

# ESCRI-SA Ongoing Performance 6 Monthly Operational Report

ESCRI-SA Knowledge Sharing Reference Group

3 March 2020

In partnership with:



**Advisian**  
WorleyParsons Group

This activity received funding from ARENA as part of ARENA's Advancing Renewables Programme

# Outline

- General asset performance and metrics
- What O&M is occurring
- Safety performance and observations
- System fault events
- System frequency event

# Key Metrics – First 12 months of operation

Key Performance Metric	Value for Reporting Period (14-12-2018 to 14-06-2019)	Value for reporting period (14-06-2019 to 14-12-2019)
Average BESS Availability	98.01%	97.35%
Total Energy Consumed	1,370 MWh	2,006 MWh
Total Energy Exported	160 MWh	768 MWh
Average auxiliary load and losses (% of 30 MW 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

# General Operational Issues to manage

- Availability
- Air conditioning
- Energy losses
- Inverters & batteries
- Communications
- SCADA alarms

# What O&M is occurring

- Routine
  - ☐ Site / housekeeping
  - ☐ Air conditioners
  - ☐ CO2 fire system
  - ☐ Diesel generator
- Corrective (some common items)
  - ☐ Air conditioners
  - ☐ Communication alarms
  - ☐ Security system
  - ☐ Nuisance alarms
- Specific items



# Air conditioners

- Some continued issues with the air conditioning units and heat load (2 additional 100 kWt units installed, another 2 additional units ordered and some breakdowns)
- Mainly related to the inverter rooms, not the battery rooms, leading to some slight power derating on very hot days (Note: Dalrymple experiences days of very high ambient temp, above 40 degC)
- Seems to be an airflow / distribution microclimate issue – more / better directed ducting?

## **Breakdowns**

- Unique units for Australia (anecdotally the largest size available). Mitsubishi Electric ex Italy
- Spares are not held in Australia and have long lead times
- Current issues are a faulty condenser coil on one unit and a condenser fan on another
- However, air conditioners did get through this summer pretty well



# Ducting





ESCRI-SA

PCS100  
BESS  
Modules

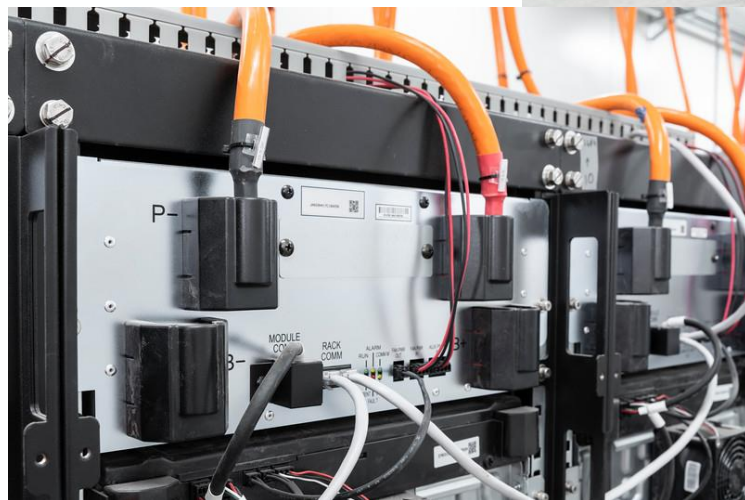




# Control System(s)

- “Reboot” issue
  - Currently there is an issue with the controller firmware that is causing a lock up and requires a reboot every approx. 100 days. Investigations are ongoing with ABB Europe but seems to stem from faulty watchdog timer
- Alarm grouping
  - Nuisance (non-urgent with no operation action required) alarms were a common issue in the first 6 months of operation, this has largely been resolved with a change in alarm grouping/hierarchy that was undertaken between ElectraNet operations and ABB
- Some battery banks “going flat”/off target dispatch
  - Over time as particular inverter groups experience slightly different temperature derating, the battery banks’ SOC will tend to diverge. This will eventually require ABB to equalise charge on Powerstores (1/12th) or cause a trip on low charge
  - ElectraNet or AGL do not have the ability to individually equalise charge

# Batteries



# Batteries

- Guaranteed remaining battery MWh capacity (annual)
- First year's charge discharge test with Samsung/CPP planned for March 2020
- Cycle life of the battery hasn't been hard (in terms of depth of discharge)
  - AGL main focus on FCAS (small energy)
  - Commissioning tests probably more onerous
- Minor corrective maintenance – early life failure (2 racks failed, < 1%)
- Took time to get the warranty replacement units but that may have been supply chain, small volume, shipping/customs issues etc.
- Failure rate pleasingly low

# BESS Tests

- 3 tests
- ABB inverter routine maintenance (~10 days)
- Samsung routine maintenance – (1-2 days) equalisation and calibration of SOC
- CPP Energy Availability test (1 day) – full discharge/charge/discharge cycle



# Safety performance and observations

## **Safety Incidents**

- The Dalrymple N BESS site is predominately unmanned
- Apart from corrective maintenance, routinely there would only be site attendance 1 to 2 days a month
- There were zero safety incidents reported during the second six months of commercial operation
- This includes near miss or Lost Time Injuries
- Maintenance is undertaken via formalised safety procedures (SWMS/JSA managed by MSP)

## **Safety Notice – Fire system**

- 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
- 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

# Miscellaneous

- Communication channels for operations could be improved – still following project contacts and relationships
- Corona virus, may effect supply chain for Italy (A/C) and Korea (Batteries)
- Plan to submit R2 report to AEMO in the next month

# System Events – First 12 months

- 14 operational system events:
  - Eleven of these events 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
- High-speed data recordings from Power System Performance Monitor (PSPM) confirmed the BESS successfully rode through the fault or responded as required

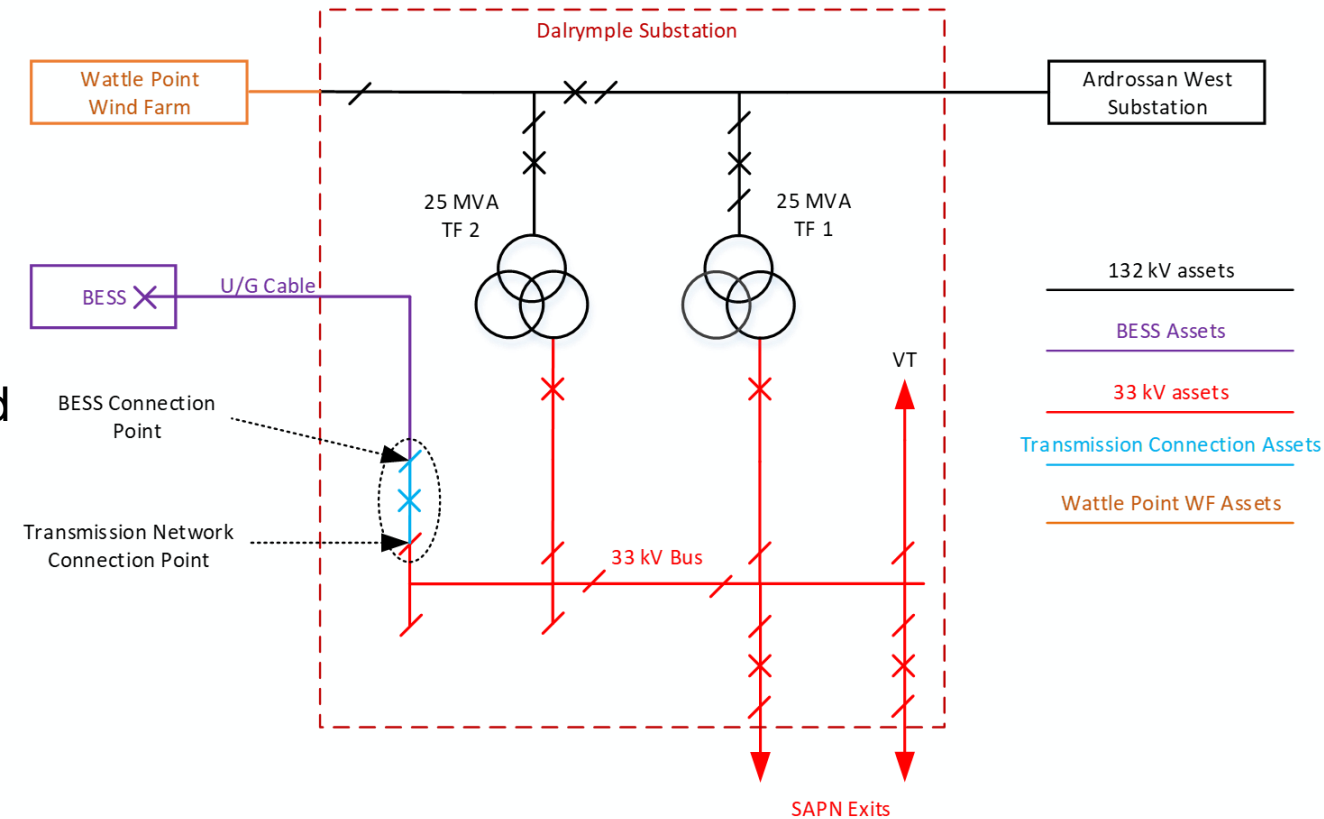
# ESCRI-SA BESS Operating in Islanding Condition

