ElectraNet

ESCRI-SA Project Update

Project Report

A presentation for the ESCRI-SA Knowledge Sharing Reference Group, Meeting 1 – February 6, 2018

In partnership with:

agl

ARENA
Australian Government
Australian Renewable Energy Agency

Advisian
WorleyParsons Group

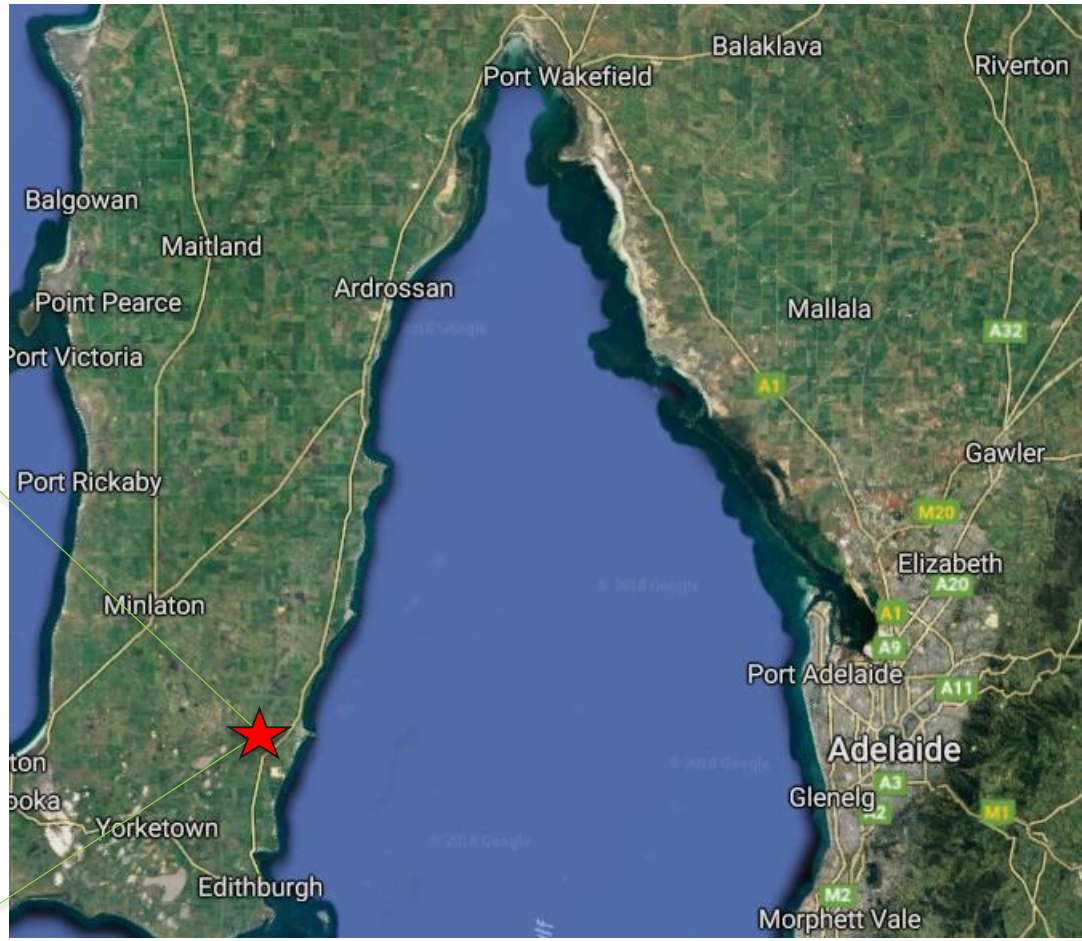
This activity received funding from ARENA as part of ARENA's Advancing Renewables Programme

PRESENTATION OUTLINE

- Delivery strategy and contracts
- Design
- Development approvals
- Site works
- Power system analysis
- Testing and commissioning
- Risks

