Photon Energy

April–June 2025

BESS Quarterly Financial Analysis

Breaking Down Revenue Potential in the Czech Republic, Hungary, Poland and Romania

What's Inside?

Breakdown of income sources, including DAM and aFRR

Operational strategies to maximise profitability

Comparison of results from the previous quarter

Contents

Executive Summary

Battery energy storage systems (BESS) in Central and Eastern Europe delivered steady financial returns in Q2 2025, with Poland and Romania emerging as key performers, particularly for longer-duration systems.

Highlights

Czech Republic

Up to **€23,658** per month for 1 MWh systems

Up to **€31,896** per month for 2 MWh systems

The Czech Republic showed strong returns across both durations, though revenue remains highly dependent on aFRR Down reservation and aFRR Up reservation. While DAM revenue is moderate, combining it with ancillary services remains essential for maximising returns.

Poland

Up to **€41,985** per month for 1 MWh systems

Up to **€55,319** per month for 2 MWh systems

Poland remains the most lucrative market overall, with revenue driven primarily by aFRR Up reservation and aFRR Down reservation. Larger systems continue to see outsized gains thanks to added flexibility and Capacity Market participation.

Romania

Up to **€14,516** per month for 1 MWh systems

Up to **€20,724** per month for 2 MWh systems

Romania performs well across both DAM and aFRR services, offering a balanced revenue stream. Value from longer-duration systems appears to plateau, with marginal gains primarily from aFRR Down activation and DAM arbitrage.

Hungary

Up to **€11,023** per month for 1 MWh systems

Up to **€16,916** per month for 2 MWh systems

In Hungary, DAM arbitrage provides the greatest income potential. Total revenues improve significantly when optimising across all services . The transition from 1MWh to 2MWh systems offers substantial upside, highlighting the importance of storage duration.

Takeaways

- Combining day-ahead market (DAM) arbitrage with automatic frequency restoration reserves (aFRR) continues to be a more profitable strategy than relying solely upon DAM arbitrage, especially in Poland and Romania
- Battery duration plays a crucial role in unlocking full market potential

Looking Ahead

As market revenues become increasingly tied to aFRR services and duration flexibility, battery sizing and strategic market selection are more important than ever.

Developers and operators looking to maximise ROI must continue to focus on multi-service optimisation and the operational advantages of longer-duration systems.

Want tailored projections for your BESS project?

Let our team model revenue scenarios
based on your location, system size and strategy.

photonenergy.com/bess

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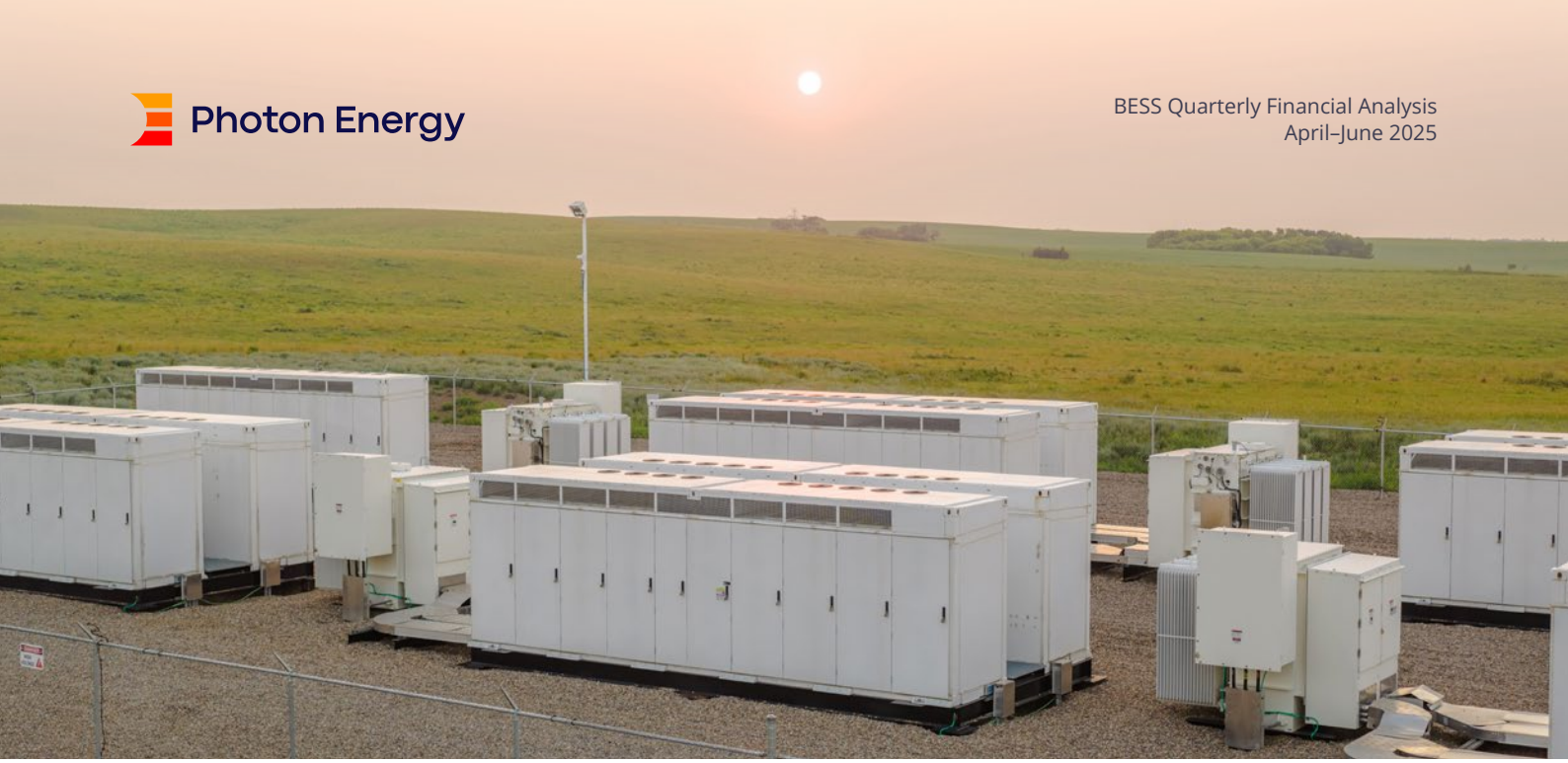


