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nyrstar

Resources for a changing world

Critical metals:

Australia's opportunity in the energy transition

nyrstar

Nyrstar is an international producer and refiner of critical minerals and metals essential for a low carbon future with operations located in Europe, the United States and Australia.

Employing over 1,300 people, Nyrstar Australia is a national multi-metals processing and refining business, operating in Port Pirie and Hobart for over 100 years to produce lead, silver, zinc, and other metals that are essential for the manufacture of products used by everyone, every day.

In 2022, Nyrstar's Australian operations accounted for around 60 percent of Australian zinc exports and around 75 percent of Australian refined lead exports.

TRAFIGURA

Nyrstar's owner Trafigura, is a market leader in the global commodities industry. Trafigura responsibly connects vital resources to power and build the world, deploying infrastructure, logistics and financing to connect producers and consumers.

Trafigura has unique insights into global market metrics, detailed supply and demand data and trading relationships between key countries and regions.

Foreword

Jeremy Weir
Executive Chairman and
Chief Executive Officer,
Trafigura

On the journey to net zero the world is going to need a lot more metal and minerals.

In fact, is it no exaggeration to say that a lack of raw materials poses a massive threat to the clean energy transition.

Decarbonising the global power mix – one of the most impactful things we can do to reduce emissions – is not going to happen without a huge increase in wind and solar power and, by extension a huge increase in the metals needed to produce them, a list that includes aluminium, copper and zinc.

The good news is that the centrality of metals to the energy transition is being recognised by policymakers around the world and reflected in new legislation such as President Biden's green subsidies package and the *EU Critical Raw Materials Act*. This will help stimulate investment in minerals extraction and metals processing.

With its vast mineral endowment and expertise in mining and processing, Australia can make an important contribution to meeting global demand for strategic metals while at the same time improving its own security of supply and increasing its influence across the Asia-Pacific region.

But this opportunity won't be fully realised without the right policy settings, including targeted investment in metals processing, the streamlining of permitting processes and the inclusion of zinc on Australia's Critical or Strategic Minerals list.

There is no time to waste. We need ambitious action before the end of the decade to make net zero by 2050 a reality.

Dale Webb
Co-Chief Executive Officer,
Nyrstar

The energy transition the world is facing is not only a daunting one, but one that is rapidly creating change as countries increase their demand of technologies and products that will lower their carbon footprint.

The outcome is a disruption in traditional international markets for commodities, with demand patterns and dynamics like we have not seen before.

A successful navigation through this transition will ultimately require nations to think very differently about the type and volume of minerals and metals they need to secure.

Strategies will need to go beyond investing in the supply of traditional battery materials and ensure that those metals needed to deliver the huge increase in renewable energy that the world needs are appropriately secured.

In this climate, Australia, is well positioned to benefit. But it must move beyond a traditional extract and export approach to resources, and have an increased focus on in-country processing of critical and strategic metals.

Processing more industrial metals and unlocking the critical minerals that are by-products of these industrial metals, will be important for Australia if it is to capitalise on this opportunity.

Not only will this support global supply but add significant value to Australia supporting its domestic industry and manufacturing as more metals are processed in Australia.

This is a once-in-a-generation opportunity that should not be missed.

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Executive summary

Key Points:

- **Based on industry estimates, annual demand for zinc is expected to grow by 2.5 million to 3 million tonnes between 2020 and 2030 - equivalent to roughly a fifth of current global supply.[1]**
- **Zinc should be included on Australia's Critical Mineral List given its importance to regional partners and global demand requirements.**
- **Australia must target investment toward existing domestic processing facilities to capitalise on value-adding production, as well as extract further critical minerals (for example germanium, indium and cobalt) from production by-products.**

When it comes to thinking about 'critical' or 'strategic' metals the focus is usually on nickel, lithium and other battery materials.

Industrial metals such as aluminium, copper and zinc are often overlooked in the conversation about the energy transition.

We think this needs to change: electric vehicles alone are not going to stop global warming but coupled with a huge increase in renewable power they might.

Electrification is among the most impactful things we can do to reduce greenhouse gas emissions (GHG) and meet the goals of the *Paris Agreement* on climate change .

Decarbonising the grid also has other benefits, such as improving security and diversity of energy supply, issues that are taking on increased importance as geopolitical tensions continue to rise.

Industrial metals also unlock other critical minerals such as germanium, indium, cobalt, antimony, tellurium, gallium and bismuth, that are also essential to the green transition.

The extraction and refining of these critical minerals is of significant sovereign value for Australia and its allies – such as the United States.

It would also support diversification of global metals processing and increase the resilience of supply chains at a time of heightened geopolitical tensions.

Of course, a renewable energy revolution will not happen without a huge increase in wind and solar power and, by extension, a huge increase in the supply of metals such as zinc required to both build this infrastructure and protect it against the elements.

Based on industry estimates, including those of Trafigura Research, annual demand for zinc is expected to grow at 2.5 million to 3 million tonnes between 2020 and 2030.[2] That's equivalent to roughly a fifth of current global supply and stands in contrast to severely depleted zinc market that has been in deficit for most of the past decade. It comes on the back of years of underinvestment in new supply.

[1]Trafigura Research, CRU, Wood Mackennzie [2]Ibid [3]Trafigura Research

WHITE PAPER | Australia's opportunity in the energy transition

That makes the availability of metal – or lack there of – a massive threat to decarbonisation. But at the same time it also presents Australia with a once-in-a-generation opportunity to benefit from a secular shift in commodities demand.