Unplanned outage on 13 June 2019

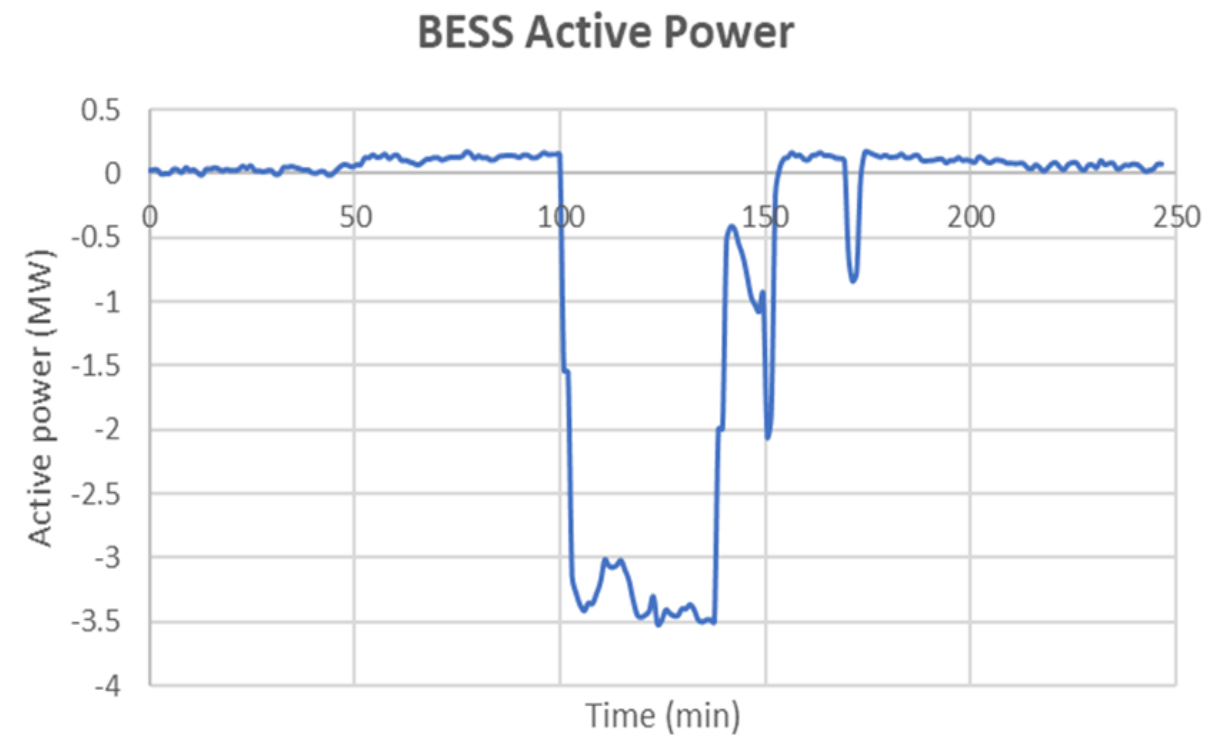
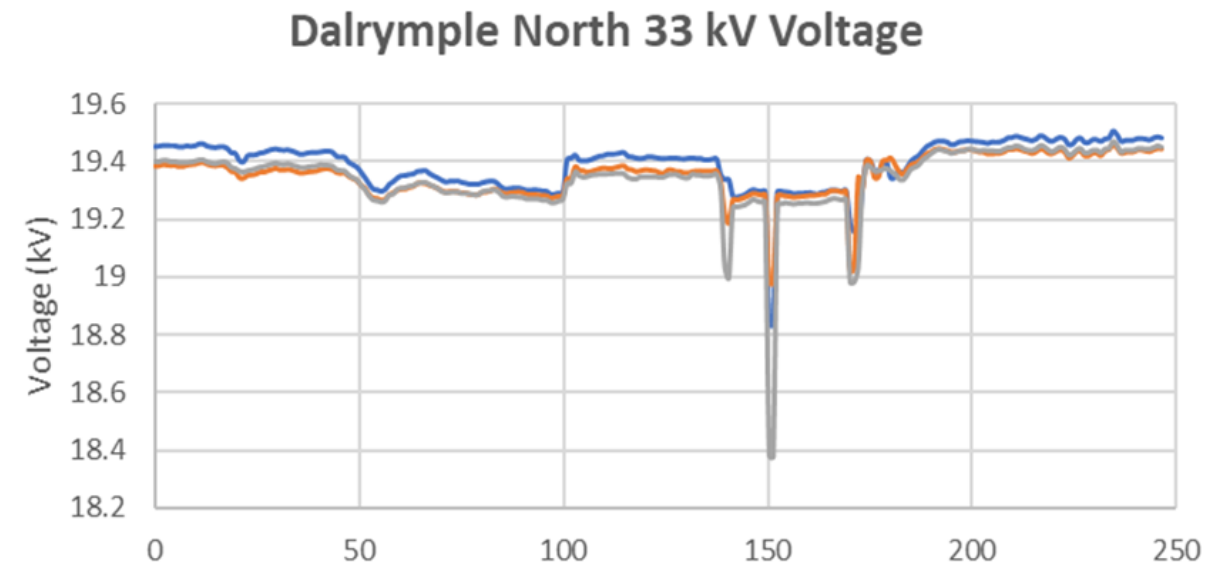
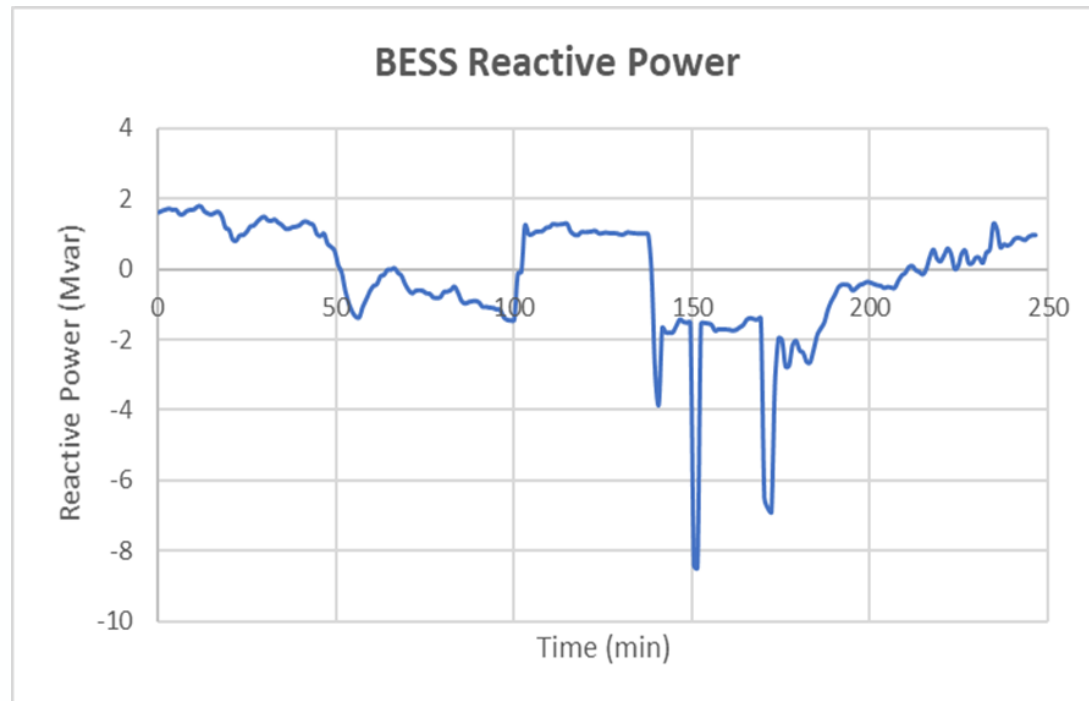