LOCATION


Construction access and laydown area
Proposed Energy Storage Facility


Balaklava
Riverton
Port Wakefield
Balgowan
Maitland
Point Pearce
Ardrossan
Mallala
A32
A1
Gawler
M20
Port Rickaby
Elizabeth
A20
Minlaton
A1
A9
Port Adelaide
A11
Adelaide
A3
Glenelg
M1
Yorketown
Edithburgh
M2
Morphett Vale

DELIVERY STRATEGY

- Accelerated delivery
- Work packages
  - EPC contract – batteries and associated equipment;
  - Telecommunication infrastructure establishment;
  - Network studies;
  - Connection to SA Power Network's 33 kV bus at Dalrymple and upgrades due to BESS' addition to the network (e.g. operation under islanded condition);
  - Development approvals, stakeholders management;
  - Protection studies / review – especially for islanded operation;
  - Islanding detection;
  - Integration with WPWF – under islanded condition.

CONTRACTS

- EPC contract: CPP
  - Systems integrator, primary and secondary systems design
  - Sub-contract: Samsung ⇔ batteries
  - Sub-contract: ABB ⇔ inverters, MV transformers, MV switchgear
  - Early engagement (ordering of part equipment, early design)
- Telecommunication contract: Telstra
- SA Power Networks (SAPN) (local distribution network)
  - Connection to SAPN's 33 kV bus;
  - SAPN due-diligence assessment – i.e. impact of BESS connection to SAPN's network and customers
- Network studies – FortEng
- Protection studies – Digsilent Pacific
- Islanding detection - Megavar

