

TWAICE

**Why software is key for safe,
efficient and profitable operations of
BESS.**

Dr. Stephan Rohr, Co-CEO of TWAICE

www.twaice.com

Munich, 5/22/2024



Relevance of BESS in the Energy Transition



Relevance of BESS in the Energy Transition

Front the meter

Behind the meter

Utility/Grid-Scale



Electricity generation and distribution

- Price arbitrage
- Capacity payments
- Ancillary service markets
- ...

~ 10 MWh – 1000 MWh

C&I



Commercial & Industrial applications

- Peak shaving
- Self-consumption optimization
- Charging infrastructure
- ...

~ 1 MWh

Residential



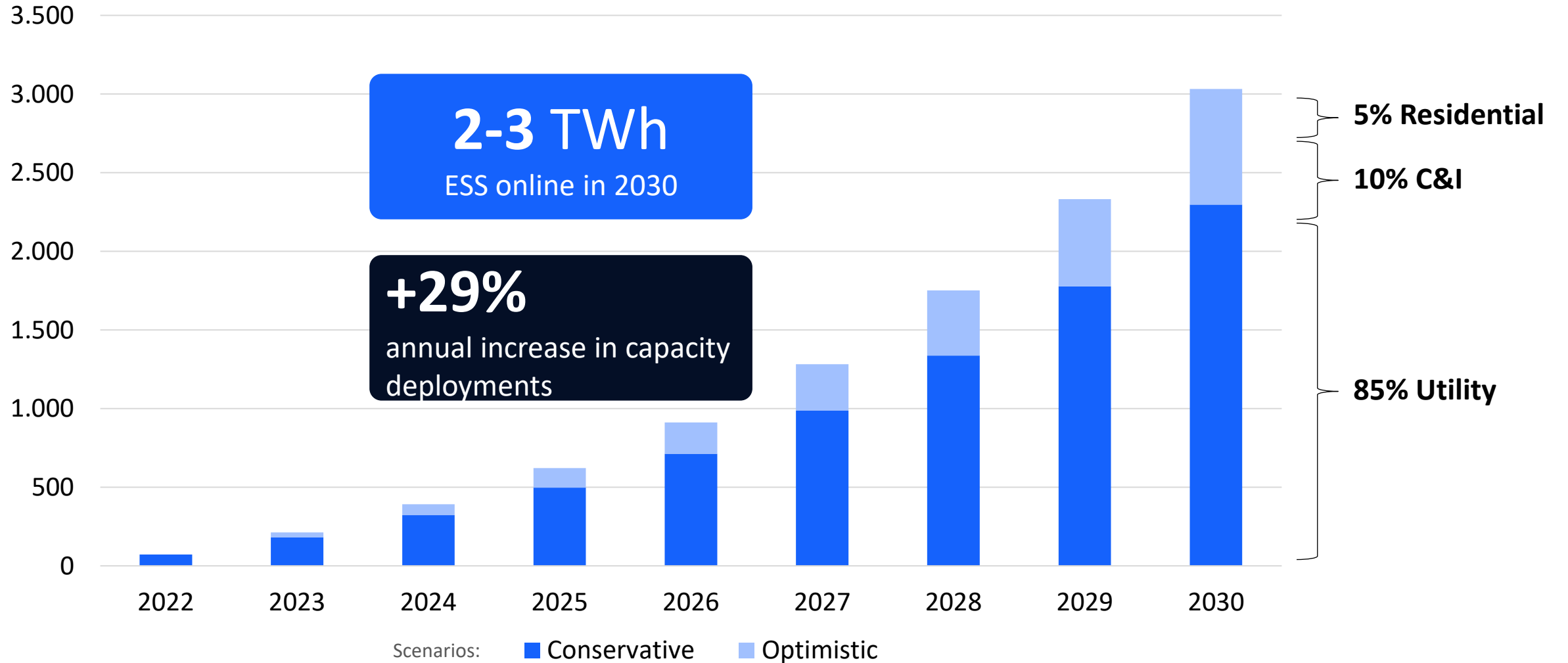
Home applications

- Renewable integration (rooftop PV)
- EV charging infrastructure
- ...

~ 0.01 MWh

Relevance of BESS in the Energy Transition

Global Cumulative Installed Battery Capacity [GWh]





Energy Neighbor

Der dezentrale stationäre Batteriespeicher Energy Neighbor ist ein netztauglich eingesetzter Energiespeicher in der 400 V Mittelspannungsebene. Er wird mit besonders sicheren und langlebigen Lithium-Eisenphosphat-Zellen (LiFePO₄) aufgebaut.

- Anwendung: Eigenverbrauch, Regelleistung, Netzstützung
- Einsatz in 400 V Niederspannungsnetz
- Abmessungen ca. 8 x 2,3 x 2,4 Meter
- Energieertrag 320 kWh
- Leistung 200 kW
- hohe Redundanz
- Mehrere Instandhaltung
- IEC 60324 Klasse 1
- Lebensdauer über 20 Jahre



The logo consists of the letters 'en' in a stylized font. The 'e' is blue and the 'n' is green.

ENERGY NEIGHBOR

Erneuerbare Energien
lokal erzeugen,
lokal speichern,
lokal nutzen.

0.2MWh Grid Storage

Gefördert durch:

Bayerisches Staatsministerium für
Wirtschaft und Medien, Energie und Technologie



Energy Neighbor

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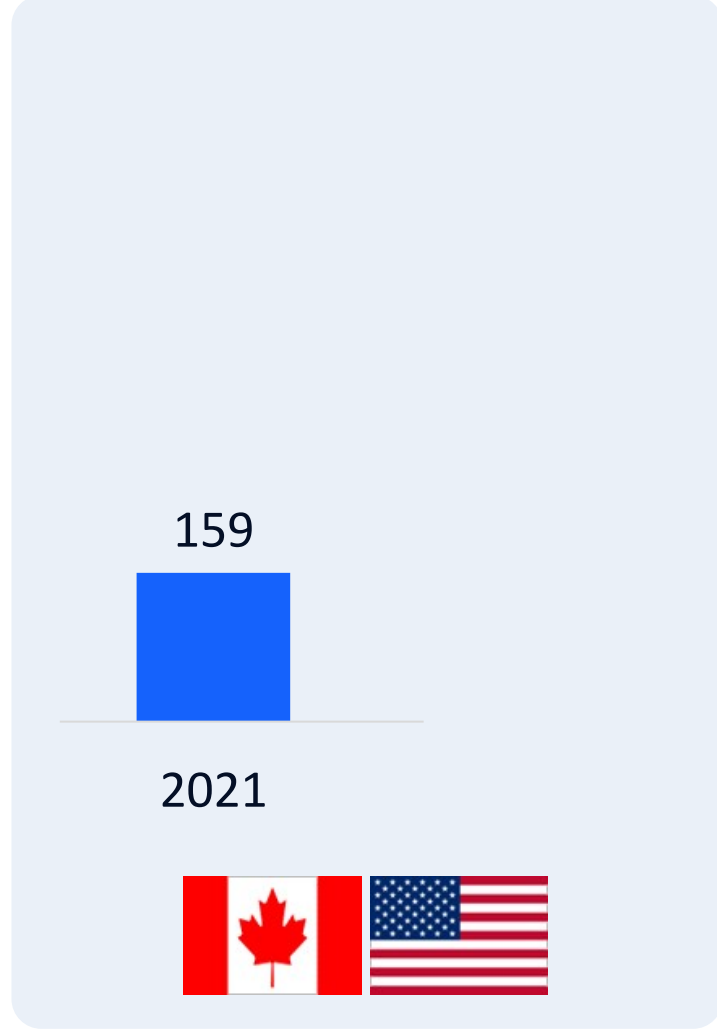
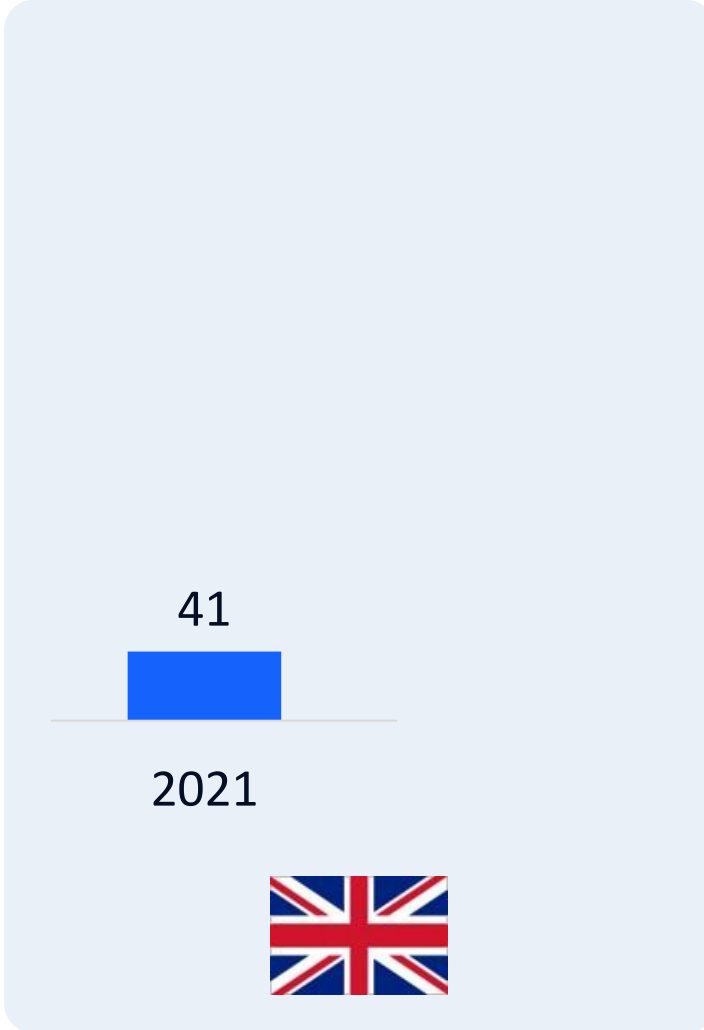
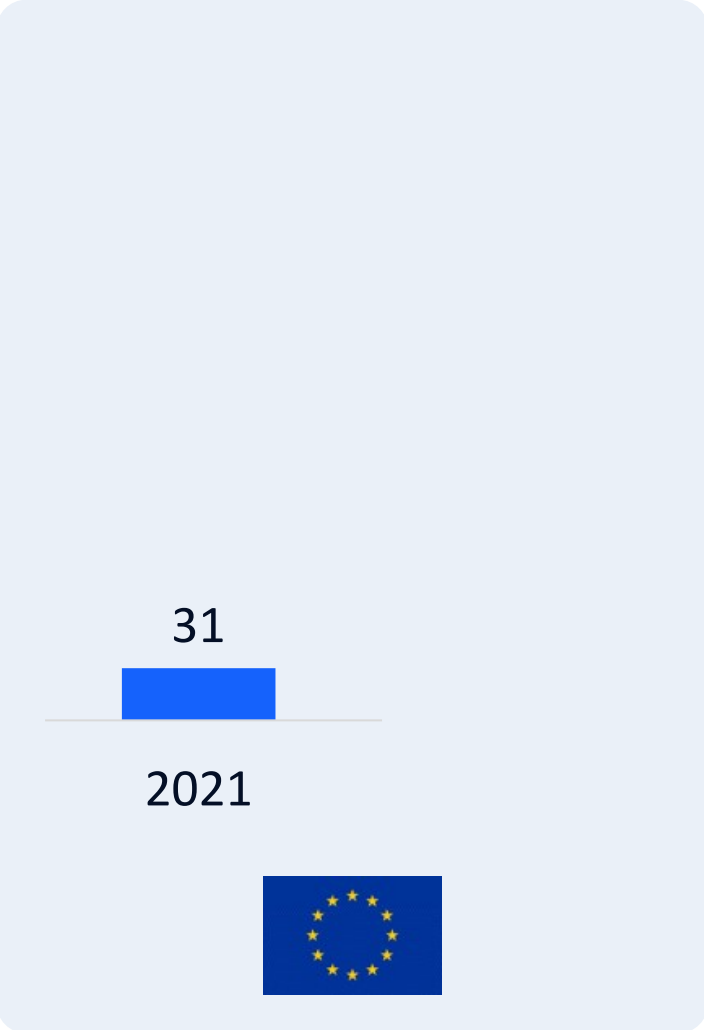
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- Energieertrag 320 kWh
- Leistung: 200 kW
- hohe Flexibilität
- Mehrfunktionsnutzung
- inkl. Inverter
- Lebensdauer über 20 Jahre



