EnergyAI

to know better

BESS
POLISH DAM
ABSORPTION CAPACITY

18.11.2025

dr inż. Paweł Włoch

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EXECUTIVE SUMMARY

Objective of the Analysis

The purpose of this analysis was to determine the extent to which the Polish Day-Ahead Market (DAM) is capable of absorbing additional energy volumes resulting from the operation of large Battery Energy Storage Systems (BESS), as well as the impact of these volumes on settlement prices. The dataset covers the period **18–30 September 2025**, characteristic of the autumn seasonal transition, and the analysis focuses on hours with extreme price levels.

1. The Polish energy market is structurally shallow

During low-price hours, market volumes ranged from 597 to 13,296 MWh, while during high-price hours they ranged from 286 to 3,349 MWh.

Even small volume shifts (400–700 MW) cause abrupt price movements:

- +500 MW demand → price increase up to +50 EUR/MWh
- +3,000 MW demand → prices may rise by as much as +2,300 EUR/MWh
- +400 MW supply → price decrease of approx. –100 EUR/MWh
- +700 MW supply → price drops down to –700 EUR/MWh

This clearly shows that with larger charging or discharging volumes, the market rapidly changes its price level, limiting the potential for stable arbitrage.

2. Large BESS capacities very quickly cannibalize their own revenues

Both charging (demand) and discharging (supply) shift the market equilibrium:

- BESS raises prices when charging,
- BESS lowers prices when discharging.

Effect:
The greater the storage capacity, the smaller the achievable arbitrage margins, because the system itself erodes the price spread that the unit relies on to generate revenue.

3. The Polish BESS pipeline (>1 GW) will further reduce arbitrage profitability

Currently confirmed projects include:

- PGE EO – 200 MW / 800 MWh, Żarnowiec
- GreenVolt – 2 × 200 MW / 800 MWh, Turośń Kościelna & Nowa Wieś Ełcka
- Orlen – 400 MW / 800 MWh, Dolna Odra

Total: 1,000 MW / 3,200 MWh

Introducing these units into the DAM will further:

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- deepen price cannibalization,
- tighten spreads,
- increase price volatility during "shallow" hours.

Key Strategic Conclusions

1. Stand-alone arbitrage does not justify investment in large-scale BESS in Poland — the market is too shallow.

The Polish Day-Ahead Market reacts sharply even to relatively small charging or discharging volumes.
As a result, large storage units (≥300 MW) almost immediately distort the supply–demand curves, significantly reducing their own arbitrage margins.

2. BESS > 300 MW are particularly exposed to self-cannibalisation and the growing competition from other storage units.

With a pipeline exceeding 1 GW, arbitrage will become a zero-sum game in which value rapidly migrates from the DAM to system services or location-specific products.

3. Smaller units (50–200 MW) offer the highest value potential — especially with higher C-rate configurations.

This is critical considering that the vast majority of currently designed storage projects use a 4-hour configuration (C-rate = 0.25).

Units with such a low C-rate have very limited capability to provide system services, while many of the most profitable flexibility products require faster cycling (C-rate ≥ 1).

However, even the most optimal power range — 50–200 MW — may lose profitability if the market becomes dominated by several >200 MW storages operating in sync during the same hours.

4. Future revenues will depend mainly on system services, local flexibility services, and congestion management — not arbitrage on the DAM.

Even in these segments, however, caution is essential, because:

- BESS competition is growing faster than the demand for services,
- 4-hour storage units are not eligible for several key products (e.g., certain FFR/FFL services),
- regulations are still evolving and may result in unfavourable market segmentation.

5. BESS should be evaluated as part of IPP portfolio optimisation — not as a standalone business case.

Storage assets can enhance the value of:

- generation profile shaping (firming),
- PPA performance,
- cross-border exposure,
- local projects affected by network constraints.

Even here, caution is needed, as the added value depends on location, generation profile, and integration with trading — not merely on the BESS technology itself.

