RISK AND RETURN ON INVESTMENTS IN PHOTOVOLTAIC POWER PLANTS THROUGH A PROJECT COMPANY AND LOAN FINANCING

Todor Georgiev[1]
[1]D.A. Tsenov Academy of Economics – Svishtov, Bulgaria
E-mail: *[1]d010221245@uni-svishtov.bg*

Abstract: The aim of this study is to present in detail the risk, financial, and engineering aspects of investments in photovoltaic power plants (PVPPs) based on the most likely scenario for financial and economic development. For investments in PVPPs with a capacity of over 1 MW, the use of the project company approach can be recommended. This approach pursues two basic goals: (1) the construction of PVPPs with optimal installed capacity and production parameters; (2) achievement of a projected level of sales and profits. Investments in PVPPs logically bear two groups of risks – systematic and unsystematic. Among these risks, attention should always be paid to the dynamics of price levels in electricity markets, which are key to the financial and economic return on investment. These calculations are also particularly sensitive to changes in interest rates when loan financing a project company with high financial leverage.

Key words: photovoltaic power plants, loan financing, project company, systematic and unsystematic risks.

This article shall be **cited** as follows: **Georgiev, T.** (2024). Risk and return on investments in photovoltaic power plants through a project company and loan financing. Economic Archive, (1), pp. 33-50.

URL: nsarhiv.uni-svishtov.bg

DOI: https://doi.org/10.58861/tae.ea-nsa.2024.1.03.en

JEL: Q32, Q43.

* * *

Introduction

Globally, intensive efforts are under way to replace fossil fuels with renewable sources for electricity production, reducing carbon emissions, and decreasing greenhouse gases (ME, MOSV. Rev. 2024). In the area of climate and environment, Bulgaria faces challenges related to the decarbonization of the energy sector, promoting clean and efficient production and use of energy and resources, improving the energy efficiency of buildings, enhancing the resilience of the transport sector, and ensuring the protection and restoration of ecosystems. (Ivanovic-Djukic, Zahariev, & Lepojevic, 2021), (Krugman, Obstfeld, & Mellitz., 2012).

The key measures for Bulgaria's ecological transition, outlined in the Recovery and Resilience Plan, focus on supporting the ecological transition (Prodanov, 1999) through ambitious reforms. These include adopting a clear framework for the gradual phase-out of coal and binding commitments to reduce greenhouse gas emissions from electricity production by 40% by 2025; accelerating the deployment of renewable energy sources; liberalizing the wholesale and retail electricity markets (Baran, 2011), and introducing governance reforms. Additionally, they aim to eliminate financial and regulatory barriers to energy efficiency investments. The plan also allocates €1.7 billion in renewable energy sources, electricity storage capacity, and interconnection infrastructure.

To ensure the fulfillment of Bulgaria's commitments, the construction of renewable energy plants will continue in the future. Increased energy storage facilities will allow the electricity generated during peak periods of renewable energy production to be used throughout the day. This will lead to the stabilization of electricity prices, including those generated from wind and solar parks.

The aim of the present study is to provide a detailed overview of the risk, financial, and engineering aspects of investments in photovoltaic plants based on the most likely scenario for the financial and economic development of the project company Solar Park Breznik EOOD. For this purpose, projected revenues, expenses, and cash flow for the period 2024 – 2035 are presented.

1. Business Plan for Investment in a Photovoltaic Plant

The present business plan (Besley & Brigham, 2007), (Block, Hirt, & Short, 1994) aims to demonstrate to potential creditors the economic feasibility of purchasing land and a project for constructing a photovoltaic power plant (PVPP) with an installed capacity of 1,300 kWh. The business plan has been developed based on an analysis of the market environment (Brealey, Myers, Allen, & Mohanty, 2012), (Dickerson, Campsey, & Brigham, 1995), (Belev & others., 2003), as well as the current conditions and forecasts for the development of the electricity market in Bulgaria and Europe. It provides a comprehensive quantitative and value-based business plan for the investment.

The project has two objectives: **(1)** to build a PVPP with optimal installed capacity and production parameters (Bezgin, et al., 2022); **(2)** to achieve the projected level of sales and profits. The investment required to implement the business plan for constructing the PVPP is calculated to amount to 2,183,770 BGN excluding VAT.

The investment period is up to 12 months after securing financing for its implementation, including the commissioning period of the PVPP and 2 months of system operation required to receive payment for the electricity produced in the first month. The trade name of the project is PVPP "Solar Park Breznik." It is anticipated that PVPP "Solar Park Breznik" will be operational no later than May 2024.

The implementation of the investment project began with the signing of an Agreement (preliminary contract) for the purchase and sale of land in Breznik Municipality on June 14, 2023. Following all the stages prescribed in the Spatial Planning Act, a construction permit was granted by the end of 2022. Additionally, in early 2023, Preliminary and Connection Agreements were signed with "Electrorazpredelitelni mreji Zapad" AD.

All these steps comply with regulatory requirements and adhere to best business practices (Clauss, 2009), (Cascio, 1989), (Copeland & Weston, 1989), (Dickerson, Campsey, & Brigham, 1995), (Dickie, 2006) both nationally and internationally (Carbauch, 2009), (Salvatore, 2007).

The geographical orientation of the PVPP panels relative to the sun, terrain positioning, shading, and losses from seasonal changes in sun orientation are depicted in Figures 1, 2, and 3.

The cost of acquiring the land and design is 352,049.40 BGN including VAT. Steps have been taken to design PVPP "Solar Park Breznik" with an installed capacity of 1,300 kWp, including the necessary adjustments to the construction permit (Zahariev, A., 2012). the connection agreement, contracts for the construction of an external connection, and the Block-module Transformer Substation (transformer station) for the PVPP. The investment amount is determined by the basic indicators for a capital-budget project (Prodanov S., 2012), (Prodanov, 2020).

