

ESCRI-SA Meeting Minutes

Meeting Name: Knowledge Sharing Reference Group, Meeting 6**Date:** 16 September 2020**Start Time:** 1:00 pm ACST**Finish Time:** 3:07 pm ACST**Location:** Online via MS Teams

Attendees:	Name	Affiliation
	Hugo Klingenberg	ElectraNet
	Rainer Korte	ElectraNet
	Laurie Antal	ElectraNet
	Viet Trinh	ElectraNet
	Fida Rafi	ElectraNet
	Mitchell Baker	ElectraNet
	Dorin Costan	ElectraNet
	Paul Ebert	Advisian (Chair)
	Lawrence Gebert	Advisian
	Barry O'Connell	AEMO
	Bruce Bennett	AGL
	Stuart Whiting	AGL
	Adam Budzynski	AGL
	Dave Johnson	AGL
	Dan Sturrock	Australian Renewable Energy Agency
	Mark Hancock	Australian Renewable Energy Agency
	Andrew Williamson	Australian Renewable Energy Agency
	Duncan MacKinnon	Australian Energy Council
	Verity Watson	Energy Networks Australia
	Andrew Burnett	Government of Queensland
	Jessica Pinder	Government of Queensland (observing)
	Jayden Crossing	Government of South Australia
	Ben Macey	Government of South Australia (1 hour)
	Grant Cushion	Government of Victoria

Apologies:	Name	Affiliation
	Stuart Richardson	Federal Government
	Emily Kennedy	Federal Government
	Mark Jackson	South Australian Government
	Rachel Hayden	Government of New South Wales
	Eamonn McCabe	Government of Western Australia
	Andrew Fraser	TasNetworks representing Govt of Tasmania

In partnership with:

**ARENA**
Australian Government
Australian Renewable
Energy Agency**Advisian**
WorleyParsons GroupThis activity received funding from ARENA as part
of ARENA's Advancing Renewables Programme

John Goodrich
Glenn Platt
Brendon Hampton
Alex Lloyd
Peter Murphy
Germane Athanasius
Chris Davies
Barry Millar
Joel Aulbury
Kate Degen
Mark Wilson
Simon Brooker
Dor Son Tan
Travis Kauschke

Australian Renewable Energy Agency
CSIRO
SA Power Networks
University of Adelaide
University of South Australia
AEMO
AEMO
AGL
AEMC
AEMC
AER
Clean Energy Finance Corporation
Energy Networks Australia (Skype)
SA Power Networks

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No	Description	Presented by	Time
1	Welcome by Chair and introduction to the meeting <ul style="list-style-type: none"> The Chair introduced himself and the context and purpose of the KSRG. Minutes from KSRG Meeting #5, held on 3 March 2020, are on the project portal. Noted that this is the final scheduled KSRG meeting. 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	Introductory remarks from ElectraNet <ul style="list-style-type: none"> A welcome was extended to all participants. 	Rainer Korte	13:05 – 13:10
3	Confirmation of minutes from previous Meeting 5 <ul style="list-style-type: none"> Minutes from KSRG Meeting #5, held on 3 March 2020 were accepted. No edits were requested. 	Paul Ebert	13:10 – 13:15
4	KSRG Terms of Reference <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/). Knowledge sharing continues for the first 2 years of operation. 	Paul Ebert	13:15 – 13:20
5	Project Update <ul style="list-style-type: none"> A summary of the Project Status was provided using a presentation which is now on the Project Portal Background and status <ul style="list-style-type: none"> 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) and near the end of a long radial line. This provides opportunity for the battery to provide islanded operation with the wind farm following network outages. 	Hugo Klingenberg	13:20 – 13:30

No	Description	Presented by	Time
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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.

Benefits and Revenue Streams

- Provides regulated market services (ElectraNet)
 - Fast frequency response benefit.
 - 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 noted. Development of the project depended on a grant for part funding from ARENA. At that time grid-scale batteries were not viable, but they are now.