Introduction

This quarterly report evaluates the financial performance of standalone 1MW/1MWh and 1MW/2MWh battery energy storage systems (BESS) in four key Central and Eastern European markets: Czech Republic, Poland, Romania, and Hungary.

We consider two main revenue streams:

- **Day-Ahead Market (DAM)** arbitrage
- **Automatic Frequency Restoration Reserves (aFRR)** – including reservation and activation (Up and Down)

Methodology

All revenue figures are calculated using an advanced optimisation tool that assumes ideal hourly operation. This allows us to simulate how a battery system could perform in each market under realistic conditions, using real market pricing from April to June 2025.

Assumptions

Roundtrip efficiency:	**94%** (charging and discharging 97% each)
Battery availability:	**96%**
Max cycles/day:	**2**
Operational window:	**0–80% state of charge** (to prevent degradation)
Forecasting noise:	**5%**

This analysis provides storage developers, operators, and investors with a benchmark for potential returns in Q2 2025, and a strategic snapshot of where opportunities are growing.

Monthly Average Revenues

The tables below compare the average monthly revenues for standalone **1MW/1MWh** and **1MW/2MWh** BESS units across four Central and Eastern European markets. Results are broken down by revenue from **day-ahead market** (DAM) arbitrage alone and revenue from **all-market optimisation** (DAM + aFRR services).

All figures represent simulated earnings under optimal hourly operation between April and June 2025, based on typical system availability, roundtrip efficiency, and operating assumptions, country and market specification.

Monthly Average Revenue per 1MW/1MWh Standalone Battery (EUR/MW)

	DAM	DAM + aFRR					
	Total	aFRR				DAM	Total
		aFRR Up		aFRR Down			
		Reservation	Activation*	Reservation	Activation*		
CZ	4,126	8,442	930	9,589	1,237	3,459	23,658
PL	4,701	18,652	124	18,659	516	4,034	41,985
RO	3,938	2,685	1,528	2,765	4,254	3,285	14,516
HU	4,928	1,802	1,406	2,724	1,593	3,498	11,023

Monthly Average Revenue per 1MW/2MWh Standalone Battery (EUR/MW)

	DAM	DAM + aFRR					
	Total	aFRR				DAM	Total
		aFRR Up		aFRR Down			
		Reservation	Activation*	Reservation	Activation*		
CZ	7,657	10,748	523	12,654	1,466	6,507	31,896
PL	8,443	23,224	156	23,642	695	7,603	55,319
RO	7,199	3,338	1,809	3,444	6,027	6,106	20,724
HU	9,080	2,313	1,815	3,696	2,103	6,989	16,916

**Note: The activation portion of income includes the cost of recharging the battery after aFRR Up activation, and the revenue earned from discharging after aFRR Down activation.*

