Santos

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
Project contact: Chad Wilson, Vice President Energy Solutions
Email: chad.wilson@santos.com; Phone: (08) 8116 7921

This project received funding from ARENA as part of ARENA's Advancing Renewables Program.

 ¡

Santos

Contents

1. Introduction 1

2. System overview, Biala-12 oil well example 2

3. Potential uses of excess energy from the solar and battery system 2

   3.1 Case study: beef industry 3

   3.2 Case study: stand-alone power systems 4

4. Learnings and opportunities going forward 4

5. Conclusion 5

Figures

Figure 1: electricity network coverage overlaid on MLA beef regions 3

Figure 2: stand-alone power systems opportunities 4

Photos

Photo 1: Biala-12 solar and battery installation 2

1. Introduction

In 2018, Santos commenced conversion of oil well beam pumps to solar and battery power as part of an Australian-first trial.

On behalf of the Australian Government, the Australian Renewable Energy Agency provided $4.2 million in funding to Santos to convert 56 remote crude oil beam pumps to solar and batteries.

Recognising the successful 2018 pilot installation at the Hobbes-1 well site, solar PV and batteries will be installed at 56 oil wells across the Cooper Basin in South Australia and Queensland.

This trial will supply each site with 100 per cent renewable energy and is the next step to commercialise the technology through scale to drive supply chain and execution synergies resulting in reduced cost.

Benefits of converting from crude/diesel fuel power generation to solar and battery include:

+ Removal of fuel consumption
+ Removal of fuel logistics and distribution
+ Reduction in maintenance costs; solar and battery are primarily static equipment
+ Reduction in risk associated with travel to remote environments
+ Increased availability and reliability of the power system

Santos has contracted CD Power, Kaefer and AGL to deliver the conversion of oil well beam pumps to solar and battery power through EPC (Engineering, Procurement and Construction) contracts. The example within this document captures the CD Power solution applied to the Biala-12 oil well.

The purpose of this report is to share knowledge capturing how solar and battery power systems utilised for oil well pumps could be applied across other industries in wider applications.

2. System overview, Biala-12 oil well example

The renewable power generation installed at the Biala-12 well comprises 36 kW of PV generation, a 48 kVA inverter, 132 kW Battery Energy Storage System (BESS) and a micro-grid controller. The existing 40 kVA crude generator will remain in place until the renewable power system is proven through a winter cycle.

Since commissioning in October 2018, the system has delivered 100 per cent availability. The system was designed to deliver continuous power to a conventional oil well pump located in the Cooper Basin. The oil well is equipped with a beam pump driven by a three phase 30 kW induction motor. The average power draw for the site is 4.5 kW peaking to 30 kW.

For further information regarding this example please refer to www.cdpower.com.au.

Photo 1 – Biala-12 solar and battery installation

3. Potential uses of excess energy from the solar and battery system

The oil well solar array is sized for the winter solar cycle when solar intensity is at its lowest. The BESS is sized for a co-incident period of low solar intensity (the "rainy week"). At most other times there is excess solar with the primary use of excess energy to charge the main battery.

Secondary uses of excess energy include maintaining battery ambient temperature to ensure long battery life (i.e. running the thermostatically controlled air conditioning unit) and powering communications enabling remote monitoring of the installation via the internet.

Additional uses of excess capacity include providing power to general power outlets and powering communications platforms (4G/LTE towers, UHF radio towers and emergency radio networks).

3.1 Case study: beef industry

There are over 38,000 beef cattle properties across Australia (ABS, 2015). Referring Figure 1 below, thousands of beef farmers fall within the off-grid or extreme fringe of grid regions.

