betashares

ASX: XMET

Invest in metal producers powering the clean energy transition

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Betashares Energy Transition Metals ETF

Introducing Betashares Energy Transition Metals ETF (ASX: XMET)

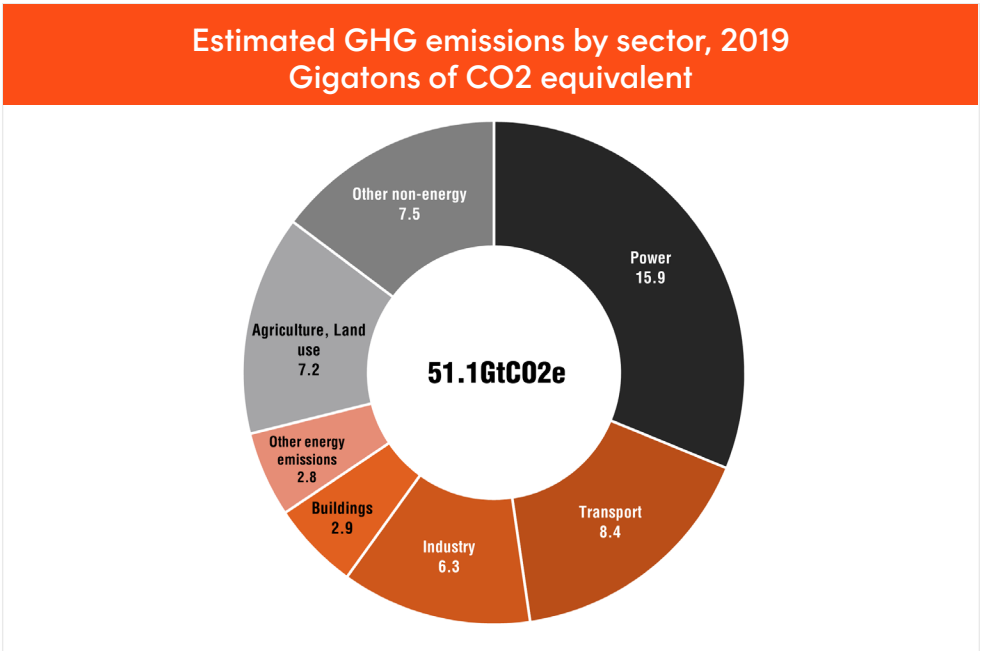
The transition from fossil fuels to clean energy technologies, such as renewable energy generation and electric vehicles, is critically dependent on a select group of Energy Transition Metals (ETMs).

Investors can now consider the Betashares Energy Transition Metals ETF (ASX: XMET), which aims to track the performance of an index (before fees and expenses) that provides global exposure to producers of a range of ETMs - copper, lithium, nickel, cobalt, graphite, manganese, silver and rare earths – as well as other companies involved in the recycling and processing of these raw materials.

Electricity demand and the shift to clean energy technologies

The energy transition requires enormous change to our economy and trillions of dollars in infrastructure spending over the next three decades.

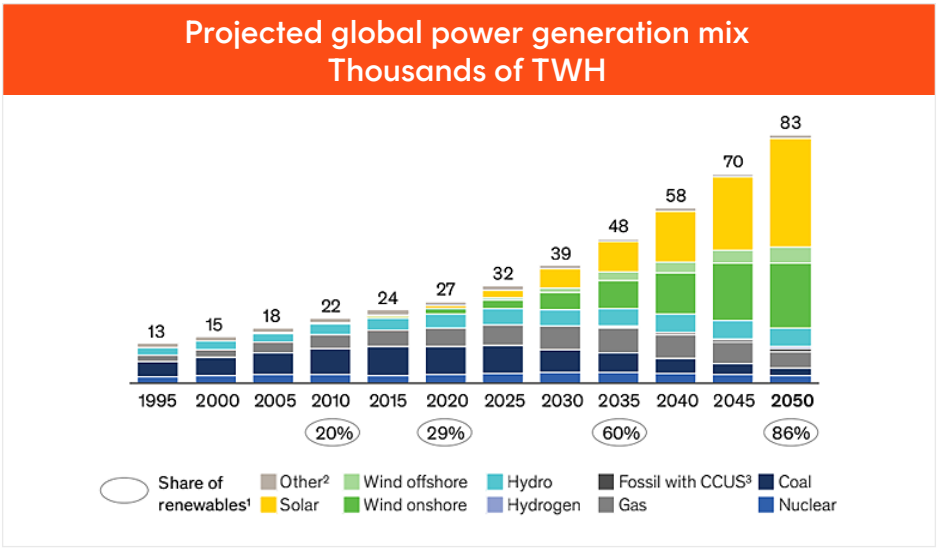
Power generation is the largest emitter of CO_2 but what is perhaps under-appreciated is that direct fossil fuel use in buildings, by industry and by transport is responsible for over a third of total greenhouse gas (GHG) emissions. One of the key requirements of the energy transition is the "electrification of everything", including home heating, the way we cook food, in industrial processes and the cars we drive.



