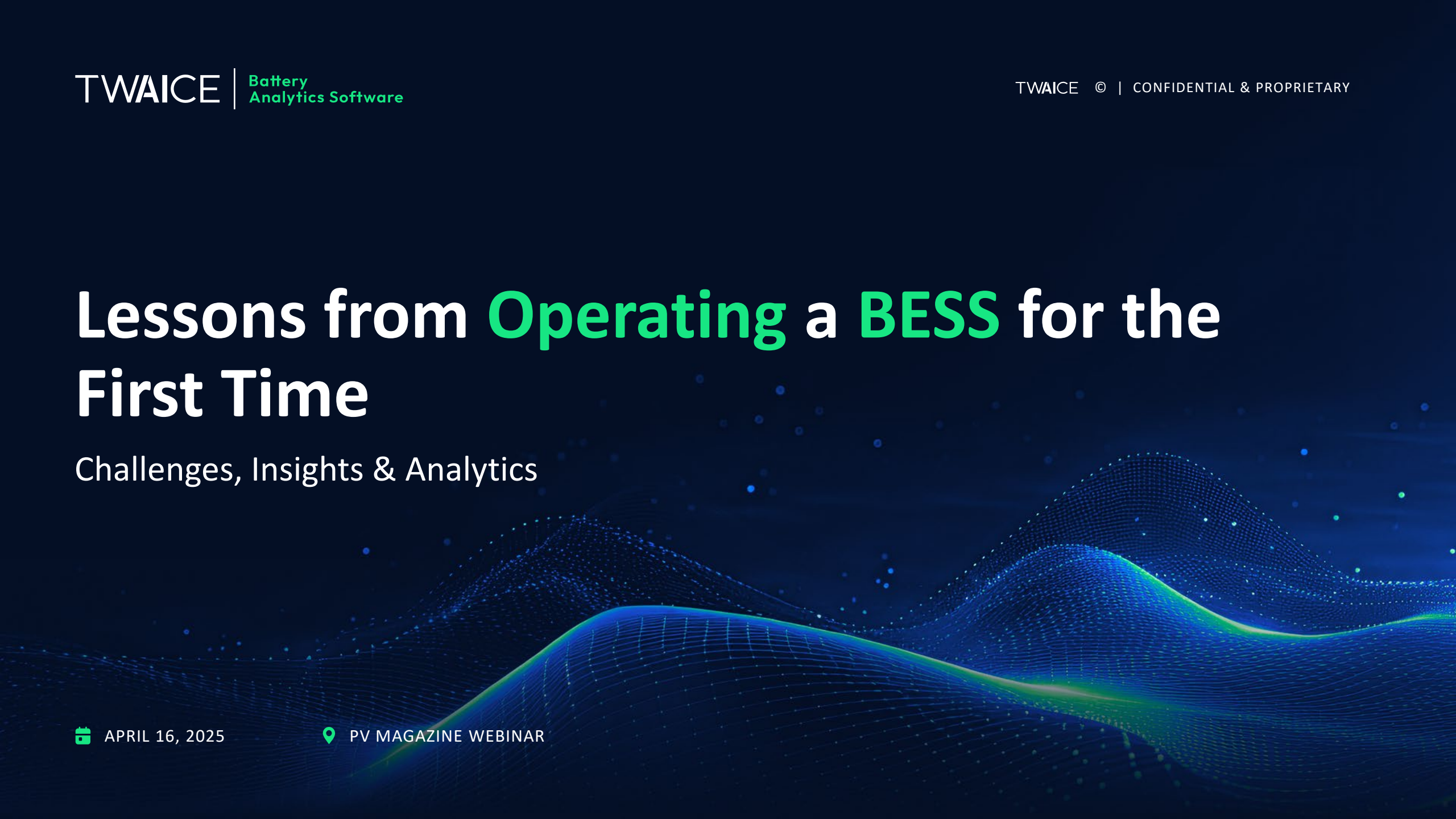
TWAICE | Battery Analytics Software

Lessons from Operating a BESS for the First Time

Challenges, Insights & Analytics



APRIL 16, 2025

PV MAGAZINE WEBINAR

Speakers

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Agenda

1. **ESS industry challenges and opportunities from the executive viewpoint**
2. **Project Background: InterEnergy's FV3 BESS**
   - Project Introduction
   - Commissioning timeline
   - Key challenges and lessons learned
3. **Analytics in Action: Using Data to Overcome Operational Hurdles**
   - Real-time issue detection (non-functioning modules, data outages)
   - Warranty tracking
4. **Panel Q&A Session**

Key Objectives

1. Obtain a deeper understanding of safety and performance of operating BESS assets through a more granular level

2. Obtain a better understanding of the risks associated with the commissioning of new BESS assets

3. Learn about the competency and expertise of BESS integrators &/or OEM's including their willingness to support the projects

4. Value that be obtained from using 3rd party analytics platforms

CEPM ZERO

Consorcio Energético Punta Cana–Macao (CEPM) is an independent utility located in Punta Cana, Dominican Republic, operating off-grid from the National Electric System (SENI). With an installed thermal capacity of over 350 MW. CEPM supplies energy to approximately 65% of the country's tourism sector.

CEPM ZERO is the initiative that aims to transition CEPM to carbon neutrality the next decade.

30% **PHASE 1** 2024/25

215 MW of solar PV projects.
115MW/149MWh Battery Energy Storage Systems (BESS)

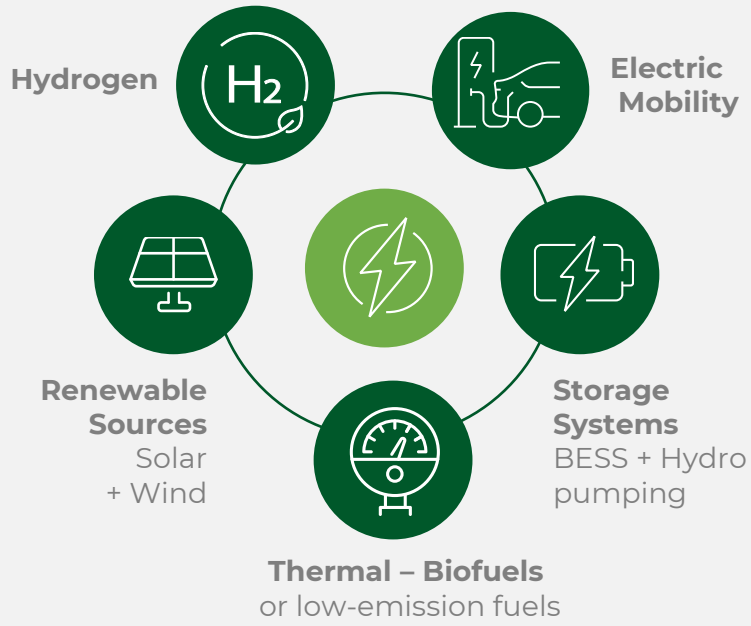
60% **PHASE 2** 2026/28

Development of wind farms with a capacity of **200MW** and BESS of **40MW/80MWH**

100% **PHASE 3** 2030

Other technologies and scenarios are being evaluated to provide grid stability

70MW/800MWh Pumped hydro (Storage)
200MW Hydrogen
145MW BESS
300MW Wind projects
560MW Solar projects



FV3 PROJECT

BESS

INSTALLED CAPACITY
12 MW

INSTALLED ENERGY
40.6 MWh

COUPLING
AC

20 ESS of 2.032 MWh each
60 PCS of 200 kW each
2 STS of 6 MW each
4 DTS to cover auxiliary consumption of ~ 17kW each

PV

PEAK POWER
24.5 MW

NOMINAL POWER
21.8 MW

BESS FUNCTIONALITIES

PV Firming
Voltage regulation
Energy shifting
Fast Frequency Response (FFR)
Virtual Sinchronous Machine (VSM)
Black start