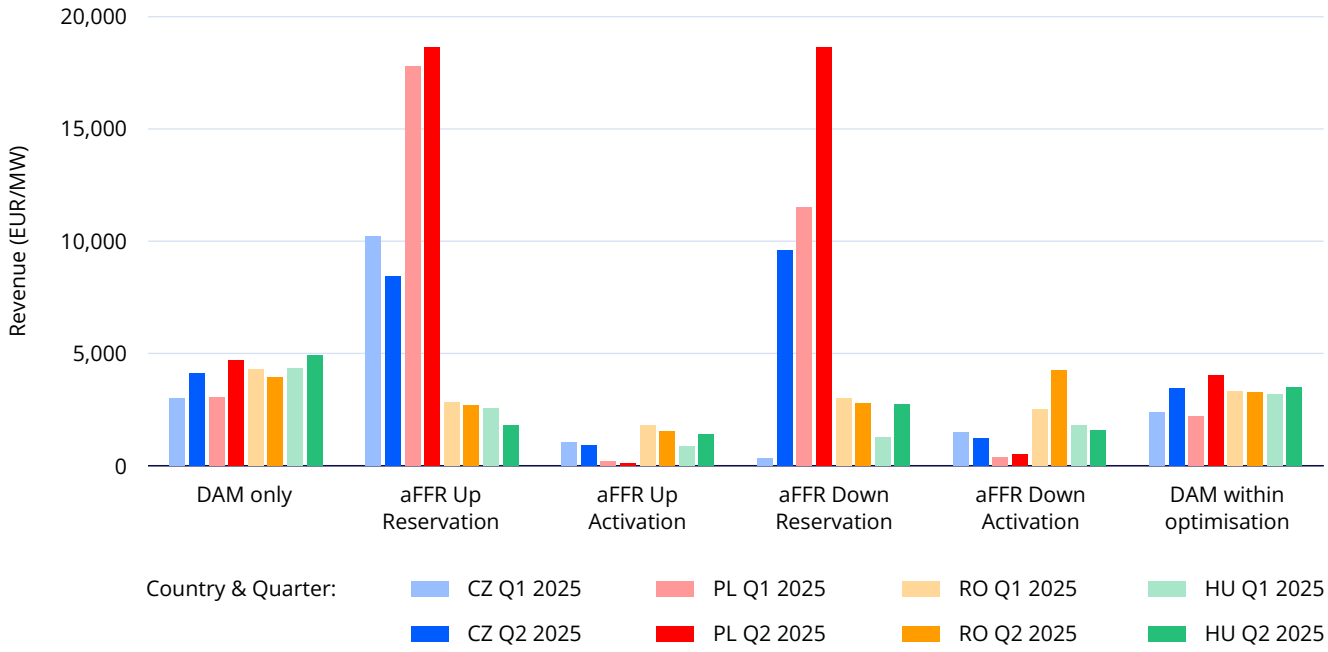
Additional Income in Poland

The Polish Capacity Market provides extra revenue that's not reflected in the tables above.
See **Country Insights: Poland** for details.

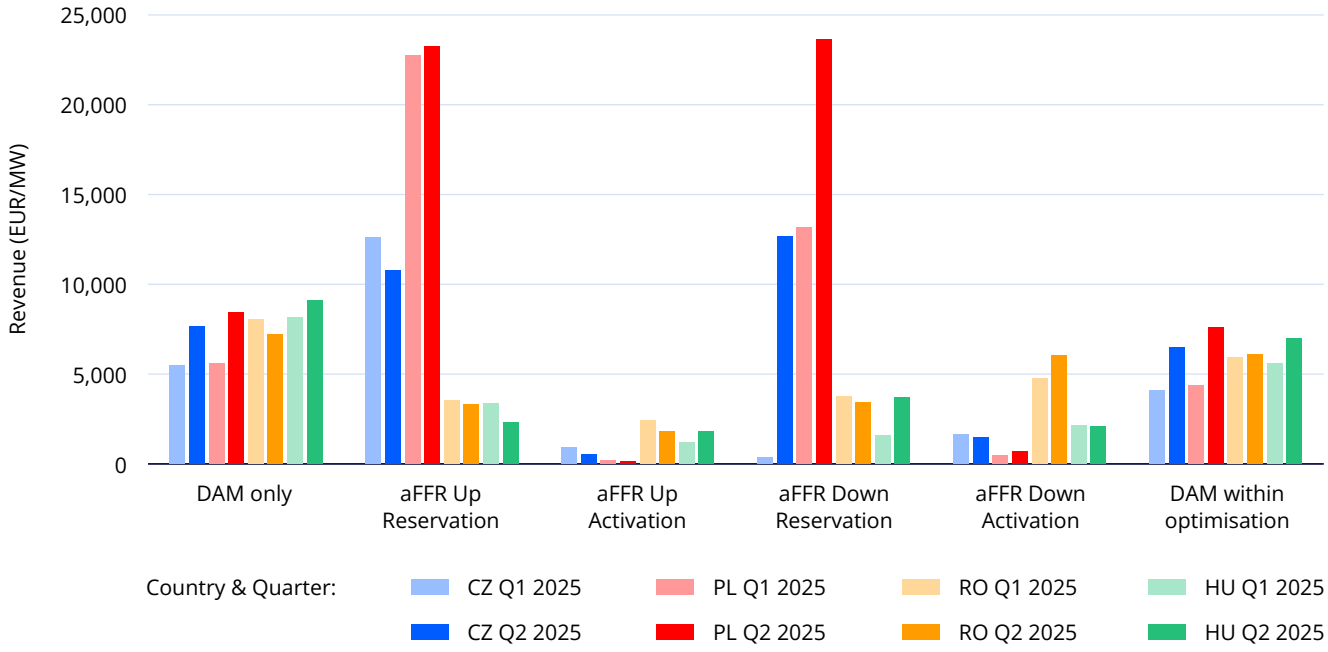
Quarter-on-Quarter Comparison

The second quarter of 2025 saw a strong rebound in revenue potential for standalone BESS across Central and Eastern Europe. All the reviewed markets reported higher total earnings than in Q1, with the exception of Romania participating only in DAM, with especially significant gains seen for systems operating with longer durations and full market optimisation.