Source: BloombergNEF New Energy Outlook, 2021

For example, in 2021, 6.5 million new electric vehicles (EVs) hit the road. Bloomberg forecast this number will jump to 39.5 million in 2030.

This shift towards electrification plus a rising middle class in developing countries is expected to increase global electricity demand by more than 200% by 2050. Not only must existing fossil fuel generation be replaced with renewables for decarbonisation, but additional renewable generation is required to triple overall electricity supply.

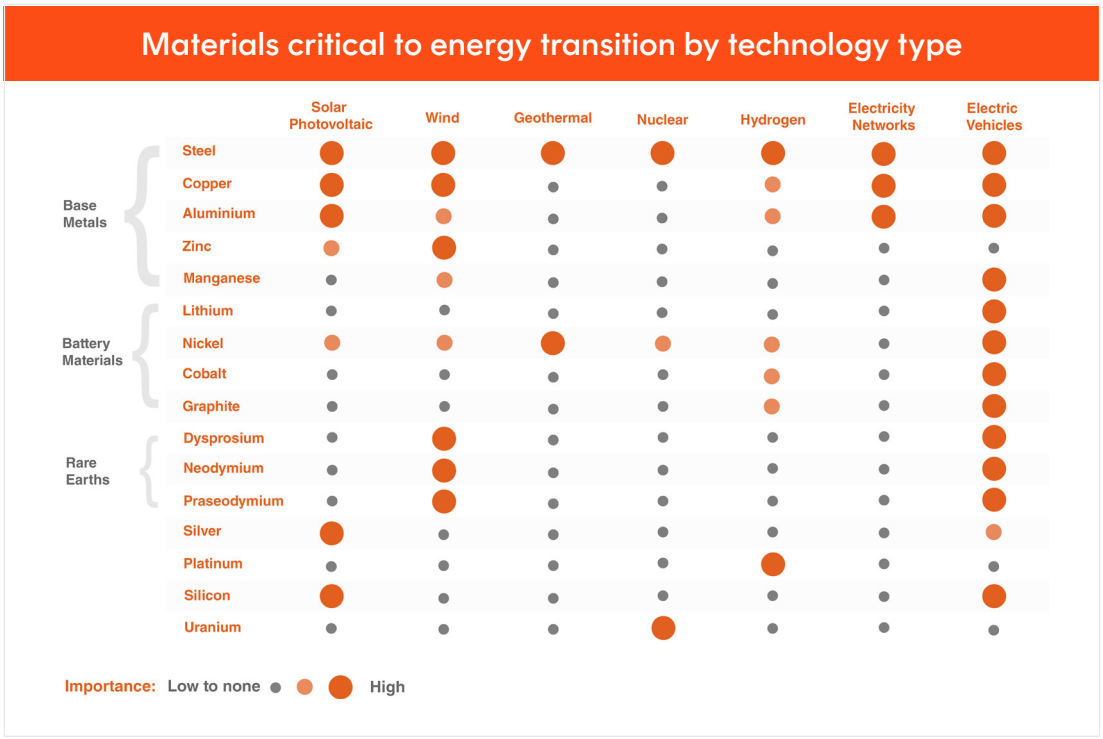


Source: McKinsey Global Energy Perspective 2022, "Further Acceleration" Scenario. 1. Includes solar, wind, hydro, biomass, bio-energy with carbon capture, geothermal, and marine and hydrogen-fired gas turbines. 2. Other includes bioenergy (with and without carbon capture), geothermal, marine, and oil 3. Includes gas and coal plants with carbon capture. Actual outcomes may differ materially from projections.

Shifting to renewables and EVs also creates a need for massive investment in supporting infrastructure. For reliability of the grid, where renewable generation can depend on the sun or wind, we will need to build more battery storage and invest heavily in long-distance transmission networks. To support adoption of EVs in the US, the Biden administration has announced it is going to build a network of 500,000 charging stations.

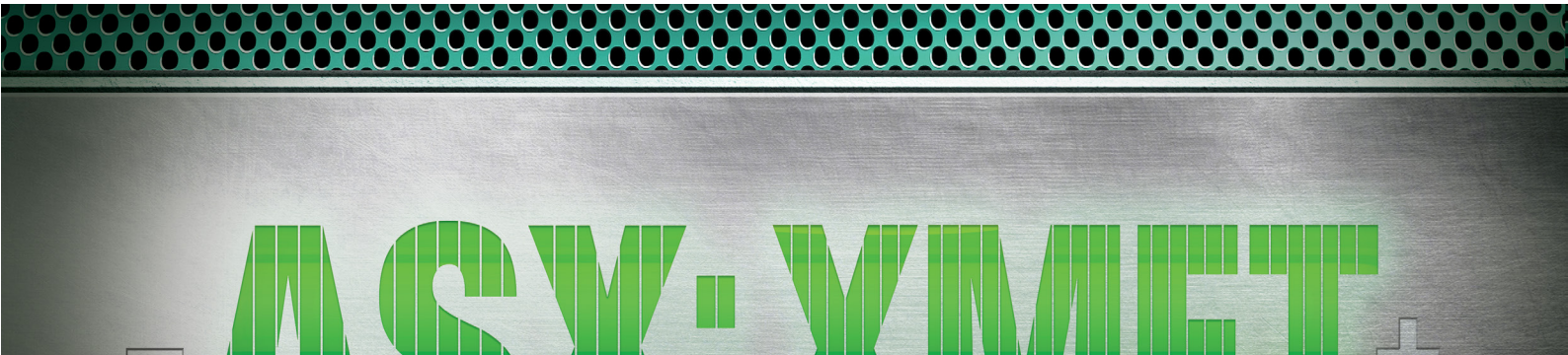
Identifying the key energy transition metals