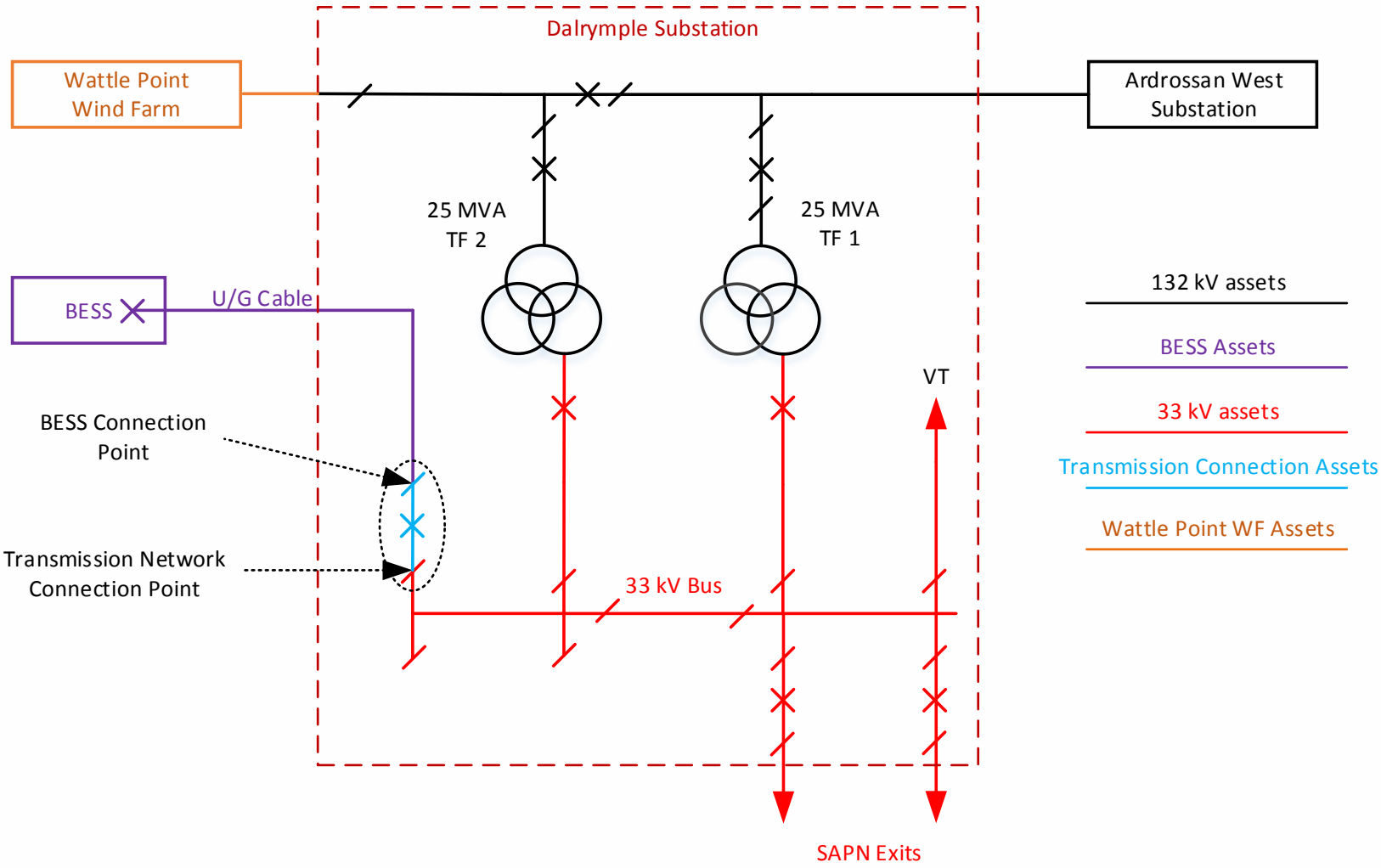
DESIGN

- Accelerated design process
- Concurrent procurement of essential / long lead equipment:
  - Batteries;
  - Inverters;
  - Switchgear;
  - MV transformers and cables, etc
- Staged design:
  - Civils / structural – so as site works could start as soon as DA received
  - Primary – so as equipment installation could start as soon as deliveries made and building available
  - Secondary / protection

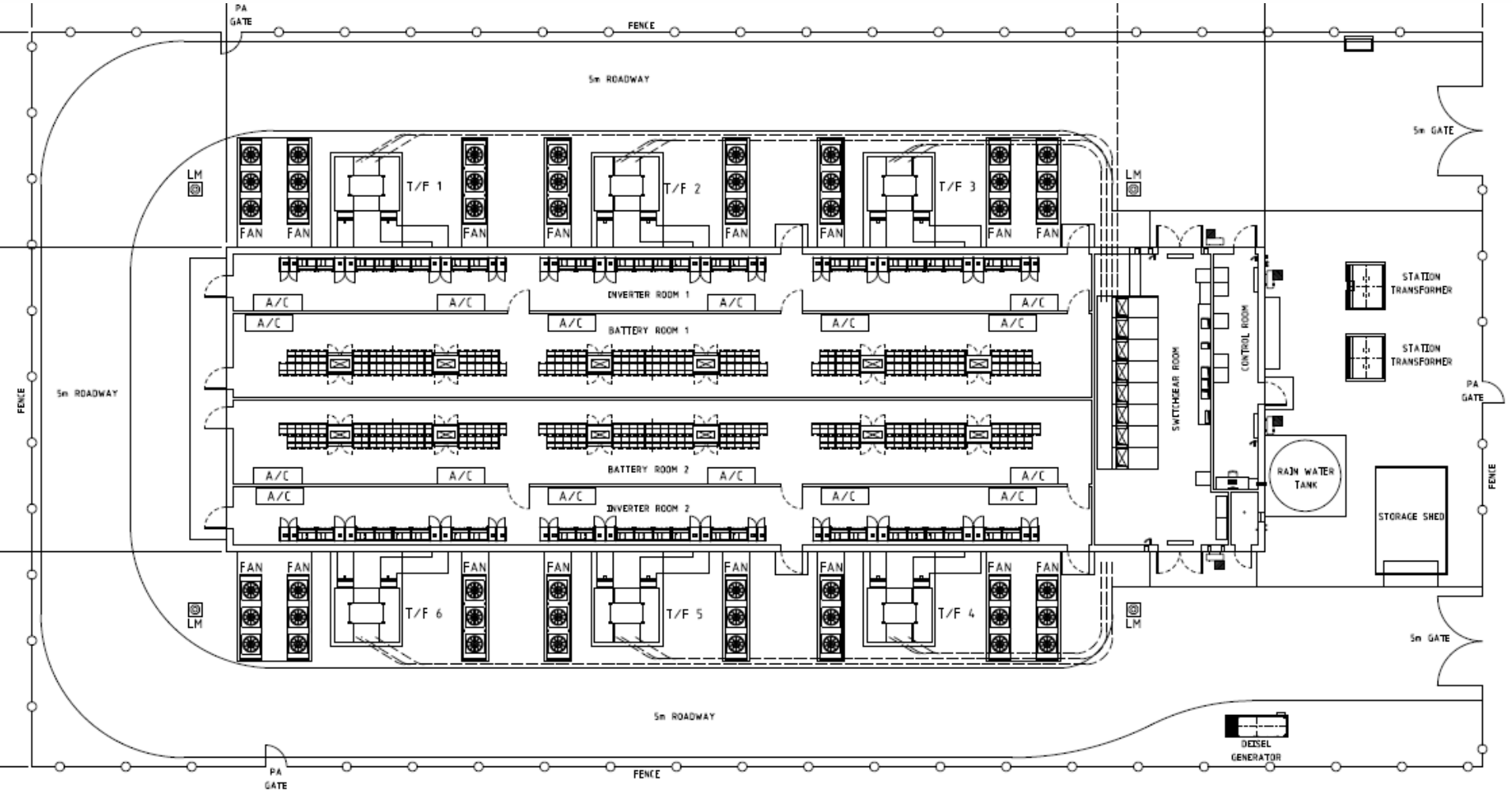
DESIGN (cont.)