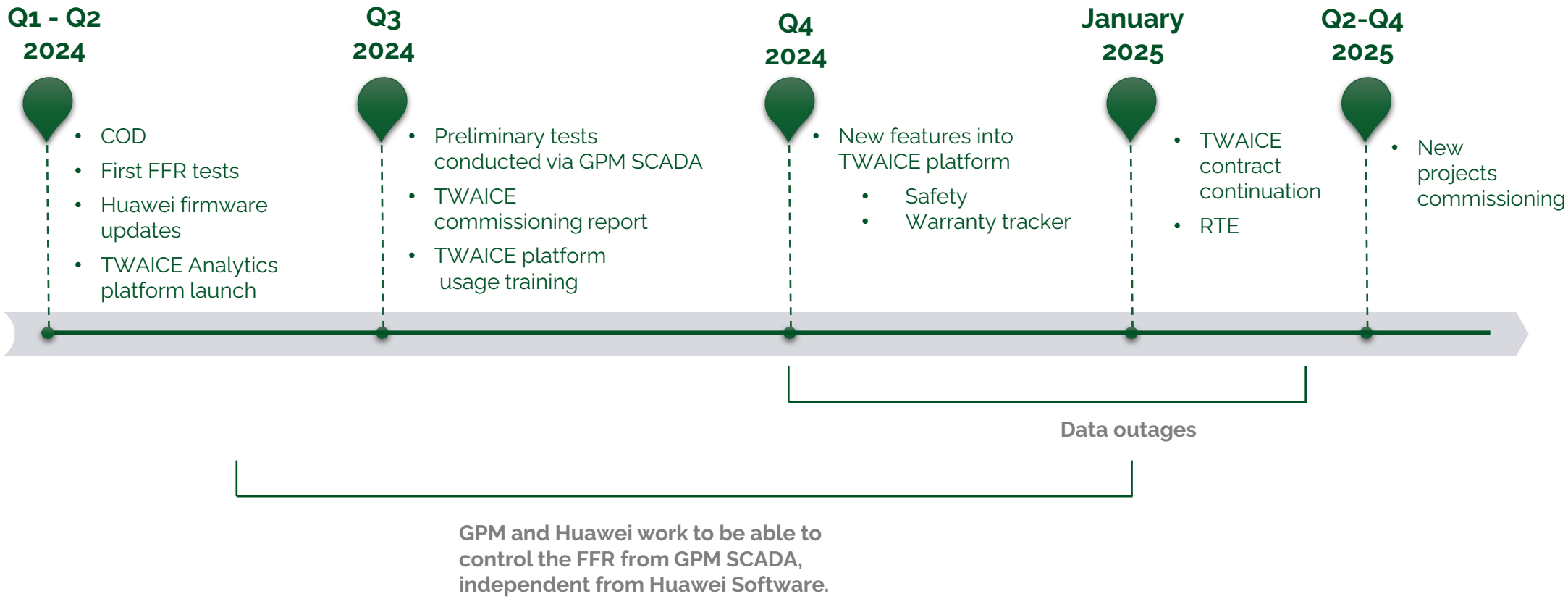
PV modules
RISEN RSM132-8-655/660MDG Bifacial

String Inverter
Huawei 330KTL 300kWac
3 x STS JUPITER 6000K

Fixed Structure
3Vx16 with 7° inclination
Reneergy

BESS
AC coupling –9 MW/36 MWh
Huawei

TIMELINE OVERVIEW



- Key issues resolved:
  - Modbus communication
  - Full PCS activation
- Remaining challenges:
  - Frequency oscillations
  - Over frequency behavior

In one day

one ESS

generates

18 billion data points

In one day

all ESS in 2030

will generate

over 400 trillion data points

Advanced analytics turns BMS data into actionable insights

Raw data from BMS/EMS

Data ingested into TWAICE cloud

Data pre-processing & data storage

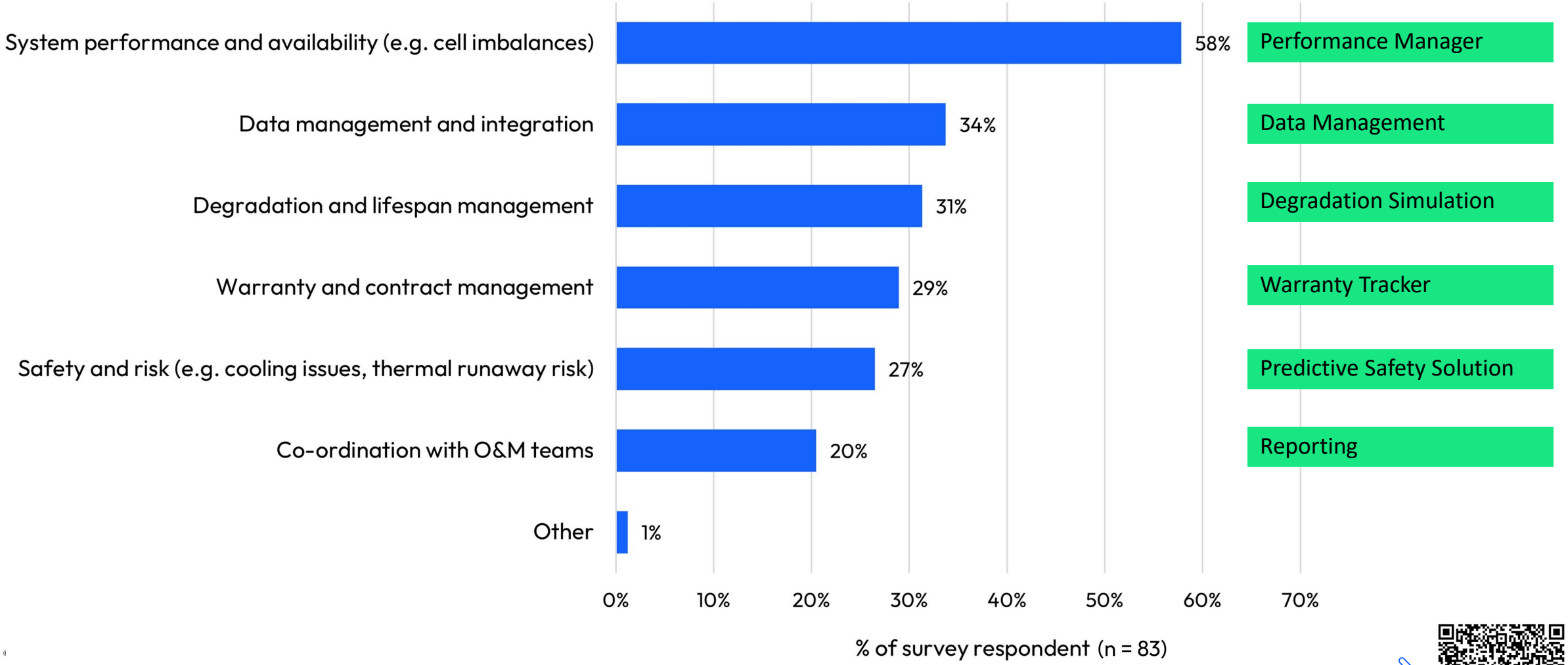
Predictive battery analytics: algorithms, safety rule detection & more

Actionable insights on TWAICE user interface & email alerts

Poll

Top challenges before BESS operations?

TWAICE Solutions to Top Challenges



Download our Report!

Development, Engineering and Procurement

Grid Code. CEPM has its own grid, there was a need of developing a grid code for the BESS operation.

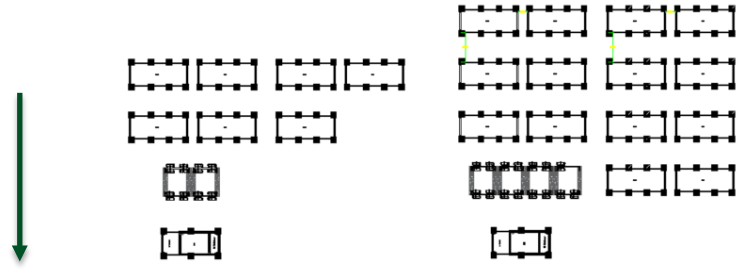
- The Grid Code lacked crucial specifications, resulting in incomplete firmware for the CEPM network and delays in fully operative system (FFR, black start functionalities).

Poor knowledge of the technology in all stages, manufacturer, authorities, construction, O&M, grid operation, etc.

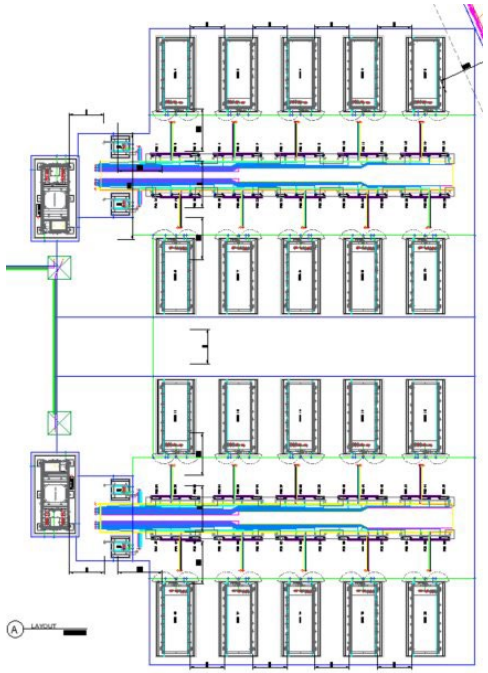
- Insufficient and inconsistency on technical documentation from the manufacturer.
- Missing spare parts on site during commissioning.
- Contracts with room for improvement.
- Vague regulation with no clear requirements.

