

Hard-earned lessons for BESS operators - warranties, diagnostics, and contract design

TWAICE energy storage system analytics



Speakers Today



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Agenda

1. Welcome & Introductions
2. Lessons from the Field (Glenn Dahlenburg, GCD Advisory)
3. Where Independent Data Fits (Chris Pickett, TWAICE)
4. Live Q&A

Where I come from, and why the contract matters

- **15 years in batteries.** Energy Queensland, from technology trials to a 200+ battery portfolio built from scratch
- **The whole chain from ideation to operation.** Supplier procurement and offtake contracts, design, maintenance and management processes and tools, and HOW THEY INTERACT.
- **The 1s and 0s were as much a concern as the MW:** you must manage the whole system digital and power as a critical dangerous asset.
- **Data, information and access decides enforceability.** Without comms, data and process, warranties are hard to claim
- **20 years of obligations.** Locked in by the contract before you turn a sod

Nobody needs a contract until something goes wrong.

Then it is too late to wish for information you never got.



LinkedIn

https://www.linkedin.com/posts/glenn-dahlenburg_reflecting-on-my-journey-with-the-energy-activity-7391684547186159616-l1CK?utm_source=share&utm_medium=member_desktop&rcm=ACoAAAF1NcgB9F9hDoC8wbW8AfHtLxguInal4p4

TWAICE: Independent analytics for enterprise BESS operations

100+

team incl. battery software engineers & data scientists

\$90m

funding for long-term security

3

offices/teams in Munich HQ (DE), Chicago (US), Berlin (DE) + Sydney (AU)

1

onsite battery research center

100+

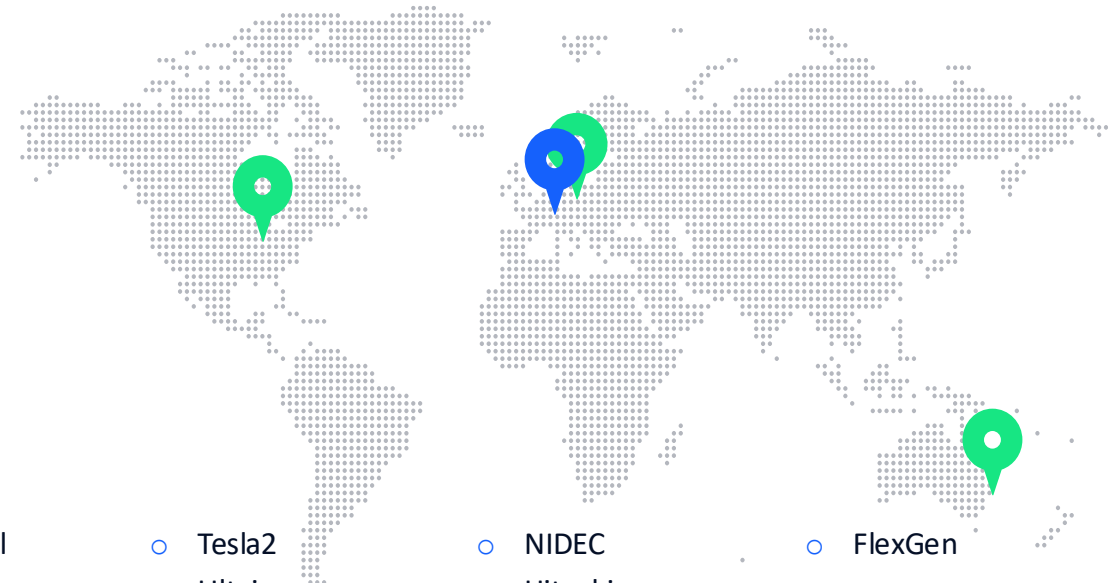
BESS projects connected, over 18 GWh+ contracted