There is significant potential to produce more zinc and other industrial metals in Australia, a country blessed with a vast endowment of mineral resources and a world-class metals and mining industry.

However, this opportunity, which could boost employment, improve Australia's sovereignty and increase its influence in the region, will only be fully realised with the right policy settings.

By adding zinc and other industrial metals to a Critical or Strategic Minerals List (as the US, Canada and South Korea have already done), Australia can tap into rising demand for metals and become a supply anchor for South East Asia.

But it should not stop there.

Australia's contribution to meeting global metals demand needs to go beyond a simple 'extract and export' strategy that relies on other countries for processing capacity.

Australia also needs to support its existing domestic processing facilities so they can expand and tap into rising energy transition demand for refined metal.

Operating one of Australia's two zinc refineries (in Hobart) and a multi-metals processing plant (in Port Pirie, South Australia), Nyrstar Australia is uniquely positioned to support expanded processing in Australia.

Australia can capitalise on the opportunity provided by the US-Australia Compact to strengthen industrial ties with the US and support the road to net zero.

The United States is a net importer of both zinc and lead, which is used in batteries that power vehicles. In 2022, it had its largest year of lead imports since 2017 and Australia has increased its exporting of lead to the US.[3]

There is no time to waste.

To have any chance of hitting a 1.5 degree Celcius global temperature goal, the supply of critical metals needs to increase so it can match the rapid pace of decarbonisation, which has accelerated following Russia's unjustified invasion of Ukraine.

Other countries have already launched or passed legislation to help them meet their climate goals through increased investments in raw materials and renewable energy.

The *EU's Critical Raw Materials Act*, unveiled in March, aims to speed up permitting and ease access to financing for new mining and refining projects. In the US, President Biden's *Inflation Reduction Act* could spur more than a trillion dollars of spending on green projects.

Australia must act now to recognise zinc as a critical mineral and increase both its extraction and metals processing capacity so that it can take a leading role in the energy transition.

Why metals are critical for the energy transition

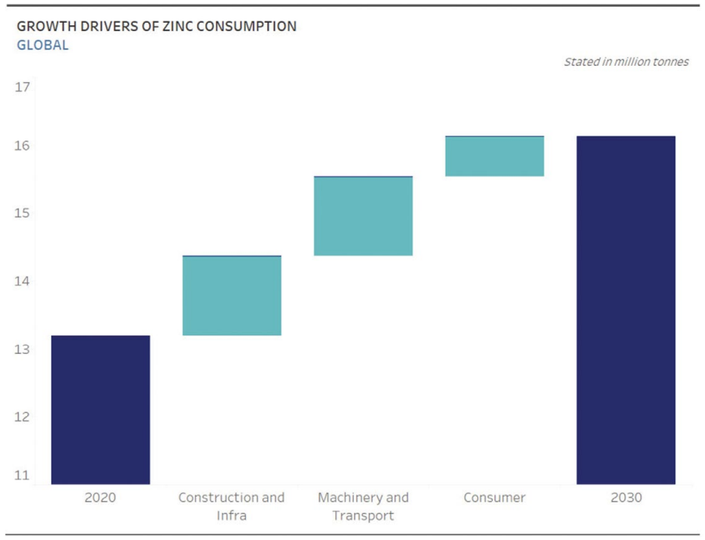
CHAPTER ONE | Why metals are critical for the energy transition

Demand projections

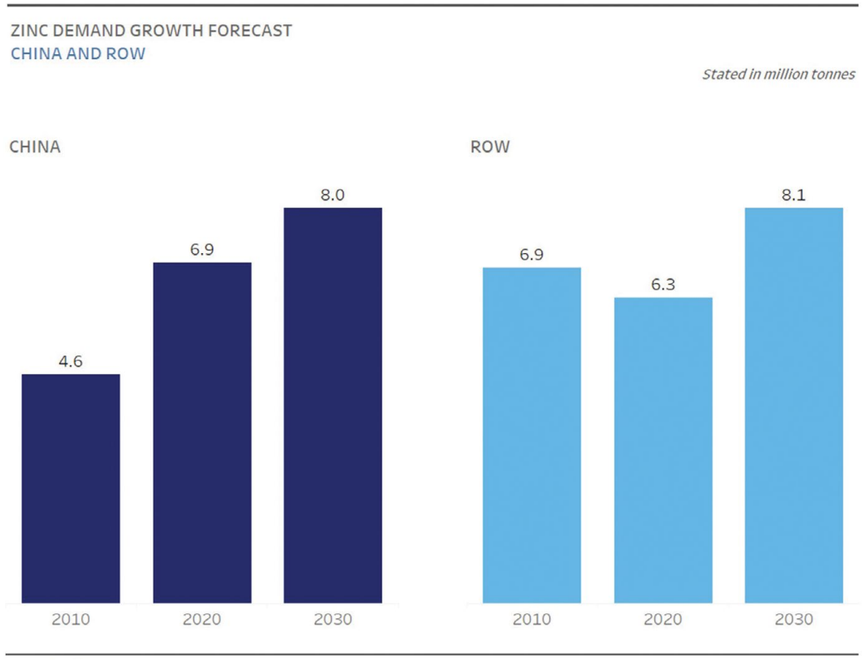
As a result of net zero targets around the world, there is significant forecast demand for industrial metals including zinc.

