Investing in Green Energy: Profitability Analysis of Solar Energy for Household Consumption in Albania

MARIOLA KAPIDANI, ENI NUMANI
Department of Finance, Faculty of Economy,
University of Tirana,
Street "Arben Broci', Tirana,
ALBANIA

Abstract: - Exhaustion of conventional non-renewable energy sources together with climate change mitigation presents challenges for policy makers globally. An alternative to address the increased demand for energy with less negative impacts on the environment is using renewable energy sources whose reserves are supplemented by natural ecosystems. Furthermore, EU directives impose actions on Member States for the reduction of pollution from conventional sources. Countries must aim to increase the share of renewable energy sources in energy consumption, as significant measures towards sustainable development. However, several factors affect the succession of green energy adoption, where financial considerations remain key determinants in decision-making by companies, families, and institutions. The study conducts a cost-benefit analysis using methods of capital budgeting to evaluate the profitability of solar energy for household consumption in Albania. The paper aims to provide insights into the potential of green energy investment in Albania, focusing on the solar energy sector and financial factors that are relevant to these investments' succession. Data analysis and forecasting are conducted for a lifespan of 30 years, assessing average data of electricity prices, the productivity of solar panels, direct costs of investment, interest rates, exchange rates, and inflation rates. The study concludes that investing in solar panels for household consumption in Albania is profitable, as it is reported that discounted benefits exceed the investment cost.

Key-Words: - green energy, solar energy, solar panels, sustainable energy sources, profitability, cost-benefit analysis.

Received: June 19, 2023. Revised: October 21, 2023. Accepted: November 23, 2023. Available online: December 15, 2023.

1 Introduction

The demographic changes that have occurred in recent years, associated with the increase in population concentration in urban centers but also with the increase in energy consumption as a result of the higher use of electric equipment, highlight the need to address alternative sources of energy production. Albania, with a population of about 2.85 million inhabitants, uses hydropower as the main source of electricity supply, thus being ranked among the countries with abundant sources of renewable energy, [1]. The use of hydropower offers an advantage in reducing CO_2 in the energy sector; however, it makes the country highly dependent and sensitive to climate change. Another indicator is the fluctuation in the level of energy production from hydropower plants, which is related to the level of rainfall in the country. This leads to an increase in the import of electricity, also reflected in the financial cost of the sector. According to official statistics, the residential building sector in Albania constitutes almost 54% of the total electricity consumption, increasing the cost of electricity supply mainly due to an augmentation in imports in the winter season. Thus, the need for a higher diversification of renewable energy sources produced in the country should be taken into consideration, aiming to use not only cost-effective technologies but with the primary focus on mitigating the long-term effects on the country's environmental parameters, [2].

Regarding the developments in the region, the energy transition to sustainable energy sources is gradually taking place in Southeast Europe, even though not all the countries are actively taking significant incentives, [1], [3]. The region traditionally uses older technology, predominantly by highly polluting power plants that should be immediately transitioned to renewable technologies within the parameters to reduce emissions. Moreover, the countries in the region that are part of

the EU have committed under the Paris Agreement, to stop using fossil fuels by 2050. These measures include coal which must be replaced earlier as an energy source, but also oil and gas reduction. In the coming years, it is expected to include all the Western Balkan countries in this agreement, as important measures of sustainable development goals, aiming the reduction of environmental effects of the energy sector, [3].

Currently, several measures have been taken in Albania, both by private entities and by public institutions responsible for incentivizing the use of solar energy, as a criterion to lower the financial costs of energy but also as a form of increasing energy sustainability. Mainly, there is an increase in adopting solar energy, especially for water heating by family consumers, companies, and to a lesser extent public institutions. However, the initial financial costs of investing in solar panels, installation, and maintenance, are determining factors in whether consumers are encouraged to "transition" to green energy by different entities, [4]. Effective energy generation, transmission, and expanded use are critical to the country's overall development agenda. Albania is expected to advance its energy-generating capabilities, especially focusing on developing hydropower and renewable energies, [2], [4]. The country's clean energy sector offers many benefits in relation to hydropower and solar energy.

This paper aims to address the recent developments in the renewable energy sector in Albania, focusing on the potential of solar energy profitability for household consumers. Quantitative data analysis is conducted using methods of capital budgeting to assess the profitability of solar panels, taking into consideration the different cost aspects of the sector. The study evaluates the expected values of electricity prices for 30 years and assesses the outputs of the solar panels in financial terms for the given interval. The study aims to contribute to the current literature on solar energy profitability, by providing evidence from the case of Albania regarding the use of solar energy in household consumption through capital budgeting analysis by using: NPV, IRR, and Payback period.