Monthly Average Revenue for April–June 2025 1MW/1MWh Standalone Battery Compared to Previous Quarter



Monthly Average Revenue for April–June 2025 1MW/2MWh Standalone Battery Compared to Previous Quarter



Quarter-on-Quarter Comparison

Key Observations

Czech Republic

In the Czech Republic, 1MWh systems saw a 53% increase in revenue, rising from €15,455 in Q1 to €23,658 in Q2. Larger 2MWh systems performed even better, with total monthly revenue growing by 63% to €31,896.

This market continues to depend heavily on aFRR Up and Down reservation, and longer-duration systems are clearly better equipped to capture that value.

Poland

Poland maintained its position as the most profitable market overall. Revenue for 1MWh systems increased by 31% to €41,985, while 2MWh systems rose by 35% to €55,319.

The steady returns reflect consistent demand for aFRR services and ongoing support from the Capacity Market, both of which reward systems with multi-hour flexibility.

Romania

Romania showed more modest growth. Revenue rose 7.8% for 1MWh systems to €14,516, and just 1.3% for 2MWh systems to €20,724.

While gains were limited, they suggest a stable and balanced market, with incremental improvements rather than sharp swings.

Hungary

In Hungary, revenues improved for both system types: up 14% for 1MWh batteries (to €11,023) and 22% for 2MWh systems (to €16,916).

Hungary remains the least lucrative of the four markets in absolute terms, but the steady upward trend signals more balanced revenue streams and growing value in full optimisation strategies.

What This Means

The second quarter highlighted the resilience of multi-service strategies and the growing advantage of longer-duration batteries. Key takeaways include:

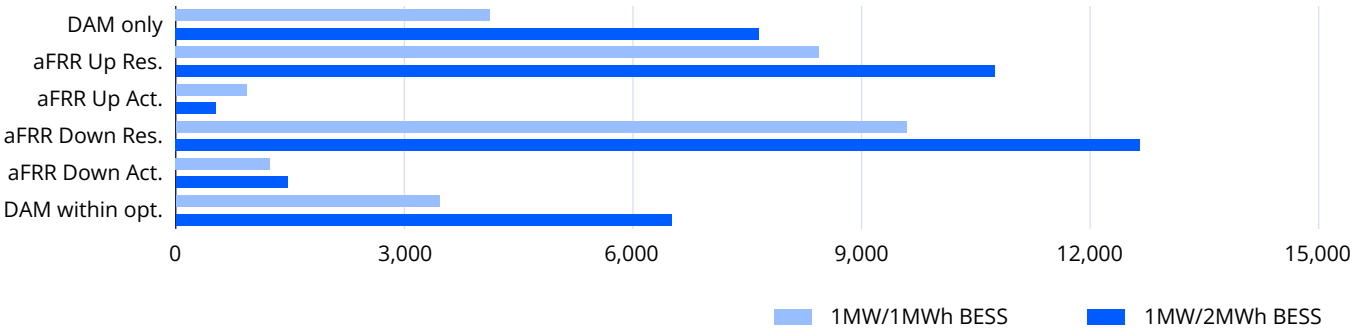
- **The growing revenue gap** between 1MWh and 2MWh systems across nearly all markets, with Romania as an exception
- **The continued value of aFRR optimisation,** particularly in Poland and the Czech Republic
- **The importance of flexibility** and sustained performance in volatile markets like Hungary

These results underline the strategic advantage of advanced modelling, operational versatility, and market selection in maximising BESS investment returns.

Country Insights: Czech Republic

In Q2 2025, 1MW/2MWh BESS units in the Czech Republic earned up to **€31,896 per month,** with nearly all revenue coming from **aFRR services,** particularly **Up and Down reservation.** This marks a significant improvement over Q1 results and reinforces the Czech market's role as a specialised hub for high-value ancillary service provision.

Monthly Average Revenue (EUR/MW)



Quarterly Trend

Compared to Q1, revenue for 1MWh systems rose by 53%, climbing from €15,455 to €23,658. For 2MWh systems, revenue increased by 63%, reaching €31,896. This increase is the highest in all of the markets analysed in this report. The gains were primarily driven by a strong rebound in aFRR Up and Down reservation prices, which remains the dominant income stream in the Czech market. DAM revenue also grew slightly quarter-over-quarter, but continues to contribute only a minor share of total earnings.

