

## ASX Announcement

16 April 2024

### Speaker Presentation – Paydirt’s 2024 Battery Minerals Conference

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Attached is a copy of the Speaker Presentation that will be presented by Globe’s Chief Financial officer, Charles Altshuler, at Paydirt’s 2024 Battery Minerals Conference being held on 16 and 17 April 2024 in Perth, Australia.

The speech is titled ‘Niobium is powering the future, facilitating the advancement of next-generation Li-ion batteries’.

This announcement was authorised for release by Paul Hardie, Company Secretary.

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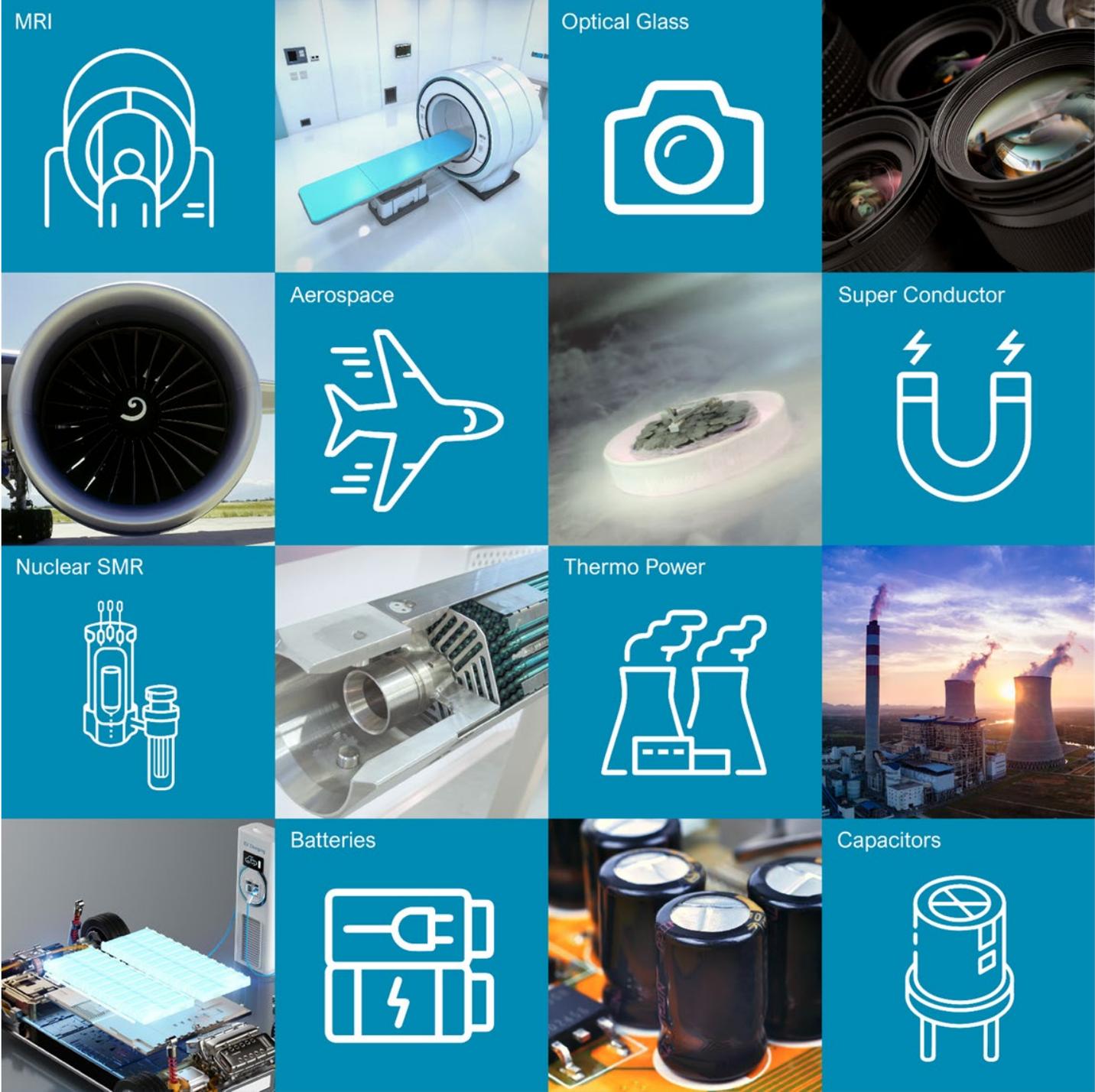
# Niobium is powering the future, facilitating the advancement of next-generation Li-ion batteries.