# Unplanned outage of the ESCRI-SA BESS on 13 June 2019

- On 13 June 2019, during protection tests at WPWF, a direct inter-trip signal to Dalrymple was accidentally initiated. This resulted in the Dalrymple 132/33 kV TF2 tripping and subsequent maloperation of the IDS resulted in the tripping of Dalrymple 132/33 kV TF1.
- The BESS successfully transitioned to islanded operation and continued to supply the local load until the System Operator restored all outage elements approximately half an hour later. No load was lost as a result of the incident.
- No planned or unplanned outages relevant to the ESCRI-SA BESS occurred during the second six months of commercial operation



## Unplanned outage of the ESCRI BESS on 13 June 2019



# ESCRI-SA BESS Responding to System Events

Transmission single-line trips or a frequency event

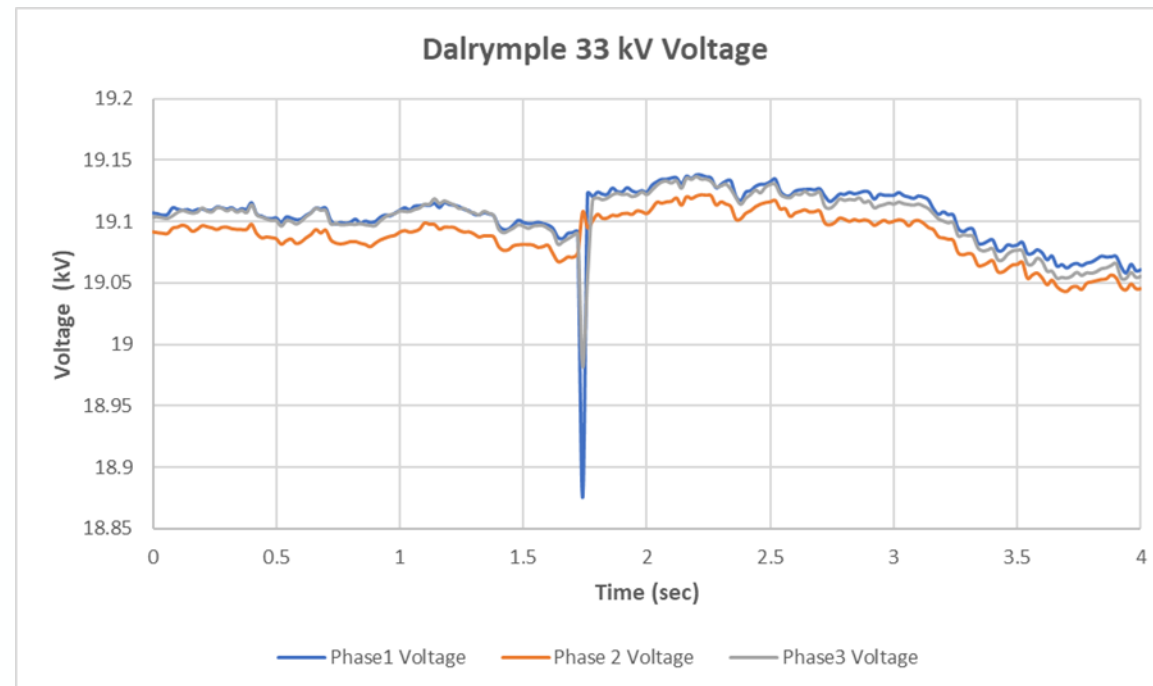
# ESCRI-SA BESS Performance During System Events

- Single Phase to Ground fault on the Davenport – Olympic Dam 275 kV line on 1 September 2019
- Single Phase to Ground fault on the Hummocks – Waterloo 132 kV line on 6 October 2019
- Single Phase to Ground fault on the Waterloo – Templers 132 kV line on 1 November 2019
- Single Phase to Ground fault on the Monash – Berri #2 132 kV line on 1 November 2019 – MurrayLink HVDC Interconnector tripped
- 500 kV double circuit in Victoria trips between Heywood and Moorabool – Loss of the Heywood Interconnector, islanding South Australia from the NEM

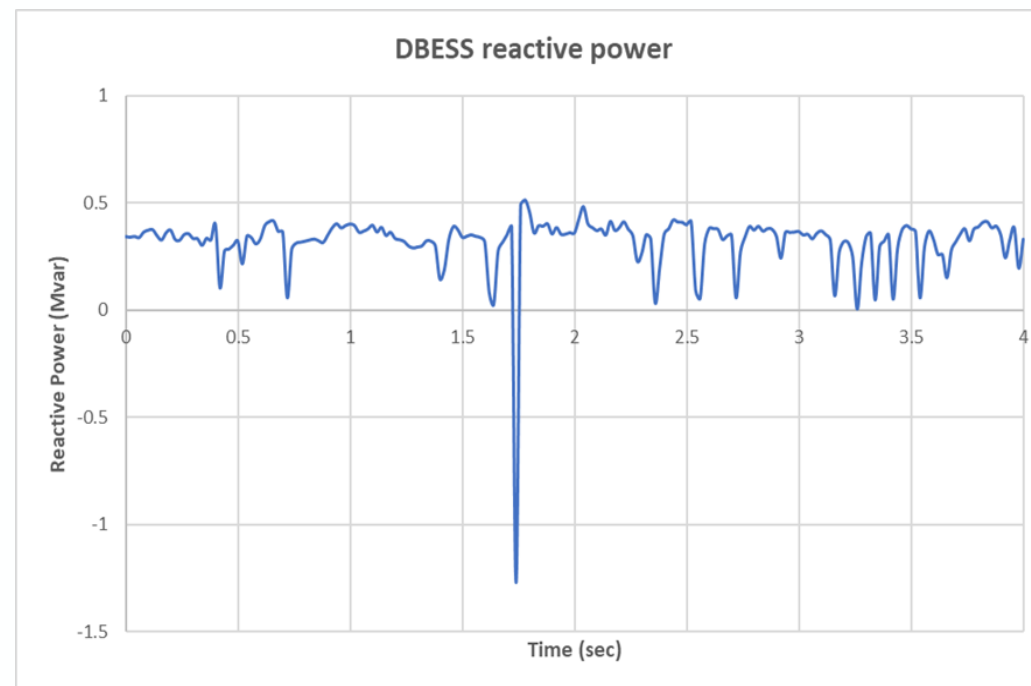
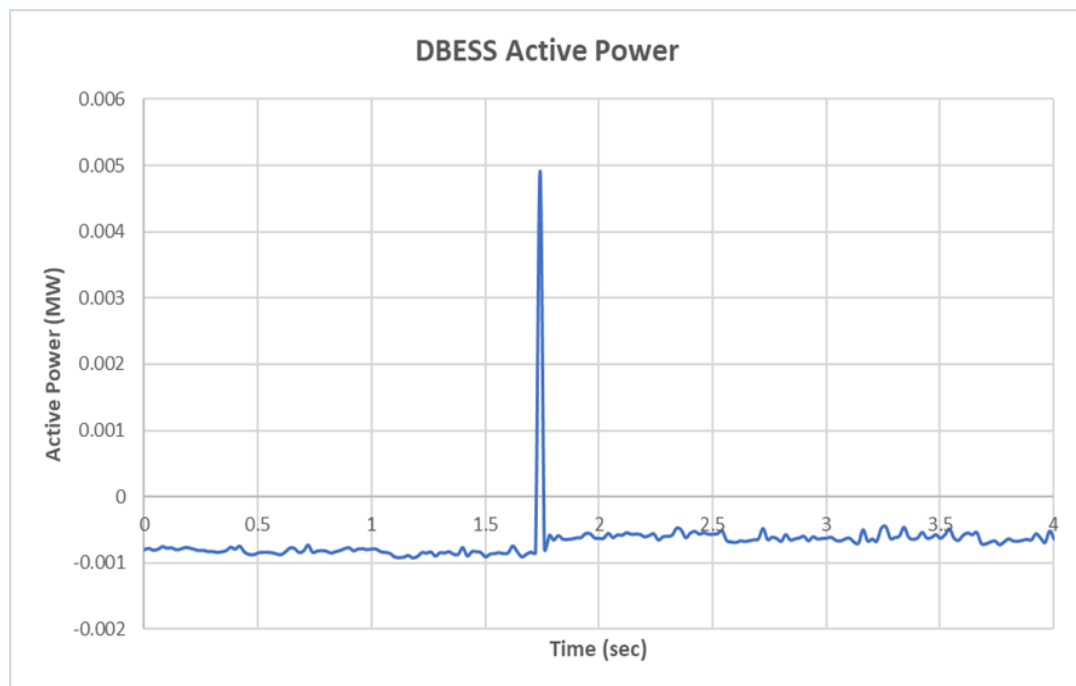


# Davenport – Olympic Dam 275 kV line fault on 1 September 2019

- On 1 September 2019 at 17:57, a single phase to ground fault occurred on the Davenport - Olympic Dam West 275 kV line. The fault was cleared and the line successfully reclosed. ESCRI-SA successfully rode through the fault as shown below.