1MW/1MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	2,989	**4,126**	↗ 38.0%
aFRR Up Res.	10,235	**8,442**	↘ 17.5%
aFRR Up Act.	1,033	**930**	↘ 10.0%
aFRR Down Res.	312	**9,589**	↗ 2,973.5%
aFRR Down Act.	1,471	**1,237**	↘ 15.9%
DAM within opt.	2,405	**3,459**	↗ 43.8%

1MW/2MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	5,468	**7,657**	↗ 40.0%
aFRR Up Res.	12,595	**10,748**	↘ 14.7%
aFRR Up Act.	929	**523**	↘ 43.7%
aFRR Down Res.	347	**12,654**	↗ 3,546.6%
aFRR Down Act.	1,631	**1,466**	↘ 10.1%
DAM within opt.	4,067	**6,507**	↗ 60.0%

Strategic Implications

- The Czech Republic continues to offer concentrated value through aFRR Up and Down reservation, with larger batteries better positioned to capture income
- 2-hour systems significantly outperform 1-hour systems, emphasising the importance of duration and dispatchability
- Operators should focus on availability, efficiency, and bidding strategy to consistently secure aFRR revenues
- The narrow income profile highlights the need for close monitoring of auction dynamics and price signals

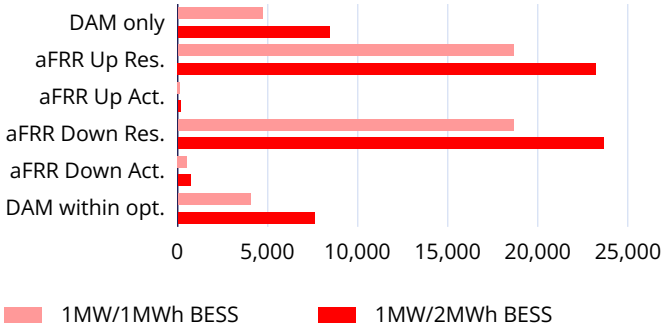
Takeaways

- A strong market for aFRR-focused strategies, particularly for well-optimised 2MWh systems
- Limited revenue diversification makes this market less suitable for entry-level operators or generic arbitrage models
- Success depends on reliability, foresight, and a deep understanding of the aFRR market
- Best suited for experienced operators who can manage risk and deliver high availability during critical periods

Country Insights: Poland

In Q2 2025, 1MW/2MWh BESS units in Poland generated up to **€55,319 per month,** maintaining Poland's status as the most profitable market for long-duration systems. Revenue was driven primarily by strong participation in the **aFRR Up and Down reservation** market, supported by stable **DAM** income and added earnings from the **Capacity Market.**

Monthly Average Revenue (EUR/MW)



The Capacity Market

Poland is the only market in this analysis offering additional income from the Capacity Market, with up to **€997/month** for 1MWh systems and **€1,995/month** for 2MWh systems in Q2 2025.

This boosts total returns and reinforces Poland's position as the most lucrative market for battery storage.

Quarterly Trend

Compared to Q1, revenues rose by 31% for 1MWh systems (from €32,106 to €41,985) and by 35% for 2MWh systems (from €40,965 to €55,319). These increases reflect continued strength in aFRR Up reservation and a rising contribution from aFRR Down reservation as the main income stream, despite moderation in price levels. DAM revenues increased slightly, while the additional support from the Capacity Market provided a reliable cushion against market variability.

1MW/1MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	3,056	**4,701**	↗ 53.8%
aFRR Up Res.	17,801	**18,652**	↗ 4.8%
aFRR Up Act.	187	**124**	↘ 33.6%
aFRR Down Res.	11,537	**18,659**	↗ 61.7%
aFRR Down Act.	397	**516**	↗ 30.1%
DAM within opt.	2,185	**4,034**	↗ 84.6%

1MW/2MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	5,588	**8,443**	↗ 51.1%
aFRR Up Res.	22,736	**23,224**	↗ 2.1%
aFRR Up Act.	218	**156**	↘ 28.6%
aFRR Down Res.	13,156	**23,642**	↗ 79.7%
aFRR Down Act.	473	**695**	↗ 46.8%
DAM within opt.	4,382	**7,603**	↗ 73.5%

Strategic Implications

- 2-hour systems continue to lead in both absolute revenue and resilience to market changes
- The Capacity Market acts as a revenue stabiliser, making Poland a strong long-term investment environment for BESS projects
- Developers should focus on long-duration, flexible systems that can take advantage of multiple value streams (aFRR, DAM, and capacity)
- Maintaining high availability and fine-tuning market responsiveness is key to sustaining competitive positioning