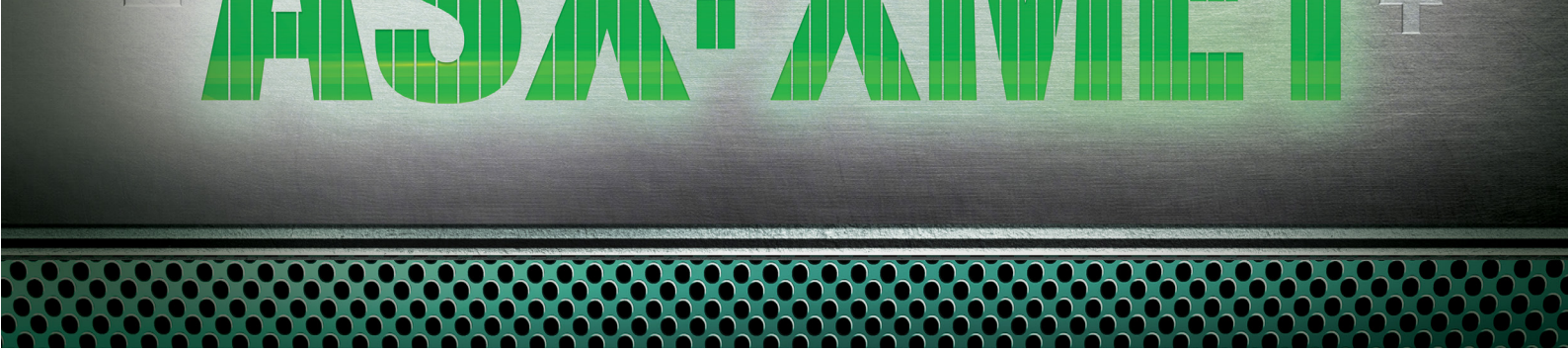
While clean energy technologies avoid the need to burn fossil fuels to generate energy, significant raw materials are needed to build the infrastructure of the energy transition. As shown in the chart below, the types of metal and mineral resources used vary by technology.



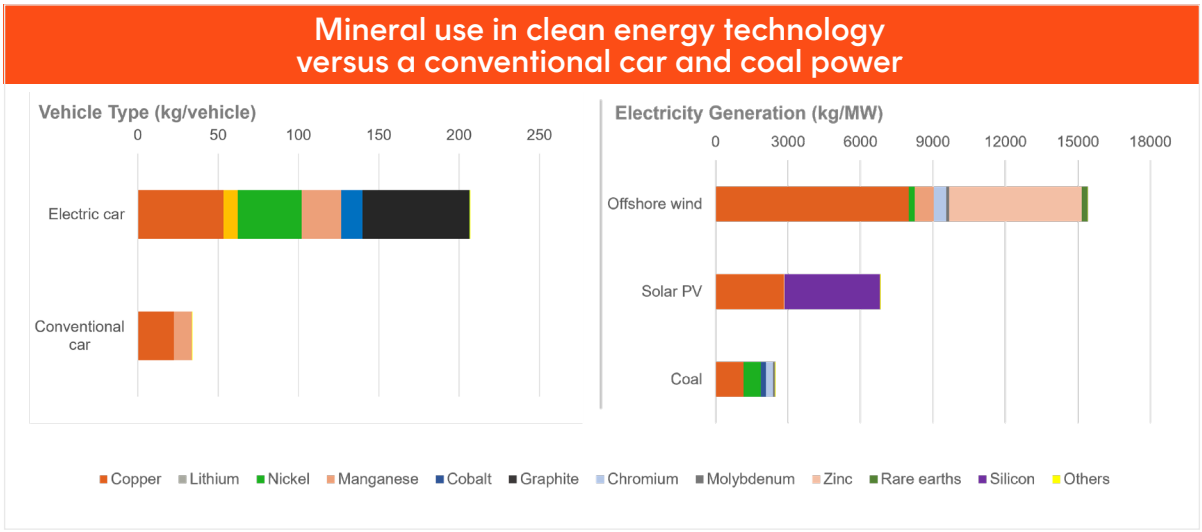
Source: McKinsey, Sprott.

While steel and copper are of high importance to almost all technologies, the use case for battery materials focusses on EVs (and stationary storage), rare earths are vital for wind turbines and EVs, and silver is used in solar PV cells.





It's important to consider whether the adoption of clean energy technologies will cause an increase in the overall demand for a particular metal. Steel may be of high importance for manufacturing electric vehicles, but the steel content in an electric vehicle is expected to be roughly comparable to that of a conventional internal combustion engine car which it is replacing.[1] For example, an EV requires significantly more copper, manganese and other battery materials than a conventional car.



