, and other infrastructure needed for integrating renewable energy. However, establishing a green bond market requires clear standards, transparent reporting, effective management of proceeds, and external credibility to minimize risks of greenwashing.

Green loans are another vital tool, especially for smaller solar projects. While green bonds are better suited for large issuers and capital market transactions, green loans can be utilized through banks to support rooftop solar systems, small and medium-sized enterprises, agricultural facilities, industrial projects that consume energy independently, and households. The Central Bank of Azerbaijan's Sustainable Finance Roadmap 2023–2026 outlines green loans, green bonds, a classification for sustainable finance, climate-related risk management, disclosure, and market transparency as essential elements for building a sustainable finance system in Azerbaijan (Central Bank of Azerbaijan, 2023). This is particularly important because Azerbaijan has a bank-based financial system, and banks can play a crucial role in increasing access to solar energy funding.

A sustainable finance classification is also key for financing solar energy. This classification system helps financial institutions, investors, regulators, and project

developers identify activities considered environmentally sustainable. For solar energy, a classification can establish criteria for recognizing solar power generation, rooftop photovoltaic systems, energy storage, and grid integration as green economic activities. This can enhance the transparency of green lending and bond issuance, lower risks of greenwashing, and help track sustainable finance flows. The Central Bank of Azerbaijan notes that such a classification can create a common language for sustainable finance and support the development of green financial instruments (Central Bank of Azerbaijan, 2023).

In addition to financial tools, mechanisms at the project level are critical for solar investment. Power purchase agreements are crucial because they provide long-term revenue stability for investors and lenders. Renewable energy auctions can also facilitate investment by creating a competitive selection process for project developers and setting tariffs. Fiscal incentives, such as tax and customs exemptions for renewable energy equipment, may lower capital costs and enhance project feasibility. These tools are especially important in emerging renewable energy markets, where investors might face greater perceived risks regarding regulations, tariffs, grid access, and currency conditions.

Azerbaijan's solar energy development already illustrates several of these project finance features. The Garadagh Solar Power Plant highlights the importance of foreign investment in utility-scale solar efforts. The Gobustan solar project is connected to the auction mechanism, while the Shafag solar project demonstrates how solar energy can aid industrial decarbonization. Plans from the Ministry of Energy for 2024 and 2025 indicate that multiple solar projects are underway through investment agreements, power purchase agreements, land lease agreements, and grid connection arrangements (Ministry of Energy of the Republic of Azerbaijan, 2024, 2025). These mechanisms directly affect the financial viability of solar energy projects.

Grid infrastructure also plays a significant role in financing renewable energy. Solar energy is a variable renewable source, and its integration into the power system requires adequate transmission capacity, grid flexibility, digital control systems, and sometimes energy storage. Without sufficient grid infrastructure, even financially viable solar plants may experience delays, operational risks, or be curtailed. The Azerenerji environmental and social impact assessment for the renewable energy integration project indicates that the planned infrastructure will support 1 GW of renewable electricity, including the 315 MW Banka and 445 MW Bilasuvar solar power plants (Azerenerji Open Joint Stock Company, 2024). The World Bank's AZURE project also aids in strengthening Azerbaijan's transmission network and integrating renewable energy, demonstrating the importance of international development finance for preparing the grid (World Bank, 2025).

The national policy context further emphasizes the importance of green finance for solar energy development. Azerbaijan's renewable energy potential is estimated at 27 GW, with 23 GW from solar energy alone (Ministry of Energy of the Republic of Azerbaijan, 2026). By 2025, the country had 9 solar power plants with a total installed capacity of 278.2 MW, while solar electricity generation reached 599.9 million kWh (Ministry of Energy of the Republic of Azerbaijan, 2025). The State Statistical Committee's energy yearbook also provides official data on energy production, consumption, renewable energy supply, plant capacity, and greenhouse gas emissions, which are crucial for assessing the broader context of the energy transition (State Statistical Committee of the Republic of Azerbaijan, 2025).

Based on the reviewed literature and official documents, three main points emerge. First, solar energy development in Azerbaijan has strong technical and policy support due to high solar potential and a growing number of ongoing and planned projects. Second, expanding solar energy requires a more robust green finance framework that includes green loans, green bonds, a classification system, disclosure, and management of climate-related risks. Third, project-level mechanisms, like power purchase agreements, auctions, fiscal incentives, international development finance, and grid connection tools, are essential for lowering investor risks and enhancing the financial viability of solar energy projects.