Scope of analysis

The objective of this analysis was to assess the impact of increasing the volumes of energy offered for sale and purchase on the aggregated supply and demand curves of the Polish Power Exchange (TGE) during the period **18–30 September 2025** (the so-called autumn transition).
The dataset includes Day-Ahead Market prices from **Fixing I** (domestic trading) and **Fixing II** (market coupling).

The analysis focused on hours with **extreme price levels** (the lowest and highest hourly price of each day).
During the examined period, volumes in the lowest-price hours ranged from **597 to 13,296 MWh**, while in the highest-price hours they ranged from **286 to 3,349 MWh**.
These values reflect the depth of the market in the hours where BESS participation in arbitrage trading is expected.

The purpose of the analysis was to determine how different storage power levels affect Day-Ahead Market settlement prices, and therefore the potential revenues from energy arbitrage.

Two scenarios were analysed:

- **Price decrease scenario:** assessment of the impact of additional supply offered at prices below the market equilibrium price.
- **Price increase scenario:** assessment of the impact of additional demand offered at prices below the market equilibrium price.

This approach is consistent with trader strategies and the **merit order** mechanism.
The intention was to place bids below the equilibrium price to ensure their execution, which—depending on the operation (charging = demand, discharging = supply)—shifted the equilibrium point.

Below is an example of an aggregated supply and demand curve, where the green line represents demand and the black line represents supply.

