

ESCRI-SA Meeting Minutes

Meeting Name: Knowledge Sharing Reference Group, Meeting 5

Date: 3 March 2020**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
	Laurie Antal	ElectraNet
	Viet Trinh	ElectraNet
	Fida Rafi	ElectraNet
	Mitchell Baker	ElectraNet
	Paul Ebert	Advisian (Chair)
	Lawrence Gebert	Advisian
	Germane Athanasius	AEMO
	Bruce Bennett	AGL
	Stuart Whiting	AGL
	Wai-Kin Wong	AGL
	Dan Sturrock	Australian Renewable Energy Agency (Skype)
	Duncan MacKinnon	Australian Energy Council
	Kate Degen	AEMC (Skype)
	Simon Brooker	Clean Energy Finance Corporation
	Verity Watson	Energy Networks Australia (Skype)
	Dor Son Tan	Energy Networks Australia (Skype)
	Jayden Crossing	Government of South Australia
	Andrew Burnett	Government of Queensland (Skype)
	Travis Kauschke	SA Power Networks

Apologies:	Name	Affiliation
	Michael Whitfield	Federal Government
	Stuart Richardson	Federal Government
	Emily Kennedy	Federal Government
	James Minto	Federal Government
	Grant Cushion	Government of Victoria
	Mark Jackson	South Australian Government
	Ben Macey	South Australian Government
	Rachel Hayden	Government of New South Wales
	Eamonn McCabe	Government of Western Australia

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No	Description	Presented by	Time
1	<p>Welcome by Chair and introduction to the meeting</p> <ul style="list-style-type: none"> The Chair introduced himself and the context and purpose of the KSRG. Each of the KSRG attendees introduced themselves. Housekeeping matters were discussed. Attendees were reminded they may be privy to confidential information and ElectraNet's approval should be sought prior to distribution of information. 	Paul Ebert	13:00 – 13:05
2	<p>Introductory remarks from ElectraNet</p> <ul style="list-style-type: none"> A brief welcome was extended to all participants. During the second half of 2019 ESCRI SA received several innovation awards. A lot has been learned through the experience of ESCRI SA. It has proved to be a headline project in numerous areas. 	Rainer Korte	13:05 – 13:10
3	<p>Confirmation of minutes from previous Meeting 4</p> <ul style="list-style-type: none"> Minutes from KSRG Meeting #4, 12 June 2019 were accepted. No edits requested. 	Paul Ebert	13:10 – 13:15
4	<p>KSRG Terms of Reference</p> <ul style="list-style-type: none"> The Chair reminded attendees of the KSRG Terms of Reference which are available on the Project Portal (www.escri-sa.com.au) The final form of presentations will be available from the Project Portal (see https://www.escri-sa.com.au/knowledge-sharing/). The KSRG continues for the first 2 years of operation. 	Paul Ebert	13:15 – 13:20
5	<p>Project Status and Update</p> <ul style="list-style-type: none"> A summary of the Project Status was provided using a presentation which is now on the Project Portal <p>Background and scope</p> <ul style="list-style-type: none"> A 3-minute video (time-lapse) showing the entire construction process was presented. The project is a nominal 30MW, 8MWh lithium-ion battery The site is located to maximise value from the battery. It is connected to the 33kV bus at Dalrymple substation on the Yorke Peninsula, close to the 91MW Wattle Point Wind Farm (WPWF). This provides 	Hugo Klingenberg	13:20 – 13:30

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opportunity for the battery to provide islanded operation with the wind farm following network outages.

Project Objectives

- Gain practical experience and learnings from the application of grid connected utility scale battery storage as an enabler of large scale intermittent renewable energy on an interconnected system.
- Demonstrate that utility scale battery storage can effectively provide network reliability and security services alongside market services.
- Demonstrate network ownership of battery storage and commercial appropriate separation of provision of regulated services and competitive energy market services.
- Demonstrate “seamless” islanded operation with 100% renewable generation following transmission outages – this has been proven to work.

