PowerUp

Manage & extend batteries life

The Value of Battery Analytics in Anomaly Detection and Resolution

How battery analytics unlocks hidden profits

Battery Asset Management Summit – Rome – December 3rd, 2025

AGENDA

1. Context
2. Capacity optimization use cases
3. Availability augmentation use cases
4. Key take-aways: annual revenue increase potential

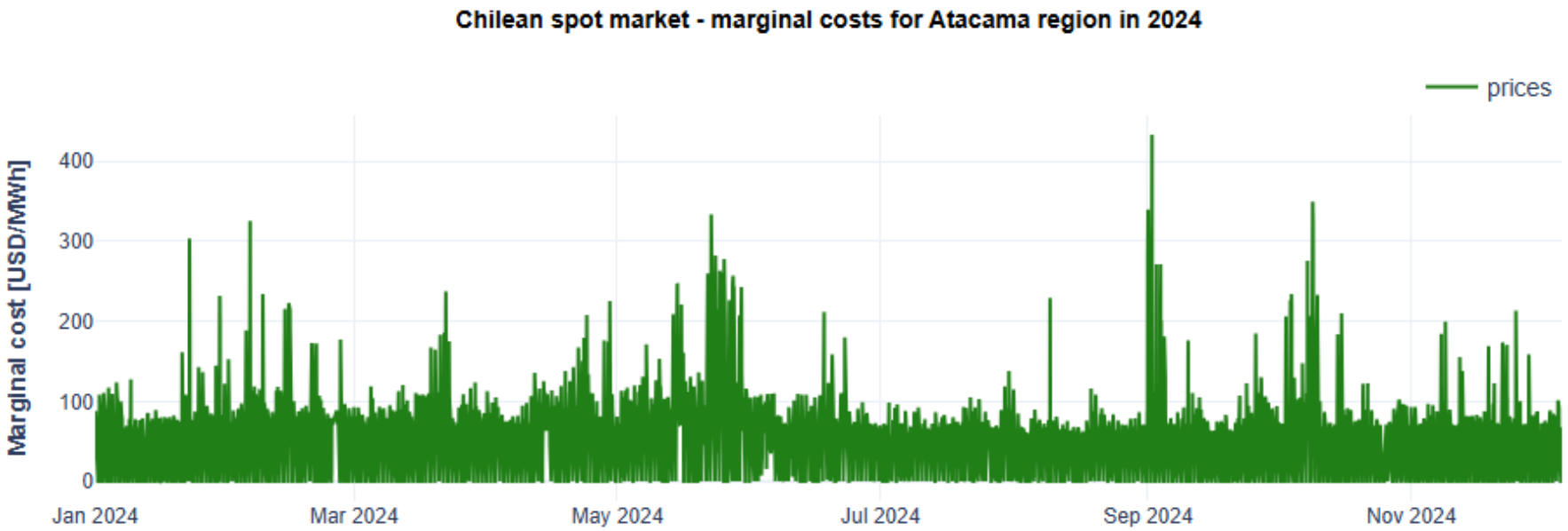
PowerUp

1. Context introduction

Battery Predictive Analytics
Optimization, performance and durability

A detailed technical-economical study

- PowerUp was commissioned to conduct technical audits on several Battery Energy Storage System (BESS) installations newly brought online in Chile throughout 2024
- BESS used for energy arbitrage with high market price volatility : “Buy Low, Sell High”
- **Many detected anomalies could have been prevented/solved with PowerUp analytics**
- Earlier resolution can easily be translated in “additional tradeable capacity” or “augmented availability and market opportunity”: in the end, additional €€€