According to Trafigura Research and industry estimates, annual demand for zinc from infrastructure and consumption, machinery and transport and consumer goods is expected to grow by a total 2.5 million to 3 million tonnes between 2020 and 2030. To put that figure in perspective, it is around 20 per cent of current global supply.

Based on current supply forecasts we see a supply gap in zinc of up to 1.7 million tonnes a year by the end of the decade. This shortfall is the equivalent of 150 percent of Australia's current total zinc mining output.



Source: Wood Mackenzie, Trafigura Research.



Source: Wood Mackenzie, Trafigura Research.

Over the past 20 years, China has been the primary growth engine of demand for metals. That is starting to change.

According to the International Energy Agency (IEA), the energy transition is now a major driver of metals demand projections.[4] Industrial metals and critical minerals are used much more intensively in the development of clean energy technologies compared to traditional resources.

ZINC: Critical to the functioning of low carbon and strategic technologies. By expanding the lifetime of steel it greatly saves lifecycle CO2 emissions, and it is an essential raw material in wind turbines, solar panels, and electric vehicles. The metal is also used by the defence industry, where it is combined with copper to make brass alloy. Brass is utilised widely in a broad spectrum of military applications, including bullet casings and other munitions and armaments.

Lead is also in demand, especially in China, India and the United States. The principal use of lead is for lead-acid batteries in vehicles.[5] Lead acid batteries are still required for the majority of electric vehicles currently produced. Lead is also used in the batteries that provide backup power to critical infrastructure such as hospitals, datacentres and telecommunhications. Additionally lead is also used in rolled and extruded products, compounds in the glass and plastics industries, shot and ammunition and for radiation shielding.

Australia is an net exporter of lead, and Nyrstar's Port Pirie operations accounted for around 75 percent of refined lead exported by Australia in 2022.

Since 2020, the United States has seen a significant increase in the quantities of imported refined lead from 313 KT to 535 KT.[6] The free trade agreement and recently announced Compact between Australia and the US could support an increase in refined lead exports from Australia to the US.

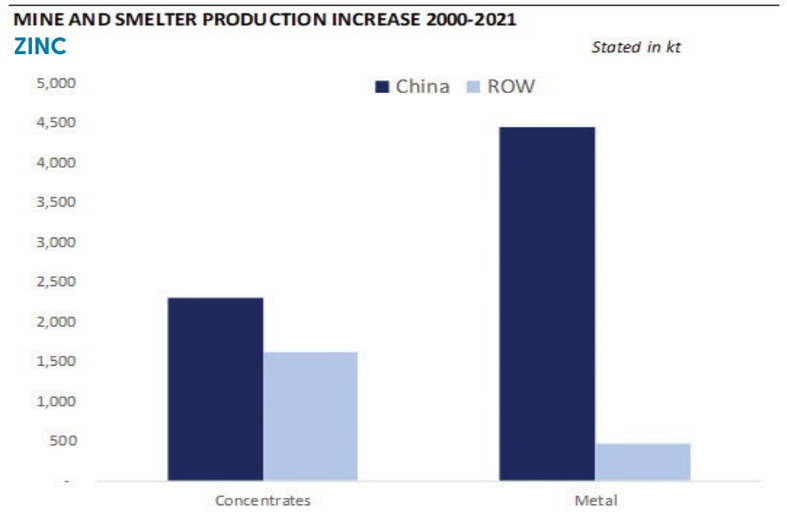
Australian domestic use of zinc and lead is also projected to continue to increase in coming years as more wind, solar and some hydro renewable capacity is developed.

[4]International Energy Agency, Executive Summary – The Role of Critical Minerals in Clean Energy Transitions – Analysis – IEA, accessed 29 May 2023, *https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary*
[5]Trafigura Research [6]Ibid

Supply projections

For many industrial metals, China has increased production over recent years at greater rates than the rest of the globe. Zinc is no exception, with China's output far outstripping the world since 2000. This has enabled China to produce a wide selection of customer-ready products to the market and assume a dominant position in global metals processing.

As a result of rapid urbanisation and industrialisation, China has been able to expand its processing capabilities at a time when many countries have closed their refineries.[7]



Source: Woodmac and Trafigura Research

Australia has an important role to play in supplying industrial metals – especially in South East Asia (SEA). For zinc, the main suppliers to SEA are South Korea, India, Australia and Japan supplying 84 percent of the total SEA imports of refined zinc and alloys last year. In 2022, Australia provided around 18 percent of SEA's refined zinc and alloy imports.[8]

In 2022, Australia exported 38 Kt of refined lead to Asian countries. However, that volume forms only 7 percent of total Asian lead imports and is a significant reduction from previous years imports to Asia. Meanwhile, Chinese exports to Asia increased from 3 Kt in 2020 to 52 Kt in 2022.