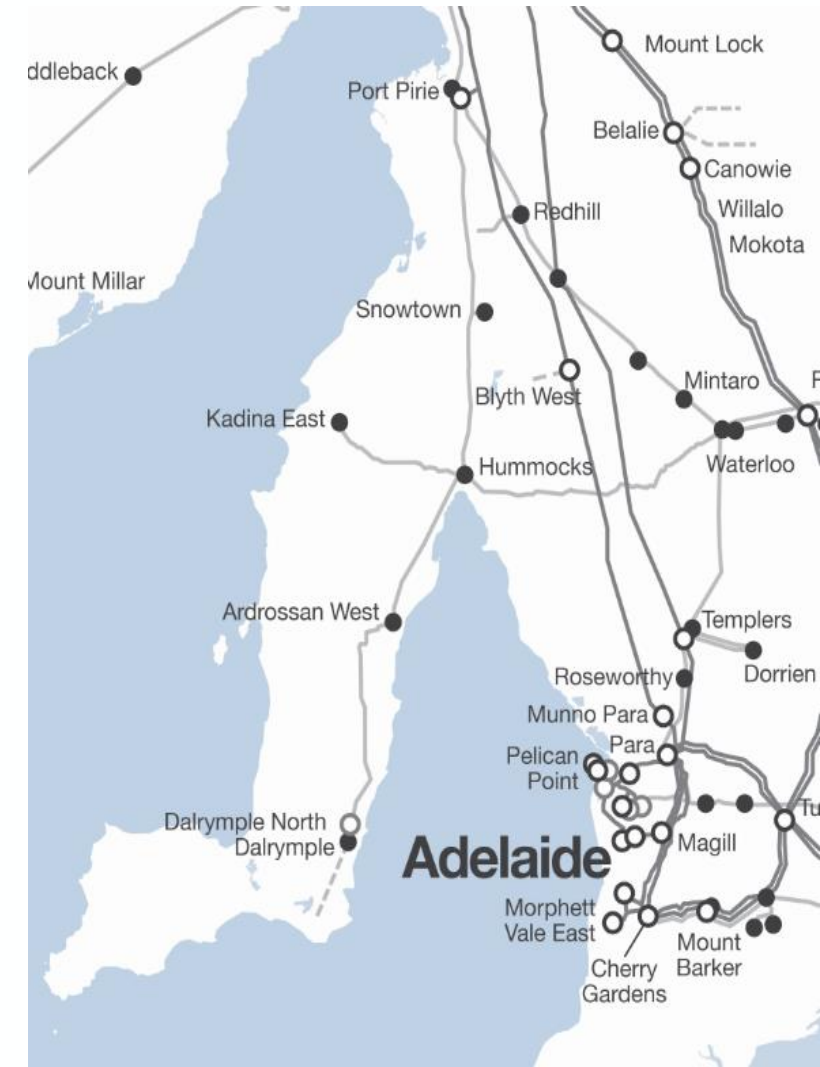
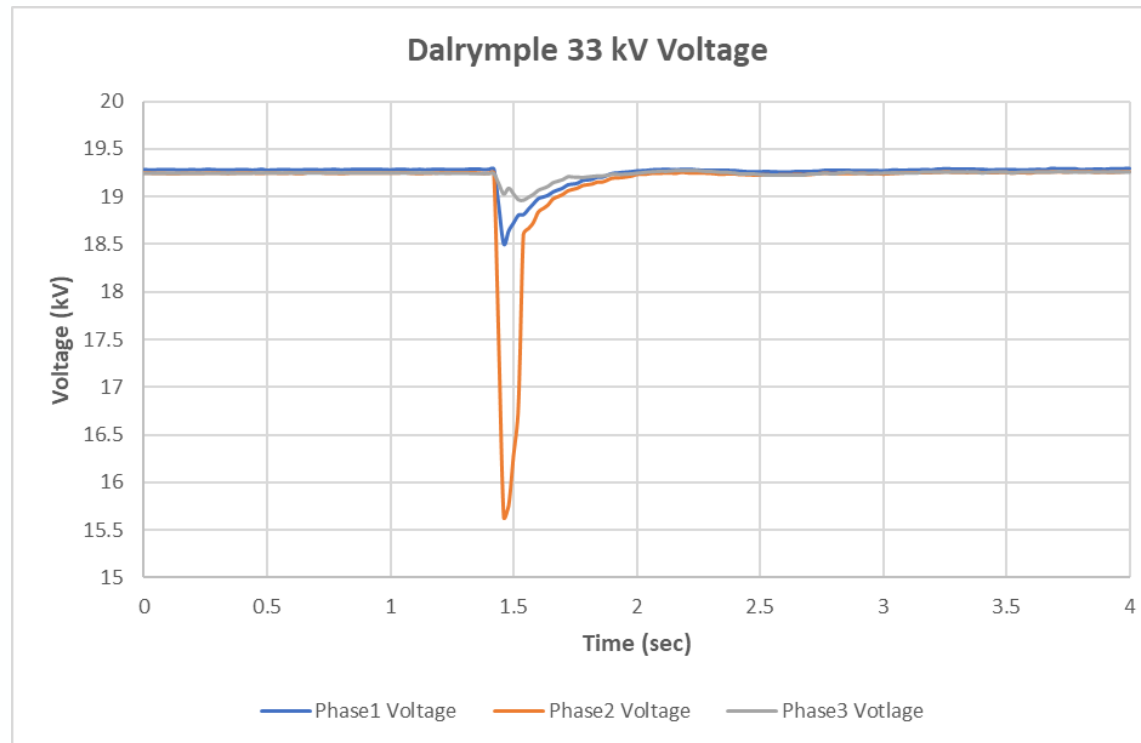