2 Overview of Albania's Renewable Energy Sector

Albania uses different resources of energy varying from the most traditional ones such as oil and gas, hydropower, natural forest biomass, coal, and other renewable energy sources. The largest share of the total energy supply in Albania is attributed to oil (64%), followed by hydropower (22%) and fuelwood (12%), according to World Bank data. Sectors such as: transportation, household, and industry consume the highest amounts of energy, respectively at 44%, 23%, and 13%. However, the primary source of electricity generation from renewable sources is hydropower, constituting 95% of the country's installed capacity with a total of 2096 MW installed, [4]. According to EUROSTAT statistics, [5], the energy share in Albania from renewable energy sources reached 45,01% of the total energy consumption in 2020, exceeding the target of 38%. The significant increase, is among other factors, attributed to the Covid-19 pandemic which led to a considerable shortage in energy consumption, mainly evident in the transport sector. The share of energy from renewable sources in Albania, 2010-2020 is presented in Figure 1.

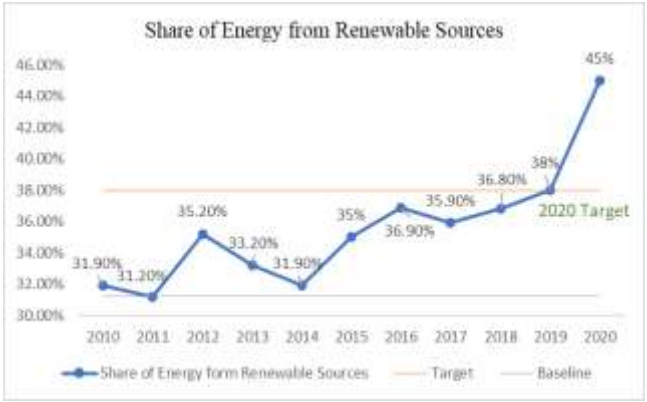

Fig. 1: Share of energy from renewable sources in Albania, 2010-2020.
Source: EUROSTAT 2022; Energy Community Secretariat, [5], [6].

In recent years, Albania has shifted its energy efficiency policy as part of the country's strategy to boost investments in green energy sources and prioritize such resource usage, [6]. However, these incentives should be strengthened by adapting fiscal policies, and support plans and by enhancing the framework of the sector regulations. The energy sector in Albania is also vulnerable to a high dependency on hydroelectricity and despite the country's vast water resources, hydropower potential is achieved at a moderate level of 35%, [7]. According to the study by the World Bank, this context of hydropower deployment is explained in part due to the limited financial viability and limited cost-recovery schemes currently in place, accounting for the low level of investment into the sector.

Taking into consideration the climate conditions of Albania, it presents a considerable potential for producing renewable energy and more specifically solar energy. Solar insolation in Albania is very high with more than 1500 kWh/m2 annually throughout the territory of the country, with peaks of 1753 kWh/m2 annually, where the western part of the country dominates in terms of solar radiation, [4]. Compared to other European countries, Albania is listed among the countries with the highest number of sunshine hours per year, presenting adequate conditions for the development of solar photovoltaic projects for power generation and solar thermal for heating purposes. The installed solar energy capacity, calculated as cumulative installed solar capacity measured in gigawatts (GW), has increased significantly after 2018, as is shown below in Figure 2. These developments are also affected by the global energy crisis that imposed higher tariffs on electricity and a general increase in the cost of energy sources, shifting the interest to alternative sources of energy less dependent on international markets, and more cost-effective.

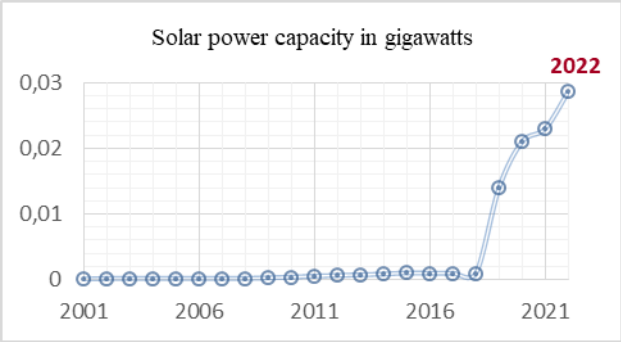

Fig. 2: Installed solar energy capacity in Albania, 2001-2022.
Source: International Renewable Energy Agency (IRENA), [4], [8].