Source: International Energy Agency, May 2021. Sprott, August 2022. The intensities for an electric car are based on a 75 kWh NMC (nickel manganese cobalt) 622 cathode and graphite-based anode. Offshore wind is based on the direct-drive permanent magnet synchronous generator system. Coal is based on an ultra-supercritical plant. Silver usage in solar PV generation is based on 20 grams used per solar panel. Actual consumption can vary by project depending on technology choice, project size and installation environment.

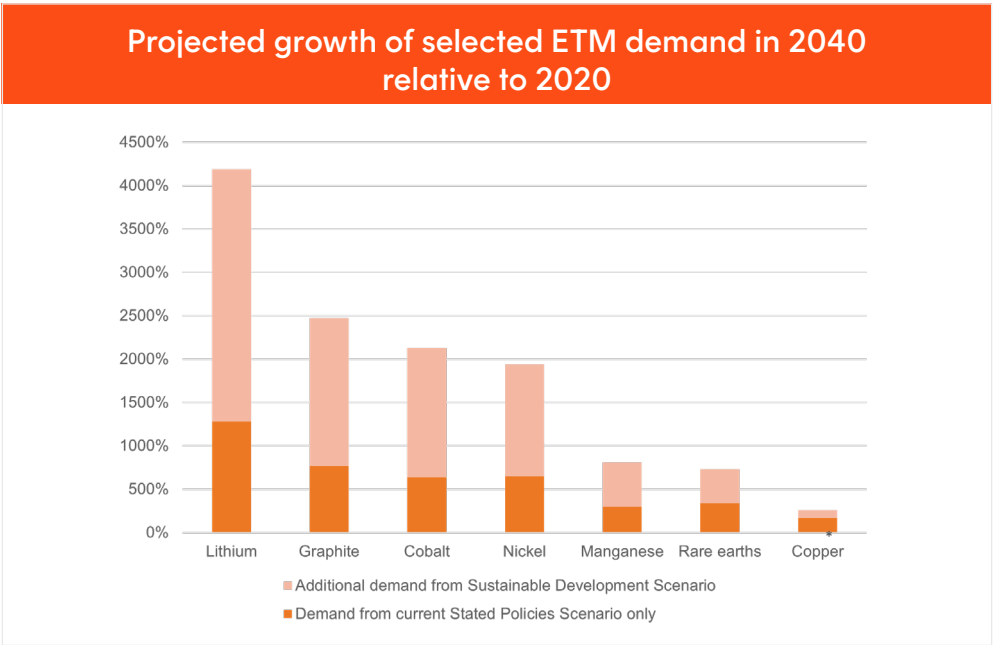
ETMs are the raw materials that are essential to the transition to a less carbon intensive economy. The ETMs identified within XMET's index methodology are copper, lithium, nickel, cobalt, graphite, manganese, silver and rare earths.

These ETMs:

- have no viable substitutes if society wants to scale clean energy technologies;
- are projected to experience a significant increase in demand;
- are likely to be constrained by available reserves, mine development lead times or processing complexities; and
- are viewed as strategically important to nation states.

Many industry analysts forecast strong increase in demand for these ETMs between today and 2050. According to the International Energy Agency (IEA), 2040 demand for lithium will be ~13 times 2020 demand based on current government policies (the Stated Policies Scenario) and could be up to ~42 times 2020 demand based on Paris Agreement-aligned adoption of clean energy technologies (the Sustainable Development Scenario).

[1]The EV revolution: The road ahead for critical raw materials demand, December 2020.



Source: International Energy Agency, May 2021. Demand from non-energy sector use of ETMs was assessed using historical consumption, relevant activity drivers and the derived material intensity. *Neodymium demand is used as indicative for rare earth elements. Stated Policies Scenario is an indication of where the energy system is heading based on a sector-by-sector analysis of today's government policies and policy announcements; Sustainable Development Scenario indicates what would be required in a trajectory consistent with meeting the Paris Agreement goals. Actual outcomes may differ materially from projections.

Global supply and demand considerations for each ETM

Copper – The plumbing of the energy transition

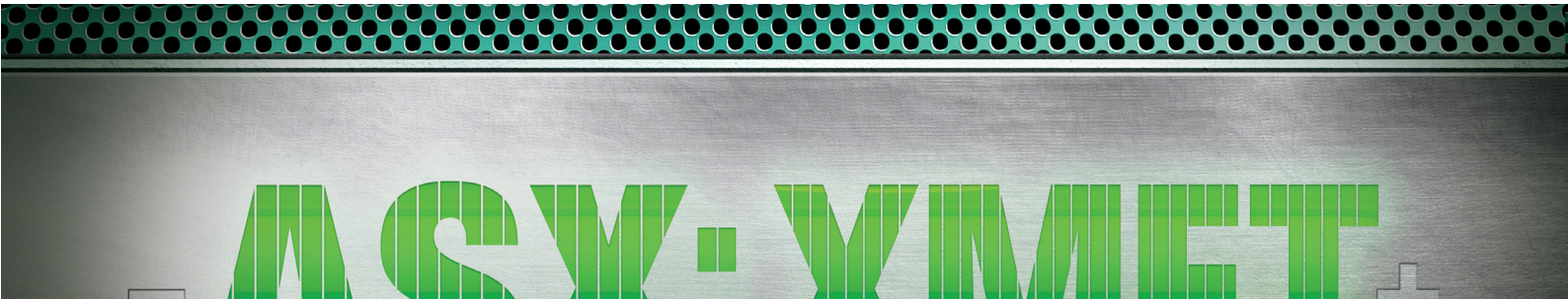
With unmatched thermal and electrical conductivity[2], copper is widely used in a broad range of electronic and industrial applications. Its attributes make it challenging to substitute. The energy transition demand for copper is amongst the highest of any ETMs (in terms of weight and value) and it is widely used across clean energy technologies serving to connect energy generation, transmission and storage.