*An essential metal driving the Industrial Revolution 4.0*

Paydirt's Battery Minerals Conference 16-17 April 2024

**Charles Altshuler**  
Chief Financial Officer

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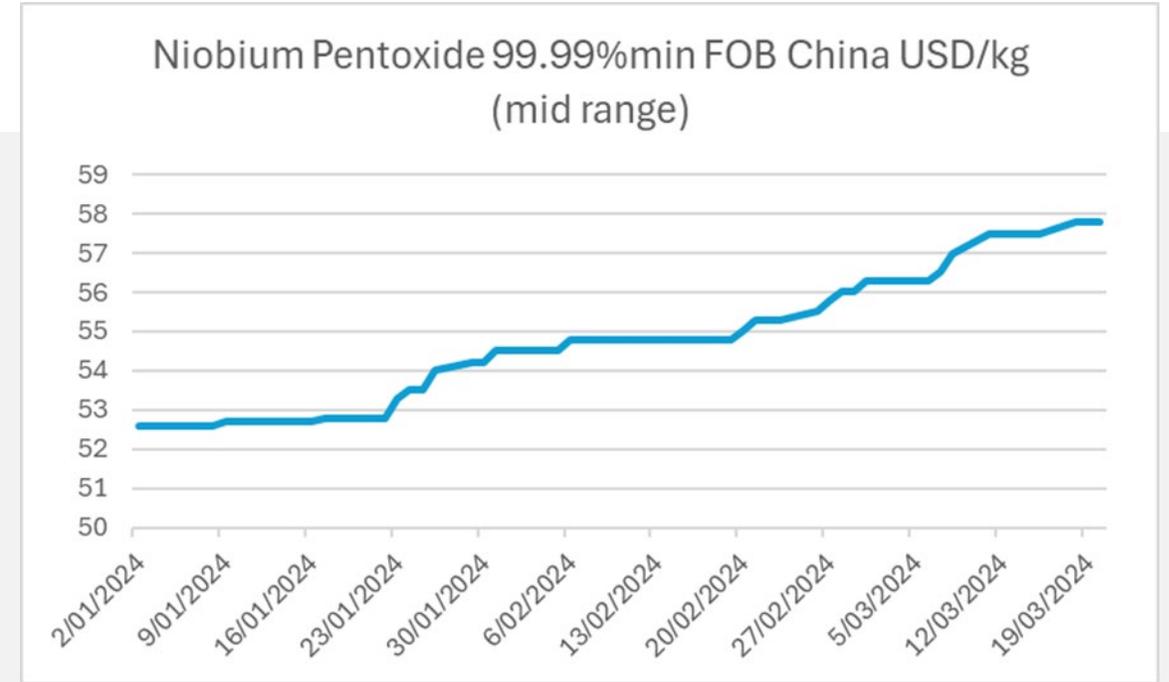
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# So Why Niobium?

# Critically ranked Number 3 of 35 on the US Critical metal list

Niobium is considered critical not just in USA but also in the EU, Australia, Japan, and India.

