

ESCRI-SA Meeting Minutes

Meeting Name: Knowledge Sharing Reference Group (KSRG), Meeting 3 & Site Visit

Date:	14-15 August 2018	
Start Time:	Day 1 - 1:00 pm Day 2 –7:30 am	Finish Time: Day 1 - 4:00 pm Day 2 – 5:00 pm (approx.)
Location:	Day 1 – Hindmarsh 3, 15 th Floor, Pullman Adelaide, 16 Hindmarsh Square, Adelaide SA 5000 Day 2 – Meet at ElectraNet Offices, 300 Pirie Street, Adelaide SA 5000	
Attendees	Name	Affiliation
Day 1 :	Hugo Klingenberg	ElectraNet
	Fida Rafi (in part)	ElectraNet
	Laurie Antal	ElectraNet
	Paul Ebert	Advisian (KSRG Chair)
	Paul Knispel	Advisian
	Matthew Rowe	Advisian
	Bruce Bennett	AGL
	Zac Ryan	AGL
	Luke Shortal	AGL
	Thomas Lozanov	AEMC
	Jess Hunt	AEMO
	Dee Butler	AER
	Dan Sturrock	Australian Renewable Energy Agency
	Anthony Dobb (Observer)	Australian Renewable Energy Agency
	Lila Oldmeadow (Observer)	Australian Renewable Energy Agency
	Andrew Burnett	Government of Queensland
	Sylvie Bath	Government of Queensland
	Brendon Hampton	SA Power Networks
	Duncan MacKinnon	Australian Energy Council
	Monishka Narayan	Australian Energy Networks
	Peter Murphy	University of South Australia
	Mark Jackson	Government of South Australia
	Michael Whitfield	Federal Government
	Simon Brooker	The Clean Energy Finance Corporation

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Attendees	Name	Affiliation
Day 2:	Hugo Klingenberg	ElectraNet
	Dorin Costan	ElectraNet
	Peter Maschmedt	ElectraNet
	Travis Crozier	ElectraNet
	Brad Parker	ElectraNet
	Kristian Masters	ElectraNet
	Jeff Ashworth	ElectraNet
	Paul Knispel	Advisian
	Matthew Rowe	Advisian
	Peter Burnell	AGL
	Simon Kelly	AGL
	Zac Ryan	AGL
	Thomas Lozanov	AEMC
	Adrian Grantham	AEMO
	Dee Butler	AER
	David Chapman	AER
	Anthony Dobb	Australian Renewable Energy Agency
	Lila Oldmeadow	Australian Renewable Energy Agency
	Andrew Burnett	Government of Queensland
	Sylvie Bath	Government of Queensland
	Brendon Hampton	SA Power Networks
	James Brown	SA Power Networks
	Peter Murphy	University of South Australia
	Joanne Mielnik	University of South Australia
	Mark Derry	Consolidated Power Projects
	Lloyd Bentley	Consolidated Power Projects
	David Lyle	Consolidated Power Projects
Grant Lindner	ABB	
Juergen Zimmerman	ABB	
Stan Cherevatskiy	ABB	
Apologies	Eamonn McCabe	Government of Western Australia
	Karl Rodrigues	CSIRO
	Barry Millar	AGL
	Stuart Richardson	Federal Government
	Matthew Peake	ElectraNet
	Andrew Fraser	TasNetworks, representing Govt. of Tasmania
	Geoff Doe	ElectraNet
	Amy Kean	Government of New South Wales
	Mark Wilson	AER

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Rainer Korte	ElectraNet
Dorin Costan (Day 1)	ElectraNet
Simon Kelly (Day 1)	AGL
Grant Cushion	Government of Victoria
Alex Lloyd	University of Adelaide

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Day 1 – 14 August - Hindmarsh 3, 15th Floor, Pullman Adelaide, 16 Hindmarsh Square, Adelaide SA