Benefits and Revenue Streams

- Provides regulated market services (ElectraNet)
 - Fast frequency response benefit increases Heywood Interconnector transfer. During project implementation the BESS was incorporated in the System Integrity Protection Scheme (SIPS). The SIPS is an important emergency control scheme that significantly enhances power system security in South Australia (SA) for the non-credible loss of multiple generators in SA.
 - Reduced unserved energy benefit.
- Provides competitive market services (AGL Energy)
 - Ancillary services revenue
 - Market cap trading

Commercial Arrangements

- The commercial arrangements between ARENA, ElectraNet and AGL were discussed.

Project Milestones

- The project key milestones were reiterated:
 - Financial close and contract award - 21 September 2017.
 - Energisation of battery system - 30 April 2018.
 - Commissioning and compliance tests of battery system – July – Oct 2018

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	<ul style="list-style-type: none"> Handover for commercial operation to AGL Energy - 14 December 2018. ARENA reporting/knowledge sharing period ends (2 years) - Q1 2021. 		

6 6-Monthly Operational Report – ElectraNet Perspective

**13:30 –
14:00**

- 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/>)

Laurie Antal

Viet Trinh

Fida Rafi

General asset performance and metrics

- The following table shows the key metrics for the respective reporting periods of the first twelve months of operation.

Key Performance Metric	First reporting period (14 Dec 2018 to 14 June 2019)	Second reporting period (14 June 2019 to 14 Dec 2019)
Average BESS Availability	98.01%	97.35%
Total Energy Consumed (i.e., in to BESS)	1,370 MWh	2,006 MWh
Total Energy Exported (i.e., out of BESS)	160 MWh	768 MWh
Average auxiliary load and losses (% of 30MW rated capacity)	2.19%	2.25%
Number of Charge and Discharge Cycles (per BOA definition)	2	4
BESS Charging Cost	\$120,000	\$101,000
BESS Discharge Revenue	\$116,000	\$97,000
FCAS Revenue	\$1.33m	\$3.73m

- Comments on the Key Performance Metrics included:
 - Availability is down to 97.35% due to a 3-day outage to fix teething issues.
 - Whilst the charge/discharge cycles contractually is approximately 250, the actual is much lower at 2-4 due to the type of usage for which the battery is deployed.

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Question: What is the reason for the large difference between energy consumed and energy exported?

- The total energy consumed and exported is measured at the NEM metering points on the 33kV bus at the substation. The large difference is because the battery is continuously in stand-by mode to support the grid should a frequency event occur.

General Operational Issues to Manage

- It was noted that the following operational issues are being managed:
 - Availability
 - Air conditioning
 - Energy losses
 - Inverters and batteries
 - Communications
 - SCADA alarms

O&M that is occurring

- O&M occurs in relation to the following plant and services:
 - Routine maintenance
 - Housekeeping of the site
 - Air conditioners
 - CO2 fire system
 - Diesel generator
 - Corrective maintenance
 - Air conditioners - four air conditioning units are now installed, together with some retrofitted ducting. The O&M contractor (CPP) considers there is now enough cooling power installed and better air flow measures are being considered. Although the air conditioners are unique in Australia and spare parts delivery can take some time, they performed well during the past summer.
 - Nuisance alarms – These non-urgent alarms, with no operation action required, were a common issue in the first 6 months of operation. The occurrence of these has largely been resolved with a change in alarm grouping/hierarchy.
 - Irritant issues on control system