Reflection on Project Outcomes and Knowledge Sharing Deliverables

- The project outcomes are itemized in the following table, together with related comments:

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Outcome	Comment
Demonstrate the deployment and operation of a large-scale BESS to deliver a combination of network and market benefits	<i>Achieved.</i> The BESS entered commercial operation on 14 December 2018
Demonstrate a contracting and ownership model to maximise the value of a BESS	<i>Achieved.</i> Wattle Point wind farm integration allows AGL use of BESS MWh capacity between 10% –90%
Test the regulatory treatment for the ownership of large-scale BESS by regulated transmission network service providers	<i>Achieved.</i> The AER has accepted ElectraNet's proposed regulatory treatment of the BESS at Dalrymple
Provide price discovery for the deployment of a large-scale grid connected BESS	<i>Achieved.</i> Price discovery provided for capital expenditure. Reporting on operational performance and market revenue in Operational Reports
Highlight and address technical and regulatory barriers in the deployment of large-scale batteries	<i>Achieved.</i> Regulatory treatment accepted, and BESS registered by AEMO

- Reference was made to the wide range of operating data that is available on the ESCRI Knowledge Sharing portal.
- It was noted that the Knowledge Sharing portal has been accessed extensively from within Australia, with good international access as well. Canadian and USA utilities have shown interest in the ESCRI project.
- The following table summarizes the quantities of knowledge sharing deliverables that have been delivered to date:

Deliverable	Requirement	Actual
Establish Knowledge Sharing Reference Group, hold regular meetings	6	6
Technical Open Days (Site visit)	2	2

No	Description	Presented by	Time
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Deliverable (continued)	Requirement	Actual
Web portal with knowledge sharing material, including operational data	1	1
Formal knowledge sharing reports	7	5
Other reports and technical articles	-	2
Presentation at industry conferences	6	9
Direct engagement with other industry participants (national and international)	-	6
Transfer of portal information to ARENA	1	Future

- One more 6-monthly knowledge sharing report and a final report will be produced.

6 6-Monthly Operational Report – ElectraNet Perspective

Laurie Antal
13:30 –
Viet Trinh
13:50
Fida Rafi

- 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/>).

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	Reporting Period		
	First 14 Dec 2018 to 14 June 2019	Second 14 June 2019 to 14 Dec 2019	Third 14 Dec 2019 to 14 June 2020
Average BESS Availability	98.01%	97.35%	98.93%
Total Energy Consumed (i.e., in to BESS)	1,370 MWh	2,006 MWh	1,499 MWh
Total Energy Exported (i.e., out of BESS)	160 MWh	768 MWh	198 MWh

No	Description	Presented by	Time
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Key Performance Metric (continued)	Reporting Period		
	First 14 Dec 2018 to 14 June 2019	Second 14 June 2019 to 14 Dec 2019	Third 14 Dec 2019 to 14 June 2020
Average auxiliary load and losses (% of 30MW rated capacity)	2.19%	2.25%	2.35%
Number of Charge and Discharge Cycles (per BOA definition)	2	4	1
BESS Charging Cost	\$120,000	\$101,000	\$76,000
BESS Discharge Revenue	\$116,000	\$97,000	\$102,000
FCAS Revenue	\$1.33m	\$3.73m	\$15.6m

- Comments on the Key Performance Metrics included:
 - Teething issues of the first year are past, callouts are less, and performance is improving.
 - Whilst the charge/discharge cycles contractually is approximately 250, the actual recorded has been low at 1, due to the type of usage for which the battery is deployed. It is generally kept at high charge.
 - Over the past 6 months revenue of arbitrage was slight and revenue on FCAS was extremely good.

General Operational Issues to Manage

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

No	Description	Presented by	Time
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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.
- Inverter maintenance.

- Corrective maintenance

- Air conditioners - four air conditioning units are now installed, together with some retrofitted ducting.

Reliability of the air conditioners has improved.

The O&M contractor (CPP) considers there is now enough cooling power installed. Work has mainly focused on ducting, to produce an even cool airflow directly in front of the inverters, rather than trying to cool the actual room.

Further adjustment of air conditioning control and sensors by OEMs may be needed. The intent is to conduct a high ambient temperature full discharge test, during summer when conditions allow.

- Alarms – Work is currently being done on how best to present alarms to the operators.
- Irritant issues on control system
 - An issue persists with the controller firmware causes a lock up that requires a reboot approximately every 100 days. It was thought that the potential reason of a faulty watchdog timer had been fixed, but the problem has reoccurred. ABB proposes to update the firmware.
 - 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. Although this is generally a minor issue it 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.