During the year 2023, the Albanian government applied a scheme to promote the use of solar panels for heating water by family customers, which aims to subsidize 70% of the cost from the Energy Efficiency Agency. This measure aims to: reduce electricity consumption and improve the supply of hot sanitary water; as well as the reduction of CO_2 emissions in the environment. Even though in the last 5 years in Albania there has been a significant increase in investments in solar energy, assessment of availability and economic potential of the sector is very limited in studies. In this context, it presents obstacles in policy development by the corresponding institutions in setting achievable targets for the sector.

3 Literature Review

For many years, studies have addressed energy contributions to a sustainable economy, stating that shifting from traditional energy sources to solar energy systems is crucial to obtain cumulative effects on the environment. The advantages of using green energy sources rely on cost-effective technologies provided, and in building a more climate-resilient energy system through diversification of energy sources, [4]. The self-consumption of energy through solar panels for the household and residential sector is an important step to reduce the electricity financial cost and greenhouse gas emissions, [9], [10]. Solar energy provides relevant benefits to the environment, but the adoption of solar energy by the industrial, commercial, and household sectors is highly dependent on economic factors, [11], [12]. The presence of challenges in solar energy generation projects includes factors such as high initial investment costs and moderate support by public institutions, [13].

The measurement of economic profitability is complex because it involves the study of intricate networks of variables involving technical aspects, accounting indicators, prediction of financial data, and assumptions on financing decisions, [14]. The study of decision-aiding tools to measure investment profitability is significantly important, considering uncertainty and it aims to provide evidence on relevant factors that may affect the decision to use solar energy. Different models are presented by authors of the field, analyzing in both absolute and relative terms the sources of value creation. Methods used by different authors include the net present value (NPV), the rate of return, and the financial efficiency, focusing on overcoming the limitations of the internal rate of return (IRR), which is generally used in benefit-cost analysis, [15].

According to IEA's study of 2022 (International Energy Agency), solar industry profitability in the past decade is reported to be volatile, showing lower average profit margins than the oil, coal, chemical, and semiconductor industries, [16]. For the European Union countries, a lack of specialization in the solar industry across the supply chain is evident, affecting the sector costs as well, [17]. However, several studies prove through sensitivity analysis that solar systems with energy storage result in being profitable for all household types, [18], [19].

The methodological approach takes into account the influence of the electricity cost and the discount rate, applying separate analyses for the different

types of systems such as photovoltaic solar panels or solar water heaters. A rising electricity price is expected to positively affect the investment in a photovoltaic solar system by making solar energy sources more attractive, [20]. The rentability of solar energy systems is affected by technological, political, and geographical aspects, [21].

Different results might be found when taking into consideration the study of the firm profitability compared to family consumers of solar energy systems, but especially when comparing implementation in different locations affected by specific weather conditions, subsidies policies, and efficiency factors, [22]. Overall, the results of several studies suggest the need for support programs to facilitate the financing of renewable energy sources, as important incentives that influence investment decision-making. In this context, cooperation between the institutional stakeholders, financial institutions, and market mechanisms is essential for the significant development of the solar energy sector, [23].

4 Methodology

In this section, an analysis of the profitability of solar panels as a source of energy for household customers is carried out. To assess the profitability of the investment, three assessment methods have been used:

(i) net present value,
(ii) internal rate of return, and
(iii) payback period.

The net present value (NPV) is the difference between the present value of cash inflows and outflows. Cash inflows are the annual savings of household consumers from the use of solar panels compared to traditional energy, while cash outflow is the initial investment necessary for the purchase and use of solar panels. The investment will be considered profitable if the net present value is positive.

NPV is calculated:

$$NPV = \sum_{t=o}^{n} \frac{CF_t}{(1+i)^t}$$

Where:
CF_t - the cash outflow or inflow of the investment project during its duration
i – the discount rate
t – the duration of the solar panel investment

In our analysis, cash outflow refers to the initial investment for purchasing and installing the solar panels. This cost is calculated based on the number of solar panels needed by a family based on data for the average annual consumption in the last three years in Albania and the market price of solar panels sold in national markets. Data is retrieved from the dataset of the Energy Regulator Authority for the annual consumption of household tariff customers for the period 2020 - 2022.