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	<ul style="list-style-type: none"> - An issue with the controller firmware causes a lock up that requires a reboot approximately every 100 days. Investigations are ongoing with ABB Europe but seems to stem from faulty watchdog timer that was not evident during the initial 6 months of operation. - Some battery banks have been “going flat”. As particular inverter groups experience slightly different temperature derating over time, the state of charge (SOC) of respective battery banks tends to diverge. This will eventually require ABB to equalise charge on the Powerstore units to avoid a trip on low charge. ElectraNet and AGL do not have the ability to equalize the charge on the units. <ul style="list-style-type: none"> • Batteries <p>There is a guaranteed remaining battery MWh annual capacity. To date the cycle life of the battery hasn't been hard in terms of depth of discharge, as AGL's focus has been on FCAS (small energy), and the batteries have generally been staying in the top 2/3 of charge which isn't regarded as “cycling”. Commissioning tests are probably more onerous than this.</p> <p>The first annual charge-discharge test with Samsung/CPG is planned for March 2020.</p> <p>There has been minor corrective maintenance on the batteries. Early life failure rate has been pleasingly low (2 racks have failed, which is less than 1%). Anecdotally this is quite good.</p> <p>The warranty replacement units were slow to arrive, but this may have been due to supply chain, small volume, shipping/customs issues, etc.</p> • BESS Tests <p>Three tests have been conducted on the overall system. These are:</p> <ul style="list-style-type: none"> - ABB inverter routine maintenance (~10 days) - Samsung routine maintenance – equalisation and calibration of SOC (1-2 days) - CPG Energy Availability test – a full cycle of discharge/charge/discharge (1 day) 		

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	<ul style="list-style-type: none"> <p>Safety performance and observations</p> <p>The BESS site is predominately unmanned. Routine site attendance is 1 to 2 days per month except when corrective maintenance is undertaken.</p> <p>There were zero safety incidents reported during the second six months of commercial operation. This includes near miss and lost time incidents.</p> <p>Maintenance is undertaken via formalised safety procedures (SWMS/JSA managed by MSP).</p> <p>If a fire is detected, an audible signal will be triggered and all personnel that may be present in the inverters or batteries room should evacuate immediately the building.</p> <p>The fire suppression will then be activated 60 seconds later. SMSC will be notified and protocols exist as to how the fire brigade would intervene.</p> <p>Miscellaneous items</p> <p>Communication channels still follow the project contacts and relationship arrangements, but these could now be improved for the operational phase of the project.</p> <p>The impact of the corona virus may affect the supply chain for Italy (air conditioners) and Korea (batteries).</p> <p>System Events</p> <p>During the first 12 months of operation there were 14 operational system events. Eleven of these were single-line trips or a frequency event. The other three events were more significant and led to the BESS supplying load to prevent or reduce the duration of an unserved energy event.</p> <p>High-speed data recordings from Power System Performance Monitor (PSPM) confirmed the BESS successfully rode through the faults or responded as required.</p> <p>Several system events were examined in detail:</p> <ul style="list-style-type: none"> - The ESCRI-SA BESS operating in islanding condition during an unplanned outage on 13 June 2019. <p>Protection tests at WPWF accidentally resulted in the tripping of a Dalrymple substation 132/33 kV transformer.</p> <p>The BESS performed well by successfully transitioning to islanded operation and continuing to supply the local load</p> 		

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	<p>until the System Operator restored all outage elements approximately half an hour later. The incident resulted in no load loss.</p> <p>It was noted that no planned or unplanned outages relevant to the ESCRI-SA BESS occurred during the second six months of commercial operation.</p> <ul style="list-style-type: none"> - Single Phase to Ground fault on the Davenport–Olympic Dam West 275 kV line on 1 September 2019. The fault was cleared, and the line successfully reclosed. The BESS successfully rode through the fault. - Single Phase to Ground fault on the Hummocks –Waterloo 132 kV line on 6 October 2019. The fault was cleared, and the line successfully reclosed. High speed data recorded at the Dalrymple 33kV bus indicated the BESS successfully rode through the fault. Approximately 25MVar was injected by the battery to support system voltage. This was a critical event in terms of BESS performance. <p><i>Question:</i> During a single-phase fault, does the battery inject Mvars only on the faulted phase? This question was taken on notice by ElectraNet.</p> <ul style="list-style-type: none"> - Single Phase to Ground fault on the Waterloo –Templers 132 kV line on 1 November 2019. The fault was cleared, and the line successfully reclosed. High speed data recorded at the Dalrymple 33kV bus indicated the BESS successfully rode through the fault. This was not regarded as a critical test of the BESS. - Single Phase to Ground fault on the Monash – Berri #2 132 kV line on 1 November 2019. The fault occurred whilst the North West Bend – Monash #1 line was out of service. This resulted in the Murraylink HVDC interconnector tripping. The fault was cleared, and the Monash – Berri #2 132 kV line successfully reclosed. High speed data recorded at the Dalrymple 33kV bus indicated the BESS successfully rode through the fault. As this fault was further away from the BESS it injected less MVA. - The 500 kV double circuit in Victoria between Heywood and Moorabool tripped. At the time of the event SA was exporting approximately 300 MW. The Heywood interconnection between South Australia and Victoria was lost and the SA transmission network transitioned to an 		