1. Cost for acquiring the title to property and projects amounting to 293,374.50 BGN excluding VAT, 352,049.40 BGN including VAT.

2. Design and construction of the 1,300 kWp PVPP at a cost of 1,652,676.35 BGN excluding VAT, 1,983,211.62 BGN including VAT.

3. Expenses, taxes, and fees (Zahariev & Dimitrov, 2015) for the notarial transfer of title to property amounting to an indicative 13,420 BGN excluding VAT, 16,104 BGN including VAT.

4. Production and delivery of a 1250 kVA transformer station – 144,300.00 BGN excluding VAT, 173,160.00 BGN including VAT.

5. Construction of the external connection and installation of the transformer station – estimated cost 70,000.00 BGN excluding VAT, 84,000.00 BGN including VAT.

6. Construction supervision – estimated cost 10,000 BGN excluding VAT, 12,000 BGN including VAT.

To secure its participation in the investment, "Solar Park Breznik" EOOD contributes, through a long-term loan provided by the sole owner of the capital (Patev, P.,2014), (Radkov & Zahariev, 2016) funds amounting to 20% of the total investment, or 436,754 BGN excluding VAT, of which 322,235 BGN excluding VAT are invested as of the time of the development of the business plan.

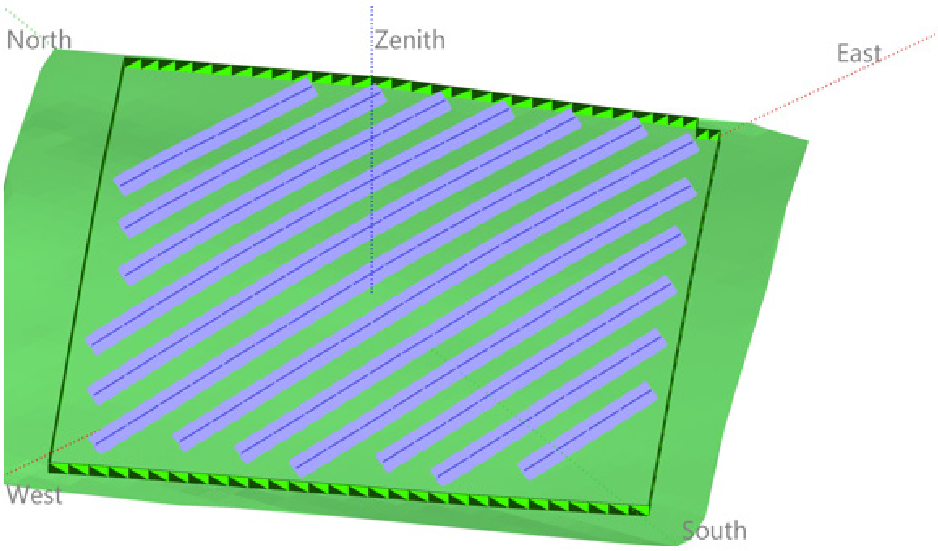


Figure 1. ***Geographical orientation of the panels in the solar park, perspective of the PV field, and surrounding shading scenario***

Source: Author's calculations, tested at Smart Energy Group

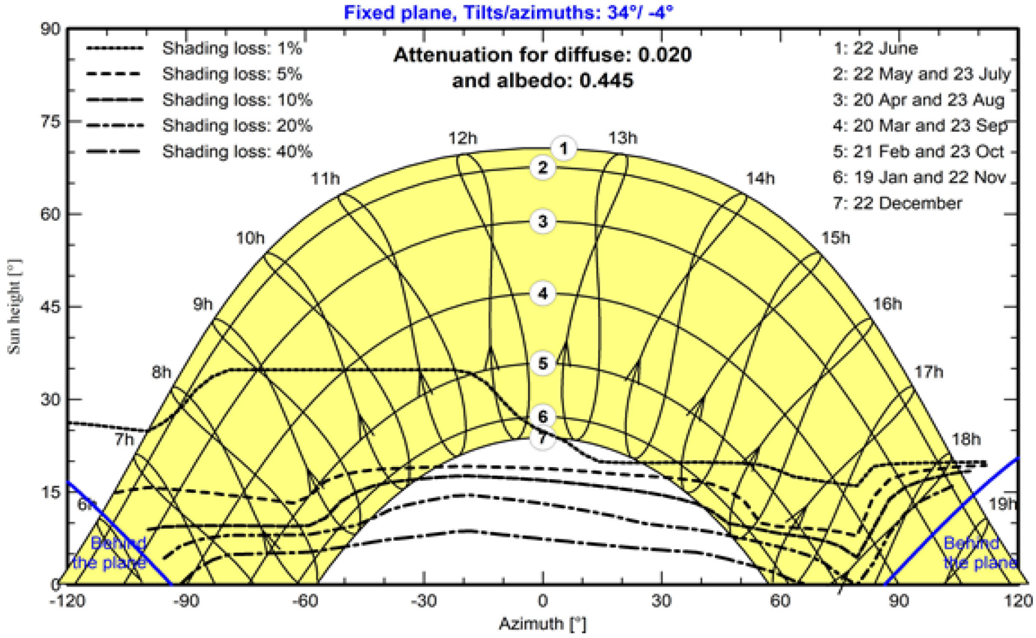


Figure 2. ***Seasonally extrapolated diagram of shading and capacity loss due to seasonal variations in the sun's position***

