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WS AMATI STRATEGIC METALS FUND

Green Paradox Explained

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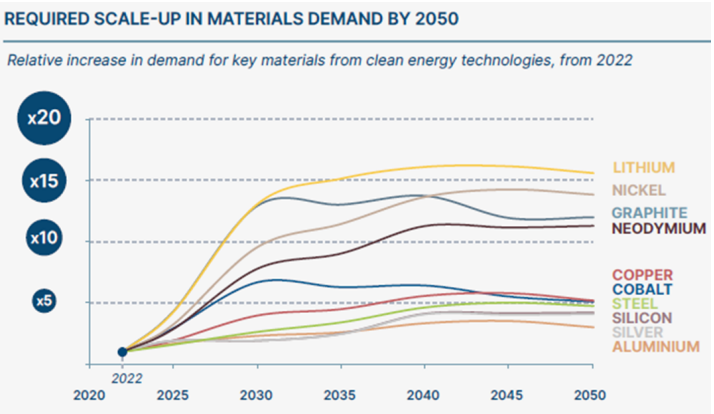
The 'say and do gap just got bigger' - understanding the green paradox is very important

The need to decarbonize the global energy supply chain is well understood. Politicians and industry leaders have waxed lyrical on the need to ween off hydrocarbons, but talk is cheap and the 'say and do gap just got bigger', etc. It is ironic then that a global task force was set up to save the planet, apply named 'The Energy Transitions Commission (ETC)'. A global coalition of leaders from across the energy landscape committed to achieving net-zero emissions by mid-century, in line with the Paris climate objective of limiting global warming to well below 2°C and ideally to 1.5°C.

Net zero can only be achieved in close collaboration with mining, but the net zero metal demand is far greater than the mining metal supply response. Somethings have to change;

- Permitting, finance and construction timescales of mines have to shorten.
- Investor appetite for mining investment needs to increase dramatically.
- Understanding scope 1, 2 and 3 emissions in the metal supply chain have to be considered and financed.

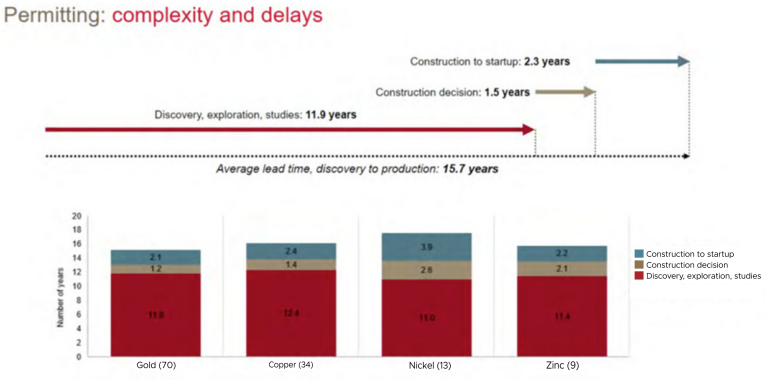
Exhibit 1: Material demand from renewable energy



Source: Energy Transmissions Commission

The average lead time from mineral discovery to metal production is 15.7yrs. Add this time scale to the 14x annual production increase by 2030 in lithium or 10x in nickel and the maths does not work. The challenges for the miners are that the battery manufacturers and tech companies move a lot quicker in business development. The mining community, regulators and policy makers move a lot slower; no time for Nimbyism.

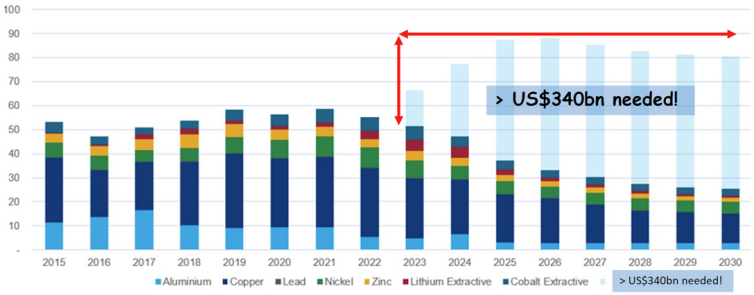
Exhibit 2: Permitting and production timelines



Source: S&P market intelligence

To meet the Paris climate objective, metal will have to replace oil, but over US$340bn of new expansionary capital is needed. With investor appetite for commodity investment at a 50 year low when viewed through the S&P Goldman Sachs Commodity Index / S%P 500 ratio, this capital will have to be found, otherwise we will create decades long bull metal price cycles through simple supply-demand economics.

Exhibit 3: Industry announce expansion capital and requirement in a 1.5C scenario



Source: BMO

Behind the scenes and away from the 'red Bloomberg screens', the battery metal sector is buoyant. There are deals being done with global industry leaders in the energy, auto, battery and refining industries. It is not surprising that 'Big Oil' is looking at 'white oil' or the lithium market for energy diversification. This industry tie up becomes ever more important once the consumer demands greener products.

The 'green' paradox is that the supposed green battery metals still attract large environmental footprints and so at some point the auto/battery industry and consumer will have to pay a carbon tax, unless they use greener sources of metal.

Currently economics is dictating the cheapest supply route for metal on to the market. Examples are:

Lithium: Low grade lithium feedstock cannot sustainably supply the growing lithium deficit?