No	Description	Presented by	Time
1	Welcome by Chair & introduction to the day <ul style="list-style-type: none"> The Chair introduced himself and the context and purpose of the KSRG. Introduction by each of the KSRG members. It was noted that the KSRG is a good forum for cross-pollination of ideas given the vast knowledge held by the members of the group. 	Paul Ebert	13:00 – 13:05
2	Introductory remarks from ElectraNet <ul style="list-style-type: none"> Brief welcome by Hugo Klingenberg. Presentation of three slides from 2018 CIGRE Session – discussion of large scale batteries. In South Australia, new generation must provide inertia or fast frequency response for grid connection allowance (as per Office of the Technical Regulator). Brief comparison of the Hornsdale and ESCRI battery assets. ESCRI-SA by design does not have a significant energy component, but the Hornsdale asset does – meaning it can be used for some energy security. ESCRI-SA can provide fault level support and black start capabilities whilst in islanding mode, which Hornsdale cannot. 	Hugo Klingenberg	13:05 – 13:10
3	Confirmation of minutes from previous Meeting 2 <ul style="list-style-type: none"> Minutes accepted from KSRG Meeting #2 – no edits requested. Housekeeping matters discussed. 	Paul Ebert	13:10 – 13:15
4	What is the KSRG – Terms of Reference <ul style="list-style-type: none"> The Chair reminded people of the KSRG Terms of Reference which are available on the Project Portal (www.escri-sa.com.au) – particularly in regards to being careful with commercial or other confidential information not in the public domain, and in relation to not making media or public announcements. 	Paul Ebert	13:15 – 13:20

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5 Project Status and Update

- A summary of the Project Status was provided using a presentation which is now on the Project Portal (see [link](#)).

Hugo Klingenberg
(on behalf of Dorin Costan)
13:20 – 13:40**Project timing and budget**

- AEMO registration received on 5th June 2018.
- Registration supported by studies in PSS/E for Generator Performance Standards (GPS).
- PSCAD studies were undertaken (for assessment of transients – e.g. at the transition between grid-connected to islanded status).
- It was noted that no energy import was allowed from the connection point (at any level and irrespective of network security impact) until the entire registration process was completed.

SAPN interface

- SAPN has a regulatory role and involvement in the project.
- Mandatory due-diligence assessment was undertaken by them regarding BESS impact on SAPN's assets and customers.
- SAPN protection changes were required to allow operation under islanded condition, but fortunately this did not require significant new equipment.
- Other SAPN works related to interfacing signals for local island black start.

Island Detection scheme

- An important design element is that no local customers to be worse-off / no degradation of SAPN services or reliability during islanding.
- BESS anti-islanding activation if insufficient number of batteries / inverters online (i.e. if there is to be insufficient fault current contribution under islanded condition).
- Topology-based islanding system employed, by monitoring breakers/disconnector statuses at various substations to deduce whether the battery is to island or not.
- Rather than following the frequency as per grid-connected mode, the asset swaps over to regulate voltage and frequency in islanding mode.
- Part of the windfarm is segregated and tripped upon islanding.
- Initial islanding testing of the BESS and Wattle Point Wind farm conducted on 10 July 2018, which uncovered a reactive power limitation issue - if a small number of BESS inverters online (see discussion below in next agenda item minutes).

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Cooling Update

- CPP has employed further cooling analysis and modifications due to hot spots observed within certain areas of the inverter room during commissioning tests.

Question: Since contact signing what are a few key learnings?

- At the time of contract signing, project management team noted the timeframes were very ambitious, but a fast agenda was set by ARENA.
- Islanding and integrating with the windfarm represent significant areas of complexity. If to repeat the project again, the islanding tests would have been mapped out more elaborately, and the standard grid-connected operation could have been completed first, with islanding attempted after.
- With extensive modelling done across three platforms, a key challenge has been ensuring the parameters on site align with those in the model.

Question: How has the battery been registered with AEMO?

- Scheduled, registered as generator and load.

Question: Regarding the commercial side of the battery, how is the reduction of expected unserved energy commercialised by ElectraNet?

