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# **Sandy Ridge:** The first Australian Mine to Operate on 100% Solar Power

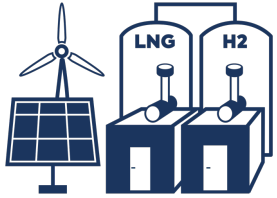
**Craig Blizard**  
Senior Technical Lead  
Pacific Energy



# Introduction

Who is Pacific Energy?

**40**  
YEAR  
HISTORY



**90+ POWER STATIONS**  
**1.1GW**



**A TEAM OF 550+**  
**ACROSS 8 LOCATIONS**



**Largest provider**  
**of remote**  
**off-grid electricity**



**48**  
**LONG-TERM**  
**PPAs**



**DECARBONISING**  
**MINING, INDUSTRY**  
**& GOVERNMENT**



**9MW**  
**WIND**



**72MW**  
**SOLAR**



**32MW**  
**BESS**



Strandline Resources,  
Coburn Mineral Sands Project



Tellus  
Sandy Ridge Facility

# Tellus Sandy Ridge System Overview

**Project:** Sandy Ridge Microgrid

**Client:** Tellus

**Project commencement:** June 2020

**Project completion:** November 2020 COD

The microgrid system was delivered under a Build-Own-Operate agreement, which covered turnkey delivery including design, engineering, procurement, manufacturing, installation, commissioning, operation and maintenance.

## Tech & Innovation

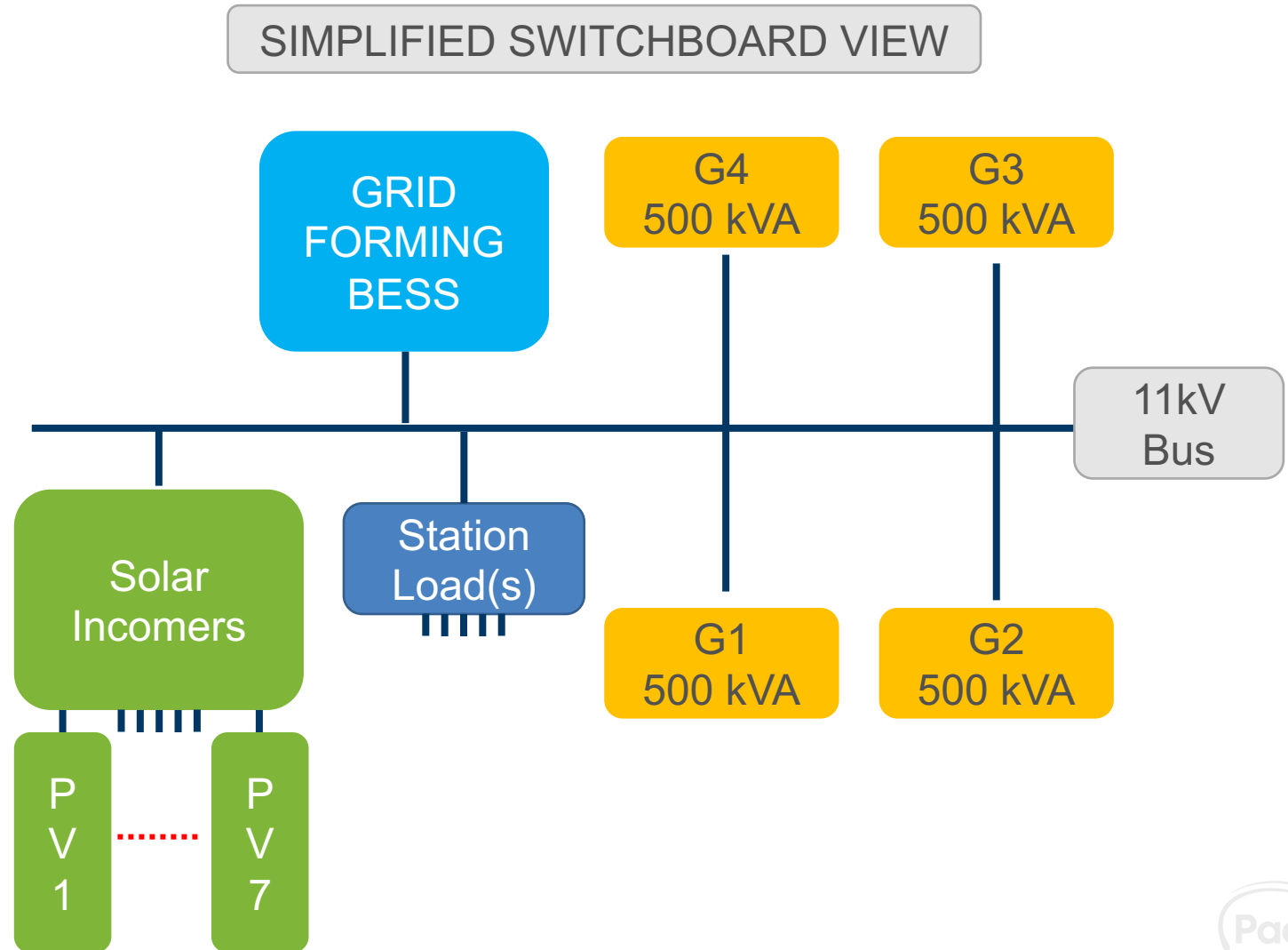
- Prior to this, no Australian mine site had achieved hydrocarbons off during daylight hours
- In house intelligent control logic and careful integration of IBRs
- Designed and manufacture of battery energy storage system
- The system can handle all environmental conditions
- A cloud camera device monitors cloud formations and their speed and direction of travel, predicting impact on system and adjusting the power sources to maintain stable energy supply