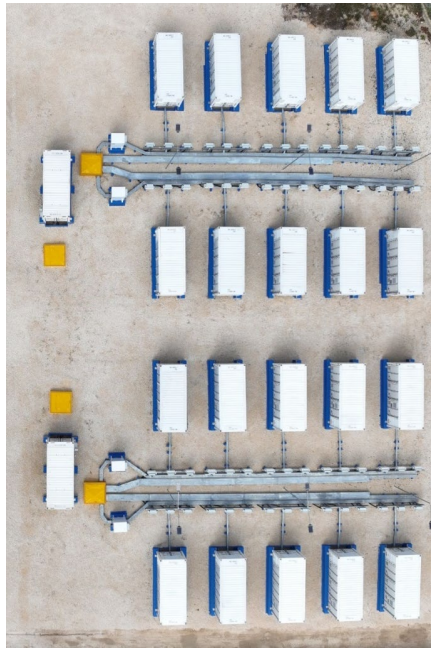
Integral solution.
During the RFP we found a few vendors with an integral solution.

INITIAL LAYOUT



FINAL LAYOUT

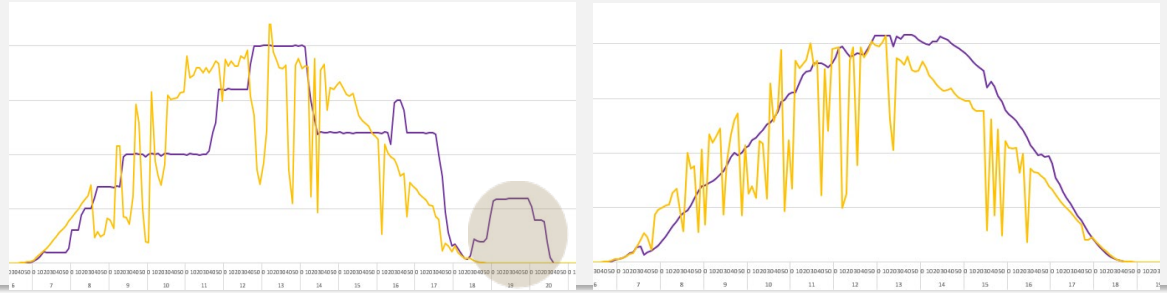




Operations and Maintenance

Challenge to define the internal operations procedure.
New renewable energy dispatch center to operate the PPC

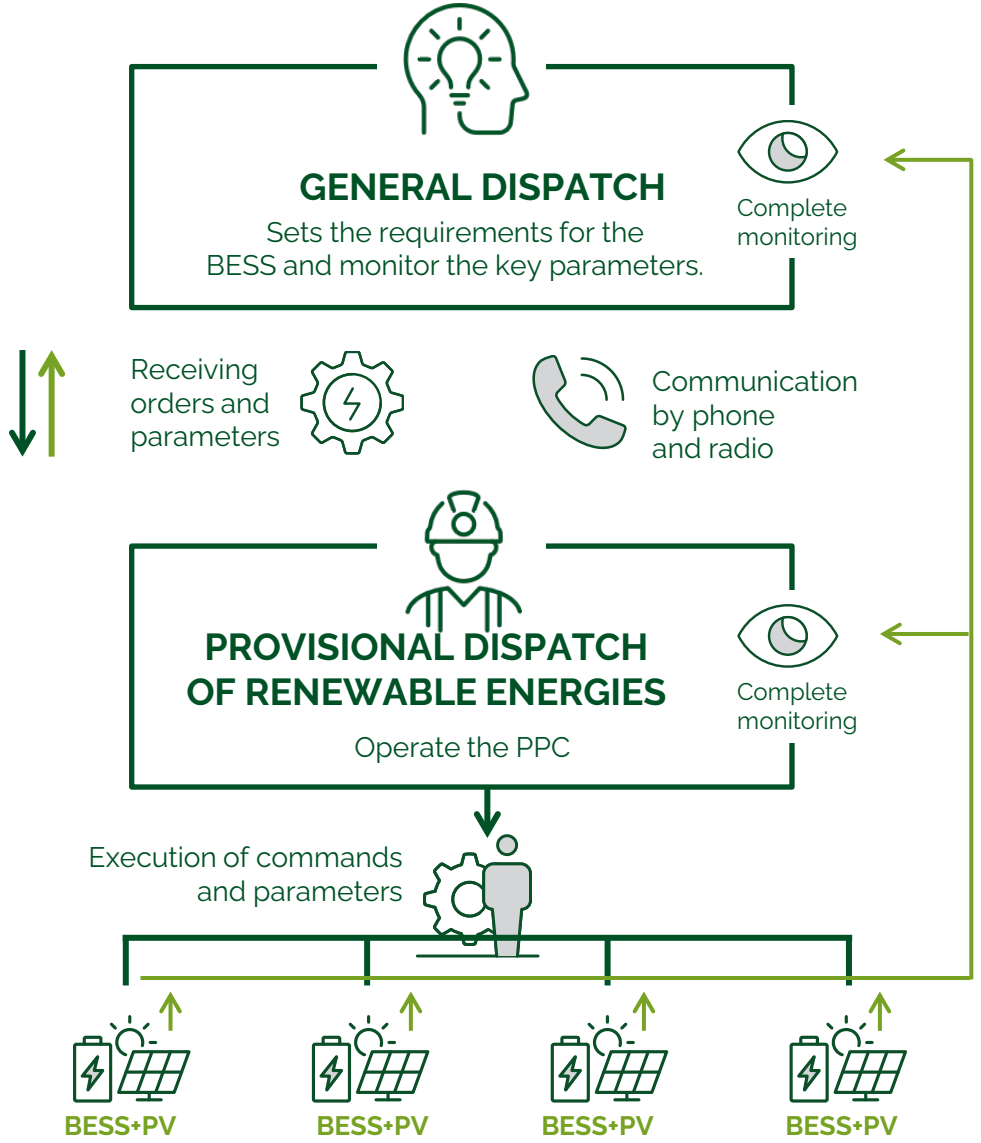
Learning how to dispatch BESS coming from the gas industry



SCADA and PPC configuration and readiness:
- Early commissioning
- Need for both software systems to interact
- EMS for the global operation

BESS KPIs
Need for a tool for BESS analytics

Guarantee Tracking.
How to track availability and performance guarantee from Huawei.



Notify Central Dispatch CEPM of the BESS availability.
Report any events or issues that may arise.

Lower Costs - Digital Commissioning to pinpoint weak spots and baseline BESS

Challenge

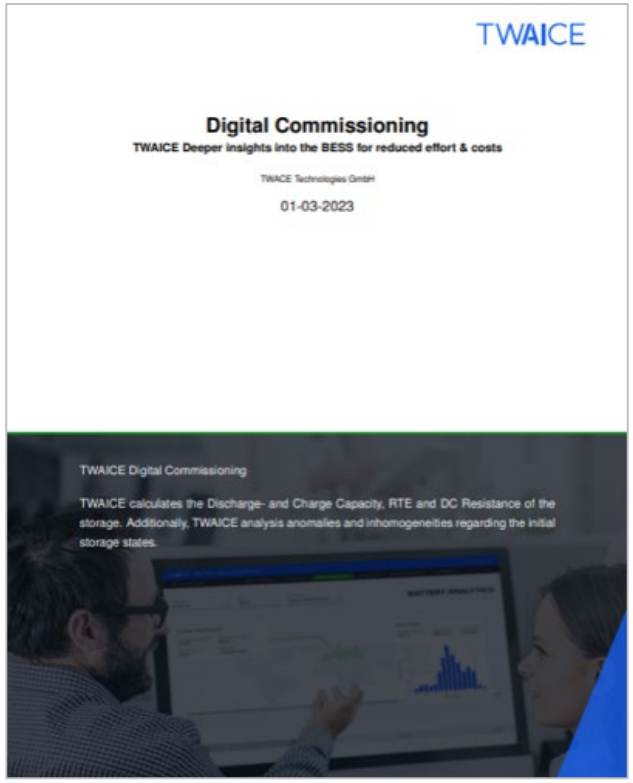
- Majority (of failure incidents happens in the first two years and around half are related to manufacturing and integration (Joint case study with EPRI)
- On-site measurements becoming more expensive & complex due to larger systems