- There are four key revenue/benefit streams. Two impacting ElectraNet are Fast Frequency Response (FFR) and unserved energy reduction. These are not physical revenue streams, but this saving and increase in customer reliability can be recovered through the regulated asset base (roughly one third of the project cost). The other third is via the lease to AGL (FCAS and Caps) and the rest has been provided by ARENA.

6 Path to Registration and Islanding Update

- A summary of the path to registration and some of the initial islanding results was provided using a presentation which is now on the Project Portal (see [link](#)).

Final path to registration

- The ESCRI-SA Project has applied for automatic access standards as far as possible.
- ElectraNet is the asset owner, but also conducts due diligence as they are the network owner – this is a rare circumstance.
- Commissioning test plan completed close to commissioning dates, normally AEMO would like two months' notice.
- AEMO SCADA System – visibility of BESS by AEMO was not adequate causing a one week delay while this was resolved.

**Laurie Antal
& Hugo
Klingenberg**

**13:40 –
14:00**

Islanding testing update

- Islanding tests conducted 10 July 2018 – test involved disconnecting from grid, leaving BESS to control but with only a 1 BESS inverter module in service.
- Upon islanding, voltage and current distortion occurred, the BESS current rating was exceeded and the system tripped.
- Testing was stopped and an investigation commenced.
- 3 simulations have now been successful in replicating the test results:
 - A single BESS module in service during the islanding was not sufficient to reduce voltage rise caused by the capacitive charging in the island.
 - With 3 BESS modules in-service, testing showed conditions during islanding are significantly improved.
 - In full island mode, a minimum of 10 BESS modules in-service is required to meet fault current requirements.
- ABB updating plans before next testing, due to commence again in September 2018.

Question: Why does the BESS trip at 45Hz - does it damage the battery?

- The BESS is set to trip at 45 and 55Hz. The frequency is limited to this band to ensure the quality of the customer supply (as equipment can be damaged). For example, there is a mine at Port Giles which is very sensitive to supply disturbances.

Question: Could the failure of the system under one BESS module have been predicted?

- Previous simulations had been conducted using twelve BESS modules.
- There has been a broad group of people used throughout the project, but very few are on site during testing, and it was thought that being overly cautious and using only 1 instead of 12 modules (in case of asset damage) would be beneficial. However, there was not sufficient reactive support.
- Learning - make sure that what is being tested is exactly what has been modelled.

Question: What was the testing preparation for the islanding?

- 1-2 months of on-site work before testing. Factory Acceptance Test (FAT) facility set up in Darwin to simulate the local grid conditions.

7 Afternoon Tea

**14:00 –
14:20**

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8 Technical performance during commissioning Laurie Antal 14:20 – 15:10

- A summary of the technical performance of the BESS during commissioning was provided using a presentation which is now on the Project Portal (see [link](#)).

Hold point test results and issues

- Hold Point Test 1 (HP1) was conducted by FortEng: 12-13 July 2018.
- Hold Point Test 2 (HP2) was conducted by FortEng: 18-20 July 2018.
- Representatives from ABB, CPP, AGL and ElectraNet in attendance.
- The hold point tests consisted of 4 tests, 2 for discharge and 2 for charge:
 - Two generation discharge test limited to 50% (15 MW) and to 100% (30 MW).
 - Two load charge test limited to 50% (15 MW) and to 100% (30 MW).
- R1 models are used to develop Generator Performance Standards (complete) – physical asset testing is not part of this stage.
- Hold Point tests check that the plant meets GPS (in this stage currently, some non-conformances noted)
- R2 testing is to ensure model matches plant during more rigorous testing conditions (still to come).
- Hold Point 1 (15 MW) results:
 - Does not meet the 2.7 second reactive power rise time when operated in voltage control mode for a voltage setpoint change of $\pm 5\%$.
 - The generating system does not regulate the voltage at the connection point to within 0.5% of its setpoint with the R1 parameters approved at registration (5% voltage droop, and $\pm 0.5\%$ dead band) in voltage control mode.
- Hold Point 2 (30 MW) results:
 - Same Results as items above.
 - The generating system does not regulate the power factor at the connection point to within 0.5% of its setpoint at discharge levels greater than 24 MW in power factor control mode.
 - The generating system did not remain in continuous uninterrupted operation during testing of over-excitation limiter (current limiter) when dispatching power – test resulted in tripping of BESS on over-frequency fault.