- Fire risk and consequence analysis, including subsequent design of fire detection and suppression systems
- Potential for rework due to (initially) unknown:
  - Conditions of Development Approval
  - Local council requirements
  - CFS requirements
  - SAPN requirements
- Little margin for error – for any long lead equipment characteristics (e.g. dimensions) mismatches / misunderstandings

DALRYMPLE SUBSTATION CONNECTION



DALRYMPLE NORTH ⇔ BESS



DEVELOPMENT APPROVALS

- Exemption request (as per Hornsdale battery project) - declined
- Crown sponsorship request (seeking speedy referral process) – July 2017
- Development approval process
  - In accordance with the Development Act 1993, section 49 (Crown Development Sponsorship)
  - Submission: July 2017
  - Public notifications, no major opposition
  - Consultation with local landowners, as per stakeholder management plan
  - Development Approval – issued (with conditions) on 11 October 2017

SITE WORKS

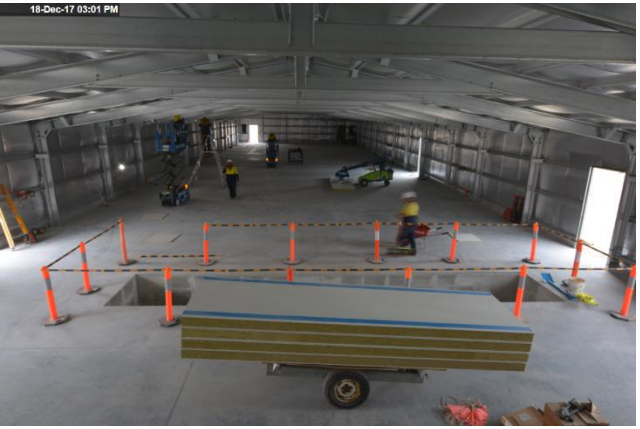
- Concurrent works at:
  - Dalrymple substation ⇔ new 33kV bay + SAPN works (33kV bus)
  - Dalrymple North ⇔ BESS
- Dalrymple North works – staged, following design progress and as allowed by the initial lack of Development Approval:
  - Site establishment / access roads;
  - Bench;
  - Foundations;
  - Building erection / cladding / internal partitions
  - Progressive equipment installation - as delivered (to be noted complications caused by inclement weather in Europe and associated delays – especially for rescheduling of resources / associated works)