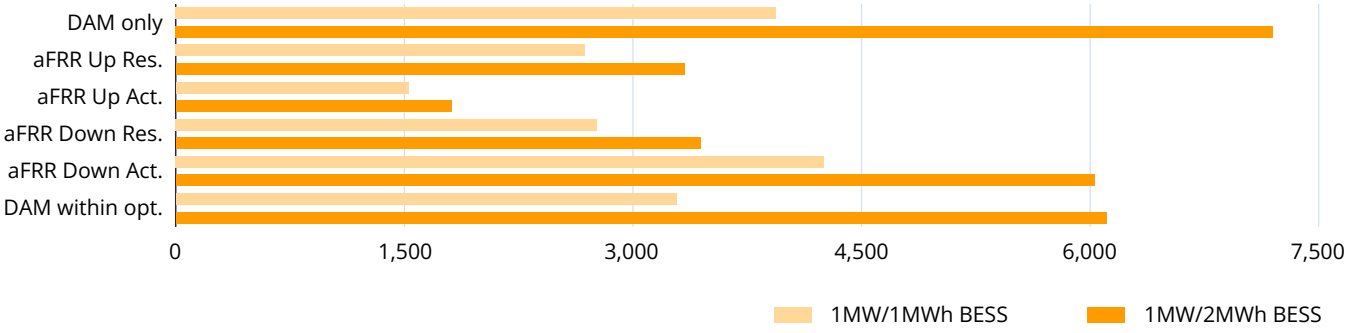
Takeaways

- Despite fluctuations in aFRR prices, Poland remains the top-performing market for battery storage
- The combination of high aFRR returns and Capacity Market participation creates a reliable and scalable revenue model
- Best suited for developers with robust system design and a multi-service optimisation strategy

Country Insights: Romania

In Q2 2025, 1MW/2MWh BESS units in Romania earned up to **€20,724 per month,** with revenue coming from a balanced mix of **DAM arbitrage** and **aFRR services,** particularly **Down activation.** While total returns were lower than in Poland or the Czech Republic, Romania remains a strategically valuable market for operators prioritising duration flexibility and diversified income streams.

Monthly Average Revenue (EUR/MW)



Quarterly Trend

Q2 revenues rose by 7.8% for 1MWh systems (from €13,468 to €14,516) and by 1.3% for 2MWh systems (from €20,454 to €20,724). While modest, this growth reflects steady performance across both DAM and aFRR services, with no major shifts in overall market structure. DAM revenues continue to play a central role, complemented by relatively stable aFRR participation, especially in Down activation. The limited growth for 2MWh systems suggests a possible plateau in incremental gains from longer durations.

1MW/1MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	4,297	**3,938**	↘ 8.3%
aFRR Up Res.	2,847	**2,685**	↘ 5.7%
aFRR Up Act.	1,789	**1,528**	↘ 14.6%
aFRR Down Res.	3,000	**2,765**	↘ 7.8%
aFRR Down Act.	2,526	**4,254**	↗ 68.4%
DAM within opt.	3,306	**3,285**	↘ 0.6%

1MW/2MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	8,022	**7,199**	↘ 10.3%
aFRR Up Res.	3,557	**3,338**	↘ 6.2%
aFRR Up Act.	2,446	**1,809**	↘ 26.0%
aFRR Down Res.	3,741	**3,444**	↘ 8.0%
aFRR Down Act.	4,753	**6,027**	↗ 26.8%
DAM within opt.	5,957	**6,106**	↗ 2.5%

Strategic Implications

- Romania offers a well-balanced revenue profile, drawing from both DAM and ancillary services
- Long-duration batteries are well-positioned to monetise aFRR Down activation and extended DAM opportunities
- While peak earnings are lower than in Poland or CZ, risk is reduced due to the lack of reliance on a single income stream
- Operators should prioritise flexibility, availability, and adaptability to shifting service demand

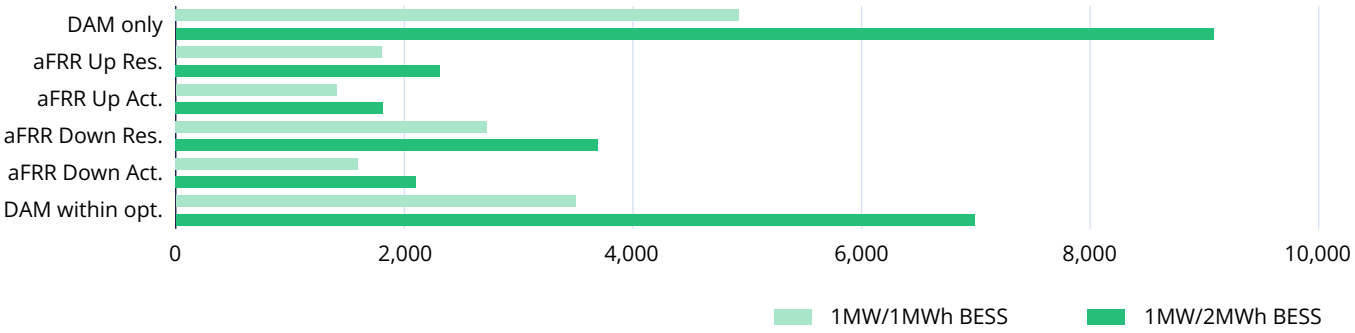
Takeaways

- Romania continues to be a stable and predictable market, particularly attractive for investors seeking steady income and lower volatility
- 2MWh systems continue to earn more in total, but 1MWh systems show stronger growth in Q2.
- Best suited for developers and operators with a long-term outlook and a preference for moderate, multi-channel revenue models

