ElectraNet

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ESCRI-SA Meeting Minutes

Meeting Name: Knowledge Sharing Reference Group (KSRG), Meeting 4			
Date:	12 June 2019		
Start Time:	1:00 pm	**Finish Time:**	4:00 pm
Location:	ElectraNet Boardroom, 52-55 East Terrace, Adelaide SA 5000		

Attendees:	**Name**	**Affiliation**
	Hugo Klingenberg	ElectraNet
	Rainer Korte	ElectraNet
	Dorin Costan	ElectraNet
	Laurie Antal	ElectraNet
	Viet Trinh	ElectraNet
	Fida Rafi	ElectraNet
	Peter Israel	Advisian (KSRG Chair)
	Alison Washusen	Advisian
	Bruce Bennett	AGL
	Stuart Whiting	AGL
	Chris Davies	AEMO
	Dan Sturrock	Australian Renewable Energy Agency
	Ben Macey	Government of South Australia
	Simon Brooker	Clean Energy Finance Corporation
	Duncan MacKinnon	Australian Energy Council

Apologies		
	Paul Ebert	Advisian
	Brendon Hampton	SA Power Networks
	Mark Jackson	South Australian Government
	Peter Murphy	University of South Australia
	Michael Whitfield	Federal Government
	Barry Millar	AGL
	Stuart Richardson	Federal Government
	Eamonn McCabe	Government of Western Australia
	Adam Budzynski	AGL
	Olga Iaroshevska	AEMC
	Mark Wilson	AER
	Emily Kennedy	Federal Government
	James Minto	Federal Government

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Grant Cushion	Government of Victoria
Andrew Burnett	Government of Queensland
Samantha Christie	Government of New South Wales
Rachel Hayden	Government of New South Wales
Andrew Fraser	TasNetworks, representing Govt. of Tasmania
Alex Lloyd	University of Adelaide
Stuart Johnson	Energy Networks Australia
Glenn Platt	CSIRO

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No	Description	Presented by	Time
1	**Welcome by Chair & introduction to the day** • The Chair introduced himself and the context and purpose of the KSRG. • Introduction by each of the KSRG members.	**Peter Israel**	**13:00 – 13:05**
2	**Introductory remarks from ElectraNet** • Brief welcome by Rainer Korte. • Practical completion and commercial handover was a huge milestone and a great step forward. • This meeting is the first chance to learn from the operation of the system. • Housekeeping matters discussed	**Rainer Korte**	**13:05 – 13:10**
3	**Confirmation of minutes from previous Meeting 3** • Minutes accepted from KSRG Meeting #3, August 2018 - no edits requested.	**Peter Israel**	**13:10 – 13:15**
4	**What is the KSRG – Terms of Reference** • The Chair reminded people of the KSRG Terms of Reference which are available on the Project Portal (www.escri-sa.com.au). • Final form of presentations will be available from the Project Portal. • The KRSG continues for the first 2 years of operation.	**Peter Israel**	**13:15 – 13:20**
5	**Project Status and Update** • *A summary of the Project Status was provided using a presentation which is now on the Project Portal (see https://www.escri-sa.com.au/knowledge-sharing/).* **Background and context** • BESS provides both regulated services to ElectraNet and competitive market services to AGL, through a 12-year lease allowing AGL operational control. • During project implementation the BESS was incorporated into the System Integrity Protection Scheme (SIPS), providing additional regulated benefits. • CPP was the principal contractor and has also been awarded the 12-year maintenance agreement. • To date the state of charge (SOC) has been limited to no lower than 4.8 MWh	**Hugo Klingenberg, Dorin Costan**	**13:20 – 13:40**

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- The SOC limit will be relaxed to 10-90% of capacity once further tests are complete.

Question: How are regulated services protected?

- The BESS is programmed to automatically react to system events

Path to Commercial Handover

- Commercial handover achieved on 14 Dec 2018.
- At handover the BESS had grid-connected functionality, but not ability to island with Wattle Point wind farm.
- Key defects at handover outlined.

Project Status

- Capital project close-out is continuing and ElectraNet are preparing for internal handover to Operations/Maintenance.
- R2 tests and outstanding functional test have been completed.
- Successful test of wind farm island operation believed to be a first for a Type 1 wind farm.
- In general, the system is working as planned and all parties are gaining operational experience.
- Additional air conditioning units have been installed and the air flow optimized.
- A further 2 air conditioning units are due to be installed in August 2019. These will reduce the risk of having to de-rate the system under extreme heat conditions.

Question: If you were to do the project again, would you specify the air conditioning systems differently?

- This system is a comparatively large indoor installation of batteries
- Under rapid discharge the temperature can reach 50°C in 1-2 minutes
- For an indoor facility liquid cooling is an alternative, however is dependent on how the inverters are configured and designed and is not an off-the-shelf solution
- The ESCRI tender was not prescriptive around how cooling was applied.
- The incremental cost of additional air conditioning systems is low compared to alternatives.
- For a future project, rather than specifying a different cooling system, recommendation is to work with the contractor to pay closer attention to the air conditioning design and ducting of air flow to optimise the performance of the cooling system.