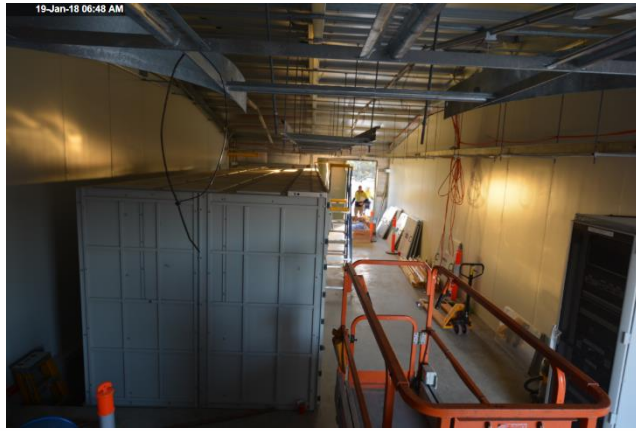
PROGRESS ON SITE

- November 2017 – end January 2018

PROGRESS ON SITE - INDOORS

- December 2017 – end January 2018





OTHER WORKS

- Panels / cubicles and protection relays ordered / progressively built
- Interfacing with local council – onerous requirements for local roads upgrades
- Interfacing with Country Fire Service (CFS)
  - Fire risk and consequence analysis;
  - Creation of 50m buffer around BESS site – no combustible vegetation in respective area;
  - Water tank – able to support fire fighting activities for 30 min, both for:
    - External fires potentially propagating inside the BESS compound; and
    - Internal fires potentially migrating outside of the BESS compound.

CONTROL MODE PRIORITIES

Priority based Services		Inherent Services	
		ID	Description of Service
1	Islanded Operation	A	Voltage Control Frequency Control Fault Current Support
	Grid Connected modes below	B	(Voltage Control or Power Factor Control) Fast Frequency Response Fault Current Support
2	Network Support - SIPS		
3	Contingency FCAS services		
4	External set point mode (P & Q) (Energy Trading Modes) Cap Trading and/or Arbitrage		

POWER SYSTEM ANALYSIS

- Protection studies
  - Comprehensive review of BESS impact on local network;
  - Both ‘Connected to Grid’ and ‘Islanded’ conditions examined;
  - Detailed Digsilent model built and constituting the basis of the protection studies;
  - Various fault conditions studied;
  - Impact / protection settings review for protection systems belonging to ElectraNet, SAPN and WPWF (132kV, 33kV, 11kV).
- Network studies
  - BESS mathematical model – challenges, compliance, complexity – i.e. able to operate in both ‘Connected to Grid’ and ‘Islanded’ condition;
  - Draft GPS / CPS developed and submitted to AEMO for review

ISLANDING DETECTION

- 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
- 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

TESTING & COMMISSIONING

- Equipment tests
- Protection tests
- GPS compliance tests – R1 and R2 tests
- Functionality tests

TESTING & COMMISSIONING (cont.)

- GPS compliance tests – R1 and R2 tests
  - S5.2.5.1 – Reactive power capability (Generator P/Q capability)
  - S5.2.5.2 – Quality of electricity generated (Harmonics / power quality measurements)
  - S5.2.5.6 - Quality of electricity generated and continuous uninterrupted operation
  - S5.2.5.7 - Partial load rejection (frequency stepping)
  - S5.2.5.11 - Frequency control (frequency stepping)
  - S5.2.5.13 - Voltage and reactive power control (Qref, Vref, cosϕ ref – setpoint stepping)

TESTING & COMMISSIONING (cont.)

- Functionality tests
  - Operating modes selection
  - Control system functionality – BESS connected to grid:
  - Transition to island
  - Islanded operation (planned outage / unplanned outage)
  - Black start
  - Grid re-synchronisation

RISKS

- Key risks addressed
  - Development approval obtained (just in time)
  - 33 kV connection arrangement agreed with SAPN & AEMO
- Remaining key risks
  - Timely completion for handover to AGL
  - GPS registration (BESS power system models still being refined)
  - Performance to specification during commissioning tests
  - BESS capabilities when islanded and unknown costs of deeper network / protection upgrades fro SAPN

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Thank you

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