No	Description	Presented by	Time
	<ul style="list-style-type: none"> - There were two inverter failures and a few inverter cooling fan replacements during the reporting period. • Batteries <p>There is a guaranteed remaining battery MWh annual capacity. This is determined by an annual charge-discharge test.</p> <p>An indicative charge-discharge test was conducted by CPP in April 2020 and this indicated the energy capacity to be slightly short. A re-test with correct test methodology is planned to be conducted within the next few months.</p> <p>Prior to a test being reconducted routine maintenance equalisation and calibration of SOC needs to be conducted, and this was completed by Samsung in August 2020.</p> <p>No battery rack failures occurred during this reporting period.</p> • Safety performance and observations <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 third 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>Inert gas has been identified as a safety issue. Lack of oxygen can result in asphyxiation.</p> <p><i>Question:</i> Who was responsible for designing the cooling system and its performance requirements, and how temperature-sensitive is the equipment? <i>Answer:</i> The EPC contractor (CPP) was responsible. The temperature studies may have been outsourced to a scientific research organization. The battery room temperature remains stable. The inverter room experiences large variations in temperature. In the worst case, derating of approximately 5% (1-2MW) occurs.</p> 		

No	Description	Presented by	Time
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Question: Were liquid-cooled inverters an option? *Answer:* Liquid-cooled inverters were not specified; cooling design was left up to the contractor.

- System Events

During the first 18 months of operation there were 21 operational system events. Sixteen of these were single-line trips or a frequency event. The other five events were more significant and led to the BESS supplying load to prevent or reduce the duration of an unserved energy event.

High-speed data recordings from Power System Performance Monitor (PSPM) confirmed the BESS successfully rode through the faults or responded as required.

Several system events in the period 14 December 2019 to 14 June 2020 were noted in detail. These include the ESCRI-SA BESS operating in island condition during unplanned outages on 20 December 2019, 31 January 2020 and 29 April 2020:

- On 20 December 2019 the Ardrossan West–Dalrymple 132 kV line successfully reclosed following a single phase–ground fault caused by lightning, resulting in the Dalrymple BESS supplying the local load for approximately 3 minutes prior to resynchronization. This was repeated on 31 January 2020.
- On 29 April 2020, Dalrymple 132/33/11kV transformers 1 and 2 inadvertently tripped due to tests at the Wattle Point Wind Farm. The Dalrymple load was successfully supplied from the BESS and operated in islanded mode for 14 minutes until attempting to re-synchronise. The BESS then tripped, and load was restored, within minutes, from the transmission network.

In the period 14 December 2019 –14 June 2020, six transmission network fault events were relevant to the Dalrymple BESS. The BESS successfully rode through each of these, which are summarised below:

- On 20 December 2019 the Ardrossan West –Dalrymple 132 kV line successfully reclosed following a single-phase–ground fault.
- On 13 January 2020 a CT failure at the Waterloo substation resulted in tripping various element in the Mid-North region.

No	Description	Presented by	Time
	<ul style="list-style-type: none"> - On 31 January 2020 the collapse of several steel transmission towers on the Moorabool–Mortlake and Moorabool–Haunted Gully 500 kV lines resulted in these lines tripping and remaining unavailable for service, effectively islanding South Australia from the NEM. Prior to the event the BESS was charging at 7MW then at the onset of the event when the system frequency rose to 51.2Hz the BESS correctly responded by momentarily imported at 18MW before settling to import steadily at 11MW. - On 31 January 2020 the Ardrossan West–Dalrymple 132 kV line successfully reclosed following a single-phase-ground fault. - On 7 February 2020 the MunnoPara–Blyth West 275 kV line successfully reclosed following a single-phase-ground fault. - On 7 February 2020 the Clare North–Brinkworth 132kV line tripped and locked out following a 3-phase-ground fault. The BESS reversed operation from export to import during the course of the event. 		

Question: What contribution was the battery able to make in the event of 31 January 2020? *Answer:* The battery soaked up excess power to help arrest the frequency rise. It behaved like a virtual synchronous generator before FCAS settings took over as the system frequency remained around 50.5Hz. More generally, the battery provides a combination of services. If it only provided one service, it could be more finely tuned to better support that specific service.