MATERIALS AND METHODS

This study uses a qualitative document analysis to explore how green finance tools can aid solar energy development in Azerbaijan. The research relies on official reports, statistical publications, policy documents, and project-level data related to renewable energy, sustainable finance, grid integration, and solar power. This approach was chosen because the study focuses on the policy, institutional, financial, and project aspects of solar energy financing instead of estimating the technical solar generation capacity through primary measurements.

The research design has four main stages. First, we reviewed national energy reports to determine the current status of electricity generation, installed capacity, solar power production, and renewable energy projects. Second, we analyzed sustainable finance policy documents to identify which financial tools are being promoted in Azerbaijan's financial sector. Third, we examined project-level documents to understand the role of power purchase agreements, auctions, grid connection arrangements, foreign investment, and international development finance. Lastly, we synthesized the gathered information to evaluate how different green finance tools apply to solar energy development in Azerbaijan.

Table 1 shows the main data sources used in this study and explains their relevance to the research goal.

Table 1: Data sources used in the study and their analytical relevance

Source	Type of data used	Analytical relevance
Ministry of Energy reports for 2022–2025	Electricity generation, installed capacity, solar power output, renewable energy projects	Used to identify the development trend of solar energy and renewable energy capacity in Azerbaijan
Central Bank of Azerbaijan, Sustainable Finance Roadmap 2023–2026	Green loans, green bonds, taxonomy, ESG risk management, disclosure	Used to assess the sustainable finance policy framework and possible financial instruments for solar energy
State Statistical Committee, Energy of Azerbaijan 2025	Energy balance, electricity statistics, energy consumption, renewable energy indicators	Used to support the national energy context with official statistical data
Azerenerji renewable energy integration ESIA report	Grid integration, transmission infrastructure, Banka and Bilasuvar solar power plants, AZURE-related infrastructure	Used to evaluate the importance of grid financing and transmission readiness for solar energy expansion
Azerbaijan Renewable Energy Agency and Ministry of Energy web resources	Solar potential, renewable energy stations, project pipeline, Garadagh, Shafag, Gobustan, Bilasuvar and Neftchala projects	Used to describe solar energy potential and project-level development
International institutional sources	Renewable energy finance, green bond principles, utility-scale solar project finance, international development finance	Used to compare Azerbaijan's case with broader green finance and solar investment practices

The document analysis focused on several key indicators and themes. The first group of indicators included solar electricity generation, the number of solar power plants, installed solar capacity, the renewable energy share in total installed capacity, and planned solar project capacity. The second group included financial and policy instruments like green loans, green bonds, sustainable finance taxonomy, power purchase agreements, auctions, tax and customs incentives, and international development finance. The third group centered on enabling infrastructure, which includes transmission lines, substations, grid connection, digital control systems, and battery energy storage.

We carried out the analysis through thematic coding of the selected documents. The main coding categories included solar energy potential, implemented solar projects, planned solar projects, green finance tools, fiscal incentives, investment mechanisms, grid integration, institutional roles, and policy gaps. We chose these categories based on the research objectives and the structure of the available official documents. After coding, we grouped the information into three analytical dimensions: solar energy development, green finance framework, and implementation conditions.

The study also uses descriptive comparison to show changes in solar electricity generation between 2022 and 2025. We based this comparison on the figures reported by the Ministry of Energy to track the increase in solar power generation over time. This comparison shows