Cash inflows represent the future savings from using solar panels instead of traditional electricity sources. The average annual consumption for the last three years in kwh is converted into monetary value using the price per kWh of electricity consumption in the Republic of Albania, which is 11.4 ALL per kwh (including VAT) for household tariff customers, [24]. For the upcoming years, the market price of electricity is indexed to the annual inflation rate to determine the expected price of electricity to be paid by household tariff customers.

The analysis is carried out for 30 years which is the average expected lifespan of solar panels. The discount rate used is the annual interest rate of the loan with maturity equal to the average lifespan of the solar panels (30 years).

The internal rate of return is the rate of return realized by the investment, where the present value of cash inflows is equal to the present value of cash outflows. So, NPV = 0. According to this method, the investment will be considered profitable if the internal rate of return is higher than the interest rate of the loan with a maturity of 30 years.

$$\sum_{t=o}^{n} \frac{CF_t}{(1+i)^t} = 0$$

The analysis based on this method is derived from the NPV.

The payback period shows the time it takes on average for a household consumer to repay the initial investment made for the purchase of solar panels. According to this method, the investment will be considered profitable if the initial investment can be repaid before the maturity of the investment in solar panels. Since this method does not consider the time value of money, the discounted payback period is calculated for a better analysis.

5 Assessment of the Profitability of Solar Panels

The following table (Table 1) provides data to estimate the average annual use of electricity by household consumers for the last three years.

Table 1. Electricity is used by household customers

	2020	2021	2022	Average
Total use by household customers (Mwh)	2,956,703	3,081,617	3,074,801	
Number of household customers	1,100,331	1,279,460	1,109,124	
Average annual use by household customers (Kwh)	2,687	2,409	2,772	2,623

Source: Energy Regulator Authority, Annual reports: 2020, 2021, 2022, [24], [25], [26].

Referring to these data, the average annual use of electricity by a family during the last three years is 2,623 kWh. Using the current price of electricity for household customers, the average annual expense of a family in our country is: 2,623 kwh/year * 11.4 ALL/kwh = 29,902 ALL/year.

Regarding the inflation in Albania, it is expected to be 3.37% in 2024 and 3.02% for the following years until 2028, [27]. For the period after 2028, the 3% targeted inflation rate set by the Central Bank of Albania was used as the expected inflation rate. Table 2 shows the average annual electricity consumption by household customers which is indexed with the expected inflation rate for the next 30 years.

Regarding the energy produced by a solar panel, it is known that a panel system with a power of 1 kWh produces an average of 750 - 850 kWh of electricity in a year, [28]. To meet the average demand of a family in our country, a total power capacity of 3.08 - 3.5 kWh would be needed. The average price of purchasing and installing solar panels with a power of 1 kWh according to the market value in Albania is currently 1,000 euros. Consequently, to meet the annual electricity needs a family should buy 4 solar panels with a power of 1 kWh and invest/spend 4,000 euros initially. The assessment of the profitability of using solar panels as an energy source is done using the average interest rate for a 30-year maturity loan, which is about 6%, [29].

Table 2. Average annual electricity expenditure indexed with inflation, years 2023-2053

Year	Expected inflation	Average annual electricity consumption (ALL)
Base year 2023		29,902
2024	3.37%	30,910
2025	3.02%	31,843
2026	3.02%	32,805
2027	3.02%	33,796
2028	3.02%	34,816
2029	3%	35,861
2030	3%	36,936
2031	3%	38,045
2032	3%	39,186
2033	3%	40,361
2034	3%	41,572
2035	3%	42,819
2036	3%	44,104
2037	3%	45,427
2038	3%	46,790
2039	3%	48,194
2040	3%	49,640
2041	3%	51,129
2042	3%	52,663
2043	3%	54,242
2044	3%	55,870
2045	3%	57,546
2046	3%	59,272
2047	3%	61,050
2048	3%	62,882
2049	3%	64,768
2050	3%	66,711
2051	3%	68,713
2052	3%	70,774
2053	3%	72,897

Source: Authors calculations

5.1 Calculation of NPV, IRR, and Payback Period

The following table (Table 3) provides inputs for calculating the profitability indicators of solar panels.

Table 3. NPV of using 4 kWh solar panels.

