

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 3,000 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 697,709.82 PLN in profit (65.4% improvement over solar-only operation).

Investment Recovery: Simple payback period of 4.30 years.

Analysis Period	2024-07-01 - 2025-06-30
Days Analyzed	365 days
Solar Farm Capacity	3,000 kW
Battery Capacity	3,850 kWh
Battery Investment (Estimated)	3,000,000.00 PLN
Baseline Revenue (PV only)	1,066,350.39 PLN
Net Revenue (PV + ESS)	1,659,619.30 PLN
ESS Additional Profit	697,709.82 PLN
Revenue Improvement	65.4%
Annual ESS Profit	698,187.70 PLN
Simple Payback Period	4.30 years

FINANCIAL ANALYSIS

ESS Solar Farm ROI Analysis Report

Baseline Revenue (Solar Only):

1,066,350.39 PLN

Optimized Revenue (Solar + Battery):

1,764,060.21 PLN

Battery Cycling Costs:

104,440.91 PLN

Net Additional Revenue:

697,709.82 PLN

Annualized Projections:

- Annual ESS Profit: 698,187.70 PLN
- ROI: 23.3% per year

BATTERY PERFORMANCE

Total Battery Cycles: 278.5 cycles

Average Daily Utilization: 0.76 cycles per day

Actual Round-Trip Efficiency: 90.1%

Total Energy Cycled: 1,072,260 kWh

ESS Solar Farm ROI Analysis Report

MONTHLY PERFORMANCE

Month	PV Only Profit (PLN)	ESS Profit (PLN)	Improvement (%)
2024-07	146,747	97,067	66.1%
2024-08	122,586	82,097	67.0%
2024-09	89,744	79,142	88.2%
2024-10	101,176	56,234	55.6%
2024-11	44,979	37,676	83.8%
2024-12	32,445	10,710	33.0%
2025-01	48,994	13,933	28.4%
2025-02	97,187	26,923	27.7%
2025-03	83,481	57,146	68.5%
2025-04	100,313	76,882	76.6%
2025-05	107,728	71,381	66.3%
2025-06	90,971	88,520	97.3%

BATTERY DEGRADATION ANALYSIS

Battery Lifecycle Overview:

- Annual Battery Cycles: 278.5
- Projected Lifespan: 28.7 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	4.3 years
Degradation-Adjusted Payback	4.4 years
20-Year Total Profit	12,432,448 PLN

ESS Solar Farm ROI Analysis Report

Average Annual Profit (with degradation)	621,622 PLN
20-Year NPV (5% discount)	4,891,917 PLN

10-Year Performance Projection:

Year	Capacity	Annual Profit	Cumulative
0	100.0%	0 PLN	0 PLN
1	99.0%	690,896 PLN	690,896 PLN
2	97.9%	683,604 PLN	1,374,500 PLN
3	96.9%	676,312 PLN	2,050,811 PLN
4	95.8%	669,020 PLN	2,719,831 PLN
5	94.8%	661,728 PLN	3,381,559 PLN
6	93.7%	654,436 PLN	4,035,996 PLN
7	92.7%	647,144 PLN	4,683,140 PLN
8	91.6%	639,852 PLN	5,322,992 PLN
9	90.6%	632,560 PLN	5,955,552 PLN

INVESTMENT RECOMMENDATION

HIGHLY RECOMMENDED: Excellent ROI with payback under 5 years. Strong business case for immediate implementation.