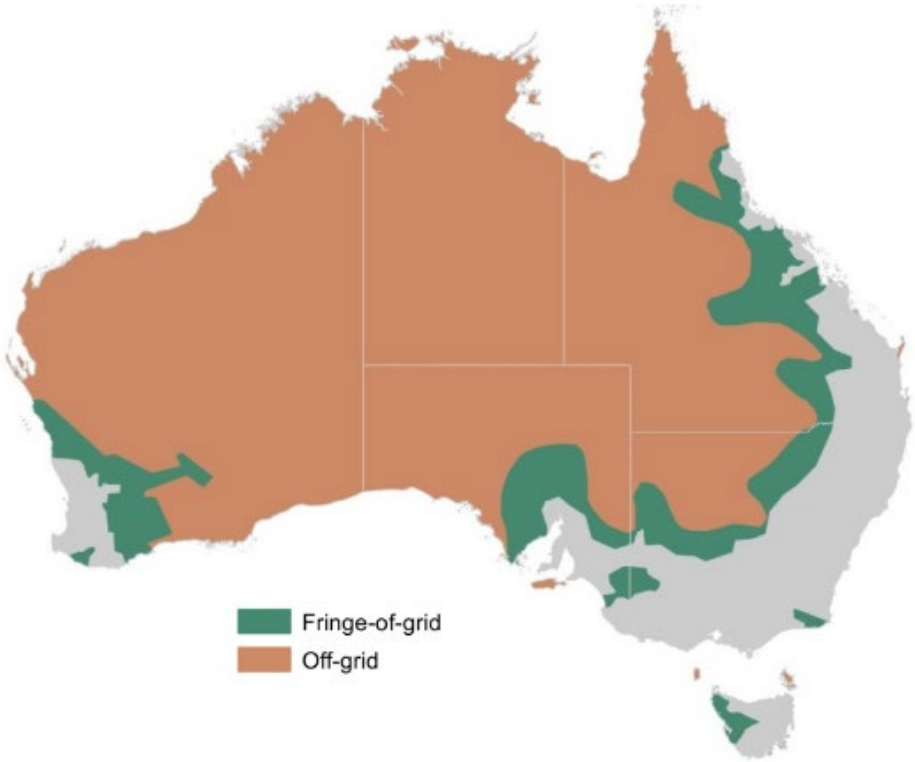

Figure 1: electricity network coverage overlaid on MLA beef regions (Source: AECOM, ABS)

The predominant energy solution for this market remains the diesel generator which has intermittent reliability, high noise and high emissions. While the market adoption of renewables is growing, high capital outlays remain a barrier to broader adoption. A complete solution built with flexibility and modularity will lower cost. Modularising renewable power generation equipment opens the door to a fleet-based solution to service the needs of remote and disperse groups of power consumers. Standardised equipment fleets are attractive to asset owners paving the way for a leased equipment solution for this market.

This project has proven high availability power from renewable sources is feasible in remote and harsh environments. Furthermore, the use of a noiseless power solution allows the power availability to be increased from a typical 15-hour operation to a 24-hour operation, improving quality of life.

In addition, further CAPEX reductions can be achieved by reducing storage capacity and maintaining 15-hour operations relative to 24-hour continuous oil and gas operations.

3.2 Case study: stand-alone power systems

On 30 May 2019, the Australian Energy Market Commission released its final report on the 'Review of the Regulatory Frameworks for Stand-Alone Power Systems - Priority 1'.

Referring Figure 2, the report sets out the Commission's recommendations for a regulatory framework to allow stand-alone power systems to be used in the National Electricity Market (NEM) as an alternative to standard grid supply.