30+

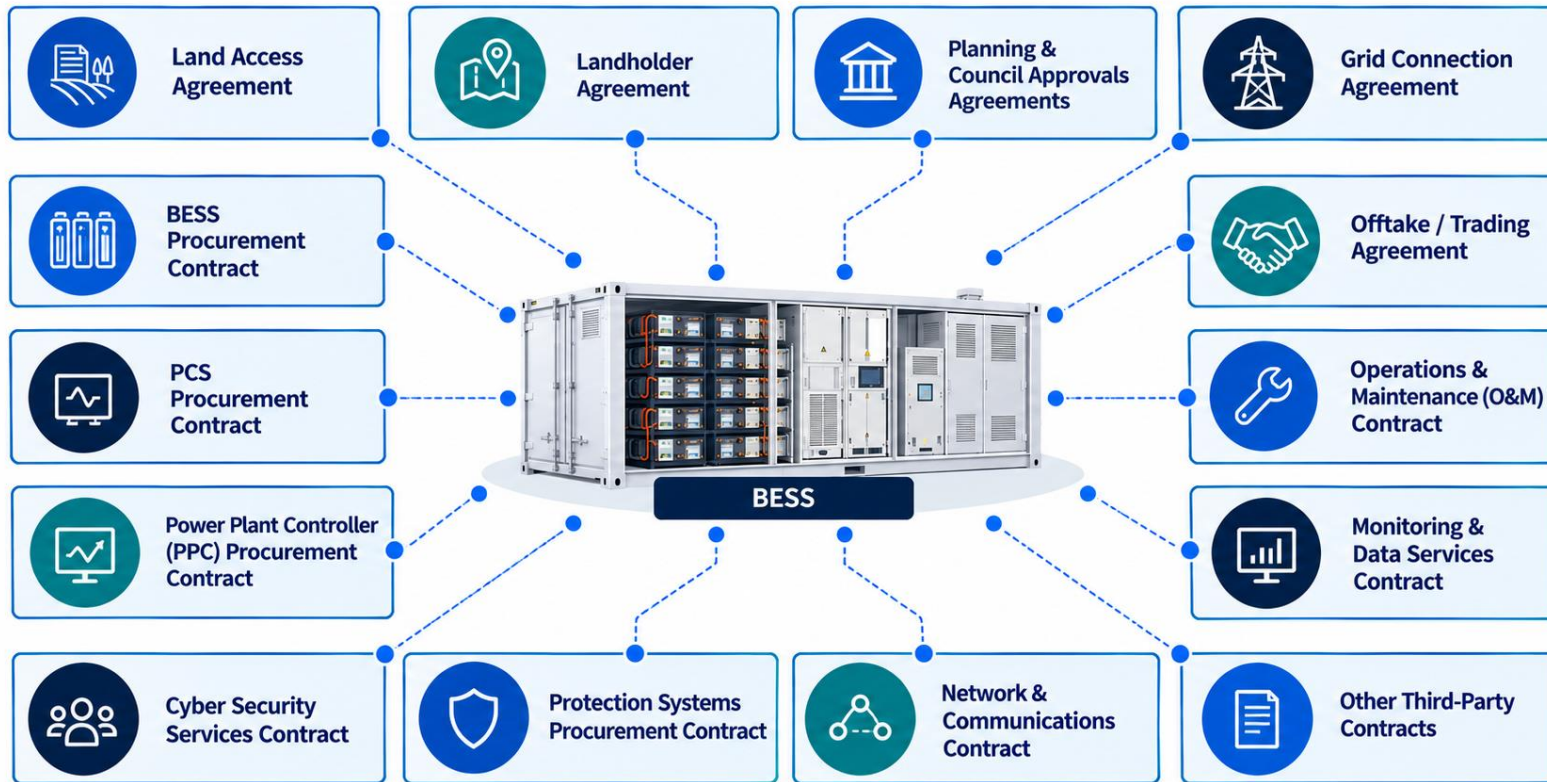
patents¹

Technologies supported in current projects:

- | | | | | | | |
|--------|---------------|-------------|---------------|----------------------|------------|-----------|
| ○ BYD | ○ Samsung SDI | ○ Sungrow | ○ Honeywell | ○ Tesla ² | ○ NIDEC | ○ FlexGen |
| ○ CATL | ○ Huawei | ○ E-Storage | ○ Powin | ○ Ulteig | ○ Hitachi | |
| ○ LG | ○ HiTHIUM | ○ Fluence | ○ Rolls Royce | ○ Ecoster | ○ Wartsila | |