Question: The battery seems to have reduced the number of outages downstream of Dalrymple. What has been the community response?

Answer: ElectraNet is not hearing anything from the downstream community, which is a good indication. In 2019 the battery supplied power to the local community for 7.5 hours of an 8-hour outage.

Question: Are there any other benefits from reduced outages? *Answer:* Voltage control in the BESS area of the network is improved.

Question: During the event of 31 January 2020 the frequency settled to 50.5 – 50.6HZ. This is not within system frequency band, so was this due to an operational protocol? How would a real machine have responded? *Answer:* The battery provides a range of services and provided the Contingency FCAS service in this instance (after providing the initial synthetic inertia response).

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R2 Model Validation Process

- A single set of parameters is required for seamless transition from grid connected to islanded operation.

Traditional Connection application process	+ ESCRI islanding
I. Finalise initial R1 model package (PSSE, PSCAD and Power Factory)	- Model validation for islanding tests (PSCAD)
II. Finalise generator performance standard (GPS)	- Islanding tests with loads
III. Finalise customer performance standard (CPS)	- Islanding tests with wind farm and loads
IV. Commissioning tests (hold point test)	- Black start tests
V. Submit final R2 model package	

Models were received from the OEM. Issues raised from R2 tests were:

Major: Power system modelling guideline non-compliant:

- Voltage and reactive power responses from simulation models in voltage control mode are outside the 10% band requirement for S5.2.5.13 assessment:
 - No limiter operation
 - Limiter operation (primary control mode is power factor).

Minor: Model fixing

- Better alignment of PSSE and PSCAD models, especially with inertia response/ overload capability response.
- Long PSCAD model initialisation time.

The model should be within 10% band of plant response:

- During the R2 tests a 30 MW discharge with + 5% voltage step exhibited improved performance with a new model from the OEM.
- During the system event of 31 January 2020 (refer above), the R2 response of the battery exhibited very good actual performance vs. PSSE and PSCAD model alignment.

Question: The response of the BESS to frequency events is a virtual synchronous generator response. Is ElectraNet expecting further learnings on VSG in future? Are there more learnings to come on how it works in the

No	Description	Presented by	Time
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system, etc.? *Answer:* Regarding the first question, ElectraNet is satisfied with what ESCRI provides into the market, given that it's a demonstration project. ElectraNet noted that it is a 30MW unit in a GW power system, and the value of spending time to more finely tune it, in preference to, say, another new system, may not be warranted.

Regarding learnings on how it works in the system, it was noted that the droop characteristic is quite steep, in that full output can be achieved for a small frequency change.

7 6-Monthly Operational Report – AGL Perspective

Bruce Bennett
**13:50 –
14:05**

- The key metrics over the first 18 months of operation were reiterated:

Key Performance Metric	Reporting Period		
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- Points of note regarding the key metrics include:
 - Over the past 6 months, discharge revenue (arbitrage) was lower than business plan, and FCAS about 10 times compared to plan.

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- Comments were offered in relation to market services provided and related performance of ESCRI:

- FCAS Revenue

A bar chart showing cost generated from FACS Recovery (to AEMO) quarterly from 2015 to 2020 was displayed, with each bar calibrated to show the contribution of each of the 4 "lower" and 4 "raise" FCAS categories. The first quarter of 2020 generated by far the highest cost of FCAS over the period.

It was noted that revenue generated includes a small amount of "lower" FCAS revenue.

- Response of ESCRI to system events

Timelines showing the BESS response to two system events were presented, the first over a 1-minute period and the second over a 20-minute period, with each displaying traces of MW Setpoint, Predicted Output, Actual Output and System Frequency. It was noted that there are opportunities to improve the response of the BESS, and modern electronics allow this to be a practicable solution. Options could include asymmetric response to system faults (different response on respective phases of the BESS output). Batteries can also be turned on and off very quickly.

A third timeline, displaying the same parameters of another system event over a 20-minute period, indicted the BESS response to inertial and FCAS demand.

Question: Why were the expectations for arbitrage revenue so low? *Answer:* The battery was configured for only 15 minutes of storage when fully charged. Accordingly, since there is not much potential for revenue from arbitrage, AGL hasn't attempted to optimize for that purpose, but rather to concentrate on FCAS where revenue opportunity is much higher.

