



EXPANDING GREEN INVESTMENTS AND ENSURING ENERGY INDEPENDENCE THROUGH THE INSTALLATION OF SOLAR PANELS IN HOUSEHOLDS

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Abstract

This article analyzes the potential for unlocking green investment opportunities in Uzbekistan through the implementation of household-scale solar panels. Meeting the energy needs of the population via sustainable and environmentally friendly sources not only strengthens economic independence but also contributes to environmental stability. The research thoroughly examines the economic efficiency of micro-level investments, the rational use of resources, the achievement of reduced electricity costs, and the prospects for scaling this model across households. Based on a SWOT analysis, existing opportunities and constraints are identified, framing this approach as a practical tool for Uzbekistan's long-term green development path.

Keywords: Solar energy, green investments, households, energy independence, environmental sustainability, SWOT analysis, renewable energy sources, prosumer, economic efficiency.



Introduction

In recent years, rising energy prices, power supply interruptions, and global environmental challenges have necessitated a comprehensive review of energy policy in Uzbekistan. The demand for continuous energy is growing steadily, particularly in rural and remote areas. Simultaneously, transitioning to ecologically safe, clean, and sustainable energy sources has become critical in mitigating climate change and reducing environmental pollution.

The widespread implementation of renewable energy sources is a cornerstone of the state policy of the Republic of Uzbekistan. Specifically, the Resolution of the President of the Republic of Uzbekistan No. PP-57¹, dated February 16, 2023, serves as a pivotal regulatory framework aimed at the rapid development of renewable energy and energy-saving technologies. In accordance with this resolution, mechanisms were introduced for installing solar panels in households and selling surplus generated electricity back to the national grid. The allocation of a subsidy of 1,000 UZS for every 1 kWh of electricity supplied to the grid, along with the tax exemption of this income, has significantly increased public interest in alternative energy.

This mechanism plays a vital role in increasing the share of renewables and ensuring the stability of the overall energy system. Utilizing solar energy at the household level is not only an approach based on green economy principles but also an effective tool for economic efficiency, energy independence, and the reduction of environmental footprints. Through this approach, each household can independently meet its energy needs, reduce costs, and transition toward a sustainable economic model.

Within the framework of this concept, this article aims to analyze the opportunities for expanding green investments at the micro-level and achieving energy stability through the implementation of solar panels in households.

Research Methodology

This research examines the opportunities for expanding green investments and achieving energy independence through the implementation of household-scale solar panels, utilizing a two-stage methodological approach.

¹ <https://lex.uz/uz/docs/-6385716>



Stage 1: SWOT Analysis In the first stage, internal factors (strengths and weaknesses) and external factors (opportunities and threats) related to solar energy utilization were systematically analyzed using the SWOT analysis method. This approach facilitated a comprehensive evaluation of practical scenarios, prevailing conditions, and potential outcomes arising from the implementation of this technology.

Stage 2: Comparative Analysis In the second stage, a comparative analysis approach was employed. Empirical differences between households with installed solar panels and those consuming traditional grid electricity were identified and tabulated based on energy costs, degree of independence, environmental impact, and investment efficiency. This approach serves to clearly demonstrate the economic benefits, cost savings, and positive environmental impacts based on empirical data.

Data and Context The analysis is based on key indicators within the context of Uzbekistan, including the number of sunny days, average energy consumption patterns, and solar panel pricing. Furthermore, the best practices of countries such as Turkey and India were studied to assess their adaptability and relevance to the specific conditions of Uzbekistan.

Analysis and Results

The implementation of solar energy technologies at the household level is emerging as a critical pathway for ensuring energy stability and transitioning toward a green economy in Uzbekistan. Consequently, this study analyzes the economic, environmental, and social efficiency of domestic solar panel installation practices.

During the analysis, the strengths, weaknesses, opportunities, and potential threats of installing solar panels in households were identified based on the SWOT methodology:



Strengths (S)	Weaknesses (W)
* Significant reduction in electricity bills	* High initial investment costs
* Creation of an independent energy source	* Requirement for technical maintenance and services
* Reduction of \$CO_2\$ emissions	* Not all household rooftops are technically suitable
* System resilience against power outages	* Panel efficiency is seasonally dependent
Opportunities (O)	Threats (T)
* Government subsidies and credit programs	* Price volatility of imported equipment
* Development of local manufacturing	* Insufficient public trust in the technology
* Creation of an energy resale market (Net Metering)	* Lack of legal/regulatory clarity in certain areas

Based on this SWOT analysis, it is evident that the positive aspects of installing solar panels in households outweigh the drawbacks. The most critical factor is the reinforcement of support mechanisms—such as credits, subsidies, and maintenance services—alongside efforts to increase public trust. Furthermore, this technology provides a positive impetus for the development of local infrastructure, manufacturing, and the service sector. Drawing on the experiences of Turkey and India, the large-scale adoption of residential solar panels has significantly reduced the demand for energy imports and strengthened overall energy stability.