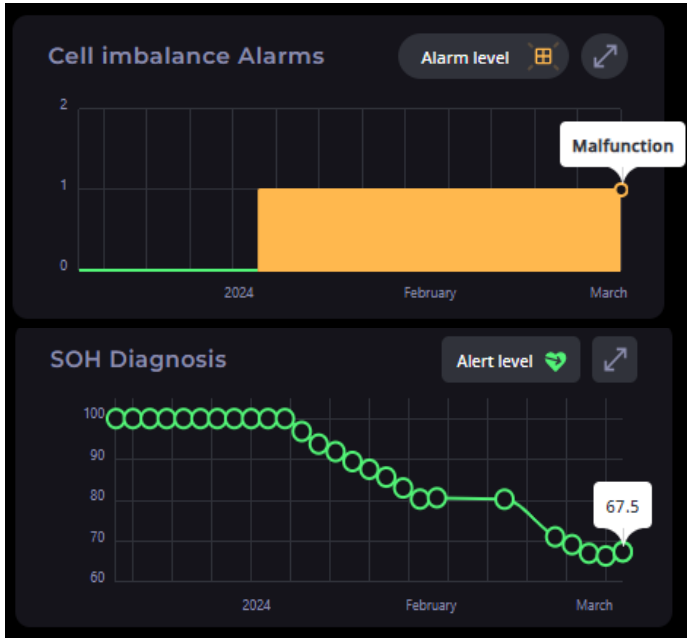


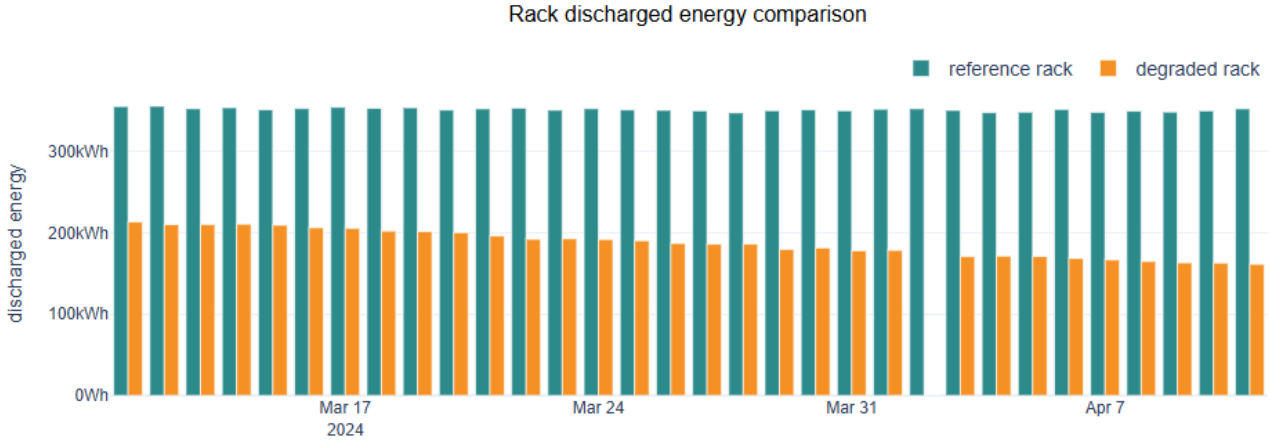
Source: National Electric Coordinator Coordinador Eléctrico Nacional (CEN): www.coordinador.cl

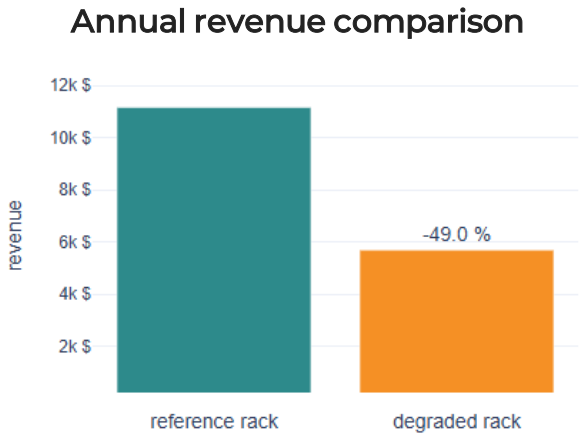
2.1. Illustrative case study
for tradeable capacity optimization

- Strong capacity loss due to cell imbalance (SOC dispersion)

  - A SOC balancing issue, which emerged in January 2024 led to a very sharp decline in usable capacity: **a loss of 49% in three months** unidentified by the BMS
  - **Reversible capacity loss**: this type of cell imbalance (SOC dispersion) would have been corrected by active rebalancing and/or BMS misconfiguration troubleshooting
  - **With PowerUp the issue would have been identified from day one with clear recommendation for swift recovery**





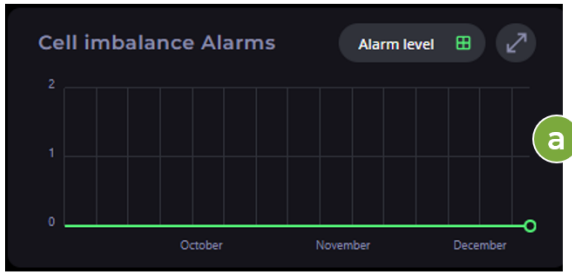


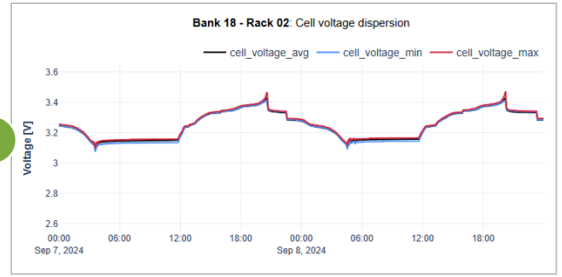
2.2. Illustrative case study for tradeable capacity optimization

