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Large scale battery storage: services and value streams

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ARENA Insights Forum 25 June 2019

Knowledge Sharing from 4 ARENA funded projects & Hornsedale Power Reserve

1

Lake Bonney

- 25MW Capacity / 52MWh Storage
- Co-located with 279 MW Lake Bonney wind farm
- Tesla - Li ion battery
- Construction complete – connection approval pending

2

ESCRI

- 30MW Capacity / 8MWh Storage
- Stand alone - grid connected but during outage will operate with the 90 MW Wattle wind farm and rooftop solar PV
- Samsung - Li ion battery
- Commissioned Q1 2019

3

Ballarat

- 30MW Capacity / 30MWh Storage
- Stand alone, located at substation
- Fluence - Li ion battery
- Commissioned Q4 2018

4

Gannawarra

- 25MW Capacity / 50MWh Storage
- Co-located with 50 MW Solar Farm
- Tesla - Li ion battery
- Commissioned Q4 2018

5

Hornsedale

- 100MW Capacity / 129MWh Storage
- Co-located with 309 MW Wind Farm (stand alone connection)
- Tesla - Li ion battery
- Commissioned Q4 2017

Key Services & Revenue Streams

Not all services that batteries provide are currently bankable.

Service	Lake Bonney	ESCRI	Ballarat	Gannawarra	Hornsedale
Wholesale energy market	✓	✓*	✓	✓	✓
Regulation FCAS	✓	✓*	✓	Registration process underway	✓
Contingency FCAS	✓	✓	✓		✓
System Security (no direct revenue)	SIPS FFR	SIPS FFR			SIPS FFR
Other	Causer Pays Factor Curtailment Management	Network Support Payments Islanding		Curtailment management	

*Storage capacity limits provision of these more energy intensive services

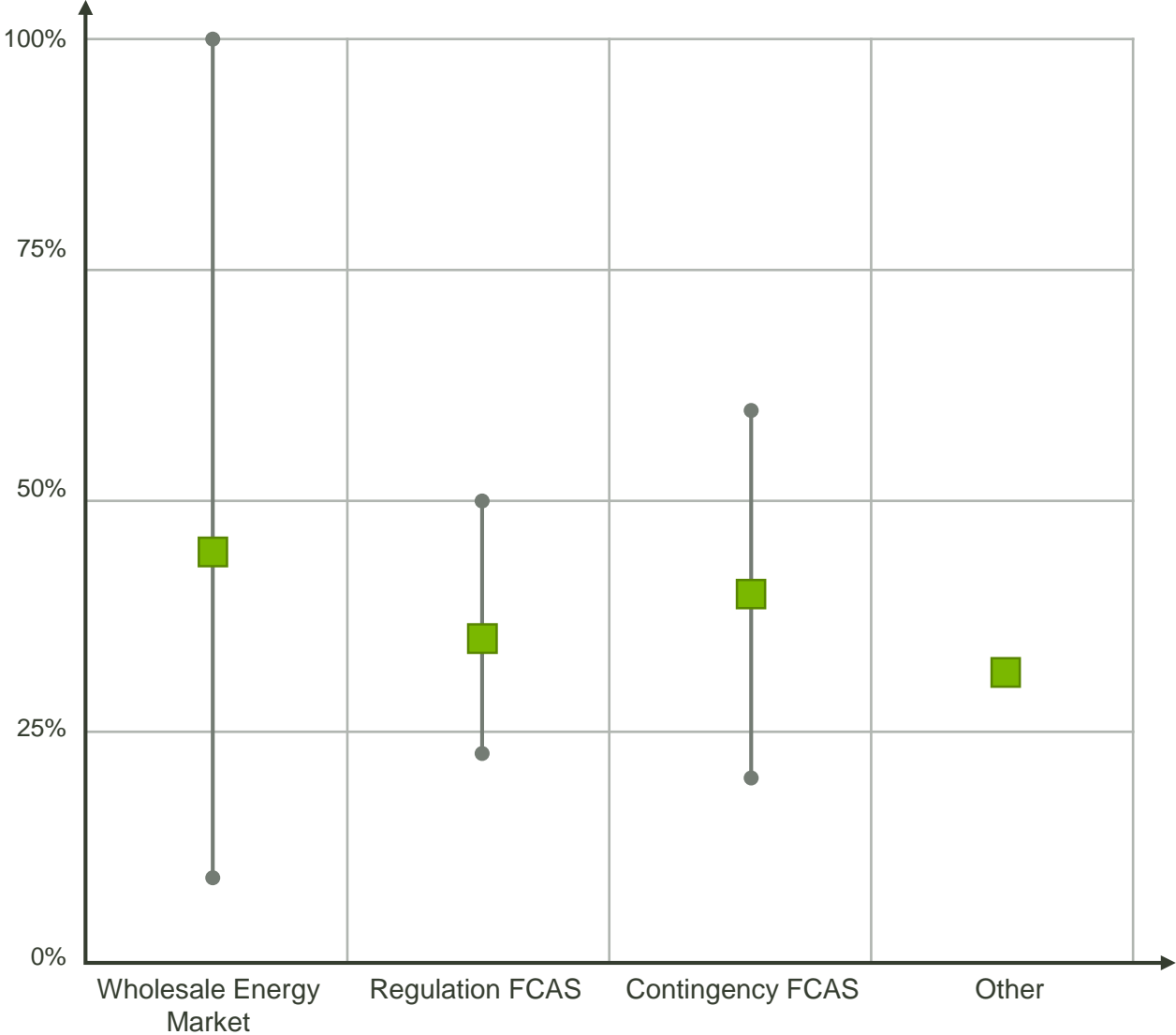
Fundamental questions for valuation of battery revenue streams