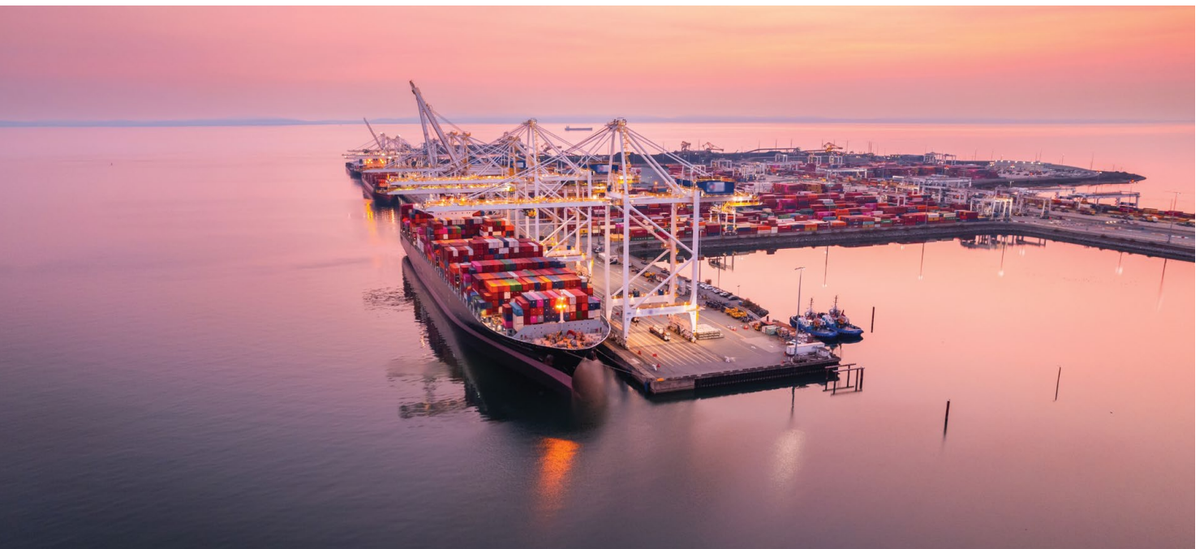
India's growth in zinc export also stands out. Exports dropped from around 100 Kt in 2015 to 33 Kt in 2019 but recovered in the last 3 years to around 171 Kt in 2022. South Korea and Japan maintain more stable shares, of 25-30 percent and around 10 percent respectively.[9]

[7]Castillo, R & Purdy, C, 2022, China's Role in Supplying Critical Minerals for the Global Energy Transition – What Could the Future Hold?, LTRC – Leveraging Transparency to Reduce Corruption, accessed 29 May 2023, *https://www.brookings.edu/wp-content/uploads/2022/08/LTRC_ChinaSupplyChain.pdf*
[8]Trafigura Research [9]Ibid

Inventories

At a time of rising demand, zinc inventories are at dangerously low levels. Apart from 2020 (COVID-19) and 2015 (China's industrial recession), demand for zinc has outstripped supply for 11 years and the gap has been filled by drawing down stock. At the end of 2022, visible zinc stocks were less than a week of global consumption.

With global stocks almost depleted, existing inventory cannot be relied on to meet increased demand, making increased production more critical.



Project pipeline

With inventory almost fully depleted, new mining projects will be required to meet forecast demand over coming years.

Globally, however, due to years of metal prices below incentive levels, there has been a limited number of new mines being developed.

According to the IEA, “today’s production and processing operations for many energy transition minerals are highly concentrated in a small number of countries”.[10] This makes the system vulnerable to political instability, geopolitical risks and possible export restrictions.

Analysis indicates this is unlikely to change in the near term. With the exception of copper, most of the industry’s output growth is expected to come from today’s major producers, implying a higher degree of concentration in the years ahead.

Adding mining and smelting capacity is becoming harder and more expensive. It is also taking longer to permit a mine.

The role of recycling and technology

Projects that allow increased extraction from existing materials are important to increasing supply of industrial metals.

Zinc is 100 percent recyclable – it can be recovered and reused without a loss in quality. Currently, 30 percent of all zinc produced worldwide originates from recycled or secondary zinc. Copper and lead can also be recycled indefinitely without any loss of performance.

It is important that policy settings are implemented that support and incentivise projects that extract greater value from existing raw materials.

[10] *Reliable supply of minerals – The Role of Critical Minerals in Clean Energy Transitions – Analysis – IEA, accessed 23 May 2023, https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/reliable-supply-of-minerals*

However, government investment will be required for many of these supply projects to be realised and broader recycling and circular economy principles to be supported.

Conclusion – we are not going to have enough metal without action

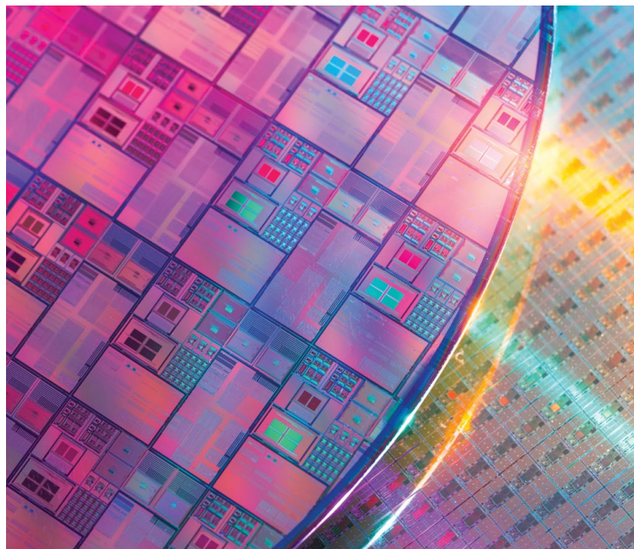
With demand for metals projected to continue to increase dramatically – more supply projects are required.

Most metals, including zinc, have supply shortages projected and, other than China, the world has not been developing projects at the rate required to meet demand over coming years.

