# ARENA's Large-Scale Battery Storage Knowledge Sharing Workshop Summary

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Australian Government
Australian Renewable Energy Agency

ARENA

## WHY COME TOGETHER?

Sharing knowledge can help to accelerate the development and uptake of renewable energy. Guided by this, ARENA brought together more than 60 stakeholders from state governments, market bodies and industry to share insights and lessons about large-scale battery storage systems.

The Large-scale Battery Storage (LSBS) Knowledge Sharing Workshop was held in Melbourne on 21 May 2019. We heard presentations about the large-scale battery initiatives from South Australia, Victoria and New South Wales; project lessons on LSBS functional capabilities; and accessing revenue streams for battery projects.

Following presentations on the future energy system, a solution design session was held regarding potential regulatory, technical and commercial changes required to maximise the impact of large-scale battery projects.

This summary presents key takeaways and discussion points from the workshop. While ARENA works to ensure that knowledge is shared effectively from its projects, due to the sensitive nature of some information presented, *Chatham House Rules* was applied to this workshop.

At the end of this document, you will find the presentations from the day that were approved for sharing.

We thank Aurecon for its assistance in compiling much of the information in this document.

## KEY TAKEAWAYS

### State large-scale battery initiatives

- All three state governments highlighted the importance of a clear state-based plan, the need for policy clarity and a focus on strategy.
- Affordability continues to be the core objective for state governments in their development of policy and strategic frameworks, achieved by increasing competition in the National Electricity Market (NEM). Network reliability also remains a strong focus.
- The projected retirement of 70% of current generation fleet by 2035 remains a large challenge for the industry. Australian Electricity Market Operator (AEMO) projections forecast that there may be energy supply shortfalls on the hottest days in Victoria in 2022.
- When preparing funding applications, developers should consider how to demonstrate their project's ability to achieve/support strategic objectives.
- With the renewable energy fraction in NSW and VIC increasing, the state governments will likely be called upon to do more to avoid looming system security risks.
- Hornsdale Power Reserve was a great example of how strong collaborations (between AEMO, network service providers and proponents) can support tight timeframes.

### Project lessons on functional capabilities

- The existing LSBS portfolio has identified and overcome many practical barriers and proves that it is still quite difficult to procure, connect and register a LSBS.
- Batteries are able to provide support, such as Frequency Control Ancillary Services (FCAS), Fast Frequency Response (FFR), synthetic inertia, rate of change of frequency (RoCoF) management, and a better (faster and more precise) response than traditional means, though there is currently limited ability to monetise these value streams.
- In addition, inverters are now potentially able to provide inertia services historically provided by synchronous generators.
- The Original Equipment Manufacturers claim their systems can do much more than they are currently being paid for or enabled by Generator Performance Standards (GPS) and access standards, including with the existing assets. For the industry to continue to grow and maximise its impact, it will be critical to unlock this potential.

- The Ballarat project demonstrates it remains very difficult to register a stand-alone energy storage asset in the NEM and to register an asset owned by another entity. These issues are the first of its kind in the energy market.
- Looking outside the Australian market for expertise and experience can help to build a more robust project team, though knowledge of the Australian market remains critical.
- ESCRI-SA has been able to prove the ability of LSBS projects to address market drivers: stabilises frequency, enables islanded operation, reduces interconnector constraints, provides arbitrage opportunities.
- Ballarat's R2 test-plan was the first of its type and can act as a guideline for future projects.
- Parameters that guarantee the performance of the battery include – reliability, power and discharge, standard power consumption, compensations on warranty, impact on business case, risk profiles and needs of the customers.
- Innovation in management of parasitic loads for stand-alone battery system is imperative.
- There is a need for:
    - a deeper understanding of the inertia and system strength support capabilities of batteries in networks of declining synchronous generation
    - better modelling of the capability of inverter-based generation and storage to support system security and stability as the penetration of asynchronous renewable generation reaches and exceeds 50%
    - deeper understanding around the technical limitations of warranty obligations.

### Project lessons on accessing revenue streams

- The technology is ahead of the rules – there are potential services (and associated revenue streams or markets) which batteries and inverters are technically capable of providing (e.g. inertia, FFR).
- The future is in automated and flexible bidding – but this needs to be more tailored to portfolio risk management rather than stand-alone profit maximisation.
- A number of LSBS projects have necessitated complex contracting arrangements, with sometimes up to 15 parties involved. Due to the complexity of these arrangements it is important that developers:
    - do not underestimate the timeframes for negotiations and contract establishment
    - leverage from market learning and guidance around how to structure contracts and agreements.
- Multiple owners of one integrated system (such as Gannawarra), are complex but the precedent for this has now been established.
- Avoid multiple iterations of contracting structures – modifying contracting arrangements and the necessary review/approval process can be protracted.
- Strong collaboration with AEMO during the grid connection process can streamline elements of the process, and ensure that any issues arising (particularly in non-standard development such as standalone, unmanned systems) are approached with pragmatism.
- Strong collaboration and coordination between teams, and within the market is critical for both project success, and the ongoing growth of the battery storage market.
- There is a need for:
    - continued knowledge sharing in the industry – to facilitate energy transformation success
    - continuation of state government facilitation of industry and federal engagement – to effectively achieve their energy objectives and resolve challenges.

### Future system capabilities

- It is evident that the power system is changing – in particular there is growth from wind, utility solar and rooftop PV. This change is likely to bring about a host of new system requirements, including new resource adequacy, frequency management, voltage management and system restoration capabilities.
- Across this suite of capabilities, battery storage is a technology that is likely to contribute to many of these system requirements; though AEMO is technology neutral and considering this in the context of supply, network and demand options.
- AEMO is conducting a number of reviews in the context of the changing energy system and its future needs, including:
    - study on investigation of high-RE scenarios
    - emerging Generation and Energy Storage (EGES) review
    - DER work program
    - also contributing to the AEMC Forward Market and ESB post 2025 Market Design work programs.
- Potential unrealised (or not fully realised) revenue sources for batteries in the future include short term forward market, operating reserve/ramping reserve market, augmented or new FCAS frameworks in addition to the existing revenue source including energy market, NLCAS, TNSPs and SRAS.

### Solution design session

- There were more challenges/opportunities identified in the 'regulatory' category than in technical or planning. This reflects the consistent theme raised throughout the day.
- Regulatory Issues
    - Services that batteries provide are not currently bankable or certain.
    - Existing services products don't reward 'better' performance above existing market definitions better suited to thermal generators.
    - Government and regulatory processes are inflexible and slow (therefore not adaptive).
    - Co-located generation and storage cannot be registered as one entity.
- Technical Issues
    - Round Trip Efficiency (RTE) has opportunity to be improved.
    - GPS places limits on accessing the full suite of services that can be provided.
    - There is a need to standardise industry terminology, and potentially minimum industry capability, around future technologies (eg. 'synchronous mode', and 'grid forming inverter').
- Planning Issues
    - There is no pathway to get to truly high RE penetration.
    - There is a mismatch between system elements (eg. load and generation being co-located, connection rate expectations vs. registration pain points).
    - Lack of transparency to facilitate efficient investment in areas of the network that most need it, or in asset sharing frameworks.