Battery Predictive Analytics
Optimization, performance and durability

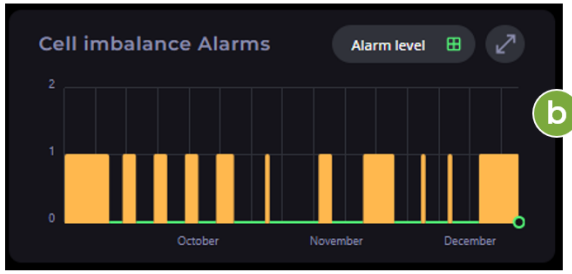
Bank affected by inter-rack imbalance issues

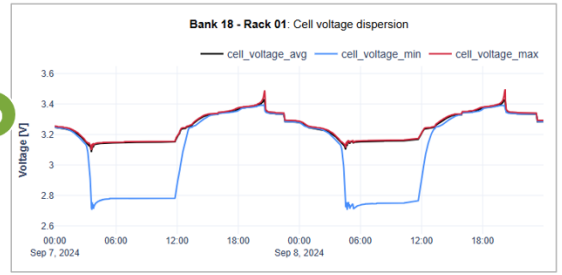
- Among 23 racks connected to the same PCS, only one is affected by cell imbalance (bank 18 – rack 01 in figure below (b))
- It acts as "**the rotten apple in the barrel**", preventing the PCS from being able to fully charge/discharge all other racks as soon as the weakest rack reaches its voltage limits
- **It only takes one unbalanced rack to limit the entire bank to ~90% of its expected performance**





a





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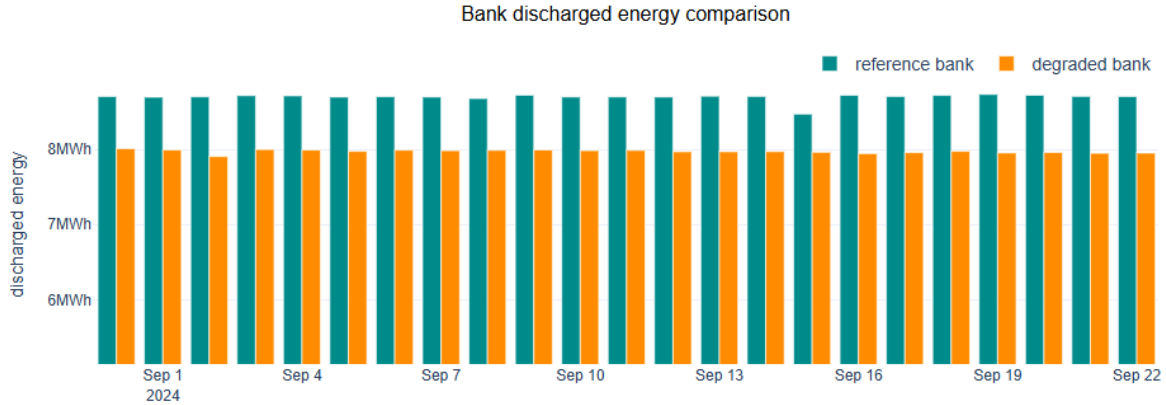
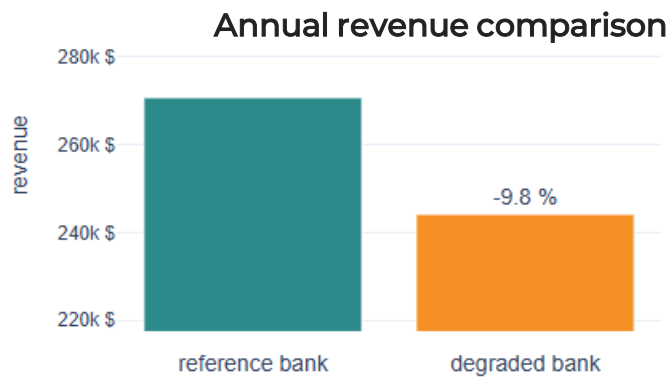