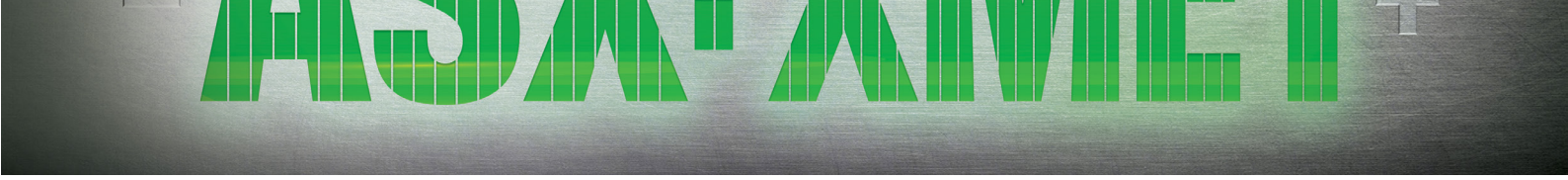
Offshore wind requires about seven times the amount of copper than that of coal powered generation, and solar requires about 2.5 times the amount of copper than coal. Today's electric vehicles use about 2.5 times the amount of copper of a conventional car (up to a mile of copper wiring), and that amount is steadily increasing with technological innovation.[3]

Despite the clear growth in future demand, future supply growth appears muted at best. Much of the world's high grade and economically viable reserves are already in production. Mines currently in operation are nearing their peak production due to reserve exhaustion and declining ore grades. On top of that, it can take more than a decade to develop a new "Tier-One" copper mine.

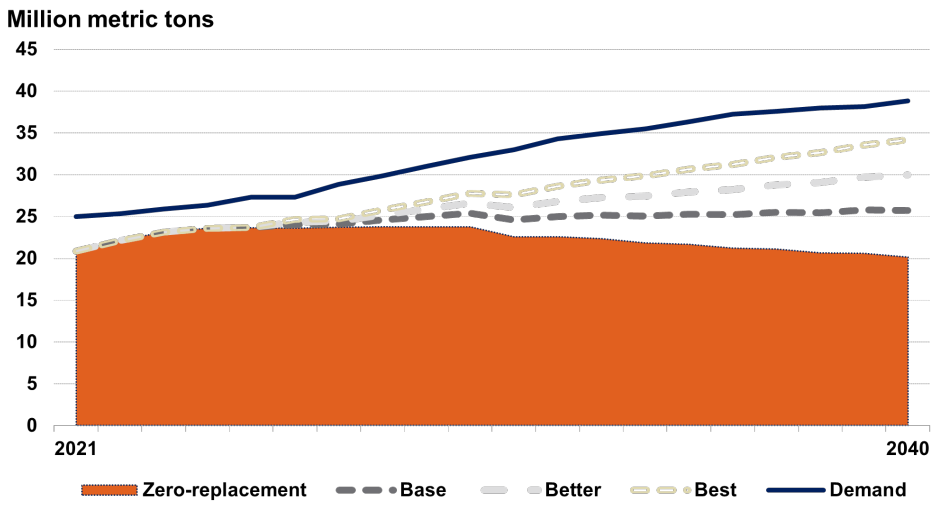
Bloomberg forecast copper supply to be in deficit even under their "best case" scenario.

[2]Only silver is more conductive but is many times the price of copper.
[3]IEA, Wood Mackenzie.





Forecast refined copper primary production scenarios versus demand



Source: BloombergNEF Global Copper Outlook, 2022. Actual outcomes may differ materially from projections.

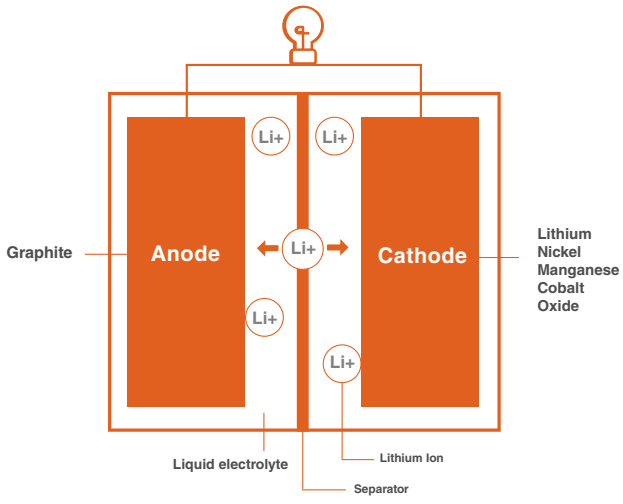
Much of the shortfall will likely need to be made up from:

- increased recycling rates, although copper already has one of the highest recycling rates of all metals; and
- higher copper prices incentivising existing producers to expand existing mines and increase recovery rates.