Year	Initial investment	Annual savings	Discounted savings	Cumulative NPV
2023	(427,480)			(427,480)
2024		30,910	29,160.1	(398,319.9)
2025		31,843	28,340.3	(369,979.6)
2026		32,805	27,543.6	(342,436.0)
2027		33,796	26,769.2	(315,666.8)
2028		34,816	26,016.7	(289,650.1)
2029		35,861	25,280.3	(264,369.8)
2030		36,936	24,564.9	(239,804.9)
2031		38,045	23,869.6	(215,935.3)
2032		39,186	23,194.1	(192,741.2)
2033		40,361	22,537.6	(170,203.6)
2034		41,572	21,899.8	(148,303.8)
2035		42,819	21,280.0	(127,023.8)
2036		44,104	20,677.7	(106,346.1)
2037		45,427	20,092.5	(86,253.6)
2038		46,790	19,523.8	(66,729.8)
2039		48,194	18,971.3	(47,758.5)
2040		49,640	18,434.4	(29,324.2)
2041		51,129	17,912.6	(11,411.5)
2042		52,663	17,405.7	5,994.1
2043		54,242	16,913.1	22,907.2
2044		55,870	16,434.4	39,341.6
2045		57,546	15,969.3	55,310.8
2046		59,272	15,517.3	70,828.1
2047		61,050	15,078.1	85,906.3
2048		62,882	14,651.4	100,557.6
2049		64,768	14,236.7	114,794.4
2050		66,711	13,833.8	128,628.2
2051		68,713	13,442.3	142,070.5
2052		70,774	13,061.8	155,132.3
2053		72,897	12,692.2	167,824.5
Value	(427,480)		595,304.5	
NPV = 167,824.5 ALL				

Source: Authors calculations

For the calculation of the initial investment in ALL (Albanian Lek), it was used the official exchange rate of the euro published by the Bank of Albania on the date of calculations (September 11, 2023).

The first method used is the net present value, which is calculated as the difference between the present value of inflows and outflows. After discounting the cash flows at the rate of 6%, the NPV of the investment in solar panels results positive (167,824.5 ALL), which shows that such an investment is profitable.

Another method for assessing the profitability of an investment is the IRR (Internal Rate of Return). Mathematically, IRR is the interest rate that equals the present value of cash inflows with the present value of cash outflows. The calculations performed show that the internal rate of return is 8.86%, which is greater than the interest rate of the loan with a maturity of 30 years. Consequently, this method leads to the same conclusion as in the case of the NPV method.

The payback period, although less frequently used, is another method applied to determine whether an investment is profitable or not. The calculations show that the repayment period of this investment is 11.73 years. Since this method does not consider the time value of money, which is the main disadvantage, the above table provides data for the calculation of the discounted payback period. Considering the latter, the investment in solar panels has a payback period of 18.65 years, which means that the investment is paid off during the period of their use.

The results of the four methods are summarized in Table 4 below:

Table 4. Summary of results

Method	Result	Investment decision
NPV	167,824.5 ALL	Profitable
IRR	8.86%	Profitable
Payback	11.73 years	Profitable
Discounted payback	18.65 years	Profitable

Source: Authors calculations

Based on the above cost–benefit analysis, we can conclude that investing in solar panels is profitable because the discounted benefits exceed the investment cost.

6 Conclusion and Recommendation

Climate change mitigation, the increased cost of traditional energy sources, and fluctuation in electricity production by hydropower sources are some of the factors that motivate a shift towards alternative green energy sources. In this context, Albania has undertaken significant steps in adapting to solar energy production in the country, although it has not reached its full potential.

This study analyses the financial profitability of solar panels for household consumption in Albania, providing quantitative evidence regarding the costs and benefits of solar energy. The study results show that solar energy investment for household energy consumption in Albania is profitable. The discounted cash flows take into consideration forecasting based on the inflation rate, interest rate, exchange rate, and electricity expenditures. The net present value method assessment shows that discounted benefits are higher than investment costs, resulting in a positive NPV. According to the internal rate of return analysis, IRR is equal to 8.86% exceeding the cost of financing the solar panels. The payback method leads to the same conclusion as in the case of the two other methods, supporting the argument of profitability in solar power usage with an investment repayment of 18.65 years. However, further steps should be taken to fasten the incentives toward solar energy in Albania, not only for the household sector but also for the private sector and public institutions.