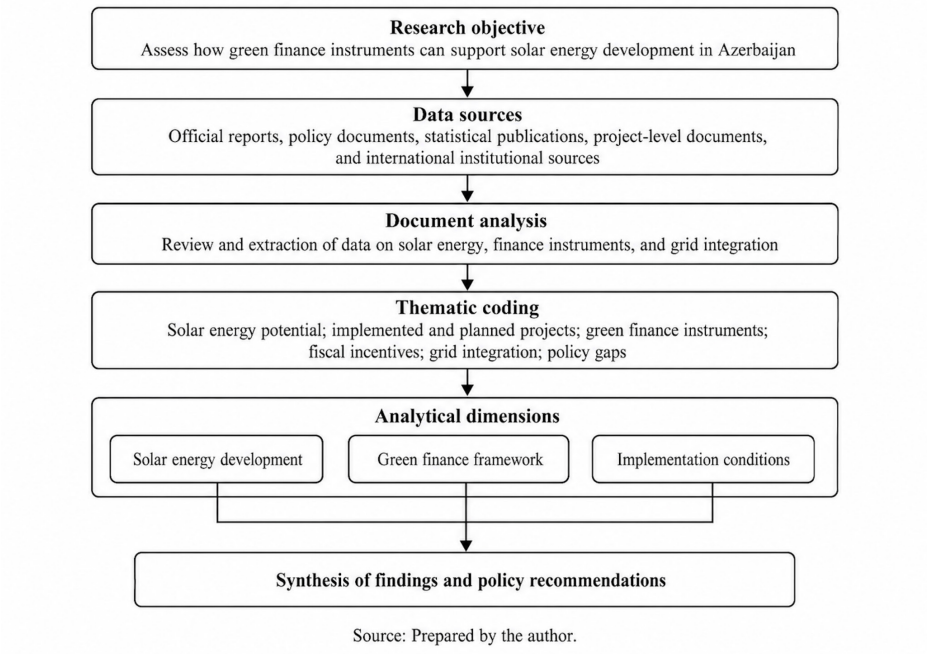

Figure 1: Research design of the study

whether solar energy is becoming a more prominent part of Azerbaijan's electricity system. Additionally, we compared selected solar projects, including Garadagh, Shafag, Gobustan, Bilasuvar, Neftchala, Shams, and Ufuq, to identify differences in scale, investment model, expected output, and financing relevance.

Figure 1 illustrates the general research design of the study.

The study has certain limitations. First, it relies mainly on official secondary data and does not include primary interviews with banks, investors, or project developers. Second, some financial details at the project level, such as exact tariff levels, loan conditions, and internal rates of return, are not publicly available. Third, the study emphasizes green finance tools and policy mechanisms instead of technical engineering modeling of solar energy systems. Despite these limitations, the chosen sources provide a strong foundation for evaluating how green finance tools can support solar energy development in Azerbaijan.

RESULTS AND DISCUSSION

The results show that Azerbaijan's solar energy sector has shifted from a limited generation base to a more significant part of the national electricity system. In 2022, electricity generation from solar power plants was 60.9 million kWh. This increased to 79.4 million kWh in 2023 and then jumped to 556.3 million kWh in 2024 and 599.9 million kWh in 2025. The biggest change occurred between 2023 and 2024, mainly because utility-scale solar generation joined the national energy mix. While solar energy still makes up a small portion of total electricity generation, the growth trend shows that solar power is becoming a more important area for energy transition and green investment in Azerbaijan.

Table 2: Solar electricity generation in Azerbaijan, 2022–2025

Year	Total electricity generation, million kWh	Solar electricity generation, million kWh	Estimated solar share in total generation, %
2022	29,004.30	60.9	0.21
2023	29,282.60	79.4	0.27
2024	28,395.20	556.3	1.96
2025	28,657.80	599.9	2.09

Source: Compiled by the author based on Ministry of Energy reports for 2022–2025

Figure 2 shows the significant rise in solar electricity production in Azerbaijan after 2023. This indicates that solar energy is becoming a more noticeable part of the national electricity system.

