RENEWABLES

ITP Battery Test Centre

October 2021

ENGINEERING | STRATEGY | ANALYTICS | COMPLIANCE

About ITP

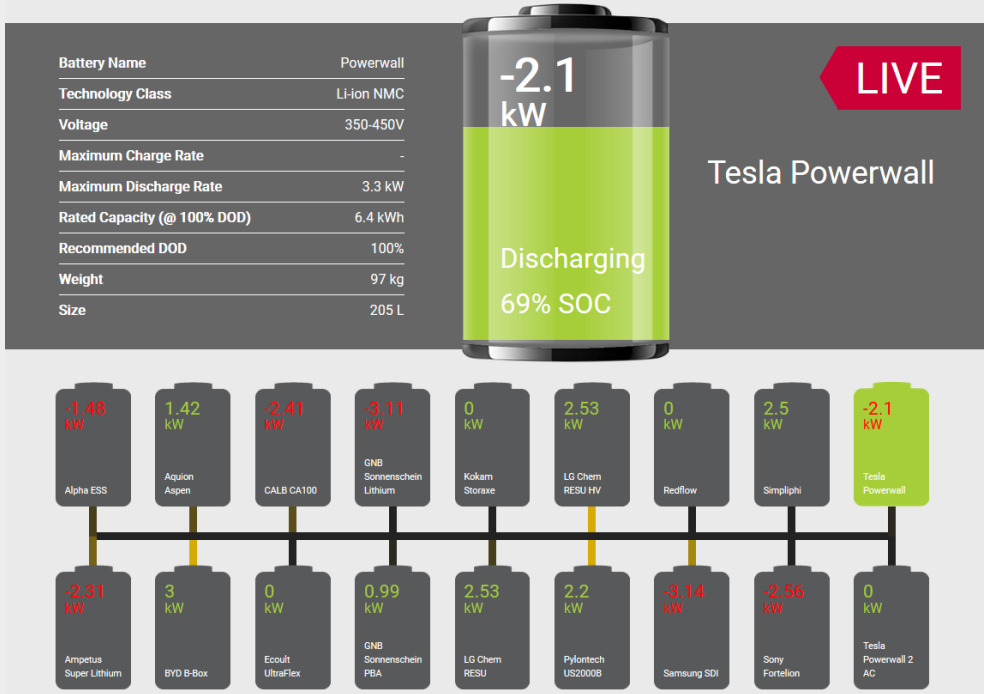
- ITP Renewables provides renewable energy consulting services throughout Australia and Oceania, including engineering, strategy and compliance, and energy sector analytics.
- We provide a unique combination of experienced renewable energy engineers, specialist strategic advisors and experts in economics, financial analysis and policy. Our experts have professional backgrounds in industry, academia and government.
- We are proud to be part of the global ITPEnergised Group, providing independent and trusted advice since 1981 (UK) and 2003 (Australia).

About ITP - Storage

- ITP specialises in battery performance testing and analysis, as well as designing and implementing storage projects and programs.
- For 35 years we have been specifying battery energy storage for remote RE / diesel hybrid mini-grids around the world.
- Recently, with rapidly falling battery prices, we have extended this expertise to on-grid applications, using a range of battery technologies.

Battery Test Centre objectives

- Expose residential-scale battery packs to accelerated cycling in Australian temperature conditions
- Compare performance against manufacturers' claims:
  - Procurement
  - Installation
  - Commissioning
  - Capacity retention
  - Round-trip efficiency
- Disseminate results to public via website and 6-monthly public reports