Country Insights: Hungary

In Q2 2025, 1MW/2MWh BESS units in Hungary generated up to **€16,916 per month,** marking a strong improvement over the previous quarter. Revenue was drawn from a balanced mix of **DAM arbitrage** and **aFRR** services, suggesting that Hungary's market is becoming increasingly favourable to flexible, duration-optimised storage strategies.

Monthly Average Revenue (EUR/MW)



Quarterly Trend

Revenues rose by 221% for 2MWh systems (from €13,899 to €16,916) and by 14% for 1MWh systems (from €9,680 to €11,023) compared to Q1. While these increases were smaller in absolute terms than in other countries, they highlight a **positive trajectory** for the Hungarian market, especially given its previously lower baseline. The improvements were supported by modest increases across all key revenue streams, including DAM participation, aFRR Up reservation and activation.

1MW/1MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	4,355	**4,928**	↗ 13.1%
aFRR Up Res.	2,545	**1,802**	↘ 29.2%
aFRR Up Act.	881	**1,406**	↗ 59.6%
aFRR Down Res.	1,257	**2,724**	↗ 116.7%
aFRR Down Act.	1,810	**1,593**	↘ 12.0%
DAM within opt.	3,188	**3,498**	↗ 9.7%

1MW/2MWh BESS (EUR/MW)

	Q1 2025	Q2 2025	
DAM only	8,138	**9,080**	↗ 11.6%
aFRR Up Res.	3,357	**2,313**	↘ 31.1%
aFRR Up Act.	1,177	**1,815**	↗ 54.2%
aFRR Down Res.	1,603	**3,696**	↗ 130.5%
aFRR Down Act.	2,150	**2,103**	↘ 2.2%
DAM within opt.	5,610	**6,989**	↗ 24.6%

Strategic Implications

- Hungary's balanced income structure makes it suitable for both short- and long-duration systems
- While absolute returns remain lower than in Poland or the Czech Republic, the market shows promising momentum
- The absence of a single dominant revenue stream may lead to greater resilience in changing conditions – but also lower peaks in income
- Operators should treat Hungary as a complementary market, ideal for portfolio diversification and multi-service optimisation

Takeaways

- Hungary demonstrated consistent quarter-on-quarter growth in Q2, reinforcing its role as a developing opportunity for BESS revenue
- While returns remain modest, the upward trend suggests future potential, particularly for operators deploying agile, flexible systems
- This market may be best suited for experienced developers looking to expand regional portfolios and explore underutilised revenue streams

Price Report

This section presents pricing data from Q2 2025 across day-ahead and ancillary service markets. These prices form the basis for the revenue modelling presented earlier and help explain changes in financial performance across Central and Eastern Europe.

All prices are reported in **EUR/MWh (or EUR/MW in case of reservation) as monthly averages** and include:

- Day-ahead market (DAM) prices
- aFRR Reservation (Up and Down)
- aFRR Activation (Up and Down)

Assumptions

The following assumptions apply to price calculations only and reflect the mechanisms and values used in each country.

aFRR Ancillary Services Pricing [1]

Country	Reservation	Activation
CZ	Pay as bid	Marginal price
PL	Marginal price	Marginal price
RO [2]	Marginal price	Marginal price
HU	Pay as bid	Pay as bid

Poland Capacity Market Assumptions

Parameter	Value [3]
Correction factor for batteries	95%
Capacity market service	Max 4 hours in row
Capacity market testing	4x per year
Capacity market hours	7–22
Latest available price	210.00 PLN/MW/year

Network Tariffs [4]

Country	EUR/MWh
CZ	38
PL	47
RO	21
HU	28

[1] 80% successful auctions for reservation and 50% for activations.

[2] In Romania, ancillary service offers must be symmetrical. Participants must participate in both directions, Up and Down.

[3] These values are valid for 2025. The price reflects the average price from additional auction. System stress events (SSE) not counted, in 2025: 0 hours of SSE in Poland.

[4] This fee is applied whenever a battery is charged from the grid, for the purpose of DAM arbitrage and when recovering from activation Up.

Price Report

Market Price Summary: Q2 2025

This table provides detailed pricing information (in EUR) for different countries and different energy market mechanisms. The table captures a range of statistics for each country, including the **mean**, **minimum**, **maximum**, and **standard deviation**.