VARTA



Average size of grid-connected BESS in MWh



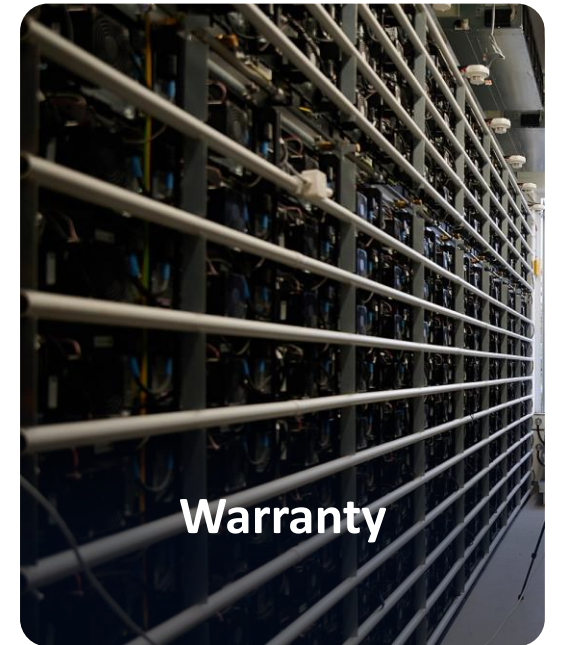
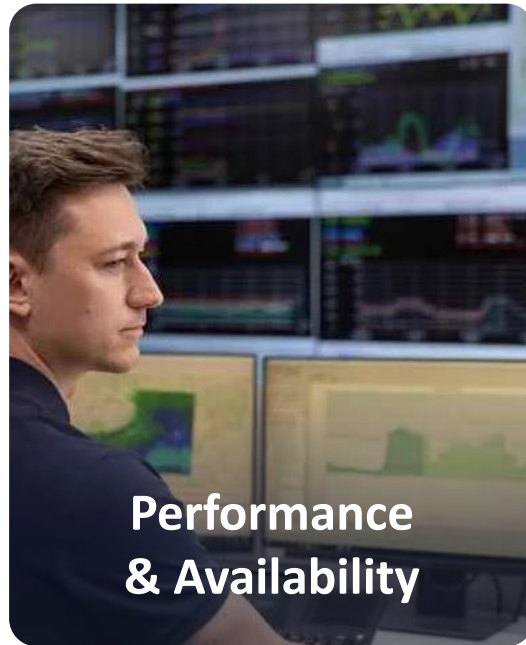
In **one** day
one BESS
generates
1.8 billion data points