A BESS is a web of contracts, and the devil is in the detail



How they interrelate

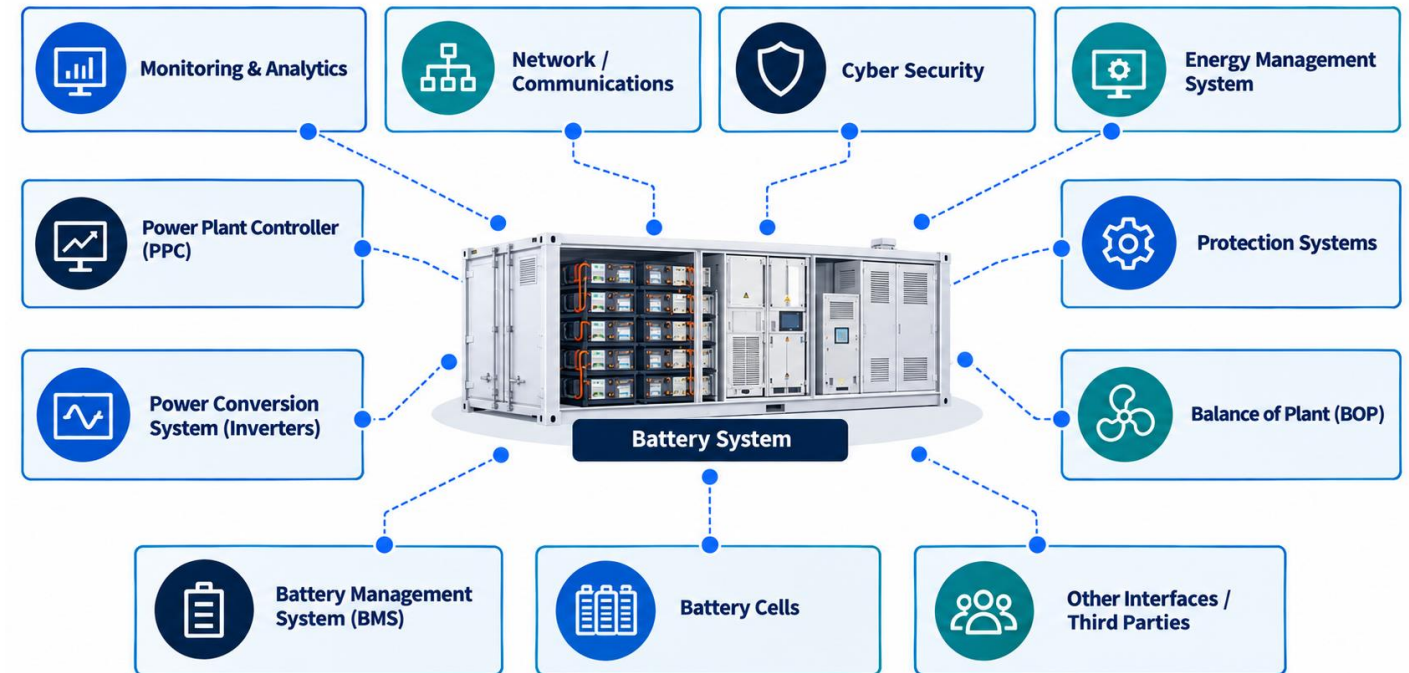
- **One change, many contracts:** a PCS firmware update can alter what the offtake promised
- **One data set:** warranty, O&M and offtake settlement all rely on it
- **One set of definitions:** availability and downtime must match everywhere
- **Risk sits at the seams:** check each interface, not just each contract
- **Asset management** of software and firmware

Good data connects the contracts: trusted independent records lets you prove performance across parties and settle issues on facts.

The multi-party puzzle: who is actually in your BESS

One system, many vendors

- Cells, BMS, PCS, PPC and network each bring their own hardware, firmware and software
- Many run on Linux stacks
- Who is your critical vendor, and what if they stop updating in 10 years?
- Manage firmware and software as an asset
- Add the offtaker or aggregator, and IT and cyber systems



There is an extensive eco-system of digital assets surrounding the BESS. They all have software, firmware, and can have operating systems, they all need consideration and management.

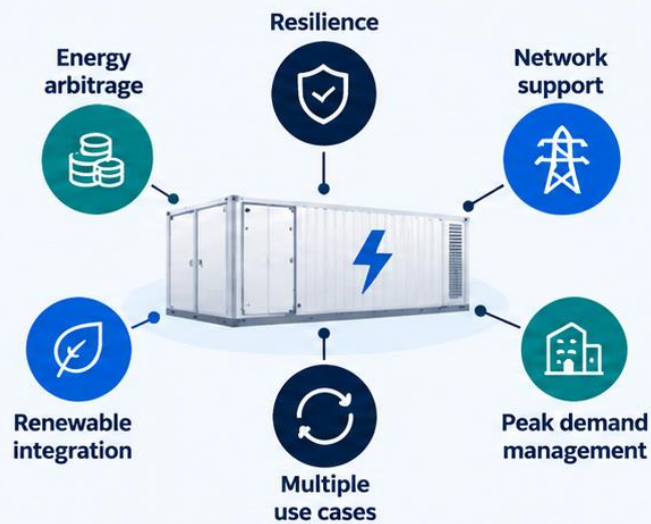
**A battery is a critical infrastructure IT asset;
as much as it is a critical infrastructure power asset.**

Lessons from the field (1 of 2)

Lesson 1: Understand your use case

- ☐ Know what you need at the connection point
- ☐ Plan the O&M practices, processes and contracts to deliver it
- ☐ Agree who does which parts of the O&M
- ☐ Validate that your practices meet your supplier and offtaker contract obligations

Lesson 1: Understand your use case



Lesson 2: Read the contract in detail

- ☐ Outsourcing O&M is fine; know what the contracts say
- ☐ Warranty terms, maintenance obligations, data you must keep
- ☐ That data lets you enforce the warranty and on-sell the asset, you need more than just cell level data, work practices and physical maintenance.