Commodity	Price per tonne at 1 April 24
Niobium oxide	\$US 58,000
Nickel	\$US 16,560
Copper	\$US 8,770
Colbalt	\$US 28,549
Lithium	\$US 15,152



- Niobium, a metal that has economic importance, as well as significant dependency on imports. Used in industries such as aerospace, the military and those related to the New Economy, especially in electronics and renewable energy.
- The critical label is due to having only three major producers worldwide currently, with a majority of production occurring in Brazil. Only 1 currently procures Niobium Oxide.
- Current niobium oxide ( $Nb_2O_5$ ) prices are \$US58,000t for 99.9% (FOB China). Increasing prices over the last 4 months.

# Advancing the energy transition through the propulsion of the next era of lithium-ion batteries.

Niobium oxide makes batteries greener, cheaper and cleaner and cobalt free.



Ultra-fast charging

Niobium oxide batteries can be fully charged in less than

**10 minutes**

at lower operating temperatures



Increased range

Niobium oxide increases the energy density of batteries by

**200%**

at a lower material cost



Better performance

Niobium oxide batteries are more stable and can withstand

**10,000**

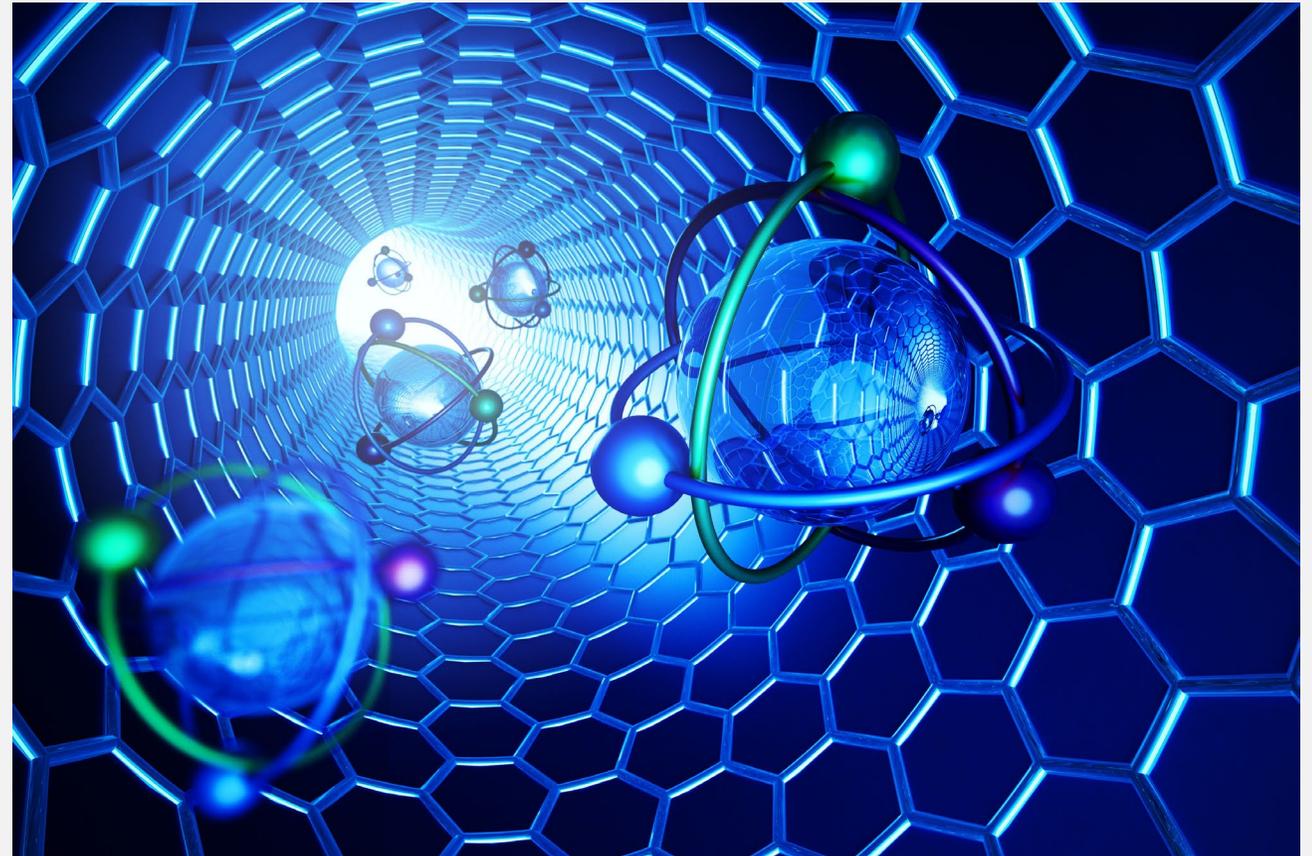
charging cycles



# Crystalline structure facilitates easier and faster transport of lithium ions into the anode during charging.

Niobium oxide atoms have multiple “parking spaces” moving from the cathode to the anode.

