Santos

# Lessons Learned Report

## Santos oil beam pump conversion to solar and battery, and other uses for the proposed stand-alone power system

## March 2020

Project commenced: 14 December 2018
Completion date: 10 September 2021
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This project received funding from ARENA as part of ARENA's Advancing Renewables Program.

# Lessons Learnt

## Lesson Learnt 1: Understanding of load requirements

**Category: Technical**

Beam pump electrical loads are cyclic with an increase in power to drive the pump's counterweight up before a reduction in load during the down-stroke. This requires electrical design and sizing to allow for both peak demand and cyclic loads.

In addition, oil reservoir composition varies over time with water entering the produced reservoir. Water is denser than oil and hence pump load will increase through production life of the well.

Following the deployment of the first 6 solar and battery units, load variation through reservoir change was reviewed in detail, resulting in larger design allowances added to solar and battery sizing.

## Lesson Learnt 2: Site layout considerations

**Category: Technical**

All installations were constrained to the existing pre-disturbed lease area with some sites requiring limited civil works to level sites. This led to solar panels being orientated to the lease orientation rather than the most optimum solar orientation. As such, it is estimated solar performance has suffered an approximate 3-4% efficiency loss.

All selected sites for the solar and battery installation were outside of potential flood zones though battery containers have been elevated as a precautionary measure. Please refer Photo 1 below as an example layout.

***Photo 1**: Stimpee-1 installation Cooper Basin*

# Lesson Learnt 3: Site Installation

**Category: Construction and Logistics**

Rock was encountered during the anchor deployments for some of the 5B MAV rack installations. A rock drill has now been included as part on installation crew toolkit.

Very hot weather in the summer months within the Cooper Basin resulted in a slowing of installation progress with future installations now targeted for April through October.

Poor road conditions caused damage to a number of pieces of equipment which resulted in reassembly upon receipt at site. Transporting at low speeds to prevent damage was found to be more efficient rather than reassembling on site. The Battery Energy Storage System (BESS) units were delivered via a longer route to maximise transport on sealed roads.

Through volume and repeatability a number of efficiency improvements were realised across; logistics, work method, materials management, operations permitting and commissioning as the project developed. The Contractor refined the delivery model resulting in optimal deployment of units in concurrent batches of three.

# Lesson Learnt 4: Commissioning and Handover

**Category: Technical**

The Contractor was able to develop site commissioning and handover procedures enabling self-performance of this function and removing this scope from the Operator (Santos).

Long term system performance will not be known for potentially 5 years as batteries, power electronics and solar panels degrade, noting allowances have been captured within the design. In addition, winter performance has yet to be measured over an extended period with the majority of the 2019 installation completed in the second half of the year.

Early operational teething issues which have now been overcome include;

1. Inverter failures are being monitored and rectified
2. A refresh charge was initially required for the battery with the system shut down, now resolved with refresh charge executed with system online
3. Batteries were not reaching 100% SoC (State of Charge) – firmware upgrade developed, implemented and resolved