This is even more pressing because the zinc market has been living off 'borrowed stock' for most of the past decade and bringing on new mining projects takes longer and is costlier than before.

Supply projects will need to come from both mining and processing. For processing – projects that utilise existing infrastructure and an existing skills base can be developed quicker and brought on-line sooner to increase the supply of industrial metals needed.

Australian projects that support global metals demand and provide structural supply for South East Asia and other allies could be important to meeting metals demand.



Realising Australia's potential

A vast mineral endowment

Australia is blessed with a rich endowment of all the resources needed to make electric vehicle motors, batteries, solar panels and wind turbines.

Australia has the largest identified economic resources of zirconium and titanium in the world and the world's second largest reserves of cobalt, lithium, tungsten and vanadium.[11]

Australia also has the third and fourth largest reserves of niobium and manganese ore, respectively.

In 2019, Australia's EDR (Economic Demonstrated Resources) of gold, iron ore, lead, nickel, rutile, tantalum, uranium, zinc and zircon were the world's largest. It also has another 15 commodities ranked in the top five for world economic resources: antimony, bauxite, black coal, brown coal, cobalt, copper, diamond, ilmenite, lithium, manganese ore, niobium.

Australia could extract and export more minerals.

According to Geoscience Australia's report on *Australia's Identified Mineral Resources 2021*, Australia has a vast endowment of mineral resources that are yet to be discovered and developed.

Extraction and refining expertise

The mining industry in Australia is highly sophisticated. The industry uses advanced technologies and techniques for exploration and extraction of minerals.

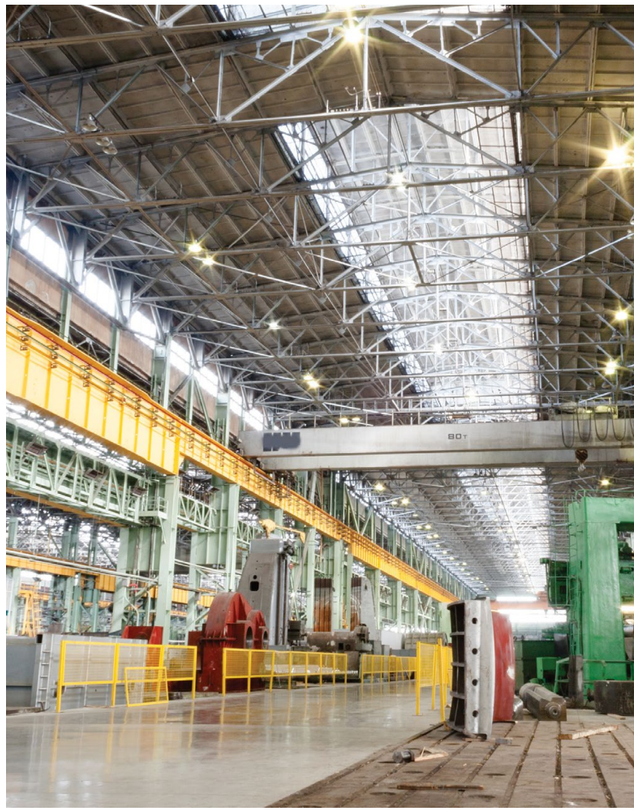
The smelting and refining industry in Australia is also highly developed and has a number of world-class refineries that process minerals such as alumina, nickel, copper and zinc.

In 2021-22, Australia's exports of minerals, metals and energy commodities were worth $413 billion and accounted for 69 per cent of total export revenue[12] .

Australian minerals have contributed 21 percent of Australia's GDP growth in the last 10 years and 32 per cent ($41 billion) of all company tax paid in the nation in 2022[13].

There is however an opportunity for Australian processing to be used more to support supply projects and strategic objectives.

In calling for a significant increase in Government investment in Australian processing, former Australian Defence Minister Kim Beazley stated that, "We need to think of it (increased Australian processing) in strategic not commercial terms.[14]



[11] *World Rankings | Australia's Identified Minerals Resources 2020, accessed 23 May 2023, https://www.ga.gov.au/digital-publication/aimr2020/world-rankings*

[12] *Tenzin, P 2023, "Mining is key to Australia's economic future," Minerals Council of Australia, accessed 23 May 2023, https://minerals.org.au/resources/mining-is-key-to-australias-economic-future/*

[13] *Ibid*

[14] *How, B 2022, Rare Earths should be included in AUKUS: Kim Beazley, accessed 23 May 2023, https://www.innovationaus.com/rare-earths-should-be-included-in-aukus-kim-beazley/*

The right policy signals are needed

The right policy signals that support leveraging its abundant mineral resources and augmenting processing capability would benefit Australian sovereignty, long-term security, the economy and Australian employment.

There is, however, a risk that Australia only sees its contribution to this global metals demand through increased extraction of minerals and rare earths.

This would be a missed opportunity for Australia and would effectively see off-shoring of potential processing capability and jobs. Australia would simply 'extract and export' and rely on other countries for processing capability – limiting economic and strategic benefits.

It is critical for the country's long-term interests to capitalise on opportunities when global markets turn in Australia's favour and unique opportunities present themselves.

With projected global demand at extreme levels and a strategic need for a more diverse supply chain, Australia has the opportunity to expand its processing capability and realise this strategic and economic opportunity.

To support supply projects to come on-line requires strong policy signals.