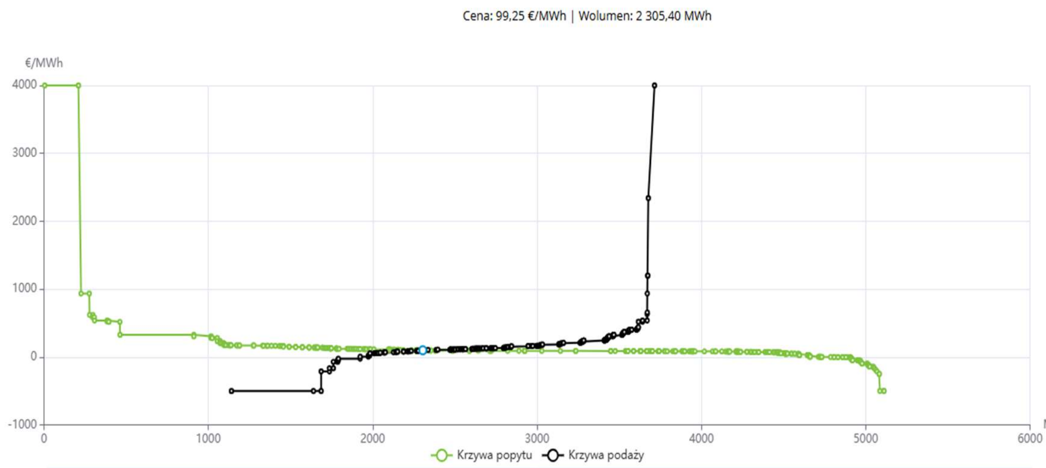

Figure 1. Example aggregated curves

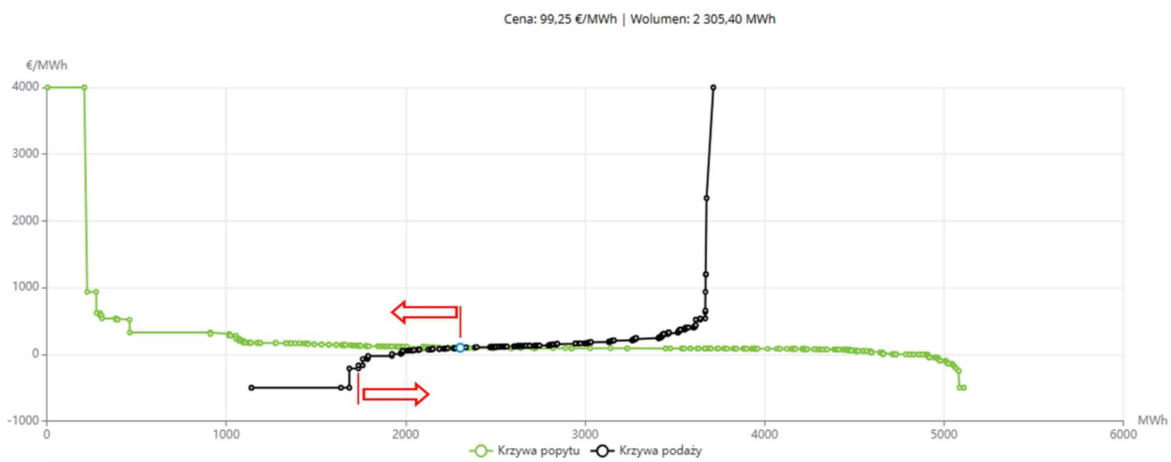

Figure 2. Introduction of a supply volume offered at a price lower than the market equilibrium price

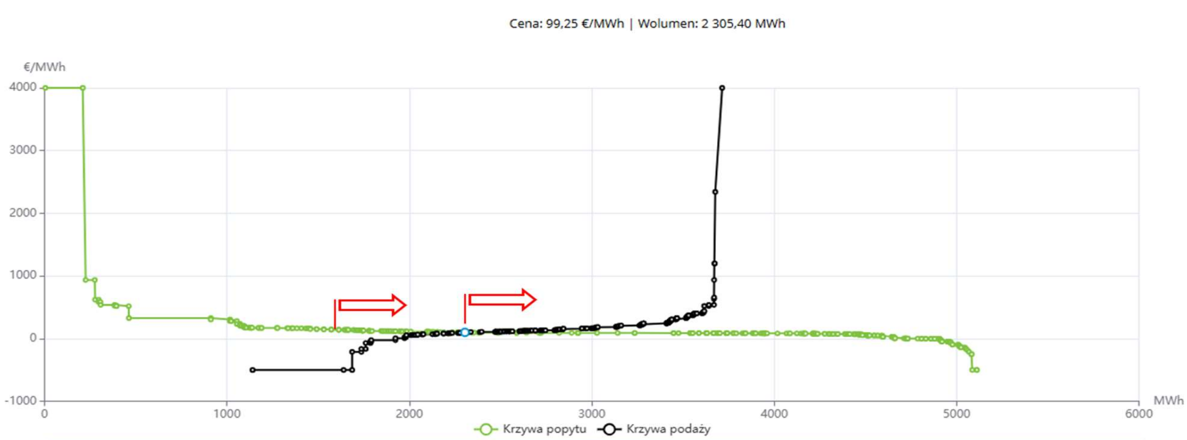

Figure 3. Introduction of a purchase volume offered at a price lower than the market equilibrium price

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Results

The chart below illustrates the increase in electricity prices resulting from an additional rise in purchase volume. This scenario reflects market conditions observed during current price minima occurring between 11:00 and 14:00.