- During charging, lithium ions move from the cathode to the anode, typically made of graphite.
- Rapid charging can cause lithium metal to accumulate on the graphite's surface, leading to performance degradation and risks like short circuits, overheating, and fires.
- Initially, niobium pentoxide has an amorphous structure, but after multiple charge-discharge cycles, it transforms into an ordered, crystalline structure.
- This transformation suggests the material's potential for fast charging and its ability to store a large amount of charge.



# How is Niobium used today in batteries?

# Powering the mining industry for a net-zero future: Enabling Electrification

Skeleton Technologies has successfully implemented supercapacitor and SuperBattery energy solutions using Niobium in various mining applications.

- Case studies highlight significant fuel savings, extended equipment lifespan, improved overall performance and reliability, even in harsh mining environments.
- An electric mining truck using this technology (no fossil fuels) can drive down the ramp (5-50 mins), load for 5 minutes, drive back up the ramp (5-50 mins), unload for 5 mins while charging at that point for +/-90 seconds and continue the cycle.
- Major manufacturers like Caterpillar and Komatsu are also progressing with electric heavy mining trucks.



# Niobium Tungsten in both anode and cathode materials

Nyobolt EV (Lotus) 35 kWh battery pack, 250 km Range and recharge in six minutes using a 350 kW DC fast charger.