## Davenport – Olympic 275 kV line fault on 1 September 2019

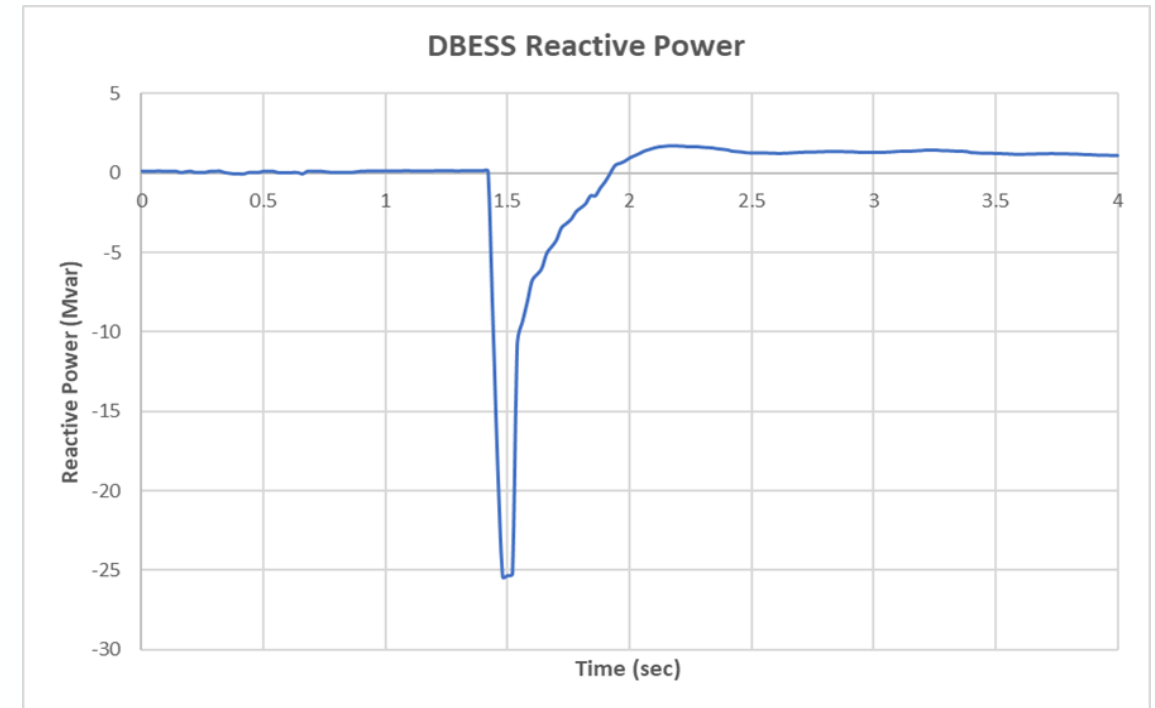
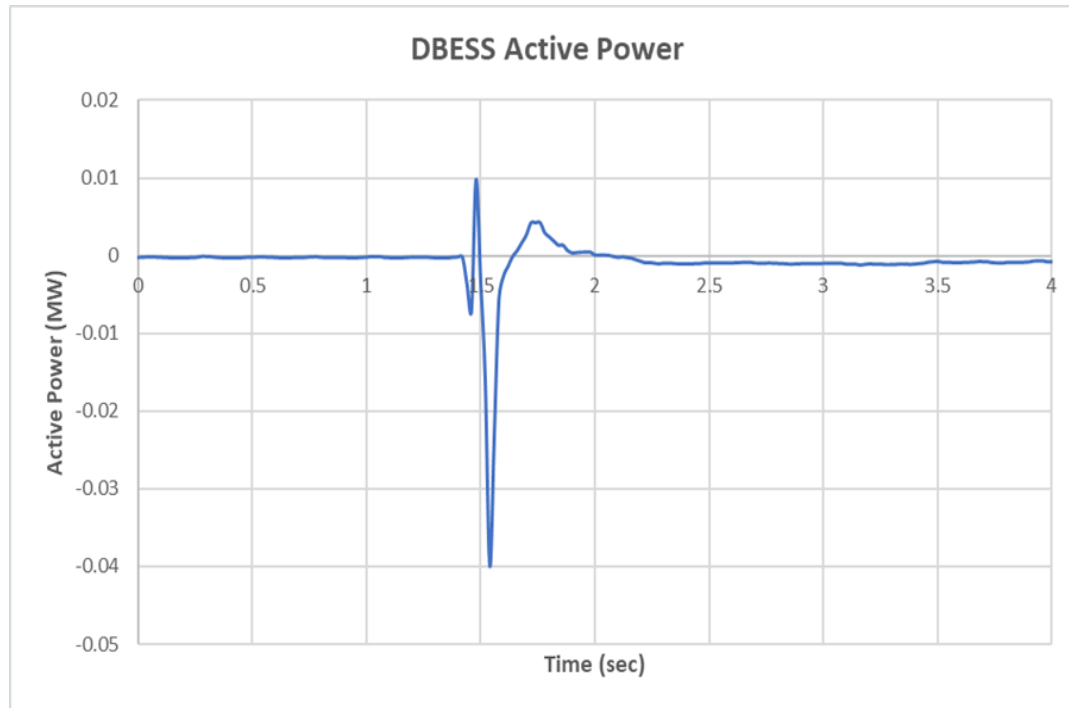


# Hummocks – Waterloo 132 kV line fault on 6 October 2019

- On 6 October 2019 at 03:35, a single phase to ground fault occurred on the Hummocks – Waterloo 132 kV line. The fault was cleared and the line successfully reclosed. High speed data recorded at the Dalrymple 33kV bus indicated the Dalrymple BESS successfully rode through the fault as shown below.



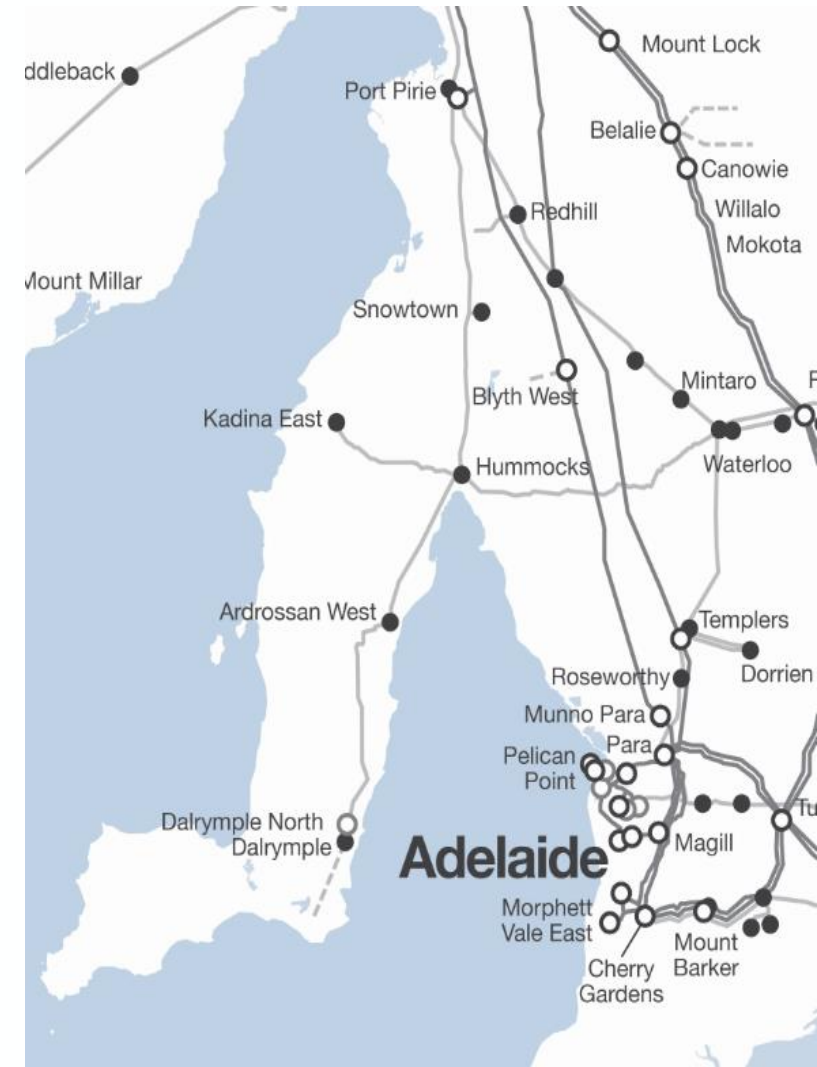
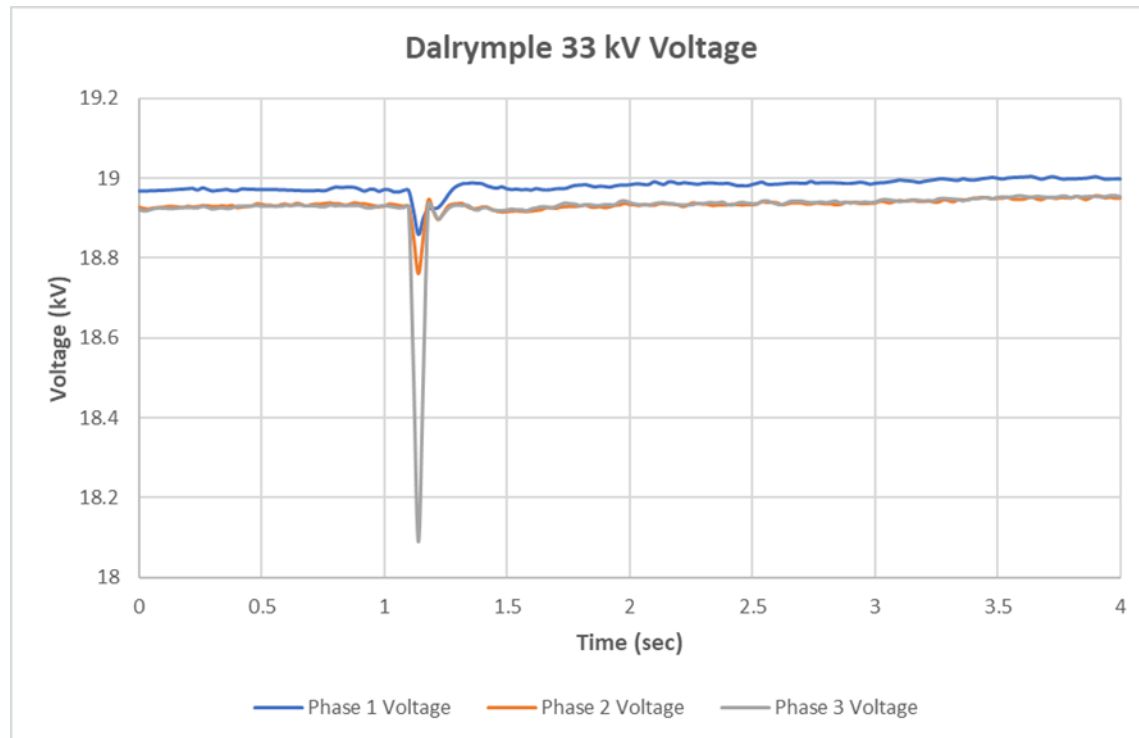
## Hummocks – Waterloo 132 kV line fault on 6 October 2019