Solution

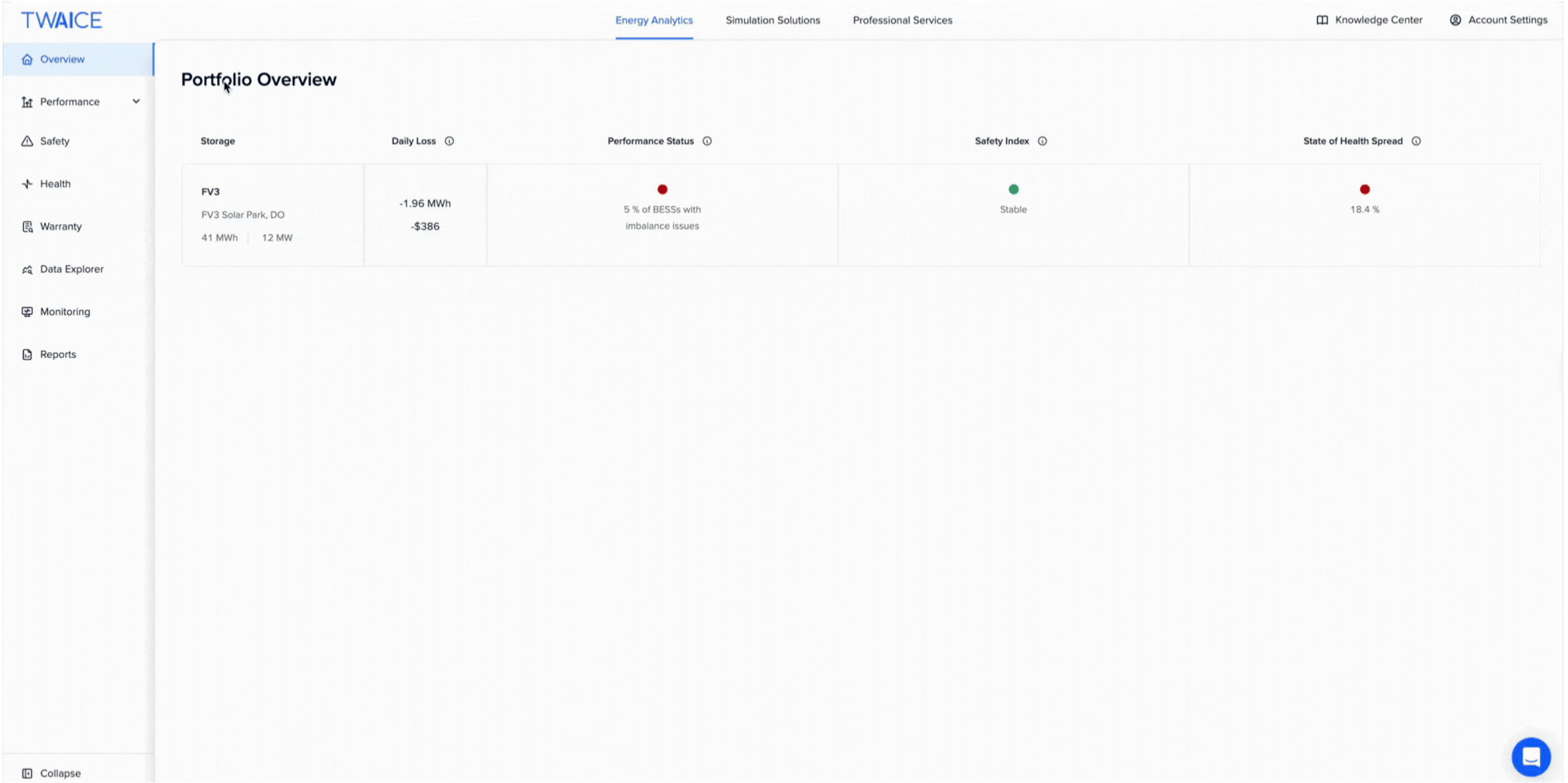
✓ Pinpointing anomalies in the system to guide onsite teams