# Tellus Sandy Ridge – System Overview

## System Arrangement

- Unmanned site / fully autonomous
- Day Time HOF as target
- 800kW Solar farm  
(7 x 120kW Inverters)
- 300kVA / 350kWh BESS  
(PCS100 Grid Forming Inverters)
- 2MW back-up diesel plant  
(4 x 500kVA DGs)
- 250kW / 400 kW average / peak loads



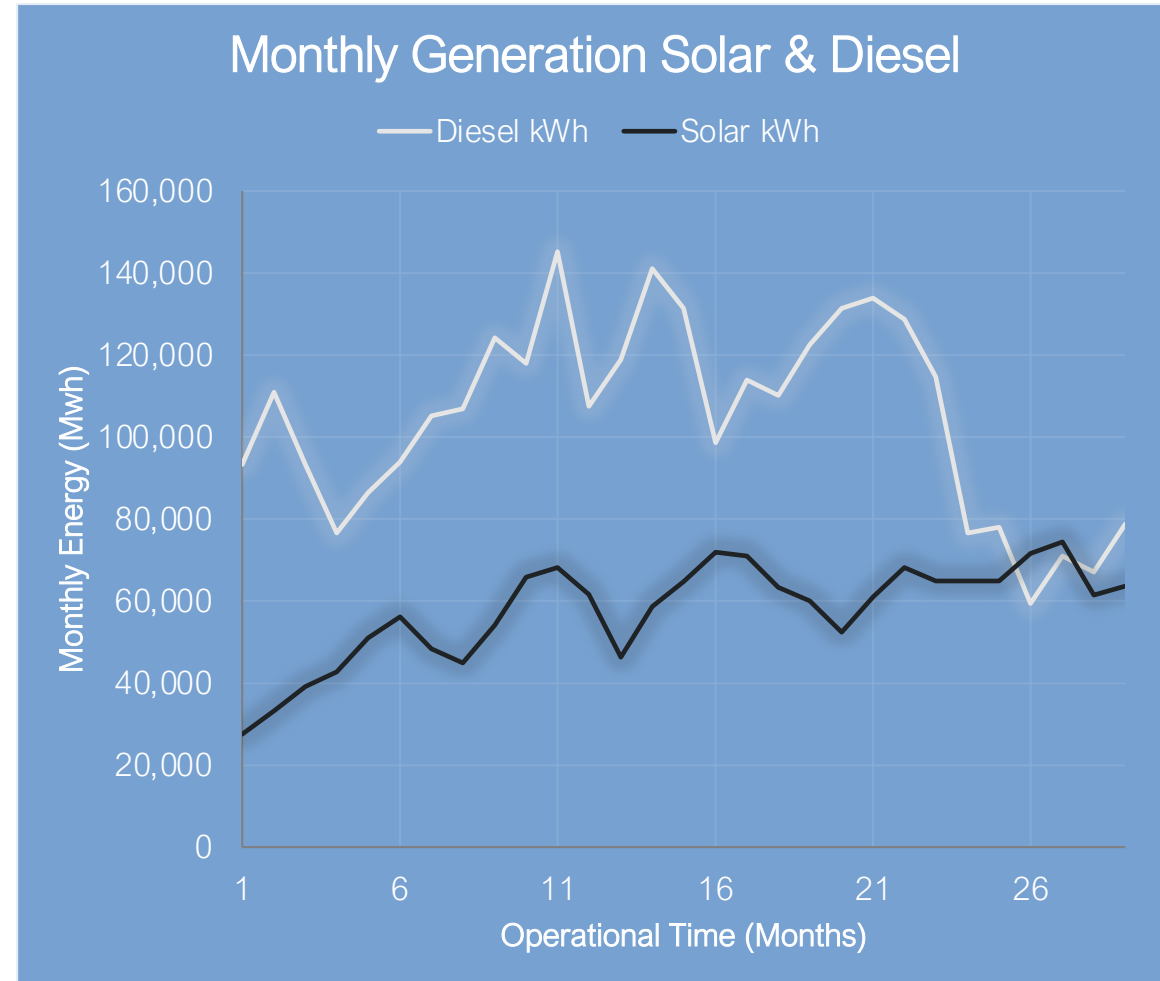
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## Tellus Sandy Ridge – Operational Outcomes



