KANMANTOO PUMPED HYDRO

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All currency referred to is Australian dollars ($) unless otherwise indicated (e.g. US$).
PROJECT OVERVIEW
OVERVIEW
TURNING EXISTING MINE INTO PUMPED HYDRO STORAGE OPPORTUNITY

KEY TAKEAWAYS
- 220MW for 6 hours generating over 1,300MWh
- 5km to 275KVA line
- Site studies already complete to Regulator standards for mining project – transferrable to PHES
- Plausible commissioning by Q4 2021
Key metrics highlight that the Kanmantoo site is one of the best sites for Pumped Hydro Energy Storage in Australia:

- Very low capital cost at < $1M / MW and < $160 / kWh
- Fast to market; possibly commissioned by end 2021
- Infrastructure already in place (ponds, water, buildings, roads, power)
- Proximity to grid and proposed renewable energy projects
- Existing studies and knowledge (environmental, geotechnical, geology, hydrogeology)
- Long established social licence to operate
- Project site 100% owned freehold land with room to establish 40MW solar facility
- Responsiveness provide spot market arbitrage and FCAS opportunities
- Low technology risk

**KEY TAKEAWAYS**

- Speed to market potential due to infrastructure and site knowledge, with low capital cost to develop, and access to various revenue streams making Kanmantoo one of the best sites for PHES development in Australia.
Hillgrove Resources (ASX:HGO) is a copper / gold producer with production and exploration assets in South Australia.

Hillgrove’s goal is to become a mid-tier copper/gold resources group with growth from the Kanmantoo Copper Mine and regional exploration discoveries.

In addition, there is an opportunity at the end of pit life to establish a Pumped Hydro, which is an enabler as a one off value generator, revenue stream or combination; **IT IS NOT CORE BUSINESS**

**KEY TAKEAWAYS**

- Hillgrove has no desire to become an energy generator and is actively looking to realise value for the pumped hydro asset
- Mining of the lower pond anticipated completion by mid 2019
- Preliminary study for Pumped Hydro Energy Storage Facility complete
- Definitive feasibility study underway
KEY CRITERIA
KEY TAKEAWAYS

- Over 400m available head at site; initial studies shows optimum head between 212m and 270m
- Short distance between ponds keeps capital cost of penstock low
KEY TAKEAWAYS

- Concept uses available mine waste rock to construct 3 GL dam.
- Waste rock has been used on site to already construct 28 GL tailings dam to ANCOLD standards.
KEY TAKEAWAYS

- Over 145,000m of drilling and 200m vertical of exposed pit face with structural mapping.
- Historic underground mining and geotechnical assessment of drill core provide excellent understanding of cavern, shaft and tunnel requirements.
- Previous 6m x 6m tunnelling experience with minimal rock support.
- 3D stress analysis completed demonstrating acceptable FOS for proposed lower pond walls.
**KEY CRITERIA**

**HYDROGEOLOGICAL / HYDROLOGY KNOWLEDGE**

**KEY TAKEAWAYS**

- Array of water quality monitoring bores established for over 10 years and measured regularly
- Extensive baseline, operating data and modelling complete for the mining operation to standards already accepted by Regulator for major project development.
KEY CRITERIA
ENVIRONMENTAL KNOWLEDGE

ALREADY HAVE ENVIRONMENTAL STUDIES ACCEPTED BY REGULATOR FOR A MAJOR PROJECT

- Flora / Fauna – baseline, operational and Ecosystem Function Analysis
- Noise – established monitoring program and sensitive receptor modelling
- Air Quality – real time monitoring network established using 6 beta-attenuators ensure compliance during PHES construction
- Rehabilitation – established rehabilitation program and endemic seed propagation facility to meet SEB offsets created by PHES

KEY TAKEAWAYS

- Extensive baseline, operating data and modelling complete for the mining operation to standards already accepted by Regulator for major project development.
LONG ESTABLISHED SOCIAL LICENCE TO OPERATE

- Over 13 years of ongoing consultation with the local community and Regulator
- Recognised as best in industry as recipient of Premier's Award for “Excellence in Community Support”
- Project support from Federal MP and State MP

BEST IN INDUSTRY COMMUNITY RELATIONS AT KANMANTOO

KEY TAKEAWAYS

- Local community supportive of Pumped Hydro at Kanmantoo
Two existing pipelines provide 2.5GLpa of water to the site from separate sources with contracted water supply and water licence in place.
5km to 275KVA line via established easements. Two options under consideration.