Some of the considerations should be in the direction of aligning the national legislation and secondary legislation supporting the solar power sector framework. On the other hand, permitting procedures should be simplified to facilitate incentives for investment in solar energy. Another aspect is supporting the private sector in accessing financing, where public institutions can be an important mechanism to ensure adequate policies, and advise project documentation, contracting, and consolidating procedures. The banking sector in Albania is an important financial source to support solar energy investments, especially in the case of household consumers. This sector could design specific financial products to support these investments, incorporated under existing products such as loans for housing, etc. Another important factor that should be taken into consideration is the human resources adequately skilled with technological insight. Education institutions and training centers should adapt their curricula in pace with the new technology trends and market dynamics to respond to the technological advancement of the renewable energy sector. Cooperation between the institutional stakeholders is imperative to formulate strategies and awareness campaigns to sensitize the public on the deployment of green energies and their benefits.

6.1 Limitations of the Study

The study focuses on evaluating the profitability of solar energy based on secondary data for the household sector in Albania. Future studies should address additional factors that contribute to the topic, gathering primary data through questionnaires. Other aspects to consider in future studies include geographical differences, risk indicators, technological factors, efficiency, government subsidies, etc. Considerations for the future should also be in studying the differences in profitability of photovoltaic solar systems when compared to solar water-heating systems.

References:

[1] PEET. (2021). The Political Economy of Energy Transition in Southeast Europe: Barriers and Obstacles. *Report on Climate Change, Energy and Environment.*

[2] Ministry of Infrastructure and Energetics, Republic of Albania. (2018). National Strategy of Energy 2018-2030 (Strategjia Kombëtare e Energjisë për Periudhën 2018-2030), [Online]. https://www.kesh.al/wp-content/uploads/2022/02/6-STRATEGJIA-KOMBETARE-E-ENERGJISE-PER-PERIUDHEN-2018-2030.pdf (Accessed Date: September 5, 2023).

[3] Ministry of Environment, Republic of Albania. (2016). Third National Communication of the Republic of Albania under the United Nations Framework Convention on Climate Change, [Online]. https://unfccc.int/sites/default/files/resource/Albania%20NC3_13%20October%202016_0.pdf (Accessed Date: September 3, 2023).

[4] IRENA. (2021). Renewables Readiness Assessment: Albania, *International Renewable Energy Agency, Abu Dhabi*, [Online]. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/IRENA_RRA_Albania_2021.pdf (Accessed Date: September 3, 2023).

[5] EUROSTAT – database. 2023, [Online]. https://ec.europa.eu/eurostat/databrowser (Accessed Date: September 5, 2023).

[6] Energy Community Secretariat. (2022). Albania Annual Implementation Report, [Online]. https://www.energy-community.org/implementation/report.html (Accessed Date: September 7, 2023).

[7] Climate Risk Profile: Albania. (2021). The World Bank Group, [Online]. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-06/15812-Albania%20Country%20Profile-WEB.pdf (Accessed Date: September 9, 2023).

[8] IRENA Agency - Statistics Database. (2023) , [Online]. https://www.irena.org/Data/View-data-by-topic/Capacity-and-Generation/Statistics-Time-Series (Accessed Date: September 7, 2023).

[9] Hesselink, L. X., and Chappin, E. J. (2019). Adoption of energy efficient technologies by households–Barriers, policies and agent-based modelling studies. *Renewable and Sustainable Energy Reviews*, vol.99, pp.29-41.

[10] Zhang, W., Stern, D., Liu, X., Cai, W., and Wang, C. (2017). An analysis of the costs of energy saving and CO_2 mitigation in rural households in China. *Journal of Cleaner Production*, vol.165, pp.734–745.

[11] Cucchiella, F., D'Adamo, I., Gastaldi, M., and Stornelli, V. (2018). Solar photovoltaic panels combined with energy storage in a residential building: An economic analysis. *Sustainability*, vol.10(9).

[12] Dong, C., Sigrin, B., and Brinkman, G. (2017). Forecasting residential solar photovoltaic deployment in California. *Technological Forecasting and Social Change*, vol.117, pp.251-265.

[13] García-López, M., Montano, B. and Melgarejo, J. (2023). Household energy consumption and the financial feasibility of self-consumption through photovoltaic panels in Spain. *Energy Efficiency,* vol.16, 57.

[14] Baschieri, D., Magni, C. A. and Marchioni, A. (2020). Comprehensive Financial Modeling of Solar PV Systems. Published in: Proceedings of the EU PVSEC 2020 - *37th European Photovoltaic Solar Energy Conference and Exhibition*, pp.2024-2027.