Different applications of software to run & improve BESS

Deep Dive

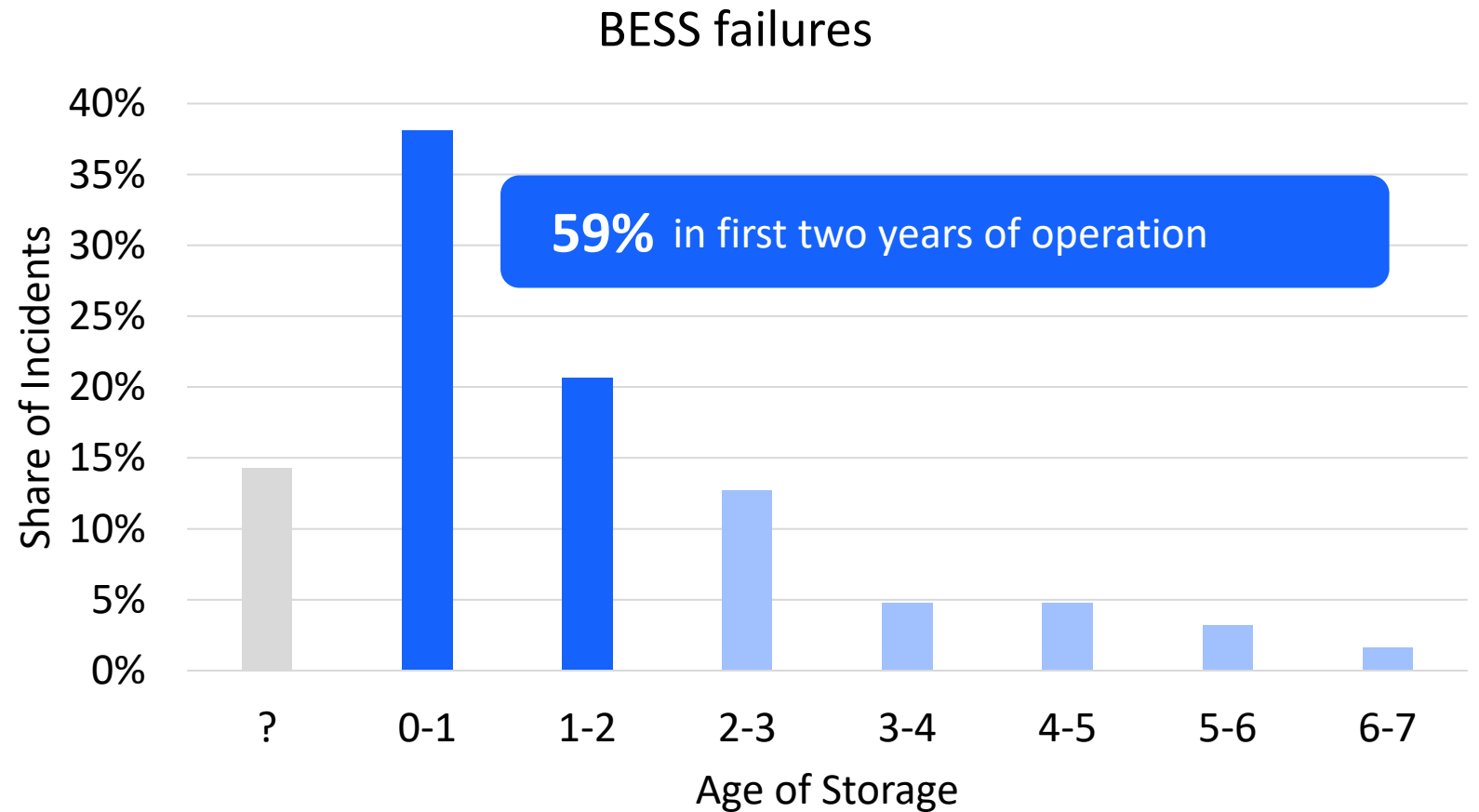


Addressing the technical challenges of BESS



Challenges of Commissioning

Faulty installation & production defects remain major drivers of BESS failures



Challenges of Commissioning

Manual effort and a lack of deep insights into the battery hinder an efficient and effective commissioning



Identification of Weak Spots & Defects



Onsite-Commissioning

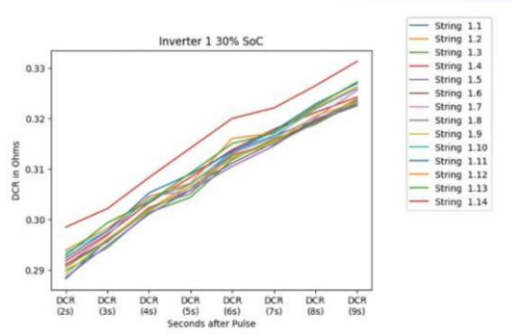


Baselining

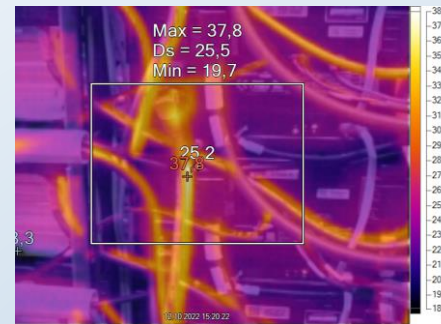
Case study: Digital Commissioning

How TWAICE's Digital Commissioning helps Austria's leading energy provider (Verbund) to scale their BESS business.

DCR anomaly identified with Digital Commissioning



Connector issue fixed on-site

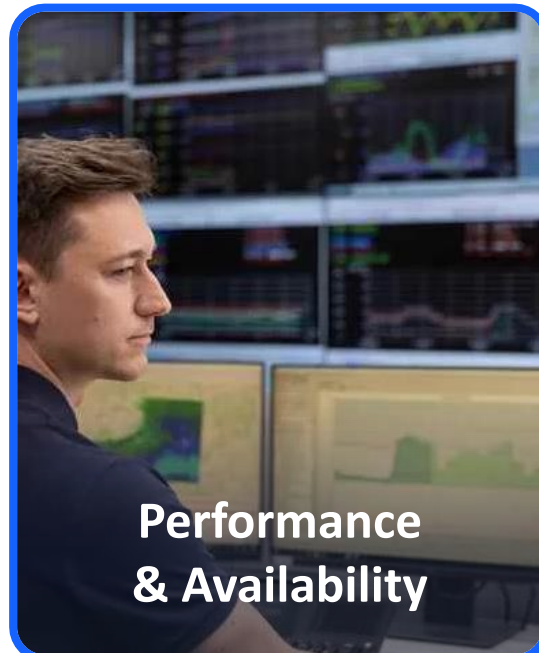


Verbund TWAICE

“TWAICE Digital Commissioning helps us to overcome the challenges posed by an increasingly heterogeneous system integrator landscape and ever larger BESS. Battery analytics software is a must-have for baselining performance at beginning of life and identifying deficiencies before operation starts.”

- Karl Potz, Head of Battery Solutions at VERBUND





82% \emptyset BM¹ availability (UK)

“Unplanned downtime led to an average availability across our fleet of **only 84%** last year”

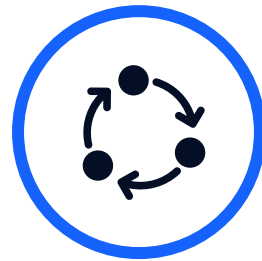
US asset owner

Challenges of Performance & Availability

The business case after commissioning is driven by the availability, roundtrip efficiency and lifetime of a storage