· 1 tonne of lithium hydroxide (LCE) generates 12 tonnes of waste (industry average)

· 1 tonne of lithium carbonate produced from lepidolite in China generates 35 tonnes in waste.

The majority of lithium carbonate is imported into China for Lithium iron phosphate batteries, or converted into lithium hydroxide and exported to Japan and South Korea to make high density/capacity batteries. This double handling creates price volatility, and one could argue the need for hydroxide conversion plants outside of China.

Nickel: The carbon intensity of nickel production from various mineral deposit types must have a cost?

· 7t CO2/t refined Ni for Class 1 nickel production from sulphide ore

· 27t CO2/t refined Ni for Class 1 nickel production from laterite ore

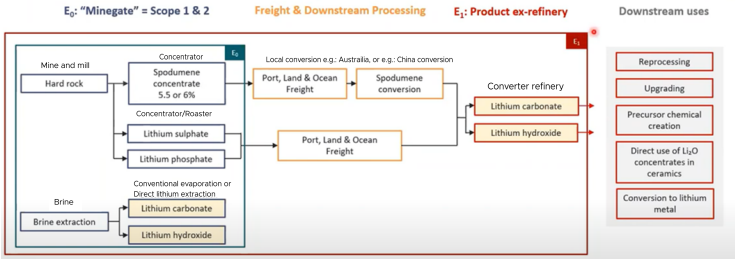
· 45t CO2/t refined Ni for ferronickel production from laterite ore

· 69t CO2/t refined Ni for nickel pig iron (NPI) production from laterite ore

Assuming a global carbon price of $70/t, the minimum carbon cost to supply class A nickel from NPI is around $4830/t. Add this onto the all-in-sustainable-cost (90th percentile) and you have theoretical nickel floor prices of >$22,000/t, (above current price of $16,777/t).

When you look at the carbon emissions in the lithium industry, things are not so clear.

Exhibit 4 – Scope 1, 2 and 3 (freight & downstream processing) in lithium



Source: Skarn Associates

If we consider 1 tonne of lithium carbonate equivalent (LCE) produced from hard rock spodumene (source of lithium) mined in Australia, it generates 13.5t of CO2 emissions (scope 1-3) when converted and refined in China. If we only consider scope 1 and 2 emissions at the mine gate, emissions drop to 2.0t of CO2, convenient then to environmentally screen to scope 2 emissions. If we consider the brine source of LCE, the emissions are lower at 3.5t of CO2, but the water use is over 470M3/t of Li hydroxide.

Amati's approach to avoiding the 'green paradox' is to invest in companies that circumvent the big carbon footprint and water use. At some point a greener product should attract a premium price. Two investment examples in the WS Amati Strategic Metals portfolio are Sigma Lithium and Centaurus Metals.

Sigma Lithium produces Triple Zero Green Lithium – a spodumene concentrate product with zero tailings, non-hazardous chemicals, 100% water recycling, renewable energy and a very low carbon footprint. Sigma is one of the largest producers of pre-chemical lithium concentrate, which can produce carbonate and/or hydroxide.

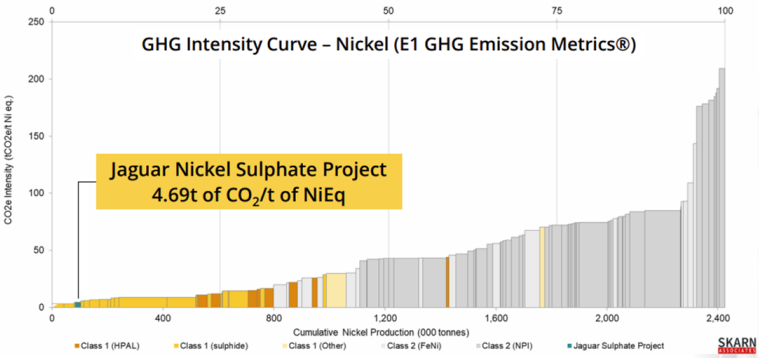
- 100% green power from hydropower delivered by the Irape plant, located 50km from the mine
- 100% water recycling less 10% loss from evaporation
- Zero tailing waste by using dense media separation, dry stacking tailings instead of using a wet tailings dam. This dry stacked

Exhibit 5: Grota do Cirilo plant site, Brazil

Source: Amati Site Visit

Centaurus Metals:
Plans to produce nickel sulphate with a life of mine CO2 footprint lower than 97% of global nickel production via pressure oxidation-solvent extraction using Brazil's renewable energy (80% national supply). The Jaguar Nickel Sulphide project contains 109Mt at 0.87% Ni, located in the Brazilian Carajas Mineral province., targeting to produce +20ktpa of nickel in sulphate for over 20 years. The region boasts outstanding infrastructure and logistics to serve the global battery supply chain, reducing the distance from mine to market.

Exhibit 6 – Global emissions for nickel mines



Source: Centaurus Metals

Understanding ***HOW*** to invest in this green paradox

Clearly we are not going to re-carbonize the energy supply chain and so mining will become an integral part of going green. The shade of green will vary in the mining industry and navigating which orebody will develop into a low carbon, low water-use mine to produce metal needed for renewable energy, will be difficult. The need for careful due diligence is obvious #Amati boots on the ground.

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