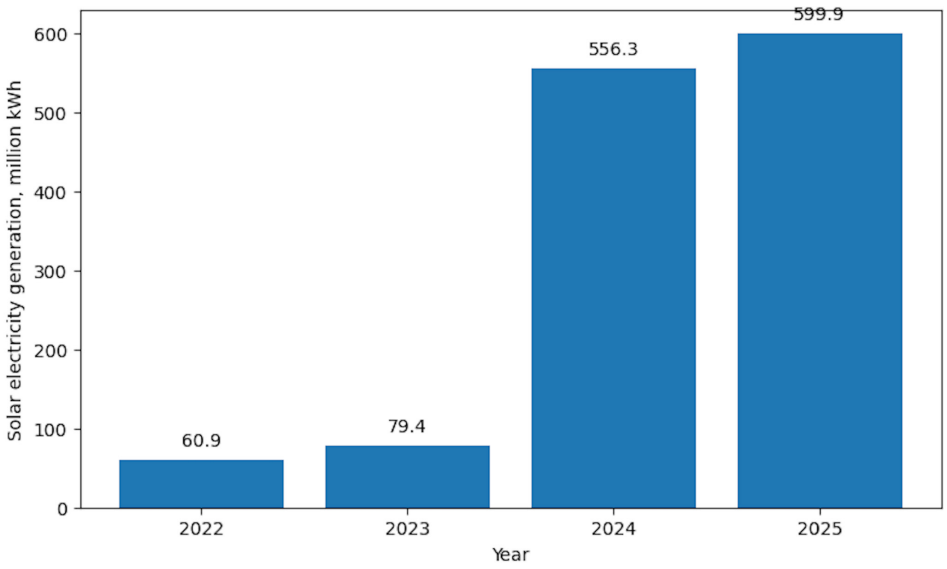

Figure 2: Solar electricity generation in Azerbaijan, 2022–2025

The data in Table 2 show that solar generation increased almost 9.9 times between 2022 and 2025. This is significant because it shows that solar energy is no longer just a potential for the future; it is now part of electricity production. However, the share of solar energy in total electricity generation remained around 2.09% in 2025. This indicates that the country has made clear progress, but solar energy still has much room for growth. From a green finance perspective, the gap between high potential and limited generation creates a strong reason for financing options that can speed up investment in solar power plants, grid infrastructure, and distributed solar systems.

The installed capacity indicators also confirm the growing

role of solar energy. In 2025, Azerbaijan had 9 solar power plants with a total installed capacity of 278.2 MW. That same year, the total installed capacity of renewable energy power plants, including hydropower, was 1,829.6 MW, making up about 18.8% of the country's total installed power capacity. In 2026, data published by the Ministry of Energy showed the total operating renewable energy capacity as 2,070 MW, which includes 278.2 MW from solar power plants. This indicates that solar energy is still smaller than hydropower in the renewable energy mix, but it is becoming the most important area for new private and foreign investment.

Table 3: Renewable and solar installed capacity indicators

Indicator	Value	Year / source context
Total installed power capacity	9,732.5 MW	2025
Number of operating solar power plants	9	2025
Installed capacity of solar power plants	278.2 MW	2025
Installed capacity of renewable energy power plants, including hydropower	1,829.6 MW	2025
Share of renewable power plants in total installed capacity	18.80%	2025
Total operating renewable energy capacity	2,070 MW	2026
Solar energy potential	23 GW	2026
Economically viable renewable energy potential	27 GW	2026

Source: Compiled by the author based on Ministry of Energy and AREA data

The difference between the installed solar capacity of 278.2 MW and the estimated 23 GW solar energy potential highlights the investment opportunity. Even if only a small portion of this potential is realized, the country will need significant funding for generation, grid connection, balancing, and storage. This makes green finance instruments crucial. Public policy can set targets and offer regulatory support, but the scale of future solar development depends on private investment, international development finance, green loans, green bonds, auctions, and long-term power purchase agreements.

Evidence from specific projects supports this view. Azerbaijan's current and planned solar projects showcase various financing and implementation models. The Garadagh Solar Power Plant is a prime example of foreign investment in large-scale solar energy. The project has a capacity of 230 MW and was developed with USD 262 million in foreign funding. It is expected to produce around 500 million kWh of electricity annually, save 110 million cubic meters of natural gas, and cut carbon emissions by 200,000 tons each year. This makes Garadagh a key example of how foreign investment and contractual arrangements can foster solar energy development.

The results in Table 4 show that Azerbaijan's solar

Table 4: Key solar energy projects and expected energy-economic effects

Project	Capacity	Investor / partner	Investment or financial indicator	Expected annual electricity generation	Expected annual gas saving	Expected annual CO_2 reduction
Garadagh Solar Power Plant	230 MW	Masdar	USD 262 million	~500 million kWh	110 million m^3	200,000 tons
Shafag Solar Power Plant	240 MW	bp / Shafag Solar Limited	Investment agreement and land lease signed	~500 million kWh	120–150 million m^3	260,000–330,000 tons
Gobustan Solar Power Plant	100 MW	Universal International Holdings Limited	Auction-based project	~260 million kWh	57 million m^3	124,000 tons
Bilasuvar Solar Power Plant	445 MW	Masdar	Part of "Mega" project	Not publicly specified	Not publicly specified	Not publicly specified
Neftchala / Banka Solar Power Plant	315 MW	Masdar	Part of "Mega" project	Not publicly specified	Not publicly specified	Not publicly specified
Shams Solar Power Plant	50 MW	Nobel Energy	Execution agreement signed	Not publicly specified	Not publicly specified	Not publicly specified