Availability



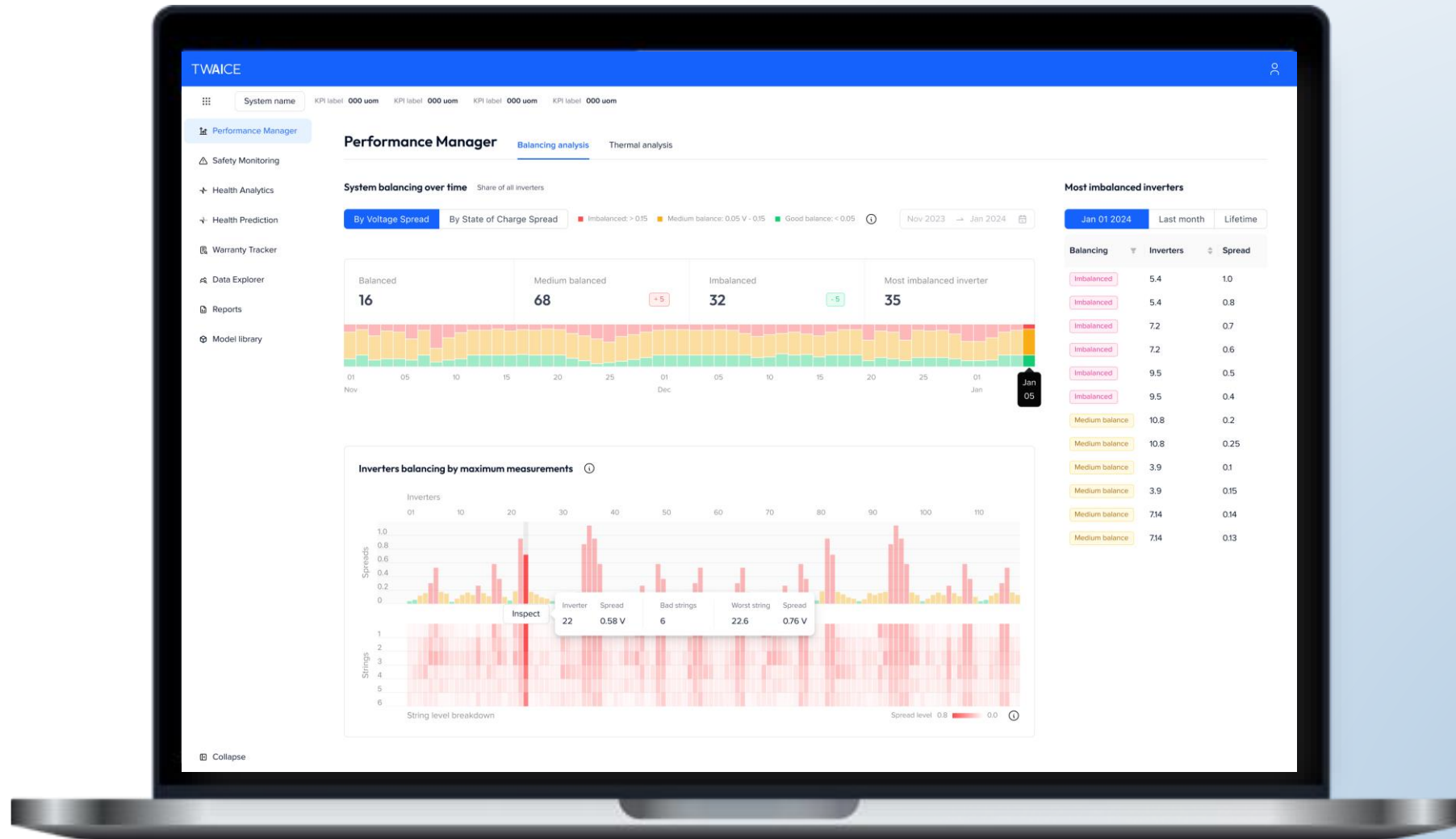
Roundtrip Efficiency



Lifetime

Challenges of Performance & Availability

Get granular insights into your storage system & find where the problems are



Example: LFP SoC Estimation – BMS Failure

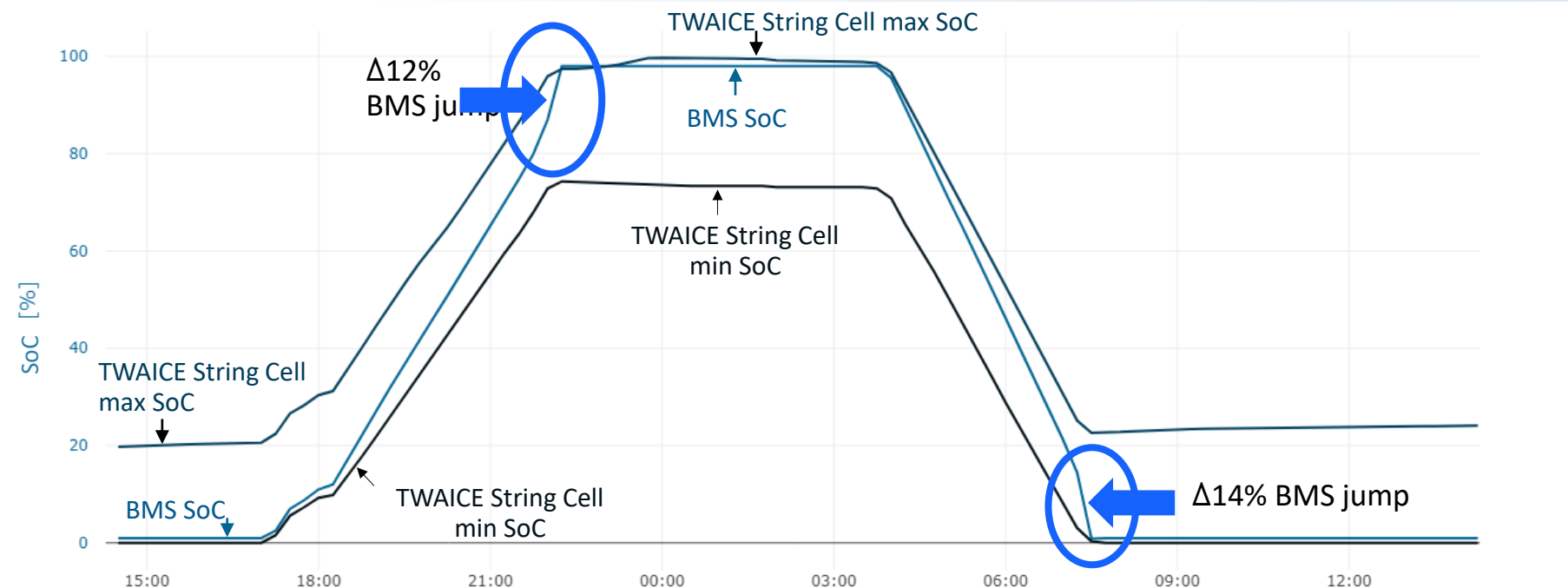
Example from a >400 MWh system – CASIO market

Indicators:

- BMS SoC is jumping by more than 10%, especially at the end of the SoC ranges

Consequences:

- Sudden interruption of operation
- Revenue loss and potential penalties
- Downtime due to component failures such as inverter tripping



Revenue loss, penalties and reduced availability can be avoided by leveraging better State of Charge calculations which highlight the uncertainty and errors of the BMS SoC

Challenges of Safety

Avoiding the worst case scenario is at the top of mind of many ESS managers – rightly so

In-Life



US integrator

Even with proven product designs and extensive safety testing, at the **scale** that storage is being deployed, **we would be naïve to assume safety incidents won't happen.**