Source: Author's calculations, tested at Smart Energy Group

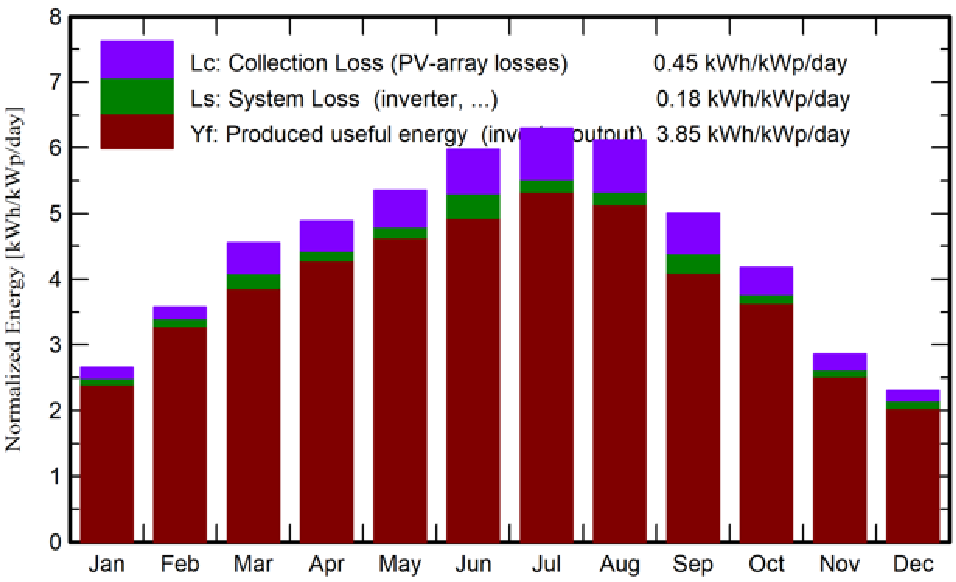


Figure 3. ***Monthly projections of losses due to seasonal changes in the sun's position relative to the location of the PVPP panels***

Source: Author's calculations, tested at Smart Energy Group

Table 1

Plan for the Utilization of Loan Funds by the Project Solar Power Plant (PVPP)

Payment	Amount VAT included	Forecast date	Loan utilization
Purchase of real estate and design	352 049,40	16.6.2023	
Advance payment for a compact transformer substation (CTS)	34 632,00	26.6.2023	
50% second installment for the CTS	86 580,00	6.7.2023	
Panels, inverters, structures, and cables - 40% advance payment	718 180,78	10.7.2023	718 180,78
Construction supervision – advance payment 50%	6 000,00	10.7.2023	
Connection of the CTS to the grid – advance payment	42 000,00	15.7.2023	42 000,00
Panels, inverters, structures, and cables – final payment upon delivery	1 077 271,16	30.7.2023	1 077 271,16
Final payment CTS	51 948,00	4.8.2023	29 208,40
Construction of PVPP	187 759,68	30.8.2023	187 759,68
Connection of the CTS to the grid - final payment	42 000,00	30.8.2023	42 000,00
Construction supervision – final payment	6 000,00	30.3.2024	
Other costs	16 104,00	30.3.2023	

Source: Author’s own calculations.

For the implementation of the investment project, the company will rely on an investment loan of 1,747,000 BGN and a working capital loan of 349,400 BGN to cover VAT payments (Zahariev, A.; Angelov, A.; Ganchev, G.; Bratanov, P.; Iliev, N.; Todorov, Zh.; Petkov, K., 2016). The financial and economic forecasts include a grace period (Cargill, 1991), (Fabozzi & Peterson, 2003) of 12 months for the repayment of the loan principal – which means that the repayments on the investment loan are to start from July 2024. The requested grace period (Nenkov, 2017) covers the investment period of 8 months, the period for commissioning the solar power plant (PVPP) of 2 months, and other 2 months to receive the first payment for the electricity produced and sold.

Table 2 ***Monthly Production Capacity Metrics of the Solar Power Plant***

	GlobHor kWh/m²	**DiffHor** kWh/m²	**T_Amb** °C	**GlobInc** kWh/m²	**GlobEff** kWh/m²	**EArray** MWh	**E_Grid** MWh	**PR** ratio
January	48.7	24.70	-1.20	82.4	77.2	100.4	96.6	0.904
February	67.6	31.70	1.10	100.2	95.0	124.0	119.5	0.920
March	110.7	49.60	4.70	141.2	133.4	164.7	155.3	0.848
April	134.1	66.10	9.60	146.5	137.8	172.7	166.7	0.878
May	168.0	80.60	14.50	165.8	155.9	193.3	186.7	0.868
June	190.0	80.20	18.10	179.2	168.3	206.9	192.0	0.826
July	203.5	81.20	20.20	195.3	183.5	222.4	214.6	0.847
August	180.8	72.10	20.20	189.6	179.0	214.4	206.9	0.841
September	125.3	54.20	15.50	150.1	141.6	171.3	159.6	0.820
October	91.4	38.60	10.10	129.6	122.5	151.8	146.5	0.871
November	54.0	27.00	5.20	85.8	80.8	102.2	98.3	0.883
December	40.8	21.50	0.40	71.3	67.0	86.6	82.0	0.887
Yearly	1414.9	627.50	9.91	1636.8	1542.0	1910.8	1824.6	0.860

Legend:

GlobHor	Global horizontal irradiance (direct and diffuse)
DiffHor	Diffuse horizontal irradiance (scattered or reflected)
T_Amb	Ambient temperature
GlobInc	Global radiation on inclined surfaces
GlobEff	Effective global irradiation, reaching the PV-cell surface, after all optical losses (shadings, incident angle modifier (IAM), soiling)
EArray	Effective energy at the output of the array (DC)
E_Grid	Energy injected into grid (AC)
PR	Performance ratio – the relationship between the generated (utilized) energy and the expected output, if the system continuously operates at its nominal efficiency (tested in laboratory conditions). Determined pursuant to the European standard IEC EN 61724

Source: Author's calculations, tested at Smart Energy Group

A financial plan has been developed for the repayment of the borrowed funds, based on the structure of revenues and the cost of capital, monthly engineering performance indicators for the solar panels, and planned losses up to the point of connection to the grid. The time horizon of the business plan covers the period from 2024 to 2035. The forecasted "incoming" and "outgoing" cash flows demonstrate the possibilities for generating profits and accumulating net cash flow, after covering the necessary business expenses and the costs of repaying the bank loan, thus generating the following sales revenues by year: 2024 – 161,354 BGN excluding VAT, 2025 – 314,697 BGN, 2026 – 313,043 BGN, 2027 – 311,388 BGN. For the entire period from July 2024 to December 2035, the sales revenues amount to 3,402,859 BGN.

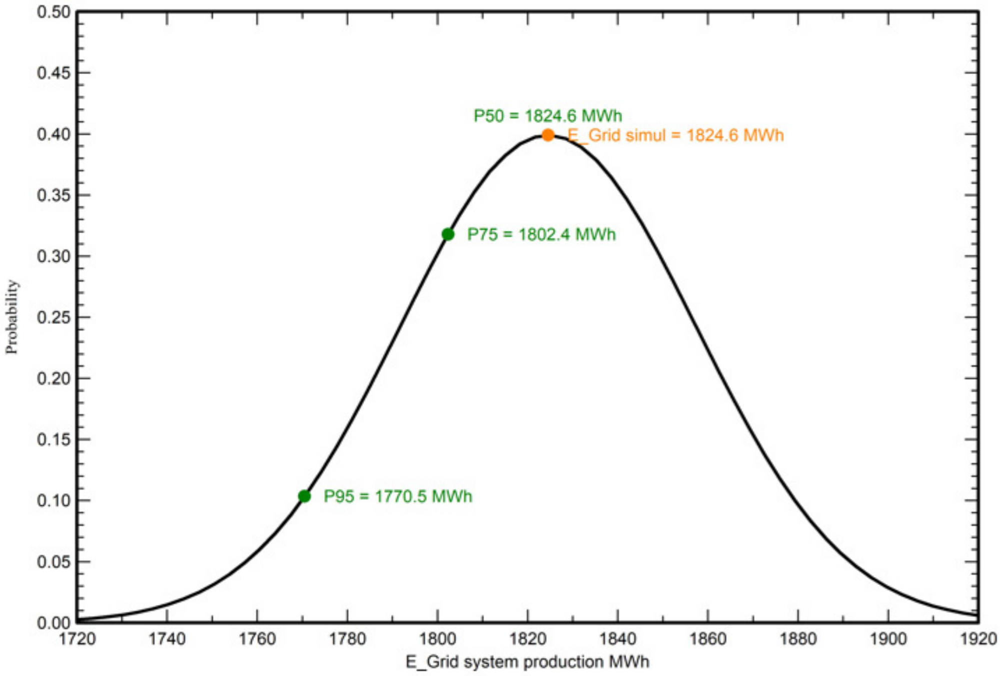


Figure 4. ***Probabilistic scenarios for sales from the PV power plant (in MWh)***

Source: Author's calculations, tested at Smart Energy Group

These are based on three probabilistic scenarios for the production and injection of solar electricity into the transmission grid. The first scenario has a probability of 50% and forecasts sales of 1,824.6 MWh. The second scenario has a probability of 75% and forecasts sales of 1,802.4 MWh. The third scenario is the most conservative, with a sales forecast of 1,770.5 MWh at a probability of 95%.

The annual expenses are as follows: 2024 – 53,191 BGN excluding VAT, 2025 – 95,899 BGN, 2026 – 89,070 BGN, 2027 – 82,569 BGN. For the entire period from July 2024 to December 2035, the operating expenses amount to 748,382 BGN. After accounting for the above revenues and expenses, as well as the costs for loan principal repayment, the net cash flow (excluding depreciation and tax expenses) is as follows: for 2024 – 28,753 BGN, 2025 – 59,979 BGN, 2026 – 65,153 BGN, 2027 – 70,000 BGN. For the entire period from July 2024 to December 2035, the accumulated cash flow amounts to 1,000,258 BGN.

Table 3

Cost Structure of the Investment Project for the Photovoltaic Power Plant

№ of order	**Name of the investment item**	**Share (%)**
1.	Real estate, including project documentation and construction permit	13.43%
2.	Design and construction of the photovoltaic power plant (PVPP)	75.68%
3.	CTS 1250 кVA	6.61%
4.	Connection of the CTS to the grid *	3.21%
5.	Construction supervision*	0.46%
7.	Other expenses – establishment of a pledge on the commercial enterprise, entries in the Central Registry of Special Pledges (CRSP), property register, etc.	0.61%
	Total:	**100.00%**

Source: Author's own calculations.

The projected cash flows (Radkov et al., Pari I banki, 1998), (Nenkov, 2015), (Keown, Petty, Martin, & Scott, 2003) demonstrate the capability of the photovoltaic power plant to generate profits and accumulate net cash flow after covering the necessary inherent expenses (Terziev, Zahariev, Pavlov, Petkov, & Kostov, 2021b) for repaying the borrowed capital in accordance with the attached repayment plan (Zahariev, 2021).