✓ Baseline the system to ensure performance

TWAICE Digital Commissioning



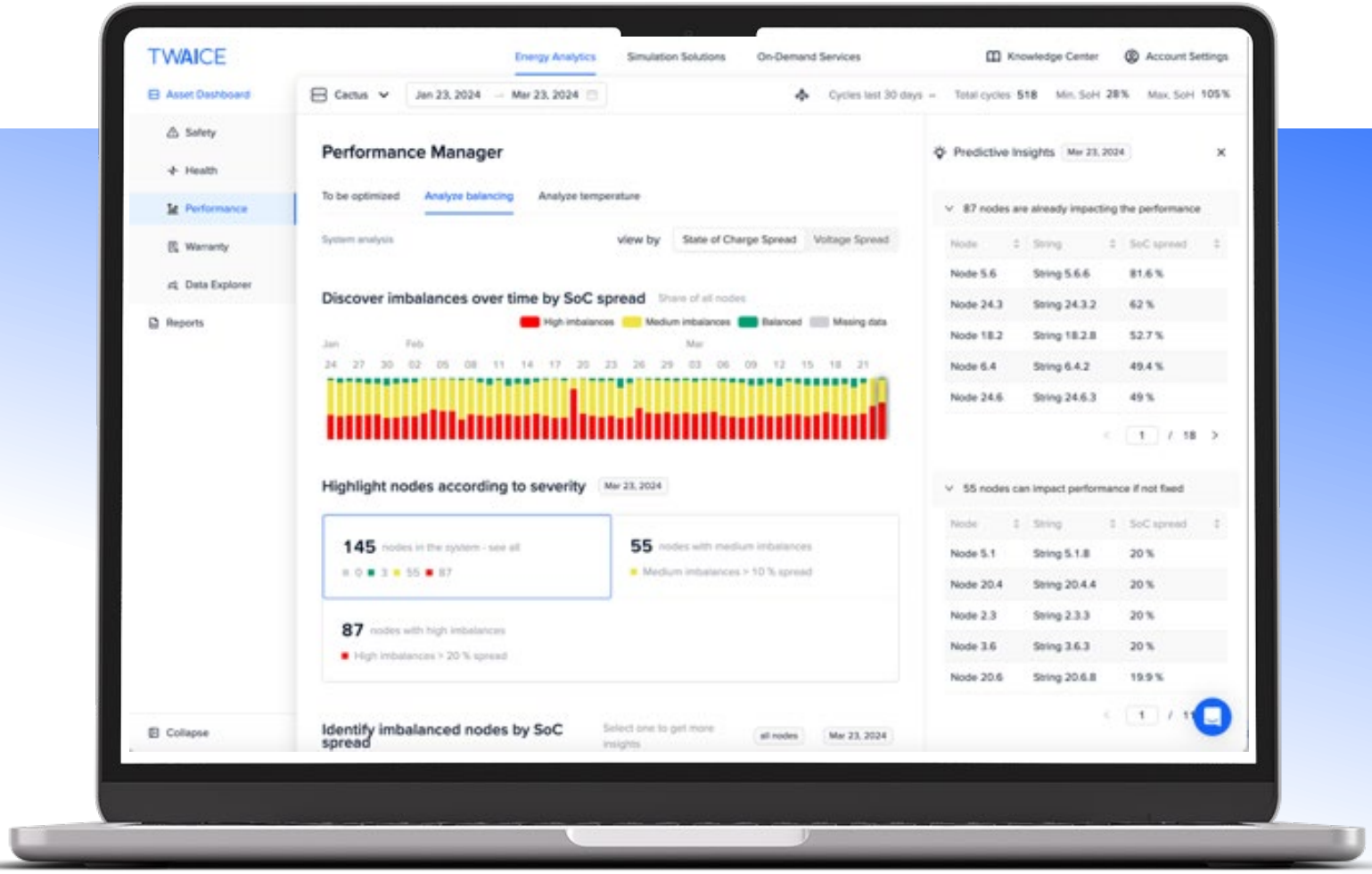
Brookfield Commissioning



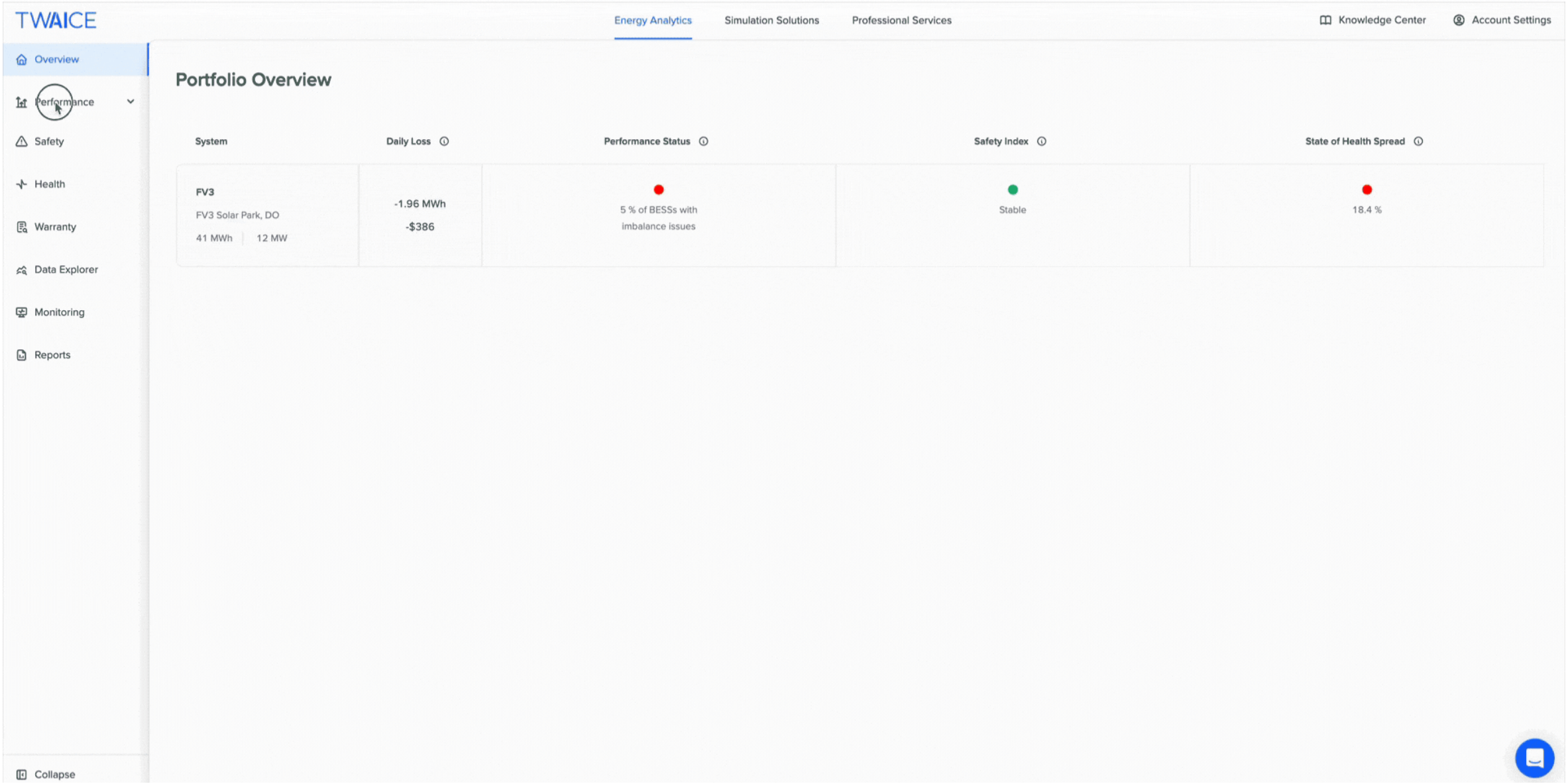
Improve availability by proactively identifying issues with the Performance Manager

Product Overview: Performance Manager

- Identify imbalances that lead to reduced capacity & unplanned SoC drop
- Pinpoint problematic components early and schedule preventive maintenance
- Identify system issues (e.g., underperforming thermal system)



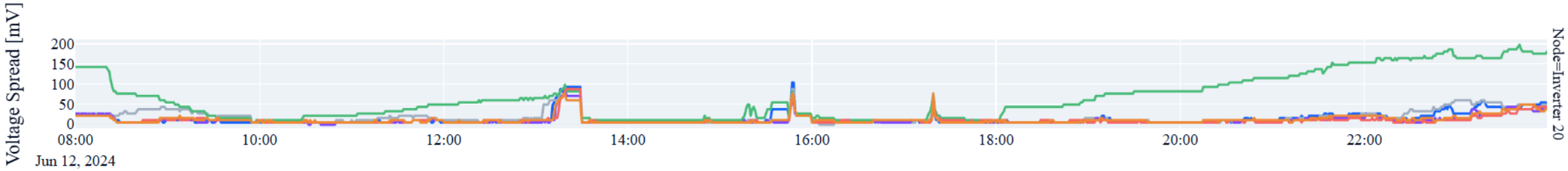
Brookfield Performance Manager



Issue Detection using TWAICE's Commissioning Report and Performance Manager

Commissioning Report - Reduced Capacity String
Reduced capacity in String 20.4 due to a disconnected module, causing a significant voltage spread. Flagged by the TWAICE Performance Manager and System Monitoring modules.

Result:
InterEnergy filed a warranty claim with Huawei, which subsequently replaced the module.



Performance Manager - Energy Availability

The Performance Manager identifies SOC imbalances, resulting in reduced available energy. However, the Huawei system's ability to bypass modules within a string minimizes capacity reduction during imbalances.

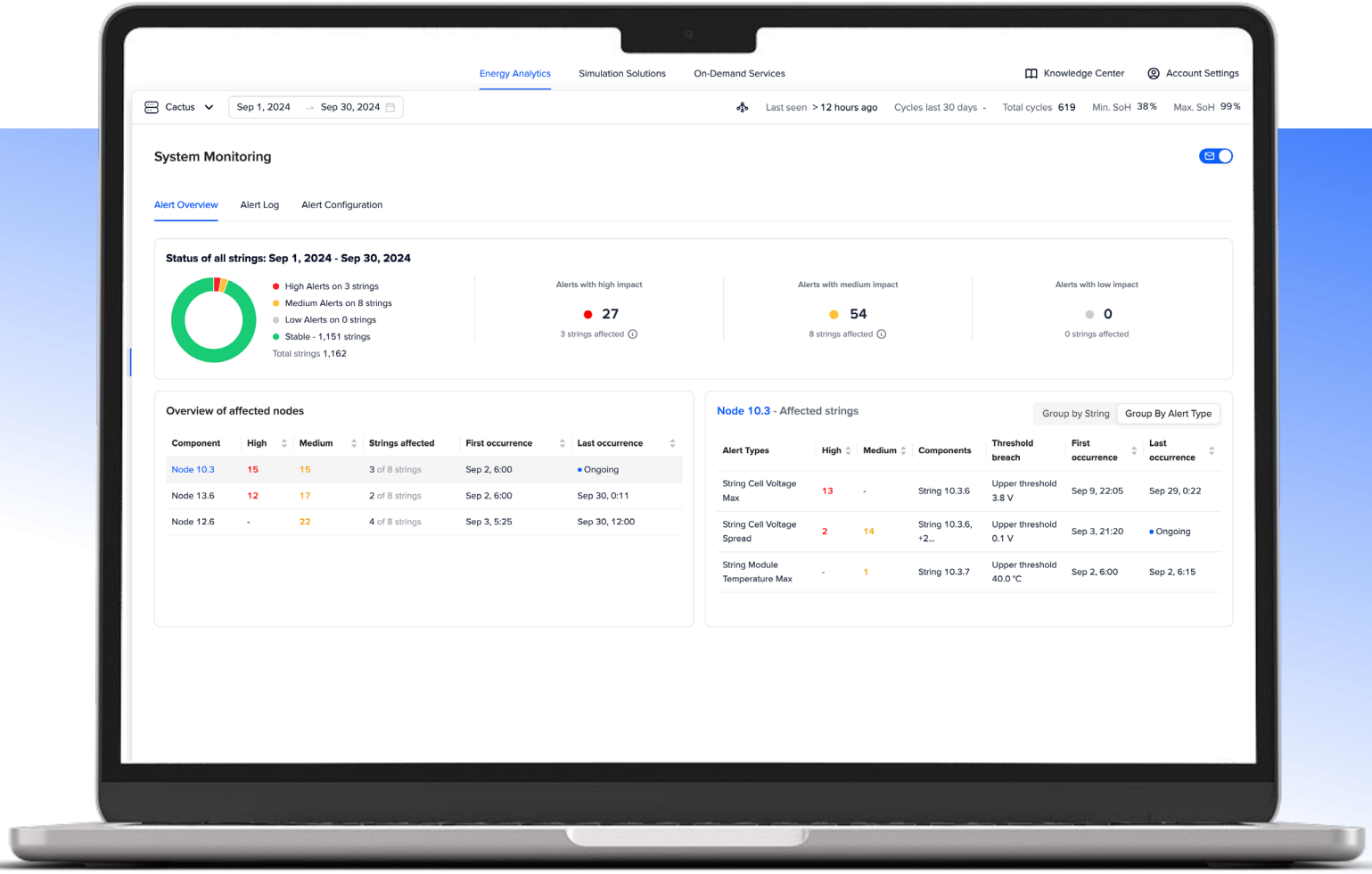
String 20.4
The imbalance was resolved after a module was replaced at the beginning of September.

String 13.3
The imbalance started at the end of October and may still be ongoing.