Battery materials projected to experience significant demand increase

Lithium-ion batteries are used in EVs and for stationary energy storage. While there are various battery chemistries that use different materials in different proportions, the batteries that currently have the largest market share and provide the highest energy density are known as NMC cathode batteries.

Structure of a lithium-ion battery



NMC cathode batteries use lithium, nickel, manganese, cobalt and graphite[4]. Even if high prices incentivise new mine supply, the sheer scale and speed of the investment to meet production required under the Paris-aligned Sustainable Development Scenario appears close to insurmountable. Battery makers are continuously innovating with the dual objectives of optimising performance and cost. Therefore, if global demand for one material pushes its price too high, battery makers seek to adjust the amount of that material used or substitute entirely for an alternative battery material. This dynamic means that demand for a single battery material is likely to be less certain and possibly more volatile than demand for a basket of battery materials.

Lithium is the cornerstone ingredient of all lithium-ion battery chemistries. It is also used in ceramics, glass and industrial lubricants. But by 2030 battery demand is expected to dominate the market.

Lithium prices skyrocketed in 2021 and 2022 as accelerating electric vehicle adoption saw battery and automakers struggling to secure supply of this essential ingredient. In response, new lithium projects have been announced that could triple the potential capacity. However, announcements don't necessarily translate into supply. There are question marks as to how rapidly these new projects will come online, and even that new announced capacity is expected to be eventually swallowed up. Lithium is expected to see the fastest demand growth across the ETMs over the coming decades.

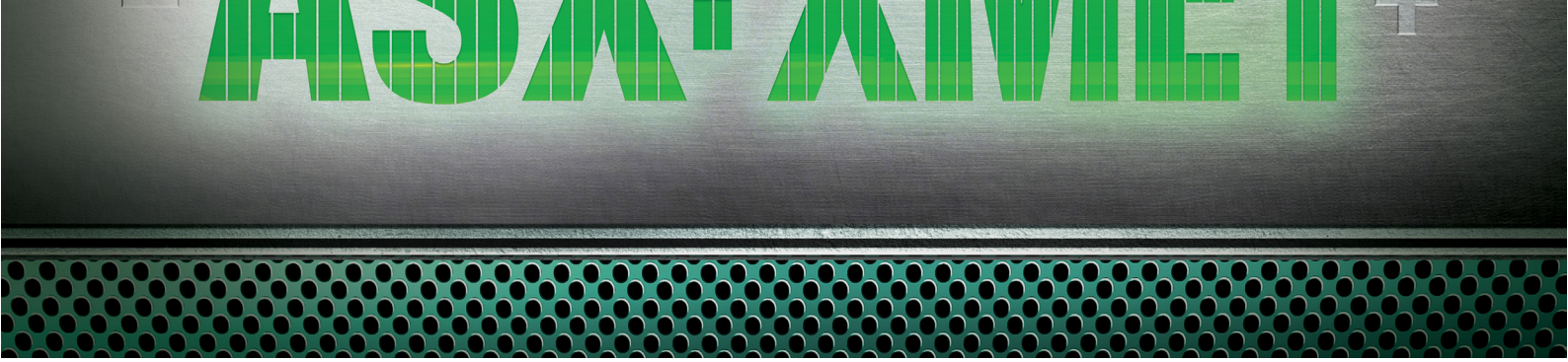
Nickel content in lithium-ion batteries has been increasing over time as nickel provides higher energy density.

Nickel products are split into:

- **Class 1** (generally processed from nickel sulphide ore): higher grade, rare deposits, used in battery cathodes (~10% of total nickel consumed); and
- **Class 2** (processed from nickel laterites): low grade, bulk tonnage deposits, largely from Indonesia, used in stainless steel and industrial alloys.

Bloomberg forecasts Class 1 production to shift into deficit from 2024 due to the rapid rise in battery demand and a lack of new supply. Developing a nickel mine typically requires two to five years and hundreds of millions of dollars in development capital. One additional channel of new supply might be a number of High-Pressure Acid Leaching (HPAL) projects in Indonesia, which allow nickel laterites to be processed into Class 1 nickel product. However, HPAL technology is commercially unproven, is technically challenging and has a high environmental impact. Other options for increasing Class 1 supply are possible but would require higher nickel prices to incentivise.

[4]Other widely used current battery chemistries are NCA (using Nickel, Cobalt, Aluminium cathodes) and LFP (using Lithium, Iron Phosphate cathodes)



Cobalt is mainly used in lithium-ion batteries, with secondary demand for manufacturing super-alloys, carbide tools and magnets. Cobalt improves stability of a nickel-rich lithium-ion battery, but battery technology has allowed for the reduction of cobalt over time.

