The Nickel West Journey Continues

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Nickel West is well placed to become a globally significant battery material supplier

Options to extend the life of our assets through the discovery and development of new mines: Yakabindie, Venus, B11 and others

Aspiring to increase the capacity of the refinery to 84kt of refined Class I metal by further debottlenecking investments

Investing in downstream battery chemicals like nickel sulphate

Cobalt sulphate testwork underway

Progressing a concept study which explores the feasibility of building a cathode precursor plant at the Kwinana Nickel Refinery
We met five of the world’s largest battery producers

- Car makers are planning significant growth in electric vehicle sales.

- Battery producers are expected to match electric vehicle growth rate while responding to growing demand from other areas i.e. Stationary Storage.

- Industry expectations for growth are remarkable - between 25% and 40% CAGR to 2025¹.

- Battery producers are also expected to play the leading role in delivering price parity with Internal Combustion Engines (ICE) (~US$100/kwh).

Battery producers have a tough job

¹. Source: BHP
The adoption of nickel rich chemistries is accelerating

Lithium-ion nickel-rich chemistries win

• Virtually all battery producers are moving to higher nickel-rich chemistries.

• Since our last visit to North Asia eight months ago (February 2017) it seems that the transition to higher nickel chemistries is accelerating.

• Nickel-rich batteries (higher intensity NMCs and NCAs) are preferred due to their:
  - superior energy density
  - lighter weight for any given battery size
  - increased vehicle range
  - lower metal cost.

**Li-ion batteries: Comparison of EV range and base metal cost using Tesla Model 3 NCA 8.5-1-0.5 battery as reference**

EV range for same EV pack weight as Tesla 3
Base Metal cost for same kWh as Tesla 3
Source: Golden Road Inc; BHP Analysis
Nickel powder and briquettes are best for batteries …

Nickel West has an advantaged position to produce nickel sulphate product

- NPI and Ferronickel are unsuitable for the battery market and they make up almost half of the world’s production.
- Cathode will be more expensive to convert.
- Other salts and hydroxides, while attractive, are small quantities and fully consumed already.
- Nickel hydroxide has low margins and is available only in small quantities.

Global Primary Nickel Production 2016 (kt)

Source: Heinz H Pariser
Nickel West has an advantaged position to produce nickel sulphate product

- We are the largest producer for briquettes and powder.
- We have access to sulphuric acid from Kalgoorlie Nickel Smelter.
- We are close to the Asian market.
- Free Trade Agreements with China, Japan and South Korea is a strategic advantage.
- Further expansions are available.

Source: BHP Analysis
Nickel West’s transition to becoming a battery material supplier is well underway

Sales to the battery sector anticipated to reach 50% by end CY18

- Powder sales to China are growing quickly.
- Briquette sales to Japan are growing even more rapidly.
- Nickel sulphate production will further increase battery sector sales in 2019.

Nickel West’s Nickel Briquette and Powder Sales to Global Battery Industry (% of sales)

Source: BHP Analysis 17 October 2017

Australian Nickel Conference
17 October 2017
Nickel sulphate interest exceeds expectations

**Significant underlying demand:**

- Interest by potential customers in nickel sulphate is significantly exceeding expectations and Stage 1 production capacity.
- While conversion to contracts is expected to see demand tighten, it is clearly very strong.
- Australian Free Trade Agreements with China, South Korea and Japan a significant advantage.
- Timing for Stage 2 to 200ktpa will be reviewed.
- Stage 2 may be brought forward.
- Preventing nickel sulphate shortages will provide added confidence to the battery market that raw material supply will not impact expansion plans.

**Stage 1 to 100kt project remains on track**
Kwinana Refinery is being expanded and modernised

**Refinery debottlenecking aspiring to take capacity to 84kt**

- As debottlenecking investments are being made, the latest technology is being installed.
- Nickel sulphate Stage 1 will be fully automated.
- Various investments are being made to automate existing processes.
- World-class equipment purchased to create a fully automated laboratory.
- Together, these and future investments will improve process stability, improve recovery and product quality, and reduce costs.
This year we conducted over 20 visits across the supply chain in China, South Korea and Japan
These meetings convinced us that there was a rapidly growing market for nickel sulphate.
We are making good progress on our cobalt sulphate plans

Nickel Metal Units
Nickel Sulphate
Cathode precursor
Li-ion cathode active materials
Li-ion battery cathode
Lithium-ion battery
EV and ESS

Cobalt Metal Units
Cobalt Sulphate

Mn/Al Metal Units
Mn/Al Sulphate

Metal Units
Cathode precursor
Li-ion cathode active materials
Li-ion battery cathode
Lithium-ion battery
EV and ESS
Together these investments could underpin a cathode precursor plant

- Nickel Metal Units
- Cobalt Metal Units
- Mn/Al Metal Units

Precursor

- Nickel Sulphate
- Cobalt Sulphate
- Mn/Al Sulphate

Cathode precursor

- Li-ion cathode active materials
- Li-ion battery cathode
- Lithium-ion battery
- EV and ESS
Kwinana Refinery has numerous advantages that may support a cathode precursor investment

**Nickel West is conducting a concept study**

- Kwinana would already host the world’s largest nickel sulphate plant.
- Kwinana already uses an ammonia leach process.
- Caustic soda is available locally.
- The additional nickel sulphate would again use sulphuric acid from our Kalgoorlie Nickel Smelter.
- Any investment would leverage the existing infrastructure at the Kwinana Refinery.
- Precursor facilities use liquid nickel sulphate avoiding crystallization and redissolution.
- With full automation, we would aim to be one of the lowest cost precursor makers.
Nickel West aspires to make a difference

• Nickel West is a fully integrated mine-to-market business with end-to-end control of its supply chain in a safe, low-risk sovereign environment.

• We have mineral resources to support the business to 2040 with a series of new mines planned to be developed over the next five years.

• We are well placed to become a globally significant battery materials supplier.

• Class I nickel powder and briquette is the preferred product for the battery market and we are the largest producer in that segment.

• We have approved the construction of a 100,000 tonne nickel sulphate plant.

• Nickel West will continue to strive to energize our future.