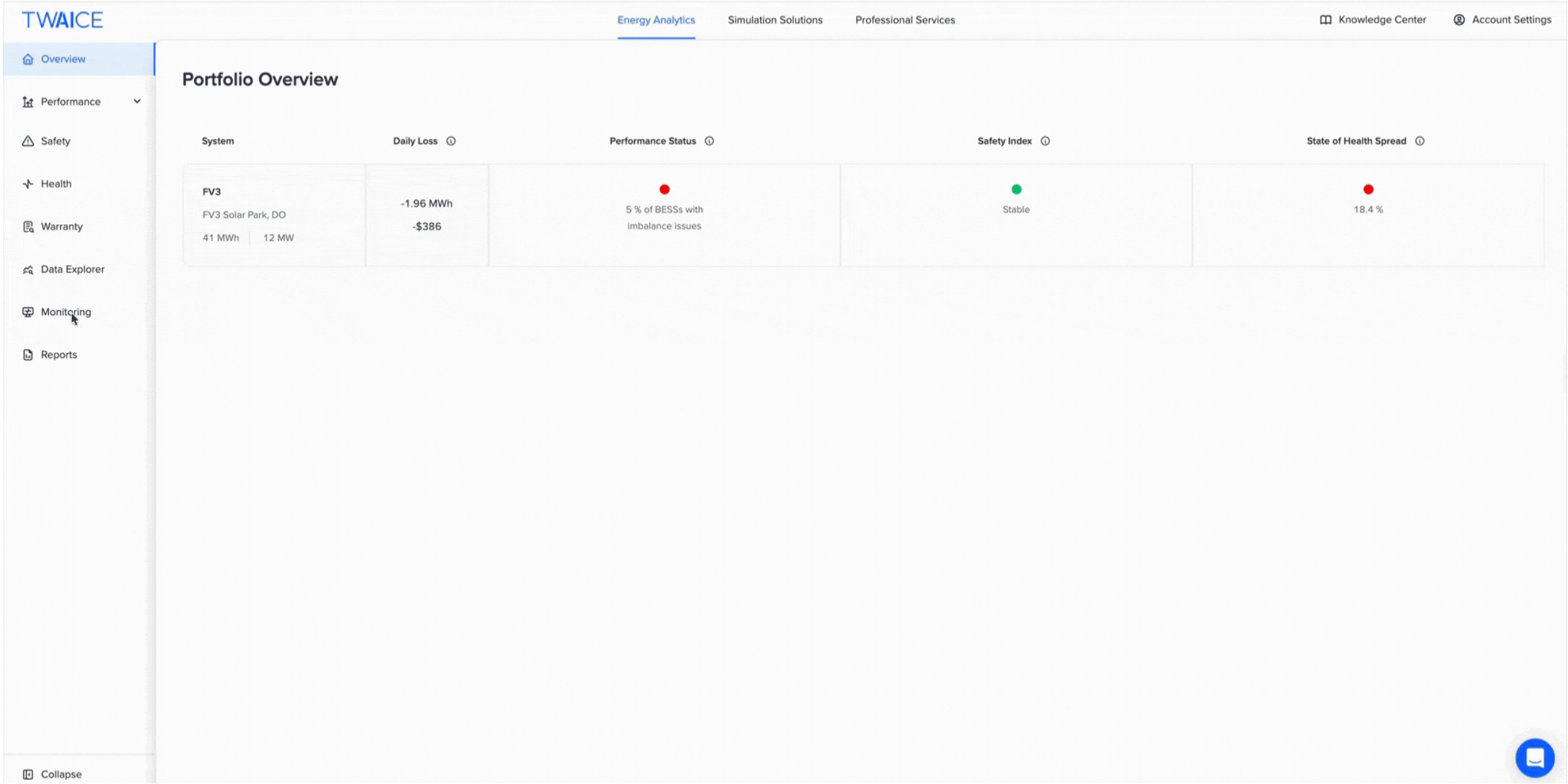
Track what is going on with your BESS with System Monitoring

Product Overview: System Monitoring

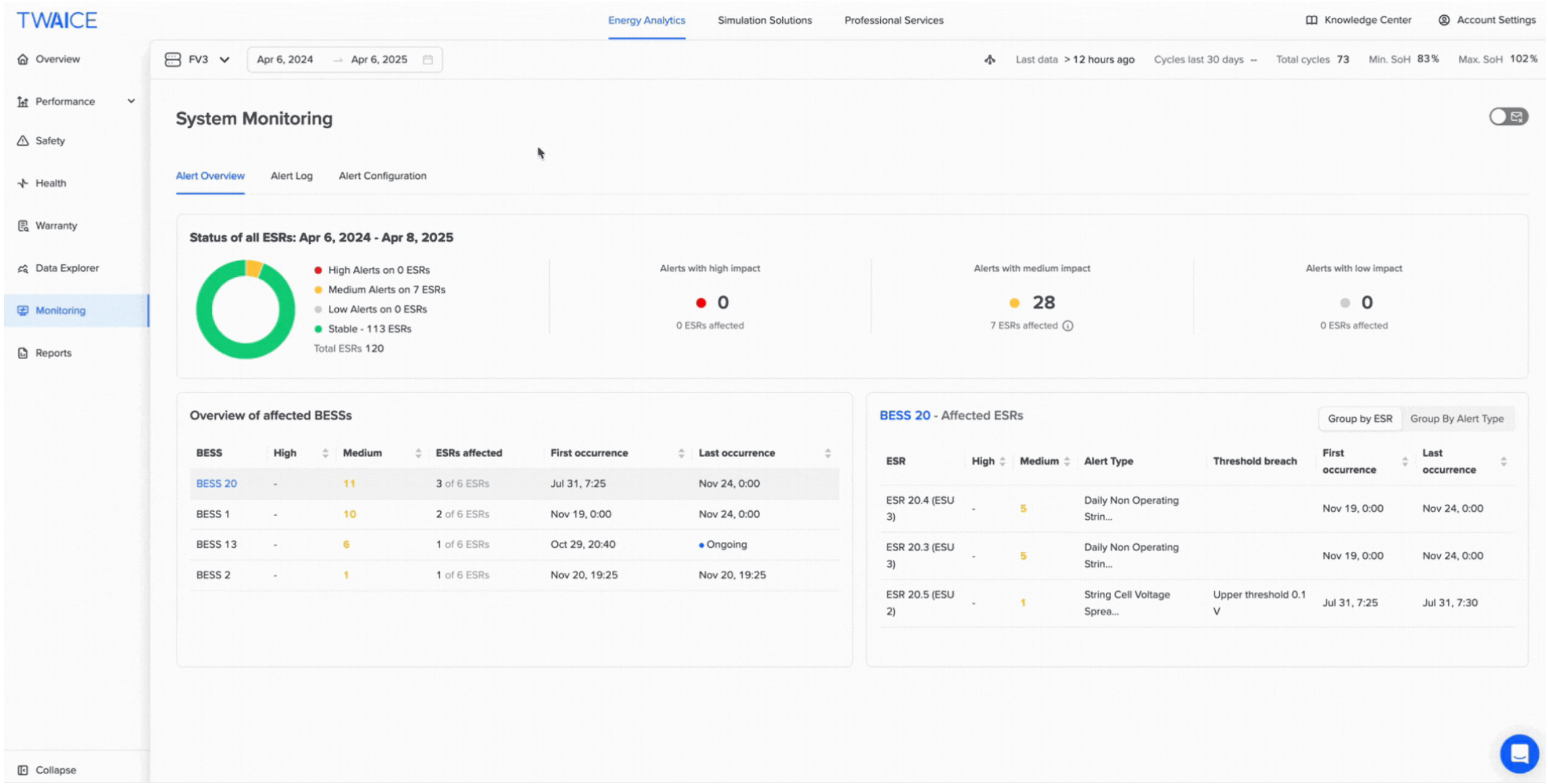
- Get a comprehensive overview of your system's status
- Monitor high, medium & low-impact alerts
- Turn on email alerts at the flick of a switch



Brookfield Data Outage

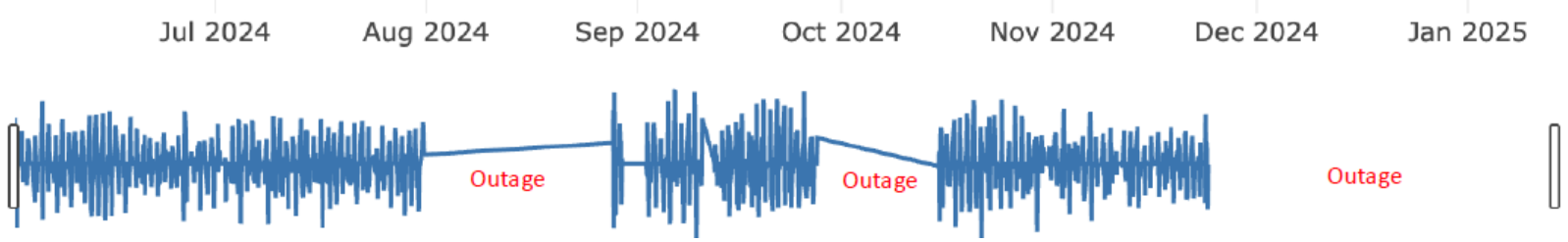


Brookfield Customer Naming



Issue Detection Using TWAICE's System Monitoring

TWAICE platform faced several data outages, primarily caused by SFTP file transfer interruptions. To improve this, an API integration between TWAICE & GPM is being developed and CEPM local team is working on a stable and reliable connection.