Industry has a responsibility to share information about demand projections and the need to act quickly to bring on supply projects. Governments have a role to play in ensuring fiscal stability, and supportive regulatory regime that fast-tracks permitting without lowering environmental or social standards. This can support development of supply projects that increase industrial and critical minerals supply.

Policy settings should also support broader national strategic objectives such as extraction and processing of minerals critical to ensure sovereignty and resource independence.

Incentivising recycling will relieve pressure on primary supply requirements and policies can be developed to support this.

Battery recycling is a new and developing industry in Australia, however with the volume of batteries reaching their end of life projected to increase in coming years, this is an important part of extracting commodity value from existing materials. Policy settings need to support recycling not only to manage the waste aspect but to realise the commodities benefit of recycling.

While recycling will become increasingly important, the intensity of metals required to build clean energy infrastructure means that secondary supply will not be enough alone to meet demand.

CHAPTER TWO | Realising Australia's potential

Australia's Critical Mineral List

As Australia develops its national Critical Mineral Strategy, there is an opportunity to also review and update its Critical Mineral List. Australia would benefit from having a Critical Minerals List in-line with its closest partners who in recent years have reshaped their lists in-line with current state considerations and objectives[15].

Aligning with the US, in light of the recently announced Australia-US Compact makes sense and would allow increased policy and investment alignment between allies.

Australia is a key zinc supply anchor for SEA markets, providing almost 20 per cent of all volumes to the region. Supply chain dynamics and disruption over recent years have further heightened the need for supply chain diversification and this is something Australia can provide to regional allies, many of whom are earlier in the energy transition to renewables than Australia.

The Critical Mineral List should be used by Australia to strengthen supply arrangements and coordination with key allies.

Canada's Critical Minerals List of 2021 had three criteria for establishing the list. Economic security, low carbon transition, and important sustainable source for partners. As a key exporter to the US, Canada understands that its Critical Minerals approach and list needs to support its allies. Australia's should do likewise.

Australian recognition of zinc as a critical mineral would support Australian expansion of zinc production and refinement which would also allow the extraction of additional valuable critical mineral by-products.

This includes indium and germanium which is currently mainly refined in China and could be exported from Australia.

[15]See Chapter 4

Including zinc on the Australian Critical Minerals List would demonstrate both the importance of this strategic industrial metal and help incentivise increased processing in Australia.

While this may not have been considered a priority under previously 'normal' supply and demand conditions, recent changes to the global and geopolitical landscape, supply chain dynamics and strategic demand for zinc provide the basis for its classification as a critical mineral.

Along with addressing increasing demand, reduced supply and the concentration of supply and refining projects in China, this step would align with the approach of the US and Canada and emphasise the strategic nature of the mineral to Australia, the region and its allies. It would support decarbonisation objectives, and through targeted investment create more jobs in Australia's regional areas.

An Australian example: Nyrstar Australia

An Australian refiner

As an Australian refiner of strategic industrial and precious metals, Nyrstar Australia provides an example of how Australian processing can be augmented to increase supply of metals.

Nyrstar at Port Pirie is one of two primary lead refiners in Australia and in 2022 accounted for around 75 percent of Australian refined lead exports. Nyrstar at Hobart is one of two zinc refineries in Australia and over the past five years has accounted for between 50 and 60 percent of Australian exports.

Opportunities for critical minerals

Nyrstar sites at Port Pirie and Hobart have the potential to produce a number of critical minerals in Australia and support supply chain diversification.

Through capital works and processing changes, indium and germanium could be extracted from existing resources already being processed at Nyrstar's Port Pirie and Hobart operations.

Nyrstar is not aware of any refining production of these minerals in Australia and this project would provide sovereignty and additional value chain benefits for Australian industry.

There are also currently small volumes of battery metals and nickel recoverable at our sites, however with capital investment in new processes, greater volumes and higher-grade products could be processed and refined.

Tellurium, selenium, manganese, antimony and bismuth are also currently in our system and there are opportunities to explore producing higher purity and value-added products from these minerals.

CHAPTER THREE | An Australian example: Nyrstar Australia

The below table shows what we currently extract and what we could process in Australia by increasing processing and refining.

CRITICAL MINERAL	In NYR AUS system	Mineral Reserves in AUS	Refined in AUS	NYR AUS able to value add refining	By-Product of strategic base metal	NYR AUS currently recov-ering (tonnes P/A)	Potential upgrade (tonnes P/A) with upgrade	Leading producers and refiners	Regions to benefit from increased recovery
Antimony	✓	byproduct of gold & lead concentrates	✗	✓	Lead	500	500	China, Russia	US, Europe
Bismuth	✓	byproduct of lead	✗	✓	Lead	160	240	China	US, Europe
Cobalt	✓	✓	✓	✓	Zinc, Copper	0	20	DR Congo, Russia	China, Europe, US
Germanium & Indium	✓	byproduct of zinc	✗	✓	Zinc, Lead	0	Ge 7, In-14-17	China, Canada	US, Europe, Japan
Manganese	✓	✓	✗	✓	Zinc	0	1000	South Africa, China	US, India, Japan, Korea
Platinum group elements	TBD	✓	✗ Limited	✓	Lead	0	TBD	South Africa	US, Europe, UK, Japan
OTHER									
Silver/Gold	✓	✓	✓	✓	Zinc, Lead	800	1200	Mexico, China, Peru	US, Canada
Selenium	✓	byproduct of lead & copper refining	✗	✓	Lead	0	30	Japan, Europe, Latam, Russia, China	China, India, US, Europe
Tellurium	✓	byproduct of lead & copper refining	✗	✓	Lead, Copper	5	5	China, Russia, Peru, Canada	US, India, Japan, Korea, Taiwan, Europe
STRATEGIC BASE METAL									
Zinc	✓	✓	✓	✓	NA	280,000	300,000	China, India, Japan, Korea	South East Asia, India, Europe, US
Copper	✓	✓	✓	✓	NA	8,000	12,000 (minor) or 250,000 (major)	Latin America, China	US, Europe, Japan, Korea, Taiwan

The figures used in this table are approximate only.