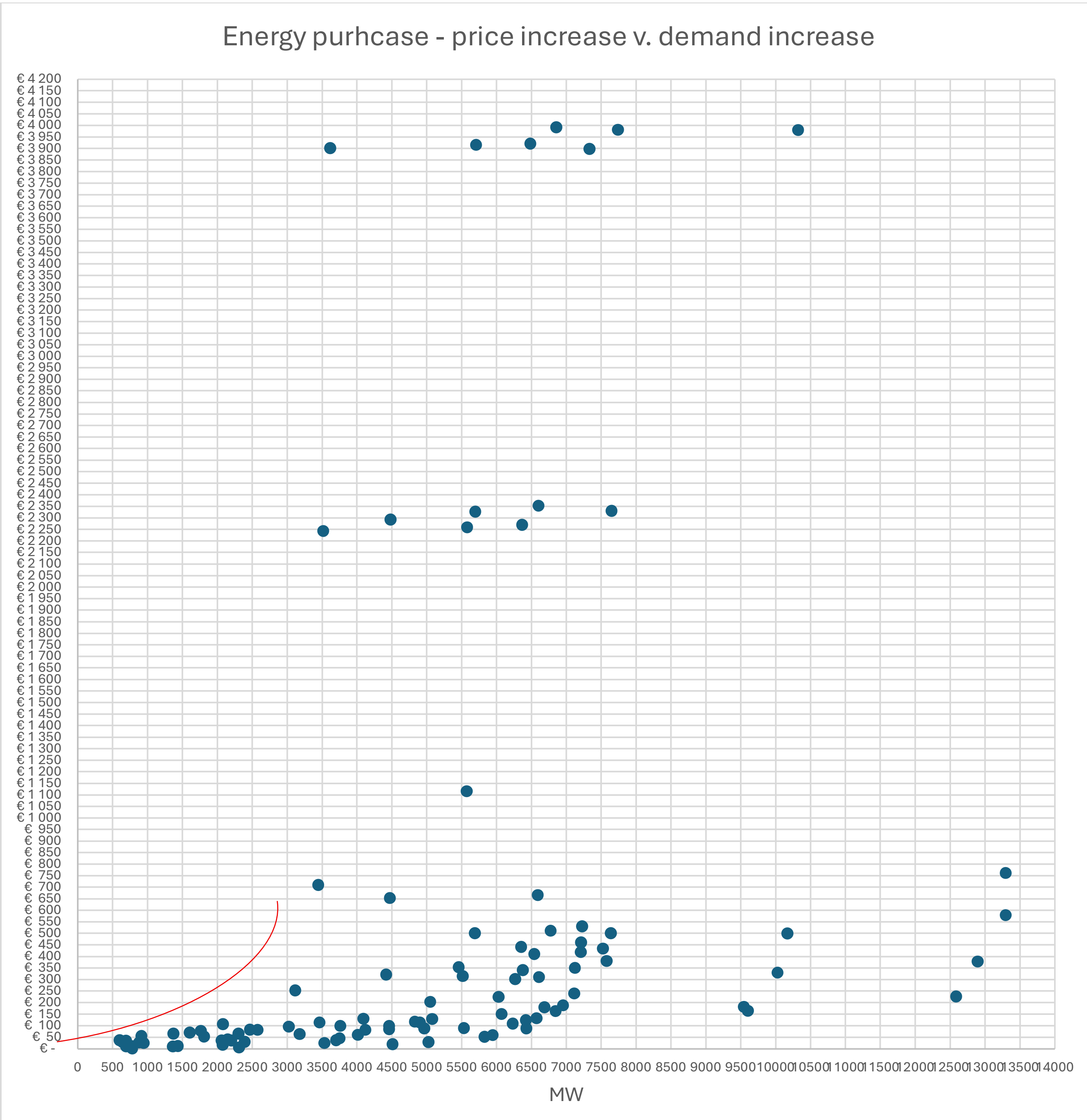

Figure 4. Energy charging — increase in purchase price resulting from higher demand

As shown in Figure 4, increasing the charging power has a significant impact on Day-Ahead Market prices:

- At a charging power of around 500 MW, purchase prices may increase by up to 50 EUR/MWh.
- Between 500 MW and 3,000 MW, the price impact can reach approximately 100 EUR/MWh.
- Above 3,000 MW, prices may rise sharply, in some cases reaching levels of up to 2,300 EUR/MWh.

These results indicate that the Polish electricity market exhibits relatively low depth when faced with high charging demand from battery storage systems.