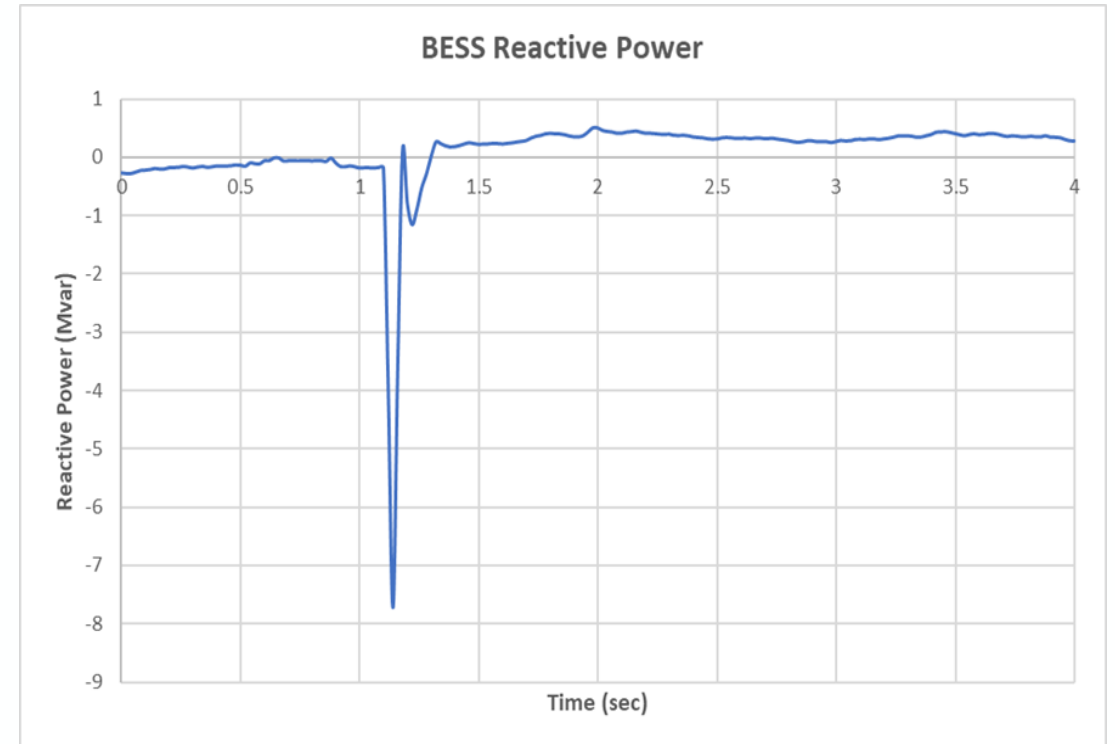
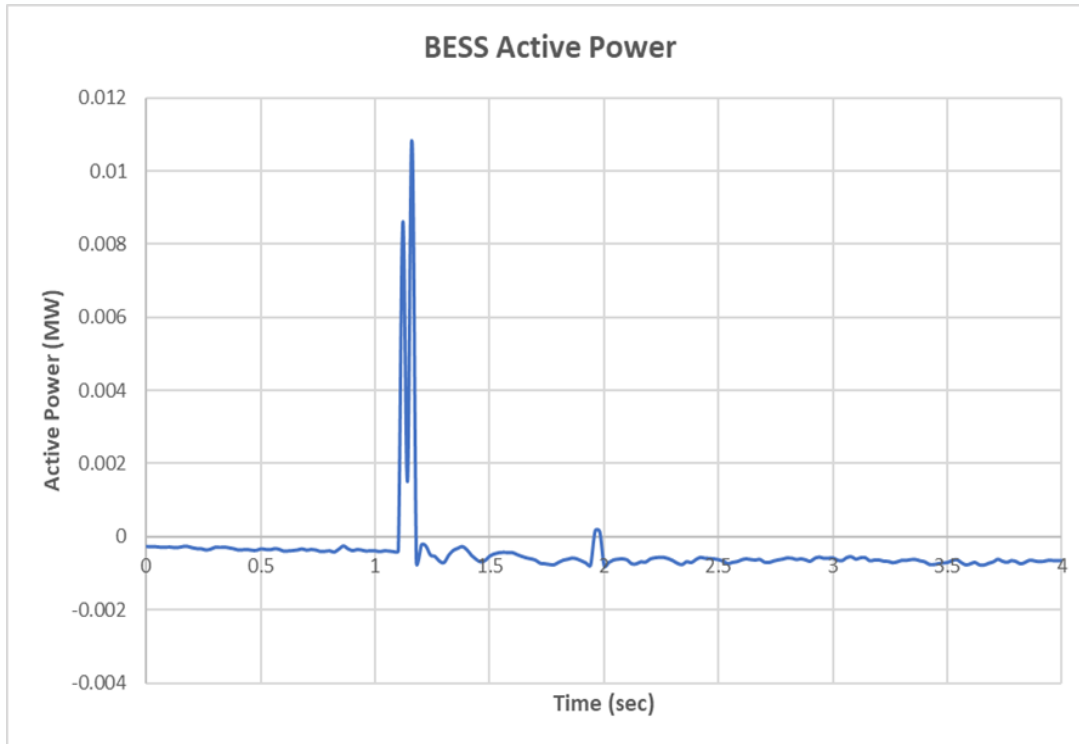


# Waterloo – Templers 132 kV line fault 1 November 2019

- On 1 November 2019 at 20:20, a single phase to ground fault occurred on the Waterloo – Templers 132 kV line. The fault was cleared and the line successfully reclosed. High speed data recorded at the Dalrymple 33kV bus indicated the Dalrymple BESS successfully rode through the fault as shown below.