What markets or other contracted services are available to the project?

What level of certainty do projects have for these revenue streams?

Current Revenue Capture

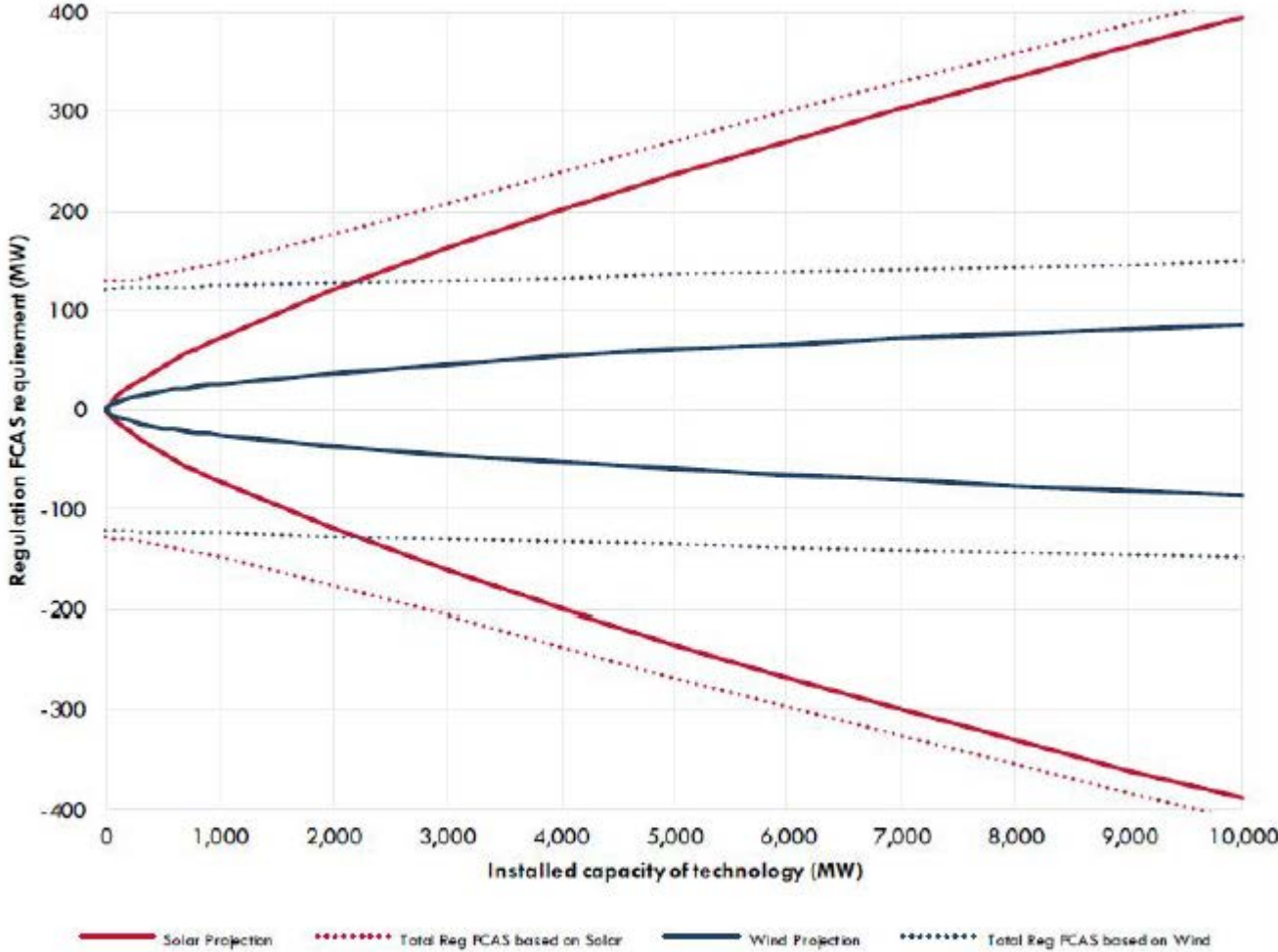
Wide range of variability in LSBS project business cases