Commissioning

Performance
& Availability

Safety



TWAICE can prevent most fire events, benefitting clients and insurers alike

70 fires

Despite existing fire prevention and mitigation measures, severe thermal events continue to happen - a total of c. 70 fires are captured in EPRI database, and the number of unreported minor incidents can only be estimated

87% caused by battery internal events

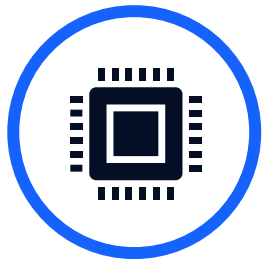
Investigating the causes for failure we see that almost 90% of the incidents are caused by battery internal events

Incidents can be detected and avoided

This analysis suggests that most of these incidents could have been detected and avoided with battery analytics by TWAICE

Challenges of Safety

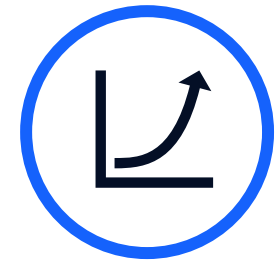
Existing issues only provide the last layer of safety – early detection is required



Limits of BMS & EMS



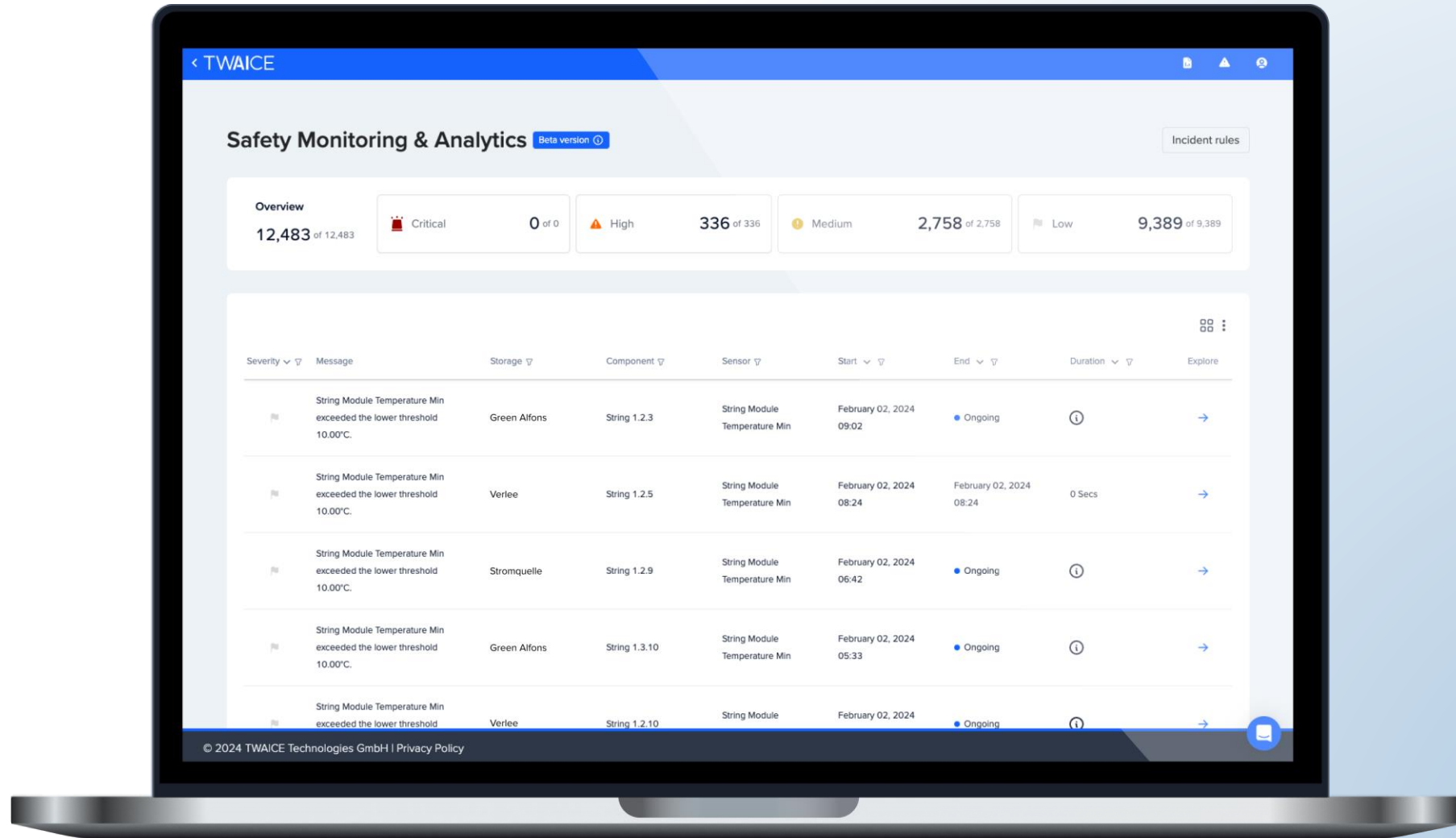
Early Detection



Scale

Challenges of Safety

Get notified of safety-critical incidents by email & view on the incident log

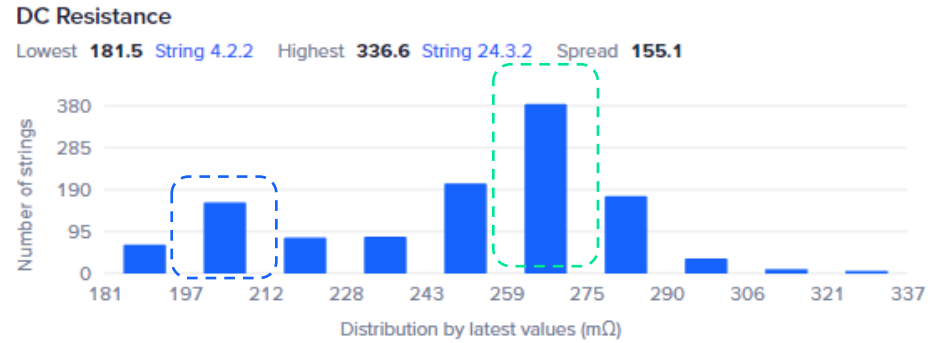


Example: Different DCR peaks observed in histogram

Example from a 400 MWh system

Indicators:

- DCR shows two different distributions in the histogram

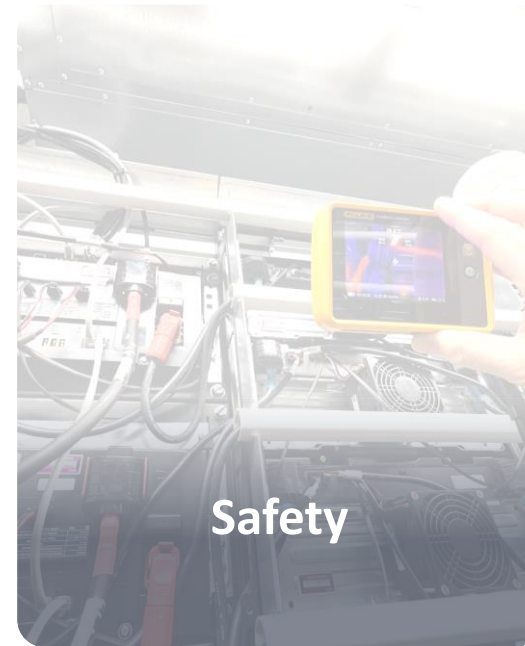
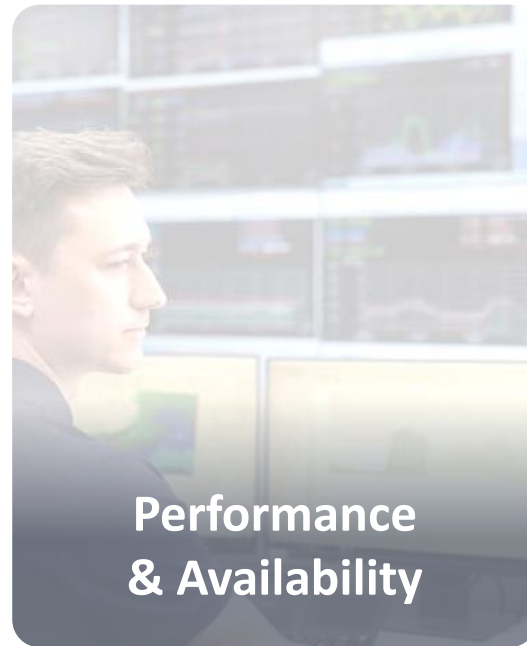


Consequences:

- Different root causes :
 - Connector issue within inverter 2 which leads to higher resistance
 - Same cell type installed in BESS, but different cell quality, relevant for warranty claims