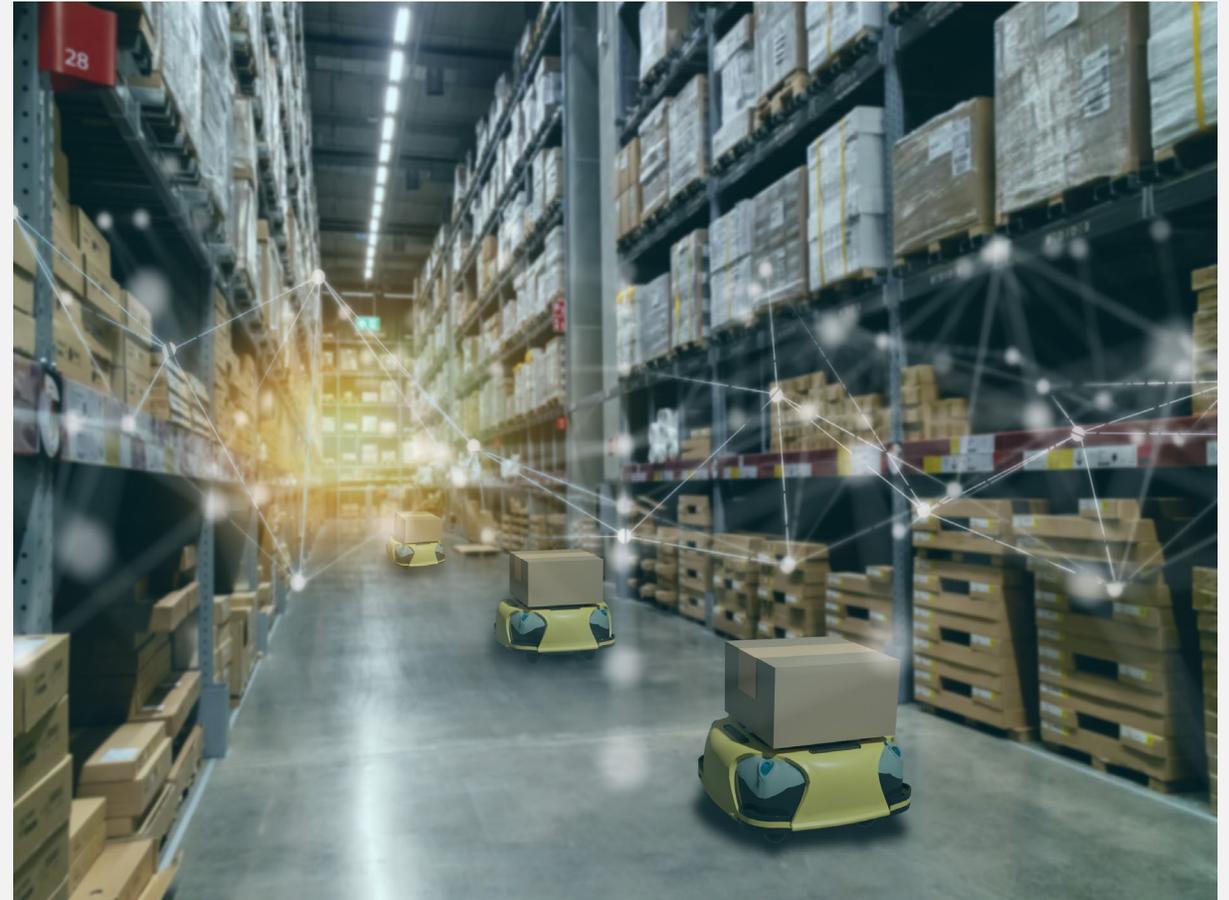
- Nyobolt are investigating alternative anode materials such as niobium tungsten and silicon due to their high energy density, as opposed to the commonly used graphite.
- Niobium-based anodes present promising solutions to overcome the limitations of graphite. They offer faster charge-discharge rates and longer battery life.
- Niobium cathode coatings and dopants are under exploration to enhance the stability and performance of cathode materials, especially in high-nickel NMC compounds. They mitigate degradation reactions, improving cathode stability, extending battery lifespan, and reducing first-cycle capacity losses.



# Enhancing Efficiency and Performance in Industrial Robotics

Nyobolt specializes in advanced battery materials using Niobium, designed for industrial and robotics applications.

- With the shift towards round-the-clock supply chain operations, it's imperative that material handling equipment is equipped with batteries capable of rapid charging.
- Nyobolt's fast-charging, long-lasting batteries answer this pressing need, fostering heightened productivity and simultaneously curbing system expenses.
- Charging time is reduced to less than 5 minutes – in ambient, refrigerated and freezer warehouses – meaning a significant increase in robot uptime and fewer robots to complete.



# Power tools – rapid charging at body temperatures

Battery Streak's lithium-ion batteries-80% capacity after 3,000 cycles compared to conventional batteries' decline after 1,000 cycles.

- Distinguishes itself with nanostructured titanium niobium oxide anodes, a departure from conventional graphite anodes, enhancing battery performance and longevity.
- To be implemented by Stanley Black & Decker.
- Contracts signed in Taiwan and Germany.



# Fortescue acquired Williams Advanced Engineering in race to net zero in 2022

High performance battery and electrification systems are at the core of Fortescue's zero emissions targets.