The primary indicators for installing 1 kW, 2 kW, and 3 kW solar panel systems under Uzbekistan's specific conditions—namely, minimum and maximum monthly energy production capacity, installation costs, and required surface area—are presented in Table 1. This data enables homeowners to pre-evaluate the most suitable panel capacity based on their energy requirements and estimate potential financial returns relative to their investment level.

Table 1

Capacity (kW)	Monthly Energy Production (kWh)	Installation Cost (UZS)	Required Area (m ²)
1 kW	150 – 224 kWh	6,000,000 – 7,000,000	6 – 7 m ²
2 kW	300 – 448 kWh	11,000,000 – 13,000,000	12 – 14 m ²
3 kW	450 – 700 kWh	16,000,000 – 18,000,000	18 – 21 m ²

The results of Table 1 indicate that a 3 kW solar system is capable of fully meeting the average monthly electricity demand of a household. (Table 2 is structured specifically based on this capacity to illustrate the economic disparity between households with and without solar panel installations.)

According to the progressive tariff system implemented for residential consumers in the Republic of Uzbekistan starting May 1, 2025, the following rates apply:

1. **0 – 200 kWh:** 600 UZS/kWh
2. **201 – 500 kWh:** 800 UZS/kWh
3. **501 – 1,000 kWh:** 1,000 UZS/kWh
4. **Above 1,001 kWh:** 1,500 UZS and higher

Based on these tariffs, an average household consuming **500 kWh** of electricity per month would incur a monthly cost of **360,000 UZS**, totaling **4.32 million UZS** annually. By installing residential solar panels, households can eliminate these recurring expenses, achieving significant long-term financial savings and economic resilience.

Table 2²: Comparative Analysis of Households With and Without 3 kW Solar Systems

Indicators	Household With Solar Panels	Household Without Solar Panels
Monthly Consumption	500 kWh	500 kWh
Tariff-Based Payment (2025)	0 UZS (Self-generated energy)	360,000 UZS
Annual Payment	0 UZS	4,320,000 UZS
Initial Investment	~18–20 million UZS (3 kW capacity)	0 UZS
Payback Period	4 – 5 years	—
Profit After 5 Years	~4 million UZS annual savings	—
Status During Outages	Independent system, no interruptions	Fully dependent on the national grid
CO ₂ Emission Impact	Positive, significantly reduced	Negative, continuous footprint
Surplus Energy	Can be sold to the grid or neighbors	None
Long-Term Benefits	Savings + Income + Environmental stability	Ongoing costs, no stability

² Table 2 was developed by the author based on the technical capabilities and economic efficiency of a 3 kW solar power system.



Analysis of Table 2

As illustrated in the table above, although households installing solar panels face high initial costs, these expenses are fully recouped within **4–5 years** through the payback period. Following this phase, homeowners achieve an annual saving of approximately **4 million UZS** and gain the potential to generate additional income by selling surplus energy back to the grid.

In contrast, households without solar installations are subject to continuous and increasing expenses, especially in a landscape of annually rising electricity tariffs. Furthermore, they remain vulnerable to power outages and continue to contribute to a negative environmental footprint while maintaining total dependency on the national grid.

Based on this, it is no exaggeration to state that installing solar panels in households is a paramount form of green investment that delivers both environmental sustainability and significant economic benefits.

Conclusion

The research and analysis conducted in this study demonstrate that the implementation of household solar panels in Uzbekistan presents a transformative opportunity. It not only addresses the nation's energy challenges but also fosters the development of a **green economy at the micro-level**. The results confirm that a solar power system is highly effective for the average household, fully covering monthly electricity demands while generating a surplus that provides additional economic value. Consequently, residential solar energy is established as a reliable, long-term, and sustainable source of financial stability for the population.

Recommendations

To accelerate the transition toward renewable energy and maximize the socio-economic benefits for the public, the following recommendations are proposed: **Effective Utilization of the Regulatory Framework:** In alignment with the Resolution of the President of the Republic of Uzbekistan No. PQ-57 (dated February 16, 2023), it is essential to streamline the state-mandated buyout of surplus electricity. This mechanism is the primary driver for reducing household utility expenses and achieving greater energy independence.



Encouraging Private Investment: For households utilizing personal capital, the data shows an initial investment payback period of 5–6 years. Beyond this period, the system generates pure net profit. Financial institutions should promote this as a low-risk, high-return investment to encourage wider adoption.

Expansion of the Green Labor Market: The large-scale deployment of solar technology should be coupled with vocational training programs. This transition will create significant employment opportunities for technical installers, maintenance specialists, and local manufacturers, while also boosting the energy consultancy and financial services sectors.

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