Challenges of Warranty Coverage



Challenges of Warranty Coverage

Tracking the warranty status is not as simple as it seems



Heterogeneity



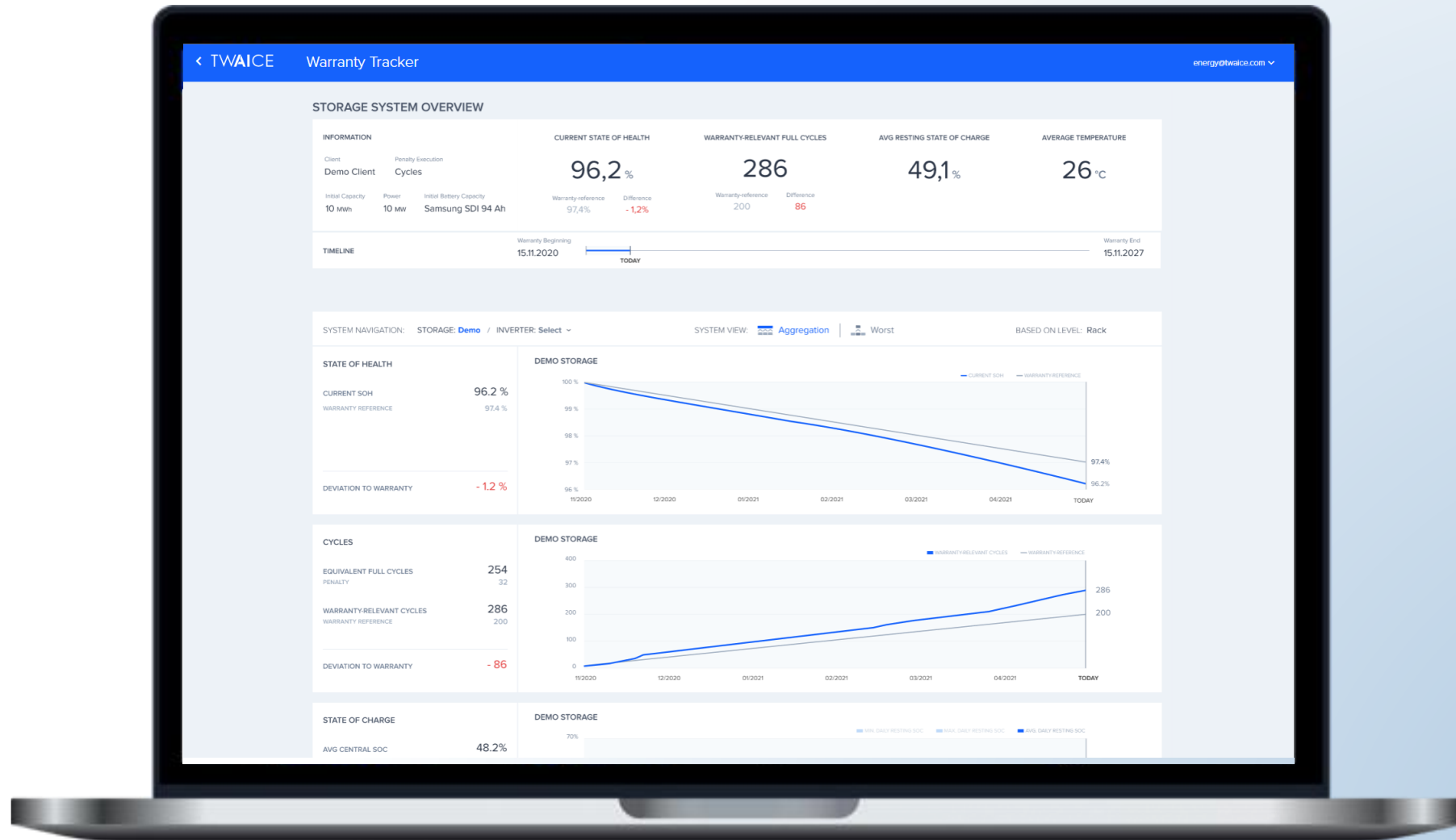
Static Coverage



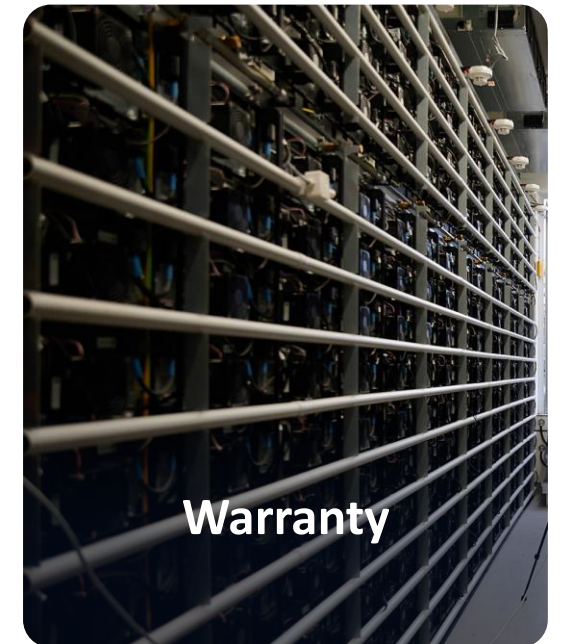
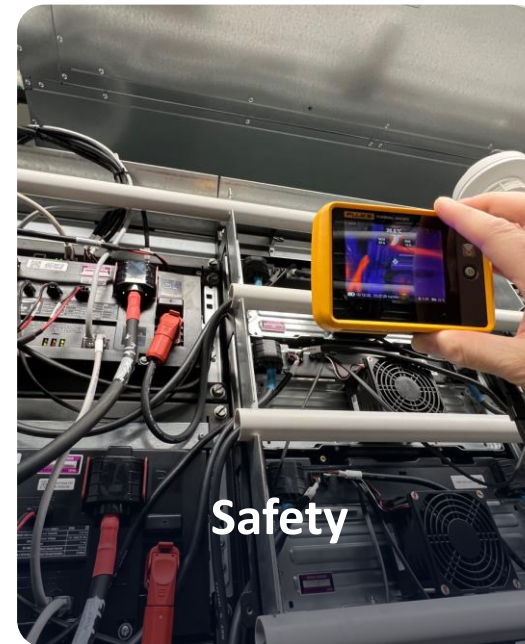
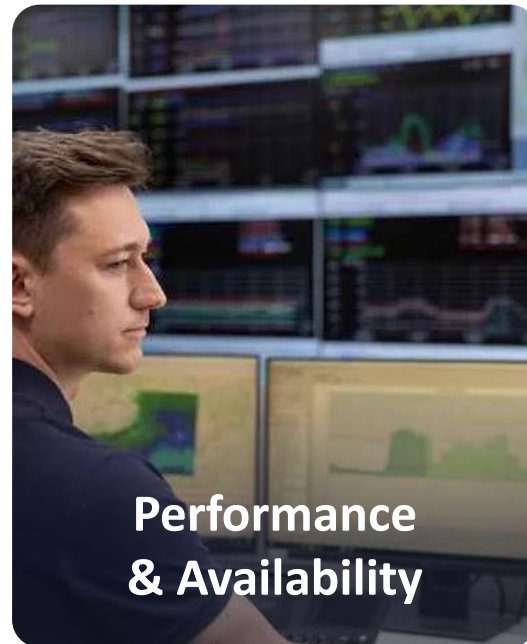
Unclear Status & Claims

Reduce warranty risks

Steer your operation within warranty limits & pro-actively manage warranty cases



Addressing the technical challenges of BESS



Leading software solutions to successfully design, validate and operate batteries at scale.

TWAICE

Unleash the Full Potential of Batteries

140+

Team incl. battery & software engineers and data scientists

2

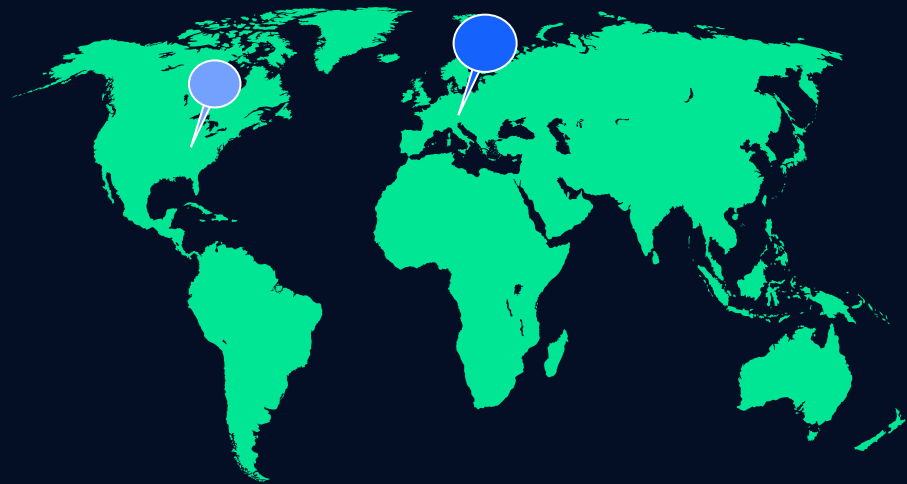
Offices in Munich (HQ), Chicago (US)

1

Onsite battery research center

30+

Patents



Mercedes-Benz



FLUENCE[®]
A Siemens and AES Company



Verbund

ju:niz

SW//M