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6	**Update on Performance Testing**	**Fida Rafi & Viet Trinh**	**13:40 – 14:00**

- *An update of performance testing was provided using a presentation which is now on the Project Portal (see https://www.escri-sa.com.au/knowledge-sharing/).*

Challenges to Achieve Islanding

- Initial testing under island operation indicated the BESS inverters were interacting with each other, causing oscillations. This was not a problem while grid connected.
- A single model is used for grid connected and island operation.
- Addressing the oscillation in island operation affected the grid connected performance of the BESS and required the R1 model to be resubmitted and renegotiation of GPS with new models

Question: Was the R1 model required for islanded operation or just for grid operation?

- AEMO only considers grid connected operation and the need to follow GPS.

Question: How do the National Electricity Rules (NER) apply for island operation?

- AEMO is not involved with island testing. However, fixing oscillations during islanding impacted grid operation and therefore required renegotiation of the GPS, involving significant effort.

Island Testing

- During unplanned island testing, a frequency spike was observed which tripped the wind farm despite being within the limits of the wind farm's GPS.
- AGL are in the process of adjusting their frequency protection. settings to prevent tripping of the turbines when forming an island.
- Unplanned island testing will be repeated once the frequency protection settings have been adjusted.

Overload Capability Test

- The model showed possible limitations of the system under overload conditions, which were confirmed under test conditions.
- The battery protection settings were negotiated with Samsung and changed to prevent tripping by allowing a few seconds in overload.

SIPS test

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- Test results demonstrated that the BESS can achieve 100% output within 250ms of a signal from the South East substation (400km away).
- Discussion around the response time of the control system, and whether an even quicker response could be achieved if coordinated at a power store, rather than inverter level.

R2 tests

- Further development of model and confidence gained from R1 and ITR testing was required prior to R2 testing
- R2 testing was completed in April 2019 and is awaiting the test report from the consultant, FortEng.
- Key test traces of voltage step and power factor control were presented showing good correlation between the modelled response and test response.
- The BESS usually operates in power factor control mode but is pre-programmed for auto-changeover to voltage control mode in response to a large change in network voltage.
- Test traces of auto-changeover were presented, showing significant injection of active and reactive power to support system voltage recovery.

Question: Would auto-changeover occur for any voltage dip, or just on islanding?

- Auto-changeover to voltage control mode would happen for any event where there is a significant voltage dip. It is not grid forming but provides support for voltage recovery.

7	**Afternoon Tea**		**14:00 – 14:20**
8	**6 monthly Operational Report – ElectraNet Perspective** • *The first 6 months of operation from ElectraNet's perspective were outlined using a presentation which is now on the Project Portal (see https://www.escri-sa.com.au/knowledge-sharing/).* **General asset performance** • The BESS provides four key services: reduction in unserved energy, Heywood interconnector benefit, FCAS and Market Trading • Of these, ElectraNet is particularly interested in the ability to reduce unserved energy events.	**Laurie Antal** **Viet Trinh** **Dorin Costan**	**14:20 – 15:00**

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- The BESS has successfully reduced unserved energy during two separate events, on the 29th March 2019 and the 7th April 2019, since commercial operation.
- The BESS provides a constant offset to reduce the Heywood Interconnector RoCoF constraint.
- In contrast, all other participating generators provide intermittent support, bidding in and out of the system with the generators online setting the limit.

Examples of normal BESS operations

- Operational data is available from portal. Typical traces for FCAS operation, periodic recharge and cap trading were presented.

System events (e.g. faults) and incidents

- The BESS has been exposed to 4 network faults since commercial operation. In each case the BESS has operated as expected and rode through faults
- Typical fault traces were presented showing the active and reactive power injected from the BESS a fault to support voltage recovery.
- The BESS has reduced unserved energy on two occasions, on 29 March 2019 and 7 April 2019.
- On 29 March 2019, failure of the Island Detection Scheme (IDS) during a large switching event resulted in an island being formed.
- The BESS formed an island and supplied the 3 MW Dalrymple load for 30 minutes.
- No load was lost and the BESS successfully resynched to the network**.**
- The island network frequency was held close to 50Hz during islanding, within frequency operating standards, and the transition would not have been noticeable to customers.
- During a planned outage on 7 April 2019 the BESS successfully transited into island operation and supplied the load for 7 hours of the 7.5 hour outage.
- During restore of one of feeders, the voltage change resulted in an incorrect island detection, tripping the BESS for the last half hour of the outage.
- The vector shift relay system, used to provide redundancy in island detection, has been found to be unreliable and has been disabled.

Question: Where is vector shift relay located?

- The vector shift relay is an on-board system located at Dalrymple.

General operational issues

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- Standby losses have been higher than expected through transformer, battery management system and inverter losses.
- Losses depend on the usage strategy of the battery. The BESS is primarily used for FCAS so standby losses are incurred to keep the BESS ready to respond to system events at all times.
- Availability has generally been very good and above contractual target of 96%.
- Cycle counting, suspect availability data (over 100%) and lock-out issues, including resolution, were discussed.