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	<p>islanded condition. This resulted in over-frequency in SA and under-frequency in Victoria. The battery gave inertial response very quickly, with power being consumed by the battery. The SA frequency settled at just above 50.5Hz. High speed data recorded at the Dalrymple 33kV bus indicated the BESS responded well to the event. This was the first over-frequency event with the BESS in service, and it demonstrated the wide range of services supported by the BESS: energy trading, synthetic inertia, FCAS and frequency response.</p> <p>A discussion was held on several aspects of the BESS functionality, including sensitivity to RoCoF (rate of change of frequency) for a grid-scale battery, synthetic inertia, and FCAS.</p> <p><i>Question:</i> Does the battery have a droop characteristic? The answer is that yes, it does, and although it performed ok it could be tuned to do even better, particularly if it was not constrained by its islanding settings.</p>		
7	<p>6-Monthly Operational Report – AGL Perspective</p> <ul style="list-style-type: none"> • Market services offered and performance against these <ul style="list-style-type: none"> – FCAS Revenue <p>The battery operates mainly as a provider of FCAS rather than as a mechanism for arbitrage.</p> <p>A graph showing revenue generated from contingency FACS over the second 6-month period of 2019 was displayed. The graph shows separately the revenue generated daily by lower and raise services, and the aggregate as a cumulative figure, resulting in over \$5m in revenue for the period. The peak revenue for any day was about \$760k. The battery does not operate with regulated FCAS.</p> <p>It was noted that this results in money being fed back to ARENA, and that the FCAS service works in a changing environment that includes aspects as diverse as NEM rule changes and transmission towers falling over.</p> – FCAS Recovery <p>A graph showing cost generated from FACS Recovery (to AEMO) over the second 6-month period of 2019 was displayed. The</p> 	<p>Bruce Bennett</p>	<p>14:00 – 14:15</p>

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	<p>graph shows separately the cost generated daily by lower and raise services, and the aggregate as a cumulative figure, resulting in over \$50k in cost for the period. The peak cost for any day was about \$700.</p> <ul style="list-style-type: none"> <li data-bbox="300 622 587 656">– Discharge Revenue <p>A graph showing daily battery discharge energy and cumulative revenue over the second 6-month period of 2019 was displayed. The peak daily discharge energy was about 15.3 MWh and the cumulative cost for the period was about \$230k.</p> <ul style="list-style-type: none"> <li data-bbox="300 831 531 864">– Charging Cost <p>A graph showing daily battery charge energy and cumulative cost over the second 6-month period of 2019 was displayed. The peak daily charge energy was about 24.9 MWh and the cumulative revenue for the period was about \$260k.</p> <ul style="list-style-type: none"> <li data-bbox="264 1032 751 1066">• Revenue performance against budget <p>It was noted that, on the regulated side of revenue, the battery provides good outage benefits. ElectraNet requested that, in the next two 6-monthly reports, more information is provided on performance.</p> <ul style="list-style-type: none"> <li data-bbox="264 1223 948 1256">• Key learnings from operating a battery within the NEM <p><i>Question:</i> How does economics (of BESS) play in conjunction with WPWF? The answer is that the battery supports WPWF during periods of islanding. It also supports the MLF of WPWF.</p> <p><i>Question:</i> Could the battery improve system strength? The answer is that it addresses some issues, but the jury is still out on whether batteries can be used to improve system strength.</p> <p>From a business perspective, it was noted that the battery has greatly improved (reduced) the outage time on the peninsula, to an extent that exceeds the expectations that were presented in the business case for the battery. Anecdotally, there are numerous intangible customer benefits.</p> <p>A key learning to other parts of the NEM is that the battery plays a key role in system security.</p>		
8	<p>Questions and discussion on performance and operations</p> <ul style="list-style-type: none"> <li data-bbox="264 1877 1110 1942">• A long discussion ensued regarding general aspects on performance and operations. Key issues raised included the following: 	All	14:15 – 14:35