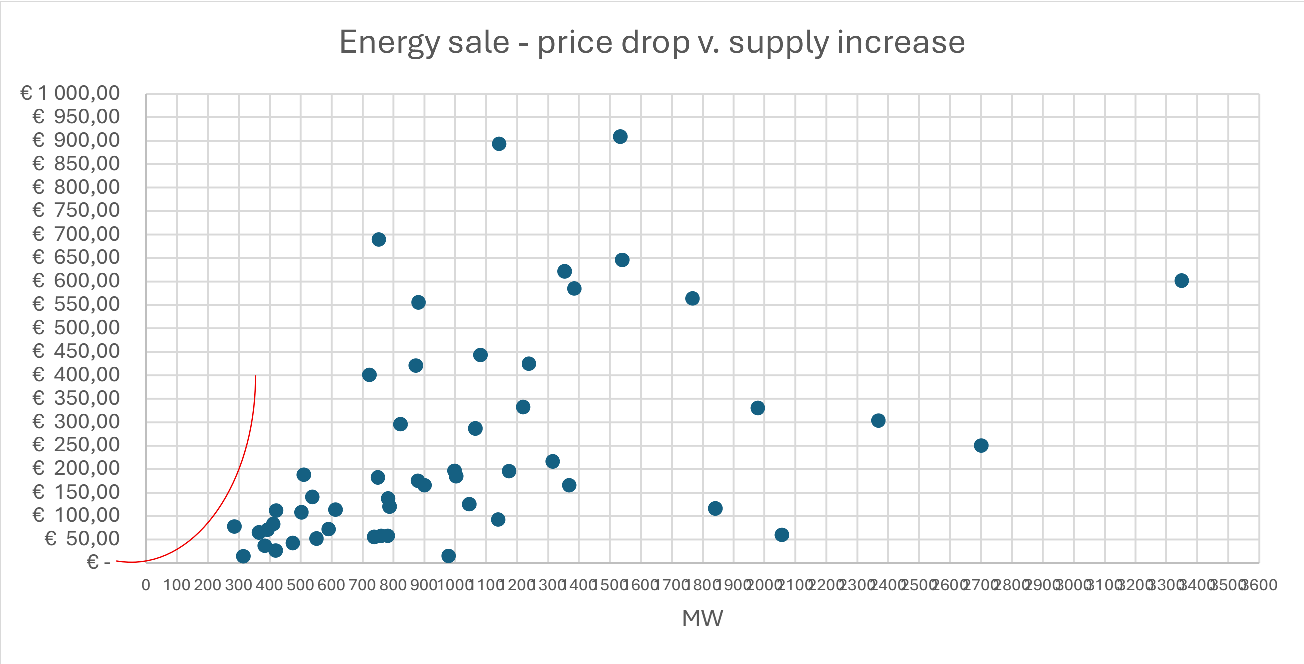

Figure 5. Discharging — decrease in selling price resulting from increased supply

As shown in Figure 5, increasing the discharging power has a clear impact on Day-Ahead Market settlement prices:

At around 400 MW of discharging, selling prices may drop by approximately 100 EUR/MWh.

Between 400 MW and 700 MW, the price decrease can reach 200 EUR/MWh.

Above 700 MW, settlement prices may fall sharply — in some hours by as much as 700 EUR/MWh.

These results clearly indicate that the Polish electricity market is structurally shallow when exposed to large discharging volumes from energy storage systems.

When interpreting Figures 4 and 5 together, it is crucial to note the so-called departure curve — the rate at which price movements accelerate as BESS charging or discharging power increases.

This curve illustrates how quickly arbitrage margins deteriorate once storage power exceeds the natural depth of the Polish Day-Ahead Market.

For comparison, the average Day-Ahead Market price from 1 January to 12 September 2025 was approximately 100 EUR/MWh.

Therefore, even price changes of 50 EUR/MWh have a significant impact on arbitrage profitability.

Announced BESS Deployments

This issue becomes even more significant in the context of large BESS projects already announced in Poland, including:

PGE EO – 200 MW / 800 MWh (Żarnowiec)

GreenVolt – two units of 200 MW / 800 MWh each (Turośń Kościelna, Nowa Wieś Ełcka)

Orlen – 400 MW / 800 MWh (Dolna Odra)

The combined pipeline of these projects amounts to approximately 1,000 MW / 3,200 MWh of storage capacity.

The entry of these units into the market will likely further constrain arbitrage revenues, deepen price cannibalisation, and increase volatility during hours that already exhibit limited market depth. For investors, this underscores the necessity of relying on diversified revenue streams beyond arbitrage, particularly system services and products related to network congestion management.

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