Refinement of parameters

- Post Hold Point Testing workshop held between ABB, CPP, FortEng and ElectraNet on 31 July and 1 August 2018 to determine actions to
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address Hold Point 1 and 2 Test results.

- ABB refining Secondary Voltage droop setpoints and primary voltage deadband values. This should improve reactive power rise and regulation of voltage at the connection point.
- Model/parameter changes are the responsibility of the contractor, ElectraNet, FortEng and AEMO to assess these changes for compliance.

Commissioning next steps

- ABB to update the BESS models with new parameters and completed simulations by mid-August.
- FortEng, ElectraNet and AEMO to conduct due-diligence.
- FortEng to retest selected aspects of Hold Point 2 Test Plan.
- Finalise Hold Point 2 Test Report.
- Completion of Milestone 3 September 2018.
- Islanding and R2 tests to follow.
- Handover for Commercial Operation at end of September 2018.

Lessons learnt during commissioning

- The complexity of developing an integrated grid and island BESS solution was underestimated in time, effort and cost, resulting in setting unachievable expectations. This included:
 - Modelling and commissioning of the BESS system to meet National Electricity Regulator (NER) requirements.
 - Expertise and experience of this type and application of a BESS in the National Electricity Market (NEM) has resulted in multiple model revisions.
 - Deeper network changes on the planned island distribution network than anticipated.
 - Simple integration with the Wattle Point Wind Farm, due to the age and lack of available models of the wind farm.
- Performance standards can be negotiated (within limits).

Question: How does this experience compare with the Hornsdale Power Reserve? Are there different network conditions to take into account?

- Tesla was more organised regarding models, and had a stronger area of the network to connect to.
- The team from ABB on the ESCRI-SA project is from the microgrid team, and the NEM process is much more formal.

Question: Regarding the issues emerging around technology, AEMO, and knowledge – how much of this is specific to site and application, rather than generic battery projects?

- Building the model took significant time, and in the future ABB will be
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able to use the current inverters on the NEM without significant rework.

- The further you are away from a strong transmission network, the harder it is to connect.

Question: If more resources could be put somewhere, what would make the most difference?

- Modelling/GPS phase – making sure the physical asset and the models are the same.

9 Handover to AGL

- A summary of the handover process to AGL was provided using a presentation which is now on the Project Portal (see [link](#)).

Commercial operations

- There would be increased revenue for AGL if AEMO accepted AGL's FCAS raise and lower contingency application – registration for this was rejected, because AEMO is concerned they will have many battery connections in coming years with a response above what they may be able to manage.
- The battery does not need to provide droop control in grid-connected mode (a free frequency regulation measure), but will assist with monetised FCAS measures.
- For commissioning and hold-point testing, the battery had to bid into the market. This required significant management and coordination, and is complicated on an asset such as this.
- Facilitation of direct communication between Asset Operator and OEM during early project stages would streamline SCADA implementation, reduce rework.
- AGL must submit dispatch offers for each of the 48 trading intervals in the trading day (in advance), and if there is a change to this they must re-bid as soon as possible. These changes could be charges/discharges for market reasons, and AGL must be re-bid up to every 5min bracket. (This is a problem only now, given the limited size of the ESCRI-SA battery, requiring a re-bidding system to be developed by AGL.)
- Currently manual re-bidding will be implemented for state of charge, whilst during future stages an algorithm will be developed taking into account price bands and a strategic re-bidding methodology.
- Automatic strategic rebidding is required as the complexity of the averaging methodology and prediction would be too time-intensive for human intervention.
- Must balance arbitrage against the ability for FCAS revenue

Bruce Bennett 15:10-**Zac Ryan 15:25****Luke Shortal**

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throughout the day, as a single discharge during daylight hours may require waiting until night to recharge.