Testing methodology

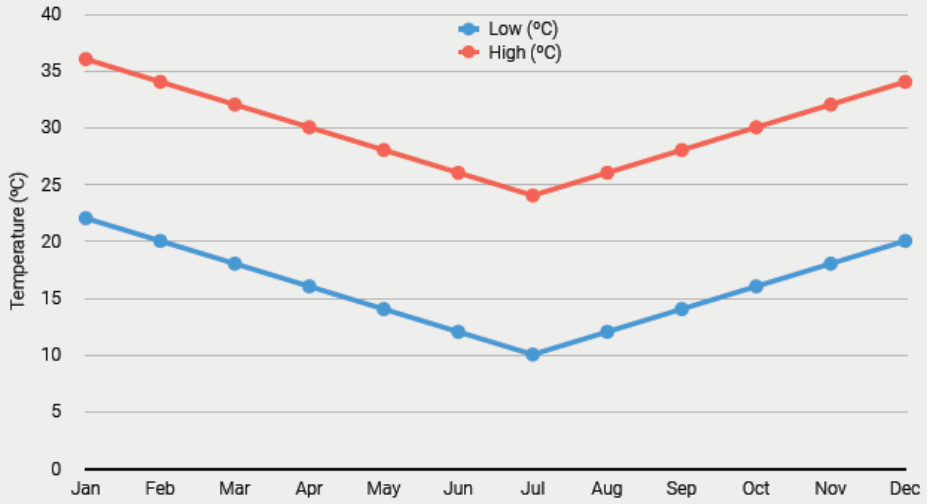


Figure 1: Daily hot and cold cycle temperatures throughout the year

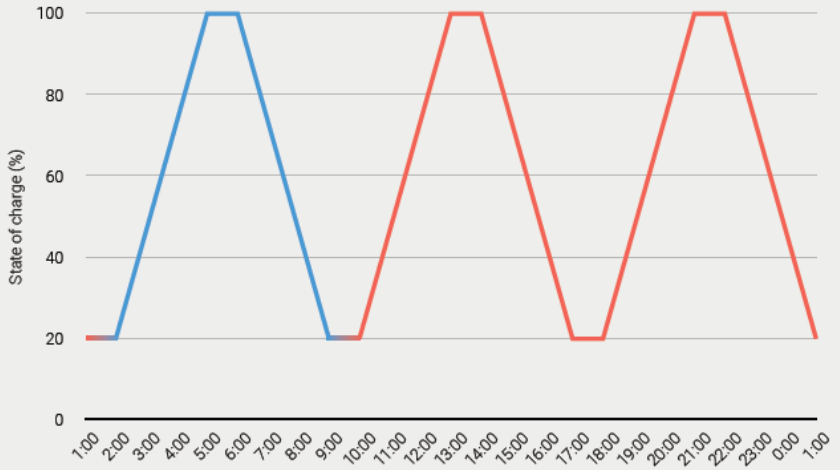


Figure 2: Summer temperature regime and charge regime

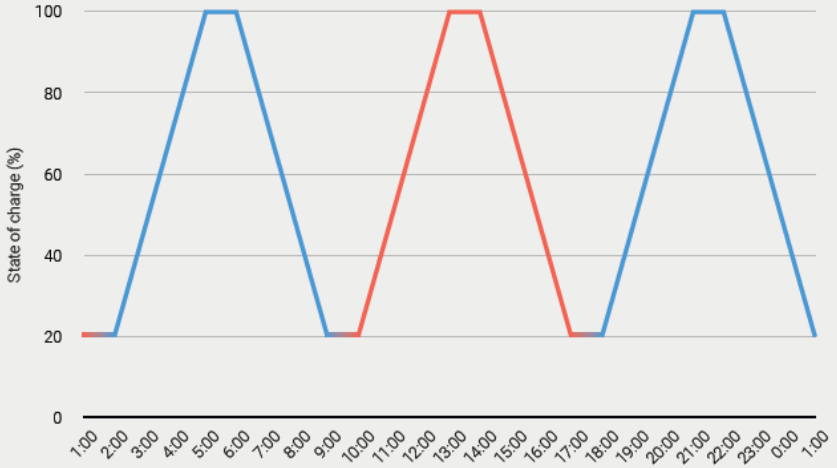


Figure 3: Winter temperature regime and charge regime

Batteries under test

Phase 1 – August 2016

Product	Chemistry	kWh nom. capacity
CALB CA100	LFP	10.24
Ecoult UltraFlex	Lead Carbon	14.8
GNB Sonnenschein	Lead Acid	14.4
Kokam Storaxe + ADS-TEC BMS	NMC	8.3
LG Chem RESU 1	NMC	9.6
Samsung AIO	NMC	10.8
Sony Fortelion	LFP	9.6
Tesla Powerwall 1	NMC	6.4