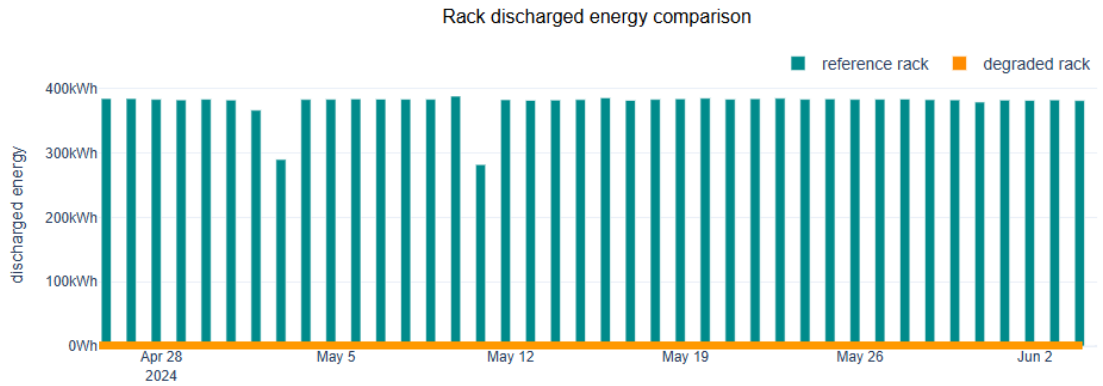


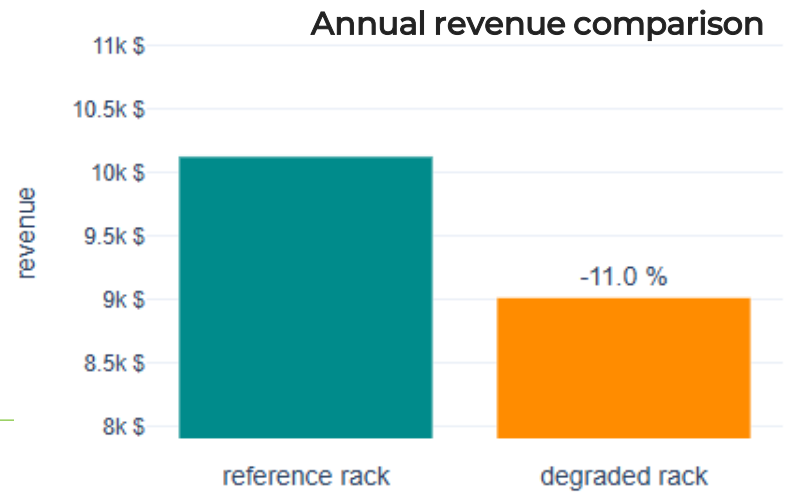
3.1. Illustrative case study for increased availability

Battery Predictive Analytics
Optimization, performance and durability

Cell imbalance leading to service interruption

- Severe cell imbalance issue on racks led to high undervoltage
- Below a certain minimal voltage threshold, the BMS deems the rack non-operational, and its usual cycling is no longer possible; PowerUp would have **identified this anomaly 2 months before**
- The corresponding figure shows a **40-day service outage** due to the undervoltage event before resolving the issue, which could have been prevented with PowerUp analytics