CHAPTER THREE | An Australian example: Nyrstar Australia

Additional Processing Capability Projects at Port Pirie and Hobart

To support increased supply of zinc, Nyrstar could develop a new Zinc Processing Plant that would expand processing capability at Port Pirie in South Australia. We would extract more zinc from existing extracted minerals and materials to supply zinc fume to our Hobart site. This would support increased zinc quantities in Australia, create local employment, reduce on-site materials and lead to the further release of Indium and Germanium.

In addition, there are a number of projects that can be progressed including a new Germanium and Indium Extraction Plant, a new cobalt and nickel process and projects that produce and refine antimony, bismuth and manganese.

Battery recycling expansion

In September 2022, Nyrstar Australia became the first company accredited in Australia to recycle single-use AA alkaline household batteries and recover commodity-grade quality metals such as zinc and copper, for international markets.

This project will allow an estimated 88 million batteries to be recycled annually, around 2,000 tonnes that won't go to landfill.

Single-use alkaline batteries, commonly used to power household appliances such as remote controls, smoke alarms and radios can be recycled into zinc and copper which is then returned to local and international commodity markets. The majority of remaining material can then be used in cement products with other commercial partners.

In addition, Nyrstar Australia and the South Australian Government are working on a project to investigate other battery recycling that could occur at Nyrstar Port Pirie. This demonstrates how major industrial processing facilities can augment existing operations and recycle batteries to return international grade commodities to market.

Major transformation – bringing together lead, zinc, copper and rare earths

In the longer term there is an opportunity to significantly expand processing across Hobart,Tasmania and Port Pirie, South Australia. Bringing together major lead, zinc and copper production into one processing business including critical minerals processing would deliver significant benefits to Australia and the local region and leverage an established skilled workforce.

Bringing these products into one large integrated production would enable increased recovery of more than just the primary metals. Lead, zinc and copper production open the door for increased production of other key primary metals such as silver and gold as well as increased release of other critical minerals such as bismuth, cobalt, germanium, indium, manganese, rhenium and some platinum group elements. This would provide a greater level of sovereignty for Australia and support diversification of supply chains.

During an expansion like this, there would be an opportunity for rare earth processing facility to be developed to support smaller rare earth industries in South Australia and Australia. This would require significant government involvement and investment with broader strategic and sovereign outcomes available. There would also be an opportunity for Universities and the R&D sector to leverage a state-of-the-art facility and increase technical expertise.

Expansion and decarbonisation opportunity

Australian primary lead smelting is described as 'hard to abate' as the processes rely on primary energy sources such as coke, coal and natural gas. In most cases there is no proven technology to replace these high emission intensity sources for heating up furnaces and as reductants.

Despite this, companies like Nyrstar are working on decarbonisation approaches to reduce their carbon emission footprint and meet emission reduction regulations. Nyrstar and its owner, Trafigura have

CHAPTER THREE | An Australian example: Nyrstar Australia

aggressive decarbonisation targets and approaches and are implementing projects across global operations.

There is an opportunity to align decarbonisation investments being considered by the Australian Governments with critical minerals opportunities – given the tangible and clear link between critical minerals processing and decarbonisation globally.

As the South Australian Government spearheads green hydrogen production in the Upper Spencer Gulf region of South Australia there is an opportunity to focus hydrogen production on processing facilities important for global metals supply. This would create green lead production and allow Australia export positioning benefits.

This would bring lead production into line with Nyrstar's Hobart Zincworks which employs electrolysis and uses predominately hydro-power.

What the rest of the world is doing

CHAPTER FOUR | What the rest of the world is doing

The United States and the Inflation Reduction Act

The Inflation Reduction Act (IRA) signed into law on August 16, 2022 is one of three main pieces of legislation passed in the US since 2021 that seeks to radically improve US economic competitiveness and industrial productivity.

The IRA targets more diversified supply chains and a substantial increase in domestic manufacturing including in critical minerals.

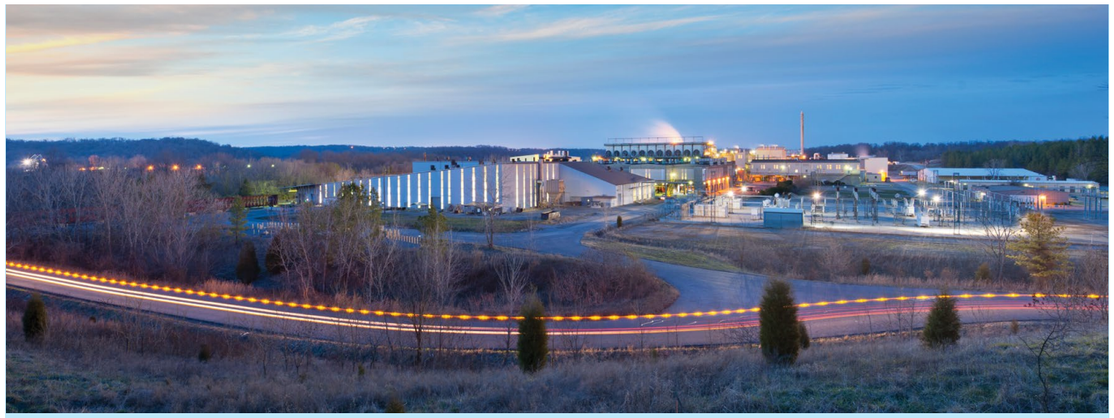
The IRA includes targeted tax incentives aimed at manufacturing US-sourced products such as batteries, solar, and offshore wind components, and technologies for carbon capture and storage.