Lesson 2: Read the contract in detail



Lesson 3: IT security, cyber, data access and compliance

- ☐ Suppliers hold remote access and can push firmware or configuration changes without your knowledge
- ☐ If a pushed update breaks something, who is responsible and who pays?
- ☐ Treat firmware and software the same as a hardware asset. Consider what happens if a sub supplier no longer exists.

Lesson 3: IT security, cyber, data access and compliance



Lessons from the field (2 of 2)

Lesson 4: Own your data

- ☐ Keep an independent data source, separate from the supplier and from the system itself
- ☐ Specify your access up front; make sure you can trace the data to the contract
- ☐ Both sides rely on it: your claim and their warranty.

Lesson 4: Own your data



Lesson 5: Who carries the downtime

- ☐ Know what downtime costs you under your offtake arrangements and use case
- ☐ Share your contract obligations with the manufacturer and maintainer so they can plan ahead
- ☐ Downtime is not only a full outage: recalibration and partial derating count too
- ☐ Find the root cause, still trade

Lesson 5: Who carries the downtime



Lesson 6: Arbitrating an issue

- ☐ Keep eyes on the asset daily, weekly and monthly; an independent view helps
- ☐ Avoid the issue first, and escalate early while things are calm
- ☐ In a dispute, keep records of what you did and how you protected the asset
- ☐ In court, written proof outweighs intentions, and the contract decides who pays

Lesson 6: Arbitrating an issue



Ten things to think about before you buy or acquire



You have spent a lot of money on this asset. Do you know what is really going on inside it?

Daily operational gaps are difficult to close without data

History

“PCS 24 trips offline. We reset, but it randomly trips again. When exactly did that start? Who’s tracking this?”



Specificity

“The EMS throws tons of generic alarms every day. We can’t triage this. How do we filter the noise?”

Active Time	Name	Ack Time	Ack'd By	Current State	Priority
☐ 9/12/16 8:17 AM	Fault			Active, Unacknowledged	Critical
☐ 9/12/16 8:17 AM	Alarm			Active, Unacknowledged	Critical
☐ 9/15/16 8:46 AM	High Alarm			Active, Unacknowledged	Critical
☐ 9/15/16 8:46 AM	High Alarm			Active, Unacknowledged	Critical
☒ 9/12/16 8:17 AM	High Alarm	9/15/16 8:24 AM	admin	Active, Acknowledged	Critical
☒ 9/12/16 8:17 AM	Alarm	9/15/16 8:24 AM	admin	Active, Acknowledged	High
☐ 9/13/16 12:12 PM	High Alarm			Cleared, Unacknowledged	Critical
☐ 9/13/16 2:54 PM	High Alarm			Cleared, Unacknowledged	Critical
☐ 9/12/16 8:17 AM	Low Alarm			Cleared, Unacknowledged	Critical
☐ 9/13/16 4:01 PM	High Alarm			Cleared, Unacknowledged	Critical
☐ 9/13/16 4:01 PM	High Alarm			Cleared, Unacknowledged	Critical
☐ 9/15/16 8:45 AM	High Alarm			Cleared, Unacknowledged	Critical
☐ 9/15/16 8:46 AM	High Alarm			Cleared, Unacknowledged	Critical
☐ 9/15/16 9:13 AM	Low Alarm 2			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 2			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 1			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 1			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 2			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 1			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 1			Cleared, Unacknowledged	High
☐ 9/15/16 9:14 AM	Low Alarm 2			Cleared, Unacknowledged	High
☐ 9/12/16 8:17 AM	Low Alarm			Cleared, Unacknowledged	Medium
☐ 9/12/16 8:17 AM	pw Alarm			Cleared, Unacknowledged	Medium

Granularity

“We know we have a bad module, but how do we prove it to the OEM? All we have is site telemetry and a weekly overview PDF.”



Your data rights are set before COD – know when to ask for what

Procure	Build	Operate & Sell
Streaming access to all OEM data Modbus or equivalent, via edge device or server	Complete mapping before commissioning Plaintext descriptions for every data point	Data transfers on sale Buyers can verify the asset's history
No vendor lock-in Raw data pushed to your own cloud, outside OEM tools	All OEM and BOP data Alarms, status codes, substation and grid tags	Every stakeholder keeps access Survives a change of O&M contractor or OEM

One set of KPIs across every site, OEM and contract

Comparable	Contract-ready	Automated
Same definitions for every OEM Raw BMS and PCS data normalized into one validated data model	KPIs that match your contract terms Availability, capacity and SoH formulas mapped to each contract's definitions	Set up once, delivered on schedule Separate KPI views for operations, warranty and offtake
Data gap or performance breach? Data completeness tracked per signal and interval	Partial downtime counts Derating and recalibration tracked, beyond full outages	Ready for due diligence Consistent history a buyer or lender can check

Questions? Reach out!



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