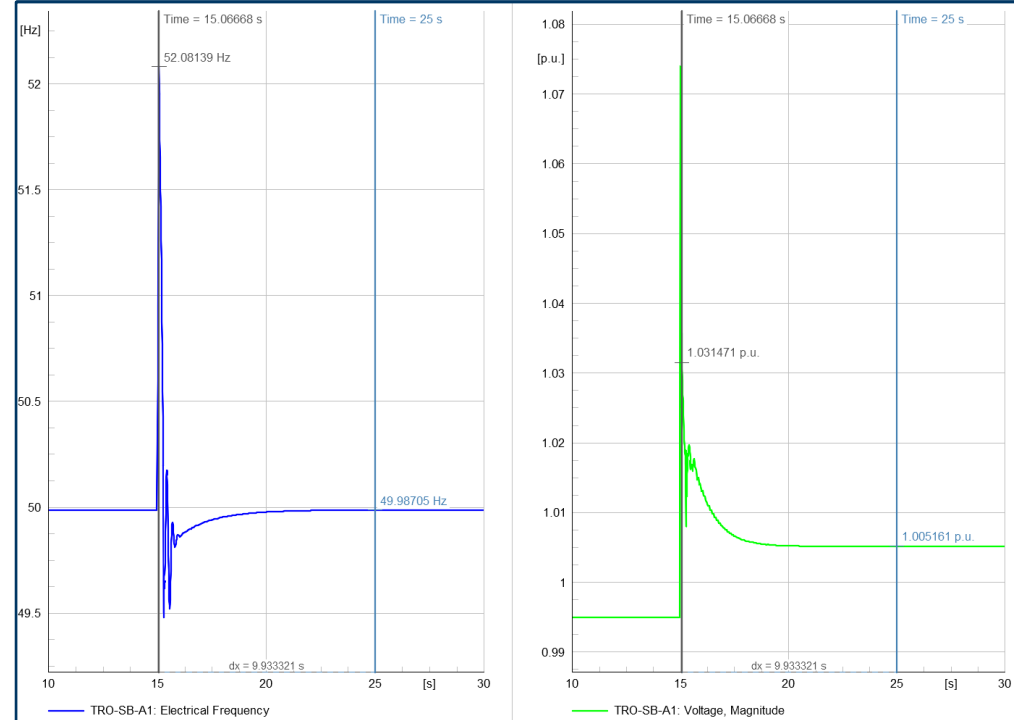
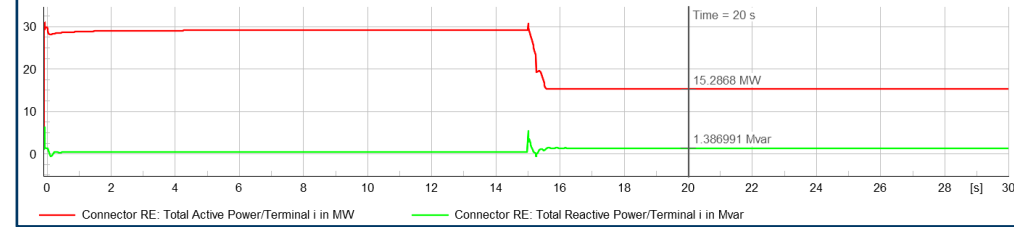
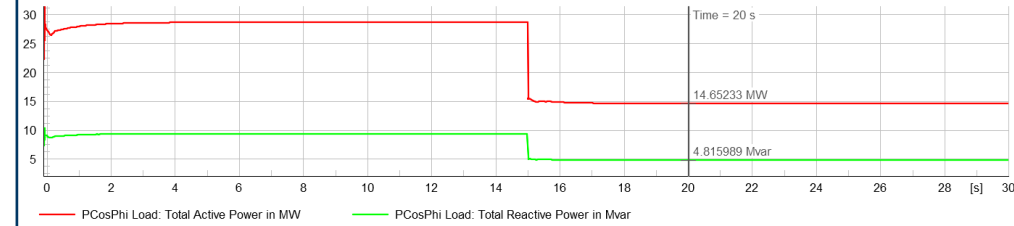
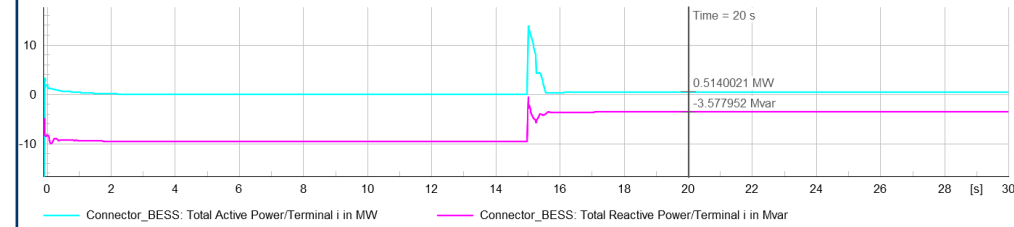
# Tellus Sandy Ridge – Operational Data