Safety performance and learnings

- There have been no safety incidents since commercial operation. The likelihood of safety incidents is reduced for general operation as site is largely unmanned
- The BESS is within a rural area and is required to operate within specified noise limits.
- One noise complaint has been lodged with a Government department in June 2019.
- Preliminary field measurements appear to be acceptable, but the testing needs to be repeated day and night for a period of time once all of the air conditioning units have been installed.

What O&M is occurring?

- Maintenance and support is provided by CPP through a 12 year contract. Remote monitoring is available to maintenance supplier.
- The system is displaying few problems as there are no moving parts. Ongoing maintenance requirements are expected to be low.

9	**6 Monthly Operational Report – AGL Perspective** • *The first 6 months of operation from AGL's perspective was outlined using a presentation which is now on the Project Portal (see https://www.escri-sa.com.au/knowledge-sharing/).* • Most value so far has been through FCAS, which has exceeded the budgeted revenue. • The revenue from trading has been lower than budgeted. • Traces of frequency during an islanding event were presented, showing that it is almost impossible to tell the difference between islanding and network operation. • AGL are currently not getting paid for the provision of synthetic inertia, although the BESS provides synthetic inertia and can respond within 30ms.	**Bruce Bennett**	**15:00 – 15:30**

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- Discussion around the difference between response time of synthetic inertia (at inverter level) and SIPS (at part controller level).

Question: Does operation of the BESS change the FCAS recovery position for the wind farm?

- The BESS and Wattle Point Wind Farm are independent assets so the BESS does not impact on the wind farm cost recovery?

Question: Why was cap trading lower than budgeted?

- In the last 6 months the state of charge has been limited to no lower than 4.8 MWh. Once this limit is relaxed then discharge revenue should increase.
- A simple, automated system is used for bidding. A more sophisticated re-bidding system may be built in future.
- AGL saw more value in FCAS than trading, however this may change when 5-minute settlement comes in.

Question: How is the wind farm controlled during islanding?

- As soon as IDS sends the islanding signal a signal is sent to the wind farm to limit output.
- Fine control is achieved through the battery control system with the park controller talking to individual turbines to drive output.

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10	**Questions and discussion on initial performance & operations**	**All**	**15:30 – 15:45**

Synthetic Inertia

- General discussion around the lack of market for synthetic inertia.
- AEMO has identified a gap in inertia when there is a risk of islanding.
- Since the SA blackout, all new generators need to provide either spinning reserve or synthetic inertia.
- Potential faster response through detection of rate of change of frequency rather than flat frequency limit.

Question: What are the settings for the synthetic inertia? How often has the BESS been responding to events?

- Settings for synthetic inertia are within the inverter and are 3 Hz/s at 30 MW and 2 Hz/s at 20 MW.
- Traces of events presented showing frequent, automatic provision of small amounts of power.

Value of Battery Systems

- General discussion around the business case for future battery installations.
- Batteries are currently not justified as a standalone investment, however AGL is monitoring future options.
- FCAS value is expected to reduce as more batteries come online. FCAS is currently the primary income stream for battery installations, which are generally price takers, however this is not considered a bankable income stream.
- The 2 year turnaround for RIT-T process is problematic if a project is "ready to go", particularly if the project is relying on this as a revenue stream rather than additional revenue.
- There is a disconnect between batteries playing a big role in the market vs knowing how it could happen in an economic way.
- Current battery installations are often partially justified on the learnings associated with the asset.

Question: Are costs likely to change in future?

- Battery costs made up around 21% of the total capital cost compared to 27% for inverters.
- The rapidly reducing cost of batteries will therefore have a lesser effect on total system cost as these cost reductions are not anticipated to apply for other system components, including the inverters.

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Question: What is driving AGL to invest?

- More and more constraints, increasing price volatility and 5 minute settlement mean that BESS systems may gain value over time.

11	**Future Challenges – next steps**	**Hugo Klingenberg**	**15:45 – 15:55**

Lessons Learnt:

- Each battery project seems to have its unique challenges and learnings.
- Network benefits are unique to the location and application. While the commercial model can be applied to other projects, the benefits are project specific.
- To date the project has achieved all 3 objectives through persistence and collaboration.
- Integration of a large wind farm with islanding is an excellent technical outcome.
- The aggressive timeline was perhaps unrealistic initially however the proponents are satisfied with the outcome.
- Signing up for a 12 year contract before detailed design and then managing it for 12 years remains a challenge.

Feedback on 6-monthly Operational Report TOC

- Include discussion within the report on opportunities, given what has been learnt.

Future Challenges and actions

- Manage availability and losses.
- Islanding testing for full integration of the wind farm.
- Installation of additional air conditioning units.
- 6 Monthly Operational Report due in to ARENA in July 2019.
- ElectraNet internal handover to operations and maintenance.

12	**Close**	**Peter Israel**	**16:00**

- Thanks were given to all attendees for their attendance and contribution.
- The Chair closed the KSRG Meeting at 4pm.

END OF MINUTES

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Certified as a correct record of the ESCRI-SA Knowledge Sharing Reference Group Meeting of 12 June 2019.

Peter Israel, KSRG Chair	***3/7/19***
	Date

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