Ufuq Solar Power Plant	50 MW	Nobel Energy	Execution agreement signed	Not publicly specified	Not publicly specified	Not publicly specified
Floating solar pilot project, Boyukshor Lake	100 kW	ADB-supported pilot	Technical assistance / pilot model	Not publicly specified	Not publicly specified	Not publicly specified

Source: Prepared by the author based on official policy documents and project evidence

project pipeline is becoming more diverse. Garadagh is a completed foreign-invested utility-scale project. Shafag is a solar project linked to industrial decarbonization through the electrification of the Sangachal terminal. Gobustan uses an auction-based model, which is important for selecting competitive investors. Bilasuvar and Neftchala represent the next phase of large-scale solar development under Masdar's "Mega" project. Shams and Ufuq demonstrate the role of medium-scale solar projects in liberated territories and green energy zones. The floating solar pilot project provides an experimental model for future deployment on water surfaces.

From a green finance view, these projects show that solar energy development in Azerbaijan needs a mix of several tools rather than just one financing model. Large solar projects need investment agreements, power purchase agreements, land lease contracts, grid connection arrangements, and sometimes state-supported infrastructure. Smaller and distributed projects may need green loans, leasing models, subsidies, or low-interest credit lines. This difference is important because the financial structure of a 230 MW utility-scale solar plant is not the same as the financing needs of a rooftop solar system for a household or small business.

Table 5: Green finance instruments and their relevance to solar energy development in Azerbaijan

Green finance instrument	**Main function**	**Relevance to solar energy in Azerbaijan**	**Expected effect**
Green loans	Bank financing for eligible green projects	Suitable for rooftop solar, SMEs, agriculture and industrial self-consumption	Expands access to solar investment beyond large investors
Green bonds	Capital market financing for green projects	Suitable for utility-scale solar, grid infrastructure, substations and storage	Mobilizes long-term capital for large projects
Power purchase agreements	Provides long-term revenue certainty	Relevant for Garadagh, Shafag, Gobustan and future utility-scale projects	Reduces market and revenue risk
Renewable energy auctions	Competitive selection of investors	Relevant for Gobustan and future solar tenders	Improves price discovery and transparency
Tax and customs incentives	Reduces initial investment cost	Relevant for imported solar equipment and renewable energy technologies	Improves project feasibility
International development finance	Provides loans, guarantees, technical support and risk mitigation	Relevant for grid integration, AZURE-related infrastructure and project preparation	Reduces financing and implementation risks
Sustainable finance taxonomy	Classifies eligible green activities	Relevant for recognizing solar energy and grid integration as green activities	Reduces greenwashing and supports bank lending
Battery energy storage finance	Supports grid flexibility	Relevant for variable solar and wind integration	Reduces curtailment and balancing risks

Source: Prepared by the author based on official policy documents and project evidence

The Sustainable Finance Roadmap 2023 to 2026 offers a foundation for several of these tools. It highlights green loans, green bonds, taxonomy, climate risk management, and market transparency as key areas for Azerbaijan's financial sector. This is important because Azerbaijan's financial system mostly relies on banks, with bank assets accounting for over 90% of the total. Consequently, green lending can serve as a useful tool for increasing solar energy finance, particularly for small and medium-sized businesses, rooftop solar systems, and industrial self-consumption projects. Meanwhile, green bonds may suit larger infrastructure needs better, such as solar power plants, transmission lines, substations, and battery energy storage systems.

Grid integration stands out as a crucial finding of the study. Expanding solar energy requires more than just building generation facilities. Transmission lines, substations, SCADA systems, balancing mechanisms, and storage capacity are also essential. The renewable energy integration project of Azerenerji is directly connected to this matter. The project aims to support the integration of 1 GW of renewable electricity into the national grid, which includes the 315 MW Banka and 445 MW Bilasuvar solar power plants, along with the 240 MW Absheron wind power plant. This project also involves constructing the Navahi substation and high-voltage transmission lines, covering the Bilasuvar GES to Navahi and Banka GES to Navahi routes. This indicates that grid infrastructure is a vital part of solar finance.