- Collaboratively, CBMM has pioneered advanced technologies in lightweight, safe batteries, and electronics, thereby catalyzing the automotive sector transformation, with Formula E as a pivotal ally.
- This same technology is being used by WAE.
- But Fortescue did not spend US\$223m on WAE to get into racing. This Formula E technology will help bring green energy to life in Fortescue's 3km long freight trains and its 400 tonne haul trucks and industrial heavy mobile equipment.



# VW, Toshiba and CBMM partners in the development of electric trucks and busses in Brazil

Niobium oxide in the battery anode of the bus: ultra-fast charging operation in less than 10 minutes.

- Toshiba has been directing its efforts towards exploring Niobium Titanium Oxide (NTO) as a potential next-generation anode material.
- NTO aims to enhance battery capacity while retaining the excellent features of lithium titanium oxide (LTO), the traditional anode material used in SCiB™ batteries.
- NTO offers approximately three times higher theoretical volume capacity density compared to LTO, while also delivering the benefits of LTO, such as extended lifespan and rapid charging capabilities



# Echion stands as the foremost provider of Niobium based anode materials for trains

Train operating companies benefit from practical fast-charging, increasing fleet productivity and route viability.

- For OEMs, it enhances battery performance in both pure electric and hydrogen fuel cell rolling stock, optimizing energy density for maximum acceleration and regenerative braking power.
- These batteries provide higher energy density and extends the range of electric rolling stock, reducing the need for frequent charging and potentially lowering track access charges.
- Infrastructure managers benefit from longer-range electric rolling stock, reducing the need for extensive overhead line equipment and making zero-emission branch lines more economically viable.



And it's not just  
batteries!!!

# Trains

## Superconducting Maglev train in Japan uses Niobium in it's magnets.

- It's groundbreaking technology by JR Central, capable of reaching speeds of 600 kmph.
- What's even more fascinating is that it operates at a temperature of -270-degree c.
- By cooling niobium-titanium alloy using liquid helium, this system achieves stable superconductivity.
- Semi-permanent electric current feeding and powerful magnetic forces, all without any thermal energy loss.



# Aerospace and Defense

Airplanes, helicopters, rockets, satellites, space stations, and spacecraft.

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- High strength-to-weight ratio, which is crucial in aerospace design for reducing the weight of the aircraft or spacecraft while maintaining structural integrity and performance.
- Stable at high temperatures, which is ideal for components that are exposed to extreme heat, such as jet engines and rocket propulsion systems.
- Enhanced proclivity for weldability and fabricability. This allows for production of complex aerospace components with precise specifications.
- Lightweight, durable components that can withstand the stresses and strains of aerospace operations, from takeoff and landing to the rigors of space travel.



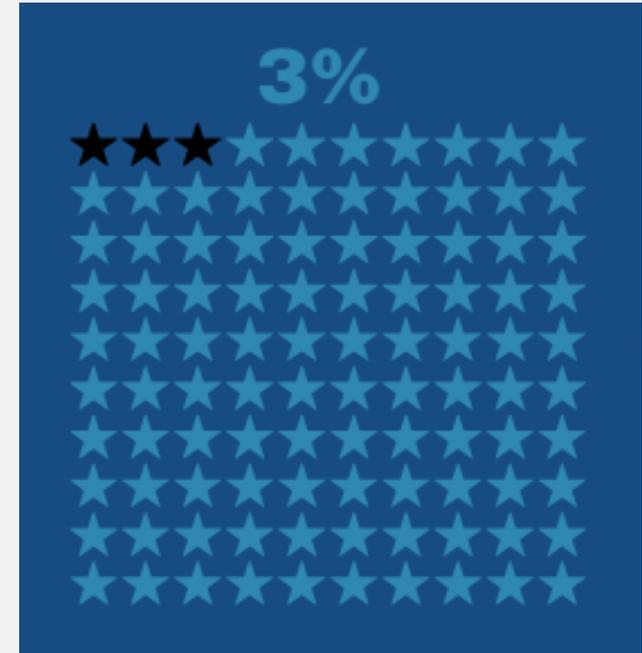
What does this  
all mean for  
Globe?