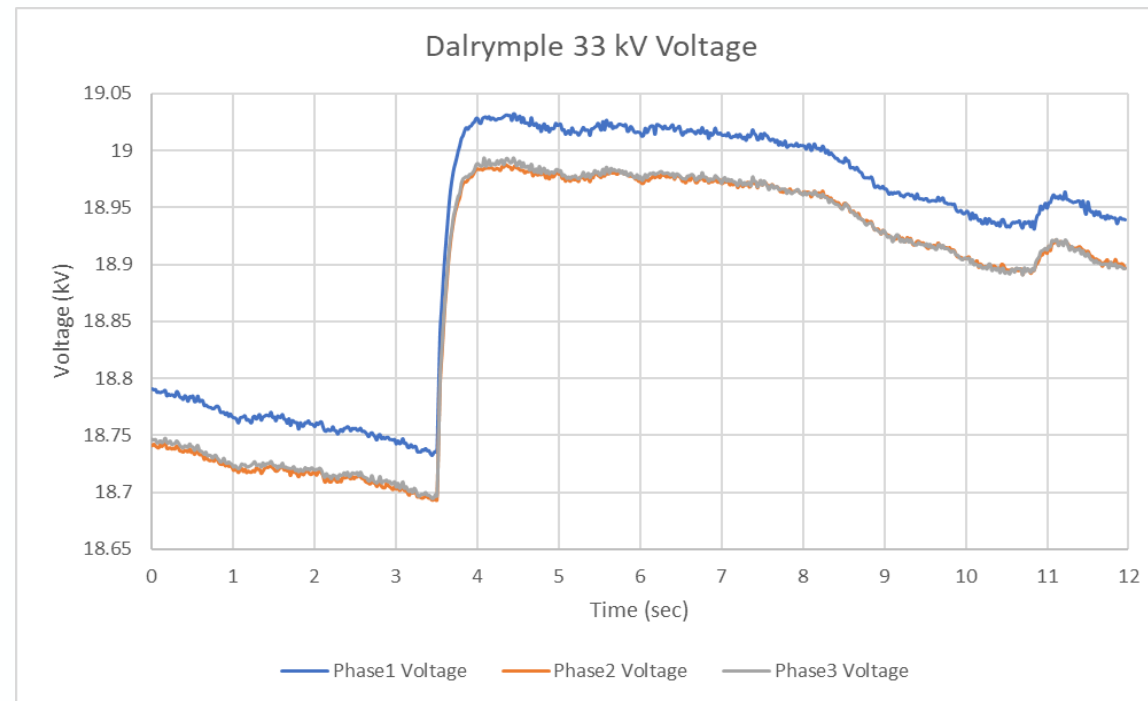


## Waterloo – Templers 132 kV line fault 1 November 2019

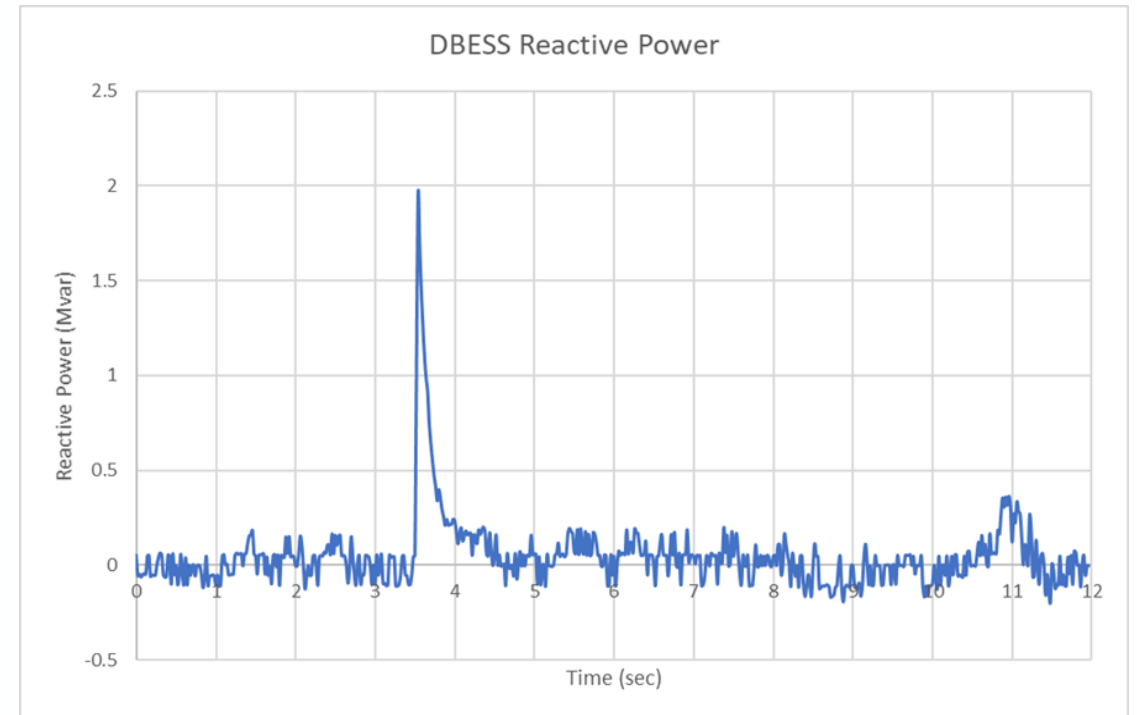
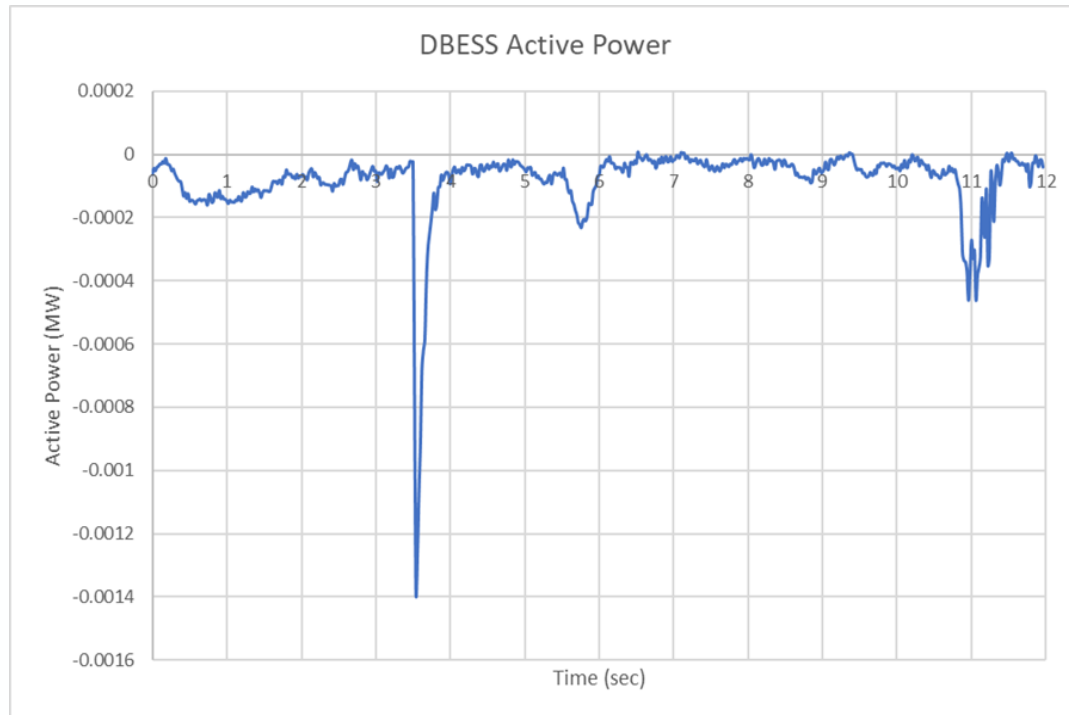


# Monash – Berri #2 132 kV line Fault - MurrayLink sever tripped

- On 1 November 2019 at 23:20, a single phase to ground fault occurred on the Monash - Berrie # 2 132 kV line. The fault was cleared and the line successfully reclosed, whilst North West Bend – Monash #1 line was out of service. As a result of the fault, MurrayLink was tripped. High speed data recorded at the Dalrymple 33kV bus indicated the Dalrymple BESS successfully rode through the fault as shown below.