In the forecast financial calculations, revenue from the sale of the produced electric energy has been included, based on a Simulation Report for the energy generated by PVPP "Solar Park Breznik." The operational expenses (Schall & Haley, 1980; Scott, 1988; Sheeba, 2011) for the activity are formed by costs (Swamy, 2009) for: park maintenance; security (Shim & Siegel, 2008); accounting services (Krastev, 2019); and insurance (Branch, Ray, & Russell, 2007; Prodanov S., 2020).

Table 4

Sources of Financing for the Investment in the Photovoltaic Power Plant

№ of order	Name of Investment Item	Own funds (BGN)	Bank loan (BGN)	Total (BGN) VAT included
1.	Real estate, including project documentation and construction permit	352 049,40	-	352 049,40
2.	Design and construction of the photovoltaic power plant (PVP)		1 983 211,62	1 983 211,62
3.	CTS 1250 кVA	143 951,60	29 208,40	173 160,00
4.	Connection of the CTS to the grid *		84 000,00	84 000,00
5.	Construction supervision*	12 000,00	-	12 000,00
6.	Other expenses – establishment of a pledge on the commercial enterprise, entries in the Central Registry of Special Pledges (CRSP), property register, etc.*	16 104,00	-	16 104,00
	Total:	**524 105,00**	**2 096 420,02**	**2 620 525,02**

Source: Author's own calculations.

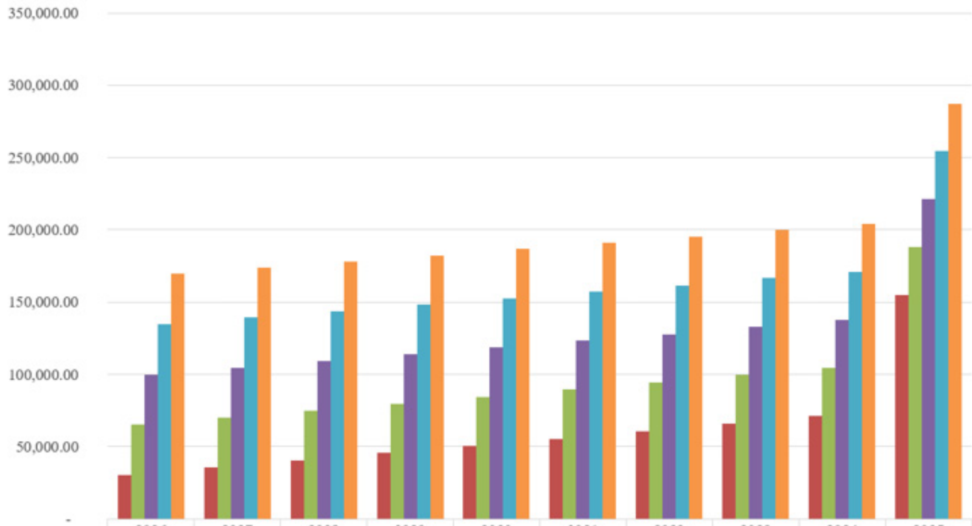
The business plan model also accounts for a projected cost increase (Lasher, 2013) of 1.2% annually for the period after 2026. Specific to the investment is the absence of costs for human resources (Zahariev et al., 2023; Opatha, 2019) as well as customs duties and fees for importing components (Zahariev A., 2014). A controlling system has been implemented to precisely validate all revenues and expenses (Krastev, 2018).

The financial expenses for the observed period are formed by an annual management fee of 0.3% on the amount upon granting the investment credit (1,747,000 BGN) and at the beginning of each new year of the loan's life, as well as interest payments on the utilized part of the granted bank loan (Zahariev A., 2012) at an annual interest rate of 4%. The projected cash flow accounts for the operation of "Solar Park Breznik" and the repayment of the investment loan.

The expenses upon granting the loans (investment loan amounting to 1,747,000 BGN and revolving loan up to 349,400 BGN for covering VAT expenses), as well as the commitment fees (Peshev, 2015; Peterson, 1994) on the unused portion amounting to 0.2% and the interest (Fama, 1975) during the grace period, are paid by the sole owner of the capital – Smart Energy Group, which is the usual business practice (Van Horne, 1989).

The final part of the business plan for constructing the PVPP with a capacity of over 1 MW through a project company is the cash flow modeling (Rao, 2011; Ritter, Silber, Udell, & Wesley, 1989), at five price levels, with an increment of 20 BGN/MW (from 160 BGN to 240 BGN) under an annual sales scenario of 1802 MW at the point of connection.

The dynamics of the net cash flow for the first 18 months (with a 12-month grace period for principal repayment) and the following eleven years with a horizon until 2025 is graphically presented. It is clearly visible how positive deviations in price levels (Ross S. A., Westerfield, Jordan, & Firer, 2000; Ross & Westerfield, 1988), considering the expected household connection to the free market, will be a factor towards increasing the investment's efficiency in the PVPP with a capacity of over 1 MW.



