

ESCRI-SA Project Status Update

ESCRI Knowledge Sharing Reference Group

14 August 2018

In partnership with:



ARENA
Australian Government
Australian Renewable
Energy Agency



Advisian
WorleyParsons Group

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

Presentation outline

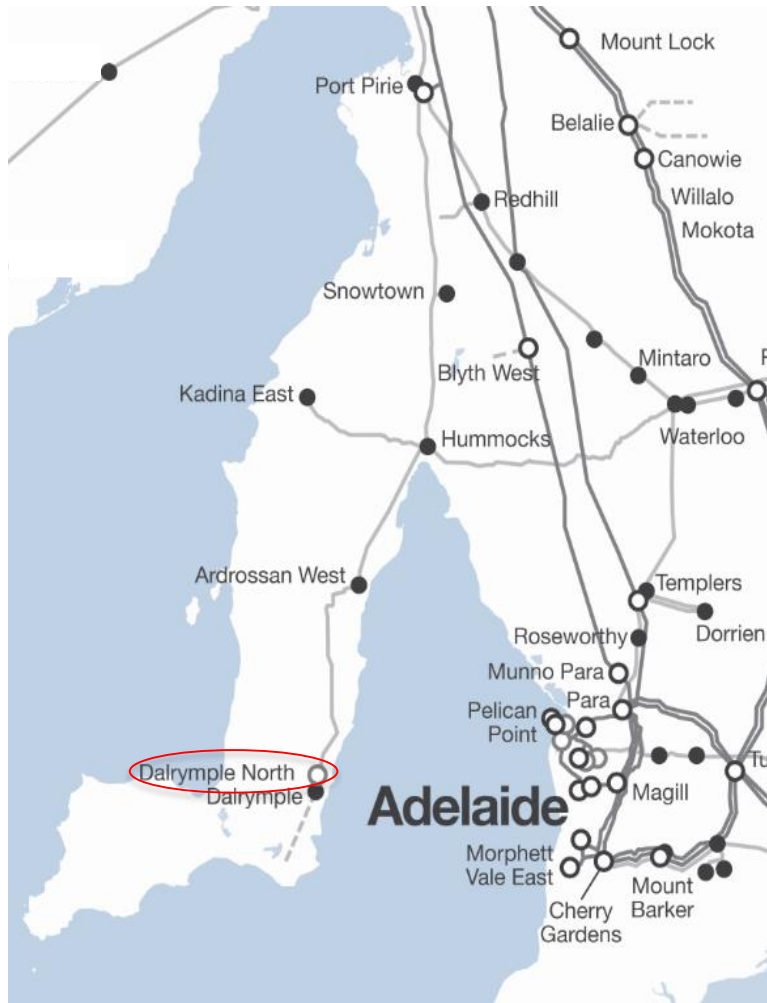
- > Scope & Location (Review)
- > Project Timing and Budget
- > SAPN Interface
- > Island Detection Scheme

SCOPE

> Project Goals

- Integrating intermittent renewable energy in an interconnected power system by coordinating the Battery Energy Storage System operation with the Wattle Point Wind Farm operation
- Provision of a range of regulated and competitive market services e.g.:
 - *Unserved Energy Reduction;*
 - *Fast Frequency Response;*
 - *FCAS; and*
 - *Cap Trading*
- Support of the Dalrymple load under islanded conditions
- Wattle Point Wind Farm integration in an islanded system (aspirational goal)
- Dissemination of knowledge as part of a Knowledge Sharing Program

LOCATION



Dalrymple North – Completed Site



Project Timing and Budget

- > AEMO registration received on 05.06.2018;
- > Registration supported by studies in PSS/E (for GPS / CPS) and PSCAD (for electro-magnetic transients assessment – e.g. at the transition between grid-connected to islanded status)
- > To be noted that no import was allowed (at any level and irrespective of network security impact) until the entire registration process was completed
- > Authorisation to import affected the ability to charge batteries and perform offline tests

Project Timing and Budget

- > Some project requirements and its R&D nature impose challenges in terms of optimising behaviour under various operating conditions, e.g.:
 - On-grid vs off-grid;
 - Speed of response (to network events and special protection schemes) vs stability
- > Such challenges attracted further work in optimising / fine-tuning the BESS behaviour, with associated time impacts
- > Ability to secure network outages attracted their own challenges, restrictions and delays
- > Mandatory coordination with SAPN and independent due-diligence review by SAPN (for BESS impact on their assets, on or off-grid) were also timely

Project Timing and Budget cont.