Source: Aurecon electronic survey of ARENA-funded LSBS projects

Current Revenue Capture

Requirement for regulation FCAS is projected to increase as solar penetration deepens



Source: AEMO 2018 ISP

Untapped Value

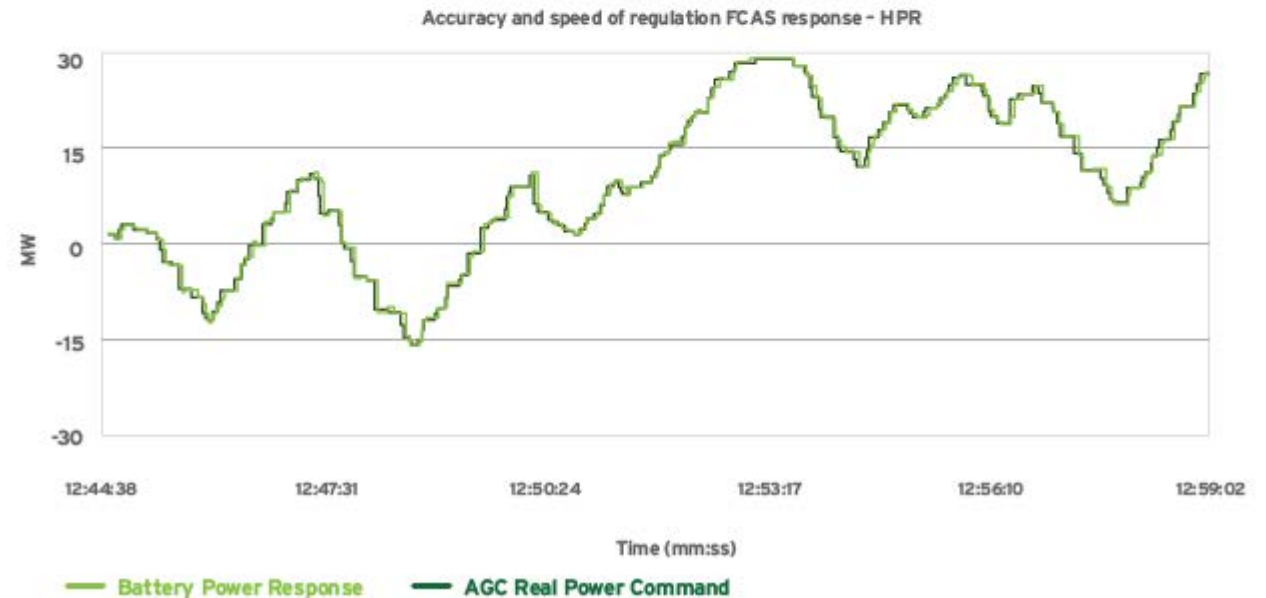
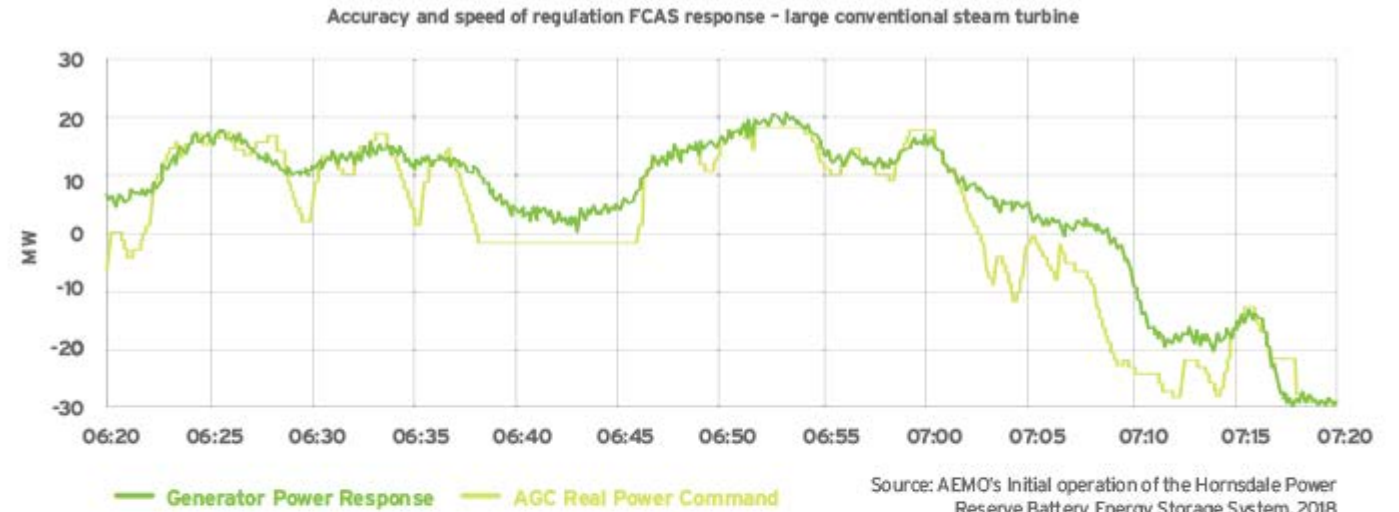
The technology is ahead of the rules

Service	Existing revenue stream	No revenue stream
Wholesale energy market	✓	
Regulation FCAS	★	
Contingency FCAS	★	
SIPS		✓
FFR		✓
Synthetic Inertia		✓
System Strength		✓
System Restart	✓ _{SRAS}	
Voltage Support	✓ _{VCAS}	
Curtailement Management	✓	
Causer Pays Factor	✓	

★ Batteries have technical capability to provide a “premium” FCAS service

Battery Performance

Batteries are offering the market a “premium” service that other types of generation cannot compete with



Opportunities for batteries

What does this mean for the energy market and battery developers?

- 5-minute settlement period rule change
 - *expected July 2021*
- NEM registration - to facilitate bi-directional resource participation
 - *AEMO Emerging Generation and Energy Storage – Grid Scale work program*
- Market reform / augmentation
 - e.g. to incentivise Fast Frequency Response / SIPS
 - *AEMC System Security Market Frameworks Review recommendations*
- Support business cases for renewable generators
 - Where system strength impact assessments identify a shortfall
- Market knowledge sharing
 - Lessons learnt and capability uplift



Key takeaways



There are **potential services** which batteries and inverters are **technically capable of providing**.



LSBS projects are **out-performing other technologies** but not receiving additional benefits for doing so.



For the industry to continue to grow and maximise its impact, **it will be critical to unlock this potential**.



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