The figures in Table 6 show that financing solar energy

Table 6: Grid infrastructure and solar integration indicators

Infrastructure / project component	Numerical indicator	Relevance to solar energy finance
Renewable electricity to be integrated into the grid	1 GW	Shows the scale of grid readiness needed for solar and wind
Banka Solar Power Plant	315 MW	Requires grid connection and transmission capacity
Bilasuvar Solar Power Plant	445 MW	Requires high-voltage transmission integration
Combined Banka and Bilasuvar solar capacity	760 MW	Represents the main solar component of the integration project
Navahi substation	500/330/10 kV	Strategic grid node for renewable integration
Bilasuvar GES–Navahi transmission line	330 kV, about 90–91 km	Supports integration of Bilasuvar solar output
Banka GES–Navahi transmission line	330 kV, about 100 km	Supports integration of Banka solar output
Planned battery storage systems	250 MW / 500 MWh	Supports balancing and flexibility for variable renewable energy

Source: Compiled by the author based on Azerenerji and Ministry of Energy data

in Azerbaijan needs to be seen as an investment issue at the system level. Solar power plants require photovoltaic panels and land, along with transmission infrastructure and storage capacity. The planned 250 MW / 500 MWh battery energy storage systems are especially crucial because higher shares of solar and wind power can raise balancing needs. In this context, green bonds and international development finance may be better suited for grid infrastructure, while green loans may work well for distributed solar systems.

Another important finding is the role of tax incentives. Renewable energy projects often rely on imported equipment, such as photovoltaic panels, inverters, control systems, and grid components. Tax and customs incentives can lower the initial capital cost of these technologies and make projects more financially viable. These incentives should be seen not just as tax policy but also as a green finance tool because they help reduce investment costs and improve the bankability of renewable energy projects.

The results also indicate that Azerbaijan's solar development has two different investment paths. The first path is utility-scale solar, including projects like Garadagh, Shafag, Gobustan, Bilasuvar, and Neftchala. This path relies on foreign investment, auctions, power purchase agreements, land arrangements, grid connection, and international finance. The second path is distributed solar, which covers rooftop solar systems in homes, public buildings, social infrastructure, and small businesses. This path needs green loans, leasing schemes, subsidies, and simpler grid connection procedures. The installation of over 5 MW of solar panels in more than 1,500 individual homes and public or social buildings in liberated territories shows that distributed solar can also play a key role in regional green development.

Overall, the findings indicate that green finance tools can support solar energy development in Azerbaijan through four main channels. First, they can attract more capital for solar projects and related infrastructure. Second, they can lower investment risks through long-term contracts, auctions, tax incentives, and development finance. Third, they can enhance transparency through taxonomy, disclosure, and ESG risk management. Fourth, they can support both large-scale and distributed solar models. Therefore, developing solar energy in Azerbaijan should be seen as a combined process of policy, finance, and infrastructure rather than just an energy generation issue.

CONCLUSION

This study analyzed the potential of the green finance instruments for the development of solar energy in Azerbaijan. The findings revealed that electricity generation from solar rose from 60.9 million kWh in 2022 to 599.9 million kWh in 2025; the country's estimated 23 GW solar potential suggests the potential for further growth. Solar energy development in Azerbaijan is transitioning from policy to large scale projects like Garadagh, Shafag, Gobustan, Neftchala and Bilasuvar projects are a testament to this.

Solar energy development needs a mix of financial, institutional and infrastructural arrangements, the study

finds. Power purchase agreements, renewable energy auctions, tax and customs benefits, green loans, green bonds, international development finance and grid modernisation can help to lower investment risks and enhance project bankability. To support large scale solar installations, long-term guarantees both contractual and grid related are needed, and to support distributed solar, green credit, green leasing and fiscal support are required. The main weakness of the study is that it uses official secondary data, which means that a great deal of information regarding tariff levels, conditions of the loans and information regarding the indicators of return of the projects is only available in an aggregated form. Expert interviews and bank-level surveys and financial feasibility modelling could serve to enhance this analysis in the future. In general, green finance offers a potential in Azerbaijan to make the transition from potential sun power to wider use of solar energy.

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