Phase 2 – July 2017

Product	Chemistry	kWh nom. capacity
Alpha ESS M48100	LFP	9.6
Ampetus Super Lithium	LFP	9.0
Aquion Aspen	Aqueous Hybrid Ion	17.6
BYD B-Box	LFP	10.24
GNB Lithium	NMC	12.7
LG Chem RESU HV	NMC	9.8
Pylontech US2000B	LFP	9.6
Redflow ZCell	Zinc-Bromide Flow	10.0
SimpliPhi PHI 3.4	LFP	10.2
Tesla Powerwall 2	NMC	13.5

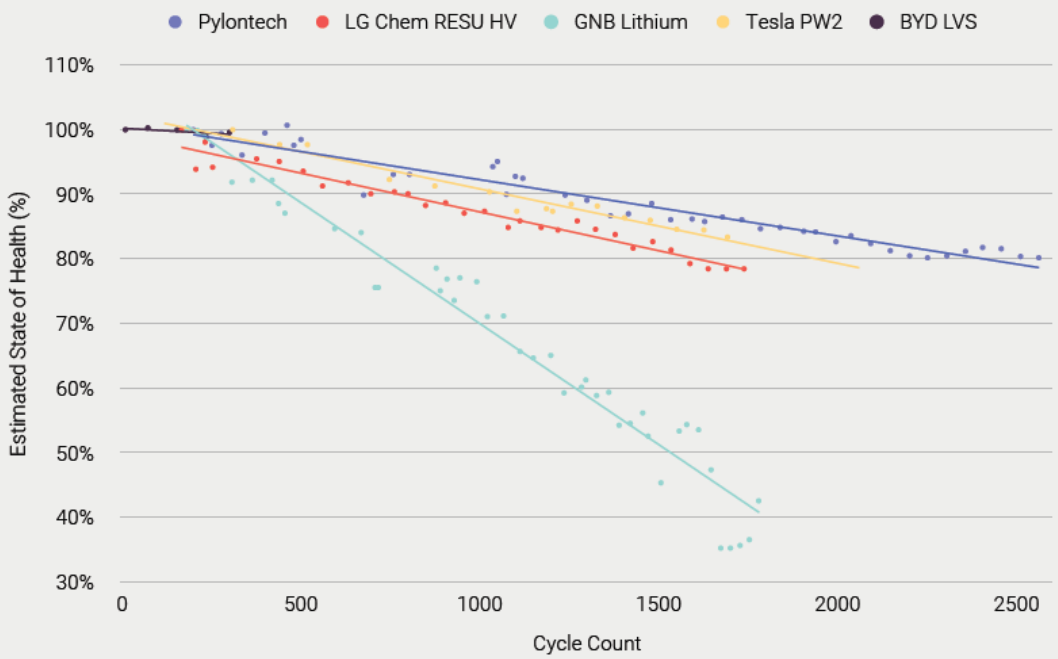
Phase 3 – Dec 2019

Product	Chemistry	kWh nom. capacity
BYD B-Box HV	LFP	10.2
DCS PV 10.0	LFP	10.0
FIMER REACT 2	NMC	8.0
FZSoNick	Sodium Nickel Chloride	9.6
PowerPlus LiFe Premium	LFP	9.9
SolaX Triple Power	NMC	12.6
sonnenBatterie	LFP	10.0
Zenaji Aeon	LTO	9.6
BYD B-Box HV	LFP	10.2
DCS PV 10.0	LFP	10.0