- Since Nov-2020, solar production of electricity by the Hybrid system has saved **471,047L** of diesel
- Reduced CO2 emissions by **1,318** tonnes
- Based on today's cost of **\$1.65** per litre of diesel, Tellus has saved **\$777,227.55** since Nov 2020
- National Pollution Inventory (NPI) results would be above the allowable threshold without the HOF operation
- Total Generation (kWh)
  - Diesel: 3,037,170
  - Solar: 1,676,325



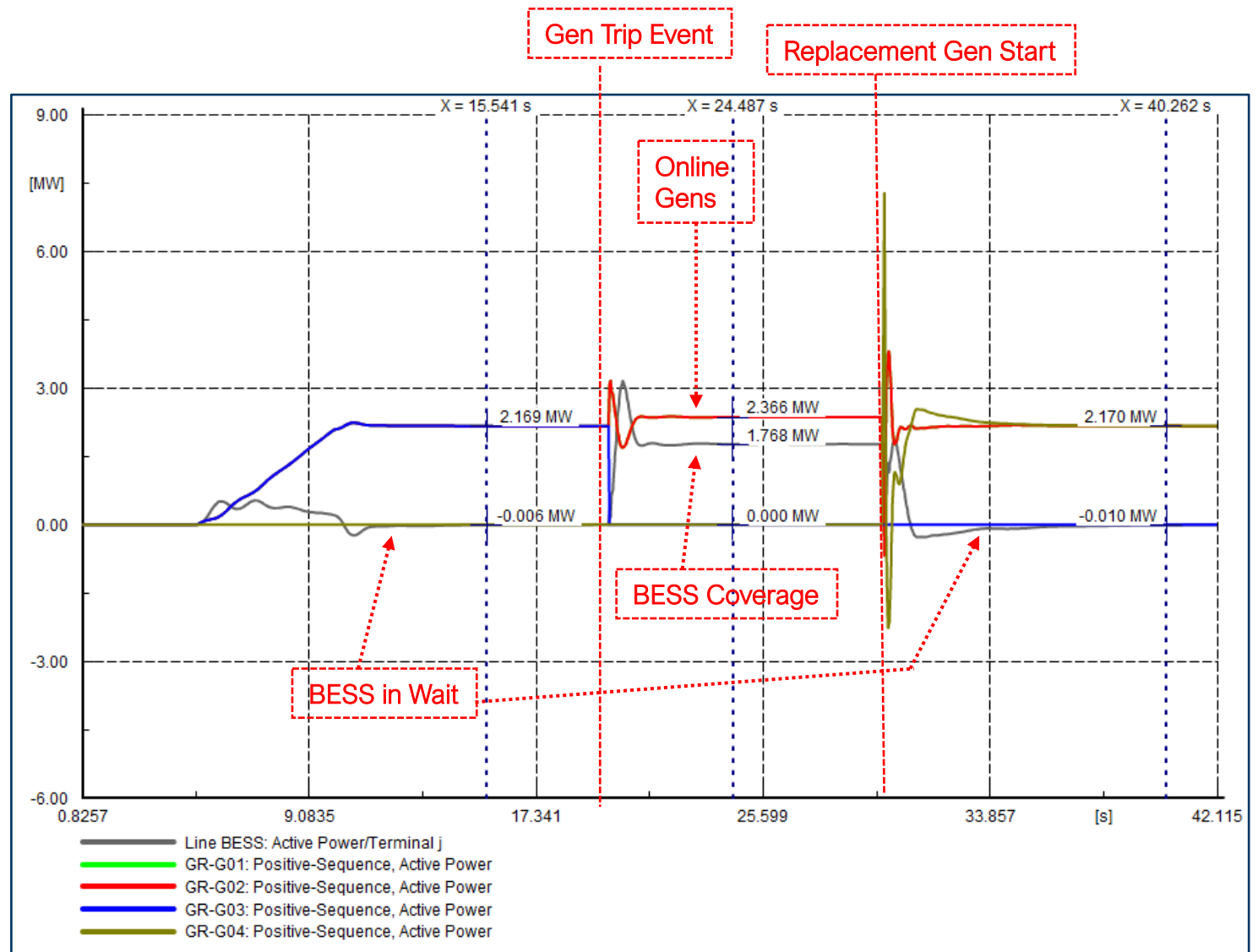
# Tellus Sandy Ridge – Key Takeaways

- Displacement of synchronous machines – who takes over those services? Who helps against the loss of system stability?
- Displacement of Inertia what does it mean in normal operation and during transients?
- Fault level drop – not just about protection / also about stability and inverter synchronisation (low SCR)
- Inverter selection of PCS100 voltage source inverters fundamental in terms of **capability** and **flexibility**
- PQ implications – harmonics / flicker and voltage imbalance
- Need to understand:
  - The **loads** (really well) – When do we have enough or too little for HOF?
  - The **renewable resource** dynamics – How much risk can we cover?
  - The **hydrocarbon generators** – How quickly can they start? How much can we count on them to take over?



# Recent Deployments

- Currently rolling out philosophy across multiple sites
- Increased plant capacities to above 10MW PV and spanning vendors and topologies
- Greater emphasis on protection coordination and on control system interaction studies
- Further utilisation of Grid forming BESS units to act as prime network resource rather than “support service”
- Sharing Q without compromising on dynamic VAR support



# Next Steps for HOF Mining

## At the Forefront

- Increased scale and greater combination of generating unit combinations
- Greater reliance on Grid forming for full time operation as principal swing machine(s) (not just helping the “machines”)
- HON as a backup case rather than standard operation
- Refinement in protection schemes beyond just the typical fault level coordination
- Wider participating of technology assets in system support and recovery i.e., frequency droop on all assets
- Wider OEM agnosticism and greater optimisation in mix between the grid forming asset types
- Greater emphasis on system studies even for mining – less about compliance and more on optimised operations
- Electrification of fleet driving major changes in load behaviour
- Possibility for H2 utilisation (Denham example case)