Outage Dates:

July 31 - August 28 (2024)
September 10 - September 12 (2024)
September 27 - October 15 (2024)
November 23 – March (2025)

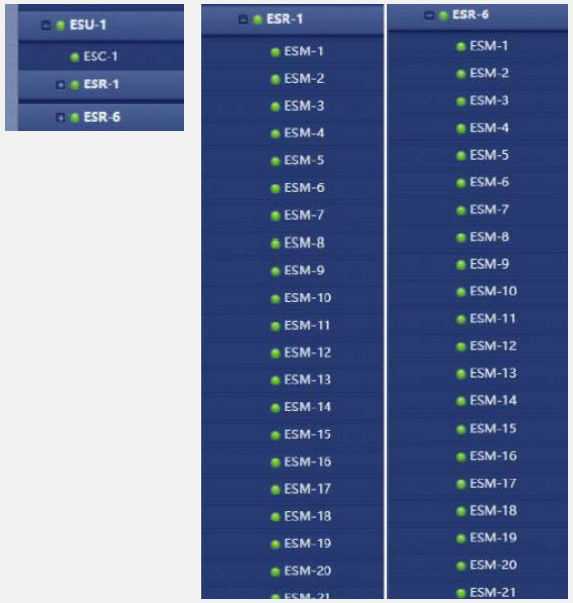
Data Nomenclature

FV3 Sensor Naming

TWAICE, GPM, and Huawei were using different naming conventions.

There is no standardization between manufacturers and users.

TWAICE incorporated customer-specific naming conventions into the platform alongside its standard naming conventions.



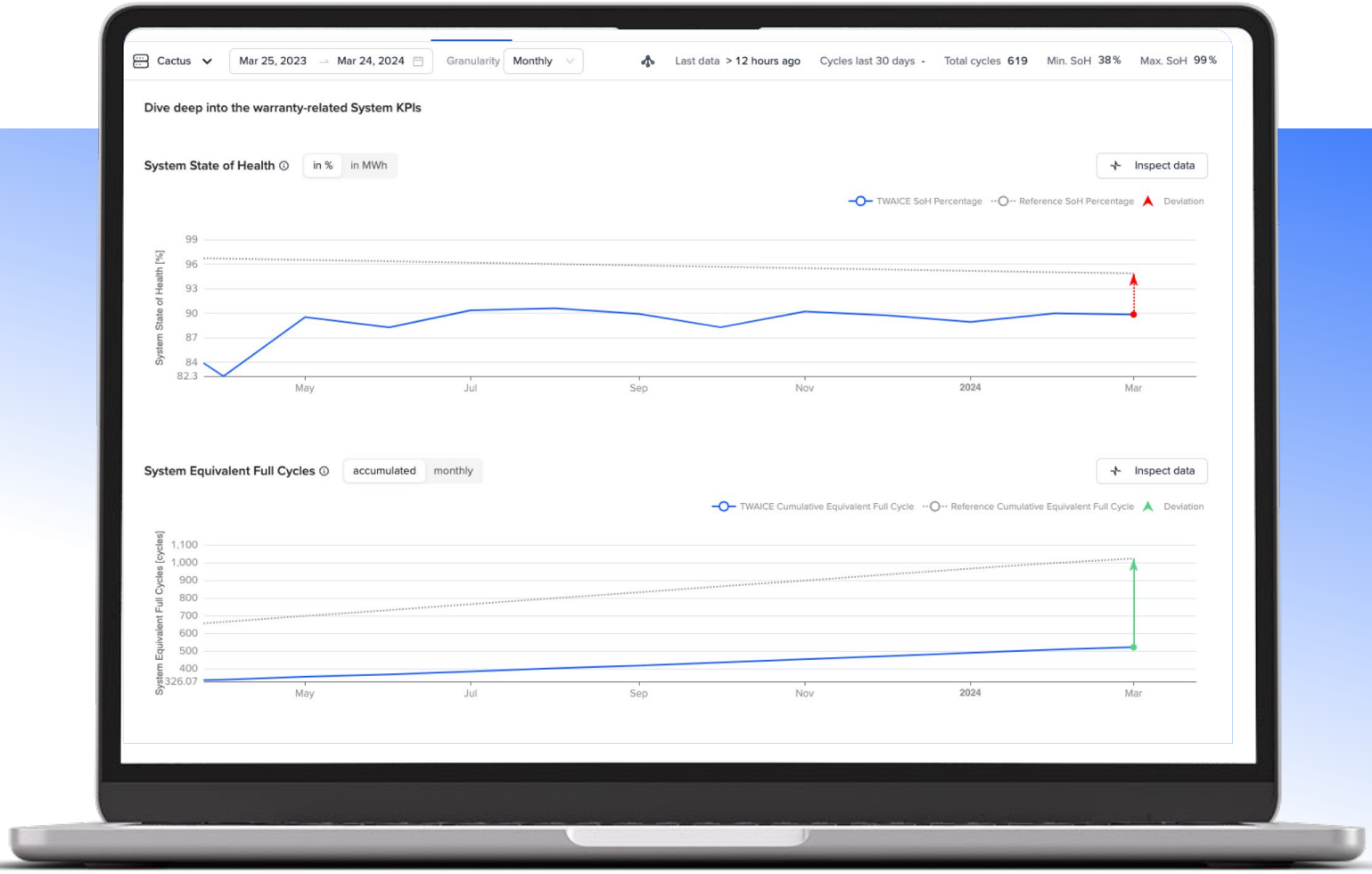
FV3 Signal Names

TWAICE NAME	GPM NAME	HUAWEI NAME
String 1.1	ECS1.01.01.BCU-1 SOC	BESS01_ESU1_ESR01
String 1.2	ECS1.01.01.BCU-2 SOC	BESS06_ESU1_ESR06
String 1.3	ECS1.01.02.BCU-1 SOC	BESS02_ESU2_ESR02
String 1.4	ECS1.01.02.BCU-2 SOC	BESS05_ESU2_ESR05
String 1.5	ECS1.01.03.BCU-1 SOC	BESS03_ESU3_ESR03
String 1.6	ECS1.01.03.BCU-2 SOC	BESS04_ESU3_ESR04
String 2.1	ECS1.02.01.BCU-1 SOC	BESS01_ESU1_ESR01
String 2.2	ECS1.02.01.BCU-2 SOC	BESS06_ESU1_ESR06
String 2.3	ECS1.02.02.BCU-1 SOC	BESS02_ESU2_ESR02
String 2.4	ECS1.02.02.BCU-2 SOC	BESS05_ESU2_ESR05
String 2.5	ECS1.02.03.BCU-1 SOC	BESS03_ESU3_ESR03