# Globe JORC Resource -68mt's

## 3000 tons of Niobium oxide production at full capacity

- The potential of electrification in mining trucks, particularly those with capacities of 90 tons or more, is significant globally, especially in regions like Australia.
- Fortescue, having acquired Williams Advanced Engineering, partnered with Nyobolt to develop battery systems for its 240-ton trucks, showcasing the feasibility of such projects.
- Using Fortescue's initiative as a benchmark, it's estimated that the global mining fleet could require 25-50,000 megawatt-hours (MWh) of energy storage capacity.
- Considering that niobium-based anodes, which require around 5 kilograms of material to store 1 kilowatt-hour (kWh), with niobium oxide constituting 25-50% of the anode material weight, the potential market for niobium in mining truck anodes alone is projected to be between 30-100,000 tons of niobium oxide.

To put all of that into perspective  
Globe's annual production in Phase 2 is 3% of the requirement for the Global Mining fleet alone.



# So, who is Globe?

**This bottom quartile cost project has been designed to ensure the production of "green Niobium" in that its Scope 1 and Scope 2 carbon emissions will be of the lowest in the world, with hydroelectric and solar power dominating its power sources. The very low carbon footprint is also supported by a unique closed-cycle Chlorination refining process, which is transformative for the industry.**

# Company Highlights.

01

Second vertically integrated niobium oxide player in the world.

02

Major low-cost resource of Niobium in a conflict free zone, Malawi Less than 1 strip ratio.

03

Attractive Project - IRR of 47% and NPV of US\$1 billion.

04

De-risked and phased project start-up.  
Phase1 = 300tpa Nb205  
CapexUS\$30m.  
Phase2 = 3ktpa Nb205  
CapexUS\$250m.

05

With fully auditable origin of metals.

06

In a market of rapidly growing global demand for high purity Niobium Oxide.

07

Fully permitted, advanced staged project with mining license and mine development agreement.

08

Pre-development Shovel ready.  
Post feasibility.  
JORC resource and reserve.

# Milestones achieved in the past 6 months.

01

Niobium/Tantalum successfully extracted and separated using environmentally sustainable chlorination refining.

02

Confirmation that Niobium/Tantalum products contain no radiation as the radioactive materials are removed in the refining process.

03

Construction of Refinery Pilot Plant commenced to produce marketing samples for the finalization of key off-take agreements.

04

Production of concentrate feedstock initiated for Globe's chlorination refinery pilot plant.

05

Successful extraction and separation of >94% of the key Rare Earth Elements (REE), as by-products of the niobium and tantalum refining process.

06

Preferred location of the Refinery to be Malawi, subject to finalisation of financial incentives with the Government of Malawi.

# Completed an Optimization Study which confirms robust financial and technical outcomes.

01

Pre-tax NPV (8%) of US\$1.004B and IRR of 47.08% on a 27-year life of mine.

02

Total unit cost of Niobium Pentoxide US\$18.90/kg and gross profit margin 71%.

03

Mine capacity of 86 ktpa ROM in Phase 1. Mine capacity increased to 1.5mtpa in Phase 2.

04

Environmentally friendly refining process – Chlorination refining producing high purity products which can command premium prices

05

Two-Phase development approach allows a significant reduction in initial upfront capital to \$30m.

Let's focus on  
the future ahead.

# Planned Project Milestones.

01

Commission and operate demonstration Chlorination pilot plant – currently being constructed. – April / May 2024

02

Produce high purity Nb<sub>2</sub>O<sub>3</sub> product (>99.95% pure) to support the signature of offtake Agreements. – Q3 24

03

Complete the update of the BFS. – Q4 24

04

Board approval to execute the project.- Q1 25

05

Mine, Concentrator and Refinery construction (all in Malawi) – Phase 1 – 18 months of construction

06

Commission and production c. 2026



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