Question: How has the change in operation to favour FCAS affected cycle operations? *Answer:* Cycle operations have been reduced. It now does not perform many full cycles, as it is kept more than half fully charged. This is also expected to extend the life of the battery.

No	Description	Presented by	Time
8	Reflections on the impact of ESCRI-SA <ul style="list-style-type: none"> Perspectives from ElectraNet <ul style="list-style-type: none"> Reflection on the WHY and HOW things have played out <p>In 2013 ElectraNet was approached by Advisian and AGL about the possibilities for large-scale storage in the system. A desk-top study was completed and in 2015 the possibility was raised with ElectraNet's board. At the time ARENA was hesitant as evolving technology could quickly make the project obsolete, and the cost gap in the business case to ARENA was an issue.</p> <p>ElectraNet is appreciative that the project was approved, as it's been very successful in achieving what it set out to do. The journey has been immensely rewarding and the partners have shown innovation and leadership. It shows in real life a project that many people have talked of as a possibility.</p> <ul style="list-style-type: none"> Ownership & commercial model <p>There had been significant discussion about network owners not being able to own batteries, but this project has provided a model for how that can be done.</p> <ul style="list-style-type: none"> Broad range of services Challenging the business <p>It was a challenging project as ElectraNet worked hard to be flexible with internal processes to achieve the timeline that ARENA and government set in public announcements.</p> International stakeholders are surprised to learn about the range of functions the BESS is performing in real life. ESCRI-SA is one of the first BESS to be registered in the NEM – a very transparent approach assisted AEMO in developing registration procedures for utility-scale battery technology. Headline innovation leadership has included: <ul style="list-style-type: none"> development of a first-of-its-kind commercial model to support the provision of regulated reliability and security services by a Network Service Provider (ElectraNet) alongside competitive market services (AGL), challenging perceived limitations to network ownership of battery energy storage technologies 	Rainer Korte	14:05 – 14:25

No	Description	Presented by	Time
	<ul style="list-style-type: none"> ▪ navigating the market registration, licencing and connection processes for the first time, paving the way for others to follow ▪ largest autonomous regional micro-grid development to date, co-optimised for both grid-connected and islanded operation with 100% renewables, allowing seamless transition between the two operating modes (for both planned and unplanned islanding) ▪ The project was shared in many forums and won numerous awards, including: <ul style="list-style-type: none"> ○ Energy Networks Australia: 2019 Industry Innovation Award ○ South Australian Premier's Award: 2019 Energy Sector – Transformational Innovation – ESCRI-SA also provides pre-emptive emergency response as part of the SA System Integrity Protection Scheme, providing fast power injection into the network following a significant loss of generation to help prevent a major loss of supply to customers. – There are a few lessons still to be fully understood. – Although the project had to be committed early, the actual cost was very close to the initial estimate of \$30m. 		
	<ul style="list-style-type: none"> • Perspectives of AGL from operating the battery in the NEM <ul style="list-style-type: none"> – The first stage of ESCRI investigated smaller capacity with longer storage time – The second stage embraced larger capacity (30MW) and shorter storage (20min). – From the outset, more revenue was expected from FCAS than arbitrage, and this has proven to be correct. – It's difficult to predict how the business case for sustaining ESCRI will develop in future. Will future revenue streams for batteries change through, for example, mandatory power factor correction, and new markets develop? However, it's working now and is very rewarding. 	Bruce Bennett	14:30 – 14:40