	2026	2027	2028	2029	2030	2031	3032	2033	2034	2035
НПП 160 лв./MW	30,370.63	35,401.02	40,427.48	45,449.95	50,468.38	55,482.74	60,492.97	66,099.78	71,108.81	154,861.08
НПП 180 лв./MW	65,153.16	69,999.70	74,842.31	79,680.94	84,515.53	89,346.04	94,172.42	99,595.39	104,420.58	187,989.01
НПП 200 лв./MW	99,935.68	104,598.38	109,257.15	113,911.93	118,562.68	123,209.35	127,851.88	133,091.01	137,732.35	221,116.94
НПП 220 лв./MW	134,718.20	139,197.06	143,671.98	148,142.92	152,609.82	157,072.65	161,531.34	166,586.63	171,044.12	254,244.87
НПП 240 лв./MW	169,500.72	173,795.74	178,086.82	182,373.91	186,656.97	190,935.95	195,210.80	200,082.24	204,355.89	287,372.79

НПП 160 лв./MW НПП 180 лв./MW НПП 200 лв./MW НПП 220 лв./MW НПП 240 лв./MW

Figure 5. ***Net Annual Cash Flow from the Investment of the Project Company in the PV Power Plant for the Period 2026-2035***
Source: Author's calculations, tested at Smart Energy Group

2. Systematic and Unsystematic Risks in Investments in PV Power Plants

The financial and technological aspects of the investment in the construction of a PV power plant, as described above, are based on the interaction between the credit institution and the owners of the project company, where both parties are motivated to hedge against risks. From the credit institution's perspective, the time horizon of these risks is logically the full term of the loan (Radkov & Zahariev, 2021), while from the investor's perspective, it is the operational lifespan of the solar park, built as an asset of the project company. In both cases, however, it is necessary to distinguish between systematic and unsystematic risks.

In **the first group**, we can include political risk, which is inherent in the "green deal" itself and the subsequent environmental regulations and goals to be achieved. The elections for the European Parliament scheduled for June 2024 have the potential for possible changes in the European Union's goals and policies towards decarbonization and the closure of all coal plants, as nationalist formations in various member states attempt to change the community's agenda and prioritize national interests over pan-European ones (Todorova, 2019).

Secondly, in the first group, we can also include technological risk, which comes from research and innovations, as well as the constant improvement in the efficiency of solar panels. With the parallel progress in technological solutions for storing electrical energy through batteries and pumped-storage hydroelectric power plants, such levels of solar energy production in Bulgaria and the EU may be reached that will exceed the absorption of electricity by businesses, households, and the public sector, potentially jeopardizing the returns on constructed and newly initiated investments in PV power plants.

Thirdly, in the group of systematic risks, we can place market risk. Trends in the price levels across various electricity trading segments are influenced by the European target model for electricity market pricing, and the direction of change is noticeably negative for investors in PV power plants. There is a general reduction in the standard deviation from the average price in the different markets and segments of electricity, which is combined with an overall leveling of national price levels (in EUR/MWh) under conditions of inter-system exchange capacities. Thus, investors' expectations for higher electricity prices and, consequently, higher returns from investments in PV power plants may need to be adjusted downward, including the emergence of the phenomenon of zero prices in the "Day-Ahead" segment.

Fourthly, in the group of systematic risks, we can include national regulatory risks and tariff restrictions for access to the high-voltage network for injecting and selling solar electricity. These tariffs are a new tool allowed by national regulators, including EWRC, and they have a significant impact on the net cash flow from the investment in PV power plants, all other conditions being equal.

In **the second group** (unsystematic risks directly related to the specific PV power plant), we can collectively include all risks covered by insurance for the solar park, including risks such as fire on the grass areas near and under the solar panels, vandalism by third parties, and hail. Hailstorms and hurricane-force winds, resulting from climate change, have the potential to cause catastrophic damage to solar parks and PV power plants. Mandatory insurance coverage generally requires a time lag between the occurrence of the insured event and the restoration of the damaged panels to their original functional state and capacity (see Figure 5).

Figure 5. ***Damage to Solar Panels After Hailstorm with Abnormally Large Hailstones (April 15, 2024, Texas, USA)***
Source: (FoxNews, 2024).

Not least, this group can also include the risks of power surges in the high-voltage network when the over-injection of peak solar energy overloads the transformers on the network. Under certain circumstances, this can cause significant damage to individual solar parks in case compromises have been made in the engineering solutions for counter-current protection.

Additionally, we must consider the risk posed by the behavior and status of competitors as suppliers of renewable energy at preferential and generally boosted fixed purchase prices.

The upcoming accession of Bulgaria to the Eurozone and the transition to a new accounting currency unit can be assessed as low-risk and generally leading to a reduction in the cost of credit resources for investors in PV power plants. Nonetheless, currency and interest rate risks (Zarkova, Kostov, Angelov, Pavlov, & Zahariev, 2023) are also to be evaluated and hedged.

In summary of the assessment of both groups of risks—systematic and unsystematic—regarding investments in PV power plants, it is essential to focus again on the dynamics in electricity market price levels. Initial investments in solar parks at the beginning of the 21st century were supported by power purchase agreements at preferential fixed prices. All new investments in PV power plants do not enjoy such guaranteed price returns. They are subject to market rules and the balance between supply and demand. Therefore, the issue of long-term electricity price levels remains debatable. There is a clear trend for consumers and major economic agents—governments, companies, and households—to build their own capacities for solar energy production. This logically acts as a factor for the long-term reduction of market demand for electricity. Consequently, it can be forecasted that long-term sustainable and affordable electricity price levels for consumers will prevail under the conditions of the "European Green Deal."

Conclusion

For investing in a PV power plant with a capacity of over 1 MW, it is recommended to use the approach of a project company. Such a project pursues two basic goals: (1) constructing a PV power plant with optimal installed capacity and production parameters; (2) achieving projected levels of sales and profits. The investment in a PV power plant with a capacity of over 1 MW through a project company necessitates the valuation of six basic parameters: (1) Acquisition of land and related projects; (2) Design and construction of the PV power plant; (3) Calculation of expenses, taxes (John & Williams, 1985), and fees for the notarial transfer of property ownership in an indicative amount specific to the municipality; (4) Construction and delivery of a transformer station with the corresponding capacity; (5) Construction of the external connection and installation of the transformer station; (6) Construction supervision.