Question: Can you use pre-dispatch forecasts to train the bidding model?

- AGL has other limited-fuel units like hydro, and there is a reliance already on pre-dispatch forecasts for general insights. However, they are insufficient for accurate time-band predictions.

Question: Do you currently use algorithm-driven bidding methodology?

- Yes, AGL does. However, one of the difficulties with this asset is that the algorithm must be optimised for both FCAS and arbitrage (and analyse opportunity costs) given the limited output capability.

Question: Have you compared the economic output of 5min vs. 30min markets?

- AGL has not done this to date. The 5min market simplifies the bidding process, but the true economic benefits have not been calculated yet.

Question: How is FFR being rewarded currently?

- AGL is not rewarded, but ElectraNet is rewarded through the Rate of Change of Frequency (RoCoF) impacts on the interconnector (which is a revenue, discussed in an earlier agenda item).

Question: Does the ESCRI-SA Project make a large difference on the interconnector?

- 30MW can enable approximately 15MW across the interconnector (due to it being located far away).

Question: Can you discharge and then still provide FCAS?

- Approximately 6.3MWh is enough for FCAS 6 and 60 second markets. However, 5-minute FCAS represents more of a challenge.
- Raise are much more rewarding than lower services – so AGL will optimise for raise markets.

Question: What if the asset is dispatching as per AEMO's instruction, but is required to island?

- AGL receives the SA pool price for any generation when islanding.

10 Discussion on Initial Performance & Operations From Here**All****15:25 –
15:35**

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11	Update on Project Portal <ul style="list-style-type: none">An overview of the Portal aims, as well as a live demonstration of the Portal was provided – this presentation can be found at this link.There have been approximately 40,000 website views since May 29 2018.There have been approximately 6 website enquiries. <p><i>Question To ARENA:</i> Will there be an aggregated website for battery information?</p> <ul style="list-style-type: none">ARENA commented that this is a good idea.	Matthew Rowe	15:35 – 15:50
12	Site visit 2 – logistics for the day <ul style="list-style-type: none">Brief notes made, including requirements for PPE.	Hugo Klingenberg	15:50 – 15:55
13	Other business <ul style="list-style-type: none">There are always significant learnings every time the KSRG meets, industry continues to see common learnings through these projects and sharing them is very important.It would be interesting to have a discussion on the concepts emerging in the safety space, recalling the requirements of the ESCRI-SA project to safeguard both against internal and external fires. <p><i>Question:</i> CEFC looking at many projects now for batteries next to solar and wind farms. Are there any lessons around GPS connection standards or procurement standards?</p> <ul style="list-style-type: none">The use case for the ESCRI-SA battery is very complex. Making a more specific use case battery will simplify the project and reduce risk/expected delays. <p><i>Question:</i> How is the move to 5min pricing expected to impact the way AGL manages their book?</p> <ul style="list-style-type: none">When it comes to the portfolio, having a decent amount of storage will make a big difference.Outside of FCAS, there is limited difference the 5min market will make.The earlier battery projects will get the best opportunity to capitalise on the FCAS markets, before it is flooded with bidders. Already seen big changes in FCAS prices based off the Hornsdale battery.	Paul Ebert	15:55 – 16:00
14	Day 1 close <ul style="list-style-type: none">The Chair closed the KSRG Meeting at 4pm.Thanks were given to all attendees for their contributions.	Paul Ebert	16:00

15 Refreshments & networking

**16:00 –
17:00**

END OF MINUTES

Site Visit

Note: A visit by the Knowledge Sharing Reference Group to the Dalrymple commissioning site was undertaken on Wednesday 15 August 2018.

The Reference Group would like to thank Consolidated Power Projects (CPP), ABB and ElectraNet staff involved for their efforts in hosting what was a very enjoyable and informative bus trip, and site visit.

Certified as a correct record of the ESCRI-SA Knowledge Sharing Reference Group Meeting of 14-15 August 2018.



Paul Ebert, KSRG Chair

5 September 2018

Date

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