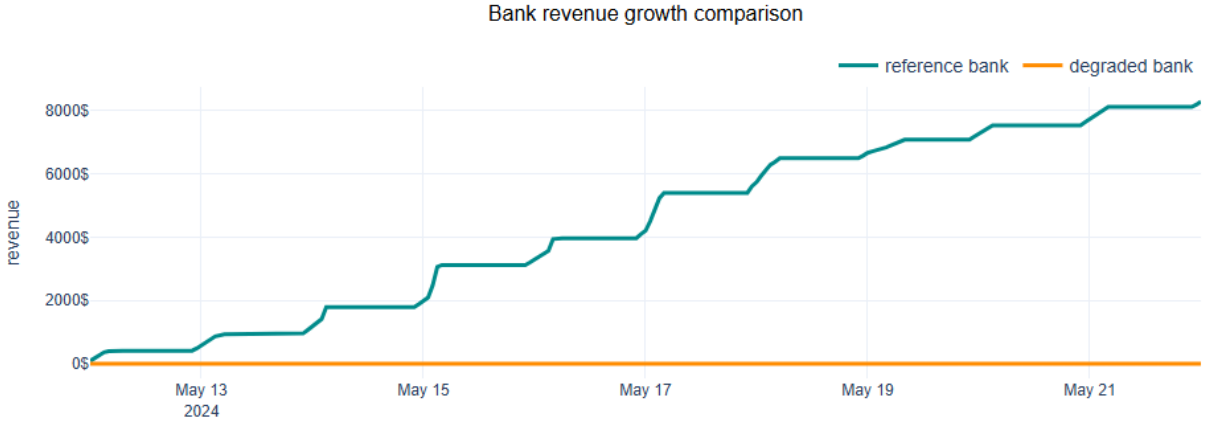


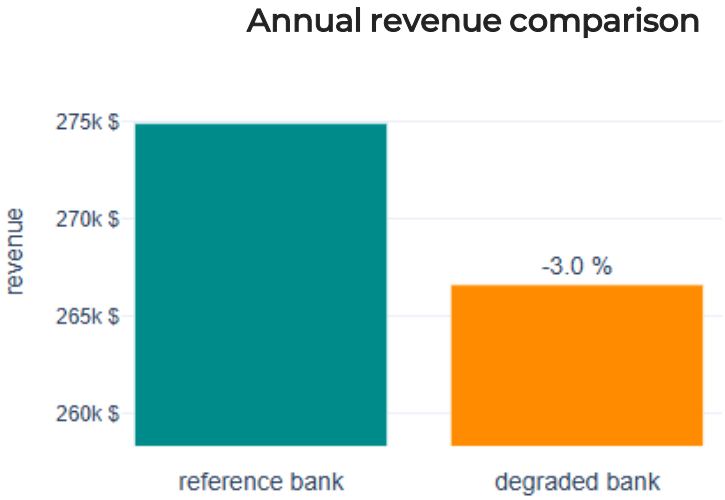


3.2. Illustrative case study for availability rate augmentation

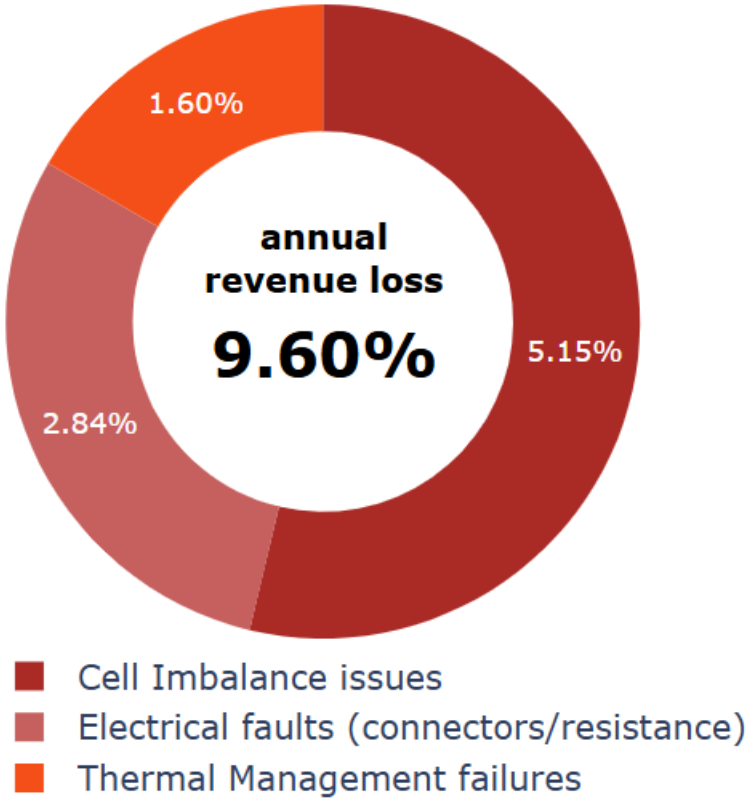
Cooling anomaly leading to service interruption

- Use case of an air conditioning problem encountered in a container, which led to a sudden temperature drift
- All racks in the given container were affected by the anomaly, therefore generating a **very costly shutdown**
- PowerUp analytics would have been able to identify **very early on** that the temperature increase was abnormal versus battery usage
- How? Thanks to a **powerful algorithm based on machine learning** using only battery data to create an electro-thermal model and predict normal battery temperature





4. Key take-aways
for annual revenue augmentation



- Summing up:

When we add up all issues: imbalances, undervoltage, cooling anomalies, resistance faults:

~10% lost BESS revenue was preventable!

Measured. Real. Operational.
This is the value of understanding and of acting early.

This is the value of having **PowerUp as your analytics partner**.

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