Investments in PV power plants logically face two groups of risks—systematic and unsystematic. Under all circumstances, attention must also be given to the dynamics of electricity market price levels, which are crucial for the financial and economic return on the investment. These calculations are particularly sensitive to changes in interest rates when the financing involves high financial leverage.

References:

Baran, D. (2011). Comparison of economic crises in view of the history and present time. *Economics & Management*, 1075-1081.

Belev, B. S., & others. (2003). The informal economy in the EU accession countries Size, Scope, Trends and Challenges to the Processof EU Enlargement. Sofia.

Besley, S., & Brigham, E. F. (2007). *Essentials of managerial finance.* Cengage learning.

Bezgin, K., Zahariev, A., Shaulska, L., Doronina, O., Tsiklashvili, N., & Wasilewska, N. (2022). Coevolution of education and business: adaptive interaction. *International Journal of Global Environmental Issues*(Special Issue on: Innovations for Sustainability Energy, Industry and Agriculture). doi:10.1504/IJGENVI.2022.10049838

Block, S. B., Hirt, G. A., & Short, J. D. (1994). *Foundations of financial management.* New York: Irwin.

Branch, B., Ray, H., & Russell, R. (2007). *Last rights: liquidating a company.* Oxford University Press.

Brealey, R. A., Myers, S. C., Allen, F., & Mohanty, P. (2012). *Principles of corporate finance.* New York: Tata McGraw-Hill Education.

Carbauch, R. (2009). *International Economics.* N.Y.: South-Western CENGAGE Learning,.

Cargill, T. F. (1991). *Money, the financial system, and monetary policy.* Prentice Hall.

Cascio, W. (1989). *Managing human resources productivity, quality of work life, profits.* New York: McGraw-Hill.

Clauss, F. J. (2009). *Corporate financial analysis with Microsoft Excel.* McGraw Hill Professional.

Copeland, T. E., & Weston, J. F. (1989). *Managerial Finance: With Tax Update.* Dryden Press.

Dickerson, B., Campsey, B. J., & Brigham, E. F. (1995). *Introduction to financial management.* Harcourt College Pub.

Dickie, R. B. (2006). *Financial statement analysis and business valuation for the practical lawyer.* American Bar Association.

Fabozzi, F. J., & Peterson, P. P. (2003). *Financial management and analysis (Vol. 132).* John Wiley & Sons.

Fama, E. F. (1975). Short Term Interest Rates as Predictors of Inflation. *American Economic Review*.

FoxNews. (27 03 2024 г.). *Hail cripples massive solar farm, sparking resident concern about vulnerable 'green' tech*. Извлечено от FoxNews Media: https://bit.ly/4cUBA4z

Ivanovic-Djukic, M., Zahariev, A., & Lepojevic, V. (2021). Corporate social responsibility in Covid-19 environment: evidence from Serbia and Bulgaria. *Proceedings of the International Scientific Conference: Emerging trends in global and national economy*, (pp. 239-250). Faculty of Economics, University of Nish.

John, K., & Williams, J. (1985). Dividends, dilution, and taxes: A signalling equilibrium. *the Journal of Finance, 40(4)*, 1053-1070.

Keown, A. J., Petty, J. W., Martin, J. D., & Scott, D. F. (2003). *Foundations of finance: The logic and practice of financial management.* Pearson Education Asia Limited.

Krastev, L. (September 2019 г.). Theoretic Aspects of Financial Controlling in the Firm. *Economic Archive, LXXII*(3), стр. 17-27. Извлечено от https://www2.uni-svishtov.bg/NSArhiv/title.asp?title=1434

Krugman, P., Obstfeld, M., & Mellitz., M. J. (2012). *International Economics. Theory and Policy. Ninth Edition.* Addison-Wesley.

Lasher, W. R. (2013). *Practical financial management.* Nelson Education.

Opatha, H. H. (2019). *Sustainable Human Resource Management: Expanding Horizons of HRM.* https://www.researchgate.net/publication/330421801.

Peshev, P. (October 2015 г.). Determinants of Interest Rate Spreads in Bulgaria. *DISCUSSION PAPERS/DP/99/2015*, стр. 5-41.

Peterson, P. P. (1994). *Financial management and analysis.*

Prodanov, S. (2012). *Capital Budgeting.* V. Tarnovo: ABAGAR.

Prodanov, S. (2020). *Ikonomikata i zastrahovatelniyat pazar v Bulgaria.* V. Tarnovo: FABER.

Rao, P. M. (2011). *Financial statement analysis and reporting.* New Delhi: PHI Learning Private Limited.

Ritter, L. S., Silber, W. L., Udell, G. F., & Wesley, A. (1989). *Principles of Money, Banking, and Financial Markets .* New York.

Ross, S. A., & Westerfield, R. W. (1988). *Corporate Finance.* St. Louis : Times Mirror/Mosby College Pub.

Ross, S. A., Westerfield, R., Jordan, B. D., & Firer, C. (2000). *Fundamentals of corporate finance.* Boston, MA: Irwin/McGraw-Hill.

Salvatore, D. (2007). *International Economics.* N.Y.: John Wiley and Sons Inc.

Schall, L. D., & Haley, C. W. (1980). *Introduction to financial management.* McGraw-Hill Companies.

Scott, D. F. (1988). *Basic financial management.* New Jersey: Prentice Hall.

Sheeba, K. (2011). *Financial Management.* Navi Mumbai: Repro India Ltd.

Shim, J. K., & Siegel, J. G. (2008). *Financial management.* Barron's Educational Series.