Galena Mining  
Abra Base Metals Mine



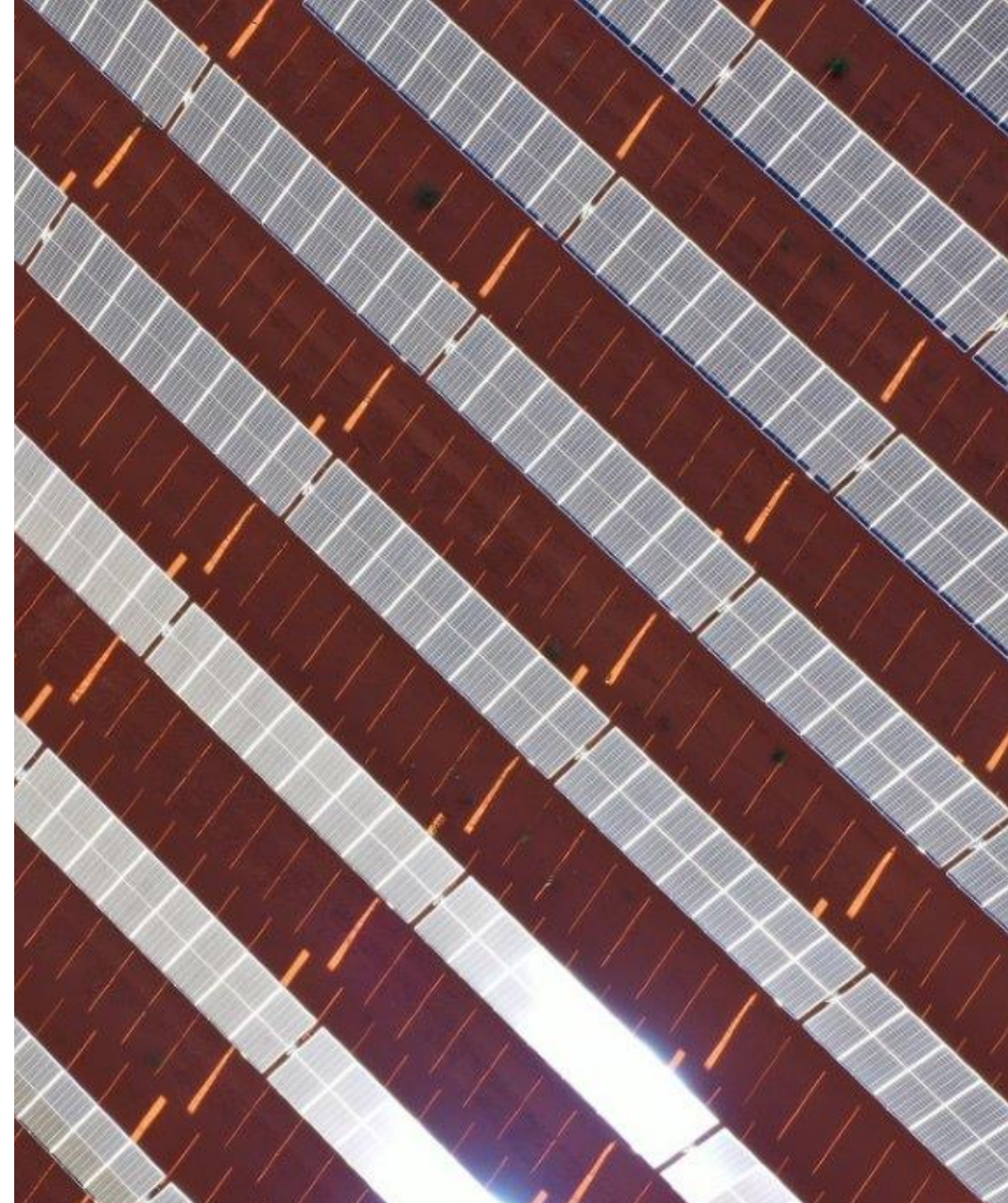
Westgold Resources  
Tuckabianna

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# Industry Commentary

## Zero Carbon Mining

- Sandy Ridge, recent and upcoming projects demonstrate that its achievable
- Power System balance and equipment selections critical
- Commercial and technical KPIs must go hand in hand
- The methodology that works for smaller systems remains scalable many MW
- Learnings here and in current projects demonstrate suitability against range of different scenarios and equipment selections
- Important to underline it's doable and commercially viable but...
  - Don't oversimplify the process
  - Invest time upfront to get power system, control and commercial models working



# Pacific Energy. A Final Snapshot.



Australia's #1 remote energy provider and market leader in integrated renewables.



Highly experienced industry professionals, passionate about customer service.



Unmatched record of project delivery, safely, on time and on budget.



Unique in-house skills covering thermal, renewable, grid connected and off-grid, storage and stand-alone power systems.



Maximising customers' energy efficiency and minimising emissions by utilising advanced technologies.



Well capitalised, with long term support from QIC.



Trusted energy supplier of leading brands:



Fortescue



WESTGOLD  
RESOURCES LIMITED



ANGLOGOLD  
ASHANTI



HORIZON  
POWER



westernpower



NORTHERN STAR  
RESOURCES LIMITED



CAPRICORN  
METALS LTD



Pilbara  
Minerals



REGIS  
RESOURCES LTD