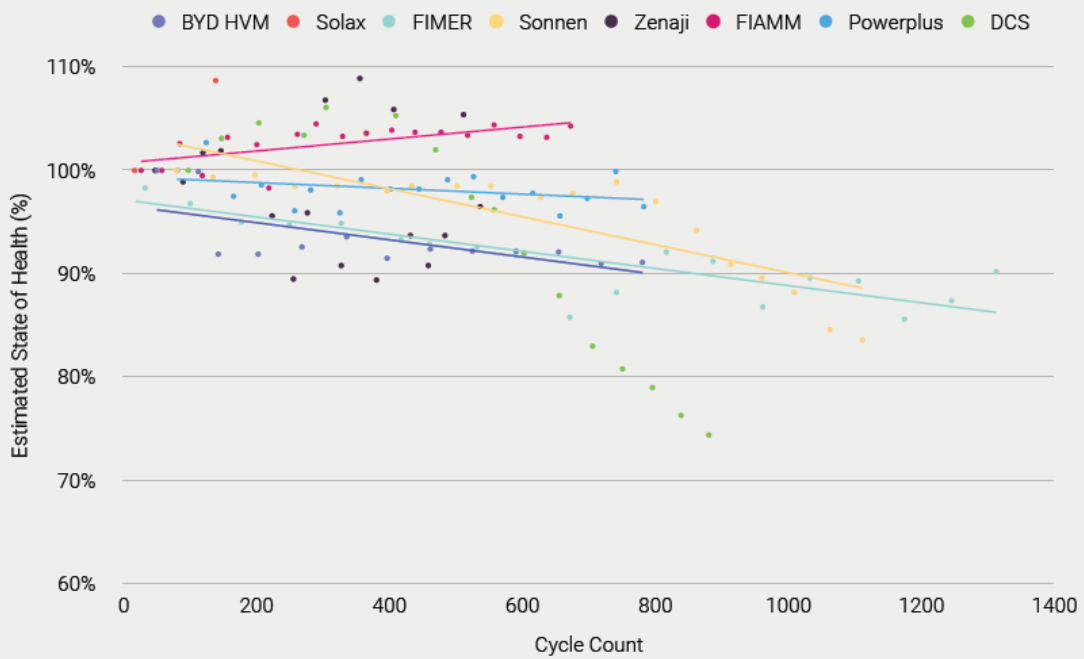
Lithium Iron Phosphate	LFP
Lithium Nickel Manganese Cobalt	NMC
Lithium Titanate	LTO