[15] Magni, C.A. and Marchioni, A. (2019). The accountingand-finance of a solar photovoltaic plant: Economic efficiency of a replacement project. *4th International Conference on Energy and Environment, ICEE*, Guimaraes, Portugal.

[16] International Energy Agency (IEA). (2022). Special Report on Solar PV Global Supply Chains, [Online]. https://iea.blob.core.windows.net/assets/d2ee601d-6b1a-4cd2-a0e8-db02dc64332c/SpecialReportonSolarPVGlobalSupplyChains.pdf (Accessed Date: September 7, 2023).

[17] SolarPower Europe. (2022). EU Solar Jobs Report 2021, [Online]. https://api.solarpowereurope.org/uploads/SPE_EU_Solar_Jobs_Report_September_2022_5925da42fc.pdf?updated_at=2022-09-20T14:05:03.808Z (Accessed Date: September 8, 2023).

[18] Kijo-Kleczkowska, A., Bruś, P. and Więciorkowski, G. (2022). Profitability analysis of a photovoltaic installation - A case study. *Energy*, Vol.261, Part B, 2022, 125310, ISSN: 0360-5442.

[19] Kruzel R. and Helbrych P. (2018). Analysis of the profitability of a photovoltaic installation in the context of sustainable development of construction. *E3S Web of Conferences*, 49.

[20] Johann, A. and Madlener, R. (2014). Profitability of Energy Storage for Raising Self-consumption of Solar Power: Analysis of Different Household Types in Germany. *Energy Procedia*. 61.

[21] Bertsch, V., Geldermann, J. and Lühn, T. (2017) What drives the profitability of household PV investments, self-consumption and self-sufficiency? *Applied Energy*, 204, pp. 1-15.

[22] Herbut, P., Rzepczyński, M., and Angrecka, S. (2018). The Analysis of Efficiency and Investment Profitability of a Solar Water Heating System in a Multi-Family Building. *Journal of Ecological Engineering*. 2018, vol.19(6), pp.75-80.

[23] Atchike, D. W., Zhenyu, Z., Ali, T., Weishang, G. and Jabeen, G. (2022). Towards sustainable energy: Factors affecting solar power system adoption by small and medium-sized businesses. *Frontiers in Environmental Science*, vol. 10, pp.186-197.

[24] Energy Regulatory Authority, Annual Report 2022 (Enti Rregullator i Energjisë, Raporti Vjetor 2022). ERE official publication, [Onlline]. https://www.ere.gov.al/images/files/2023/07/26/Annual_Report_2022.pdf (Accessed Date: September 8, 2023).

[25] Energy Regulatory Authority, Annual Report 2020 (Enti Rregullator i Energjisë, Raporti Vjetor 2020). ERE official publication, [Onlline]. https://www.ere.gov.al/images/files/2021/08/23/Annual%20report%202020.pdf (Accessed Date: September 8, 2023).

[26] Energy Regulatory Authority, Annual Report 2021 (Enti Rregullator i Energjisë, Raporti Vjetor 2021). ERE official publication, [Online]. https://www.ere.gov.al/images/files/2022/09/16/Annual%20report%202021.pdf (Accessed Date: September 8, 2023).

[27] Albania: Inflation rate from 1998 to 2028, Statista, [Online]. https://www.statista.com/statistics/444466/inflation-rate-in-albania/ (Accessed Date: September 10, 2023).

[28] Allen, N., Corinne, T and Allen, S. (2023). How much power does a solar panel produce? *Forbes,* [Online]. https://www.forbes.com/home-improvement/solar/how-much-power-does-a-solar-panel-produce/ (Accessed Date: September 10, 2023).

[29] Bank of Albania (2023). Nominal interest rates and effective interest rates for Individuals (Normat nominale dhe norma efektive e interesit për Individë). https://www.bankofalbania.org/Mbikeqyrja/Sistemi_financiar_normat_e_interesit_dhe_komisionet/Normat_nominale_dhe_NEI_per_individe (Accessed Date: September 11, 2023).

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Mariola Kapidani has worked on the theoretical background and literature review of the paper and the overview of the sector developments.
- Eni Numani conducted the quantitative data analysis and forecasting of the variables, by developing the methodology of the study.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

This publication is made possible with the financial support of AKKSHI. Its content is the responsibility of the authors, the opinion expressed in the paper is not necessarily the opinion of AKKSHI.

Conflict of Interest

The authors have no conflicts of interest to declare.