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	<ul style="list-style-type: none"> – ElectraNet indicated that is keen to deploy more batteries if business cases allow, but noted that each installation is bespoke, and the ESCRI-SA model cannot necessarily be located elsewhere without modification. – Batteries could possibly be used for supply in high-bushfire risk areas. – As each new battery enters service, the FCAS opportunities for each are reduced. <p><i>Unresolved questions:</i></p> <p>How is the market value of battery capability to support low probability, high impact, events assessed?</p> <p>How do roof-top solar PV installations react during system events?</p>		
9	<p>Summary and next steps</p> <ul style="list-style-type: none"> • Key learnings / challenges <ul style="list-style-type: none"> – Demonstration project with an aggressive timeline -pushing technical boundaries, e.g. wind farm islanding, vector shift. – Regulatory treatment. – Obtaining equipment models and evaluation of Generator Performance Standards (GPS). – Clarifying AEMO registration and metering requirements. – Improving understanding of performance parameters - obtaining/refining equipment models for evaluation of GPS, exacerbated by optimising control for both grid-connected and islanded operation. – Islanding challenges. – Managing commercial contract signed before design was completed. • Knowledge Sharing Portal <p>The Knowledge Sharing portal was highlighted. This contains:</p> <ul style="list-style-type: none"> – ARENA knowledge sharing commitments – Project delivering substantial knowledge sharing benefits to stakeholders – Real-time data 	Hugo Klingenberg	14:35 – 14:50

No	Description	Presented by	Time
	<ul style="list-style-type: none"> – Data downloads – Reports – Presentations – Knowledge Sharing Reference Group <ul style="list-style-type: none"> ▪ Agendas ▪ Minutes – Refer to web address www.escri-sa.com.au/knowledge-sharing/ 		
	<ul style="list-style-type: none"> • Statistics on the Knowledge Sharing portal usage <p>Usage of the portal is good and interesting. The statistics show the substantial knowledge sharing benefits that have been delivered to stakeholders. In summary, for the 12-month period to 14/12/2019:</p> <ul style="list-style-type: none"> – Page views: 2040 – Unique page views: 1650 – Average time on page: 121 seconds – Report/presentation downloads: 123 – Data downloads: 333 		
	<ul style="list-style-type: none"> • Further comments <ul style="list-style-type: none"> – ElectraNet is pleased that the ESCRI-SA installation is working well. – Islanding challenges were resolved before the first 6-months of operation was completed, but there is a risk that some unforeseen event will disrupt operations in future – There are 11 years of commercial contract remaining – Information on the degradation rate will be available at the next KSRG meeting. – Operation reports are issued 6-monthly. The second report has been submitted to ARENA for approval. There are scheduled to be two more 6-monthly reports, followed by a concluding consolidated report. 		
	<ul style="list-style-type: none"> • Second Operational Report and KSRG Meeting 6 <ul style="list-style-type: none"> – Operation reports are issued 6-monthly. The second report has been submitted to ARENA for approval. There are scheduled to be two more 6-monthly reports, followed by a concluding consolidated report 		

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	– KSRG Meeting 6 is scheduled to be held on 16 September 2020		
10	Close of meeting All attendees were thanked for their attendance and contribution. The Chair invited participants to suggest issues to discuss at the next meeting. The Chair closed the meeting at 14:55	Paul Ebert	14:50 – 14:55
11	Networking afternoon tea Attendees at the ElectraNet office participated in afternoon tea.	All	14:55 – 16:00

END OF MINUTES

Certified as a correct record of the ESCI-SA Knowledge Sharing Reference Group Meeting of 3 March 2020.

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Paul Ebert, KSRG Chair28 August 2020

Date

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