Automatically track BESS warranties & LTSAs with the Warranty Tracker

Product Overview: Warranty Tracker

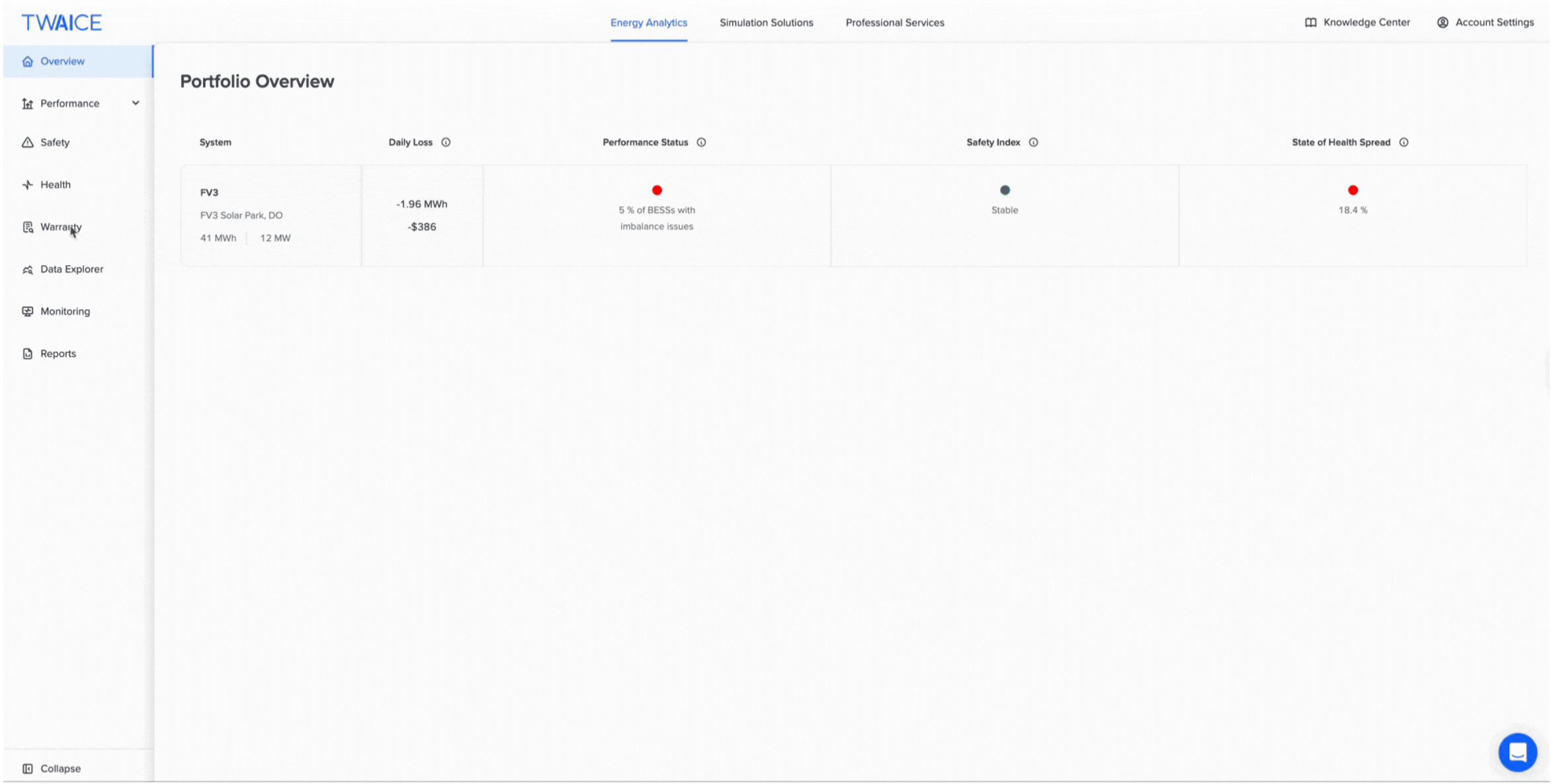
- Automatically track warranty indicators on a dashboard
- Support decision making and communication during disputes



Poll

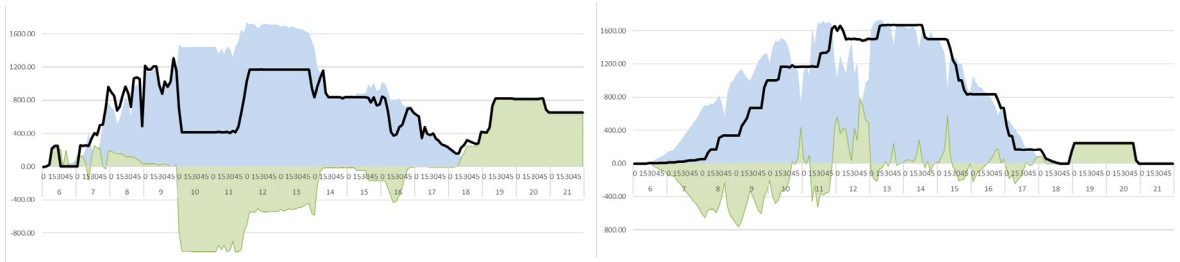
Requirements for availability reporting

Brookfield Warranty



Warranty Tracking

Total Energy generated by the PV from January 1st until November 30th, 2024
36.53 GWh

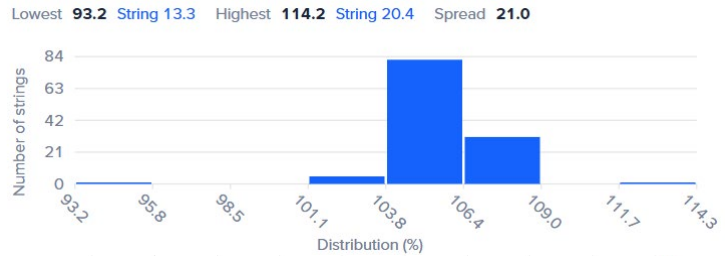


Total charge BESS: 8.35 GWh
(22% of the generated energy)

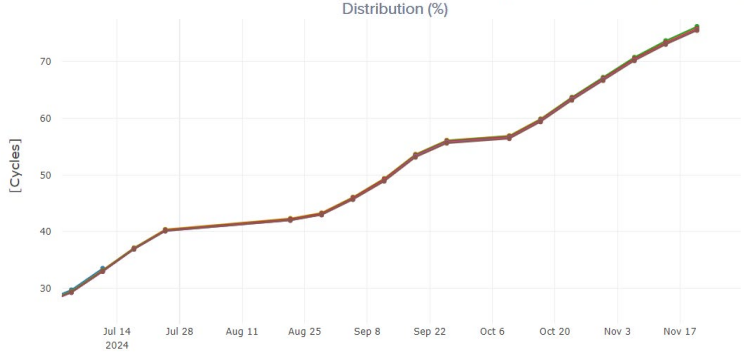
Total discharge BESS: 6.82 GWh
- RTE of ~82%
- 20% of the BESS always charged (limit SoC)

Performance monitoring with specialized software (TWAICE) shows:
- Equivalent full cycles: 73
- Min. SoH: 93.2% (in a problematic string), the rest all above 101.1%
- Max. SoH: 114%

TWAICE State of Health calculation



TWAICE Equivalent Full Cycles calculation



WARRANTY CONDITIONS YEAR 1
Equivalent full cycles: 365
SoH: 95.6%

Through TWAICE platform it is possible to confirm that:

System Condition:
System in excellent overall condition.

Safety & Monitoring:
- No high-impact safety alerts.
- 4 non-operating string alerts under investigation.
- 1 medium-impact cell voltage spread alert, slightly affecting energy availability.

Performance:
- System balanced; only 2 strings with high imbalances (1 already repaired).
- Effective cooling with no high module temperatures.

Warranty & Availability:
- SOH exceeds expectations; EFCs are lower than anticipated.
- Consistent system availability above 96%.

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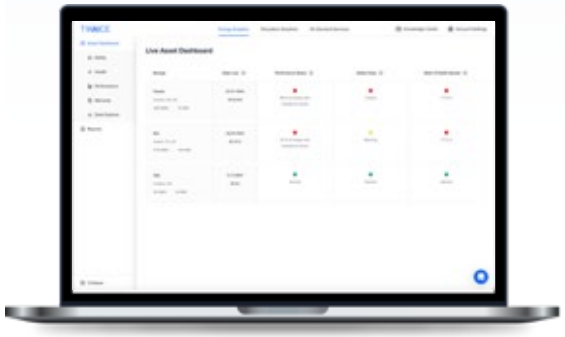
Combine powerful AI analytics with deep industry and technology know-how

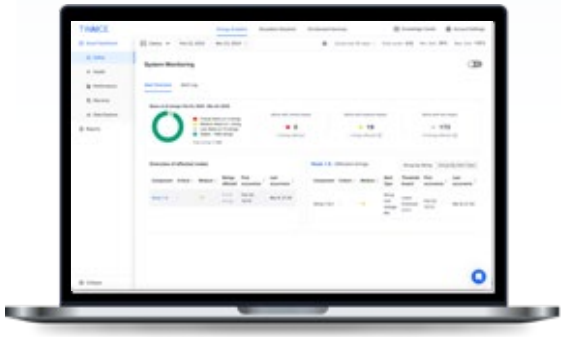
EFFICIENTLY MANAGE YOUR BESS PORTFOLIO

- ✓ Optimize BESS health & lifetime
- ✓ Access dashboards & standardized KPIs
- ✓ Streamline communication with automated reports



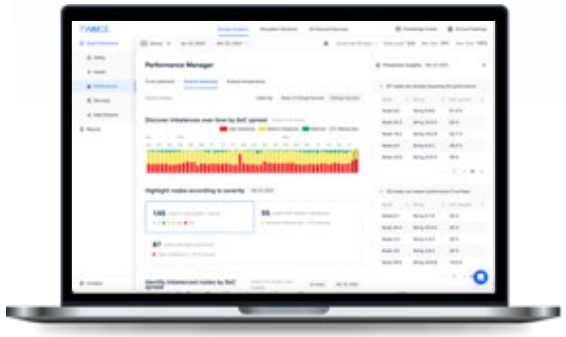
AVOID FIRES & REDUCE INSURANCE PREMIUMS

- ✓ Identify safety-relevant trends across your fleet
- ✓ Get alerts & recommendations



IMPROVE AVAILABILITY & REVENUE

- ✓ Pinpoint components that are harming revenue
- ✓ Get recommendations on what to fix (e.g. balancing or replacing modules)



AUTOMATICALLY TRACK BESS WARRANTIES & LTSAS

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Any questions? Contact us!

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