Performance results

Phase 2

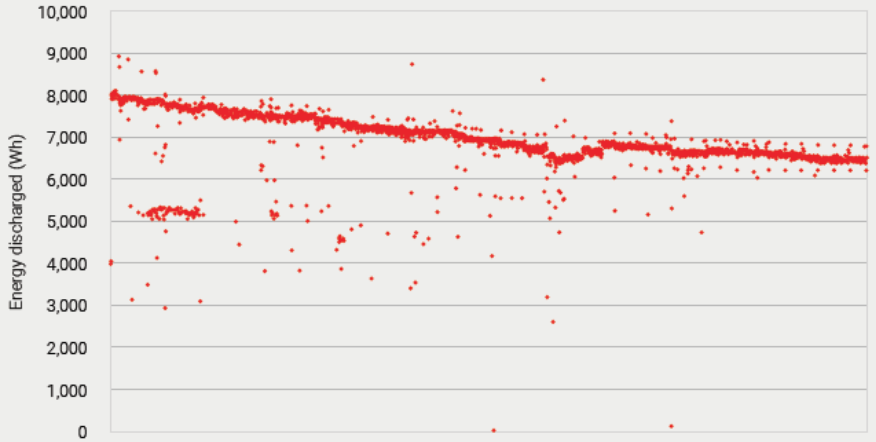


Phase 3

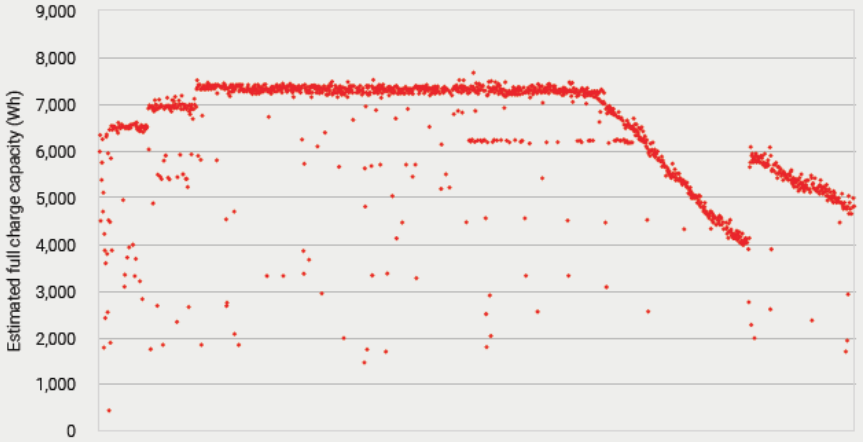


Performance results

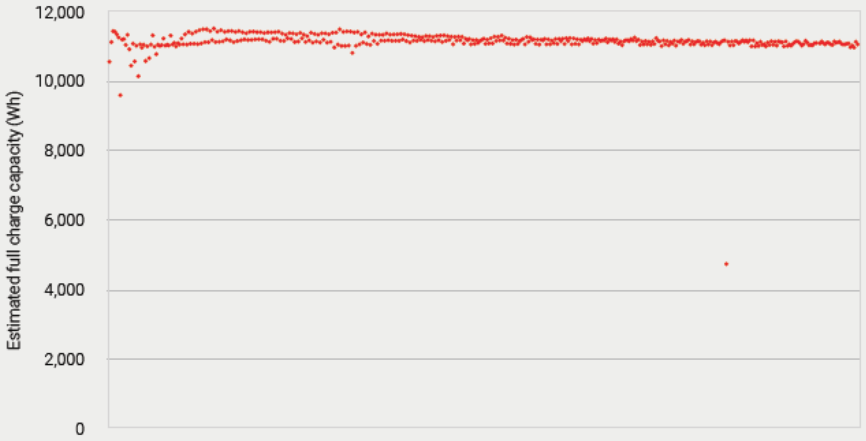
Phase 1 LFP – 3,330 cycles



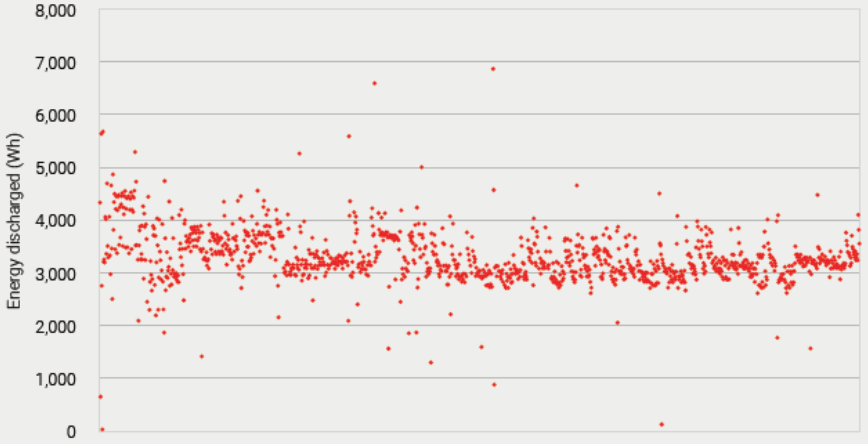
Phase 3 LFP – 1,100 cycles



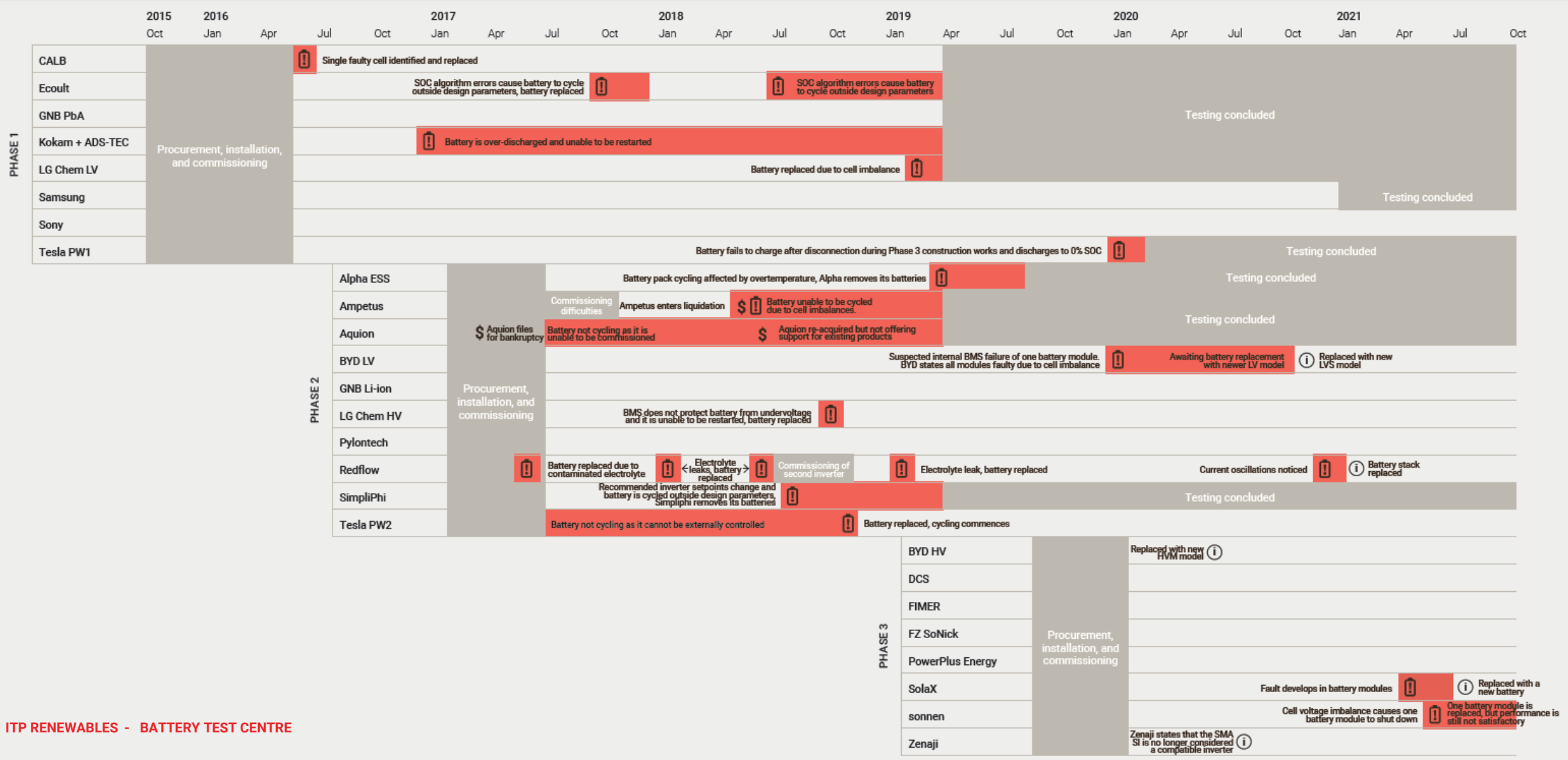
Phase 2 zinc-bromine flow – 450 cycles



Phase 3 LTO – 540 cycles



Operational summary



Lessons learned

- Some batteries retaining capacity well and broadly meeting expectations
- However, capacity degradation and reliability issues apparent with many batteries, demonstrating the need for improvements in:
  - Battery management
  - Integration & control
  - Technical sales & sales support
  - Monitoring and post-sale support
- Further price reductions also required for mass-market uptake

Quality through testing

- Next Public Report due this month, pending ARENA approval
  - All reports available at www.batterytestcentre.com.au
- ITP has recently led the design of the Distributed Energy Resources Lab with project partners ANU, UNSW Canberra and Evoenergy and funded by the ACT Government
  - A fail-safe testing environment of a simulated distribution network into which users can connect a collection of commercial and custom devices
  - The aim is to develop protocols for multi-technology solutions to avoid early technology lock-in, streamline research and development and maximise the number of products which can be used across Australian networks.

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