Location of proposed PHES in close proximity to proposed 375MW wind facility at Mannum and 127MW solar facility at Tailem Bend.

Connection enquiry process underway with ElectraNet.
Hillgrove own the land of the proposed PHES site freehold with no Native Title claimants.
KEY TAKEAWAYS

- Basis of design 220-250 MW for 6 hours producing upwards of 1300MWh.
- Additional storage capacity in upper and lower pond to run longer if economical but optimal returns in current SA market achieved with 4-6 hour operation.

Source: Cultana Knowledge Sharing Report 2017
Capital cost less than $1M / MW driven by:

- Short distance between ponds reduces penstock capital.
- High head arrangement reduces machine and cavern size, which are in good ground.
- Close proximity to grid.
- Existing infrastructure and knowledge from mining operation applicable to PHES studies.
- 100% freehold of site.
- Simple process with low technological risk.

Comparison of CAPEX per installed MW

Source: Public data on respective projects

**KEY TAKEAWAYS**

- One of the lowest capital cost per installed megawatt storage projects in Australia.
Capital cost less than $160 / kWh which places project well below industry range and competitive with other storage technologies.

Source: Lazard Levelized Cost of Storage Analysis v2.0, 2016

**KEY TAKEAWAYS**

- One of the lowest capital cost per kWh generation in Australia.
**KEY CRITERIA**

**VALUE IN ENERGY AND FCAS MARKETS**

- Fixed speed reversible pumped turbines, fast response (~10 sec) due to short waterways and low capital cost of project provides market opportunities in:
  - Arbitrage in spot market.
  - Firming contract with RE projects.
  - $300 caps.
  - FCAS; Synchronous condenser mode with ~10 seconds mode change to full load.
  - Potential for black start.

**KEY TAKEAWAYS**

- Kanmantoo is well suited to compete in both the energy and the FCAS market because of the low capital cost and very rapid mode change capability due to the short water ways.
- Low capital and fast response enables opportunity to chase arbitrage in spot market.

*Source: Watt Clarity*
KEY CRITERIA
LAND AVAILABLE FOR COMPLIMENTARY SOLAR PROJECT

100% LAND OWNERSHIP  
+  
GRID CONNECTION  
+  
PUMPED HYDRO CONSUMER  

OPPORTUNITY FOR LOW CAPITAL COST SOLAR FACILITY AT KANMANTOO

KEY TAKEAWAYS

- Sufficient freehold land adjacent to the network connection point to establish a 40MW solar facility to supply power to PHES and / or directly to market.
- Design uses simple, proven processes and technology
  - Not reliant on unproven / novel concepts to be successful such as using seawater or developing evaporation covers.

- Site is 100% owned as freehold
  - No native title claimants.

- Site is already permitted and established as a mining project.
  - Excellent understanding of geotechnical risk, hydrogeological risk, environmental and social impacts.
  - Successful ANCOLD dam construction using rocks stockpiled near upper pond site, established rehabilitation processes.
  - Existing infrastructure speeds build; lower pond being constructed as part of mine, water supply already on site, existing easements for nearby network connection to 275kVA line.

**KEY TAKEAWAYS**

- The existing mining operation de-risks the PHES project through existing knowledge, infrastructure, and permitting, which reduces cost and time to market.
KEY TAKEAWAYS

- Operational by Q4 2021 which makes it one of the first to market in Australia.
Hillgrove have no desire to become an energy generator but seeking to realise value for shareholders by monetising the pumped hydro opportunity.

- Continue definitive feasibility study to increase project value and maintain timing to market.
- Seek partner to take this forward with / without Hillgrove.
- Open to buy out, revenue royalty stream or combination.

**KEY TAKEAWAYS**

- Hillgrove intend to advance the project to maintain timing to market whilst assessing divestment and development options.
Key metrics highlight that the Kanmantoo site is one of the best sites for Pumped Hydro Energy Storage in Australia;

- Very low capital cost at < $1M / MW and < $160 / kWh.
- Potential to be first to market; commissioned by end 2021.
- Infrastructure already in place (ponds, water, buildings, roads, power).
- Proximity to grid and proposed renewable energy projects.
- Existing studies and knowledge (environmental, geotechnical, geology, hydrogeology).
- Long established social licence to operate.
- Project site 100% owned freehold land with room to establish 40MW solar facility.
- Responsiveness to provide spot market arbitrage and FCAS opportunities.
- Low technology risk.

Hillgrove actively seeking investors to develop Kanmantoo PHES project

Further information:
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