There is substantial funding for investments in domestic battery supply chains and significant incentives for domestic production of clean energy technologies like solar, wind, carbon capture, and clean hydrogen.

Alongside proposed financial subsidies the US has also made broader policy changes. To support more supply projects they have sought to reform permitting

In 2021, the US Government added zinc to its Critical Minerals List. This was part of a clear shift in strategic thinking to prioritise sovereignty and support supply chain diversification and independence. This decision looked at more than just supply and demand, and also considered the impact of a 'single point of failure' – when supply is concentrated in one country, the risk factor is higher.

The announcement on 20 May 2023 that Australia and the US had entered into a Compact is significant. In seeking to coordinate policies and investments to support the expansion and diversification of critical minerals supply chains provides – Australia has an opportunity to closely align its policies, investments and Critical Minerals Lists.



CRITICAL MINERALS OPPORTUNITY AT NYRSTAR TENNESSEE US

Nyrstar operates the only primary zinc producing smelter located in the US in Clarksville, Tennessee, which has been in operation since 1978 and produces three critical minerals to support the domestic U.S. supply chain.

Nyrstar is studying the potential to build a state-of-the-art germanium and gallium recovery and processing facility at its primary zinc smelter in Clarksville, Tennessee. Nyrstar is engaging with Federal and State Governments to secure support to increase supply of these critical minerals.

Europe

The EU's Critical Raw Materials Act, unveiled in March 2023, aims to speed up permitting and ease access to financing for new mining and refining projects.

The proposed Act identifies a list of critical raw materials and a list of strategic raw materials crucial for technologies for the green and digital transition, as well as for defence and space.

It seeks to in some ways match the US' IRA by building European capacities by strengthening domestic supply chains, streamlining permitting procedures and providing incentives and access to finance, and Research and Development.

It also sets clear 2030 targets for domestic capabilities along the supply chain. These include the stipulation that at least 40 percent of the EU's demand for 'strategic' raw materials come from its own processing facilities by 2030.

Approach of other Countries

Zinc is also on the Canadian Critical Minerals List 2021. Key to this is the Canadian Government's stated focus of supporting development of domestic and global value chains for the green and digital economy as well as enhancing allied relationships.

South Korea has listed zinc as one of eight 'strategic minerals' in 2020 as is copper, nickel and lithium.

CHAPTER FOUR | What the rest of the world is doing

Saudi Arabia has launched a mining fund with the aim of investing up to USD15 billion in overseas mining assets, to secure the access to the minerals it needs for domestic mineral processing and to support other industrial activities like steel making.

Closer to Australia, Indonesia has banned the export of raw nickel, forcing foreign mining companies to invest in domestic smelting capacity. The country has since attracted huge investment into nickel processing, most of it from China. A ban on copper concentrate exports is set to come into force later this year. According to recent press reports, this will allow miners time to complete the construction of domestic smelters.

CONCLUSION | Australia needs to act

Australia needs to act

Demand for industrial metals including zinc is projected to increase exponentially over coming years.

And with a lack of supply projects in the pipeline, there is a risk of a shortage of key metals to meet the needs of the green transition.

Australia, with its rich endowment of mineral resources, has a unique opportunity to help meet this clear need.

Without investment and expansion of existing processing facilities these resources will move offshore with no value-add processing.

Through more extraction and importantly augmenting its world-class processing and refining capacities Australia can support global supply of metals as well as meet strategic objectives.

This includes providing an anchor for South East Asia and supporting exports to the US under the new Compact, helping diversify supply chains and bringing through more critical minerals at the same time.

Other countries are moving ahead to meet the strategic challenges the world faces.

The United States are overseeing a dramatic investment in sovereign manufacturing and capability through the IRA which will in part be aligned with Australia. Europe is also moving ahead with its own plans to increase resource independence and bring on-line more supply projects to meet global demand.

Countries such as Saudi Arabia and South Korea are also rapidly developing their strategies to expand processing capability.

If Australia sits back and allows other countries to lead – it will miss the opportunity to expand metals processing and contribute to national and global security.

Now is the time for Australia to make strategic investments to increase both extraction as well as metals processing capability.

Key to this is updating its Critical Minerals List to align with the US and invest in more supply projects, supporting industry in doing the hard work of decarbonising and implementing policies that drive the investment Australia and the world needs.

Action points

To that end we reiterate the following action points:

1. Inclusion of zinc on Australia's Critical or Strategic Minerals List, and;
2. Targeted financial investment in increasing both industrial metal and critical minerals processing capacity in Australia;
3. Streamlining of permitting for metals processing projects that support key objectives of Australia's Critical Minerals Strategy and the strategies of key allies such as the US.

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