

ESS Solar Farm ROI Analysis Report

EXECUTIVE SUMMARY

This analysis evaluates the financial viability of adding a 3,850 kWh battery storage system to a 1,000 kW solar farm. The analysis covers 365 days from 2024-07-01 to 2025-06-30.

Key Finding: The battery system would generate an additional 531,427.07 PLN in profit (149.5% improvement over solar-only operation).

Investment Recovery: Simple payback period of 5.64 years.

Analysis Period	2024-07-01 - 2025-06-30
Days Analyzed	365 days
Solar Farm Capacity	1,000 kW
Battery Capacity	3,850 kWh
Battery Investment (Estimated)	3,000,000.00 PLN
Baseline Revenue (PV only)	355,450.13 PLN
Net Revenue (PV + ESS)	806,972.87 PLN
ESS Additional Profit	531,427.07 PLN
Revenue Improvement	149.5%
Annual ESS Profit	531,791.07 PLN
Simple Payback Period	5.64 years

FINANCIAL ANALYSIS

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Baseline Revenue (Solar Only):

355,450.13 PLN

Optimized Revenue (Solar + Battery):

886,877.20 PLN

Battery Cycling Costs:

79,904.33 PLN

Net Additional Revenue:

531,427.07 PLN

Annualized Projections:

- Annual ESS Profit: 531,791.07 PLN
- ROI: 17.7% per year

BATTERY PERFORMANCE

Total Battery Cycles: 213.1 cycles

Average Daily Utilization: 0.58 cycles per day

Actual Round-Trip Efficiency: 90.2%

Total Energy Cycled: 820,351 kWh

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MONTHLY PERFORMANCE

Month	PV Only Profit (PLN)	ESS Profit (PLN)	Improvement (%)
2024-07	48,916	86,869	177.6%
2024-08	40,862	67,817	166.0%
2024-09	29,915	61,144	204.4%
2024-10	33,725	38,048	112.8%
2024-11	14,993	25,900	172.7%
2024-12	10,815	6,977	64.5%
2025-01	16,331	7,959	48.7%
2025-02	32,396	19,463	60.1%
2025-03	27,827	43,767	157.3%
2025-04	33,438	53,976	161.4%
2025-05	35,909	51,168	142.5%
2025-06	30,324	68,339	225.4%

BATTERY DEGRADATION ANALYSIS

Battery Lifecycle Overview:

- Annual Battery Cycles: 213.1
- Projected Lifespan: 37.5 years
- Cycle Limit: 8,000 cycles to 70% capacity
- End-of-Life Capacity: 70%

Impact on Financial Performance:

The battery degradation analysis shows the impact of capacity reduction over time on investment returns.

Metric	Value
Simple Payback Period	5.6 years
Degradation-Adjusted Payback	5.8 years
20-Year Total Profit	9,743,481 PLN

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Average Annual Profit (with degradation)	487,174 PLN
20-Year NPV (5% discount)	3,155,836 PLN

10-Year Performance Projection:

Year	Capacity	Annual Profit	Cumulative
0	100.0%	0 PLN	0 PLN
1	99.2%	527,542 PLN	527,542 PLN
2	98.4%	523,293 PLN	1,050,834 PLN
3	97.6%	519,043 PLN	1,569,878 PLN
4	96.8%	514,794 PLN	2,084,672 PLN
5	96.0%	510,545 PLN	2,595,217 PLN
6	95.2%	506,296 PLN	3,101,512 PLN
7	94.4%	502,046 PLN	3,603,559 PLN
8	93.6%	497,797 PLN	4,101,356 PLN
9	92.8%	493,548 PLN	4,594,904 PLN

INVESTMENT RECOMMENDATION

RECOMMENDED: Good ROI with reasonable payback period. Solid investment opportunity.