## Monash – Berri #2 132 kV line Fault - MurrayLink sever tripped



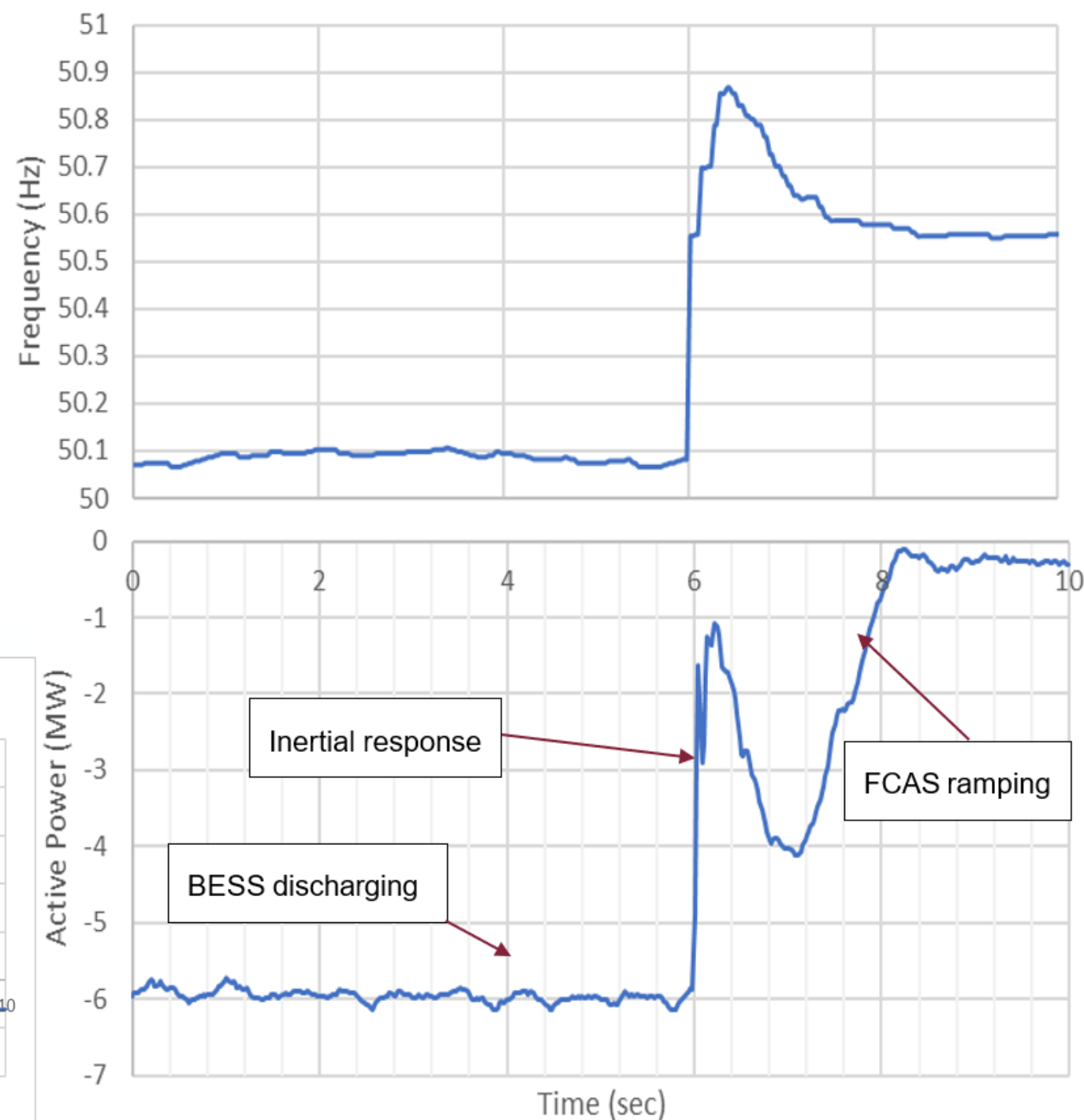
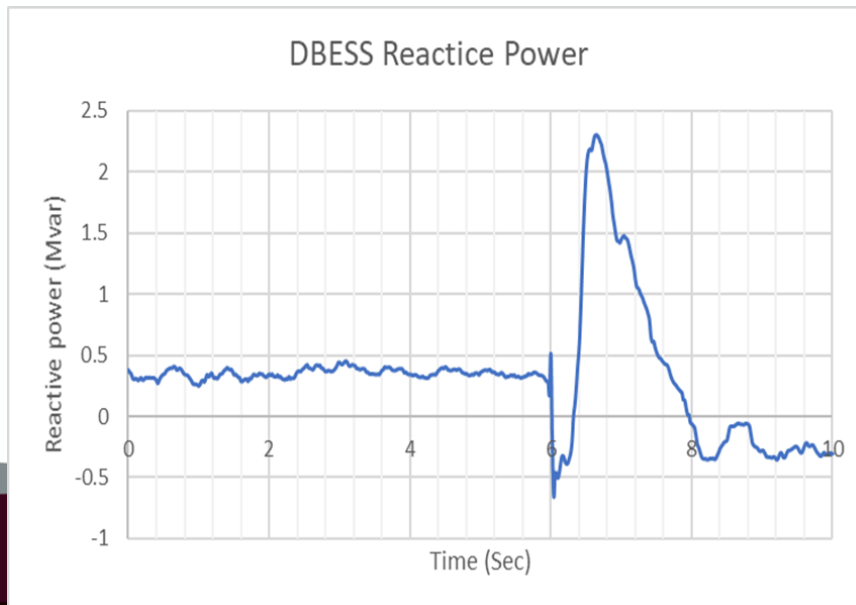
# Heywood Interconnector tripped on 16 November 2019

- On 16 November 2019 at 18:06, the 500 kV double circuits between Heywood and Moorabool were tripped as the result of a fault. The Heywood interconnection between South Australia and Victoria was lost and the SA transmission network transitioned to an islanded condition with SA exporting approximately 300 MW at the time of the event. High speed data recorded at the Dalrymple 33kV bus indicated the Dalrymple BESS responded to the event as shown below.



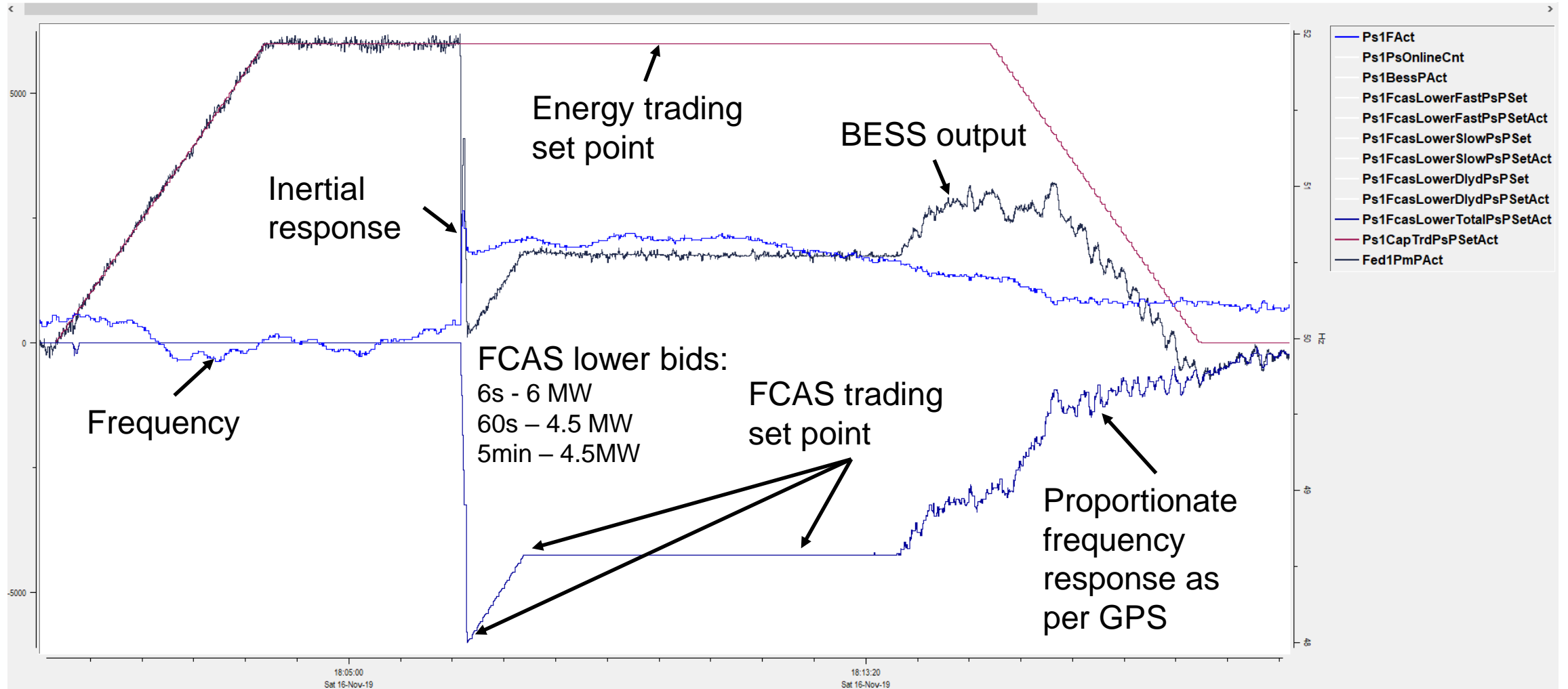
# SA Islanding from NEM

- On 16 November 2019 at 18:06, the 500 kV double circuits between Heywood and Moorabool tripped
- The Heywood interconnection between South Australia and Victoria was lost and the SA transmission network transitioned to an islanded condition with SA exporting approximately 300 MW at the time of the event





# Energy trading, Synthetic Inertia, FCAS, Frequency Response



# Thank you

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