The global market for cobalt is still small relative to other ETMs, and the IEA forecasts very significant growth in demand under various scenarios, even factoring in a continued reduction of cobalt content in battery chemistries.

Global supply of cobalt is dominated by two countries – the Democratic Republic of Congo (DRC) for production and China for refining (both around 70% of global share). Significant concerns exist around the practice of artisanal mining in the DRC due to ESG issues[5] and supply chain reliance on Chinese cobalt refiners. Many battery and automakers have shown a strong preference for non-DRC sourced cobalt processed in countries like Finland, Belgium and Canada.

Manganese is used in lithium-ion batteries to improve the power capability and can reduce costs by replacing a portion of nickel and cobalt. Indeed, development is ongoing into manganese-rich battery chemistries and this might provide an alternative to nickel-rich chemistries if that commodity becomes scarce/expensive.

Currently, around 2% of manganese production is used in batteries, with steel production accounting for 90%. The ore is plentiful and mining is relatively simple. However, processing the ore into battery grade manganese sulphate is technically challenging, requiring significant capital investment and stringent quality control. These factors create high barriers to entry for new producers.

Graphite is expected to experience the second fastest demand growth of any ETM[6]. Today, graphite is mainly used in steel production and metallurgy, but growth will come from its use as an anode material in batteries. A 100kWh electric vehicle requires approximately 114kgs of graphite.

Bloomberg forecasts graphite will remain the dominant anode material well into the 2030s, but we may see some substitution with lithium, silicon and/or silver if all solid-state battery (ASSB) technology becomes commercially viable in the future.

[5]DRC cobalt mining has been plagued by corruption, poorly health and safety regulation, and the potential presence of child labour.

[6]Noting that Graphite is in fact a non-metal element.

Rare Earths & Silver – key ingredients for wind and solar

Rare Earths are required to make high performance permanent[7] magnets used in:

- wind turbines, to remove the need for a traditional geared system. Magnets require less maintenance, leading to lower operational costs and longer turbine lifespan. This is particularly advantageous in offshore wind generation.
- electric vehicle engines, where their light weight and magnetic strength allow for increased range, better use of space, reduced weight and lower battery costs.

China dominates supply, with approximately 40% of the world's reserves, 60% of global production and 90% of global refining[8]. The risk of Chinese export controls has led to the US government funding two projects in 2020 – from Lynas Rare Earths and MP Materials. Given the rapid rise in projected demand, production will need to increase, both inside and outside China.

Silver is a metal that is both very ductile and highly conductive. It is used in jewellery, as an investible asset, and in a wide range of industrial applications including:

- solar panels to capture electrons produced by sunlight striking the cells. Each panel contains ~20 grams of silver; and
- electric vehicles to provide highly efficient electrical connections between the battery and other engine components. Electric vehicles contain 25-50 grams of silver.

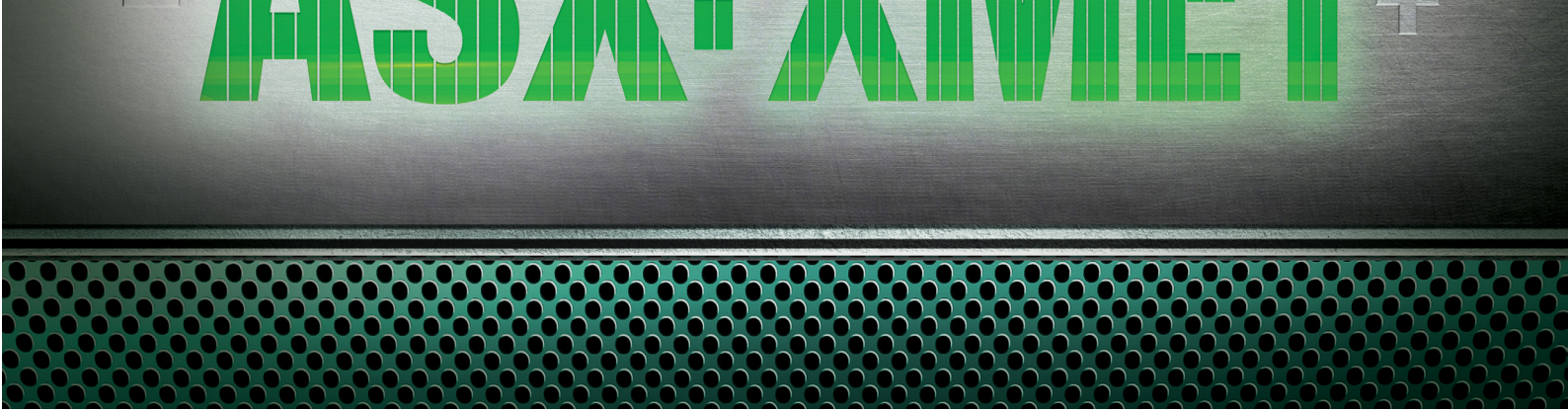
While technological advances have allowed manufacturers to reduce the amount of high-cost silver used in solar panels, electric vehicles and solar PV are two of the fastest growing clean energy technologies, providing a strong demand backdrop.