No	Description	Presented by	Time
	<ul style="list-style-type: none"> There have been technical challenges and lessons from islanding Wattle Point wind farm with BESS. 		
	<ul style="list-style-type: none"> Perspectives from Worley/Advisian 	Paul Ebert	14:30 – 14:40
	<ul style="list-style-type: none"> The concept was floated in August 2013 with AGL, then with ElectraNet The target was demonstration of utility-scale energy storage for the integration of renewables. The initial concept was for any energy storage technology other than pumped hydro. Target budget of \$25-30m. The initial target commercial operation date of around August 2016, compared with actual, has demonstrated the extent of work that was needed, especially around islanding. The latest AEMO ISP paints an even more complicated view of the future. We still have a long way to go to optimise the role of energy storage in the NEM. 2020 statement of opportunities mentions storage (mostly around pumped hydro). The technical capability and effectiveness of batteries (and inverter-coupled plant) still needs progression/consideration. The lessons from ESCRI need to be carefully considered and acted on. Worley/Advisian has had various roles throughout the project – it has been satisfying to work with the partners, and to watch the project develop and succeed. 		
	<ul style="list-style-type: none"> Perspectives from ARENA 	Mark Hancock	14:40 – 14:45
	<ul style="list-style-type: none"> The ESCRI-SA Project originated from the 2015 ARENA-funded ESCRI Study which examined the role of medium to large (non hydro) storage on the SA transmission system. At the time there were no large-scale batteries in the NEM and ARENA was considering funding one or more large scale storage projects. The Project had several innovative aspects, including: demonstrating both regulated and market services under a network ownership model; operating in islanded mode to 		

No	Description	Presented by	Time
	<p>improve local supply reliability; use of FFR to increase Heywood interconnector capacity.</p> <ul style="list-style-type: none"> – The project objectives were successfully achieved. ARENA is especially pleased with the knowledge sharing from this project. 		

9	Questions, discussion and further perspectives “from the floor”	Paul Ebert	14:45 – 15:00
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Question: Given the high returns on FCAS, what risk/benefit arrangements were in place? *Answer:* ElectraNet responded that the financial model was based on revenues. AGL advised that they took risk on market revenue and agreed with ARENA to refund 75% up to the amount they contributed. AGL expects ARENA will recover the full \$12m they contributed.

Question: What changes are suggested in the partnership arrangements to allow better outcomes? *Answer:* ElectraNet’s view is that every battery application is unique. A cookie-cutter approach may not work at other applications. Where regulated services are needed, this works best at the extremity of a system where support is needed. The ESCRI partnership has displayed good will by all parties, and ElectraNet would like to be involved in further battery projects. A challenge was the compressed timeframe which required an approach without the RIT-T. The value of regulated services was limited to less than \$6m. Real-life data of standby costs, losses, etc. is now known, to assist other projects. AGL advised that ARENA took revenue risk, and this helped the project to proceed. ARENA was not expecting to recover its funds.

Question: What is the future focus? *Answer:* A key benefit for ESCRI-SA was reduction in unserved energy, through islanding. As successful as this has been, a key future focus for future batteries will more likely be fast frequency response and voltage control.

Question: Has this project set a precedent for navigating AEMO processes or is there some way to go yet? *Answer:* AEMO processes were not fully suitable when ESCRI was seeking approval, but they’ve improved now, and refinement is ongoing. Workarounds were required at the time. Goodwill was displayed by AER and AEMO.

This battery and others have improved AEMO’s processes. The connection process has become more complex, through consideration of issues such as system strength, etc., but not specifically due to batteries. Much greater analysis is required prior to connection, and a lot of resources (human and computer) are consumed to meet the requirements. A collective challenge is how best to go about the process in a fit-for-purpose approach.

No	Description	Presented by	Time
	<ul style="list-style-type: none"> Further comments by ElectraNet on developing trends: AEMO's 2018 ISP signaled massive closure of thermal generation in the 2030's, leading to stronger reliance between regions and pumped hydro. In AEMO's 2020 ISP it is recognized that pumped storage has higher cost than batteries. The interconnector between SA/NSW is close to approved, and battery is now almost the storage system of choice. In line with the purpose of ESCRI-SA, batteries are now seen as occupying a central place in the future. 		
10	Acknowledgements Rainer Korte thanked ARENA for its support of the ESCRI-SA project, and acknowledged it is great that they'll have their initial investment refunded. He thanked all presenters during this KRSR meeting and expressed pleasure in working through the project with the project partners. Although the approvals process was arduous, ElectraNet wishes to be a leader in the transition to a lower carbon future.	Rainer Korte	15:00 – 15:05
11	Close of meeting All attendees were thanked for their attendance and contribution. The Chair closed the meeting at 15:07 ACST.	Paul Ebert	15:05 – 15:07

END OF MINUTES

Certified as a correct record of the ESCI-SA Knowledge Sharing Reference Group Meeting of 16 September 2020.



Paul Ebert, KSRG Chair

3 November 2020

Date

In partnership with:


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