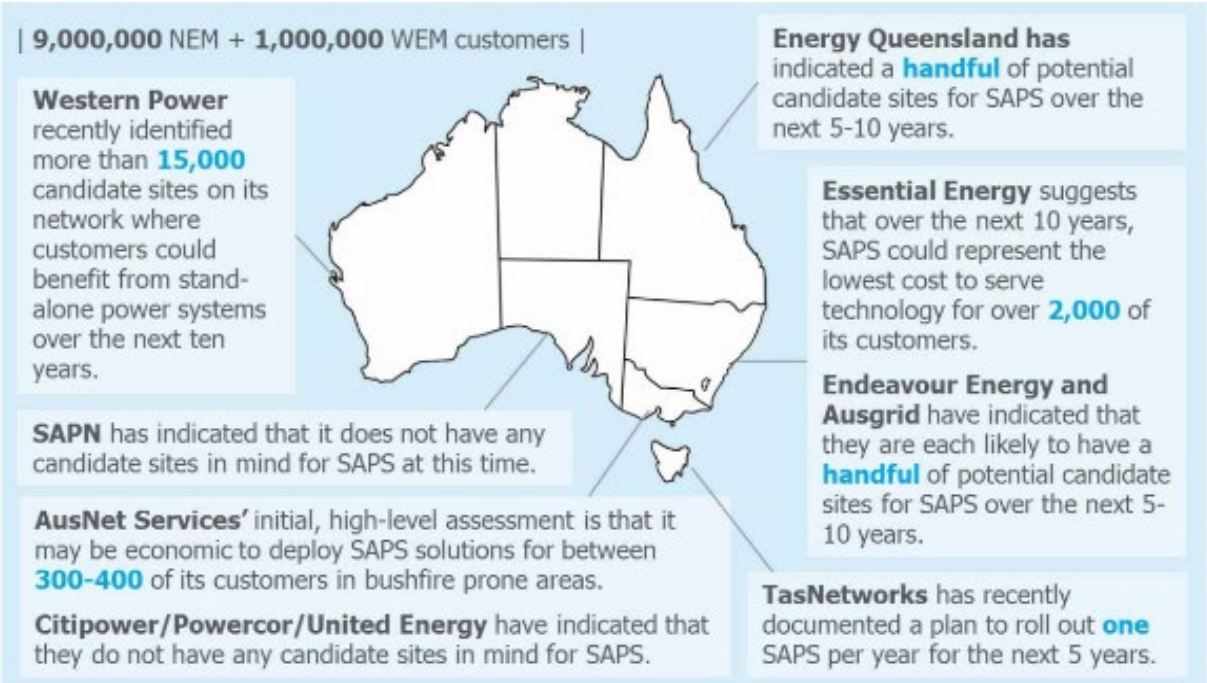

Figure 2: stand-alone power systems opportunities (Source: AEMC)

Modularising the solar and battery beam pump solution offers several advantages to the distributors, including commonality of equipment, efficiency in training and inventory, scalability and flexibility.

The demand profile for this application is expected to be similar to the beef industry case study. The solar beam pump trial has provided performance data to enable extension into this market with confidence.

4. Learnings and opportunities going forward

High capital costs associated with 24-hour renewable generation may be offset through developing moveable and multi-use power generation solutions. Increasing system modularisation enables moveable solutions and therefore access to wider financing models, such as leases or power purchase agreements. Furthermore, the costs associated with fixing ground mounted solar arrays are a material proportion of the total costs. Development of rapid deployment techniques to mount solar panels provides a material opportunity to reduce cost.

Battery costs remain high with battery storage offerings in the market today not well suited to the harsh conditions found in the remote power market or the transport conditions required to reach remote locations. Packaging methodologies need to move beyond the present industry solution of building rooms to accommodate system components to more tightly integrated packages including not only power subsystems but also ambient control, communications, security, vermin control, radiation damage, data collection, mobility and civil considerations.

The continued trajectory of declining battery costs which has mirrored that of PV will aid this technology.

Central to addressing these challenges is continued knowledge and information sharing to drive awareness of the developing product set and awareness of the viability of renewables.

5. Conclusion

The project has proven that renewable micro-grids (comprising solar and battery) can deliver high availability power in continuous load applications in remote harsh environments. Santos is leveraging the implementation of the solar beam pump project by introducing renewables into other areas within its operations.

Other industries such as agribusiness (beef) and remote power customers which lend themselves to stand-alone power systems can benefit from these learnings.

Further information can be requested through Chad Wilson, Vice President Energy Solutions Santos: chad.wilson@santos.com.