Country	Market Type	Mean	Min	Max	Std Dev
Czech Republic	DAM	76.6	-224.5	283.1	52.9
	aFRR Down Reservation	21.6	5.0	84.0	12.1
	aFRR Up Reservation	18.9	14.9	42.3	4.0
	aFRR Down Activation	32.0	-2,650.4	1,497.9	134.3
	aFRR Up Activation	106.4	-339.5	2,483.2	119.9
Poland	DAM	89.7	-120.0	458.8	59.9
	aFRR Down Reservation	41.0	5.8	200.7	42.6
	aFRR Up Reservation	40.8	6.8	269.1	32.5
	aFRR Down Activation	87.1	-246.8	403.0	73.2
	aFRR Up Activation	96.0	-239.7	642.2	71.8
Romania	DAM	85.8	-100.6	408.7	57.0
	aFRR Down Reservation	11.9	6.6	14.7	2.4
	aFRR Up Reservation	11.5	8.5	14.5	1.0
	aFRR Down Activation	-48.0	-1,412.6	3,280.5	204.2
	aFRR Up Activation	178.8	0	1,840.6	197.6
Hungary	DAM	84.0	-210.1	462.1	59.7
	aFRR Down Reservation	6.2	0	50.0	8.9
	aFRR Up Reservation	4.1	0	49.2	7.3
	aFRR Down Activation	-18.5	-402.5	14.5	32.9
	aFRR Up Activation	116.9	0	2,817.0	203.9

Note: The positive Down activation prices represent a situation when the client is paying for charging the battery during activation, the negative Down activation prices represent a situation when client gets paid for charging the battery during activation.

Price Report

Market Insights

Day-Ahead Market (DAM)

- DAM prices **declined significantly** in all analysed countries, with steepest drops in the Czech Republic and Hungary
- **Volatility increased** in the Czech Republic, Poland and Hungary, while slightly decreasing in Romania
- **Hungary and Poland** remain the most volatile DAM markets

aFRR Reservation

- aFRR Down reservation prices increased significantly in the Czech Republic and Poland, but declined or remained low elsewhere
- aFRR Up reservation prices declined in the Czech Republic, Hungary and Romania, but increased slightly in Poland
- Poland was the only market to post gains in both Up and Down reservation pricing

aFRR Activation

- aFRR activation price volatility increased in most countries, with the exception of Czech Republic (Up and Down) and Hungary (Up only)
- Romania and Hungary posted negative average aFRR Down activation prices, with Romania's becoming more negative quarter-over-quarter
- The highest aFRR Up activation prices were observed in Romania, Hungary and the Czech Republic, all above €100/MW on average

Takeaways

- Czech Republic offered the strongest price signal for flexibility, with a significant surge in aFRR Down reservation prices
- Poland's increases in both Up and Down reservation prices helped support continued revenue strength, especially in longer-duration systems
- Romania's increasingly negative aFRR Down activation prices limit income potential, reinforcing the importance of flexible, long-duration systems to manage volatility
- Hungary's improved aFRR Up activation pricing presents an opportunity for flexible systems, although price levels remain modest and volatile elsewhere

Conclusion and Outlook

Battery energy storage in Central and Eastern Europe continues to offer strong revenue potential — especially for longer-duration systems optimised across multiple services. In Q2 2025, all four markets saw positive revenue trends, with **Poland and the Czech Republic leading in absolute growth, and Hungary showing moderate improvement from a lower base.**

While aFRR reservation income dipped slightly in some areas, full-market participation, combining DAM arbitrage and ancillary services, consistently delivered financial upside.

The most successful systems in this quarter were:

- **Well-sized.** 2MWh batteries consistently outperformed 1MWh systems in total earnings, thanks to their extended discharge duration and increased service eligibility
- **Strategically operated.** Flexibility to participate in both DAM and aFRR was key to maximising returns across all countries
- **Market-aware.** Revenue performance closely mirrored changes in local price trends and market conditions, reinforcing the importance of continuous monitoring and adaptation

Czech Republic continued to reward systems focused on aFRR Down and Up reservation, though its market remains narrower in scope.

Poland remains driven by high aFRR reservation prices. **Capacity Market income** provides an additional revenue stream, further boosting long-term potential.

Romania offered a relatively balanced revenue mix, but Q2 growth was limited, highlighting the importance of flexible, long-term strategies.

Hungary showed modest momentum, with improved aFRR Up activation pricing supporting gradual revenue growth.

What to Watch in Q3 2025

- Will aFRR reservation prices rebound in Poland or continue to soften?
- Can Romania's pricing environment continue to support flexible systems, or will regulatory changes introduce new barriers?
- Will Hungary's improving revenue signals and flexibility gains attract broader investment interest?

Ready to model revenue for your BESS project?

Whether you're planning a new system or assessing returns in a specific location, our team can run tailored simulations based on your system size, duration, and strategy.

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