- > Costs incurred in relation to SCADA works – uncharted territory and requirements for various stakeholders – e.g. ElectraNet, AGL, AEMO control centres
- > Expenditure in relation to various studies: PSSE (GPS / CPS), PSCAD (EMTP), PowerFactory (protection performance assessment)
- > Complex commissioning process:
 - BESS parameters determined and behaviour simulated as much as possible via studies
 - Outages and coordination with multiple stakeholders (Enet, SAPN, AGL, AEMO, consultants, etc)
 - Real-life behaviour attracted re-tuning and a repeat of the above cycle

SAPN Interface

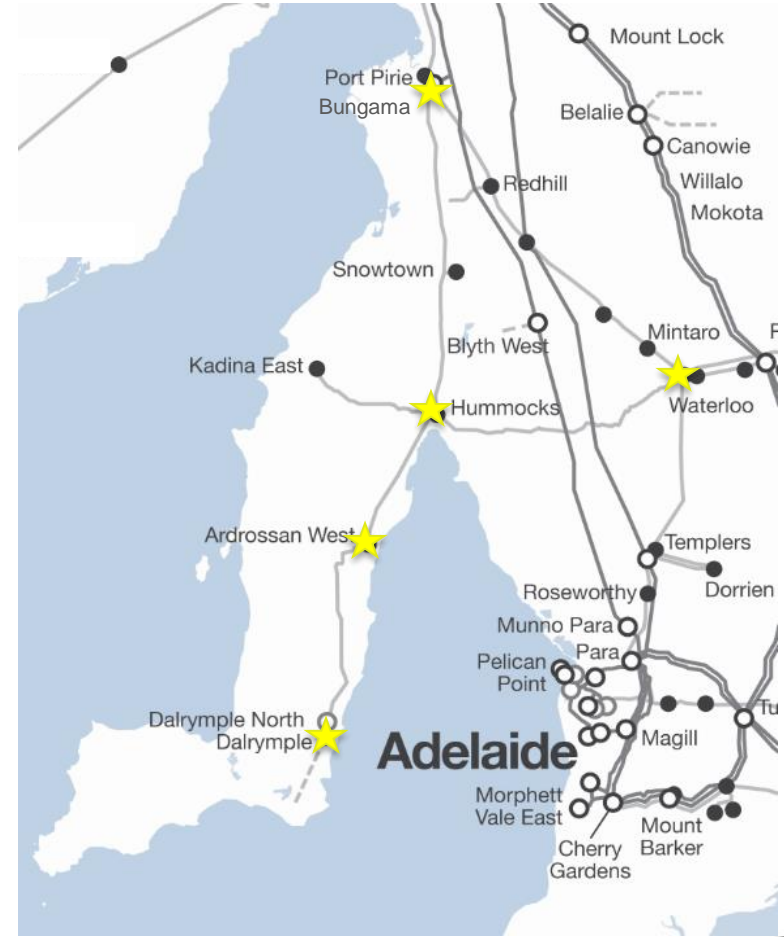
- > SAPN has a regulatory role and involvement in the project
- > Mandatory due-diligence assessment of BESS impact on SAPN's assets and customers
- > SAPN protection changes to allow operation under islanded condition
- > Other SAPN works related to interfacing signals for local island black start
- > Changes required for metering / increased power / energy import and export
- > Minimum notification periods for outages affecting SAPN assets or for outages affecting SAPN customers

Island Detection Scheme (IDS)

- > SAPN requirements:
 - no local customers to be worse-off / no degradation of SAPN services reliability – as a result of BESS connection
 - Implementation of BESS anti-islanding capability
- > BESS anti-islanding activation for:
 - Insufficient number of batteries / inverters online (insufficient fault current contribution under islanded condition)
 - Islanding detection system in-operational

Island Detection Scheme cont.

- > Topology-based islanding system
 - Monitoring circuit breakers / disconnectors statuses at various substations (via auxiliary contacts) ⇔ planned outages
 - Monitoring protection relays - i.e. CB imminent tripping under fault conditions detected via protection relays (even before the CBs would open) and transmitting trip signals via telecommunication systems ⇔ unplanned outages
- > Topology based system extending to 5 substations (Dalrymple, Ardrossan West, Hummocks, Bungama and Waterloo)★



Island Detection Scheme cont.

- > Respective substations all brownfield, with associated challenges in terms of documentation and accessibility for works
- > Upon detection of island – IDS performs several functions
 - Signal sent to BESS – for synchronous to isochronous transition
 - Signal sent to WPWF – offloading of excess generation – avoid overload of local ENet transformer from Dalrymple
 - Switches off relevant CBs at Dalrymple such that inadvertent reconnection to unsynchronised grid is prevented
 - Changes Dalrymple AVR behaviour / control in islanded condition;
 - Modifies limits for local special protection scheme
 - Performs controlled BESS re-synchronisation to the grid once adequate conditions occur

Cooling Modifications

- > Good battery room performance
- > Hot spots observed (with thermal camera) within certain areas in inverter room
- > Temperatures reached above 40°C (at which performance derating starts) during hold point testing which is more onerous than normal operation but with favourable ambient conditions (~10°C)
- > Additional AC modules to be installed, temperature settings to be reviewed
- > Ducting solution to better direct airflow to be installed

Questions



ElectraNet Pty Limited

PO Box 7096, Hutt Street Post Office
Adelaide, South Australia 5000

P+61 8 8404 7966 or 1800 243 853 (Toll Free)

F+61 8 8404 7956 **W** electranet.com.au

ABN41 094 482 416 **ACN**094 482 416

Thank you

Dorin Costan

ElectraNet

52-55 East Terrace

Adelaide SA 5000

Ph. 0421 067 791

Email: Costan.Dorin@electraNet.com.au

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