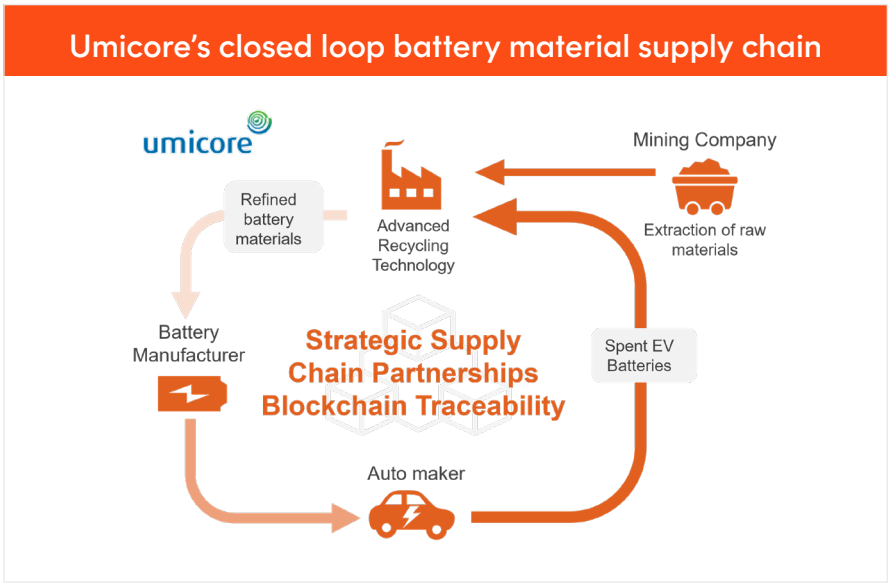
Recycling is a big part of the solution

Given the increased value of many ETMs, several leading companies are developing recycling solutions. One example is Belgian company Umicore, which has formed strategic partnerships with automakers and battery manufacturers to provide sustainable, closed-loop lithium-ion battery material production. This reduces dependence on primary metal production, which emits more carbon dioxide. It also means automakers can extract residual value from spent batteries by re-selling to Umicore, potentially allowing an automaker to offer guaranteed disposal value to electric vehicle customers.

[7]Rare earths are a family of 17 elements. Of these, neodymium dysprosium, praseodymium and terbium are specifically used to make permanent magnets.

[8]McKinsey, IEA, as at 2019.





EU lawmakers are seeking to introduce stringent requirements that more than half of a battery's weight must be recycled, providing a further tailwind for recyclers as the first generation of electric vehicles reach the end of their useful lives.

The Betashares Energy Transition Metals ETF (ASX: XMET)

One way to invest in the energy transition is through the producers of the raw materials that are essential for renewables, EVs and other clean energy technologies. XMET offers Australian investors global exposure to mining companies and producers of a range of ETMs, as well as other companies involved in mining, exploration and recycling of these metals.

[9]For producers that are an existing component of XMET's index, the revenue threshold is 40%.

Example companies in XMET's Index, as at 31 October 2022

Company Name	Country	ETM focus
Freeport-McMoRan	US	Copper Producer
IGO Ltd	Australia	Nickel Producer
Ganfeng Lithium	China	Lithium Producer
MP Materials Corp	US	Rare Earths Producer
Syrah Resources	Australia	Graphite Producer
Eramet SA	France	Manganese Producer
First Majestic Silver	Canada	Silver Producer
Sumitomo Metal Mining	Japan	Diversified (Copper and Nickel)
Umicore SA	Belgium	Recycler

Source: Nasdaq. No assurance is given that these companies will remain in XMET's index or will be profitable investments. Please see the XMET fund page for current holdings.

XMET's index focuses on 'pure play' mining companies and producers that have at least 50%[9] of their revenue generated from one of the eight key ETMs. Also included are diversified ETM producers, pre-production ETM mining companies and other companies involved in the recycling and processing of these raw materials.

Companies will not be included in XMET's index if their revenue from certain business activities (such as oil and gas production and thermal coal extraction) exceeds a defined materiality threshold, if they are non-compliant with the UN Global Compact principles, or if they have a controversy rating of 'Severe'.[10]

Companies that produce ETMs stand to benefit from a projected increase in demand coupled with constrained global supply. However, as the energy transition unfolds, demand for each individual ETM may be volatile and uncertain. XMET provides a convenient and cost-effective way to gain exposure to a range of producers and other industry players across eight key ETMs.

[10]As determined by Sustainalytics. The controversy rating reflects a company's level of involvement in, and how it manages, incidents with negative ESG implications.

There are risks associated with investment in the Fund, including market risk, international investment risk, commodity price and ETM company related risks, and concentration risk. The Fund's returns can be expected to be more volatile (i.e. vary up and down) than a broad global shares exposure, given its concentrated exposure. The Fund should only be considered as a component of a diversified portfolio, given its concentrated exposure. For more information on risks and other features of the Fund, please see the Target Market Determination (TMD) and Product Disclosure Statement, available at www.betashares.com.au.