Swamy, M. (2009). Financial management call for new approach to ethical-based financial statement analysis. *Journal of Financial Management and Analysis, 22(2)*, 70-84.

Terziev, V., Zahariev, A., Pavlov, T., Petkov, K., & Kostov, D. (2021b). The effect of exogenous variables on P/E determinants in the context of expected post COVID-19 crisis recovery. The case of Balkan capital markets. *66th International Scientific Conference on Economic and Social Development, Rabat, 26-27 March, 2021, Economic and Social Development (Book of Proceedings). 66*, pp. 184-203. Cakovec, Croatia, 2021: ISSN: 1849-7535. doi:SSRN: https://ssrn.com/abstract=3814860

Todorova, T. (2019). Government Budget Balance and Economic Growth. *Economy & Business*, 114-127.

Van Horne, J. (1989). *Fundamentals of Financial Management.* New Jersy: Prentic Hall.

Zahariev, A. (2012). *Debt Management.* V. Tarnovo: ABAGAR. doi:10.13140/RG.2.1.4872.3607

Zahariev, A., Ivanova, P., Zaharieva, G., Slaveva, K., Mihaylova, M., & Todorova, T. (2023). Interplay between CSR and the Digitalisation of Bulgarian Financial Enterprises: HRM Approach and Pandemic Evidence. *Journal of Risk and Financial Management, 16*(9), 385. doi:https://doi.org/10.3390/jrfm16090385

Zarkova, S., Kostov, D., Angelov, P., Pavlov, T., & Zahariev, A. (2023). Machine Learning Algorithm for Mid-Term Projection of the EU Member States' Indebtedness. *Risks, 11*(4), 71. doi:http://dx.doi.org/10.3390/risks11040071

Zahariev, A. (2012). Fiskalna decentralizacija i finansovo upravlenie na obshtinite v Bulgarija (Tom 13). (Tsenov, Red.) Svishtov: Biblioteka "Obrazovanie i nauka". Retrieved from www.researchgate.net/publication/313576435

Zahariev, A. (2014). Mitnicheski rezhimi (Tom 80). (B. ". nauka", Red.) Svishtov: AI "Tsenov".

Zahariev, A. (2021). Tehniki za proektno finansirane. Svishtov: AI "Tsenov". Retieved from https://www.researchgate.net/publication/349643789

Zahariev, A., & Dimitrov, M. (2015). Za efektivnata fiskalna politika v otvorenata ikonomika na ES. Godishnik, SA "Tsenov", 68(1), 7-44. Retrieved from https://www.researchgate.net/publication/298833162

Zahariev, A.; Angelov, A.; Ganchev, G.; Bratanov, P.; Iliev, N.; Todorov, Zh.; Petkov, K. (2016). Finansov analiz. V. Tarnovo: FABER.

Krastev, L. (Mart 2018 r.). Prakticheski aspekti na finansoviJa kontroling vuv firmata. Narodnostopanski arhiv, 3-18.

ME, MOSV. (Rev. 2024). Integriran plan v oblastta na energetikata i klimata na Republika BulgariJa 2021 - 2030 g. Retrieved from https://commission.europa.eu/publications/bulgaria-draft-updated-necp-2021-2030_en?prefLang=bg

Nenkov, D. (2015). Opredeljane na stojnostta na kompaniite. Sofija: IK na UNSS. doi:ISBN 978-954-644-779-1

Nenkov, D. (2017). Finansovo upravlenie za sazdavaneto na stojnost v kompaniite. Ikonomicheska misal, kn. 6, str. 33-47.

Prodanov, S. (1999). Modeli za otchitane na ekzogenni vazdejstvija varhu investicionnija izbor. Kapitalovo bjudzhetirane (str. 113-152). V.Tarnovo: Abagar.

Prodanov, S. (2020). Investicii i investicionni reshenija: metodika-prilozhni aspekti (Tom 142). Svishtov: Biblioteka "Stopanski svjat".

Patev, P. (2014). Mezhdunaroden finansov menidzhmant. Svishtov: AI "Tsenov".

Radkov, R., & dr. (1998). Pari i banki. Sofija: ABAGAR.

Radkov, R., & Zahariev, A. (2016). Mezhdunarodni finansi. V. Tarnovo: Faber.

Radkov, R., & Zahariev, A. (2021). Mezhdunarodni finansi. Svishtov: AI "Tsenov". Retrieved from www.researchgate.net/publication/349645262

Todor Georgiev is a Ph.D. student in the Department of Finance and Credit at the D. A. Tsenov Academy of Economics in Svishtov, Bulgaria. His dissertation topic is "Investments in Photovoltaic Power Plants - Financial and Environmental Aspects." His **research interests** include energy efficiency, renewable energy sources, and photovoltaic power plants.

ORCID ID: 0009-0008-3358-5320

ISSN 0323-9004

Economic Archive

Svishtov, Year LXXVII, Issue 1 - 2024

D. A. TSENOV ACADEMY OF ECONOMICS
SVISHTOV

Народностопански архив година LXXVII книга 1 - 2024

Economic Archive Year LXXVII, Issue 1 - 2024

Editorial address:
2, Emanuil Chakarov street, Svishtov 5250
Prof. Andrey Zahariev, PhD – Editor-in-Chief
☎ (++359) 889 882 298
Rositsa Prodanova, PhD – technical secretary
☎ (++359) 631 66 309, e-mail: nsarhiv@uni-svishtov.bg
Blagovesta Borisova – computer graphic design
☎ (++359) 882 552 516, e-mail: b.borisova@uni-svishtov.bg

ECONOMIC ARCHIVE

YEAR LXXVII, BOOK 1 – 2024

CONTENTS